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## Abstract about this Special Issue

## "Exploratory Research Opportunities of Computing in Life Sciences"

Computers are employed in lifestyle science in a variety of ways, including the usage of sensors and other devices that only a laptop can comprehend, as well as computers' incredible ability to do complex studies fast. Information Science majors learn to collect, analyze and interpret many different information sources to understand our world. They study how we interact with all things digital, including software, devices and algorithms, and are able to create social and technological solutions that are truly engaging for those who use them, apply those solutions to real problems, and evaluate their effectiveness. Computational Life Sciences is quickly becoming one of the most important and exciting fields in all of science and generation. The intersection of modern biology, bioinformatics, genomics, big data analytics, quantitative mathematical modelling, information discovery and synthesis, text mining, computational bio-imaging, scientific sciences, molecular dynamics, and high-performance computing is known as computational life sciences. The complexity of biological structures necessitates this approach in order to comprehend the operation of regulatory networks and to go from remote qualitative descriptions to a more comprehensive understanding. The complexity of biological structures necessitates this method in order to comprehend the operation of regulatory networks and to go from qualitative descriptions to quantitative knowledge. Computational Life Sciences is having a significant influence on a variety of technologies, including biomarker development, treatment objectives, and drug discovery. As a result, one of the most important tasks for this study in the next years will be to extract relevant statistics from enormous amounts of data and to build larger computer models to examine the more difficult features.

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# CASE STUDY ON TRI-PHASE NATURE INSPIRED MODELS FOR UNCERTAINTY HANDLING IN EARLY PREDICTION OF DYSLEXIA AMONG CHILDREN

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## ABSTRACT

The learning disability in children's due to neurological related processing issues which affect writing and reading comprehension is known as Dyslexia. Discovering such learning disabilities at the earliest may improve the children's academic knowledge. This paper focuses on conducting a case study about learning disabilities among school children to detect the presence of dyslexia in the early stages. This study collects students details from both parents and teachers of four different centers within Tamil Nadu state. The prediction is done using three different models they are Quantum Particle Swarm Optimization Enabled Intuitionistic Fuzzy Artificial Neural Network, Neutrosophic Clustering with Artificial Bacterial Foraging and Paraconsistent Neutrosophic With Whale Optimization-based rule pruning. These three models, performance is analyzed based on the collected information to detect the presence of dyslexia at their earlier stages.

**Keywords:** Dyslexia, Foraging, Neutrosophic, Paraconsistent, and Quantum.

## 1. INTRODUCTION

There are no reliable statistics on the number of dyslexic children in India. However, it is roughly estimated that minimum 10% of the school going children could be affected by the learning disability[1]. Dyslexia is often undetected owing to its subtle neurological condition which escapes easily from identification. As per World Federation of Neurology, dyslexic is referred as a disorder manifested by learning difficulties, difficulty in intelligence and socio-cultural opportunity. It reports that dyslexia are prevalent among boys than girls with the rough estimated ration of 4:1[2]. This is a case study, and only male and female students from elementary schools were chosen as the sample of students from four different institutions that provide specific teaching

methodologies for students with learning disabilities. In this study, two distinct types of questionnaires were created to obtain feedback from both parents and teachers about the children.

The parent questionnaire has 20 questions about their child's behaviour, issues during birth, reading and listening difficulties, day-to-day activities, and family history of learning difficulties. The questionnaire for teachers has 12 questions about the student's phonological awareness skills, issues learning letters and sounds, decoding and word recognition challenges, reading fluency in a context or from a material, spelling difficulties, and reading comprehension , and so on. The three different prediction model's results reveal that the dyslexic child is facing issues in almost every area of study at the primary level, especially in reading. The difficulties faced by the dyslexic child can be alleviated, to some extent, with the help of a cooperative attitude and positive approach by parents and teachers. Some psychiatrist sessions and speech therapy will help the dyslexic child to overcome the learning abilities.

## 2. RELATED WORK

This section discusses some of the current research in the field of dyslexia detection. Jothi and Bhargavi et al[3] conducted a thorough investigation of many facets of Alzheimer detection studies. They examined numerous dyslexia detection methods that used machine learning methods, design validation, image processing and many tools to assist the prediction of non-dyslexic and dyslexic children. Shahriar[4] in their findings, reported about the contribution of machine learning models using EEG, MRI, eye tracking and facial image acquisition for early detection of dyslexia. They have also observed the negative emotions of dyslexic children that occurred as a consequence of dyslexia such as anger, frustration and low self-esteem. Vani and Meenatchi[5] investigated the effects of neurological disorders on reading, writing, and comprehension. Eye movement used in their study to detect dyslexia using machine learning.

In their work, VaThomais et al[6] developed a DysLex machine learning model for detecting dyslexia using Support Vector Machine. The children's eye movement is tracked while they are silently reading. As a result, students' reading disorders are identified. Rezvani et al[7] created a dyslexia detection model that uses a neurobiological classifier to distinguish between dyslexic and non-dyslexic children. The weighted connection of the matrix is computed using EEG data, and the classification models employed in this study are k-NN and SVM. Opeyemi et al[8] conducted a comprehensive analysis of several machine learning algorithms, emphasizing the relevance of deep learning in achieving acceptable accuracy levels. Biomarkers used as the main factor in the deep understanding of dyslexia in children.

## 3. METHODOLOGY OF TRI-PHASE NATURE INSPIRED MODELS FOR UNCERTAINTY HANDLING IN EARLY PREDICTION OF DYSLEXIA AMONG CHILDREN

This research work was carried out in three phases. All the phases focus on detecting dyslexia in children at an early stage. This procedure uses data from four distinct institutes in Tamilnadu, India. Rashmika Centre for

Learning & Counselling Coimbatore, Sankalp The Open School Chennai, School Readiness Programme (SRP) Centre Udumalpet and Seagull Training & Study Centre Trichy in the 71 students between the age group of 6 and 10.

The first phase addresses the issue of vagueness and imprecision in the dataset by introducing intuitionistic fuzzy fused cognitive learning, which outperforms fuzzy-based models when compared[9].

The second phase works as an optimized unsupervised model. In this phase, the instances under investigation are unlabeled. So this the instances were clustered using neutrosophic c-means clustering and the centroid for forming clusters were selected by the bacterial foraging approach. In addition, this phase concentrates on enhancing the dyslexia dataset by imputing the missing values using boosted decision tree[10].

The third phase provides a classification model based on the neutrosophic inference system that enriches its activity by introducing paraconsistent logic to establish favourable and unfavourable rules, which are then trimmed using the whale optimization approach[11]. As a result, all of these process work together to create an intelligent model for detecting dyslexia in children at an early stage.

## 4. RESULTS AND DISCUSSIONS

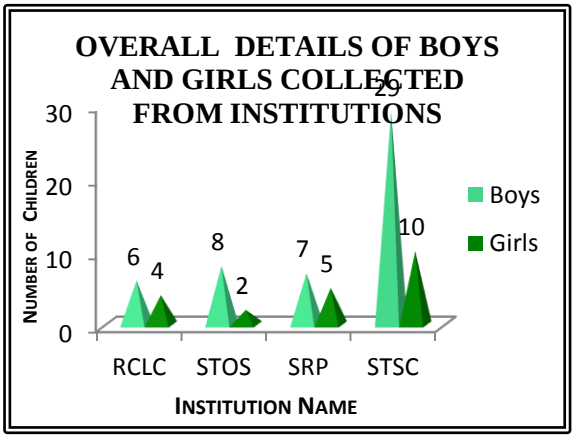
This section discusses about the performance analysis of four different models using Quantum Particle Swarm Optimization based Intuitionistic fuzzy artificial neural network (QPSO-IFANN)[9], Optimized Neutrosophic C Means clustering using behavioral inspiration of Artificial Bacterial Foraging (ONCMC-ABF)[10] and Whale Behavior based Rule Optimization on Paraconsistent Neutrsophical Classification (WBRO-PNC)[11] for dyslexia prediction. The detailed explanation is as shown in the following subsections. This case study gathers data for 71 children under the age group of 6 to 10 from 4 separate institutions. From the Rashmika Center for Learning & Counselling Coimbatore 6 Boys and 4 Girls students, Sankalp the Open School 8 Boys and 2 Girls students, 7 Boys and 5 Girls students from the Madathukulam Center for School Readiness Program (SRP) and 29 Boys and 10 Girls from the Seagull Training & Study Center Trichy are collected. Totally there are 50 Boys and 21 girls. The ratio of boys and girls is 5:2.It is observed that the proportion of boys is higher than that of girls according to information collected from four different institutions. Table1 and Graph1 shows the information collected from the four institutions.

This case study collects the dataset of 71 students under the age group of 6 to 10 from 4 different institutes. The table 1 and the figure 1 shows that from Rashmika Centre for Learning& Counselling, Coimbatore, 6 male and 4 female students' information are gathered from both parents and teachers. From Sankalp The Open School, Chennai consist of 4 male students and 2 female students' information. From School Readiness Programme (SRP) Centre, 7 male students and 5 female students' details are collected. From Seagull Training & Study Centre, 29 male students and 10 female students' information are collected. According to the information

collected from four different institutes it is observed that proportion of male students is higher than the female students were 50 boys and 21 girl students which is approximately 5:2 ratio. In this case study, the sample was taken from the primary school children of four different institutions. Such organizations give special teaching methodologies to those students with learning disabilities. Two different formats of questionnaires were prepared to collect feedback about the students from both parents and their teachers. The screening questionnaire[1] for the child's parent is based on a 1998 research published in the British Journal of Occupational Therapy which says scoring 7 or more "YES" suggests that the children need further assistance with their learning impairment. The teacher Observation Questionnaire[2] was adapted from the Dyslexia Teacher Observation Questionnaire, Texas Scottish Rite Children's Hospital Texas.

**Table 1: Overall details of Boys and Girls Collected from 4 Institutions**

| Name of the Institutions | Boys | Girls |
|---|---|---|
| **Rashmika Center for Learning & Counselling, Coimbatore (RCLC)** | 6 | 4 |
| **Sankalp The Open School, Chennai (STOS)** | 8 | 2 |
| **Center for School Readiness Programme (SRP), Madathukulam, Udumalpet** | 7 | 5 |
| **Seagull Training & Study Centre, Trichy (STSC)** | 29 | 10 |
| **Total** | **50** | **21** |




**Graph 1: Overall details of Boys and Girls collected from 4 Institutions**

**Table 2: Personal information of children collected from parents**

| S.No | Attributes | Description |
|---|---|---|
| **1** | MPP | Medical Problems during Pregnancy |
| **2** | BBAT | Born Before / After Term |
| **3** | CAB | Complications at Birth |
| **4** | ED | Extremely Demanding in first 6 months of Life |
| **5** | MOC | Miss out on Crawling |
| **6** | SLW | Slow Learning to Walk(normally 12 to 16 months) |

| | | |
|---|---|---|
| **7** | SD | Speech Difficulties |
| **8** | ENTP | Ear/Nose/Throat Problem |
| **9** | LDTS | Difficulty in Learning to Dress / Tie Shoelace |
| **10** | BW | Bedwetting after 5 years of age |
| **11** | RCF | Difficulty in Reading Clock Face |
| **12** | LRB | Difficulty in Learning to Ride Bike |
| **13** | CB | Difficulty in Catching Ball |
| **14** | DSS | Difficulty to Sit Still |
| **15** | ORS | Over React for sudden noise |
| **16** | RD | Reading Difficulty |
| **17** | WD | Writing Difficulty |
| **18** | CD | Copying Difficulty |
| **19** | WOD | Work Organizing Difficulty |
| **20** | HRDF | History of Reading Difficulties in Family |

The parents' questionnaire consists of 20 questions related to their child's behaviour, difficulties in their time of birth, difficulties in reading and listening, day-to-day activities and family history of learning difficulties. The teachers' questionnaire consists of 12 questions related to the phonological awareness skills of the students', difficulties in learning letters and learning sounds, difficulties in decoding and recognition of words, fluency in reading a context or material, difficulty in spelling and reading understanding. The table 2 lists the 20 attributes collected from parents about their children. The data obtained in reading disabilities are linked to their birth information cognitive behavior, communication and reading skills and genetic issues.

**Statistics on personal information of children**

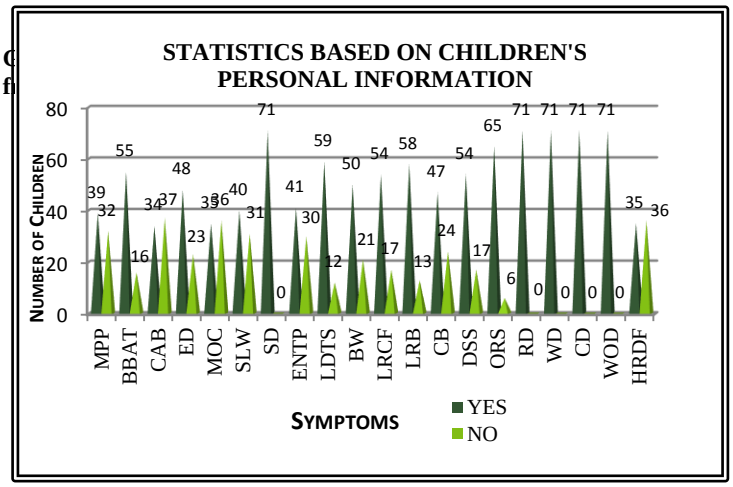
The table3 and graph2 demonstrate the presence or absence of 20 different metrics used by 71 children to determine the presence or absence of dyslexia. From table3 it is clearly shown that most of the children are affected by the following symptoms. The details are listed below. Graph3 illustrates these learning disability symptoms that affect children to understand the presence or absence of dyslexia based on information obtained from parents for this case study. These symptoms are associated with skills in phonology, motor ability, and concentration.

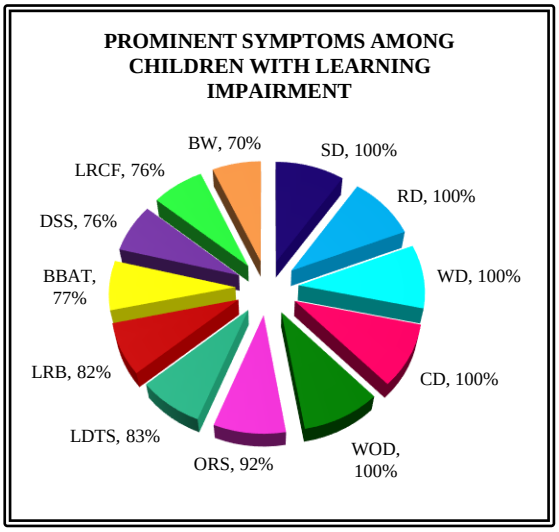
-

**Table 3: Statistics based on personal information of children collected from Parents collected from parents**

| S.No | Attribute | Description | YES | NO |
|---|---|---|---|---|
| **1** | MPP | Medical Problems during Pregnancy | 39 | 32 |
| **2** | BBAT | Born Before / After Term | 55 | 16 |

| | | | | |
|---|---|---|---|---|
| **3** | CAB | Complications at Birth | 34 | 37 |
| **4** | ED | Extremely Demanding in first 6 months of Life | 48 | 23 |
| **5** | MOC | Miss out on Crawling | 35 | 36 |
| **6** | SLW | Slow Learning to Walk (normally 12 to 16 months) | 40 | 31 |
| **7** | SD | Speech Difficulties | 71 | 0 |
| **8** | ENTP | Ear/Nose/Throat Problem | 41 | 30 |
| **9** | LDTS | Difficulty in Learning to Dress / Tie Shoelace | 59 | 12 |
| **10** | BW | Bedwetting after 5 years of age | 50 | 21 |
| **11** | LRCF | Difficulty in Reading Clock Face | 54 | 17 |
| **12** | LRB | Difficulty in Learning to Ride Bike | 58 | 13 |
| **13** | CB | Difficulty in Catching Ball | 47 | 24 |
| **14** | DSS | Difficulty to Sit Still | 54 | 17 |
| **15** | ORS | Over React for sudden noise | 65 | 6 |
| **16** | RD | Reading Difficulty | 71 | 0 |
| **17** | WD | Writing Difficulty | 71 | 0 |
| **18** | CD | Copying Difficulty | 71 | 0 |
| **19** | WOD | Work Organizing Difficulty | 71 | 0 |
| **20** | HRDF | History of Reading Difficulties in Family | 35 | 36 |




**Comparative study on affected boys and girls**

According to the parent's information in table3 about their wards' response to the learning impairment symptoms, the table4 is constructed. The table4 and graph4 describe the number of boys and the number of girls with "YES" response to the symptoms. From the analysis it is observed that

**1. The following symptoms are found to be *more common in Boys than Girls***

Medical problems during pregnancy (MPP) [56%-28 Boys | 52%-11 Girls]. Born before/after term (BBAT)[80%-40 Boys | 71%-15 Girls] .Complications at birth (CAB)[50%-25 Boys | 43%-9 Girls]. Extremely demanding in first 6 months of life(ED)[70%-35 Boys | 62%-13 Girls]. Slow learning to walk (SLW)[60%-30 Boys | 48%-10 Girls]. ENT problem (ENTP)[62%-31 Boys | 48%-10 Girls]. Learning to read clock face (LRCF)[78%-39 Boys | 71%-15 Girls]. Difficulty in catching ball (CB)[68%-34 Boys | 62%-13 Girls]. Difficulty in sit still (DSS)[80%-40 Boys | 67%-14 Girls]. Over react to sudden noise (ORS) [94%-47 Boys|86%-18 Girls].

***2.* The following symptoms are found to *be more common in Girls than Boys***

Difficulty in learning to dress / tie shoelace (LDTS)[80%-40 Boys | 90%-19 Girls] , Bedwetting after 5 years of age (BW)[66%-33 Boys | 81%-17 Girls], Difficulty in learning to ride bike (LRB)[80%-40 Boys | 86%-18 Girls]

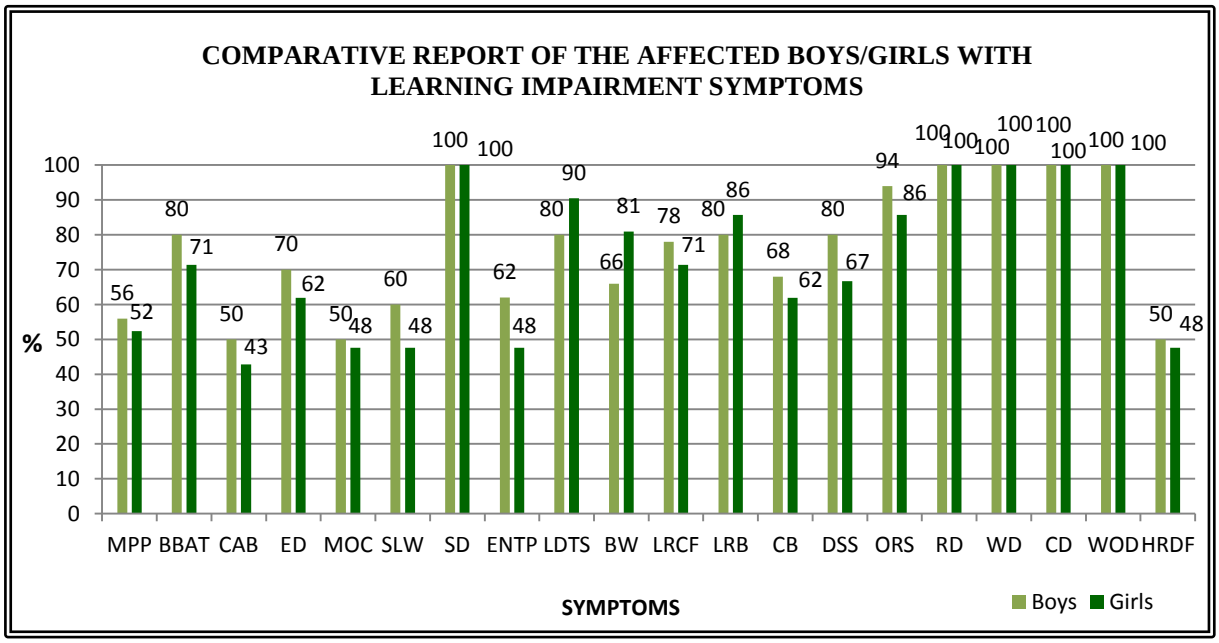
**3. Girls and boys are approximately *equally affected* with the following symptoms**

Miss out on crawling (MoC)[50%-25 Boys | 48%-10 Girls], History of reading difficulty in family (HRDF)[50%-25 Boys | 48%-10 Girls]

4. **Both boys and girls *experience 100%*in the below mentioned symptoms**

Speech difficulty (SD) , Reading Difficulty (RD), Writing difficulty (WD), Copying difficulty (CD), Work organizing difficulty (WOD)

Symptoms of dyslexia are more widespread in boys than girls. The condition may be developed or hereditary or acquired. Cognitive and neurological disabilities are responsible for developmental dyslexia. External factors such as birth complications, early childhood illness and decreased care and balance & coordination problems are responsible for acquired dyslexia. Dyslexia usually involves difficulty in reading, writing, spelling, arithmetic, memory, direction and, time.




**Graph 4: Comparative report of the affected boys/girls with symptoms of**

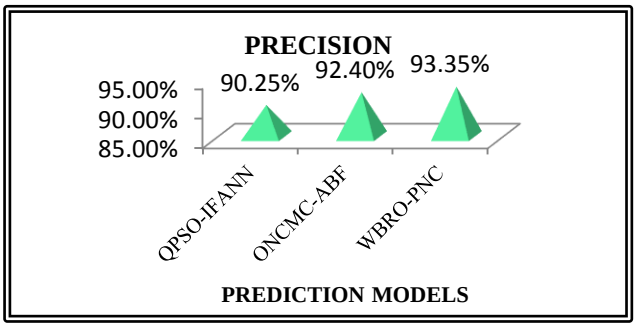
**dyslexia based on the information collected from parents**

## Performance Analysis of 3 Proposed Prediction Models

This section explains the performance analysis of three proposed dyslexia prediction models.

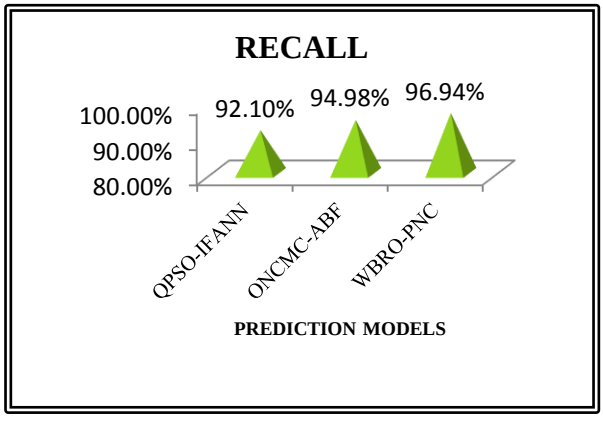
| S.NO | MODEL | QPSO-IFANN | ONCMC-ABF | WBRO-PNC |
|---|---|---|---|---|
| 1 | Precision | 90.25% | 92.40% | 93.35 % |
| 2 | Recall | 92.10% | 94.98% | 96.94 % |
| 3 | F-Measure | 91.17% | 93.67% | 95.11 % |

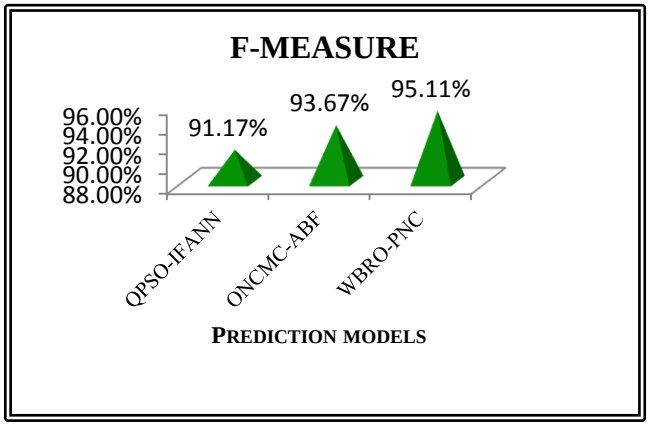
**Table 4: Performances analysis of 3 different prediction models to detect dyslexia among children**




**Graph 5: Performance Analysis based on precision of 3 proposed models**

The table 8 shows the performance of three different proposed models namely Quantum Particle Swarm Optimization based Intuitionistic fuzzy artificial neural network (QPSO-IFANN), Optimized Neutrosophic C Means clustering using behavioural inspiration of Artificial Bacterial Foraging (ONCMC-ABF) and Whale Behavior based Rule Optimization on Paraconsistent Neutrosophic Classification (WBRO-PNC) based on precision, recall and F- Measure. The performance of ONCMC-ABF and WBRO-PNC produces better results because of their ability to handle impreciseness, vagueness, inconsistency and uncertainty with the knowledge of Neutrosphical problem solving. Graph7, graph8 and graph9 show the precision, recall and f-measure values of three separate QPSO-IFANN, ONCMC-ABF, and WBRO-PNC models. It is found that QPSO-IFANN's performance produces minimal accuracy relative to two other models because it cannot handle the situation when the prediction of dyslexia is unpredictable, unacceptable and inadequate. Comparatively ONCMC-ABF performs less than WBRO-PNC due to the presence of inconsistency in clustering the other cognitive impairment symptoms The WBRO-PNC has neutrosophic & paraconsistent ability. It prunes the rules with whale behaviour optimization also. There by slightly increasing the rate of detecting accuracy.



**Graph 6: Performances analysis based on of 3 proposed models**

**Graph 7: Performances analysis based on Recall F-Measure of 3 proposed models**

## 5. CONCLUSION

This paper conducted a case study. It is observed that the dyslexia child faces issues in academics with a large margin while comparing to non-dyslectic children or students. Dyslexic child needs five times more effort than the non-dyslexic student with the assistance of teachers with special materials and techniques. The early prediction of dyslexia may help the dyslexic student to overcome this problem with proper guidance and support. This case study investigated the detection of dyslexia among school children's in Tamil Nadu by collecting the details from four different institutions. As the nature of dataset is impreciseness, and ambiguous when multiple symptom of cognitive impairments is detected by neutrosophic models both in supervised and non-supervised machine learning paradigm produces better result compared to the standard clustering or classification models. The performance results demonstrate the ability of the three newly developed models of dyslexia prediction substantially help parents to identify signs of dyslexia in their children, and also recommends that they should take their children with such symptoms to the experts in the field for clinical assistance.

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**P-2**

# ANALYSIS ON ENERGY EFFICIENT ROUTING PROTOCOLS IN WSN FOR WILDLIFE HABITAT MONITORING

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## ABSTRACT

The use of new and advanced wildlife monitoring technologies is shifting the paradigm of wildlife conservation and management. These digital technologies are helping wildlife conservationists and researchers around the world to monitor and manage wildlife with more precision and efficiency. A network of wireless sensor nodes can be used to collect information from a variety of applications including military, environmental, medical, habitat monitoring, and scientific applications. Wireless Sensor Network (WSN) is always an interesting field as it gives enhanced data sensing and communication medium for various applications. Data communications are processed to give better solution using some secure network model. Routing protocols have a large scope of research work when implemented in WSNs, because the functioning of these protocols depends upon the type of network structure designed for the application or the network operations carried out using these protocols for a specific application model. Studying the behavior of wild animals is a difficult task due to the difficulties of tracking and classifying their actions. Nowadays, technology allows designing low-cost systems that make these tasks easier to carry out, and some of these systems produce good results. This paper presents a study on different sorts of Wireless Sensor Networks routing strategies includes energy efficient routing protocols for Wildlife Habitat Monitoring. An overview of all related intrusion detection methods has been presented in this paper. We have highlighted the benefits and shortcomings for classical methods. The research suggestions and guidelines are considered to enhance the particular conditions. The proposed work will be beneficial for the wildlife researchers, biologists and farmers to effectively monitor the health of the animals, and learn about the behavior, physical condition and movements.

**Keywords:** Conservation, Protocol, Routing, Sensor and Wildlife.

## 1. INTRODUCTION

Wireless networks [1, 2, 3] are a type of computer network that is connected together through any kind of cables. This kind of network is good to implement anywhere without establishing any cables or equipment to connect together. Generally, the wireless network is a flexible network that uses wireless media (radio waves) to transmit and receive data over the air. This network minimizes the need for wired connection and integrates the communication between the wired and wireless communication devices. Mostly, the wireless network relies on information from one to another point using electromagnetic waves without using any physical communicating devices [4, 5]. Radio carriers at source end transmit the radio energy to destination carrier and then the energy is transferred as data at the destination end. Multiple radio spaces exists in same carrier so that different radio waves can be transmitted at the same time without interfering each other.

Some of the common advantages of wireless networks are,

- Mobility
- Flexibility
- Reduced cost
- Simplicity and Scalability

The most advantage of wireless network is mobility[2]. The network users can easily connect together without any special devices are features and it allow the users to roam freely within the defined radius. As wired networks are stable, the users cannot move the devices however; in wireless network, the mobility is possible within the defined radius. It supports productivity, service opportunities, and so on, which are not possible at wired network. In wireless network, the changes in network configuration are easily processed. Whereas in wired network, the configuration changes takes more time and cost. Flexibility provides a rapid deployment in wireless networks. The networks have a different set of devices to communicate together through wireless communication. This network uses a number of base stations to connect variant of users with existing networks. In any area through antennas and base station, wireless network can easily deployed. By authentication and authorization services, the network can add or remove users easily. Through hotspot connectivity, the wireless network can easily deployed in airports, railway stations and other public areas[3, 4, 5].

In wired network, deployment of cables and network equipment's takes more time to set up a network in any specific location. In addition, the data transmissions between networks and between computers within a network are normally processed using routers, switches or other network devices. Adding a system in a network is a tedious process where it may cost more problems such as IP (Internet Protocol) configuration problems, resource allocations, user access and so on. Whereas in wireless networks, the cables and other networking equipment are not necessary except for a hotspot. It can deploy within an hour at any specific location. It does not need more cost compared to wired networks. As this network comprises of different wireless devices the

accessing and authentication are processed easily than wired networks. Wireless Sensor Networks (WSNs) is a self-configured and infrastructure less wireless networks[6]. The major work of WSNs is to monitor temperature, sound, pressure, and so on in the environment where it is actually deployed. In addition, it also supports military, healthcare and other foremost applications to transfer the collected information to the sink node or Base Station (BS) where the data can observed and analyzed. BS acts as interface between the user and network. Whenever, users need information from the network then user injects the query at BS and gathers the appropriate results from the network. With the advancements in WSN the real-time collected data from the camera-traps can be wirelessly transmitted to a remote station through wireless protocols. This will tremendously reduce the human requirements and delay in the monitoring of wild animals[7, 8, 9]. Energy efficient routing protocols are needed to send the packets efficiently from the source node to the control or monitoring station (Figure 1). This paper proposes and studies a WSN based system for generic target (animal) tracking in the surrounding area of wildlife passages.

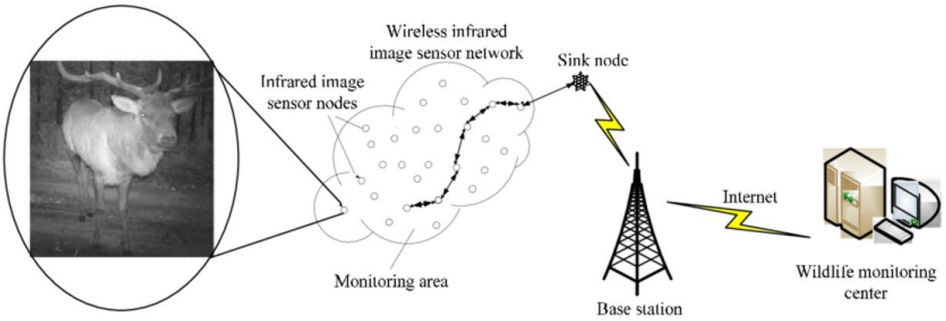


**Figure 1: Wireless Sensor Networks in Wildlife Habitat Monitoring**

The rest of the paper is organized as follows. In Section 2, Protocols in WSN for Wildlife Habitat Monitoring is discussed. Section 3 details the Factors affecting routing in Wireless Sensor Networks. Energy-Efficient Routing Protocols of WSN used for Wildlife Monitoring is discussed in Section 4. Finally, Section 5 concludes the paper.

## 2. PROTOCOLS IN WSN FOR WILDLIFE HABITAT MONITORING

The topology based routing protocols (Figure 2) can also be termed as the table-based routing that depends on the current topology of WSN [3].

Further, the topology based routing can be classified into,

- Proactive Routing Protocols
- Reactive or On-demand Routing Protocols
- Hybrid Routing Protocols

***(i) Proactive Routing Protocols:***

In proactive routing, mobile nodes use table-based routes that are pre-established [2]. Hence, the routes are considered dependable and nodes are not needed to wait for the process of route discovery that reduces the latency. Conversely, overhead acquired for the construction of routes and its maintenance can rigorously corrupt the performance of the network, limit scalability and the route table may use a lot of memory as the network develops. Additionally, the recurrent topology changes due to node mobility tend to some fusty route in the route table that causes packet drop.

***(ii) Reactive Routing Protocols:***

It can also be defined as the on-demand routing protocols, the source nodes determine and frame an optimal route to the destination only when it is required. For example, AODV (Ad hoc On-demand Distance Vector) [2] routing providing the route establishment from source to destination only when there is a demand. Moreover, on-demand kind of routing requires minimum memory and storage capability than the proactive protocols. But, in the network range where mobile nodes can roam more randomly and frequently, the discovery of route may not succeed since the route is longer and connects may breaks because of the mobility of nodes, in some critical cases like obstacles. Further, the latency can be increased for all data traffic due to the delay caused during the process of route discovery.

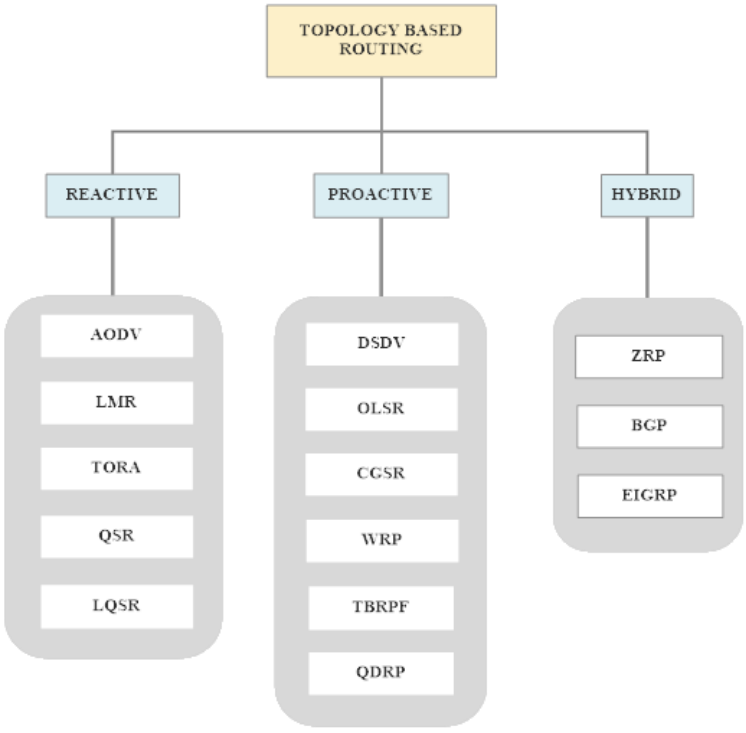


**Figure 2: Types of Topology-based Routing Protocols**

When location-based routing protocol is concerned, it needs only the location information of nodes to frame routes. No source nodes are required to set up the route to the destination before forwarding packets. Differently, reactive routing protocols are not depending on the route requests for the establishment. This property helps the

location-based routing protocols to minimize the additional overhead imposed by the topological limitations in the process of route discovery. Typically, a node is required to know the location of its neighbours and its corresponding destination for packet transmission 5. This may lead the protocols to adapt to all kind of topological changes and link breaks inefficient manner since the next hope is identified locally. Hence, it is to be stated that the location-based routing is typically more reliable than the on-demand routing protocols.

***(iii) Hybrid Routing Protocols***

In general, it combines the best features of both geographic based routing and on-demand routing protocols. These features are getting together to result in the hybrid routing, which is reliable and loop-free, provides lower control overhead on the network. This involves finding a path from source to destination as long as the whole communication network is not separated. The hybrid protocol is a combination of both proactive and reactive protocols. In this case, if there is no traffic in the network then proactive routing protocols results in high control overload[6]. The use of reactive routing protocol is based on the demand for maintenance and discovery. Hence, the transmission speed is increased. Zone Routing Protocol (ZRP) and Zone-based Hierarchical Link State Routing Protocol (ZHLS) are hybrid protocols. Here the routing is established with proactive routes and then serves the demand from additionally activated nodes through reactive flooding. The main disadvantages of these algorithms are, the performance factor depends on number of nodes activated and the reaction to traffic demand depends on gradient of traffic volume.

## 3. ENERGY-EFFICIENT ROUTING PROTOCOLS OF WSN

In this section, we categorize the various research models of WSN [10, 11] based on different aspects to show the major protocol routing issues. The main motive of this literature is to analyze the limitations of previous routing protocols, attacks and its resource utilization concepts which can be used for wildlife monitoring [12, 13, 14]. Routing protocols have a large scope of research work when implemented in WSNs, because the functioning of these protocols depends upon the type of network structure designed for the application or the network operations carried out using these protocols for a specific application model.

***(i) Analysis via public auditing architecture***

A mechanism to sense the malicious packet dropping. Correlation between the lost packets at every node and homomorphic linear authenticator (HLA) is deployed. To ensure proper reception of packets the HLA [15] is used and indirect reciprocity is applied to confirm the forwarding of packets at each node. To calculate the correlation between lost packets, the open packet loss information from every node in the route is essential. In the path from sender to receiver, the node with minimum reputation dropped more packets. This mechanism provides an improvement in the detection accuracy of selective packet dropping. Correct forwarding reduces the imperfect estimation of reputation.

The entropy method to find out how the packets are lost in the network. Packets are missed due to an error in the connection or malicious drop. Conventional method does not accurately detect whether the packets are lost due to connection error only or both connection and malicious drop, so entropy is employed [15]. To support the truthfulness of entropy the HLA (homomorphic linear authenticator) is introduced. HLA is a public auditing architecture which permits the detector to verify the accuracy of the lost packet information reported by intermediate nodes. Packet-loss reporting by each and every node establishes a mutual communication between the source and the destination node [16].

EGMP (Efficient Geographical Multicasting Protocol) [17] to conserve the privacy and detect the packet dropping attack in a wireless ad-hoc network. To authenticate the truthfulness of the packet loss information, a public auditing architecture HLA (Homomorphic Linear Authenticator) was developed. In the case of larger networks, EGMP (Efficient Geographical Multicasting Protocol) is adapted to divide into different zones. Identifying the hop where the packet is dropped is an open challenge. To sense selective packet dropping the truthful and decision statistics are visibly proved. Reliability is essential to compute the correlation between lost packets appropriately. Using ACF (Auto-Correlation Function) high detection accuracy is feasible. To reduce the computation overhead in the network, a packet-block-based mechanism is used and the spotted malicious nodes are removed [18].

An algorithm for detecting selective packet dropping and refining the detection accuracy. The suggested system witnesses a sequence of packet losses [19] in the network and it wants to determine whether the losses are instigated by link errors only or by the pooled effect of link errors and malicious drop. In the insider attack case, the malicious nodes that share the route, use their information of the communication context to selectively drop a small number of packets acute to the transmission.

The accurate detection is difficult because of the selective dropping of packets and recurrent change in topology. The correlations between the bitmap generated are calculated to identify the lost packets. This, in turn, causes a progress in detection accuracy. Hence, the anticipated detection scheme is attacked resilient to diverse kinds of network environments such as static and mobile networks. It attains better detection accuracy and overcomes communication overhead.

***(ii) Table driven scheme***

A meta-heuristic search diagram, based on the AODV routing protocol [20] the min and max variants of ACO with DRPI (dynamic route pheromone bound value information table) verification tables were integrated. Ant Colony Optimization (ACO) is an optimization approach used for the quick algorithmic procedure. To find the optimal path over the network and to enhance the communication process the ACO is applied in a wireless network. Few changes are introduced in the Ant Colony Max-Min Ant System which results in an optimal path. The operations carried in each node are fault tolerant and simple. The delay is minimal which provides a better

throughput. When the malicious node is detected and isolated there is an increase in the data forwarding capacity of nodes thus reducing the packet loss rate.

A system which adds two new tables and new packet type to AODV protocol to detect and prevent black hole attack. The tables are RRT and NIT. RRT (RREP Record Table) stores all route reply packet (RREP) information from neighbor's node and NIT (Node Information Table) [21] stores the malicious node. The source node routinely broadcasts an alarm message to other nodes in the network when a black hole is detected. The RRT stores the RREP for a predefined time and computation is carried out to find the difference between the destination sequence number in RRT and the destination sequence number in RT (Routing Table in AODV). The differences between them are compared and if it is high then the node is malicious and it is removed from RRT. This methodology provides a higher packet delivery ratio.

A Trust Table and a timer to detect the malicious node. The source node and the destination node are not in direct contact with each other, and there are many intermediate nodes present. An RREQ message is advertised which triggers the route detection process. Now the malicious node sends the RREP message to the source node without examining its routing table [22]. Once the transmission of data is initiated from the source node the malicious node fails to forward it to the destination node.

A technique using the sequence number of the node. Using this feature the safe routes are identified and black hole attack is prevented. The first entry in the RRT (Route Request Table) is the first route reply from the malicious node which has a high destination sequence number. In the next step, the first destination sequence number and the source node sequence number are compared. If the difference between them is high, then that particular node is declared as the malicious node, which is instantly removed from RRT [23]. The packet end-to-end delay is kept low, thereby enhancing the performance.

DEBH (Detecting and Eliminating Black Holes) for sensing and detaching the cooperative black hole nodes in MANET. The main objective is to minimize the packet overhead and enhance the throughput of the network. A data control packet and an extra Black hole Check (BCh) table is used for spotting and removing malicious nodes. A packet is propagated containing the ID of the malicious node [24]. The BCh table is updated with the data control packet and the number of trustable nodes rises intensively. Accumulation of the trustable nodes leads to a decline in the delay and packet overhead. DEBH is capable of detecting all active malicious nodes, thus eliminating faulty routing information.

A high reliable routing protocol based on the cross-layer constraints of channel state association information for MHWNs. The conventional on-demand routing protocols for Multi-hop Heterogeneous Wireless Networks (MHWNs) normally consider the hop count time as the measurement for the calculation of the shortest path. The impact of coupling the intermediate nodes based on the period of routing may not be integrated into the

route measurement. If the communication node moves freely, the impact of fading and interference becomes high [25]. This process results in continuous routing reconstruction and the utilization of bandwidth is low and high protocol overhead may occur. To make the effective coupling relationship between the current relaying node and the next forwarding one, there is a need for highly reliable routing protocol which is based on node dependency so it is termed as Routing Protocol Based Node Dependency (RPBND) by the analysis of the channel state association information. By transferring a set of short training sequences with fixed parameters of transmit power and data rate, the receiver may send a feedback of instantaneous channel state, which will serve as the weight of the communication link for preferred routing decision making. Finally, they concluded that the method is helpful in improving the stability and reliability of the routing with respect to the current link cost that may maintain as low.

An Improved Harmony Search Based Energy Efficient Routing Algorithm (IHSBEER) for WSNs, which depends on congruity search (HS) calculation (a meta-heuristic) [26]. To address the WSNs steering issue with HS calculation, a few key upgrades have been advanced: First of all, the encoding of amicability memory has been improved dependent on the attributes of directing in WSNs. Furthermore, the development of another agreement has likewise been improved. They presented dynamic adjustment for the parameter called Harmony Memory Considering Rate (HMCR) to maintain a strategic distance from the rashness in early ages and fortify its nearby hunt capacity in late ages. In the meantime, the change procedure of HS calculation has been disposed of to make the proposed directing calculation containing less parameter. At long last, a viable neighborhood search technique is proposed to upgrade the nearby hunt capacity, in order to improve the assembly speed and the exactness of directing calculation.

Two trigger-based, vitality proficient directing conventions that guarantee network for occasional information gathering applications. They proposed conventions On-Hole Children Reconnection (OHCR) and On-Hole Alert (OHA) take care of any routing gap issue dependent on nearby and worldwide data, individually. They suit all the topology arrangement calculations and system offices of single way connect with single arrangement stage [27]. They handle the untimely finish of system lifetime in such systems; particularly, when the BS is a long way from the ROI. Besides, they dodge the persistent powerful topology development, not at all like other dynamic directing conventions. These conventions progressively reconnect the separated hub at whatever point a steering opening happens with negligible system arrangement overhead.

A novel altered directing routing right now. The recently proposed improved energy effective LEACH (IEE-LEACH) convention thinks about the lingering hub vitality and the normal vitality of the systems. To accomplish good execution as far as decreasing the sensor vitality utilization, the proposed IEE-LEACH [28] represents the quantities of the ideal CHs and precludes the hubs that are nearer to the base station (BS) to participate in the group development. Moreover, the proposed IEE-LEACH utilizes another limit for choosing

CHs among the sensor hubs, and utilizes single bounce, multi-jump, and crossover interchanges to additionally improve the vitality proficiency of the systems.

The system lifetime upgrade by creating PSO based strategy. So as to accomplish the ideal execution, the total proposed model is partitioned into different stages where most importantly, sensor hubs are sent haphazardly. Afterward, group head determination is performed trailed by the most limited way ID [29, 30]. So as to limit the vitality utilization, they applied multi-objective PSO. Therefore, fitness work calculation experiences the moderate combination which prompts the untimely arrangement bringing about corrupted correspondence execution. So as to address this issue, we present another wellness work calculation which thinks about remaining vitality parameter and details another vitality utilization model for every hub which assists with improving the force utilization during information transmission and gathering by thinking about the resting periods of sensor hubs.

These energy efficient protocols can play a vital role in the deployment of Wildlife habitat monitoring using Wireless Sensor Networks. The WSN design will carry out data communication in order to prolong the node lifetime in the network. This is also used to prevent connectivity degradation by the use of employing aggressive energy management approaches.

## 4. CONCLUSION

This paper presents a study on different sorts of WSN routing strategies. An overview of all related intrusion detection methods has been presented. The benefits and shortcomings for classical methods are highlighted. The challenges and limitations of current approaches are highlighted. The research suggestions and guidelines are considered to enhance the particular conditions. Monitoring wild animals, especially those that are becoming endangered is important for biology researchers. Solutions for the monitoring already exist; however, they all have drawbacks, such as limited range or lifetime, sensing modality, reporting delays, unreliability of operation. In this paper a survey on the routing algorithms required for improved animal monitoring sensor system is discussed.

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# MOBI-X CONSTRUCTION REPRESENTATION FOR MOBILE AGENT MINING IN HORTICULTURE APPLICATION

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## ABSTRACT

In a mobile agent system, if agents' usefulness can be surveyed and assessed between friends of ecological displaying, it can lessen the investigation weight of unvisited states and inconspicuous circumstances, subsequently an efficacious learning measure must be sped up. In order to develop a precise and effective model in certain time span is a critical issue, explicitly in complex climate. To beat this emergency, the examination expects a model put together information mining approach based with respect to tree construction to accomplish co-appointment among the mobile agent, adequate demonstrating and less memory usage. The expected model proposes Mobi-X design to mobile agent system with a tree structure for adequate demonstrating. This work is enlivened by information mining idea in mobile agent systems where an agent can assembled a worldwide model from dispersed nearby model held by singular agents. Therefore, it builds demonstrating precision to offer legitimate reproduction result for circuitous learning at starting phase of mining. To work on mining method, this expected model depends on re-testing approach with cooperative standard mining to joining parts of developed tree. The tree structure furnishes the elements of mobile agents with helpful experience from one companion to another network, surely of consolidating every one of the accessible agents in the field of horticulture. The reproduction results shows that proposed re-testing can achieve effectiveness and speed up the usefulness of mobile agents based collaboration applications.

**Keywords:** Agent, Associative, Knowledge Mining, Mobi-X and Rule Mining.

## 1. INTRODUCTION

In general, sensor networks are ingeniously conveyed in different recognizing and checking applications [1]. In this applications, mobile organizations produces enormous measure of information in type of streams. Those information streams from mobile organizations can be mined to pull out information progressively about detected climate (for example, mining certain practices) and organization itself (for example dissecting broken hubs), and this offers difficulties for information mining approaches [2, 3]. Information mining draws near, which are set up well in the customary data set systems, have right now accomplished an unrivaled arrangement of consideration as promising instrument to pull out fascinating information from mobile information streams[4]. With information disclosure in systems administration, one explicit interest is to get standards of conduct of hubs, which are advanced from meta-information deciding information practices[5].

Finding personal conduct standards (that is, related examples) from organization can be amazingly valuable in different applications that require fine grain perception of actual conditions (for instance, transportation organizations, structures, war zones) which may deal with essential conditions, for example, poisonous gas holes, fire and blast [6]. Affiliation examples can likewise push off to distinguish future occasion sources. Finding the future occasion source may cause the forecast of flawed hubs, in any mobile organization [7]. For example, affiliation design mining perceives the occasion of event from a particular hub, in any case no such occasion has been accounted for successively; this indicates the likelihood of mobile hub disappointment [8]. It can too perceives the beginning of ensuing occasion when affiliated examples lies over chain of related occasions, for instance, issue experienced in explicit cycle on mobile, may triggers flaws in resulting measure additionally [9]. Cooperative examples can uncover a progression of transiently related mobile hubs [10]. Those examples can upgrade activity highlights (For instance, perceiving missed perusing and strong asset the board, rest alert timetable hubs on mobile). Despite the fact that there are tremendous mining approaches have been researched in the past to remove rules from mobile hubs associated in the organization, affiliation rule mining in reason for continuous mobile availability from information stream isn't so natural. A case of agent based affiliation rule age could be (MA_1,MA_2→MA_3,80%,λ), which can be interpreted as trails: assuming occasions from MA_1 and MA_2 are gotten, there is 80% shot at achieving an occasion from mobile agent MA_3 inside the 'λ' timeframe. Rule system depends on limitation named as least help edge which addresses least lower destined for help of affiliation rules result. Assuming least help edge is set as high, higher worth information is removed.

Therefore, if the base help limit is lower, an extremely enormous measure of affiliation rules are delivered, as these standards are non-educational. In this examination, legitimate connection among information objects of mobile agents secures invalid inspecting of information on account of trivial guidelines. As mobile agents set up occasions among mobile hubs, it is fundamental to use appropriate measures to accomplish personal conduct standards that have more grounded relationship of information. In this manner, re-inspecting of information objects in mobile agents can be performed. In order to determine this emergency, in this examination, an affiliation rule based mining approach with a plan of tree structure is expected. The system is named as Mobi-X engineering[8]. The expected standards of conduct catches affiliation rules of mobile agents as well as

development of tree for constant mobile agent system is used to create virtual encounters like slip by time during rule mining in the field of horticulture. As mining of affiliation occasions identified with agent information is exceptionally huge in assorted constant applications, no such system has been displayed yet.

The critical test in mining affiliation occasions of mobile agents are:

(1) A appropriate plan to find related examples of mobile occasions by protecting the properties of mobile network to ensure search space decrease;

(2) Modelling a tree structure for ongoing mobile agents that are able to procure information content in occasion foundation and to get predominant mining execution.

(3) Previous data from mobile agents may goes to be more insignificant for impending occasion foundation among mobile hubs, it is crucial for plan the tree structure more versatile[9]. Hence, most recent data can be caught all the more adequately, along these lines making ideal usage of memory and take out total arrangement of recent developments based affiliation rule set. To give such tree development, reasonable information re-examining must be resolved.

This work offers strategies to dig affiliation rule for agents and in view of this after commitments are made:

- To characterize a novel kind of Mobile agent named as Mobi-X design for affiliation rule age to mobile agent and to gain the connection among information objects.
- So as to accomplish such affiliation rule, a very conservative trees structure named X-affiliation mine tree (X-AMT) and mining calculation that can practically find design from mobile agents with single sweep of information objects.
- X-AMT tree is additionally improved with re-examining approach with sliding window approach and mining calculation is expected. This takes out ongoing affiliation design throughout information objects in both time effective and memory use. Re-inspecting is adjusted during the development of tree to manage the changing idea of information objects and to ensure prevalent usage of memory.

The remainder of this paper is coordinated as follows. In Section 2, the connected works are depicted exhaustively. In area 3, issue detailing of mining related examples and proposed Mobi-X tree structure is introduced. In Section 4, is exploratory outcomes are introduced and examined. At last, Section 5 finishes up the paper.

## 2. RELATED WORKS

In [11], A.Saleem Raja, offer overview of Agent based distributed data mining architecture; Distributed Association Rule Mining algorithms and an inside view of prevailing agent sourced association rule mining frameworks and specify the issues in prevailing framework. At last, the author provides framework termed Mobile Agent based Distributed Association Rule Mining (MAD-ARM), which is tried to eliminate communication overhead and guarantee mobile agent security. In [12],G.S. Bhamra et al, provides an effort to reconsider the functionality of Mobile Agents in Distributed Association Rules Mining. The perspective of

inside view of prevailing frameworks in this domain offered and a novel implementation and design termed Agent enriched Mining of Strong Association Rules (AeMSAR) from Distributed Data Sources is provided. Outcomes are verified and validated and would be integrated in upcoming work.In [13], Gongzhu Hu et al, explained numerous kinds of agents are utilized to carry out encryption and decryption of secure sum operations and secure union. In this investigation, with 8000 transactions, the outcome (optimal frequent k-item set) by this method utilized to data distributed moves over three sites is similar as an outcome that would be attained from Aprior algorithm with similar data resides over single host. Data performed using agents are indistinguishable and scrambled and being encrypted and decrypted when entire hosts participate. In [14], P.T.Kavitha et al, spotlights the crisis of mining frequent item sets on distributed and dynamic data sets in diverse distributed and parallel systems with static and mobile agents. The author anticipate a technique to reduce response time and rises the knowledge mining accuracy for global set of frequent item sets, so as to determine frequent item patterns in infrequent item sets. In the further direction, the static agents concept can be substitute using indexing approach can be utilized in regions such as unmanned vehicles, robotics and so on. to offer communication procedure amongst distributed systems in an effectual manner.

In [15], Yue Fuqiang et al, acquire an attain a superior accuracy of outlier detection algorithm, to ensure algorithm in space and time efficiencty, in this work are sourced on model anticipated DDMMMA distributed data mining point of displaced clusters, large scale data stream mining crisis distributed to every local agent on autonomous, therefore to be distributed algorithm to diminish space complexity of algorithm, however also diminishes time complexity of algorithm, the modelling of novel frequent pattern-based local outliers detection algorithm. In distributed algorithm, node in distributed data stream distribution in certain time period is frequently related with global distribution of difference, node detected outliers may be extremely distributed in other nodes in significant data. Henceforth, every node merely consider local outlier detection is not suitable. In [16], Yashaswini Joshi et al, anticipated MADFPM algorithm for frequent pattern mining of distributed databases utilizes mobile agents and determined to be superior based on performance. MADFPM performance is superior than traditional client-server model as pre-processed compact data in disjoint matrix form is modified to central site instead of transferring complete data to central site and then processing is performed. MADFPM performance is also superior in contrast to other mobile agent-based techniques, PMFI-A and PMFI as it diminishes network traffic and computational cost. In [17], Darshana Patel et al, examined mobile agent algorithms in application of data mining domain and with merging of effectual agent algorithm and novel design of D-Apriori algorithm and can attain quicker data retrieval for distributed data mining. Mobile agent paradigm consumes decreased latency and bandwidth. It is observed when local model is lesser than local data; transmitting model only, diminishes load on network and requirement of network bandwidth. As well, sharing merely model, indeed of data, offers reasonable security for certain organizations as it prevail over privacy issues. Consequently, entire local models are aggregated to offer last model by aggregation, reduced data transfer is subsequent key attribute of resourceful DDM algorithm. As well, effectual, complex and robust characteristics can be realized with mild code.

In [18], Xining Li et al, discussed the strategy of mobile agents deployment in DDM applications. The benefits of adopting mobile agents for DDM are to scale dynamic, large and remote data sources, where diverse databases distributed over Internet. The author modelled database management module and data service discovery module. Programming interface of that module is to set system construct recognizes competency to merge logic programming language with functionality of placing data services and managing remote databases. Based on those system tools, mobile agents may investigate data sites, move over internet to accumulate helpful information and communicate with every other to produce global perspective of data over aggregation of distributed computations. In [19], Vuda Sreenivasa Rao et al, illustrated Distributed Data Mining (DDM) field based on these confronts in examining distributed data and provides numerous algorithmic solutions to carry out diverse data analysis and mining operations in a basically distributed way that provides careful concentration to resource limitations. As multi-agent systems are frequently distributed and agents have reactive and proactive characteristics which are extremely resourceful for Knowledge Management Systems, merging MAS with DDM for data intensive applications is demanding. In [20], Romeo Mark A. Mateo et al, anticipate expert mobile agent (EMA) that carry out data mining to assist patient diagnosis. EMA utilizes neuro-fuzzy to develop consultation function. As well, pre-processing of appropriate data based on expert profile is illustrated to train fuzzy systems more effectually. Outcomes from simulation demonstrate neuro-fuzzy performed other superior accurate classifiers. As a future work, the functionality of the anticipated works on multi-agent framework in ubiquitous healthcare.

## 3. PROPOSED METHODOLOGY

As a general rule, programming agent indicates smart program that do a few errands concerning clients and capacities like an individual associate. Programming agents are outfitted with the versatility property and it is named as mobile agents. Generally, mobile agents are a self-governing movable program which can move or move from its own host control starting with one hub then onto the next in heterogeneous organization to do certain undertakings. In this manner, program that capacities over have are suspended during execution at a discretionary point, and moves to another host (demand host to next objective) and execution continued from suspension point. As an agent is put, it will continue to work despite the fact that the client is detached from network. They execute computational allegory that is similar to how individuals complete business in day by day schedule that is, visiting a spot, use administration and move. At the point when an agent procures a worker, it is apportioned to an agent execution climate. Too, it has certain verification qualifications; its beginning part is started.

To complete this errand, mobile agent can move itself to resulting worker in assurance of administration/asset, generate new agents or speak with other fixed agents. With culmination, mobile agents get the results to sending customer or another worker.

### *(i) Pattern mining through mobile agent*

This part exhaustively indicates the ostensible meaning of critical thoughts needed to deal with related examples of item information to produce affiliation rule [21]. As no all around procured metric beats to assess design, whole certainty is raised as an action that can gain genuine transient connections between information objects which is used in late examinations. In any case, all certainty assessment protects descending conclusion property. Consequently, this certainty measure is used to mine related examples from information streams. Expect two cases, previous is distinguishing related examples from whole information streams, last is decide late affiliation design from information streams as in Table I.

**Table I: Time slot and epoch of mobile data stream**

| Time Slot | Period |
|---|---|
| 1 | $D_1$ $D_2$ $D_3$ $D_4$ $D_7$ $D_8$ |
| 2 | $D_1$ $D_5$ $D_6$ |
| 3 | $D_2$ $D_5$ $D_6$ $D_7$ $D_8$ |
| 4 | $D_1$ $D_2$ $D_4$ $D_7$ |
| 5 | $D_1$ $D_2$ $D_4$ $D_5$ |

Lemma 1 (Associated Pattern): An information stream design is supposed to be related example, if certainty design is higher than or equivalent to gave least certainty edge, min_patt_conf. For certain and boundaries: least help limit for information object designs is determined as min_sup and min_patt_conf performed by application/client, the emergency related with related example can be given as: depicting total example set with help and certainty which isn't lesser that particular edge.

It is viewed as that network design involves set of mobile hubs conveyed in impromptu way and report the gathered information to sink. A short time later, sink models periods/age (as in Table I) from got information and jelly it in data set.

### *(ii) Mobi-X design*

For Mobi-X design, think about mobile organization engineering, with age tuple and schedule openings [22]. Different cases experienced in mobile correspondence through mobile agents are thought of and decided as different cases, they are given underneath:

Case 1: Define a mobile information stream officially with an endless succession of ages, Mobile information stream = D_1,D_2,… D_n, where E_TS(r) ,r ∈[1,n], where 'r' is shown up age. All age is considered as tuple E(E_TS,Y). Sliding window 'W' is indicated as set of whole ages among r^th and s^th (s > r) ages and 'W' window size is |W|= s-r. MDS (mobile information stream) with sliding window includes three groups. On the off chance that there is 'M' age and 'N' clusters in 'W'', each group involves M/N ages; in this manner, size of each bunch is given as |M/N|. Here, sliding window is given clump to-bunch, that is, sliding amasses new cluster and disposes of more seasoned group from present window.

Case 2: (Support for information designs in sliding window 'W'): Support of information stream design 'X' in window 'W' is determined as Support_W (X) indicates measure of ages in 'W' that contains 'X'. Hereafter, information stream designs is named as incessant in sliding window 'W', if support isn't lesser than min_sup, that is, $0 \leq min\_sup \; 〚 \leq |W| 〛$ .

Case 3: (Association information design 'X' in 'W'): Data design 'X' is named as affiliation example of 'W', if the certainty is higher than or equivalent to gave least certainty limit of 'W'. For a gave MDS, |W|, min_sup and min_conf, the issue in mining related information stream is to decide whole example in|W| which has an action lesser than separate edges, which is set of as of late got design in mobile information stream.

Backing: Rules hold with help (Sup) in mobile exchange dataset, if support % of exchanges involves $D_1 \cap D_2$. Likelihood of involves exchanges An and B information exchanges.
Certainty: Rules holds in 'T' with certainty conf % of exchanges that contain D_1 and D_2.

***(iii) Mobi-X information tree (X-AMT)***

In this part, the plan of Mobi-X tree structure is furnished in an arranged construction with pre-characterized mobile hubs in standard request, that is, in plunging or rising request. It is planned by perusing age individually from mobile information stream with pre-characterized request and guides each age in the way of prefixed tree. Thusly, prefix tree can be indicated as information stream in packed structure, while different ages share assorted information practically speaking. This kind of way covering is determined as pre-fix sharing [23]. Pre-fix tree structure goes to be more compressive while prefix-sharing occurs. As a result, prefix sharing gets gigantic addition whole mining measure.

The at first expected Mobi-X tree structure is planned by assessing ages from mobile hub information base with simply one output. Therefore, MDS is unbounded, persistent and requested information arrangement. Hence, it is inadequate to keep up with whole components of mobile information stream in tree throughout tremendous measure of time. Notwithstanding, past data are out-dated and current data may diverts to be more critical from the mark of information revelation. To manage this situation, Mobi-X tree structure is developed with sliding window model which uses sliding window to notice ongoing ages.

***(iv) Mobi-X tree usefulness***

The starter idea driving Mobi-X tree structure is the development of pre-fix tree which is fabricated dependent on the request for information stream appearance into the hub network, after that rebuild tree in recurrence slipping request and finally pack tree by incorporating support mobile hub in each part of tree. Then, at that point design development strategy is utilized to mine connected information design from Mobi-X tree structure [24, 25]. This tree development contains two stages: addition stage and pressure stage. The development interaction of Mobi-X tree depends on mobile hub data set.

If there should be an occurrence of inclusion stage, Mobi-X tree puts together hubs in agreement to hubs' appearance into data set and it is built by embeddings every age is information base in a steady progression to it. In this stage, Mobi-X tree keeps a hub control list (NO-rundown). NO-rundown involves unmistakable hub found in all ages in data set in understanding to appearance request and contains support worth of each thing in information base.

Fundamentally, Mobi-X tree is unfilled without any branches, and starts the development with invalid root hub as displayed . With mobile hub data set, as in Table I, first age (that is, TS =1) {D_1 D_2 D_3 D_4 D_7 D_8} is embedded to tree < { } D_1:1 D_2 : 1 D_3 :1 D_4 :1 D_7 :1 D_8 : 1 > limit. In this manner, starting tree limb is worked with D_1 as essential hub (after root hub) and D_8 is last hub. Backing tally sections for mobile hubs D_1 D_2 D_3 D_4 D_7 D_8 and refreshed in same time. Prior to embeddings second age, mobile hub of TS = 2 are arranged from {D_1,D_5,D_6} requested as {D_1,D_2,D_3,D_4,D_7,D_8,D_5,D_6} to protect NO-rundown and supplement TS=2 into tree. Thusly, in the wake of adding all ages (TS=6), complete Mobi-X tree is planned. Sense that each hub in Mobi-X tree contains regular event of ages. The last NO-rundown of built Mobi-X tree structure is given as NO. Here, addition stage and rebuild pressure stage.

A definitive target of rebuilding pressure stage is to accomplish amazingly minimized Mobi-X tree construction will utilizes more modest memory and help speedier mining measure. In this stage, at first sort NO in slipping request using blend sort and re-structure tree structure in agreement to plummeting request. To recreate Mobi-X tree, tree rebuilding approach is called as (branch sort approach) expected in CP-tree. Branch sort uses combine sort to sort every way of tree structure. This method at first takes out unsorted ways; accordingly sort whole way and re-embeds into tree. In this segment, a basic and an adequate pressure approach that picks comparative help mobile hubs in each branch and union them into single hub. At last, Mobi-X tree is organized and compacted.

Despite the fact that Mobi-X tree and CP tree have certain similitudes in development tree stage, nonetheless ensuing contrasts exist: I) Mobi-X tree complete pressure that combines same help hubs in single hub and consequently it is reduced [25]. This ensures that Mobi-X tree manages lesser hubs than CP-tree. ii) Subsequently, memory of Mobi-X tree is lesser than CP tree. iii) CP tree utilizes FP-development based mining way to deal with build regular examples. Consequently, FP development mining can't be straightforwardly applied on Mobi-X tree as it mines not only incessant hub designs [26, 27], nonetheless successive related hub designs. From now on, design mining approach can be managed extra Mobi-X tree[28, 29].

*Algorithm 1:*

Input: Mobile data set, hub appearance request, min_sup, min_conf

Output: Association example of mobile hubs

Stage 1: Begin

Stage 2: Not in list

Stage 3: Mobi-X tree - tree with invalid instatement

Stage 4: while (end of NO) do

Stage 5: Scan an age from hub area in mobile data set

Stage 6: Insert filtered age into Mobi-X tree in understanding to FP tree development

Stage 7: end while

Stage 8: Compute FP tree from NO in plummeting request with combine sort approach;

Stage 9: for each branch in Mobi-X tree do

Stage 10: Sort branch in FP utilizing branch arranging approach

Stage 11: end for

Stage 12: for each branch is re-developed Mobi-X tree do

Stage 13: Recognize support hub in each branch and union them to single hub

Stage 14: end for

Stage 15: while mining demand from client do

Stage 16: Input min_sup and min_conf from client

Stage 17: for hub from NO-rundown do

Stage 18: Mining (NO rundown)

Stage 19: end for

Stage 20: end while

Stage 21: end

The fundamental activities of related example mining from Mobi-X tree are: i) checking length simultaneous hub ii) creating restrictive example for each hub, and iii) displaying contingent tree for each example base. In this manner, related example are developed from restrictive tree

Here, development of very conservative Mobi-X tree works with subsequent mining of related information object design utilizing design approach. The same of FP development mining procedures, it mines recursively Mobi-X tree of diminishing size to deliver related examples by creating contingent example base and partner restrictive trees without any additional data set sweep. To bargain added highlights of Mobi-X tree, design mining technique contrived dependent on FP development.

## 4. CONCLUSION

In this work, a novel affiliation designs identified with mobile hub that catches the co-occurences and transient connections among hubs. To remove those examples, a tree engineering named as Mobi-X design that stores information in compacted way, sourced on this Mobi-X tree a mining calculation called sliding window is expected which usefully mines affiliation designs over data sets in a single sweep. As it's anything but functional to save all components of mobile information in a tree, when tree are broke down and caught for stream. Here, a further developed tree structure named mobi-X tree which strongly perceives affiliation designs from mobile

stream information in single pass with sliding window. With this proposed model, tree can be fabricate once and mined utilizing various properties, subsequently making it amazingly fitting for intelligent mining. To advance asset use, a way to deal with adjust window size progressively is given here. The examination of execution breaks down portrays that the expected methodology was very productive and solid for mining affiliation design over mobile information and outflanks winning methodologies in both memory use and runtime, and also scale it to negotiable measure of different stages in the field of horticulture. In future, the examination will be stretched out to use separated information to improve functional effectiveness of mobile agents, and consequently to accomplish longer lifetime and to advance solid correspondences in further areas of horticulture.

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**P-4**

## EXPLORATION OF PRECISION AGRICULTURE USING WIRELESS SENSOR NETWORKS

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## ABSTRACT

Agriculture is very important to human beings as it serves the basic needs of people and acts as a backbone for the economy of the country. Precision agriculture involves the use of modern technologies which helps farmers to utilize their resources effectively to get more yield and profit. Wireless sensor networks can be used to monitor the agriculture field, to improve the production and to reduce the cost and wastage in farming. They help farmers to decide the site in which plants can be grown effectively with real time data collection about the field information. The real time data collected can be used to decide the amount of water, fertilizer and other resources required for plantation. In order to monitor the agriculture field, various parameters like soil moisture, temperature, humidity are considered. Sensors are deployed in the agricultural field in which crops are to be grown. These sensors are responsible for real time data collection. They closely monitor the field, collect data periodically and transmit those data to the centralized control unit. In addition to the sensors and control unit, there are routers, communication gateways, power systems and user interface elements available in a Wireless Senor Network. All these components help in data collection and real time field monitoring for improving the growth and yield of plants. They also help in providing right amount of resources required for the plants. In this paper, we review the application of wireless sensor networks in precision agriculture. This review also focuses on the comparison of various approaches adapted in the literature for precision agriculture

**Keywords:** Precision Agriculture, Wireless Sensor Networks, IoT, Sensors.

## 1. INTRODUCTION

Nowadays Agriculture sector is drastically improving with the invention and use of new technologies. There are different types of new technologies available to improve agriculture and precision agriculture has become a popular method to improve the yield with the available resources. The use of modern technologies like Internet of Things, drones and block chain to monitor the agriculture process is termed as precision agriculture[1]. By using these modern methods, farmers will be able to cultivate the crops which are suitable for the type of the soil, atmosphere and resources they have. Precision agriculture helps farmers to reduce the cost of production so that they will get profit for their product. This technique also helps to increase the productivity rate and

reduce wastage in agriculture as it continuously monitors the agriculture field and collects relevant data. In order to monitor the field, Wireless Sensor Networks (WSN) are used[2].

A WSN contains sensors which are capable of sensing the environment in which they are placed and are able to gather field data, send them to a place called base station. The base station will read the collected data and analyze them in order to take a decision. The advantage of using WSN in these kind of applications is that it is easy to deploy the sensor nodes in the field. As nodes can communicate among themselves and also to the base station without wired infrastructure, the deployment becomes very simple. Thus it is quite easy to deploy such sensors without investing huge amount. With powerful sensors, it is possible to cover huge agricultural areas for the purpose of monitoring the field. There are some important features to be considered while deploying and using the sensor nodes for data collection and transmission. Energy conservation is one such feature which is to be mainly considered as these sensor nodes may consume lot of energy while trying to acquire data for transmission. Another feature to be considered is the type of data transmission [3] from sensor nodes to the central point of data aggregation. If sensor nodes consume high energy, it will not be possible to efficiently monitor the field continuously for a log period. Hence energy efficiency is vital for the sensor nodes. After collecting data, they need to be properly transmitted to the destination using the shortest path.

Data collected by the wireless sensor nodes are to be stored in the cloud environment by using Internet of Things (IoT) technology so that it will be helpful for efficient utilization of various agricultural resources like soil, water, fertilizer, pesticide etc.,[4]. IoT enables farmers to monitor remote agricultural fields and helps us to gather and analyze huge data efficiently. By combining IoT with cloud and WSN, farmers can monitor and control their field efficiently. Hence in this review, we analyze these three aspects in precision agriculture namely WSN, IoT and Cloud technology.

The rest of this paper is organized in the following manner. Previous work related to the review is presented in Section 2. Precision agriculture technique is discussed in Section 3. Application of WSN for precision agriculture is presented in Section 4. Various approaches used in precision agriculture are compared in Section 5. Finally, Conclusions are drawn in Section 6.

## 2. LITERATURE REVIEW

D.D.Dasig Jr.[1] proposed the deployment of IoT based precision agriculture and also developed an online crop management system. The author developed an application which provides various environmental details of the form like temperature, water level, pH value and dissolved oxygen level. These details will help the formers to analyze their field condition and manage it. Mina Mirhosseini et al.[2] introduced an improved version of a search algorithm which improves the energy consumption of Wireless Sensor Network. The proposed method improved the operation of network and sensors. Fekher Khelifi [3] proposed a new agriculture monitoring method to provide an efficient coverage of the field. The author showed that the proposed method improves energy

efficiency and network lifetime. P. Sanjeevi et al. [4] proposed an algorithm which provides an effective way of coverage of the agricultural area by deploying the sensor nodes using region based cluster approach. The proposed system will be helpful for efficient utilization of resources, thereby solving the problem of irrigation shortage. Alexandros Zervopoulos et al. [5] proposed the installation of a WSN which can improve the sensing of nodes in the field. D. Anitha et al[6] proposed a method which mainly focuses on soil moisture data to predict plant growth. The authors analyzed that the proposed method will prevent usage of excess water thereby saving water resources for the formers. Yousef Hamouda and Mohammed Msallam[7] proposed a precision agriculture system which improves the energy consumption of sensor nodes in a wireless environment. In addition to this the system is capable of increasing the lifetime of network while maintaining soil moisture which will increase the crop yield. Naila Nawaz Malik et al. [8] analyzed the issues of precision agriculture like soil moisture, humidity and temperature. The authors also developed an interface to analyze the results of the network which collects the data.

## 3. PRECISION AGRICULTURE

Precision agriculture is the combination of several modern technologies like telecommunication, mobile computing, information processing, remote sensing, Global Positioning System (GPS) and Geographic Information System (GIS) [9]. The goal of precision agriculture is to achieve maximum productivity with minimum available resources. This is possible by incorporating variabilities in the yield, soil, field and crop. Sensors and GPS technology can be used to manage different types of variabilities. By using sensors, remote fields can be monitored, soil in those fields can be analyzed and based on this, over or under usage of fertilizer or pesticides is known. By managing temporal and spatial variability in the field, production is increased. Risks like crop damage and wastage of crops are reduced, resulting in high profit. Precision agriculture also helps farmers by providing environmental factors which are specific to their agriculture field. Environmental factors like soil, temperature, water, humidity and light affect the growth of crops [10]. Precision agriculture helps farmers to overcome several problems by monitoring the field and recommending the right amount of resources. Pest attack is an important factor to be considered in agriculture which is closely associated with crop growth. This results in low production. Disease prediction in the crop can be done in precision agriculture. This will help farmers to take some precautionary measures to avoid damage in crops [11]. Image of plants are collected by sensors and analyzed for predicting the disease. Various image processing techniques are applied in this case in order to accurately identify the disease. In addition to image processing, data mining techniques are also applicable in collecting, analyzing and visualizing the results.

## 4. WIRELESS SENSOR NETWORKS FOR PRECISION AGRICULTURE

Wireless Sensor Network is a collection of sensing devices which are distributed over some geographical area and are capable of collecting the environmental factors and transmitting them to sink nodes. Sensor nodes are deployed in the agricultural field for gathering various environmental parameters like humidity, temperature, soil moisture, water level etc., Various routing protocols are examined in the literature for carrying the

transmitted data to the destination. They include Ad-hoc on demand distance vector routing (AODV), Ad-hoc on demand multipath distance vector routing (AOMDV), Dynamic Source Routing (DSR) etc., [12]. WSNs are built using star, mesh or tree topologies [13]. Star is a single-hop topology in which every node communicates to the other node only through the cluster head which is the central hub. In mesh every node can directly communicate to the other node without connecting to a central node. Hence in this arrangement, every sensor node is acting as a relay node in transmitting data to the other node. Tree is a multi-hop topology. In this type of arrangement, one root node and many cluster nodes are used for data transmission. Every cluster consists of a set of sensor nodes. Data gathered from these nodes are passed to nearby cluster heads and they in turn carry data to the root node.

There are two categories of WSN namely structured and unstructured. In unstructured WSN, dense nodes are used to monitor a particular area and this leads to difficulty in maintaining the network. In structured WSN instead of densely populated nodes, only few nodes are used for monitoring and hence it is easy to manage the network. The advantage of using wireless sensor network in precision agriculture is that it can be easily deployed without investing huge amount for its infrastructure. WSNs are preferred for precision agriculture due to various reasons. Nodes of WSN are capable of self-healing [14]. They are also capable of sensing the environment and transmitting data with low power. Though there are various reasons for the popularity of WSN for precision agriculture, there are some limitations which are to be resolved. Energy efficiency, deployment of sensor nodes, routing protocols, cost, communication range, fault tolerance and scalability are important factors to be considered in WSNs[15]. Energy efficiency can be achieved by minimizing collision in the network. Protocols which work on time division multiple access scheme help in minimizing collisions[16]. Apart from this, there are some situations in which transmission of packet takes place when the receiver is not ready (also known as over emitting) and nodes receive packets which are not destined for them (also known as overhearing). It is possible to conserve energy of WSNs by minimizing the aforementioned situations with the proper usage of protocols and routing mechanisms. Transceivers in the network consume most of the energy to transmit and receive data. Hence incorporating sleep mode in the nodes will conserve energy since communication will not take place during sleep mode. Radio optimization techniques will also help in conserving energy in the sensor nodes. Another method to reduce energy consumption is to reduce data transmission from transmitters to receivers.

In addition to WSN, there are other types of solutions available for precision agriculture namely wireless multimedia sensor networks, applications based on mobility of nodes, tag-based systems and smart-phone based applications [17]. These solutions are viewed as alternatives for solving problems in precision agriculture.

## 5. APPROACHES USED IN PRECION AGRICULTURE

Possible approaches used in the literature for improving precision agriculture are analyzed in this section.

- **Using IoT Architecture**:

Different layers like IoT device layer, IoT gateway layer and IoT platform layer are designed in this approach. The sensor nodes in the device layer are responsible for reading the temperature, dissolved oxygen and water level. The sensor node will monitor the environmental factors in the field.

- **Path optimization**:

  Unmanned aerial vehicles (UAVs) are employed to collect observed data from the sensor nodes. A model is developed here in which the UAV path is optimized to reduce the flight time and increase the life time of sensors.

- **Path loss prediction**:

  In order to transmit accurate data, sensor nodes which are placed in the agriculture fields should communicate properly but this might be a problem when the signal travelling from one sensor node gets attenuated before it reaches the other node. Due to this loss of signal, we may not be able to get accurate data from the sensors. This problem is solved by predicting the path loss in the network

- **Synchronization of WSN**:

  Time synchronization is an important issue to be considered when real time data from the agricultural field are to be transmitted to the destination for taking correct decision. Since there are numerous nodes available in the field, their local clock may differ. This results in time variation whenever an event occurs. To overcome this issue, a synchronization scheme is applied.

- **Routing protocol:**

  Though there are various reasons for depletion of energy in sensor nodes, data transmission and complex routing process are major cause of concern. Thus designing a proper routing protocol is important. Application of energy efficient routing protocol will reduce the energy consumption and load in the cluster heads.

- **Variable sampling interval:**

  Sampling interval is the time between two sensing events. This may be applied for measuring two agricultural parameters. In traditional method, this sampling interval is constant. As an alternate method, a variable sampling interval is proposed to efficiently use water for the crop depending on the soil condition. This method treats different areas of the field differently based on the soil condition. Table 1 presents the work reported in literature on application of WSN for precision agriculture.

**Table 1 : Summarizes various approaches used in precision agriculture**

| *Author* | *Work Done* | *Tools/Techniques/Algorithms used* |
|---|---|---|
| D. D. Dasig Jr.[1] | Online Crop Management System which is based on IoT and WSN was developed | IoT device layer, gateway layer and platform layer |
| Mina Mirhosseini et al.[2] | Environmental conditions in precision agriculture was monitored. Energy consumption of WSN improved | Binary Quantum-Inspired Gravitational Search Algorithm was improved and used |
| Fekher Khelifi [3] | Developed a field monitoring system for efficient coverage of agricultural area | Routing algorithm which is based on the clusters was proposed for energy efficiency in WSN |
| Sanjeevi et al. [4] | Proposed an architecture based on WSN for monitoring agriculture | IoT system with WSN and Arduino technology |
| Alexandros Zervopoulos et al. [5] | Designed and installed a system with improved sensing aspects for precision agriculture | Synchronization mechanism is applied in WSN |
| D. Anitha et al. [6] | Plant growth is predicted by analyzing soil moisture data | Polynomial regression is applied for data analysis |
| Yousef Hamouda and Mohammed Msallam [7] | Proposed a system with variable sampling interval for precision agriculture | Sampling interval selection algorithm is used and evaluated using event-driven simulation |
| Naila Nawaz Malik et al. [8] | Virtual Environment is set for monitoring environmental parameters | NS2 simulator was used to analyze the results and network issues are discussed |
| N. Zhang et al.[9] | Reviewed various precision agriculture technologies | Different research databases were extracted for analysis. |
| Mohamed Rawidean Mohd Kassim et al. [10] | Designed an Intelligent Greenhouse Monitoring System which is based on WSN | A web-based application was developed with real-time sensors, sensor configuration environment and expert system support |

| | | |
|---|---|---|
| Uferah Shafi et al. [11] | Reviewed different sensors, communication technologies of WSN and also presented a case study of WSN for precision agriculture | Different research databases were extracted for analysis. |
| R.Balamurali and K. Kathiravan [12] | Compared various routing algorithms using WSN | Simulated in NS 2.35 for testing the routing protocols |
| Mohammad Hossein Anisi et al. [13] | Reviewed WSN technologies, classified and analyzed their energy efficiency in precision agriculture | Different research databases were extracted for analysis. |
| Mr. Kunal Goel and Dr. Amit Kumar Bindal[14] | Reviewed various sensors, routing algorithms and also discussed Microbial Fuel Cell used in precision agriculture | Different research databases were extracted for analysis. |
| Haider Mahmood Jawad et al.[15] | Reviewed the applications of WSN in precision agriculture, classified and compared various energy efficient WSN protocols | Different research databases were extracted for analysis. |
| Herman Sahota et al. [16] | Designed an energy efficient WSN for precision agriculture | Sensor data were collected periodically with MAC and Network layer design with routing protocols like S-MAC and T-MAC for energy efficiency |
| J.M. Barcelo-Ordinas et al. [17] | Reviewed various applications of WSN, surveyed various sensors, hardware and software solutions for precision agriculture | Different research databases were extracted for analysis. |
| Gilson E. Just, Jr. et al.[18] | Simulated a model with reduced flight time and increased life time of sensor | Developed a graphic UAV simulator for evaluating battery consumption |

| | | |
|---|---|---|
| | nodes through unmanned aerial vehicles (UAV) path optimization | of UAV, flight distance and flight time |
| AHMED et al [19] | Proposed a model to reduce network latency in the IoT-based precision agriculture | WiLD network and 6LoWPAN WSN networks are connected to reduce delay |
| Xuemei Li et al. [20] | Designed and implemented a WSN based greenhouse | A-node hardware was deployed in the green house along with software node node implementation |
| S. K. Dhillon et al. [21] | Reviewed various energy prediction techniques of WSN for precision agriculture | Different research databases were extracted for analysis. |
| M. Srbinovska et al. [22] | Designed a low-cost greenhouse monitoring system based on WSN | Low-power, low-cost WSN is built using nodes which belong to MSP430 microcontrollers |
| Madhumathi R et al. [23] | A software system was proposed to measure soil parameters for better production | Sensors are deployed and connected through Arduino microcontroller |
| G.Sahitya et al. [24] | Developed a system which collects sensor data for precision agriculture | WSN is designed using ZigBee devices. |
| Damien Wohwe Sambo et al. [25] | Proposed wireless underground sensor network path loss model for precision agriculture | Complex Dielectric Constant is predicted accurately and measurements are evaluated using real sensor nodes |
| A.M. Patokar and V.V. Gohokar [26] | Designed a multi-parameter monitoring system using WSN and IoT | Test assembly was created for working in real environment. |
| Dr.R.Malathi Ravindran, Mr.P.Prabhakaran [27] | Reviewed various WSN approaches for precision agriculture | Different research databases were extracted for analysis. |

| | | |
|---|---|---|
| Devi Kala Rathinam. D et al. [28] | Reviewed WSN techniques for modern agriculture | Different research databases were extracted for analysis. |
| Kashif Naseer Qureshi et al. [29] | Developed a system which conserves energy in WSN | Gateway energy-efficient routing protocol was proposed |
| Divyansh Thakur et al.[30] | Reviewed different WSN technologies, environmental parameters and communication technologies | Different research databases were extracted for analysis. |

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## 6. CONCLUSION

Precision agriculture is the practice of using various modern technologies like IoT, WSN, Cloud computing and so on. By adopting these technologies, we can reduce wastage of crops and increase their productivity. Based on the various environmental factors observed by the sensors deployed in the field, real time crop monitoring is possible. These observations help farmers to optimally use water, fertilizer, pesticide and other resources. Various environmental parameters like soil moisture, pH level, humidity, temperature can be monitored and using these values, it is possible to grow suitable crops in the agricultural field. Despite these advantages there are some issues to be addressed when modern techniques are used for precision agriculture. In this paper, we reviewed the application of WSN in precision agriculture and compared various approaches used in the literature. This study also highlights some major issues of WSN like energy consumption, path optimization and time synchronization.

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**P-5**

# CREATION OF DENSE M NETWORK FORM FOR MOBILE AGENT SUPPORTED EFFORT FLOW DEVELOPMENT WITH RECURRENT ITEM SET MINING IN FARMING PURPOSES

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## ABSTRACT

Mobile computing offers a solid platform for implementing enormous scope and complex effort process of mobile based applications with mobile specialists. Nonetheless, different difficulties, in explicit its optimal booking methodology for multiple clashing destinations are not yet settled as expected. Winning multi-target effort process planning methods are as yet confined from multiple points of view, for example, encoding is limited by earlier specialists' information while managing dynamic continuous emergency, which impacting the booking performance. In this examination, a Dense-M-network (DMN) model in mobile specialist reinforcement learning based framework for helping planning is performed. The effort process of mobile specialists over mobile network is noticed and optimization of multi-work process completion time is assessed. For this reason, Markov chain based weighted incessant item set is intended for assessing the effort process of mobile applications and to assess state contribution of relating applications. The weighted incessant item set is competent of related equilibrium between make length computation without earlier master information and incorporates with the strategies of dynamic ongoing environment. To approve the performance of expected model, a broad simulation was done and it outperforms the regular models like multi-target PSO, DQN algorithm in terms of optimal plan production for farming applications.

**Key words:** Mobile agents, Markov chain, Modelling, Q-Learning, Reinforcement learning, aberrant learning, weighted frequent item set.

## 1. INTRODUCTION

Mobile computing is a world view to manage agents in portable systems administration. It is explicitly utilized for conveyance and use method of data services and IT assets to offer software, foundation, stage and applications by means of versatile organization in adaptable and on-request way [1]. Versatile processing develops half breed application climate with information mining, distributed computing, portable edges, web by upgrading stockpiling capacity and computational capacity over versatile terminals and offering clients with clever and rich useful experience. Additionally, versatile registering acquires the two detriments and benefits of mining and portable web[2]. The Features of transparency, asset imperatives and vulnerability causes higher un-dependability in Quality of Service (QoS) and more prominent vulnerability arrangement alongside extreme security emergency in portable systems administration[3]. Explicitly in opposite side of complex service prerequisites, how to ensure believability of blended services and how to accomplish viable service arrangement have turned as a hotly debated issue in portable registering based investigates[4]. Various service structure and undertaking booking techniques have been expected for regular Internet climate[5]. In addition, they can't bargain the dynamic members joint effort in versatile processing markets. For this reason, agent based versatile registering models are presented[6]. Multi-agent demonstrating alongside portable cloud frameworks is amazingly less complex to project knowledge, self-rule and inception of cloud substances and to secure free advancement of cloud service market, which is closer to business market quintessence[7].

As of late, more novel AI are turning out to be dynamically more impressive and flexible, significant exploration endeavours are compensated for utilizing Q-learning based calculations and reinforcement calculations in deciding close ideal effort process planning with service-of-level (SLA) understanding limitations]. Despite the fact that there are more multi-agent reinforcement learning (MARL) models and approaches for multi-robot control, appropriated load adjusting, de-brought together organization directing, traffic light issues and electronic closeouts, MARL based effort process planning approaches are non-existent till date [8-9].

Regarding above perceptions, in this examination, we model a booking issue into multi-measures association based weighted Markov affix and discrete-occasions to expect Multi-agent reinforcement learning based structure with Dense-M-Network (DMN) for multi-target effort process planning focusing at enhancing both effort process finish cost and time. Here, DMN agents are prepared with Multi-agent reinforcement learning climate and gave to information from inheritance framework like neural organization heuristics. Consider each DMN agent's detects any remaining agents' prizes and activities and pick its joint conveyance activity notwithstanding natural updation[10].

The expected model is furnished with following advantages:

- Agents are prepared for effort process planning with heterogeneous VM and various sorts of interaction model with changing asset designs;
- Scheduling plan with multi-way effort process can be achieved without mediation of human or with earlier master information. Broad planning cases were completed with various effort process formats throughout reproduction tests with constant information agents over versatile information. Trial results clearly show that the expected model effort solidly than customary ones regarding cost streamlining and make length.

To model DMN more viably, solid and palatable, the expected model needs to manage beneath given central issues are tended to:

- What is more fitting framework for multi-specialist based mobile computing model?
- How Mobile specialists associate with each other?
- As Multi-stream booking is setting mindful, what is an incorporated and useful trust management model?
- What learning algorithm is more fitting for taking care of customer administration inclinations?

In opposition to other winning examination efforts, this examination essentially focuses on impact with outside mechanisms on multi-stream booking measure. The fundamental commitment of this investigation is given underneath:

- Modelling Dense-M-network (DMN) for multi-target effort process booking scheme with trust mechanism.

- Anticipated planning model with Weighted Frequent example mining for assessment reason.
- Design of Markov chain model for assessing effort stream of mobile applications and to determine state contributions with client administration requirements in farming applications.

Also, different emphasis are completed in experimentation to prepare and test confided in mechanism and learning models with mobile computing. Rest of the investigation is coordinated as trails: Section II started brief related efforts. Area III gave network model notwithstanding configuration modelling. Markov chain based regular item set for trust assessment is expected. Performance assessment is furnished in segment IV alongside augmentation of future works.

## 2. RELATED WORKS

This part explains related exertion in setting to trust issues, multi-stream scheduling plan and reinforcement learning.

### a. Forecasts in Mobile Computing

Administration scheduling is a fundamental factor for influencing client fulfillment and execution of mobile computing frameworks [11]. Till date, investigators have been locked in with more elevated level exploration results. The traditional assignment scheduling calculations essentially focuses on optimization time, comprising Min-Min, Max-Min, RR, and FCFS, OLB MET, sufferage and its corresponding calculations[12]. As undertaking scheduling is NP-hard emergency, analysts gathers in laid accentuation in heuristic scheduling calculation, that includes Simulated Annealing, Genetic calculation, Particle Swarm Optimization, Ant Colony Optimization and so on [13].

The conventional assignment scheduling in mobile environment focuses on two components: 1) ability of scheduling frameworks are enhanced (load balancing, energy saving, throughput and so on), 2) optimizing mobile clients' QoS destinations (financial plan, deadline, security, decency and so forth) Creator in[14] expected asset co-designation approach for adequate burden balancing methodology. Investigator in [15] displayed an intellectual structure of bio-inspired plan to determine a model answer for scheduling task in IoT applications. Damian et al. predictable energy-effective methodology to schedule the task in various security constraints.

Effort on unparalleled dip of combined energy and self-sufficiency of mobile materials, certain different investigators carry out agent based mobile frameworks[16]. Author in [17] anticipated fourteen different heuristics scheduling approach for at the same time implementing sack of errands in mobile conditions and with a flexible clous asset distribution approach. They displayed an agent based Mobile BoT execution apparatus named Mobile agent to help concurrent BoTs execution in numerous agents.

In mobile administrations arrangement, creators expected an agent based model to structure that makes benefit in multi-cloud climate for assorted kinds of mobile administrations. To develop and execute administration creation of frameworks proficiently and viably in mobile computing climate, Author in[18] expected novel scheduling approaches and administration choice which could radically attain ideal organization based on decreased energy utilization, lesser running dangers and ideal QoS correspondingly.

In as divergent to the previously mentioned arrangements, this work altogether thinks of applying learning and trust method to further develop validity, to improve administration grouping and to advance effective exchange rate and client satisfaction over agent based mobile.

**b. Agent supported confidence in plan:**

Trust has been approved as a useful way to deal with resolve dependability and notoriety of issues in dispersed open conditions. Here, in [19] expected unique trust way to deal with measure correctly and distinguish clients' intellectual attributes. In 2015, Li demonstrated a trust mindful help brokering model and named it as T-dealer for useful assistance matching in mobile cloud climate. Likewise, Tan et al. given a combined weighted model based on relative entropy to gauge client qualities. Certain investigators focus on transformative calculations by merging trust instruments. Wang portrayed trust evaluation approach based on cloud model. In[20] autor demonstrated duplicity identification based trust model and excitation model. It portrayed trust based dynamic methodology for multi-agent mobile models. In [21], offered methods for trust assessment for cloud based agent applications. Wang et al. portrays trust based probabilistic suggestion approach for interpersonal interaction exercises. To satisfy trust necessities over multi-cloud networks, Author in [22] expected three-overlap arrangement comprising trust based bootstrapping, trust foundation and trust based libertine coalitional game. Deng et al. innovatively expected two-stage suggestion methodology to strongly push off profound learning in initialization and to usefully combine clients' interest with trusted models that solidly upgrades proposal accuracy and viability.

In [23], creator expected an optimization approach sourced in Gaussian model and another utility sourced way to deal with assess client inclination. Sourced on online diagram regularized client inclination learning (OGRPL), Author in [24] offered a novel system for bound together inclination learning method. With profound client inclination learning, Yin et al. expected novel administrations suggestion approach for digital actual frameworks. Yin likewise recommend administration quality expectation mode which is skilful to in co-work network area and unequivocal relationship among administrations and clients.

As of now, Reinforcement learning, game hypothetical models and approaches are widely used to multi-constraint measure scheduling emergency. It is viewed as that balance thought in multi-agent training approaches and game speculations are incredibly strong in handling multi-objective and multi-constraint optimization emergency. Duan et al. expected consecutive co-employable gaming calculation for make-range

and cost optimization while satisfying capacity constraints for huge scope work process scheduling. Creator in[25] offered reinforcement learning sourced model for multi-work process scheduling with various needs submitted at assorted times in cloud climate. Iran et al. expected confirmation control calculation and appropriated load balancing sourced on fluffy game-hypothetical model for huge scope SaaS mists. Wu et al. expected an improved Q-learning calculation with weighted wellness work for optimization of burden balancing and fulfilment time in cloud climate. Based on the most given examinations, clearly after each exchange, client assessment is quantifiable and clear which is incorrect in certain models. Now and again, client assessment over administrations is emotional to multi-work process. Hereafter, it is crucial for model a suitable and integrated trust assessment approach.

## 3. PROPOSED METHOD

Here, Dense-M-network (DMN) model in mobile specialist reinforcement learning based framework for helping planning is performed at first. Work process of mobile specialists over mobile network is noticed and optimization of multi-work process completion time is assessed hence. Then, Markov chain based weighted continuous item set is intended for assessing the work process of mobile applications and to assess state contribution of comparing applications. The weighted regular item set is competent of related equilibrium between make range computation without earlier master information and coordinates with the approaches of dynamic ongoing environment.

### a. Dense M Network structural design

This segment clarifies exhaustively about the proposed Dense M Network architecture (DMN). DMN architecture is a mobile specialist based methodology which is an overhauled form of reinforcement learning architecture that comprises inward world model and strategy learning. M-specialist model uses comprises of four states: current state(Cs_st), activity (Aa_st) as contribution, next state (Cs_(st+1)) and rewards (rds_(st+1)) as yields. Learning specialist utilizes ongoing experience of social affair information from different environments to build virtual model and update its comparing esteem work. This methodology is termed as immediate learning model. After approximation of virtual model over the environment, it ought to repeat virtual encounters to accomplish extra approach learning, termed as circuitous arranging or RL. DMN structural design co-ordinates reinforcement learning algorithm to produce DMN framework comprising activity, arranging, model learning and direct RL. Direct RL is one-venture learning measure, where model learning is executed to approve encounters (Cs_st,Aa_st,Cs_(st+1),rds_(st+1)). Mobile specialist randomly picks state-activity sets as information sources and anticipates next state and offers award as virtual encounters.

The expected model depends on Dense M Mobile network architecture be that as it may uses tree structure for modelling specialist based environment. Tree model is to create virtual encounters to increment added cycle esteems. From now on, the expected specialist comprises of two between leaving measure, backhanded learning and direct realizing, that is, arranging. In direct learning measure, mobile specialist notices environmental

information termed persistent states (Cs_(st+1)) and picks activity (Aa_st). Then, at that point, specialist travels to ensuing ceaseless state (Cs_(st+1)) and accomplishes (rds_(st+1)) reward. Activity and persistent state sets (Cs_(st+1), Aa_st) are embedded to set Ii_st.

The dense Mobile specialist totals simultaneous states, Cs_(st+1),Cs_(st+2). To discrete states Cs_st. Accordingly, utilizes this experience (Cs_st,Aa_st,Cs_(st+1), rds_(st+1)) to approximate mobile environment straightforwardly. While in the event of backhanded learning, tree model substitutes environment and activity nonstop state sets, (Cs_(st+1), Aa_st) are achieved from set Ii_st. At the point when recovered activity consistent state sets are given to tree model, variety in ensuing nonstop states and rewards has been recognized. Next simultaneous nonstop states are accomplished from i_(- st+1)=i_(- st)+ Δi_Aa and virtual experience (i_st, Aa_st,i_(st+1),rds_st) to accelerate learning measure. Distinction activity in each area will offer contrast variety of ceaseless states, rewards rds_st and i_Aa.

This work expected three assorted advancement sorts of DMN model for sharing information utilizing multi-specialist system dependent on heterogeneous tree structure. The model comprises of homogeneous multi-specialist with mobile network models implemented with choice braid. Specialists have two models while in learning measure: sharing mode and learning model. In former, specialists share information with each other from model, while in last mentioned, specialists gets strategy and build its own model for the arranging reason (aberrant learning).

Model taking in comes closer from RL have been delineated regularly. In [26-27], mobile specialists learns strategy in stochastic environment, consequently this model learning ought to consider progress likelihood amongst two states after a move is made. This model thinks about variety amongst current and resulting constant states in the wake of performing activity. Three assorted information sharing methodologies are modelled to complete arranging in Dense M network dependent on different mobile communication conventions and its comparing techniques.

**a. Mobile Agents' position accomplishment**

The same of correspondence between other systems administration model, mobile agent sees in ceaseless state and complete activity measure. This is alluded as persistent state-activity sets. In the event that agent does blending, it presents immense blunder for worldly contrast learning, and afterward it communicates state activity pair to different agents. At the point when resulting agent gets that activity pair, it arranges it over leaf hub in its own tree, it checks whether there is any adequate information about region identified with fitted leaf. In the event that it's anything but done, agent labels that information as obscure information and sends a solicitation to different agents for help.

Nn_sum= ∑_(ij=1)^(Cs_st) [Nn_ij^Aa<csNn〗 (1)

In Eq. (1), 'Cs' is considered as steady, 'Nn^' is limit, that is, amount of tests in leaf hub must be satisfied. This mean and difference calculation is explicitly for assessment of amount of persistent states and square amounts of consistent conditions of each bunch in leaf hubs. Mobile agent then, at that point communicates demand produced from constant state-activity pair of other mobile agents. Then, at that point, agent which gets this state-activity pair solicitation and returns data of leaf hubs whose region is covered by other pair.

Markov chain measure is considered for state-activity pair sequencing in mobile agent. In multi-agent case, joint activity π_s t is results of numerous agents for picking agent.

Lemma 1: Finite Markov chain is considered as Tuple, sτ^δt=(ij ϵ Ii,St,Aa,Rs,Ps)

St = limited arrangement of states.

Aa = limited arrangement of unadulterated activities at state's'

Ps = progress likelihood of framework

Consider work process booking measure as Markov chain with planning functionalities, that is, cost and make length as two agents. Each mobile agent thinks about activity and compensations of another agent. Subsequently, joint circulation π_s t, is resolved for picking all agents. Mobile agents need to choose activity Aa_ij^Tt and coming about activity is given as Aa^Tt=(Aa_1^Tt,… ,Aa_Ii^Tt) is performed. Regarding activity pair and present status, each agent gets prize and framework completes state St_(st+1) with change likelihood P[st_(st+1) | Ss_t,Aa_Tt ]. The cycle is rehashed at time Tt+1. State space of framework is described by right now accessible VM and succeeding mobile undertakings are planned to objective VM for additional execution. Activity pair involves planning likelihood of errand planned to VM.

Here, agents are worked with to pick activity pair in agreement to fixed approach. At the point when agent 'I' does a_i^', it ought to likewise perform Aa_ij activity, as the utility of VM with mobile agent is more prominent than o equivalent to expected utility of Aa_ij^' for all Aa_ij.

*Algorithm:*

Input: Parameter choice

Output: Next state, fixed strategies, reward

1. Declaration of memory for performing agent usefulness with irregular weight
2. activity pair and state is initialized
3. Sense starting state
4. While S ≠ max. Information planning

Assuming likelihood ∈,

Pick arbitrary activity of agent

Else

Select a ∈f;

5. Execute activity blending
6. Present state and ensuing state (next state)
7. keep state change of state and ensuing states
8. Perform arbitrary likelihood change from memory;
9. Register target planning with different agents
10. Decide related balance for each exchange
11. In the event that s' is end condition,

ti=r;

Else

$$st=ri+ \gamma \max\_Aa^{\prime}[Q (Aa^{\prime},st^{\prime})]$$

12. Educate Dense M organization with agent based timetable planning to different agents
13. Return State rate, activity pair and
14. End

To plan on the dependency on mobile agents is affected by remuneration components situated in communication between agents. Now and then it prompts different balance issues. To determine this emergency, Equilibrium arrangements in Markov chain is acquainted here with resolve instable results. Agents based related harmony is considered for strong over-simplification. It works with conditions among agent's system that is, setting up joint circulation among mobile agents. In this manner, no agents will be strayed singularly. The response for work process booking is given by associated harmony.

## 4. CONCLUSION

A definitive objective of this examination is to determine the multi-target work process booking in multi-specialist registering in versatile organization. Along these lines, we demonstrated work process planning as stochastic Markov chain model and develop support learning with decentralized versatile specialist structure. This system has the ability to foster corresponded harmony based answer for achieve strength in work process booking. The expected DMN based RL system is furnished with a blend of traditional RL calculation for learning with novel model for associated and helpful harmony. This examination does a broad lemma calculation as for various work processes planning utilizing versatile specialist in network climate. It additionally spotlight that it goes about as gauge way to deal with handle winning calculations like DQM in applications of farming in rural areas.

As a future expansion, the investigation wanted to think about Quality of Service (QoS) measurements like security, dependability, load adjusting, etc by starting fitting methodologies for booking for cross authoritative work processes. The expected model is sourced in QoS information premise over undertakings did by portable specialist. In addition, in viable execution it is viewed as more exorbitant and devours immense opportunity to collect information during run-time. Accordingly, future bearing is proposed to offer examination of frameworks model for prescient QoS when ordinary QoS information is not fulfilled.

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**P-6**

# IDENTIFY AND RECOGNIZE ENDANGERED ANIMALS FOR WILDLIFE CONSERVATION USING DEEP LEARNING MODEL

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## ABSTRACT

The conservation status of wild animals denotes that they will become extinct soon with the impact of globalization. When determining the status of wild animals, many factors are taken into account, including statistics such as the number of individual's left, the overall increase or decline in the population over time, and breeding success rates. With the effect of globalization and human threats to wild animals, a model to identify and protect the existing animals to save nature is essential. Deep Learning techniques are the state-of-the-art technique for automatic object detection and classification of animals in wildlife conservations with camera trap videos/recorded webcam videos. Classification algorithms use input training data to predict whether the following data will fall into one of the established categories or not. But choosing an appropriate dataset and predicting the number of images per species to attain categorization accuracy is a difficult task. YOLO algorithm is based on convolutional neural networks (CNN) used to detect real time objects. In this work, the YOLOv4 model is used to identify endangered animals using a custom image dataset from the open image repository using a deep convolutional neural network and results in the Mean Average Precision (MAP) value of 87.4%. This approach can used in real time by wildlife rangers, journalists to identify animals from videos and security alarm to protect from intrusion and damage by wild animals with less false positive rate and high precision value.

**Keywords:** Deep Learning, YOLOv4, Classification, Endangered and Conservation.

## 1. INTRODUCTION

Tracking observations, or occurrences of animals at specific times and locations, are essential for wildlife preservation and protection. This data is useful for identifying population sizes, distributions, and environmental interactions. If animals become endangered, identifying the measures to ensure these animals' lives are not in danger is essential[1]. The recent development in deep learning accelerates information extraction and processes huge volumes of data with high accuracy. Images and videos are processed by deep learning Convolutional Neural Networks (CNN) for animal's identification and classification.

The number of convolutional layers, neurons, the different type of connection among the layers, activation and optimization functions, differentiates deep learning networks from one another[2]. The You Only Look Once (YOLO) is a model for real-time object detection based on CNN with a single neural network to perform both classification and prediction of bounding boxes for detecting objects. In this work, YOLO model is applied in detecting the endangered animals in the camera trap images/webcam videos with high speed and precision from a custom dataset.

Camera traps are becoming a more popular tool for wildlife monitoring to capture high-definition images and videos. It is evidence to answer ecology-related scientific issues like what are the geographical distributions of animals and identify the rare animals. The task of manually evaluating mass amounts of camera trap

data/webcam videos is a prohibitively most expensive one; In this work video source of endangered animals is taken out from geography channel[3] for input to YOLOv4 model to train and test custom datasets.

The paper is organized as Section 2 explores related previous work done with YOLO model. In Section 3 working of CNN and YOLO for multiple object detection is explored. Section 4 describes the proposed work of identifying and recognizing animals and Section 5 presents the results of the of the model. Finally, Section 6 concludes the results and future research scope of this work.

## 2. RELATED WORK

Deep Learning algorithms extract features from raw data and classify images using supervised/unsupervised algorithms. It is used in many real-world applications like speech recognition, machine translation, recommended system, image recognition, and playing games[4]. In the literature, much research work on identifying animals in camera trap images using deep learning algorithms with different data sets is carried out. It includes S. B. Islam et al[5] build an automatic monitoring system to identify and recognize snakes, lizards, and frogs in the defined geographic area using CNN. The data are extracted from image repository ImageNet, Kaggle and it results in an accuracy of 69% for training and 60% for testing. Hendry et al.[6] proposed an automatic license plate recognition system to recognize vehicle number plates with high accuracy. Sliding window with YOLO for a single class detector with 36 distinct models used and results in license plate detection and recognition with the accuracy of training and testing 98.22% and 78% respectively.

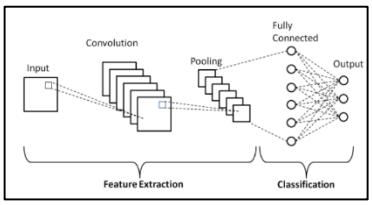
Mohammad Javad Shafiee et al.[7] proposed a modified YOLO model for real-time object detection with the average object detection is 38.13%, and it performs speedup of ~3.3X in a video compared to the YOLOv2 model.Kristo et al.[8] simulate modified YOLO to monitor illegal movements around the border of protected areas for identifying Global terrorist threats with Faster R-CNN and Cascade R-CNN. With cascading of 106 convolution layers and 2 fully connected layers for input size 812 × 812 × 3 Madasamy et al.[9] detect objects with small-size drones for the surveillance detection system.

To protect stray animals and overcome social issues, YOLO model for identifying animals through mobile devices and results out with a precision of 95%. CNN with the squeeze-and-excitation architecture harnessed by Knausgard K.M et al[10] for identifying temperate fish detection and classification, with the accuracy of 99.27% using the pre-training model and post-training model ranges between 83.68% and 87.74%. Mohamad Haniff Junos et al.[11] proposed a YOLO-P model to detect and localize objects at palm oil plantations, which classify fresh fruit bunch, grabber, and palm tree objects. W. Fang et al.[12] used the Tinier-YOLO model for Real-Time Object Detection Method for Constrained Environments, which results in MAP of 65.7% on PASCAL VOC and 34.0% on COCO.

All the related work indicates the YOLO model is well suited for object identification and classification, Of course, there are many variations of YOLO versions used in research, YOLOv4 is located in the optimal and superior model for most accurate detectors in terms of both speed and accuracy.

## 3. CONVOLUTIONAL NEURAL NETWORK

Convolutional Neural Network (CNN) is designed for object detection with the flow of images captured from any image acquisition method. CNN has three components input layer with the image file, the convolutional pooling layer process the images and the fully connected network layer performs the classification[13] as shown in Figure 1 (a).



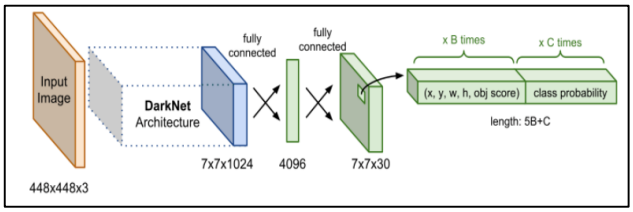




**Figure 1. (a) CNN Architecture** **1. (b) YOLOv4 Architecture**

The proposed model comprises an input layer, convolution layer, pooling layer for feature extraction, classification is done on the fully connected layer and output layer. CNN process image/video as an input and creates multiple boundary boxes on all the objects in the image. CNN identifies the existence of an object with bounded regions through convolutional layers, pooling layers and fully connected,output layers results all the idenfied objects with the confidence and probability scores [14,15].

### Yolo Model

In this work, the open-source object detection, classification model YOLO[16] is used for identifying endangered animals. It is a deep learning-based model designed for multiple object detection proposed by Joseph Redmon et al in his research paper "YOLO for unified real-time Object Detection" in 2015.

Dark Net is a deep convolutional neural network[17] that splits the input image into grid cells of boundary boxes for object classification as shown in Figure 1(b). It results out huge numbers of bounding boxes for an image that are consolidated into final predictions of objects[18.] While using a Deep learning model like YOLO to predict multiple images in a captured image/video, the network makes millions of guesses for an image and predict the object with high probability[19.]

The workflow of YOLO has the following process

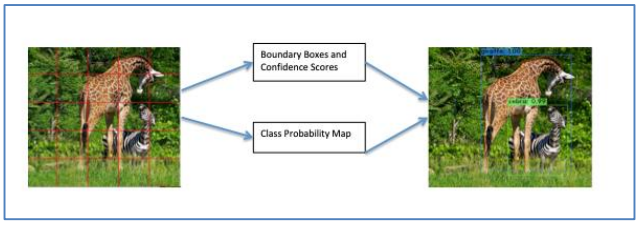
1. Pre-train a CNN network with the dataset after preprocessing for image detection and classification.

2. The input image is split into S×S cells. The existence of objects is identified with the center cell information. It identifies multiple objects with bounding boxes and every object with the information of confidence score, probability scores.
3. The bounding box coordinates are defined by four (x,y,w,h) (x-coordinate,y-coordinate, width, height) where the values are normalized to 0 to 1.
4. Confidence score[23]represents the possibility of cell containing the object:

$$\text{Confidence Score} = \Pr \text{ X IoU(predicated bounding box, true bounding box)}$$

where Pr = probability ,IoU = interaction under union of boundary boxes.

5. If the object is identified in the cell, the model measures the probability of object predicted in every class Ci, i= 1 to K Where K is Pr (the object in class Ci / number of cells containing an object in cells).
6. If an input image contains S×S×B bounding boxes, with 4 location estimates, 1 confidence score, and K probabilities for object classification. The predicted values for an image is S×S×(5B+K) is available in the final convolutional layer [20] as shown in the Figure 2(a).



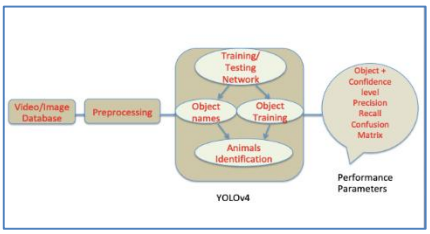




**Figure 2: (a) :Multiple Prediction of YOLO** **2. (b): Proposed System Work Flow**

Multiple predictions are output for the given input image as shown in the Figure.2 (a)

Prediction 1: (X, Y, Height, Width), Class giraffe: 100%

Prediction N: (X, Y, Height, Width), Class zebra: 99%

The (X, Y, Height, Width) is referred to as the "bounding box," or anchoring box. Human annotators have manually labeled this box and the object class for the custom dataset [21.]

## 4. PROPOSED DESIGN APPROACH

In India, the number of engendered animals increasing year by year, to identify and protect them, this work apply a deep learning model with a custom dataset created from the open image repository for animal detection in the wild life. The dataset contains Tiger, Lion, Snow Leopard, Rhinoceros, Panda and Dolphin with 600 images in all categories for training and testing the images extracted from the camera traps/web camera footages. The proposed system flow diagram explains the working of the system as shown in the Figure 2(b).

## Workflow of the Proposed System

1. Animal's images extracted from the Open image repository, as litertature don't suggest benchmarking dataset for endangered animals.
2. The images are preprocessed to work with the existing training data and generalize to other situations permits the model to learn from different situations.
3. In training, hundred pictures of six kinds of objects were randomly selected for the custom dataset. The six specific categories are Tiger, Lion, Snow Leopard, Rhinoceros, Panda and Dolphin choosen after annotations and setting the regions of boundary boxes. During the testing phase 400 images for all category is used with the threshold value of 0.5.
4. During object detection the images captured from the videos are compared with the testing object and results out the detected objects with boundary boxes and confidence level as shown in the figure 3.
5. The performance matrix of the system as shown in the Table 1 consists of the confusion matrix, which has True Positive, True Negative, False Positive and False Negative with precision and recall parameters[22.]

**Table 1: Performance Parameters of the model**

| Parameter | Values |
|---|---|
| Precision | 0.75 |
| Recall | 0.79 |
| Training Time | 1 day |
| Average IOU | 60.49 % |
| True positive | 15 |
| False Positive | 5 |
| False Negative | 4 |

True Positive (TP): Positive value classified as positive
True Negative (TN): Negative value classified as negative
False Positive (FP): Negative value wrongly classified as po
False Negative (FN): Positive value wrongly classified as ne

The precision value denotes the object identified under TP with values of TP + FP which is resulted by the model. If the value is high, it results in the correct object is identified. Recall is the ratio of TP object identified with TP + FN by the model [23.]

$$\text{Precision} = TP/TP+FP$$

$$\text{Recall} = TP/TP+FN$$

The whole experimental process is conducted Google Colab (GPU).The number of iterations was 12000 and the all image was scaled for the height and width of 416 ×416.

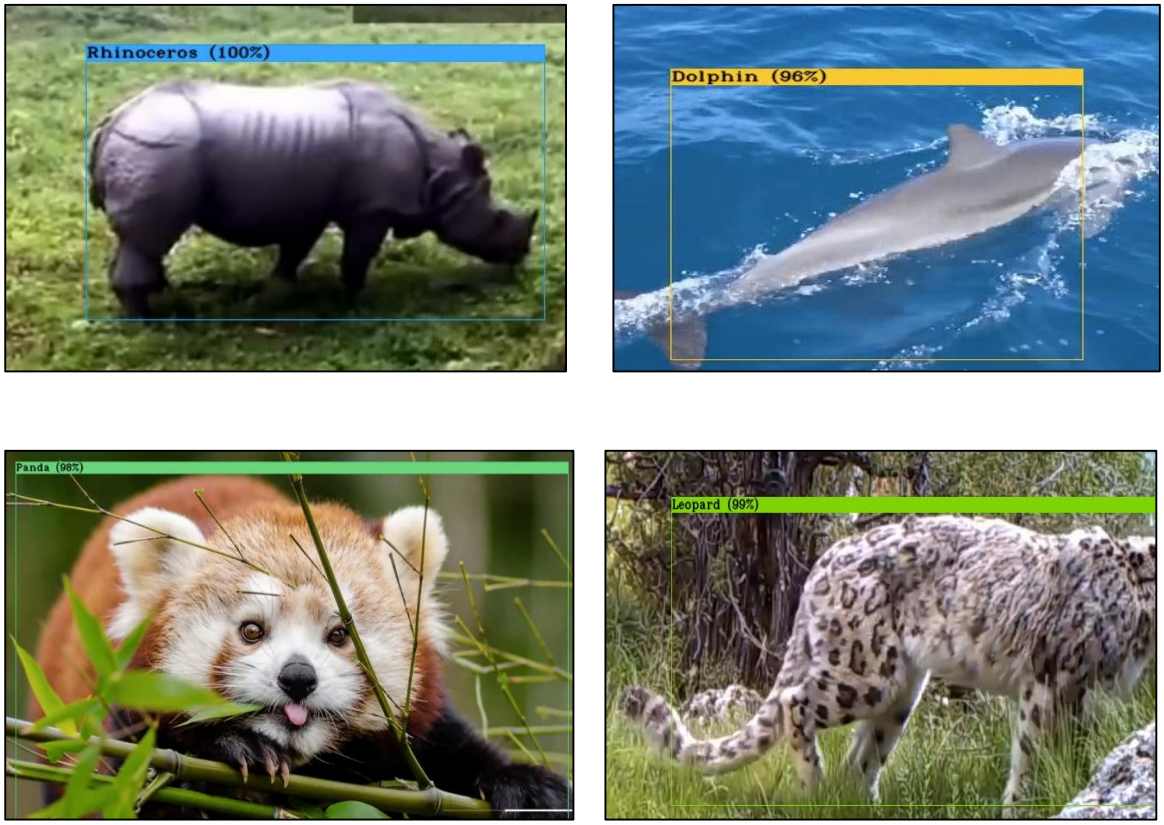



**Figure 3: Detected Wild Animals with Confidence Score**

## 5. RESULTS AND DISCUSSION

The experiments with the configuration described in the previous sections are results in identifying and recognizing all the objects in the video. The performance of the model is measured with confusion matrix, accuracy of the model by Mean Average Precision (MAP). The MAP value is 87.4 % means out model performing well and the model identifies all the objects in the video. Final avg_loss calculated by YOLOv4 in Figure 4 is 1.3082, which will vary according to the size of the dataset.

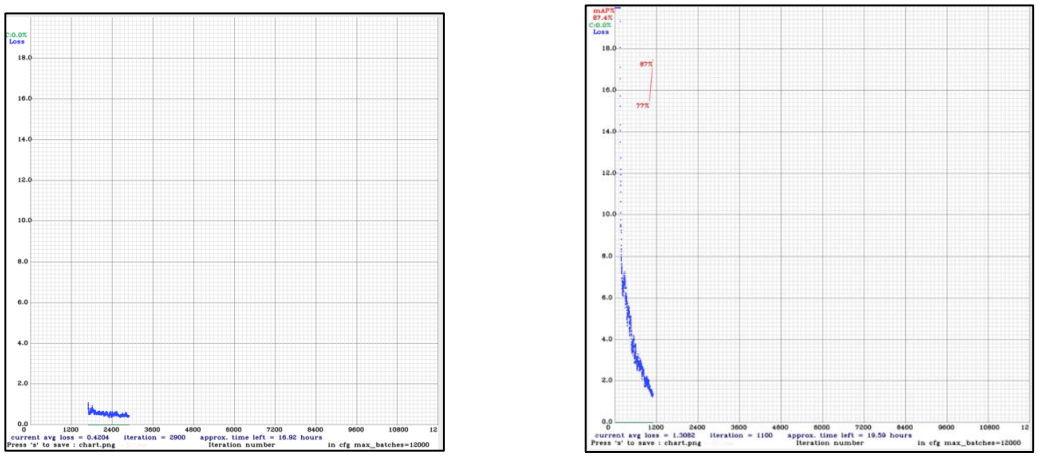


**Figure 4: Average Loss function and MAP Value Range**

## 6. CONCLUSION

This paper evaluates YOLOv4 algorithm for real-time object detection of endangered animals in wildlife. The proposed model was experimented on a challenging custom dataset, to detect the objects with 87.4% MAP value. Future work aims to capture the real time videos from camera trap and analyze the real time videos with optimum MAP and build a hybrid detector model for wild life conservation.

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# AN EFFICIENT DETECTION AND CLASSIFICATION OF DIABETIC RETINAL FUNDUS IMAGES USING FEATURE EXTRACTION

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## ABSTRACT

Diabetic Retinopathy (DR) is caused by high sugar level diabetes is an eye disorder. The DR is detected by analyzing retinal fundus images at early stage and treating the diseases reduces the risk of vision. The present methods for DR detection takes more amount of time for detecting and preventing. In this paper, the proposed hybrid classification method is effective for image processing in detecting DR from fundus images. The proposed method includes DR image preprocessing, DR image blood vessel segmentation and removal, DR feature extraction and selection and DR image classification steps. These methods are effective in detecting and preventing the disease very early stages with minimum amount of time and also increases the detection performances. Diabetic retinopathy is complicated disease between diabetic patience's. Many diabetic patients are affected with various disease and which is more complicate to detect the types of disease. The DR is categorized by severity of lesions and lesions produces sequence of changes in the hard exudate, micro aneurysms and also soft exudate. The simulation is performed using MATLAB for MESSIDOR and DIARETDB1 datasets and results are validated with different parameters. MATLAB tool is more suitable for images processing and datasets are well defined which is extracted from the reliable sources. In this experiments, two algorithms are used to detect and classify the fundus images such as Support Vector Machines (SVM) and Fuzzy C-Means Clustering (FCM). The result for the experiment is compared with SVM and FCM which shows greater efficiency and effectiveness. The proposed method DR sensitivity is 98%, DR specificity is 92% and DR accuracy 89.1%.

**Keywords:** Diabetic Retinopathy, preprocessing, MATLAB, Support Vector Machines, Fuzzy C-Means Clustering (FCM), MESSIDOR, DIARETDB1.

## 1. INTRODUCTION

A common disease among worldwide is diabetes which is more common cause for human blindness having age within 50 years due to lack of insulin. Diabetic Retinopathy (DR)[1] is a diabetic eye disease more prone to the people affected by diabetes. The diabetic retinopathy affects retina of human eye due to diabetes mellitus and causes blindness to affected patients[2]. A person having diabetes for longer time has more number of chances of affecting and developing diabetic retinopathy. Diabetic retinopathy is more effective and is easy for diagnosing eye disease at early stages. The percentage level for diabetic patient's is almost higher in every region of the world in which the chances are higher for more industrialized countries.

The DR generally has different stages such as 1. Non-proliferative Diabetic Retinopathy (NPDR), 2. Proliferative Diabetic Retinopathy (PDR)[3] and 3. Macular Edema (ME). The NPDR is also termed as background diabetic retinopathy which is the initial stage of DR. The PDR is advanced stage of DR[4] where the surface of retina has very small blood vessels which bleeds easily. The ME is a background diabetic retinopathy

identified at the side of the blood vessels. These blood vessels are affected and damaged by diabetes leads to blindness[5].

The DR is diabetic eye disease which is diagnosed when there is a sufficient level of changes in the human retina. At the former stage in DR, it is very difficult to provide effective treatment. The early stage screening and detecting helps to treat in better way. Also auto screening method is required for reducing the manual effort and time spent in diagnosis. The image capture and digital processing techniques make the process more cost effective and easier[5].

The International Clinical DR (ICDR) and Early Treatment Diabetic Retinopathy Study Research Group (ETDRS)[6] provides different levels for DR:

Level 0 – No retinopathy

Level 1 – Mild NPDR

Level 2 – Moderate NPDR

Level 3 – Severe NPDR

Level 4 – Proliferative DR

The remaining paper will be given as follows, section 2 described literature review of DR detection and in section 3 described the proposed methodology of DR and section 4 experimental results of DR which includes the proposed framework and section 5 includes conclusion for the proposed work.

## 2. LITERATURE REVIEW

In DR method the most important factor is lack of knowledge about the disease and undergoing the treatments after major changes in the retina which have to be processed with less effectiveness. The early stage screening of DR development reduces the risk factor of blindness by 50% in human eye. The retinal fundus images is useful for retinal disease diagnosis in early stage which avoids many complications in eye blindness. These DR diseases are identified and detected by using image processing techniques[7]. The SVM is used to divide the input fundus data into three categories such as mild, moderate and proliferative DR. When the exudate areas in fundus images exceeds beyond the optical disc means the classifier system cannot provide expected results.

Auxilio Medina et al[8] proposed method for fundus image characterize for diabetic retinopathy into 2 types such as NPDR and PDR. These two techniques is subdivided into three subphases namely, 1. Order, 2. Extraction and 3. Image handling. Ege et al.[9] proposed DR analysis in automatic way for various statistical classifier which includes k-nearest neighbor, Bayesian and Mahalanobis. The DR is detected automatically Kaur and Kaur (2015) and Gharaibeh (2016) for exudates by using pixel method and eye retinal based process. Asha et al. (Karegowda et al., 2011) used DIARETDB1 dataset which mainly focuses on detecting exudates and back propagation method is used for classifying the fundus images.

Sopharak et al. proposed FCM based clustering method for detecting exudates in human eye which is been affected by DR disease. [Farrikh Alzami, 2019] proposed grade classification for diabetic retinopathy based fractal analysis and random forest method using MESSIDOR dataset. [Kumar, 2018] describes an improved methodology system for detecting diabetic retinopathy by extracting total number of microaneurysms and area of infection using imporved color fundus imaged which is been extracted from DIARETDB1 dataset.

[Athinarayanan et al, 2019] describes the feature extraction for Cancer Detection[10]. [Etemi Joshua Garba et al 2019] uses extracted features from images captured by multimedia security devices[11] and [Deepa et al, 2020] extracted the features and used the SVM classifier for cytomegalovirus images. The proposed system is described the feature extraction for diabetic retinal fundus images[12,13].

## 3. PROPOSED METHODOLOGY

The diabetic retinopathy is one of the complicated disease among diabetic patience's. The level of DR is classified by severity of lesions which produces series of changes in hard exudate, micro aneurysms and soft exudate. The common problem in DR is to identify different levels accurately by analyzing the affected retinal blood vessels[14]. So the changes in retinal blood vessel is taken for the detection process with texture feature, color characteristics of the retinal images are used as important factors for detecting the diabetic retinopathy disease.

The detection of diabetic retinopathy methodology is divided into various stages:

1. *DR image preprocessing,*
2. *DR image blood vessel segmentation and removal,*
3. *DR feature extraction and selection,*
4. *DR image classification*

### DR image preprocessing

In image processing concepts preprocessing is an essential step which generally improves the fundus images for identifying the DR levels. There are two preprocessing phases, 1. Image Denoising and 2. HSI model (Gharaibeh, 2016; Obaida, 2015; Al-Nawashi et al., 2016). Mostly the input image size used is 2240 X 1488 which is used for DR fundus image segmentation[15]. The quality of fundus image is enhanced by avoiding require image size, non-clarity and blur images.

### HIS Model

The DR images retrieved from public databases is generally in RGB format and these fundal images can be converted into HSI model by using HSI model steps. These model is a parallel process for HIS and includes sequential steps for the partial automated conversion of the retinal fundus images (Sopharak and Uyyanonvara, 2007).

### HIS Model conversion

1. Input retinal fundus image in RGB format
2. The RGB format is transformed into (0 1)

$$\varnothing = \cos^{-1}\left\{\frac{\frac{1}{2}[(R-G]+(R-B)}{(R-G)^2+(R-B)(G-B)^{1/2}}\right\}.$$

$$S = 1-\frac{3}{(R+G+B)}[\min(R,G,B)].$$

$$I = \frac{1}{3}(R+G+B).$$

equation (1)

**Image Denoising**

The image denoising process removes the noise from retinal fundus image and this process is usually carried out before image processing step. The retinal fundus images retrieved from public database contain noise which is to be removed at the early stage of the preprocessing method. The denoising of retinal fundus image is given by,

$$f(g) = 1/\sigma^2\sqrt{2\pi}\, e^{\frac{-(g-m)^2}{2\sigma^2}}$$

equation (2)

Where 'm' represents mean value of Gaussian noise, 'g' represents pixel of fundus image and 'σ' represents standard deviation of fundus image.

***Dataset:*** In this study fundus image has been taken from two public dataset for analyzing diabetic retinopathy[16]. MESSIDOR dataset totally has 1200 fundus images in which the DR levels are calculated according the severity of DR disease. DIARETDB1 dataset contain 89 images for DR detection process.

**DR feature extraction and selection**

In feature extraction raw data dimensionality is reduced for managing group of process. The retinal fundal images is used to extract some useful features to detect DR disease more efficiently and more effectively. The DR extraction is subdivided into 1. DR Exudates 2. DR Micro-aneurysm and 3. DR Retinal hemorrhage respectively.

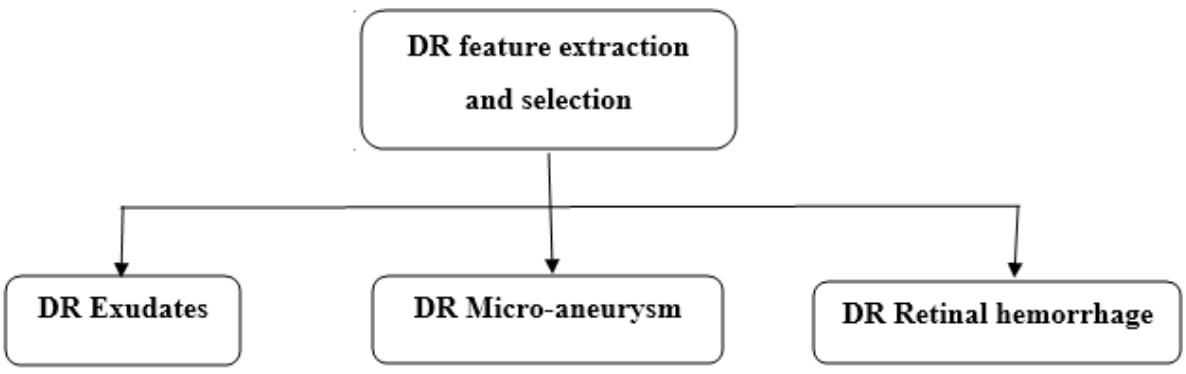


**Figure 1: DR Feature Classification**

**DR Exudates extraction**

The DR Exudates extraction is based on retinal fundal images pixel level which calculates hue, standard deviation, intensity, location of yellow fleck and mean intensity.

**DR Micro-aneurysm**

The DR Micro-aneurysm extraction uses pixel intensity, shape, grey scale, coefficient features for efficient extraction of the features from retinal fundal images.

**DR Retinal haemorrhage**

The DR Retinal haemorrhage is caused by diabetics in human eye which leads to bleeding from blood vessels on the eyes. The haemorrhage features is extracted which is based on texture features and splat features for retinal fundal images detection.

**DR image classification**

The DR image classification is the last phase in diabetic retinopathy disease process which classifies the features as DR Exudates extraction, DR Micro-aneurysm and DR Retinal hemorrhage. The proposed Hybrid Classification Algorithm (HCA) uses three combination of classifiers Support vector machines and Fuzzy C-mean algorithm is used to classify retinal fundus images. The classifiers is used to separate normal retinal images and fundus retinal images which uses 250 images for the classification. The Support vector machine uses degree 3 and kernel radial bias for classification of fundus images.

***Proposed Hybrid Classification Algorithm (HCA)***

Step 1: Input the retinal fundus image from public dataset

Step 2: Identify the candidate region in fundus image

Step 3: Classify the fundus image using SVM method

Step 4: Extract the affected region and detect the blood vessel segmentations using filter and fuzzy C-means method

Step 5: SVM features are classified and grouped into classes.

***Support vector machine (SVM):*** The SVM is a supervised based method used for both classification and regression in data mining problems. Mostly SVM uses classification rather than regression for given problems and it includes more number of features.

## 4. EXPERIMENTAL RESULTS

In this experimental section the proposed hybrid algorithm performance is evaluated for classification and detection of retinal disease processed by classification and segmentation step. The following measure are used to identify the various measures in the retinal images. In proposed method several algorithms are used for effective result for identifying diabetic retinopathy disease. The DR image preprocessing, DR image blood vessel segmentation and removal, DR feature extraction and selection, DR image classification are used to improve DR sensitivity, DR specificity and DR accuracy of segmentations and classification.

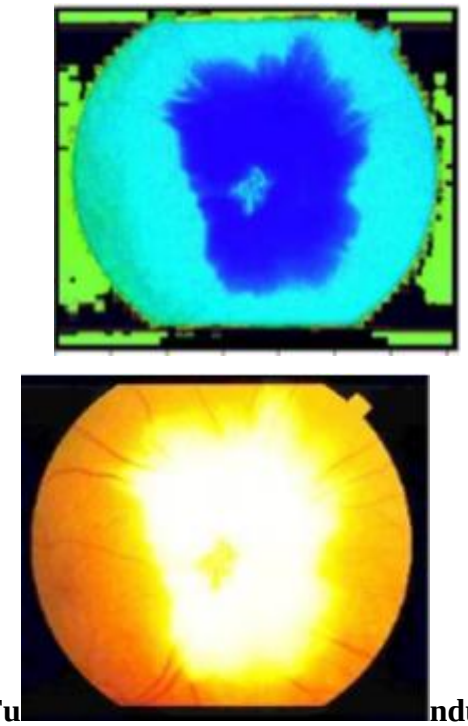

**Figure 1. a) Abnormal Fundus Image before Preprocessing**

**1. b) Abnormal Fundus Image after Preprocessing**

DR Sensitivity is defined as probability of detecting the DR disease affected people.

$$\textbf{DR Sensitivity} = TP/TP + FN * 100\%$$

DR Specificity is defined as the probability to exclude people without DR disease condition.

$$\textbf{DR Specificity} = TN/TN + FP * 100\%$$

DR Accuracy is defined as the closeness degree between positive value and measurement.

$$\textbf{DR Accuracy} = TP + TN/N * 100\%$$

True Positive (TP) uses positive result which detects fundus diseases, True Negative (TN) uses negative results which doesn't detect disease. False Positive (FP) uses positive result but cannot express it and False Negative (FN) uses negative result with diseases.

**Table 1: DR Sensitivity, DR Specificity and DR accuracy**

| Method | DR Sensitivity | DR Specificity | DR Accuracy |
|---|---|---|---|
| SVM | 91 | 86 | 87.4 |
| FCM | 97 | 89 | 88.3 |
| HCA | 98 | 92 | 89.1 |

In table 1, parameters DR sensitivity, DR specificity and DR accuracy is estimated for SVM, FCM and proposed HCA methods. The SVM DR accuracy is 87.4% for fundal images, FCM classifier results in 88.3% and proposed HCA method results 89.1% DR accuracy.

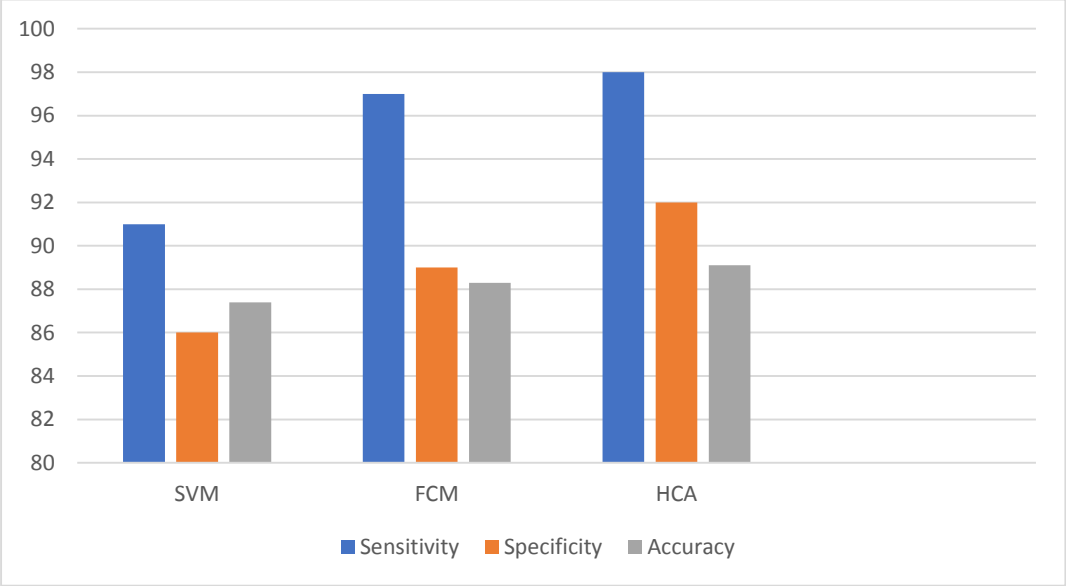


**Figure 2: Comparison of DR sensitivity, DR specificity and DR accuracy**

The SVM DR sensitivity is 91% for fundal images, FCM classifier results in 97% and proposed HCA method results 98% DR sensitivity. The SVM DR specificity is 86% for fundal images, FCM classifier results in 89% and proposed HCA method results 92% DR specificity respectively.

## 5. CONCLUSION

The early stage detection of diabetic retinopathy helps in preventing and avoiding blindness. In this paper DR preprocessing and DR feature extraction of retinal fundus image is made for identifying diabetic retinopathy. The disease detection is done by four phases DR image preprocessing, DR image blood vessel segmentation and removal, DR feature extraction and selection, DR image classification. The proposed HCA image processing method is described in detail and the different metric analysis is carried out (DR sensitivity, DR specificity, and DR accuracy). The experimental results shows that the proposed image feature extraction and classification with hybrid algorithm has high DR sensitivity is 98%, DR specificity is 92% and DR accuracy is

89.1 respectively. The proposed methodology will be effective and efficient to detect retinal fundus images for diabetic retinopathy disease.

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P-8

# SCALABLE AND SECURE SHARING OF PERSONAL HEALTH RECORDS IN CLOUD COMPUTING USING ATTRIBUTE-BASED ENCRYPTION

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## ABSTRACT

Personal Health Record (PHR) holds a great position as it centralizes the server to preserve a patient's personal health record in a centralized way which greatly facilitates the storage, access and sharing of personal health data. Still, there is a considerable privacy problem as personal health information is probably exposed to third-party servers and unauthorized parties. To guarantee the patients control over their PHRs, a method to encrypt the PHRs before storing them on cloud is practiced. But still issues like risks of privacy, efficiency in key administration, flexible access and efficient user administration, have remained the important challenges toward achieving better, cryptographically imposed data access control. In this research paper, we developed a mechanism for control of data access to PHRs stored in cloud servers using ABE encryption approach to encrypt each PHR file. In this proposed article we specialize in the multiple data owner scheme, and divide the users into security domains that highly reduce the key management complication for owners and users. In this system patient privacy is promised by exploiting multi-authority ABE. Our system also enables a key management paradigm, multiple data owner scenarios and increased complexity between data and end-users. Extensive analysis and experimental results are presented which shows the safety and efficiency of our proposed scheme.

**Keywords:** Personal health record [PHR], Personal Health Information [PHI], Attribute-Based Encryption [ABE].

## 1. INTRODUCTION

In the current scenario, Personal Health Record (PHR) has emerged as a patient-centric model of health information exchange. A PHR service allows a patient to create, manage, and control health data in one place through the web, which has made the storage, retrieval, and sharing of medical information more efficient. In Particular, each patient is promised full control of their medical records and can share their health data with a wide range of users, including healthcare providers, family members, or friends. (e.g., Secure management of personal health records by applying attribute-based encryption) [2],[13] Due to the excessive price of constructing and keeping specialized statistics many PHR offerings delegated the moderator, for example Microsoft health vault. Recently, storing personal health records in cloud computing has been proposed. While it's exciting to possess PHR services for everybody, there are many security and privacy risks that would impede its wide adoption. The main concern is whether the patients could control the sharing of their sensitive Personal Health Information (PHI), especially when they are stored on a third-party server that people may not fully trust. Although there are existing healthcare regulations that are recently amended to incorporate business associates, cloud providers are usually not covered entities. On the other hand, due to the high value of the sensitive PHI, the third-party storage servers are often the targets of various malicious behaviours which lead to exposure of the PHI. To ensure patient-centric privacy control over their PHRs, it is essential to have fine-grained data access control mechanisms that work with semi-trusted servers. (e.g., Achieving secure, scalable, and fine-grained data access control in the cloud)[12].

Every patient who searches through the website can verify and get a complete unique patient ID. Hence, it is used for additional information like the availability of medical doctors, surgery and patient's health record. In case the affected person is admitted for the surgery, or the patient is in need of appointments, all of the crucial information might be up to date and it can be verified by the doctors through online mode. Moreover, the patients can access the records whenever and wherever required. Because the virtual technique might assist many individuals who require clinical offerings for their small inconveniences. So, our answers aren't the handiest effective however additionally has valued affordability. This paper identified some challenges and issues in the existing system so the proposed work consists of a potential solution that enhances the adoption of PHR and provides secure access through an Attribute-based encryption algorithm. The organization of the article is as follows Section 2, literature survey is discussed. Section 3 refers to the proposed system, Section 4 represents the Methodology, Section 5 contains the results and discussions of the project, section 6 contains the reference of the projects and Section 7 discusses the conclusions and finally the future enhancements for the project.

## 2. LITERATURE REVIEW

The proposed work primarily focuses on privacy and security in cloud-based Personal Health Record repositories using attribute-based encryption. The associated work has been done by many researchers and also provided some solutions which are listed as follows.

Jystadi Hemalatha, M. Sri Lakshmi, Dr S. Prem Kumar (2014) proposed affected person-pushed skeleton and suite of the machine to perform fine-grained and adaptable facts get right of entry to manipulate for IHRs and focused on the exclusive fact's supervisor situation, and hole the customers with inside the IHR framework into diverse safety areas that surprisingly lessens the important thing management intricacy for holders and customers. An excessive stage of affected person safety is ensured all of them at the same time as with the aid of abusing multi-energy ABE. This scheme moreover empowers dynamic modification of getting right of entry to techniques or file properties, enables green on-hobby client/feature disavowal and break-glass get to beneath pressing situation[3].

Kotapati Saimanoj, Grandhi Poojitha, Khushbu Devendra Dixit, Laxmi Jayannavar (2020) paves the way to creating a software program that enables a clean transition from office work to e-papers. It is a web-primarily based platform that gets rid of the want of paper prescriptions with inside the Hospitals that proposes E-Medical Management a good way to boom the performance of affected person control, time table control of the docs and delivers well-known get right of entry to the affected person facts everywhere with inside the hospital[4].

Ming Li and Shucheng Yu (2013) have carried out a study on sharing non-private statistics and the use of Attribute-Based Encryptions to deliver scalable facts to get the right of entry to manipulate for PHRs. They assure an excessive diploma of affected person privateness concurrently of exploiting multi-stage ABE. This key additionally permits dynamic amendment of getting right of entry to coverage or record characteristic, think green on-call for user/characteristic revocation and break-glass get right of entry to beneath emergency state of affairs[7].

Nishitha Ramakrishnan and Sreerekha B (2015) have proposed that the customers whom all can get right of entry to the PHR's are divided into a couple of safety domain names just like the Health Care area, the general public area which significantly reduces key control complexity for the affected person and customers of PHR. The benefit of the technique used is that even an actual time provider from a document may be received for the affected person with the aid of referring to the PHR of the affected person online[8].

Pradeep Deshmukh (2016) has proposed a body painting for storing the fitness statistics and getting access to them with the aid of using sufferers and physicians as legal with the aid of using a key-manipulate scheme. The proposed scheme has double facts safety with the aid of introducing isolation among encryption schemes of transmitted facts and saved facts[9]. Priyanka R. Padol, Harshada K. More, Nutan V. Mandre, Pooja N. Shimpi

(2018) used characteristic-primarily based encryption and targeted at a couple of facts proprietor state of affairs and affected person privateness is assured concurrently with the aid of exploiting multi-authority ABE. It additionally permits dynamic amendment of getting right of entry to rules or record attributes, helps green on-call for user/characteristic revocation and break-glass get right of entry to beneath emergency scenarios[10].

R. Sumithra, V. Jayalakshmi, and R. Priya (2020) proposed a singular approach for getting right of entry to manipulate PHRs. They used leverage RSA set of rules to encrypt every affected person's PHR record and targeted at a couple of facts proprietor scenarios, dividing the customers with inside the PHR machine into a couple of safety domain names that drastically lessen the important control complexity for proprietors and customers. An excessive diploma of affected person privateness is assured concurrently with the aid of exploiting the multi-authority ABE. This technique permits dynamic amendment of getting right of entry to policies or record attributes, helps green on-call for user/characteristic revocation and break-glass get right of entry to beneath emergency scenarios[11].

Vishal Jagdale, Dinesh Kekan, Ishwar Baride (2015) have evolved a version and a mechanism for manipulating facts to get the right of entry to PHRs saved in cloud servers. To gain green and modular facts get right of entry to for PHRs, they furnished ABE encryption technique to encrypt every PHR record and attempted to recognition at a couple of facts proprietor scheme, and divide the customers into safety domain names that exceptionally manipulate the important thing control hardship for proprietors and customers. In this machine affected person privacy is assured with the aid of using exploiting multi-authority ABE and additionally permits amendment of getting right of entry to rules or record attributes, and break-glass get right of entry to beneath emergencies[14]. This article is mostly related to work based on the security of PHR, in cloud computing using Attribute-Based Encryption [ABE] techniques.

## 3. PROPOSED SYSTEM

Security is the major challenge in traditional methods based on PHR due to theft of unencrypted computers, portable devices and other media used to store patient records. Cloud-based PHR stores all the information in the remote server that connects all health care centres and overcomes the drawbacks of the existing system. India is a large population country surrounded by multilingual peoples in each state. Thus, converting PHR records in one common language is much more possible with a single click using web applications. Hence this provides an additional advantage to the suitability of PHR in the India Health Care System. The following architecture diagram shows the proposed PHR framework based on cloud computing using an attribute-based encryption algorithm.

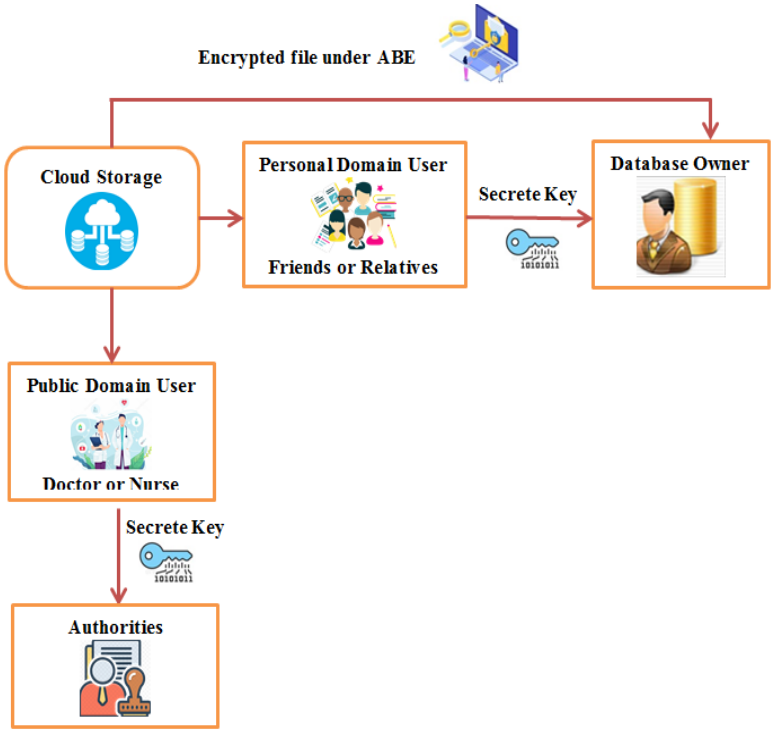


**Figure 1: Framework of the model**

To guarantee the patients' management over getting admission to their personal PHRs, it's miles a promising technique to encrypt the PHRs earlier than outsourcing. In the proposed work we advise a unique affected person-centric framework and a set of mechanisms for facts to get admission to manage PHRs saved in semi-relied on servers. To reap fine-grained and scalable facts, get admission to manage for PHRs, leverage attribute-primarily based totally encryption (ABE) strategies to encrypt every affected person's PHR record. To make certain affected person-centric privateness manage over their personal PHRs, it's important to have fine-grained facts get admission to manage mechanisms that paintings with semi-relied on servers. In order to shield the private fitness facts saved on a semi-relied the server, we undertake attribute-primarily based total encryption (ABE) because the main encryption is primitive. Using ABE, get admission to guidelines are expressed primarily based totally on the attributes of customers or facts, which permits an affected person to selectively percentage her PHR amongst a fixed of customers through encrypting the record below a fixed of attributes, without the want to realize an entire listing of customers.

## 4. METHODOLOGY

### *(i) Authentication*

Authentication is the primary module on this work. Only legal individuals can get entry to the application. This module presents permission to a selected unmarried consumer. Authentication includes Doctors, Patients, and Admin. It reduces the faux consumer and complements the safety of the application. The unauthorized customers can't carry out any transactions. (e.g., Shared and searchable encrypted data for untrusted servers)[1].

### *(ii) Maintain Health Record Details*

The affected person sends appointment information directly to the medical doctor. Hence the medical doctor is capable of screening the affected person's appointment information to carry out surgical treatment and operation etc. The patient is capable of seeing the medical doctor's prescription and surgical treatment result directly through online.

**(iii)** ***Health Record Owner***

The fitness document proprietor is the principal module on this application. The major intention of the framework is to offer stable affected person-centric PHR get entry to and green key control at an equal time. The key concept is to divide the gadget into more than one protection domain name inclusive of public and personal, consistent with the one-of-a-kind customer facts to get entry to requirements. The non-public fitness document includes customers who get entry through primarily based on their expert roles, inclusive of doctors, nurses, and scientific researchers. In practice, fitness may be mapped to an impartial area in society, inclusive of the fitness care, government, or coverage area. The significant customers get entry to PHRs primarily based on getting entry to privileges assigned via the means of the proprietor[5].

***(iv) PHR Accessibility using ABE***

The authorization of fitness statistics is maintained in this phase. After importing the fitness document into the server, the proprietor retrieves the essential information through mail identity notification to acquire entry to the unique facts. The facts are encrypted and uploaded into the cloud server. Each fact proprietor (e.g., affected person) relies on the authority of her own, which makes use of an ABE gadget to control the name of the game keys and get entry to rights of patients details that exist in the document. For PSD (Personal Domain) entry to, every PHR report is classified with its fact's attributes, whilst the important thing length is best linear with the number of report classes a consumer can get entry to. Since the quantity of customers in a PSD is frequently small, it reduces the weight of the proprietor. While encrypting the facts for PSD, all that the proprietor desires to recognize is the intrinsic facts properties. Based on consumer permission the fitness document permission can be given and touchy attributes have hidden the usage of the ABE technique. The following Figure 2 shows the ABE algorithm working principle in the PHR framework.

***(v) Data Confidentiality***

The owners upload ABE-encrypted PHR files to the server. Each owner's PHR file is encrypted both under a certain fine-grained and role-based access policy for users from the PUD to access, and under a selected set of data attributes that allows access from users in the PSD. Only authorized users can decrypt the PHR files, excluding the server.

**(vi)** ***Survey Report***

In this phase survey of Health statistics exist in the cloud server. This module affords the ability to submit the survey file with brand new protection coverage. This additionally affords facts approximately the disease-affected facts via means of making use of the ABE approach to enhance consumer privacy coverage.

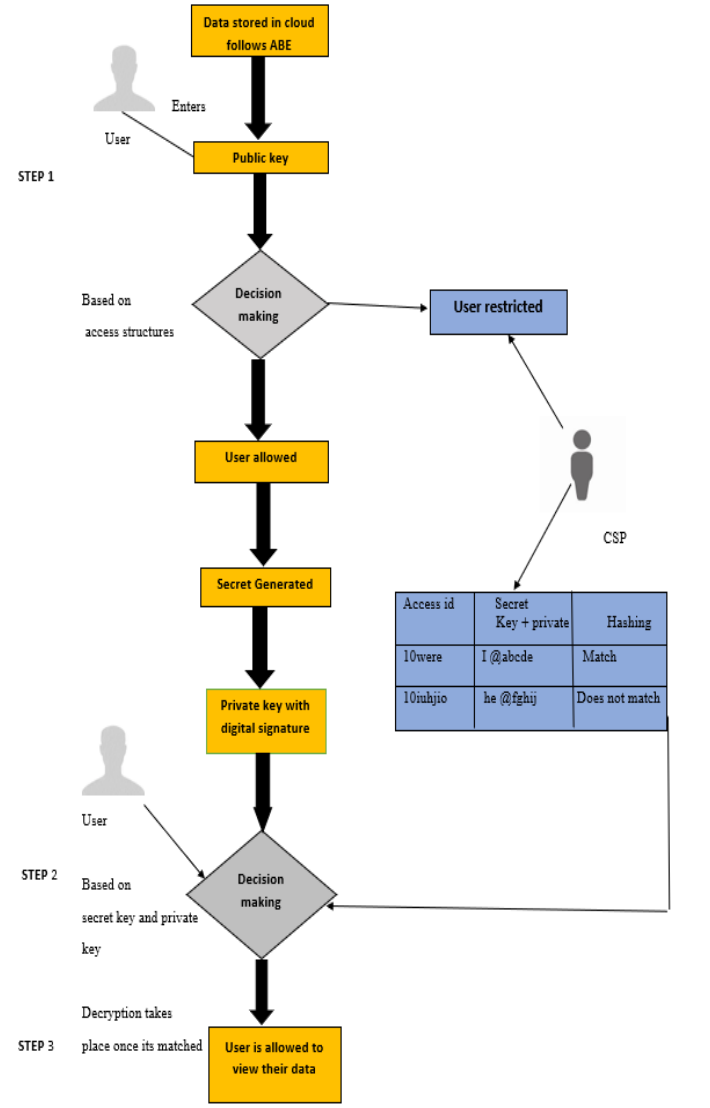


**Figure 2: Flowchart of the working module**

***The following primary steps are used to access the proposed framework***

**Step 1**. Doctor registration can include the name, email, specialization, etc.

**Step** 2. Patient registration can include the name, email, disease, etc.

**Step** 3. PHR owner registration which is a personal health record owner can register their respective details.

**Step** 4. Login via the PHR portal and choose the view doctor list and give the acceptance of the doctor.

**Step** 5. Patient login can be fetched from access control which includes visible appointment, doctor prescription and surgery.

**Step** 6. Select appointment and provide necessary details for getting appointment from doctor.

**Step** 7. In doctor login choose appointment and check the details of respective patient and confirm surgery schedule.

**Step** 8. The doctor prescription can be viewed through Patient login as well as the surgery details will be stored in an encrypted format.

**Step** 9. Provide username and password in the emergency and give Patient ID to send mail.

**Step** 10. The Secret key will be generated through respective mail and the detailed view of the report can be fetched.

### *(vii) Algorithm*

Definition: Cipher is a set of rules that is carried out to standard textual content to get ciphertext. It is the unreadable output of an encryption set of rules. The period "cipher" is every so often used as an opportune period for ciphertext. The ciphertext isn't always comprehensible till it's been transformed into an undeniable textual content with the use of a key. Private-key Cryptography: In this cipher, even the attacker is aware of the plaintext and corresponding ciphertext. The sender and receiver should have a pre-shared key. The shared secret is a saved mystery from all different events and is used for encryption in addition to decryption. This cryptography is likewise referred to as a "symmetric key set of rules".

## 5. RESULT & ANALYSIS

The proposed work is cloud based Personal Health Records (PHR) with a secure ABE algorithm to get admission to the environment. The statistics values are maintained beneath a third-party cloud company gadget. The statistics can handiest be accessed through the doctors, patients. The important things are maintained and disbursed to the authorities. Hence the information is steady and scalable. This is more desirable to help the ATTRIBUTE BASED ENCRYPTION algorithm. The statistics owner, cloud company, key management, safety process, authority evaluation and customer are the six phases that's protected withinside the module and additionally the person identity-primarily based totally get admission to mechanism additionally provided.

### *(i) Cloud Provider*

The cloud company module is used to store the PHR values. The PHR values are saved in databases. Data proprietor uploads the encrypted PHR to the cloud providers. Users get right of entry to information also maintained beneath the cloud company. (e.g., Privacy-aware attribute-based PHR sharing with user accountability in cloud computing)[15,6].

### *(ii) Data Owner*

The information proprietor module is designed to preserve the affected person's details. The characteristic choice version is used to choose touchy attributes. Patient Health Records (PHR) are maintained with unique characteristic collections. Data proprietor assigns get admission to permissions to diverse authorities.

### *(iii) Key Management*

The key control module is designed to manipulate key values for one-of-a-kind authorities. Key values are uploaded with the aid of using the facts owners. Key control process consists of key insert and key revocation tasks. Dynamic policy primarily based totally key control scheme is used with inside the system.

### *(iv) Authority Analysis*

Authority evaluation module is designed to affirm the customers with their roles. Authority permissions are initiated via the means of the statistics owners. Authority primarily based totally key values are issued by means of the important thing control server. The key and related attributes are furnished via means of the principal authority.

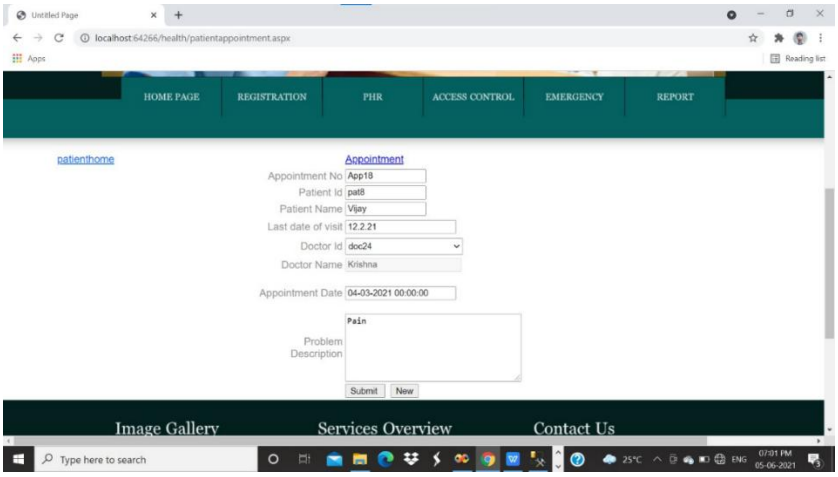


**Figure 3: Patient Appointment**

### (v) *Client*

The consumer module is used to get entry to the patients. Personal and expert get entries to fashions are utilized in the system. Access class is used to offer exclusive attributes. The consumer gets an entry to log and keeps the consumer requesting information for the auditing process.

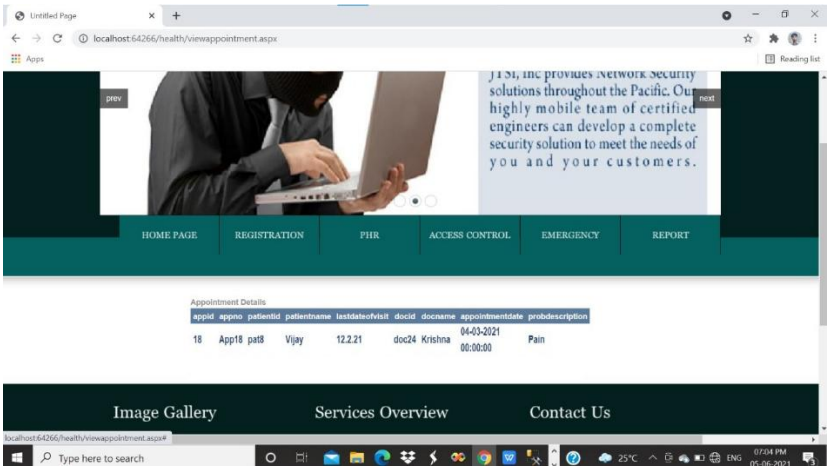


**Figure 4: Appointment details seen by doctor**

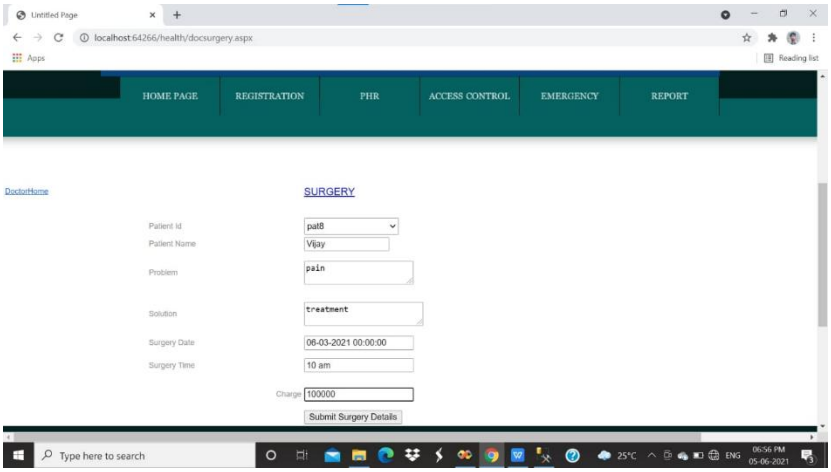


**Figure 5: Surgery Descriptions**

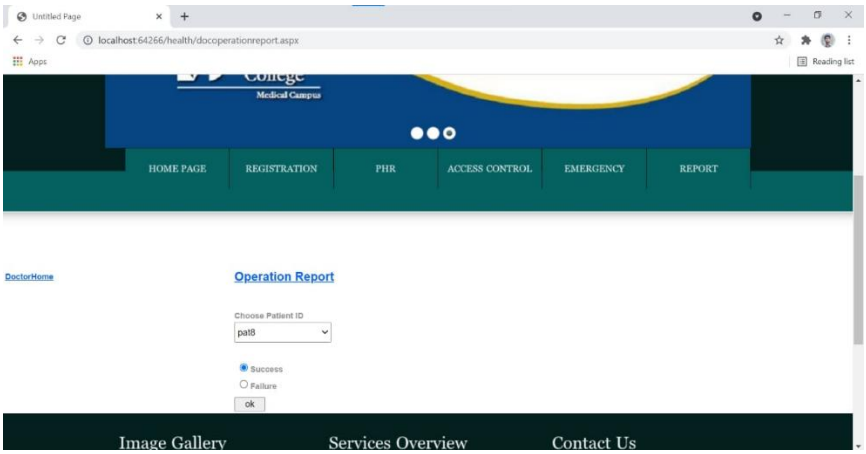


**Figure 6: Operation Report**

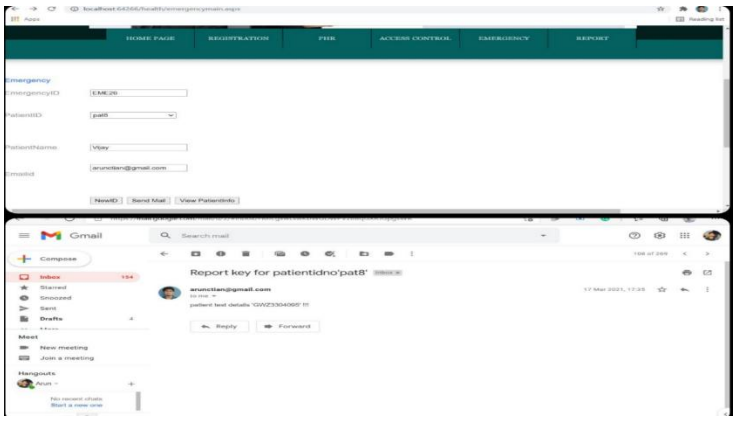


**Figure 7: Emergency and Key Information**

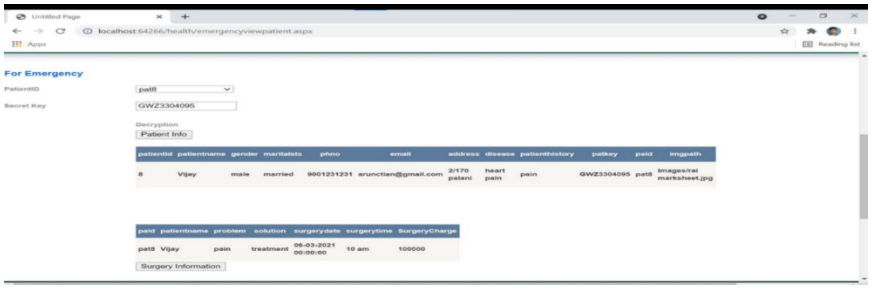

**Figure 8: Patient and surgery information**

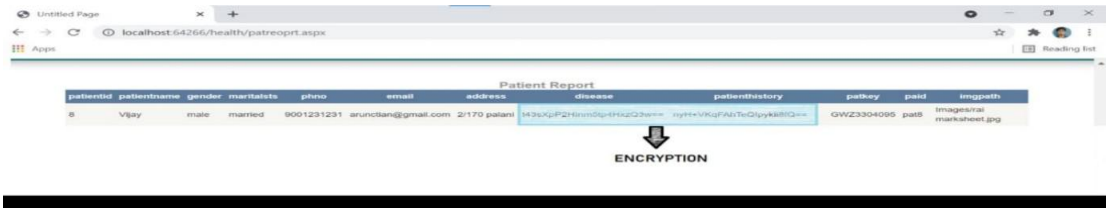


**Figure 9: Patient report**

The Figure-3 denotes a patient's appointment to the doctor in that it has an appointment no, patient id and name, etc., and the Figure-4 doctor can see the appointment of a patient and the Figure-5 denotes the surgery details in that it has a problem, solution, surgery date, and time. The Figure-6 denotes the operation report by the doctor.

The Figure (i.e.,7,8,9) depicts the emergency web page, which is to ensure entry of the patient, it contains emergency ID and patient ID. Patient is verified through email identification. After the verification process patients can view their report and as this is an emergency column, the patient can intimate their doctor as an emergency by clicking the Option send email. Now it comes to the doctor's domain, where they could see emergency patient mails, by ensuring patients security, only doctors can access the information and reports of the patient, by entering their patient ID and Decryption code which is unique for all patients mails. After knowing the patient's problem, the doctor would study the reports and reply to the patient as soon as possible**.**

## 6. CONCLUSION AND FUTURE SCOPE

The structure of secure sharing of the personal health record in cloud computing has been proposed in this paper. Considering patients inconvenience in sharing their health report, attribute-based encryption is a good technique in securing the health report. The model utilizes attribute-based encryption to encrypt health records so that the patient can access their reports and have complete control of their privacy through encrypting their PHR files so that the data are saved securely in cloud servers. The model addresses the unique challenge provided by multiple users and PHR owners. It is scalable in securing the sharing of personal health reports. The proposed cloud enable web application satisfies the end-user and the application is accessed from more than one system simultaneously and easily. In the future, to provide high security and privacy for Personal Health Record (PHR), the existing Multi authority attribute-based encryption could be further enhanced to proactive multilevel authority ABE. The future enhancement for the project would not be concluded, as it would be implemented as an android application. The requirement will be more than the websites when it enters corporate sites as an android application runs on android version 6. This would enhance more bonding between patients and the hospitals as it is online, patients could access any doctor at any hospital linked within the database.

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# MANIFOLD HOPS IN PASTURE OF ENVIRONMENT SCIENCE FOR PRESERVATION OF INFORMATION WITHOUT LOSS

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## ABSTRACT

Ecologists are starting to open new avenues of inquiry at greater spatial and temporal resolution, allowing them to "observe the unobservable" through the use of wireless sensor networks. The wide range of transmission medium is covered by the wireless sensor network. The sensor nodes are used to collect information from unreached fields. Due to its increasing popularity many research are done to increase its energy level for effective transmission. Wireless Sensor Network (WSN) is an infrastructure based Wireless network made up of manifold minuscule sensor nodes (SNs) that sense information from their unequivocal environment and by collaborating with each other, transmit it to a base station[1]. The data has to be collected from the environment where man power can't be used. The SNs have the ability to sense data, process it and transmit it. Since they are battery operated, small in size and economical, they can be practical and useful. The data which is collected should reach the base station without any loss. Moreover, real-time data flows allow researchers to react rapidly to events, thus extending the laboratory to the field[2]. So improving the performance by increasing the hopes in the field is proposed here. In turn the battery level of each nodes are taken in to account for avoiding data loss, We recapitulation some existing uses of wireless sensor networks, diagnose possible areas of application, and review the underlying technologies in the hope of stimulating additional use of this promising technology to address the grand challenges of environmental science.

**Keywords:** Multiple Hops, Wireless, Sensor, Networks, Cluster Heads.

## 1. INTRODUCTION

Ecology enriches our world and is crucial for human wellbeing and prosperity. It caters new knowledge of the kindred between people and nature that is vital for food production, maintaining clean air and water, and sustaining biodiversity in a changing climate. But Collection of information of environment and doing research is a tedious work[3]. It is not that easy for an Ecologist to collect data remote location where humans cannot reach.

Some uses Typhoon for collecting data which has impact of releasing more carbon which affects the environment. Spoiling the Environment while collecting data leads to big issues. But due to its rich environments and ecosystems researchers are interested in collecting information for their research. In order to gather data Wireless Sensor Networks can be used[4]. By establishing wireless connections to sensors in time for the researchers without leaving their labs can collect data without any loss.

## 2. WIRELESS SENSOR ARCHITECTURE

WSN (Wireless Sensor Network) is the most archetype services occupied in commissary and industrial utilization, because of its technical progress in a processor, communication, and low-power usage of embedded computing apparatus[5]. The wireless sensor network architecture is built with nodes that are used to observe the environs like temperature, humidity, pressure, position, vibration, sound, etc[6].

These nodes can be used in diversified real-time applications to achieve various tasks like smart reveal, a discovery of adjoin nodes, data processing and storage, data assortment, target tracking, monitor and controlling, synchronization, node localization, and effective routing between the base station and nodes. Presently, WSNs are beginning to be organized in an enhanced step[7].

These networks certainly cover a huge number of spatially dispersed, little, battery-operated, ingrained devices that are networked to caringly collect, growth, and transfer data to the operators, and it has controlled the effectiveness of computing & processing. Nodes are tiny computers, which work jointly to form networks[8].

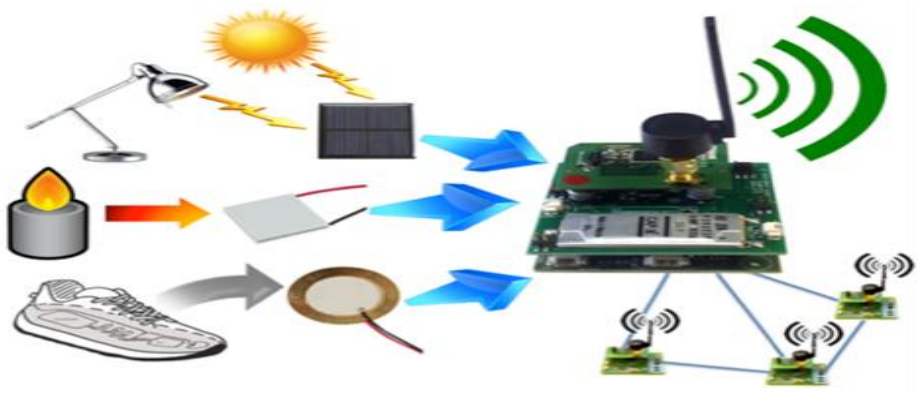

**Figure 1: Wireless Sensor Networks**

**Energy Consumption**

In WSN, power devastation is one of the main issues. As an energy source, the battery is used by equipping with sensor nodes. The sensor network is regulate within dangerous bearings so it turns complicated for changing otherwise recharging batteries[9]. The vitality consumption mainly bank on the sensor nodes, operations like communication, sensing & data processing. Throughout communication, the energy consumption is very high. So, energy consumption can be avoided at every layer by using efficient routing protocols[10].

**Data Observation in Environment:**

Through the Observational System (OS), NEON field scientists congregate a wide variety of observations and samples at terrestrial and aquatic field sites at regular intervals all through the year. The OS is subdivided into the Aquatic Observation System (AOS) and the Terrestrial Observation System (TOS)[11]. These systems are designed to proffer standardized, distributed observations of organisms as well as substantial physical and chemical properties. Aquatic perceptions are used to indicate the channel and lake morphology, organism affluence and diversity, biogeochemistry, seasonal climatic and hydrologic changes, and riparian articulation.

Terrestrial observations characterize plant phenology, diversity, biomass, and productivity, as well as the abundance, diversity, phenology, and (for some groups) pathogen status of organisms including birds, small mammals, ticks, mosquitoes, ground beetles, and soil microbes[12].

## 3. INFORMATION COLLECTION THROUGH MULTIPLE HOPS

An Ecologist can gather the data within hours by using the wireless sensor network. The Sensor nodes are deployed in the obscure area. The testimonies which are collected by the senor nodes are directed to the base station and from there the researchers will receive the information[13]. For instance, it collects data from 30 meteorological and stream flow stations located throughout an area of 200 hectares (ha) in 1 minute instead it takes more than 3 days to collect habitually. It also collects new types of data, such as sounds, still images, and video, providing new insights on processes. Instead of using single hop we can use multiple hops to collect data[14].

Sensors are grouped into clusters in which each cluster is headed by an elected node responsible for transmitting the cluster's data to the BS. We denote the $i^{th}$ ClusterHead by Hi where $i \in \{1,2..N-1\}$ and the BS by Head Nodes. Thus, the corresponding set of CHs and BS is denoted by $H=\{H1,H2,,HN-1,HN\}$ where $|H|=N$. Each CH Hi makes its decision to dynamically select the next hop Hj for routing (which can be another cluster head or the BS) based on a probabilistic function. The source node chooses in a stochastic way between multi-hop transmission through other CHs and direct transmission to the BS[15].

From the context of inter-cluster communication, the network consists of CHs and BS and can be modelled as a complete graph G=(N,E) where the set of vertices N represents the CHs and the BS and the edges set E represents the wireless links connecting each pair of CHs (Hi,Hj) or pairs of CH-BS (Hi,HN) for $i,j \in \{1,2,,N-1\}$. Figure 1 depicts the graph model used.

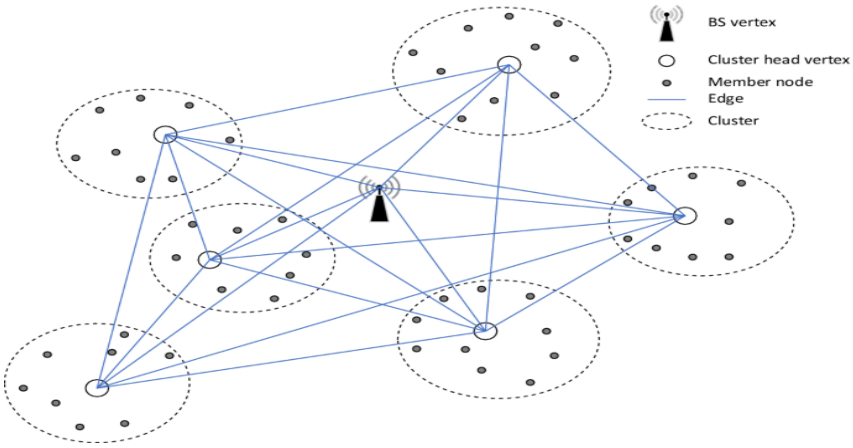


**Figure 2: Information Collection through Multiple Hops**

## 4. PERFORMANCE ANALYSIS

In this article we present that the data are collected more efficiently using multiple hops in environment rather collecting manually. For Instance while congregation information in remote area requires more time and some time data are lost due to environmental issues. This is can be avoided by using multiple hops in remote area. The sensor senses the data and passes it to the nearby head which in turn pass it to another head and from there it can reach the base station. From the base station researchers can get the information without any loss and in less time. As depicted in the figure cluster head will take care of transmitting the data to the base station.

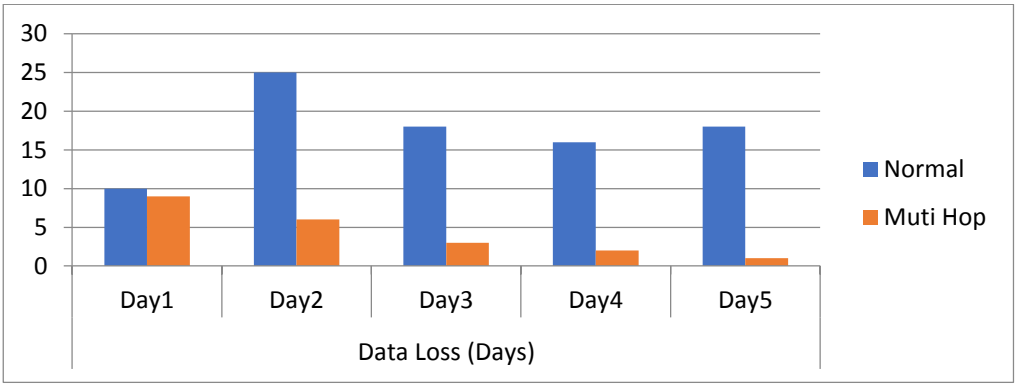


**Chart 1: Data Loss is less in Manifold Hop WSN**

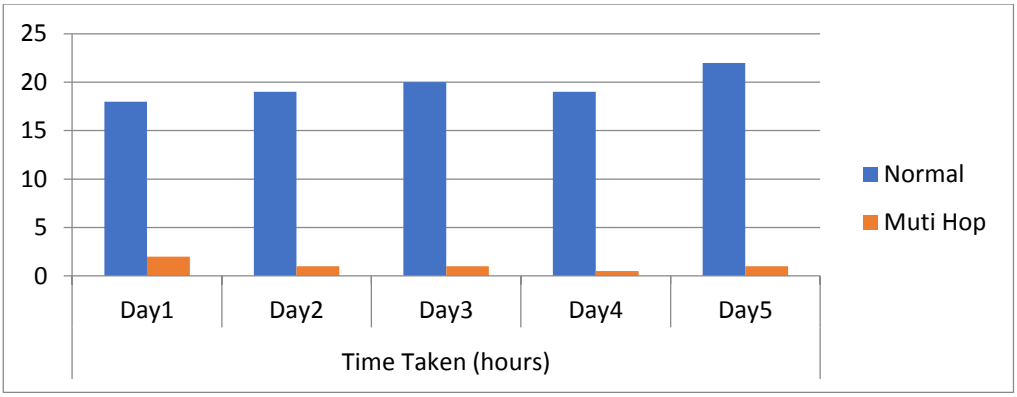


**Chart 2: Time taken is less in Manifold Hop WSN**

## 5. CONCLUSION

Wireless sensor networks are a new sampling tool for ecologists and field biologists. This tool ushers in a third wave of the "land-based" sampling that began with researchers' expeditions to remote areas to take measurements at a point in time and at a location, followed by the advent of data loggers that would allow researchers to leave collecting devices and return to that point (or set of points) to download information collected at predetermined intervals. To accomplish this goal, we regarded the sensor network as a graph-based intelligent model using mobile agents within each CH. It also maintained the coverage area of distant nodes for longer periods. The Ecologist found it easy to gather data for their research. The information loss is preserved and time is less in this approach. The energy consumption of sensor nodes is high which leads to change the battery of sensors periodically. In the future the energy preservation protocols can be implemented to extend the life time of the sensor nodes.

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# DEPLOYMENT OF AUTO MINI SENSOR DEVICES TO MONITOR ENVIRONMENT AND CONTROL AGRICULTURAL PARAMETER

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## ABSTRACT

In recent years the usage of Wireless sensor Networks in farming is the knowledge of civilizing yield yields and supporting decision-making with high expertise sensor and examination tools. Usage of Mini sensors is a new thought that is adopted in the world to strengthen production, diminish physical labor time, and also make sure the management of fertilizers and irrigation process are successful. It uses vast quantity of particulars and information to advancement the usage of agricultural resources, yields, and the value of crops. This is a higher upgrading and optimized territory level of administrative approach used in crop growing fields. Therefore use of WSN is a new-fangled exceedingly developing technique in which farmers give optimized inputs such as water and fertilizer to enhance productivity, quality, and yield. It requires a enormous sum of information about the yield condition or yield vigor in the growing time of the year at sky-scraping spatial verdict. Autonomously of the data groundwork, the large amount of critical purpose data from Field is to provide shore up to farmers in running their business. Since all sensors like agricultural sensor, top soil sensor and yield sensors are rely on the battery influence and that are located in the argumentative environments so replacing it is a tedious task. But the use of sensor nodes in large farms to read the crop status, irrigation level, weather condition helps the farmers to improve their cultivation with less manpower. In this paper we provide the strategy to use sensors to read the field status to improve productivity.

**Keywords:** Wireless, Sensor, Networks, Nodes, Sink, Actuator System.

## 1. INTRODUCTION

The Wireless Sensor Networks (WSN) is futured for observing an environment. The major errand of a wireless sensor node is to cram and gather information from a definite field, arrange them and send it to the mobile sink where the request lies[1]. In the wireless sensor networks (WSN), the line up method is adopted which is worn for the diffusion of the data packet. If there is serious of traffic load issues, then line up handling of the load is not capable and the sensor node is not well-organized which might cause data waiting and leads to overflow in the sensor nodes. Because of such issues the effectiveness and consistency in transmission of information could not be obtained. The sensor nodes produce the energy gap in the routing pathway. This is then formed by manifold hops process which is based on relaying the data packets[2]. The Centralized arrangement techniques which are appropriate for networks for handing out the power ability rely frequently on an exclusive device. Plentiful sink in WSN and a topology arrangement method in the wireless network will robotically reconfigure the set of associations. This is done in order to project the node breakdown. The quantity of retransmissions caused by arbitrary fatalities of messages in wireless communication is considered. Sensor node is capable using in frequent industrial, military and undeveloped applications, such as transportations, transfer monitoring, ecological monitoring, elegant offices, and battlefield[3]. Given that the sensor node is vigor constrained and its communication distance is inadequate, it is infeasible for all the sensors to broadcast the collected or transferred data straight to the bottom location.

## 2. MONITORING THE FARM USING SENSORS

Wireless sensors and elegant transducers are equipped with a quantity of micro-controllers have the capacity for processing and network supervision. We can unite the Wireless communication procedure, such as 802.11, 802.15.4 and 802.15.5. The requirements for designing the wireless sensor communications (WSN), along with the issues associated with the wireless sensor demonstration, the user necessities, data reliability, the safety measures for facing the issues and bandwidth all are well defined in this principles. The data from farmhouse technology is regained by the data compilation gadget through confined network. Then it is accumulated, analyzed and pass on to the managing device via wireless means of communication. Pedestal on this information the supervisor bus serve and organize the performance of the farmhouse machines. The feed acquiesce mapping organization tool consist of a humidity sensor, a GPS component, load cell and Bluetooth wireless communication component for yield mapping[4]. The Network pasture has the positioned doorway node for effective communication. The purpose of this doorway node is to gather data from Clusters and from the beginning nodes that lie close to the gateway node. The aggregations of composed information from all nodes are transferred to Base station. We additionally add this rechargeable entryway node at a large quantity at cheaper cost than the cost of the feeler node. This approach reduces the overall organization cost. For a sensor node, the duration can be distinct as the period of instance (possibly the number of rounds) after which it is not capable to transport any information for a network.

This can be chosen by the bereavement of the primary node or 10, 80 or 100% of the nodes. One of the major aims is the addition of the network duration by the diminution in the vitality procedure between associate nodes and the accumulation heads. For these steering protocols assist in observance a track of outstanding energies of the sensor nodes and enthusiastically get used to the clusters to these standards.

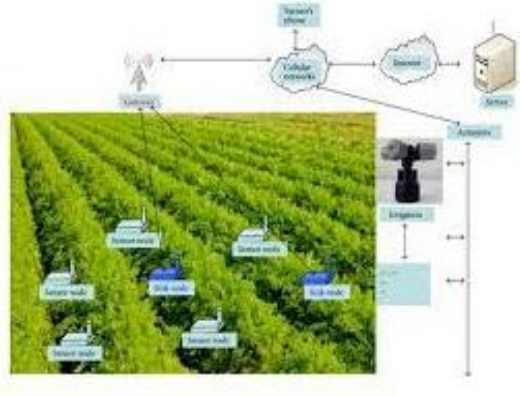

**Figure 2: WSN, Base Station & User**

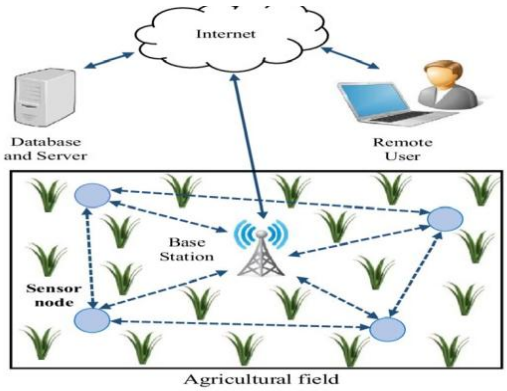


**Figure 1: WSN in the Field connected virtually**

The assortment of WSN and nebulous control [5] is aiming at the countenance of ecological information observing, a multi-bound monitoring organization is intended by Xinrong and Chang based on less-power

ZigBee wireless communication tools to progress overall the level of method automation and monitoring. The perception results for temperature and precipitation have shown that this method is steady, high consistent in data broadcasting and easy to use, and can be broadly used in a mixture of areas of regular monitoring of ecological parameters. The wireless sensors networks (WSN) are categorical as the compilation of sensor nodes that carry out a specific task and they are on behalf of one of the technological solution and progress of the organization of crops. Wireless equipment as shown, known for its simple fixing up and safeguarding is contemplation preponderant to enlarge automatic irrigation network and appropriate hot research. Water precondition control is a derogatory facility in particular in the irrigation symmetry for farming behavior. It is momentous to make sure the amplitude of water in the reservoir is for all time at its suitable level and capable to be flowed to irrigation method when it reaches the greatest stage to prevent water from overflow in the adjacent areas.

The concernment of wireless sensor network (WSN) for water irrigation organizes chaperon[6] is self-possessed of a multifarious sensor nodes with a networking holding ability that can be deployed for an ad-hoc and un-fluctuating counsel function. The constraints involved in the water corollary control such as the water point and motor association of the gateway controlling the stream of water will be calculated in the actual time by the sensors that propel the data to the base location or control/ monitoring area.

## 3. CONTROLLING THE PARAMETERS

### Sensing the Temperature

In the plant thriving system, the temperature is one of the treacherous factors considerably determining plant proliferation and progress. A dwindling in temperature underneath the optimal circumstances often creates consequences in suboptimal plant development. Dissimilar cultivars have need of an antithetical temperature level for the photosynthesis progression and chrysalis, which can progress the plant growth period. It will ultimately bring us pervasive economic reimbursement[7]. The sensors congregate the data pertaining to temperature from a particular substratum and renovate the data into a comprehensible structure for an appliance or a viewer. The temperature sensor faultlessly procedures temperatures slower varying from serious applications such as amenities or accommodation and sends them to the user's webpage[8].

### Sensing the Moisture

Moisture sensors are extravagantly used in medicine, agronomics, and ecological monitor. The sensing collateral used in clamminess sensors can categorize into earthenware, polymers, and composites[9]. The clamminess sensor could be located in the growth alcove to uphold the moisture level. If the moisture level becomes less than the plant stipulation, the sensors will forward the signals to atomization nozzles to perform their work.

**Daylight Intensity Sensor**

As we know, all vegetable plants and flowers want monstrous daylight, and each plant assortment reacts in a peculiar way and has the dissimilar functioning to deal with light fortitude. Some plant convoy out well in low light obtrude and some in high light force[10]. The daylight sensor is an electronic tool which is used to identify the existence or no existence of light and darkness. There are considerable amount of light sensors including photo resistors, photodiodes, and phototransistors. These light sensors extricate the gist of light in a growth compartment and intensify or slash the luster of light to a further satisfied level. Daylight sensors can be worn to automatically manage the lights such as on/off. By carrying the sensor network in plant growing ideology, the farmer could be able to monitor luminosity intensity without any human interfering[11].

**Sensing the Oxygen Level**

The befitting oxygen concentration in the root surroundings is critical to remain the root metabolism in nourishment elucidation. The extant oxygen retention for the root location is a tremendously significant facet because low concentration influences the root respiration, nutrient blending, and consequently, the plant development[8]. Though, the Oxygen sensor testimony determine series is in between 500 and 5000 portion per million[12]. There are two leading types of the Oxygen sensors which involve of non dispersive infrared carbon dioxide sensors and compound carbon dioxide sensors, whereas the oxygen disclose in a gaseous surroundings by its emphasize absorption and self-possessed of an infrared locater, an intervention filter, a radiance tube, and an infrared source. However, the CCDS of insightful layers are based on polymer or heteropolysiloxane with low-energy consumption [13].

**Storage Management**

Wireless Sensor Network supervises method to grain depository to supervise temperature and clamminess in the grain storage area with stable demonstration including data gathering, transmission, storage etc[14]. The nodes can use battery to provide vigor and is installed expediently. This organization has been broadly used in miniature and medium-sized granaries. A habitual monitoring method of granary support on WSN is invented by Ling Xu & co is a innovative conception to store granary[15]. This formation consists of the legitimate monitoring integral and the receiving component using the aptitude sensor equipment and the wireless communication technology, a fashionable form of sensor network in current years. It can be generally used for humidor monitoring method of the granary.

## 3. PERFORMANCE ANALYSIS

The constantly greater than ever food hassle lack speedy improvement and amendment in the food accomplish system. Though, in order to enhance the supremacy and productivity of the enlightened crop, peoples are poignant towards the new plant crop growing technologies in farming. Thus, the plant growing using WSN is one of the expanding plant growing technology in farming as a modern-day cultivation technique, where the plant is sophisticated in an air atmosphere and no any soil maintenances is provided. In the plant growing

system, a numeral of the parameter are necessary to control for flourishing plant growth since there is no growing medium provided to the plant.

The wireless and actuator system present several advantages counting faster reaction to challenging climatic circumstances and better eminence organizing of the yield that produces at a lesser labor charge. This progression in the plant growth system through wireless sensor network for monitor growth compartment atmosphere is advantageous. Every sensor senses the information based on the constraint and passes the statistics to the DAB which is exceedingly resourceful. From here the data gets moved to the Head Node and then it moves to the Root Node which is coupled to the work station. Dealing out and elucidation of the data is completed at the work station and the outcome drawn out is in defined form which can be worn for improving yield production.

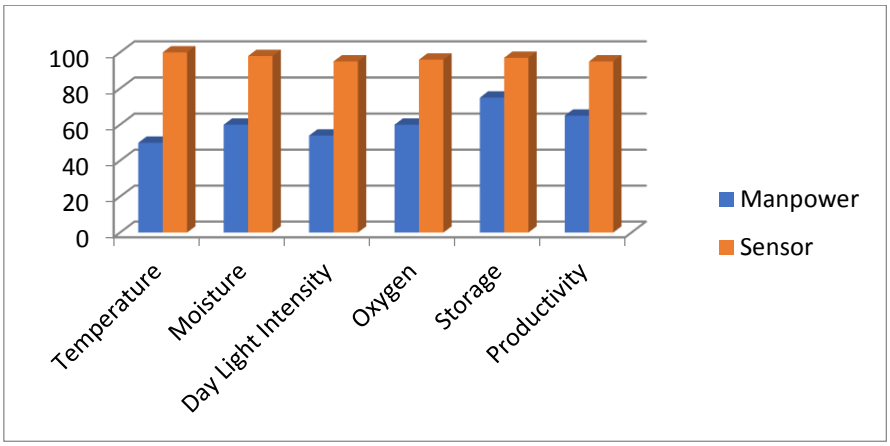


**Figure 3: The Agricultural Parameters controlled by sensors**

## 4. CONCLUSION

The use of Auto Mini sensor to study the field results in controlling the agricultural parameters which in turn increases the productivity. Use of WSN technology in Agriculture will helps the farmers to be acquainted with the accurate values of the necessities that they require to improve the yield productivity. The examination of these parameters helps them in enchanting better decision at the exact time and at the right place. In spite of issues our WSN prototypes give prospect to gather round valuable information for grassland weather monitoring. The technology offer unbelievable opportunity for the growth system to amplify the capability, consistency, and availability between the farmers and growers. We deem that our evaluation article will give to the implementation of the highly developed monitoring technology in the plant growth system. On the other hand, the system provides a series of information which could be mandatory by plant scientists to give a better understanding of how these ecological and nutrient parameters associate with plant growth. In Future we refer to use Multiple Hop sensors to preserve energy and data loss.

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# FORECASTING COVID-19 USING AUTOREGRESSIVE INTEGRATED MOVING AVERAGE MODEL

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## ABSTRACT

Data mining is the process of mining enormous databases for hidden information, unexpected patterns, and new laws. Machine learning seeks to answer the question of how to create computers that adapt from their

experiences and adapt automatically. It is at the interface of computer science and statistics, as well as at the heart of artificial intelligence and data science, and is one of the most quickly expanding technological topics today. Data mining is extremely important in the field of healthcare. Data mining applications in medical field will profit health care providers, such as hospitals, clinics, physicians, and patients. It will help in the premature acceptance of novel technologies, and primary discovery of deadly diseases, in-order-to to lessen medical expenditures. These days, the covid-19 virus is a major threat to healthcare sector, and it should be taken seriously. More than a million people have been affected by this threat throughout the world. Accordingly, the primary goal of this work is to estimate the number of confirmed instances based on time series data from a single variable. The Autoregressive Integrated Moving Average (ARIMA) models are used in this study to anticipate system dependability. This time series approach is incredibly versatile and requires few constraints. For this univariate time series, the Auto Regressive Integrated Moving Average (ARIMA) is utilized for analysis, and the analysis is carried out with the help of the Python programming language. Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. In this paper, we have used the data set of Covid 19 patients, applied ARIMA and done the future prediction.

**Keywords:** Autocorrelation, Autoregressive, Covid-19, Dataset and Forecasting.

## 1. INTRODUCTION

Data mining[1, 2] is the process of predicting outcomes by looking for anomalies, patterns, and correlations in huge data sets [3, 4]. In numerous sectors, data mining has been utilised to improve customer experience and experience, as well as product safety and usability. Predictive medicine, customer relationship management, fraud and abuse detection, healthcare administration, and analysing the success of various therapies are all areas where data mining has shown to be useful in healthcare [5, 6]. In this world, people are affected by covid-19 in different ways some of them have mild symptoms and recover from the disease without hospitalization. The most common symptom of this disease is fever, cold and tiredness[7]. It is mainly transferred from infected person coughs, sneezes, and exhales to another person[8]. The best way to prevent from infection is by washing hands and using sanitizer frequently. Till now total cases across India are 29,935,221 and recovered cases 28,844,199. The active cases of covid-19 are forecasted using a machine learning model in this article, which is beneficial.

### (i) Forecasting

Using historical and current data, forecasters make educated guesses about what will happen in the future. An everyday example is making an educated guess about what a certain variable will be at some future point. Prediction is a word that means the same thing, but in a broader sense. Following are the techniques in time series forecasting [9]

### (ii) Techniques in Time series forecasting

- Auto Regression (AR)
- Moving Average (MA)
- Autoregressive Moving Average (ARMA)
- Autoregressive Integrated Moving Average (ARIMA)
- Holt Winter's Exponential Smoothing (HWES)

## 2. METHEDOLOGY

### (i) Data Set Description

Evidence of COVID-19 infection in India is gathered through Kaggle from 30 January 2020 to 19 May 2021 for several states. Predictive models are trained using this data. Data cleansing is critical to get the forecast-relevant data [8,10].

### (ii) Problem Statement

The Objective here is to forecast number of Confirmed cases using Time series Techniques.

### (iii) ARIMA

ARIMA is a time series forecasting approach that is among the most effective available. It makes predictions about the future value based on the values of the past. The parameters p, q, and d are utilised as stand-alone parameters in the ARIMA model. The autocorrelation function and partial autocorrelation function are used to estimate the parameters of the system. [11, 12]

The following are the parameters:

P is the model's lag order, or the number of lag observations.

d: the degree of differencing is the number of times the raw observations are differed.

q: Moving average window size, or the order of the moving average, is a technical term.

### (iv) Stationarity Checking

To determine if a time series is stationary under the ARIMA model, the first step is to examine the time series. The Augmented Dickey-Fuller (ADF) and rolling statistics assist in determining if a station is stationary. The ARIMA model performs best when our data exhibits a steady or consistent pattern across time. This means that the mean of the data and the variance of the data must remain constant over time in order for the model to work. When the data is moving uphill and downwards, it indicates that it is not in a fixed position [8, 13].

This is seen in Figure 1, which shows that the covid 19 confirmed cases in India is not stable, which implies that the mean and variance are not constant. The Augmented Dickey Fuller Test may be used to make a strong inference about whether or not the data is stationary (ADF). Figure 2 depicts the ADF Test report of confirmed cases in India, according to the ADF.

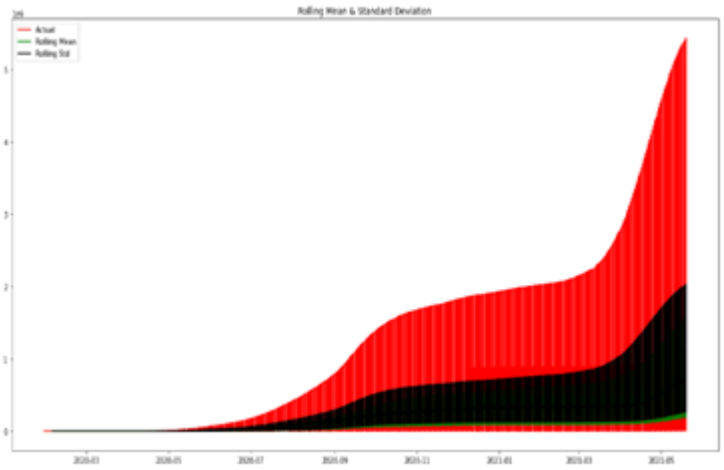

**Figure 1: Rolling Mean and Standard Deviation**

```
Dickey-Fuller Test:
Test Statistic                  6.293326
p-value                         1.000000
Lags Used                      43.000000
No. of Obs                  15042.000000
Critical Value (1%)            -3.430785
Critical Value (5%)            -2.861732
Critical Value (10%)           -2.566872
dtype: float64
```

**Figure 2: ADF Test of covid 19 Confirmed cases**

In the above ADF test statistics shows that the p value is higher than the threshold value which indicates the data is not stationary.[14]

### (v) Transforming Data

There are a variety of data transformation strategies that may be used to transmit data that is stationary. Log scale, exponential, and shifting methods are employed in this approach to convert a piece of data[8]. The log transformation and differences methods are the most commonly used to stabilize time series[9]. After conducting log scale, we discovered that some of the data in the dataset included negative infinity values. We were able to resolve these types of difficulties by using the replace function to convert negative infinity values to zero[14, 15]. After doing log transformation again check the Stationarity and able to conclude the data is stationary now based on the below results. In Dickey Fuller test the p value is very much less than 0.05 and reject the null hypothesis and hence the data is now stationary[16, 17]. Before fitting into ARIMA model understood the trend, seasonality and residual of the dataset the above parameters are understood with below figures.

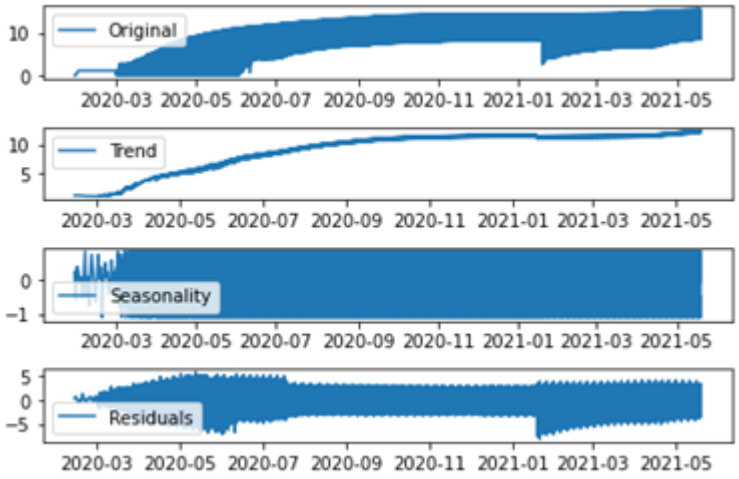


**Figure 3: Plotting of Seasonality and Trend**

### (vi) Forecasting Model

The ARIMA (p, d, q) model is used to forecast confirmed COVID-19 cases. It is expressed as

$$ARIMA\ (p, d, q): Xt = \alpha 1 Xt-1 + \alpha 2 Xt-2 + \beta 1 Zt-1 + \beta 2 Zt-2 + Zt \quad (1)$$

Where $Zt = Xt - Xt-1$ (2)

Here, Xt is the predicted number of confirmed COVID-19 cases on the t th day, α1, α2, β1 and β2 are parameters whereas Zt is the residual term for $t^{th}$ day .

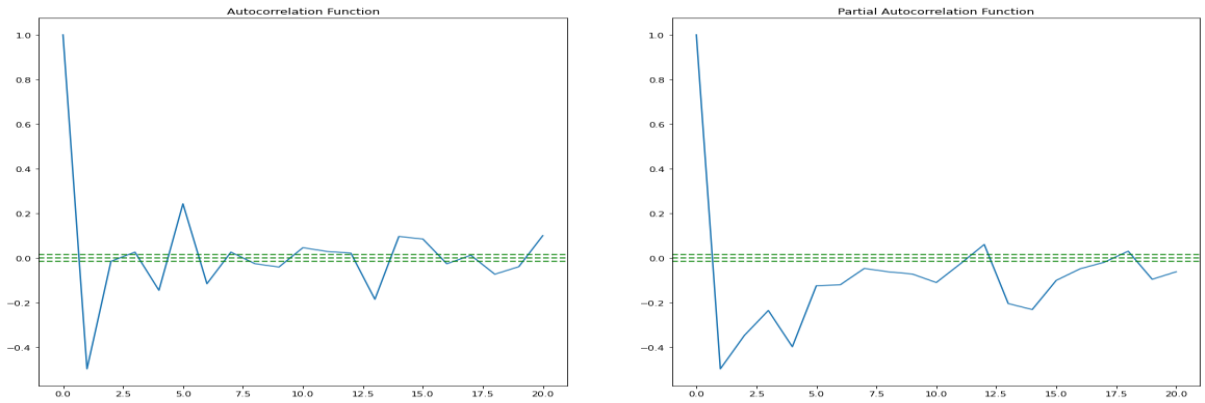


**Figure 4: Autocorrelation and Partial Autocorrelation**

To find the optimal value of p and q the below graphs are used. From the below Partial Auto Correlation graph and Auto Correlation graph we could conclude the p and q values are to 0. The differentiation lag d value is also set to 0 and now the ARIMA parameters are (0, 1, 0).

## 3. RESULT AND DISCUSSION

For the aim of developing application programme interfaces for machine learning, the experiment makes use of the Python programming language, which is a publicly accessible high-level general-purpose interpreted

programming language. Numpy, pandas, and matplotlib are some of the Python libraries that were utilized. Taking into consideration the aforementioned variables, the expected dates for the near future are generally in accordance with the current situation.

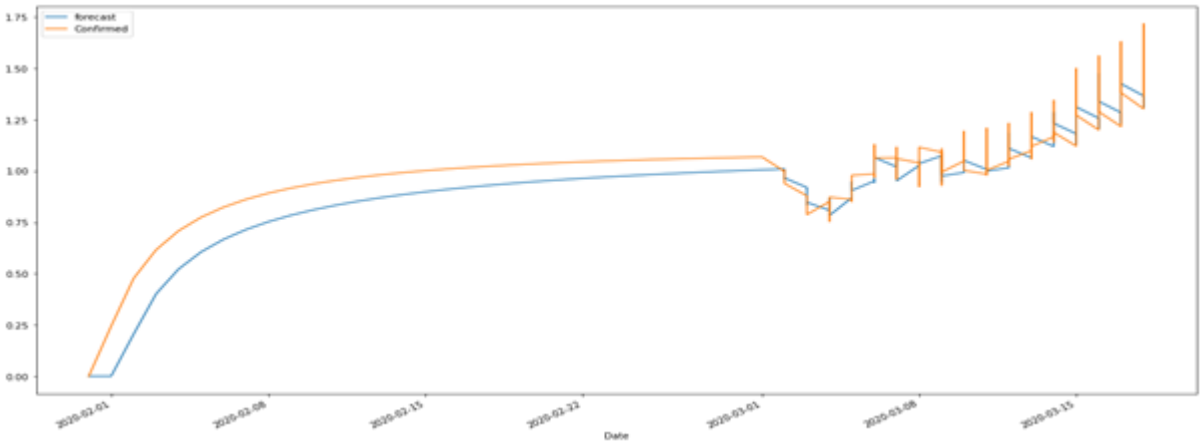


**Figure 5: Forecast confirmed Cases.**

## 4. CONCLUSION

The analysis of data related to covid-19 confirmed cases in India was carried out and investigated. In accordance with the data available as of the 30th of January 2020 and the number of confirmed cases projected using the ARIMA time series model, the upcoming dates are mostly consistent with the actual dates in the past. It can, however, be made better by using certain preventive steps.

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# CONSTRUCTING AN EFFICIENT CLASSIFIER MODEL FOR NATURAL VEGETATION USING REGIONAL CONVOLUTIONAL NEURAL NETWORKS

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## ABSTRACT

The computation of natural vegetation is a time-consuming and carried out monotonous. This work concentrates on providing a sensor-based natural vegetation process or monitoring system. The significant element for this

vegetation process is based on IoT sensors with micro-controllers for system processing, establishing communications among the interconnected nodes and various connected sensors. Some real-time data access is performed with the remote monitoring technologies. An available online dataset is considered for validation using Regional- Convolutional Neural Networks (R-CNN) and a rule-based system model. This approach is used for analyzing the standardized values. When the collected values are higher than the fixed threshold value, an alert is generated and moved to the remote location. The efficiency of the proposed R-CNN model is used to acquire natural vegetation monitoring system with lower power devices, higher mobility, and precision values.The sensitivity of R-CNN model is 98.58%, 94.50% specificity, 98.89% PPV, 96.58% NPV, and 96.58% prediction accuracy.

**Keywords:** IoT- Internet of Things, regional convolutional neural networks,rule generation, higher mobility.

## 1. INTRODUCTION

It is noted that the forest inventory relies on the remote sensing approaches and forest management [1]. In remote sensing, light detection and ranging are adopted for accurately predicting the forest attributes, i.e., diameter and height of the tree, crown base height, leaf area index, and canopy cover for extracting more information. At present, Unmanned Aerial Vehicle (UAV)-borne, airborne, terrestrial LiDAR, and mobile are some of the commonly used approaches in the natural vegetation process. Moreover, these systems have their drawbacks in predicting the essential information [2]. The UAV-borne and down-looking airborne can offer highly resourceful canopy tree information; however, it lacks track information[3]. As this method, the mobile LiDAR system, i.e., the backpack, can offer essential tree truck information but lacks in providing the vertical field of measurement and view range and outcomes in the missed canopy information [4]. The terrestrial laser scanning-based single location scans suffer from the occlusion effect over the leaves and trees and multi-scan TLS data registration, which is time-consuming [5]. The multi-platform data fusion has the efficiency to offer a resourceful solution to deal with the constraints of every detection and ranging platform.

At present, there are diverse commonly adopted cloud registration frameworks like point-based, feature-based, and target-based techniques [6]. Here, target-based approaches require the help of exterior data to registered detection and ranging point clouds, for example, positioning information from Global Positioning System (GPS), target registration can be predicted easily or color information attained from cameras. Next, feature-based approaches work like of target-based approach that uses polygons/lines/points for registering LiDAR points; however, these features are predicted with issues like traffic signs, roads, roofs, and buildings [7]. Subsequently, point-based approaches match directly with point clouds relying on the geometric information offered by these ranging points. The iterative nearest point approach is extensively adopted under these categories. Moreover, point cloud registration models are generally problematic over forest regions. The external registration information needed by the target-based methods is inaccurate, unavailable, or hard to attain in forests. For instance, GPS positioning data are unreliable over the forest canopies due to multi-path errors

and GPS signal attenuation 8. Moreover, handling the ground targets or attaining color imagery is extremely expensive and time-consuming. Feature-based approaches are extensively utilized in urban and indoor environments where regular features like orthogonal and parallel line segments and conjugate least-squares surfaces are determined easily [9].

Generally, the forest environment is highly complex and irregular than the urban and indoor environments and shows regular and similar features as in urban and indoor environments. It is absent or difficult to find it [10]. Usually, point-based approaches like ICP require regular detection and ranging points for registering coarsely before executing the algorithm. Moreover, these coarse registrations over the forest environments are generally attained by manual selection of tie points which is time-consuming and labor-intensive.

In recent times, there are diverse marker-free data-based fusion approaches anticipated by various researchers to handle the issues in missing reference features over forest regions. For instance, H. Guan et al. [11] uses geometrics features over the light-based detection and ranging points for registering the multi-scale TLS data. H. Song et al.[12] anticipated a multi-scan data registration approaches with the adoption of populated triple sets, eigenvalues, and tree locations. X. Liu et al. [13] adopt simulated annealing to predict the optimal 3D-transformation among the corresponding coordinate systems of the tree locations derived from the UAV and backpack data. These approaches rely entirely on the geometric information of tree-stem, or it looks for the globally optimized registration outcomes with tree attribute constraints like tree locations and DBHs. Moreover, the geometric information of tree steam is generally not available from the top-end data like UAV data and optimized globally to attain a solution that fails in accuracy estimation of tree-related attributes, and the accuracy is generally lower. The major challenge of this study is how to efficiently and accurately register the multi-platform points in the forest regions? And how is this challenge efficiently handled for forest applications? H. Xia et al. [14] discuss a novel multi-platform data registration framework for forest applications using the unique spatial tree distribution over the forest regions by registration process [15].

## 2. RELATED WORKS

Drylands face crucial challenges with native vegetation deterioration due to anthropogenic activities and climatic changes, as Nogueria et al. [16] described. These activities are crucially influenced by the ecosystem's available services and vegetation patterns, and it causes harmful influence over the natural resources and human-being sustainability. Dryland ecosystems are characterized by constraint and sparse native vegetation due to weather conditions, i.e., low precipitation and high temperature. Moreover, vegetation in the desert region plays a substantial role in battling promulgating carbon sequestration. Guo et al. [17] discuss the significance of native vegetation, which is crucial for understanding the atmosphere and earth, like soil erosion, droughts, and climatic changes. Therefore, monitoring vegetation is a pre-dominant phase in restoration to identify degraded fields. Zou et al. [18] discuss the concepts of remote sensing images for the past few decades and offer synoptic insight towards the territory coverage and hauling out essential information on the phenomenon with nominal economic

factors. These technologies provide information extraction from the ecological elements merged with the ancillary data over the GIS to evaluate degradation over a certain period. Thus, researchers use spectral measurements acquired from various satellite sensors like vegetation indices (VI) to examine the seasonal vegetation and compute the drought consequences.

Various investigators perform extensive studies on remote sensing to monitor and map vegetation at regional and local scaling based on the different sensors discussed by [19]. The sensors acquire the images in pre-defined spatial resolution to specify ground measurement [22]. Spectral resolutions change due to wavelength intervals as sensors collect the earth's surface reflectance. The temporal resolution of the provided remote sensing images is attained from the speed and orbital path. It shows the satellite revisit rate for gathering ideas from a specific location [23].

## 3. METHODOLOGY

This section shows three stages for predicting the growth of trees over the drylands. It includes dataset acquisition, segmentation, and classification. Here, the deep learning classifier model plays a substantial role in the prediction process. The simulation is done in the MATLAB 2018a environment, and metrics like prediction accuracy are evaluated to show the significance of the model.

### a. Dataset

Here, Moderate Resolution Imaging Spectroradiometer (MODIS) is used for monitoring the development and vegetation growth over the land covers of Tamil Nadu (TN). MODIS is available for a 500m resolution (8 days) temporal period to derive the Normalized Difference Vegetation Index (NDVI) for mapping the terrestrial vegetation. The onboard terra sensor surface was downloaded from (HTTP:// search.earthdata.nasa.gov). It is mathematically expressed as in Eq. (1):

$$NDVI= (\rho (NIR-red))/(\rho (NIR+red)) \quad (1)$$

Based on Eq. (1), the theoretical values are specified based on the ratio ranging from -1 to +1; however, the higher IV is related to higher biomass where the index value (bare soil, water bodies, and non-vegetated areas) falls nearer to 0. Table 1 depicts the various land cover regions of TN and corresponding geographical regions. Table 2 depicts the NDVI during vegetation greening and browning.

**Table 1 Land covers of TN and geographical regions**

| S. No | Coverage region | Area (sq.km) |
|---|---|---|
| 1 | Built-up | 5289.639 |

| | | |
|---|---|---|
| 2 | Cropland (Rabi) | 13630.053 |
| 3 | Cropland (Kharif) | 5232.519 |
| 4 | Forest (Scrub) | 2559.802 |
| 5 | Forest (Swamp) | 166.526 |
| 6 | Forest (Evergreen) | 5434.105 |
| 7 | Forest (Deciduous) | 8684.933 |
| 8 | Plantation region | 9070.512 |
| 9 | Wasteland | 536.470 |
| 10 | Water bodies | 8310.207 |
| 11 | Wetland | 950.959 |

**Table 2 Natural vegetation (pixel %)**

| | **NDVI** | |
|---|---|---|
| **Season** | **Positive (%)** | **Negative (%)** |
| Rabi | 59.73 | 40.29 |
| Kharif | 86.53 | 13.49 |

**b. Traditional Convolutional Neural Networks (CNN)**

The most commonly known and notable network model provides superior performance for learning features and performs classification. It is an FFNN (Feed Forward Neural Networks), and the parameters are trained with conventional stochastic gradient descent. The CNN model comprises various blocks known as convolutional, pooling, and fully connected (FC) layers. These processing layers play a substantial role in the network model. The former convolutional layer carries out convolution operations among the input, filters, and output feature maps. Generally, feature mapping is performed in a non-linear activation function (AF). The non-linear transformation is done in Rectified Linear Unit (ReLU) for feature mapping generated by the first convolution layer. It initiates system non-linearity and is used for AF. The convolution layer functionality is to haul out various input layered features and attain weight sharing. Every stage's input/output features are provided in a set of array forms and known as feature maps. For instance, if the 2D input images x, the provided input is decomposed in a sequential manner x={x_1,x_2,…,x_3}. The convolutional layers are expressed as in Eq. (3):

$$y_j = f\left(b_j + \sum_i k_{ij} * x_i\right)$$

Here, y_j specifies the j^th output of the convolutional layer, and x_i specifies the input feature map, k_ij is the convolutional kernel with input map x_i. * specifies discrete convolutional operator, f is non-linear activation function, b_j is trainable bias. The pooling layers perform the sub-sampling function to diminish the feature

mapping dimensionality. Based on the average and maximal functions, the functionality of the pooling layer is partitioned as average and maximal pooling. The fully connected layers are known as FFNN, which performs higher-level feature abstraction. Often, it is the last layer and performs the final non-linear feature combination to perform the prediction process. The activation functions of the FC layer have to be chosen with practical tasks. The sigmoid functions or softmax are adopted for evaluating the posterior probability of the grid.

**c. Regional Convolutional Neural Networks (R-CNN)**

The architecture of the proposed R-CNN model is performed using the AlexNet model. The anticipated R-CNN model and the hyperparameters are tuned based on the dataset. The input patches are provided as a 3D data representation of a*a*z with 25*25*11. The regional CNN model is composed of 3 convolution layers, two pooling, and 3 FC layers. Convolution layers have 64, 128, and 256 kernels and 256 kernels with 3*3 uniform kernel sizes. The convolution layers are followed by ReLU activation functions and the pooling layer. Here, zero padding is used for retaining the dimensionality, and the pooling layers perform maximal pooling. Zero padding is used for retaining the dimensionality, and the pooling layer performs maximal pooling and summarizes 2*2 neighborhoods with 2-pixel strides.

The three weighted layers are FC layers with 128, 64, and 32 neurons. The FC layers output is fed to a 2-way classifier known as softmax and evaluates the probabilities of the class labels. The CNN parameters are learned automatically during training and represented as the convolutional layers' kernel and FC layers' weight. R-CNN training is performed to predict the suitable parameters to reduce the error among the ground truth labels and predicted results on the training dataset. Here, the anticipated R-CNN model converts the input patches from the pixel values to the probability classification outcomes. Figure depicts the flow diagram of the anticipated R-CNN model.

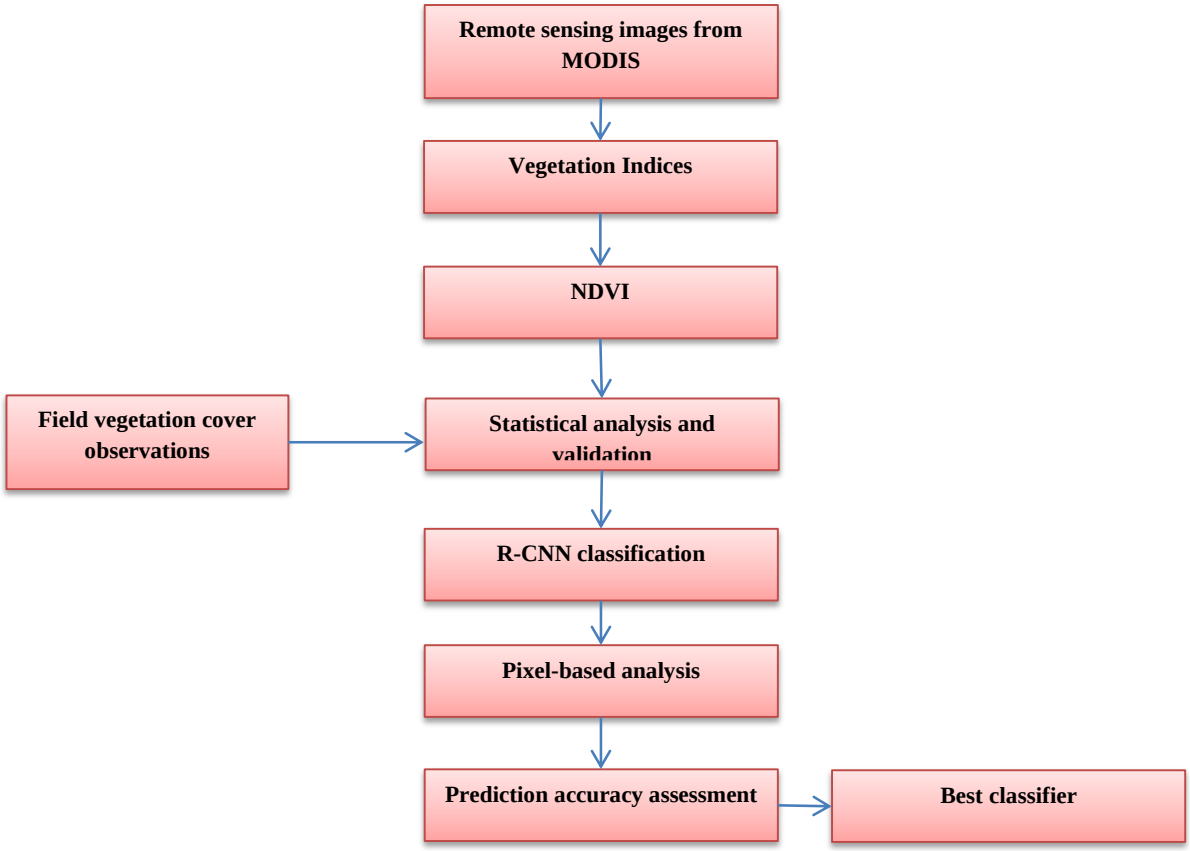



**Figure 1: Flow diagram of the R-CNN classification model**

The parameters are evaluated using the loss function via FFNN. The learning parameters are updated based on the loss value using the stochastic gradient. The hyper-parameter variables need to be provided for initiating the training process. Recently, dropouts are commenced with a regularization approach, and dropout rates do FC layers, and the value is set 0.5 to reduce over-fitting. Random search is more efficient for hyper-parameter optimization than manual and grid search. The random search was adapted to hyper-parameter optimization and enhanced the speed and accuracy of the model. Table 5 depicts the R-CNN hyper-parameter values.

**Table 3: R-CNN parameters and hyper-parameters**

| | **Parameters** | **Hyper-parameters** |
|---|---|---|
| **Convolutional layer** | Kernels | Kernel size: 3*3; No. of kernels 64, 128, 256,Stride = 1<br>Padding, AF = ReLU |
| **Pooling layer** | --- | Pooling, Max_pooling, Filter size 2*2, Stride 2 |
| **FC layer** | Weights | AF: softmax, No. of weights |
| **Other** | | Weight initialization , Optimizer, Loss function<br>Window size, Epochs, Dropouts, Learning rate |

The R-CNN model is appropriate for vegetation analysis, and it cannot reveal more information than the available data. The predominant benefit of CNN relies on how this spatial information is extracted with the model.

## 4. NUMERICAL RESULTS AND DISCUSSIONS

This section discusses the numerical outcomes of the proposed R-CNN model. The simulation is done in MATLAB 2018a environment on Intel Core i5 processor, Windows 8 OS, and 16 GB RAM. Some of the evaluation criteria are considered the key factor for evaluating the classification performance and guide the classifier model to provide better prediction accuracy. There are five statistical measures like overall prediction accuracy; sensitivity, specificity, negative predictive value (NPV), and positive predictive value (PPV) improve classification ability. These metrics are mathematically expressed as in Eq. (4) – Eq. (7):

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad (4)$$

$$Specificity = \frac{TN}{FP + TN} \quad (5)$$

$$Sensitivity = \frac{TP}{TP + FN} \quad (6)$$

$$PPV = \frac{TP}{FP + TP} \quad (7)$$

$$NPV = \frac{TN}{FN + TN} \quad (8)$$

Here, True Positive (TP) and True Negative (TN) is depicted as the number of samples classified appropriately as positive and negative samples, respectively. False Positive (FP) and False Negative (FN) are the numbers of misclassified samples. Sensitivity is depicted as the percentage of positive samples appropriately classified, and specificity is defined as the percentage of negative samples adequately predicted.

**Table 4: Comparison of various metrics during the training process**

| Phase | Performance | R-CNN | CNN | RF | SVM | MLP | KLR |
|---|---|---|---|---|---|---|---|
| Training | **TP** | 3127 | 3127 | 3054 | 2861 | 2800 | 2940 |
| | **TN** | 2997 | 2997 | 2797 | 2323 | 2350 | 2372 |
| | **FP** | 199 | 200 | 400 | 875 | 850 | 823 |
| | **FN** | 65 | 70 | 143 | 340 | 396 | 345 |
| | **Sensitivity (%)** | 98.58 | 97.85 | 95.57 | 89.60 | 87.65 | 89.6 |
| | **Specificity (%)** | 94.50 | 93.78 | 87.52 | 72.70 | 73.53 | 74.25 |
| | **PPV** | 98.89 | 94.03 | 88.45 | 76.70 | 76.9 | 78.15 |
| | **NPV** | 96.58 | 97.76 | 95.18 | 87.40 | 85.8 | 87.5 |
| | **Overall prediction accuracy (%)** | **96.58** | 95.85 | 91.60 | 81.5 | 80.60 | 81.99 |

**Table 5: Comparison of various metrics during the validation process**

| Phase | Performance | R-CNN | CNN | RF | SVM | MLP | KLR |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Validation** | **TP** | 740 | 740 | 582 | 533 | 492 | 580 |
| | **TN** | 667 | 667 | 770 | 750 | 764 | 722 |
| | **FP** | 130 | 134 | 32 | 53 | 37 | 78 |
| | **FN** | 60 | 61 | 220 | 270 | 310 | 223 |
| | **Sensitivity (%)** | 93.56 | 92.50 | 72.60 | 66.60 | 62.50 | 72.25 |
| | **Specificity (%)** | 84.56 | 83.40 | 96.15 | 93.50 | 95.50 | 90.25 |
| | **PPV** | 85.86 | 84.80 | 94.95 | 91.2 | 93.20 | 88.10 |
| | **NPV** | 82.5 | 91.75 | 77.85 | 73.80 | 71.25 | 76.50 |
| | **Overall prediction accuracy (%)** | 90.5 | 87.95 | 84.78 | 80.10 | 78.50 | 81.25 |

The validation phase is utilized to examine the classification performance after every epoch. The validation outcomes are being used whether the training is terminated and hyper-parameters are fine-tuned. The accuracy and loss are two various indicators for computing the training effect. After the training process, the overall prediction accuracy is 96.58%, and the loss is tended to be 0.3 after the 100th epoch. The over-fitting issues are intended to be reduced, and the overall prediction accuracy is 90.5% after the validation process, and the loss is 0.40, respectively. The reduced validation loss specifies that the proposed R-CNN model is aware of over-fitting issues.

**Table 6: Comparison of hyper-parameters of benchmark approaches**

| Approaches | Hyper-parameters |
|---|---|
| RF | No. of trees = 160, Maximal_features: sqrt, Bootstrap: True, Maximal_depth = 20 |
| SVM | Penalty factor = 100, Kernel function = RBF, Gamma = 1 |
| MLP | No. of hidden layers = 1, Learning rate = 0.001, Momentum = 0.2, Alpha = 0.01, Iteration = 300, Activation function = ReLU, Optimizer = Adam |
| KLR | Kernel function = RBF, Tuning parameter = 0.02, Regularize parameter = 0.025 |

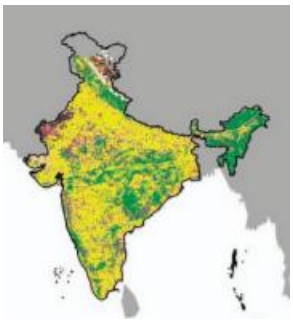
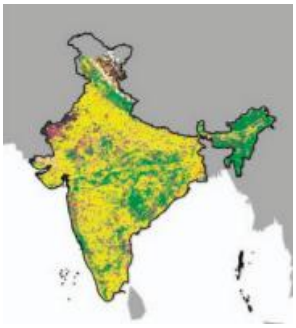
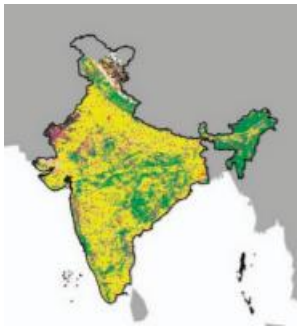


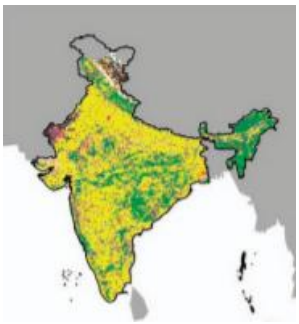
**Figure 7. a: Sample 1**

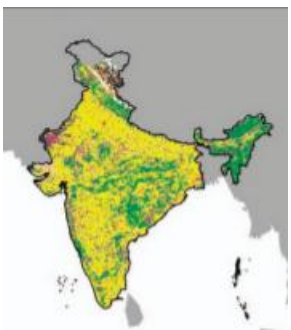


**7. b: Sample 2**



**7. c: Sample 3**





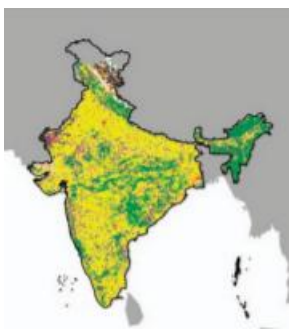


**Figure: 7. d: Sample 4** **7. e: Sample 5** **7. f: Sample 6**

## 5. CONCLUSION

In this research, a novel R-CNN model is designed to predict land cover regions using the MODIS dataset. Here, the pre-processing model is explored for predicting the land cover regions to measure vegetative regions. This method is used for predicting the validation and training of the samples. The R-CNN model is more appropriate for the prediction of land cover susceptibility. Hyper-parameters are optimized to enhance prediction accuracy. Various common approaches consider regularization, training samples, architecture complexity, and batch normalization are utilized in the R-CNN to reduce overfitting and underfitting issues. The dataset is fed to the classifier model, and the prediction probability was designed. Finally, the R-CNN performance was evaluated with conventional ML approaches using metrics like accuracy, sensitivity, specificity, PPV, and NPV. The sensitivity of R-CNN model is 98.58%, 94.50% specificity, 98.89% PPV, 96.58% NPV, and 96.58% prediction accuracy. However, there are various constraints in this research. For instance, the impact of diverse R-CNN models for predicting outcomes is not evaluated. Additionally, some appropriate data is required for the experimental validation of the approaches. Recently, the R-CNN methods are extensively increasing. Various diverse architecture is derived, and different classifiers models need to be proposed. Exploring and comparing various classifiers is not appropriate to enhance the prediction process in the future.

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## WIRELESS SENSOR NETWORK ON BIO WITH COMPARITIVE ALGORITHM: A REVIEW

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## ABSTRACT

A wireless sensor network (WSN) has the importance with wireless interfaces in which they work to communicate from one to different system of a network. Several abstractions are harnessed to ease out the difficult WSN application development. The Wireless Sensor Network depends purposely on the different applications like bio inspired network, it must also consist some of the factors like environment. Nowadays we all depend only on the networking that is the sensoring networks for the purposes of performing many of the task. The aim of this presentation design is focused on cost, hardware and system limitations. Wireless Sensor Networks (WSNs) processed in many range in possible applications as such the environment checking, army actions, aim tracking and observation system, vehicle motion control, earthquake detection, patient monitoring systems, pollution control system etc. This type of a network that comprise SNs that are used for monitor and to process a data in particular location and transfer data same to destination remote location, that is known to be Base Station (BS). Every node in the WSN is called SN that holds only one sensor and many process operated with the low battery devices. WSN is also helpful in detecting foreign agents over the air or water. WSN deployed randomly that defines sensor node of the network with large area. Every sensor node consists of three subsystems: communication, sensing and processing subsystems. The first one communication system interchange information with other external systems. The main process is to collect the information from the environment. This paper we mainly discuss on the task of many algorithm types and how they are indeed of performance. The main aim of sensor node is to transfer a data with less limited amount of energy. There are three levels processed such as the work, node and the infrastructure. The main aim of this paper are the abstraction levels, and also survey of the WSN protocols and different algorithms. WSNs emerge as an active research area mainly advantaged to avoid annoying circumstances in various fields.

**Keywords:** WSN, Abstraction, Routing, Base Station, Infrastructure, Metadata.

## 1. INTRODUCTION

In focus by an affluence of concept and practical experiment, wireless sensor network (WSNs) have gained attention in research community in last two years. WSNs is an alternative to wireless networks where it has its own way of usage in huge number of national and military applications and also in bio using topology. A wireless sensor network (WSN) is a wireless network that has dispersed self-regulating sensor devices which are used to lookout physical or environmental circumstances. Wireless sensor network involves many connected sensor nodes that are able to link with one another and exchange data and information. These nodes collect information

on the environment such as pollutant, and transfer the data to base station. The latter transmits the data to a wired network or activates an action, counting size of information received. WSNs are greatly used in low bandwidth and delay acceptance applications in areas of civil, military, environmental and health care checking. WSN node consists of low-power sensor devices, embedded processor and module.

In this paper we mainly determine the main usage of the WSN and how it is performed in the nodes to process each data. And how each algorithm perform in their own task. Sensor network process to the internet acts as a intermediate to the user. In this survey paper we find the scope of each algorithm and the progressive of work in the sensor networking. Now the WSN is becoming the trending process as the direct communication of the design. The possibility of using Wireless Sensor Network is mainly the low cost and a friendly one to result in every problem.

**Requirements**

- Wireless Sensor Networks which has small and component nodes.
- It is reliable and also secure.
- Its cost is low in both maintenance and component
- Self-configuration and reconfiguration
- It have the ability to communicate directly or through base.

**System Architecture**

This figure 1 represents how the WSN works from the internet. Where the sensor network acts as a source and the user as a destination, it works according to the representation. When the user want to process any of the task it permits only to the sensor network to process with the help of internet, the architecture is given in the following as the part.

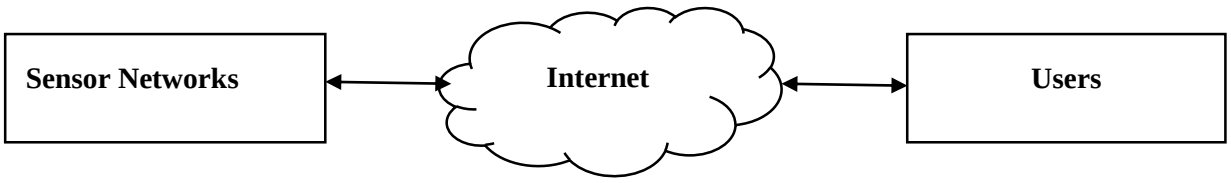


**Figure 1: Represents how the WSN works from the internet**

## 2. ABSTRACTION LEVELS OF WSN

There are three levels based on the levels of WSN that is the node, network and the infrastructure as follows,

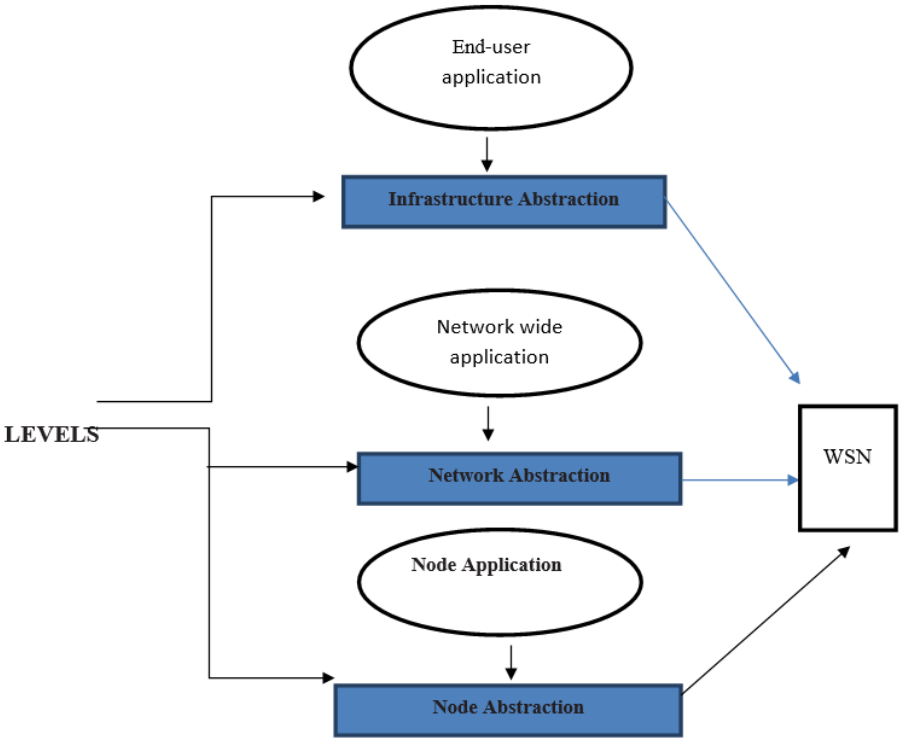


**Figure 2: Levels of WSN**

### Node Abstraction

This is mainly used to process hardware and communication protocols that executes application on each physical node, this is one of the bio inspired level based on the WSN. They perform such actions as analysis a sensor, handling measured data, sending data to parties when they need, and even processing applications further in the network.

### Network Abstraction

Network abstraction affords such services as data access through requests, and data handling in network through fusion and also in collection. The network abstraction level provides access to the Wireless Sensor Network depth data, but the measurement data itself is rarely sufficient for end-user application. This is the main usage of this level.

### Infrastructure Abstraction

This type of abstraction make separate end-user application from the sensor networks and makes the application faster and easier. These provisions are ruled by the end-user applications, and therefore these are the requirements for the infrastructure abstraction.

## 3. RELATED SURVEYS ON INFRASTRUCTURE ABSTRACTION

A Service Oriented Middleware (SOM) provides Wireless Sensor Networks as facilities for application developers. WSN derived specifications for SOMs are runtime services, discovery, configuration, clearness,

automated finding and restoration change between devices and systems. SOM assists in handling of huge data, security, and provision for Quality of Service (QoS)[17]. This is mainly based on the bio informatics. However, Mohamed and Al-Jaroodi [17] claims as only a few of their plotted work report even half the existing requirements. SOMs is considered as subsection of infrastructure abstractions. It involves network abstraction services from the application developer.

Dafoe and Yu [18] survey sensor web proposals. It is one subset of infrastructure generalization of the WSNs. It is observed that integrating WWW as a factor in infrastructure abstraction is not an anticipated approach for every application because of the connection to internet faces security problems for example in hospitals and factories

**Requirements of Abstraction**

| GENERALIZATION | DATA METHOD | META DATA | HANDLING |
|---|---|---|---|
| GNS | Query with data | 3holds metadata | Process on Virtual sensors |
| SENSOR MAP | Query with data | 5 holds metadata | Displaying a map |
| OGC SWE | Events and alerts | 1contains process metadata | Creating notifications |
| QUERY WITH STREAMS AND HISTORICAL DATA | Data and time | 4not mentioned | Aggregate data |

## 4. PROTOCOLS & ALGORITHMS OF WIRELESS SENSOR NETWORK

Wireless Sensor Network has major job of the sensor node in sensing data and displays into the lowest station in different environment. There are numerous existing proposed routing protocols that exist for manipulating the routing track from source node in lowermost station (Sharmaa et al., 2011). The strategy of routing protocols in WSN bio topology should deliberate the ability and resource limitations to network nodes, the time varying prominence and of wireless channel, and thus the option for packet damage and interruption. To proceed with these proposals, various routing plans for Wireless Sensor Network are proposed in (Labrador et al., 2009), (Akyildiz et al. 2002), (Bouhkerce, 2008, Al-karaki et al., 2005, Pahnn et al., 2005) and (Waarrte et al., 2006).

The first lesson of routing protocols accepts an even path when all nodes are measured noble. It has many rewards, though counting less overhead to take care of the arrangement and multiple routes between nodes for liability the impartiality of potential for the inventions.

A second lesson of distribution protocols understand an arrangement on the network to process energy productivity, constancy, and scalable. In this type of protocols, network are processed in groups during which a node with advanced less energy, that is for example let assume the termination role of an cluster head. It helps in directing an activity in promoting information in various clusters and also within the clusters.

The third lesson uses quality built terminology, when a source node analyses an occurrence rather than and distinct sensor node. An attention of nodes completes the assigned tasks by spreading the extended node. Many approaches is used to communicate, multi task interests and distribution of an object and also the nodes to process. A fourth lesson of affecting protocols uses and position to address. Position based is suitable in applications where they spot to the node inside the physical attention. Such a query may guess detailed area where the interest may arise.

**Clustering Algorithm**

There are various clustering algorithms which has been suggested earlier, however these algorithms doesn't aim in reducing the effort consumed within system. Many algorithms are experimental and focus to get less number of clusters such as node in cluster is present at primary hops distanced from cluster head. As per our framework, creating less number of clusters will not make sure of minimized energy consumption. In [7], authors proposed a clustering algorithm which focuses on increasing the lifetime of network with optimal connection of nodes to cluster head and effective cluster size. Clustering algorithm needs each node to comprehend the entire structure of the network that is not possible in huge sensor networks. McDonald et al. have projected a dispersed clustering algorithm for mobile networks that confirms the possibility between any two nodes during a cluster is restricted over time [23].

There are many types of the algorithm based on the clustering, and the first one would be the LEACH which is used to control messages overhead and the second type is the SEP algorithm represents the uniformity, HEED determine the fixed distribution among the stations. DWEHC is the type for the purpose of connection among the network the final one is the DEEC for the fixed one.

1 - c*(i-1)/ (j-1))

**Euclidian**

$d = \sqrt{[(x_1 - x_2)^2 + (y_2 - y_1)^2]}$.

**Manhattan Distance**

Distance= [xB-xA]+[yB-yA]

**Table 1: Comparison of WSN Algorithms & Protocols**

| | **Random**(R) | Assortment **Level** | **Clustering Method Distributed (D)/ Centralized (C) /Hybrid (H)** | **Position Awareness (Y/N)** | **Cluster Head Flexibility Fixed (Fc)/ Mobile (M)** | **Clustering Properties** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ***Count Variable (V)*** | ***Size Variable (V)*** | ***Compactness Variable*** | ***Numbe*** | ***Topology*** | **Connectiv on** |
| **LEACH** | RA | - | DIS | NO | F | V | SV | V | N U | one | **Direct Link** |
| **SEP** | RA | Two | DIS | NO | F | V | SV | V | N U | one | **Direct Link** |
| **HEED** | RA | - | DIS | NO | F | V | SV | V | N U | one | **Direct Link** |
| **DWEHC** | RA | - | DIS | NO | F | V | SV | V | N U | one | **Direct link** |
| **DEEC** | **RA** | Mult i | **DIS** | **N O** | **F** | **V** | **SV** | **V** | **N U** | **one** | **Direct Link** |

**Routing Algorithm**

The routing algorithm procedure uses is a major factor in the performance of routing location. The purpose of the routing algorithm is to make conclusions for the router regarding the best paths for data. Think of the routing algorithm as the transmission of the router. In the same way that traffic officers guide and outline the way cars enterprise over junctures, routing algorithms make decisions regarding the path data will take from one network to another. The router uses the routing algorithm to compute the path that would best serve to moving the data from the source to the endpoint.

**Algorithm 1:** Routing Pseudocode

Initialization of network and parameters
update the local experimental value
**while** close conditions **do**
forward ant is released to search route towards router
broad-minded ant returns and updates pheromone
**end while**

In this we have discussed the merits and demerits of each algorithm. So each is different from one another and perform a different tasks using Wireless Sensor Network. The figure represents different algorithmic process. From each survey they result various algorithmic process as a continuously where each differ from one another as a part Wireless Sensor Networking. And we have also discussed about the comparison chart which level of algorithm is equally performing the task without any of the disadvantage progress as the above we have discussed the below table as follows,

**Table 2: Advantage and Disadvantage of Clustering Routing Protocols in WSN**

| PROTOCOL | MERITS | DEMERITS |
|---|---|---|
| LEACH | Less problem | Non undying |
| SEP | Identical supply of energy | Small device networks |
| HEED | Scalability and Continuous distribution | Tall overhead |
| DWEHC | Reconnectivity | Great overhead |
| DEEC | Calibration | Less scalability |

## 5. CONCLUSION

The main usage of this wireless sensor network is to avoid the threats that we are facing in the day-to-day life, with the help of this it is been avoided using some of the algorithm techniques and also in the future it is also extended in the different way to process data from one station to another station. There are many of the techniques that are presenting in the securing of data using the computational and bio related networks. In this survey we have taken the wireless sensor networking and also the types and tools that is been processed and also the usage of this network and also different node structure that take part in it where network topology plays a major role using its different type and also each perform their own task. This paper gives an overview of wireless sensor network. Here we mainly discussed about some algorithms used in the wireless sensor networks. Which play a major role in each task and we discussed the merits and also there are demerits to be changed in the future work.

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**P-14**

# DESIGNING A BIOINFORMATICS SOFTWARE DEFINE NETWORK EXCHANGE (SDX) AND NETWORK FUNCTION VIRTUALIZATION BASED ON DYNAMIC TRAFFIC CONTROL MANAGEMENT SYSTEM

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## ABSTRACT

SDN is a software Application layer, it provides compensation such as condensed instruction manual efforts in bioinformatics such as dynamic network scalability, and central management of network plans. In traditional networks, each system and the network tool in enterprise or data centre is configured physically; the all requirements of the manual reconfiguration and it having a less traffic controls so always there's a change in network. But The SDN architecture specifies the high level traffic flow control, the system reference points, and many network interfaces to the controller. This structural design describes the variety of functions to the internal blocks are managed by BioSDX controller by using NFV. Explicit block with the intention of these functions, be illustrated to aid the explanation, but are not per se required in an implementation. The network interfaces of the functional nodes are not specified. The SDN's architecture allows an SDN controller to manage a broad range of data plane resources. A number of different data planes exist; SDN's offers the potential to unify, and simplify the configuration of this diverse set of resources. The concept of Dynamic traffic management system encompasses operations performed by BioSDX server for the asking by a client, for instance operations between SDN controllers and NFV's or applications.

**Keywords:** Dynamic traffic management system, BioSDX Topology, Virtualization.

## 1. INTRODUCTION

The detailed study of the concept of Software Defined Networking is being done. The applications of the concept in a present scenario are being studied and different forms of applying are also studies. A topology has of few systems connected with an OpenFlow controller which can be configured based on our requirements. We can configure the controllers based on our necessity. SDN was commonly related to the OpenFlow protocol for remote communication with network plane elements for, the aim of determining the trail of network packets across a network switches.

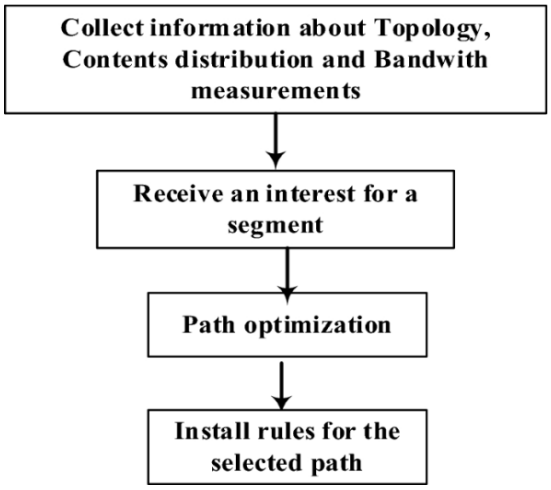


**Figure 1: Transmission flow control of SDN topology**

## 2. ARCHITECTURE OF SDN

The SDN architecture is based on OpenFlow protocol. The following function of SDN architecture is given below:

1. **Openly programmable:** Network controls are directly programmed by the NFV.
2. **Agile:** The networks **controls** are forwarding from administrators are energetically regulating a network-wide interchange flow to meet varying needs.
3. **Centrally managed:** Network Components are logically programmed by SDN controllers.
4. **Programmatically configured:** SDN network manage the all a network configuration, and manage, all network resources very speedily, with dynamic, automated within help of SDN programs. And it will write them because the programs do not depend on proprietary software.

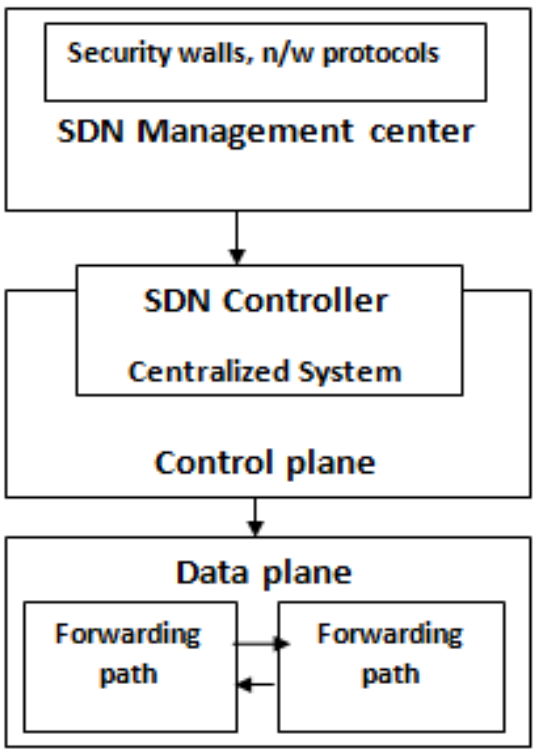


**Figure 2. Architecture of SDN**

**BIOSDX Topology**

Software Defined Networking may be a relatively new paradigm for network management that's supported the principle of detaching the packet process (Data plane) from the routing process (Control Plane)[1]. As the use of SDNs expands, new needs are arising and so are doing new opportunities to fulfill them. The creation of latest tools to hide necessities within the field of security and monitoring was the first purpose of this investigation line. Due to the time constraint, he was just ready to test it within the limited conditions of a virtual setting in only one physical machine. The purpose of this thesis is to contribute to the investigations in security and user monitoring in virtualized networking infrastructures[3].

**Main Objective of SDN**

- Understand the Softwar Defind Networking technology
- Get up to date configuration with network virtualization tools like Minnet and with the OpenFlow.
- Recognize network slicing techniques, and implement an experimental netwrk slicing situation using a slicing tool like Bio SDX OpenVirtexs.
- Investigate architectural choices to guarantee full virtual network communications control for security and monitoring reasons
- Implement a circulated verification of the idea with in distance downward to breakdown all traffic barriers.

## 3. EXPERIMENT RESULTS AND PERFORMANCE ANALYSIS

**Bioinformatics Requirements and condition**

- Understand and experiment the SDN main concepts, using the Mininet platform and the dynamic traffic management system are built in controllers
- Learn how to connect external controllers to the Minnet platform and how to evaluate the netwrk organizer.
- Deploy a BioSDX, SDN and NFV platform
- Experiment the platform functionalities

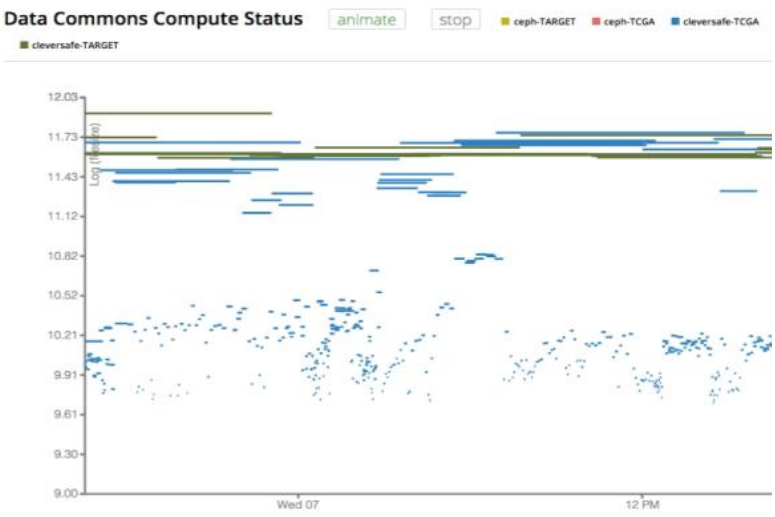


**Figure: 3: Bioinformatics Data Flows**

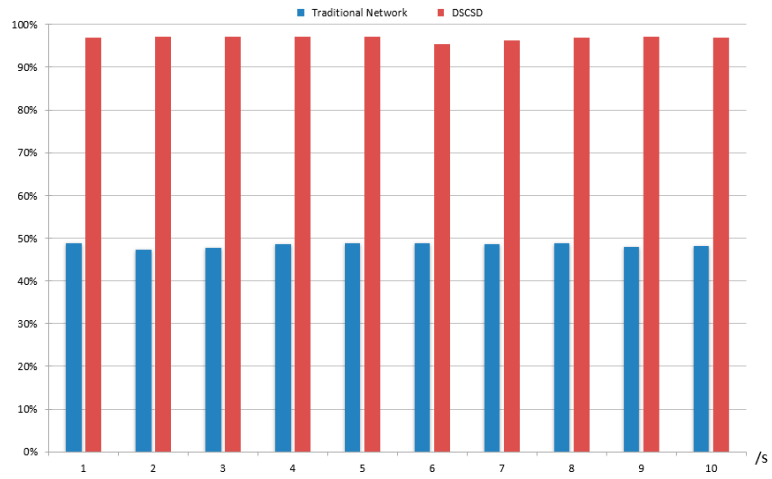


**Figure 4: Overall link consumption comparison.**

During Test 2, figure 3 shows the correlation of conventional organization it held that the loss acknowledgment of the example of five hubs streams in a customary netwrk was high, with two of them near 100%. With respect to the general connection use, the normal connection use of our plan was kept at 98%, while that of customary organization was simply 45%. For an examination, we confirmed the high improvement of connection usage by utilizing DTMS.

$$sw[\mathrm{S}] = \frac{\sum f \in flow(s) Bits(N)}{range(s)}$$

Where *Bits* (*N*) stands for the number of nodes(host) bits processed by source node *s* per second.

$$dw\ [\mathrm{T}] = \frac{\sum f \in flow(t) Bits(N)}{bandwidth(t)}$$

Where *Bits* (*N*) stands for the number of nodes (host) bits processed by destination node *t* per second.

**Simulation of BioSDX network in NFV**

The simulated BioSDX networks are developed in additional 1000 system and it is supported in Mininet simulators. During this section the way to handle multiple user demand that is associate degree advanced issue in electronic network management, application, wherever use will access network or computer content from any device at any time[7]. And it is offer SDN with management plane & information plane to regulate operate in centralized manner. The simulation describes Mininet with SDN design embrace fast SDN with example.

**Input:** *T*=(*S*, *D*), *Sw*, *DW*, *s*

**Output:** *d* [|*S*|], *p* [|D|]

1: *d*[*s*] ←0; *d* [*D*] ←∞, for each *y*≠*D*, *y*∈*S*

2: **insert** *y* with speed limit of *d*[*s*] into the priority simulator Queue of G when y∈*S*

3: **while** (*G*∈*s*)

4: *y*←Extract speed-Minrange (G)

5: **for** each s contiguous to *y*

6: **if** *d*[*S*] > *d* [*D*] +*Sw*[*y*, *s*] +*DW* [*y*] **subsequently**

7: ***p* [*D*] ←*d*[*S*]** speed is calculated

**Parameters using Bioinformatics simulation**

We have measured the subsequent parameters, so as to check the performance of the BioSDX and Non-SDN primarily based controllers:

- **Throughput:** the common output practiced by stations connected to the Access Points within the network, measured by numeration the amount of knowledge packets received by the stations.
- **Set-up Time**: The time from once a wireless station sends associate association request to once it receives associate association reply and joins the Wi-Fi network.

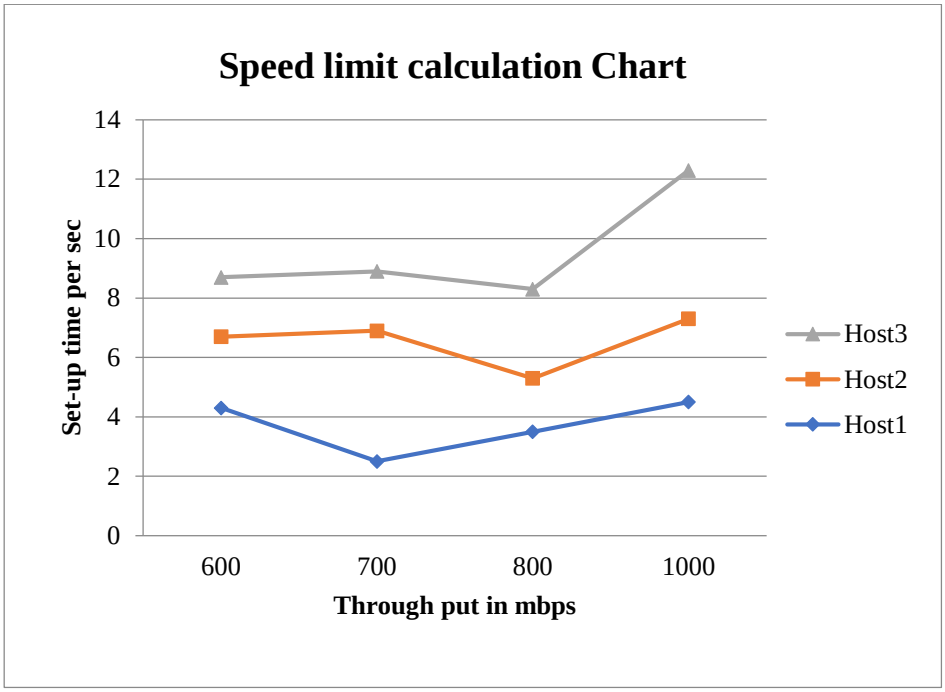


**Figure 5: The speed limit calculated by the NFV**

**Table.2. Speed limit chart in SDN using DTMS**

| Limit of speed | Host1 | Host2 | Host3 |
|---|---|---|---|
| 600 | 4.3 | 2.4 | 2 |
| 700 | 2.5 | 4.4 | 2 |
| 800 | 3.5 | 1.8 | 3 |
| 1000 | 4.5 | 2.8 | 5 |

The following table 2 mentioned the speed limit of the different hosts and the result it will be calculated by the above mentioned Bionimbus method. The following parameters are calculated by the set-up-time and dissimilar throughputs of the different host.

## 4. CONCLUSION AND THE FUTURE WORK

To understand this goal, we designed DTMS, a dynamic traffic scheduling and congestion control scheme across data centers supported SDN15. The instant a flow arrives from the BioSDX, it relies on the connection of traffic parameters and link information to pick paths. Furthermore, it are able to do real-time dynamic scheduling to avoid congestion caused by the burst of instantaneous traffic, and may also balance the link loads. Compared with traditional approaches, the experiment and analysis had a clear effect on the classification and diversion of flows, thereby improving the link utilization across data centers. Meanwhile, Bionimbus is being designed so that researchers can morosely access, analyze innovatively adopted the mechanism of a multilevel feedback queue for congestion control, which is suitable for various sorts of flows and may implement anomaly detection through preventing malicious be due chronically occupying the bandwidth. Our proposed DSCSD scheme are often easily deployed to the prevailing data center networks to affect the low utilization of link resources like the info centers of live video streaming platforms and online video platforms. Even though our proposal solved the traffic scheduling problem within help NFV with proficiently17. The longer term enhancement of BioSDX is that the 5G project at IIT-B has been finding out the way to use associate SDN primarily based controller, to manage access points deployed in villages." Networks are getting larger, bandwidth requirements are increasing along with the number of connected devices and our data networks will have to change and adapt to that growth Datacenter technologies"19. Hence, our topology models a real-life network. Within the current implementation, a listing of shoppers is holding on at the WLAN controller, supported by admission management choices square measure created.

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**P-15**

## SMART IRRIGATION SYSTEM FOR TOMATO PLANTS USING ARDUINO

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## ABSTRACT

The ultimate goal behind agriculture is to maximize crop yield. This automatic plant monitoring system helps the farmers to maximize crop production by irrigating the optimal amount of water. The major issue that is currently been undertaken is water for the crops. Each and every crop needed a different level of care and maintenance, whereas the amount of water need also varies for the crop. This autonomous system monitors the parameters such as light intensity, humidity, temperature and soil moisture which has effects on the crop growth. The soil moisture sensor measures the moisture content of the crop and transmits the data to the Arduino. The Arduino automatically send the signal to trigger the pumping of the water once the moisture content drops below the threshold value and halts when the moisture reaches the absolute value. Thus, this autonomous system helps the farmers to monitor the crop growth effectively to enhance productivity.

The idea is to build a Wireless Sensor Node (WSN) that would continuously monitor the light, temperature, humidity and soil moisture of the crops at regular intervals that will be presented to a system for processing the values based upon the threshold values of the specific crops and perform a predictive analysis over the data and supplying the suitable amount of water which in turn employs the precision agriculture.
Once the analysis is performed alert is sent to the respective person to decide crop watering or not. By continuous monitoring, crops will increase the yield by maintaining it in the optimum climatic conditions

**Keywords:** Arduino Node Automated Agriculture, Precision Agriculture, Water Monitoring, Wireless Sensor Networks.

## 1. INTRODUCTION

Agriculture is the backbone of India and it accounts for the second-largest agricultural land with favorable climatic conditions. It holds the record production of food grains all-time high of 252.68 million tons in 2015. India contains half of its overall population to be farmers (India Brand Equity Foundation, 2004). In recent times, the climatic conditions are changing which are affecting the seasonal crops in specific leading to a decrease in the production. There is an increase in agriculture mechanizations to solve these problems by monitoring the field in a specific manner to supply the water on the necessity to increase production.

## Agriculture & Internet of Things

India's agriculture is composed of many crops, with the foremost food staples being rice and wheat. Indian farmers also cultivate pulses, potatoes, sugarcane, oilseeds, and such non-food items as cotton, tea, coffee, rubber, and jute. Yields per hectare of crops in India are generally low compared to international standards. Improper water management is another problem affecting India's agriculture. At a time of increasing water shortages and environmental crises, for example, the rice crop in India is allocated disproportionately high amounts of water. One result of the inefficient use of water is that water tables in regions of rice cultivation, such as Punjab, are on the rise, while soil fertility is on the decline. To avoid the aforementioned6, this paper discusses water conservation and how to keep away from water shortages for crops.

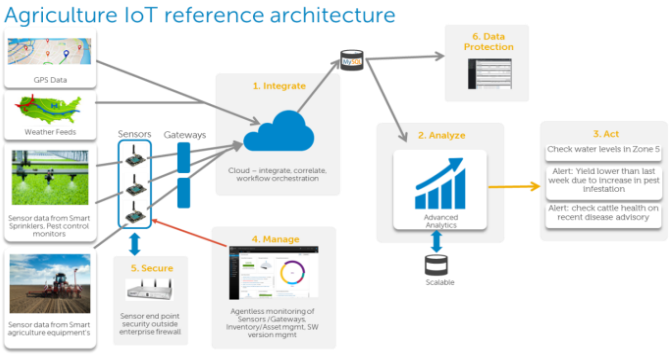


**Figure 1. Architecture for precision farming**

The Internet of Things (IoT) is ground zero for a new phase of global transformation powered by technology innovation, generating significant economic opportunities and reshaping industries20 and can be loosely described as a network of inter-connected devices that can be accessed through the Internet. By using, water wastage and insufficient watering for crops can be avoided. The existing models followed in precision farming are shown in Figure 1.

## Benefits

IoT transforms the agriculture industry and enabling farmers to contend with the enormous challenges they face. The industry must overcome increasing water shortages, limited availability of lands, difficult to manage costs while meeting the increasing consumption needs of a global population that is expected to grow by 70% by 20502.

## 2. MATERIAL AND METHODS

### Proposed System

The idea is to build a Wireless Sensor Node (WSN) that would continuously monitor the light, temperature, humidity and soil moisture of the crops at regular intervals that will be presented to a system for processing the values based upon the threshold values of the specific crops and perform a predictive analysis over the data and supplying the suitable amount of water which in turn employs the precision agriculture. Once the analysis is

performed alert is sent to the respective person to decide crop watering or not. By continuous monitoring, crops will increase the yield by maintaining it in the optimum climatic conditions.

**Building a Wireless Sensor Node (WSN)**

The reliable low power WSN which communicates to the network using the internet protocol (IP) transfers the real-time data from the sensor at particular distance is deadly task20 but it is achieved with the help of Arduino Uno, a microcontroller that has an ATmega328 chip which is amazingly powerful and convenient to perform low level operations6. It acts as a motel on which the sensors are connected.

**Light Dependent Resistor**

Light being the important aspect for the photosynthesis to occur in crops it is noted with the help of LDR. The resistance on the sensor is decreased when light falls on it and increased during dark. The amount of light is found with the help of amount of resistance and Illumination (Lux) which are indirectly proportional to one another.

**DHT22**

Temperature and humidity plays an important role in determining the crops growth. The output voltage obtained is proportional to the celsius (temperature) and relatively the instruments humidity relies in temperature, pressure, mass etc. By calibrating the measured quantities and calculating allows to measure humidity6.

**Soil Moisture Sensor**

Efficient irrigation water management will increase yield, improve crop quality and conserve water. A soil moisture sensor measures the dielectric constant(soil's ability to transmit electricity). It has probes to pass current through the soil and read the resistance. More water means high electrical conductivity (low resistance) and vice versa so resistance and electrical conductivity is inversely proportional6.

**Esp8266**

Esp8266 is a lower power Wi-Fi module with IEEE 802.11 b/g/n that works on 3.3v which is interfaced with Arduino that acts as the bridge for sending sensor readings to the local network via Arduino. An essential functionality is that it can be pushed into deep sleep mode allowing to improve the performance of the node.

**Figure 2: IoT based Watering System**

### System Overview

The sensor node is deployed and placed at strategic position on the field. Each sensor is placed in appropriate places like Soil Moisture sensor the probes are inserted into the soil and whereas the LDR and DHT22 are kept above the soil5.

The whole sensor node has its own protective shield around to avoid damage to the equipment's physically or electrically.Fig.2 represents how the esp8266 is connected to Local Wi-Fi. The read values are transmitted over to the network through the Esp8266 Wi-Fi module which is connected to the local Wi-Fi. Then the Values are stored inside a database present in host on the same network. The data is fetched from the database and given to the predictive engine which does the operation based upon the threshold values for that specific crop and returns an alert message if it does not satisfy the criteria and notify whether to water the crops or not.

## 3. RESULTS AND DISCUSSION

### Tomato Crop under Observation

Tomato is a warm season crop, it requires both warm and cool climate. The plant is highly affected by adverse climatic conditions and it cannot withstand frost and high humidity. Tomato perform well on most mineral soils, however they like deep, well drained sandy loans. Soil depth 15 to 20 cm proves to be smart for healthy crop(Olaniyi et. al., 2010). The required temperature value of different parameters for proper growth of the crop is presented in Table1.

**Table 1. Temperature values of different stages**

| Stages | Suitable Temperature |
|---|---|
| Seed germination | 16-19 |
| Seedling growth | 21-24 |
| Fruit set (day) | 15-17 |
| Fruit set(night) | 20-24 |
| Red color development | 20-24 |

## Soil Moisture

Soil with proper mineral is needed and maintains adequate water throughout their growth period. In summer irrigation at intervals of 3-4 days and 10-15 days necessary to maintain wet soil. When the moisture reaches below 2m the crop has to be watered in order to maintain the wet state16.

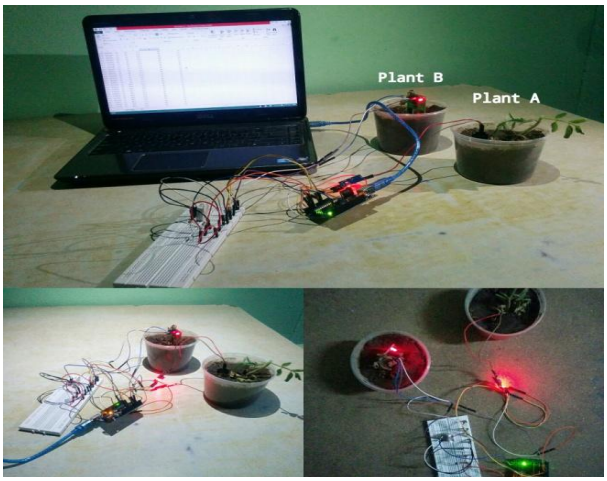


**Figure 3. Laboratory Set-up in Observation Period**

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | Timestamp | Light | Humidity | Temperature | Soil Moisture Plant A | Soil Moisture Plant B |
| 2 | 10:23:16 | 65 | nan | nan | 36 | 13 |
| 3 | 10:23:17 | 65 | nan | nan | 36 | 13 |
| 4 | 10:23:19 | 65 | 47.8 | 33.1 | 36 | 13 |
| 5 | 10:23:20 | 65 | 47.8 | 33.1 | 36 | 12 |
| 6 | 10:23:21 | 65 | 47.8 | 33.1 | 36 | 13 |
| 7 | 10:23:22 | 65 | 47.8 | 33.1 | 36 | 13 |
| 8 | 10:23:23 | 65 | 47.8 | 33.1 | 36 | 13 |
| 9 | 10:23:24 | 65 | 47.8 | 33.1 | 36 | 13 |
| 10 | 10:23:25 | 65 | 47.8 | 33 | 36 | 13 |
| 11 | 10:23:26 | 65 | 47.8 | 33 | 36 | 12 |
| 12 | 10:23:28 | 65 | 47.8 | 33 | 36 | 13 |
| 13 | 10:23:29 | 65 | 47.8 | 33 | 36 | 13 |
| 14 | 10:23:30 | 65 | 47.8 | 33 | 36 | 13 |
| 15 | 10:23:31 | 66 | 47.8 | 33 | 36 | 12 |
| 16 | 10:23:32 | 65 | 47.9 | 33 | 36 | 13 |
| 17 | 10:23:33 | 65 | 47.9 | 33 | 36 | 13 |
| 18 | 10:23:35 | 65 | 47.9 | 33 | 36 | 13 |

**Figure 4. Sample dataset of temperature and humidity gathered from sensors**

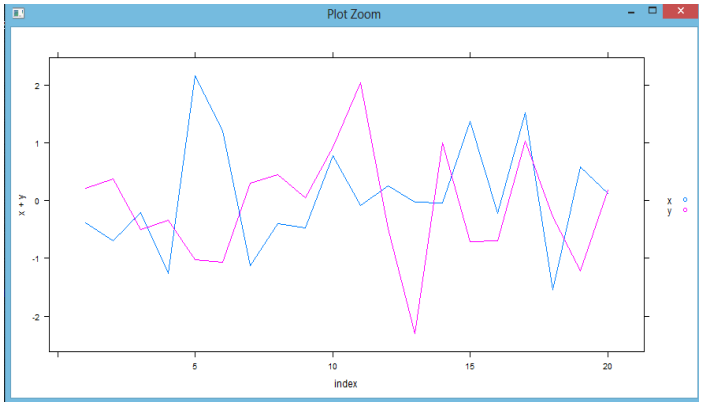


**Figure 5. Comparison of water level in plant A and plant B**

Tomato plants Plant A and Plant B are kept in the similar circumstances where plant A is kept under the automated water monitoring system and plant B is watered on a regular basis following traditional water supply methods.

**Data Sets**

The data collected from the sensors from both the plants are accumulated in a worksheet and the worksheet is used as the database for computation.

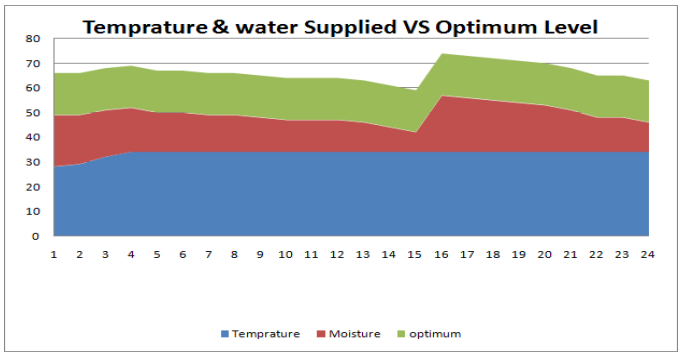


**Figure 6. Data visualization of different parameters**

## 4. CONCLUSION

The automatic crop watering systems reduce the water wastage and automate the crop irrigation. The proposed approach is implemented to measure the growth of the crop and environmental parameters such as temperature and humidity. The results of the field test shows that the autonomous watering system provides better crop growth compared to the traditional watering method. Furthermore, this method performs remote monitoring of the crop watering. These autonomous systems help the farmers in continuous monitoring and improve the crop production. In future, fertilizer management using PH level indicator is provided based on the nutrition level in the soil.

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**P-16**

# A PILOT STUDY ON CLOUD TECHNOLOGY IN AGRICULTURE

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## ABSTRACT

A preliminary foundation of revenue in a country like India is Agriculture. Agriculture is the backbone of our country. Rural farmers rely on the traditional methods. A very huge data is generated in agriculture sector. Access to the data needs centrality for the case of ease. Keeping the data central still seems a challenge. Effective usage of technology has made a drastic change in the agricultural sector. Cloud computing is one among the needed incorporation with agriculture sector that leads to overall development. Cloud technology is a commercial infrastructure that eradicates maintenance of worthy computing hardware, software, Information technology, staff, infrastructure and recourses. Cloud technology makes sure of sharing a group of network-based environment along with servers, storage, services and other cloud related resources. Digitalizing India has not left agriculture sector as the demand for digitalizing and need for data centers pushed the sector to cloud usage. Cloud implementation in agriculture sector helps to keep data related to agriculture centralized which helps in many ways. Information related to weather, crops, farmers, fertilizers, soil and pesticides can be kept and accessed centrally with cloud technology. Smart agriculture can make the sector data pollution free leading to easy access and usage. This paper is organized in a way that a study is made on cloud computing models, special properties of cloud, the way how cloud is deployed as private, public or hybrid, benefits of cloud, issues arising from the constituents on end-to-end work flow and the emerging challenges in agriculture sector.

**Keywords:** Cloud Technology, CDSS, AMIS Iaas, PaaS, SaaS, Agriculture.

## 1. INTRODUCTION

Cloud computing is an on-demand IT infrastructure which requires internet as a base for its working. This technology helps in sharing resources, applications, programmed software and other resources. Cloud computing bank on distribution of resources to achieve consistency and scale[1]. The entire architecture is dependent on the internet which makes users comfortable and utilize the resource in minimum cost and work independently. Country like India that produces food grains and other products in the largest lack in centralizing agriculture related data and information. This leads agriculture to stay behind in the fastest developing modern era. Present methods of productions process remain outdated as many methods are not modernized[2]. This automatically paves a way for slower development in agriculture sector. Hence a gap relies in supply demand chain of farmers agriculture products. This environment leads to a poor economic growth nationally which

creates a negative impression on farmers economic conditions also. Implementing Cloud facility in agricultural sector will help to eradicate the decentralization of data[3]. Crops and framers related data as when stored centralized gives a vision of availability. Ultimately anytime, anywhere access is possible as devices are connected to cloud through internet.

## 2. FEATURES OF CLOUD COMPUTING

a) Self-service on-demand: People who are in need of a service related to server can automatically avail without human intervention. Computing and service availing facility is thus increased and obtained on-demand at any time from service provider without any assistance.

b) Extensive network access: A user may have any mechanism specifically of their own interest to obtain the capabilities over the network with possible platforms using mobile phones, PC's, thump tops, laptops and tablets

c) Hasty pliability: As the demand increases the cloud services can be quickly and flexibly obtained, sometimes inevitably for faster transfer of scaled data in and out. The facilities and services are unbounded to the consumer leading to the purchases in any amount at any time.

d) Calculated service: Though lot of cloud services are free of cost there are also pay per use-provision. A charge is made measuring the consumption so in order to endorse the maximum resource use efficiently.

e) Resource sharing: A multi-tenant model is used in order to provide computing resources to server multiple needy having varied physical and virtual resources. These resources assigned and reassigned as it goes dynamically based on the user's demand. Virtualization of the resources makes the users more comfortable in resource usage as they get a high level of virtual availability despite knowing the location of the resource actual resident.

## 3. TYPES OF CLOUD DEPLOYED

a) Public Cloud: A cloud architecture that provisions software applications, data storing facilities and other computing resources offered to the public either free of cost or pay as per the use. Several organizations own cloud infrastructure which is availed by the people publicly. Some cloud owners are Amazon, Azure, Google[4,5]. Public cloud is entirely held by external providers and any issues raised and services needed is supplied to the user thus handled by them.

b) Private Cloud: A cloud infrastructure that entirely maintained and hosted by private concern especially for their private use. Maintenance is solely by the host organization

c) Community Cloud: A cloud type exclusively used for a particular community who possess common interest. The entire infrastructure is managed and controlled either internally or third-party hosts.

d) Hybrid Cloud: A combined infrastructure that includes more than one cloud types possibly private and public or Community. Thought this structure is hybrid it remains unique held together by standards and technology helping in portable application and data.

## 4. CLOUD COMPUTING MODELS

a) **IaaS (Infrastructure as a Service) Model**: This service provided in hardware base computing resources such as processing power, memory, storage, and networks for cloud users to run their application on-demand. This allows users to maximize the utilization of computing capacities without having to own and manage their own resources. Virtual Machines (VMs) and design virtual infrastructure, network load balancers are used as Information Technology infrastructure resources by the user of this cloud architecture based on needs. The IT architects need not maintain the physical servers as it is maintained by the service providers. Examples of IaaS providers include Amazon Web Services (AWS), Google Compute Engine and OpenStack etc[6].

b) **PaaS (Platform as a Service) Model:** This provides the users the ability to develop and deploy an application on the development platform provided by the service provider. The usual way of application development will be done locally and hosted in a common central location. In stand-alone application progress, the application will be developed by traditional development platforms result in licensing - based software, whereas PaaS changes the application development from local machine to online. For example - Google App Engine, Windows Azure Compute etc[7]. Typical PaaS providers may provide programming languages, application frameworks, databases, and testing tools apart from some build tools, deployment tools and software load balancers as a service in some cases.

c) **SaaS (Software as a Service) Model:** This provides ability to the cloud users to access an application over the Internet that is hosted and managed by the service provider. Thus, the cloud users are relieved from dealing or governing an application the development platform, and the underlying infrastructure. SaaS changes the way the software is delivered to the customers. SaaS provides users to access large variety of applications over internets that are hosted on service provider's infrastructure. Personnel can make his/her own word document in Google Docs online which entirely runs on cloud. She/he can edit a photo online on pixlr.com so she/he need not install the photo editing software on his/her system - thus Google is provisioning software as a service.

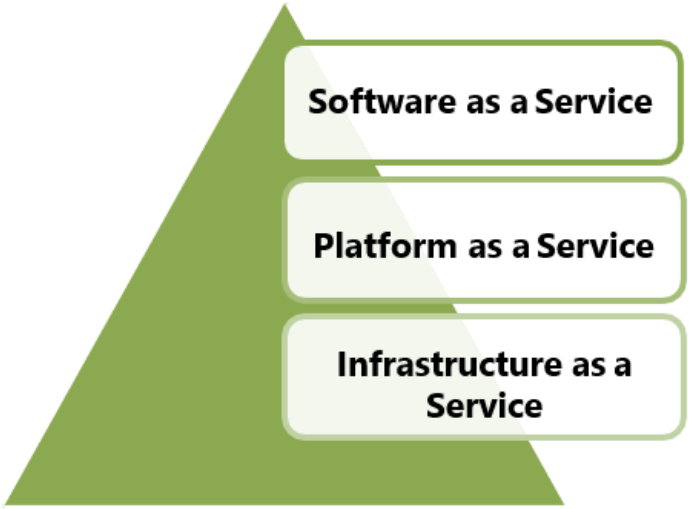

**Figure 1: Cloud Computing**

## 5. CLOUD COMPUTING IN AGRICULTURE

### a) Cloud in Agriculture

A cloud architecture when effectively used by farmers can seizure information relevant to all the crops that they had cultivated and based on which they can make decision on what next needed to be used for cultivating. Information related to weather stored centrally helps a lot to the farmers on weather forecast based on which crop related decisions can be taken by the farmers. There a varied applications based on cloud from sensors to monitoring tools helping to collect soil related data, agriculture field images and several inferences on the soil ground. Sensors in the field is used to find where the bale of hay is located and the amount of wetness it has. Using Centralized Decision Support System (CDSS) cloud manages all data correlated to land, location, area, soil and land characteristics[8]. Soil related information gives farmers a vital knowledge on the types of crops that can be cultivated. Any farmer who is new to agriculture can make use the applications based on cloud and do effective irrigation. Farmer data from various region can be taken, monitored and studied to find the participation of local farmers. This can help in the documentation of principal agricultural areas, which are helpful for policymakers while framing their strategies. Professional Consultation is necessary for farmers regarding various problems. A cloud-based architecture's application becomes a common centralized place for the solutions are available for that farmer frequently face. Side by experts provide solutions to specific problems too, with a rather short response time. Using Agriculture Management Information System (AMIS) can be an e commerce cloud-based software where farmers can sell their crops to the end users or retailers directly without any intermediaries[9].

### b) Benefits of Cloud Computing in Agriculture

1. Readily available of data
2. Globally connected communication
3. Nation's Economy is increased
4. Growth in nation's GDP
5. Makes sures of food security
6. Urban – Rural movement
7. Good market price for Food, Fertilizers, Seeds

### c) Cloud computing applications in agriculture

**i. In height amalgamation and Exchange of agriculture information**

The Agriculture Information Resources Cloud (AIRC) users are able to get agricultural information through a variety of terminal not just the computer, which promotes the information sharing significantly[10].

**ii. Real-time monitoring and guidance in agricultural production**

Cloud computing technology already achieves real-time visual monitoring of crop growth, not only able to quickly get the surface information but also be able to detect the water and fertilizer content in the soil[11].

**iii. Tracking and monitoring of the agricultural products quality**

**d) Challenges in Cloud Technology in Agriculture**

**i. Availability of Gadgets**

Cloud technology becomes a biggest challenge in the rural area where the financial condition of the economically backward people still remains low. Affordability to the computer gadgets seems hard[12,13].

**ii. Network Connectivity**

Internet access is not so much available in the interior villages. Network does not remain stable due to many situations like rain, cyclone and adverse climate conditions[14]. The internet connectivity in the remote area of mountains worsens the condition.

**iii. Illiteracy in ICT Usage**

Most of the old era farmers are not aware enough about ICT tools and hand on them[15].

## 6. CONCLUSION

Cloud computing in agriculture is emerging and growing swiftly which paves a way for well-established agriculture information base for the farmers and the nation. Cloud technology supports the farmers with a varied application dependent on the cloud access wherever they sustain. The farmers need not worry about the software or the information handled by the application as it is in cloud and not in any fixed location. The major need for the farmers is to have the gadgets necessary to access cloud applications. In the future cloud in agriculture will definitely make a remarkable growth in the agriculture sector. Effective usage of cloud implementation and usage will benefit for sure. This paper presents the cloud technologies and the different models employed for different applications sustainably used by the farmers. The benefits of cloud technology in agriculture with some challenges addressed. As of now many agriculture sectors taking a paradigm shift

towards cloud. Cloud computing benefits in the economic growth but still has many challenges in its way. Proper awareness and sharing knowledge on the cloud technology among farmers will sure lead to a successful economic development in India.

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**P-17**

## A METHODICAL AND BEST DOABLE LINE OF ATTACK OF SMART AGRICULTURAL COMMOTION BY MEANS OF IOT

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## ABSTRACT

Agriculture is the backbone of India. There are many jobs and opportunities in our country but agriculture is the only thing which feed us and make human alive. In olden days, the farming method was easy for the limited population. But now-a-days for the growing population, the production will be insufficient so smart farming is the method used to increase productivity and yielding. Smart farming is an appear concept, because the IoT sensor used to provide information about the agriculture fields. It reduces wastage of water and better yield crops. The issues in farming can be overcome by these smart farming process. The aim of smart farming is to maintain the optimum conditions of the crops. Now-a-days agrirobots also been developed for the purpose of smart farming which minimizes workers and save time. Internet of things (IoT) plays a major role in smart farming. IoT agricultural network topology represents an ideal scenario for smart farming. Many countries has implemented IoT policies and guidelines. The area of implementing of IoT is extensive and can be implemented in each and every fields. This article is about the implementation of IoT in agriculture, which is used by farmers to keep track of the field details. IoT helps simplified way of cultivation by accessing information through internet. Using IoT farmers can manage the farming field in easy way. So the farmers can easily monitor their overall business process with the help of IoT technology.

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**Keywords:** IoT (Internet of Thing), Smart farming, sensor, agrirobots, network

## 1. INTRODUCTION

As time passed, more technologically innovations have greatly shaped the development of the world. "The internet of things has the probable to revolutionize the globe, just has the internet do [1]. It is truly the future of communication that has transformed things of the real world into smarter devices. IoT - It's a system of interrelated computing devices and it have ability to transfer a data over a network. The IoT helps people to live and work smarter and also gain complete works over their lives. So the IoT is used in many systematic process like in smart traffic control, smart cities etc..The main goal of iot is to connect the internet from standard devices like pc, tablet, mobile etc. to relatively computing devices like heater, toaster etc. By improving the aspects of our life [2] , IoT has virtually makes everything smart with the power of data collection, AI algorithm and networks. IoT devices they collect ,the sensor data and share it to the connecting to the IoT gateway, where the

other edge device data sent to the cloud to be analyze locally. Sometimes these devices interconnect with other related devices and get information from the another one. These devices work without human intervention[2]. In everyday life IoT is one of the most important technology and it will continue to pickup steam as more businesses realized the potential of connected devices. IoT is essential to the business, where it enables companies to automate process and to reduce the labor cost. It also improves the service delivery, minimizes the wastage and cost of products is less expensive to the manufacture[3].

## 2. LONG-ESTABLISHED SCHEME OF FARMING IN INDIA

Agriculture is the primary sector for the 50 % of population live hood in India. For the rising urban and rural demand, the production of food leads the farmers to follow the hybrid seeds and fertilizers for more yield [3]. India is called the land of farmers ,where the 17 % of the economy of the country is directly or indirectly involved in the agriculture sector. In our economy the only person who get the everything at retail, but he sells the output at wholesale and don't get any benefit from both the ways. Farmers are the only man who do the business in loss by knowingly so they are the people who can provide us food . In early days ,the situation of the farmers are worried because of the changing climatic conditions in India and also because of the proper seasonal rain drought occurs ,soil erosion and using of excessive chemical and pesticides in the field. Due to this factors ,the farmer's both production and income rate is decreased [4]. The farmers do not get the benefit of regular rations. Farmers live under a dismal situation and it often leads them to die of starvation. Suicide among the farmers has become a common in the recent times. In the present days ,the government is taking actions for problems faced by them[4] . So the government provides loan to the farmers but also the raw materials for their cultivation ,expansion of the loan for the farmers are also provided, education programs to teach the modern ways of agriculture, free soil and manure testing labs, etc.., so without farmers ,a mankind cannot progress.

## 3. TRIBULATIONS FACED BY FARMERS

Our India is a developing country, the majority of populations are belongs to the rural area and their primary job is agriculture. But it's been decades these rural living in the same way they used to live over 30 years ago. it is because the agriculture is not a profit-making job anymore. Some problems which has been facing by farmers such as

***a)*** **Lack of Storage Facilities** : In the absence of market place the local traders dominate the market and exploitation of farmers takes place. The problems are not only created for farmers by middlemen but it's for consumer. The situation of poor farmers is even worse[5] The farmers are faced to sell their at whatever prices is offered to them.

***b)*** **Irrigation *:*** The India is the second largest irrigated country of the world. The irrigation is the most important in agriculture field. A tropical monsoon country like India where rainfall is unknown,

undependaple and inconsistent India can't be achieve their sustained goal in agriculture unless and until the more the cropped area is brought under confident irrigation[6].

***c)*** **The Soil Erosion** ***:*** The large area of fertile lands is suffer from soil erosion by wind and water. This area must be treated properly and restored to its original fertility.

***d)*** **Agricultural Marketing** ***:*** Agricultural marketing still continues to be in a bad condition in rural India .In the vacation of sound marketing facilities, the farmers have to depend upon local traders and the middlemen for the dumping of their farm produce which is sold at throw-away price.

## 4. FARMING IN INDIA

There are many techniques in IoT help the farmers to increase the yield of cropping . Some of the important techniques are

***Devices in control to manage farming :*** Some of the devices like sensors, control systems, detectors and hardware equipments can be used to footpath the work of employers, crop yielding, water irrigation level and efficiency of the equipments that are employed farming. This helps the farmers for the better production of agricultural products[7].

***Monitoring the yield :*** By tracking the growth of crops we can able to regain the growth of the crops by stopping the jeopardy at preliminary stages.

***Precision farming :*** The main aim of precision farming is to scrutinize the statistics that has been fashioned by the smart farming equipments .There are n number of precision farming techniques like analyzing the soil condition, livestock management, tracking of the vehicles, water irrigation monitoring by these kind of techniques helps the farmers to work in an efficient way and make quick decisions in a shorter period[8].

***Climatic conditions :*** In India cropping is being done in a efficient way based on the climatic condition .Usually farmers have a poor knowledge on the climatic conditions due to this there is a drastic effect on crop yield and quality of the production. Nevertheless IoT provide the farmers to understand the climatic conditions in the well-organized way by supplementing the sensors and detectors inside and outside the crop-growing field[9]. The sensor is capable of detecting day by day weather conditions like rainfall, clamminess, moisture level in a very precise plane. After detecting the weather condition the sensors is capable of transmitting the information to the user/farmer through alerts.

**Farm Animals Monitoring And Administration :**

How IoT helps in cropping as well as it is used to track the animals. Always farming in India is done by the combination of growing domestic animals, why because the waste produced by the domestic animals is being highly used as the manure, and this gives high yield to the crops and supports for organic farming. So in that note farm animals also being tracked by the IoT application sensors to monitor and maintain their health and performance[10]. As well as monitoring the cattle's with the help of sensors helps the farmer to reduce the staffing expense. Some of the sensors that are used are SCR by Allflex and Cowlar , these devices has been added as a tag to the cattle and monitoring is done[11].

Some of the measures to be taken before employing the IoT solution based agriculture to avoid the challenges to be faced.

1. The hardware equipment should be chosen based on the information we need as well as the quality of the sensor should be tested before being employed in the agricultural field. So the quality of the sensor will assure the reliability of the farming process.

2. The analysis of the data should be done in an effective way by applying the predictive algorithms and incorporating the machine learning techniques to overcome the difficulties faced

3. Hardware maintenance is a challenge nowadays. For the reason that this plays an foremost role in IoT based husbandry. The farmers should ensure the durability of the hardware equipment[11].

4. The mobility of the devices should be ensured by the farmers. So that farmer can access the information on the field all the way through smart receiver or desktop computer.

5. The internal structure of the system should be more secure this will eliminate the hacking of information from the field can be avoided.

6. The connection between these facilities should be real as well it should be done in effective manner even it should withstand in the poor weather conditions and ensure non disruptive operations. Today the smart farming done with various IoT based solutions and various connection protocols are employed to ensure unified standards .Some of the technologies like 5G and space based will help to eventually yield the growth of agricultural process[12].

7. There should be frequent reception of data from the field so that farmers can analyse the data for example receiving the weather report.

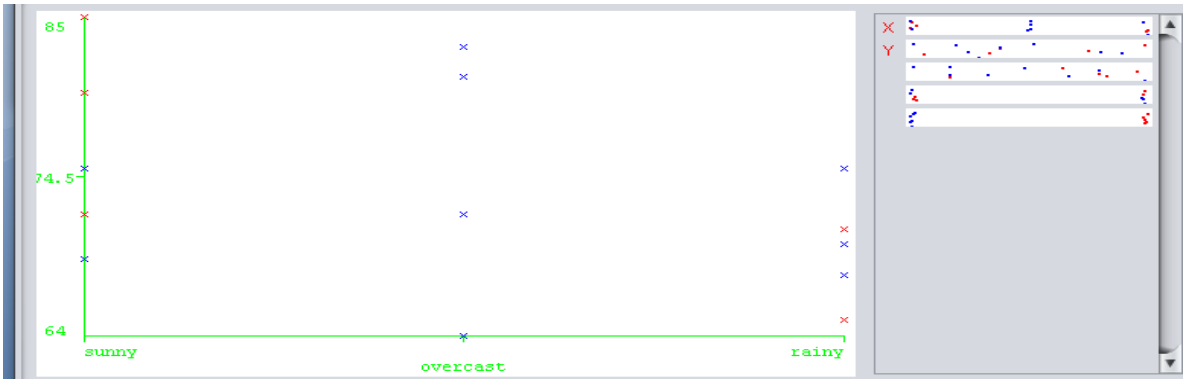


**Figure 1: Sample weather report**

**Table I: Difference between traditional and smart farming**

| Farming factors | Traditional farming | Smart farming |
|---|---|---|
| Physical work | High | Less |
| Cost of labour | High | Comparatively less |
| Irrigation | Done using old traditional methods | Using some hardware equipment like tube wells monitored by sensors |
| Weather conditions | Self monitoring | Hardware devices employed |
| Aesthetic benefits | High | Low |
| Production | Low | High |
| Environment friendly | Yes | No |

**Smart farming cycle using IoT :**

To make the farming in an optimized way smart farming using IoT follows a cycle

1. Examination
2. Verdict
3. Decisions
4. Battle


**Figure 2: Smart farming cycle using IoT**

Some of the Applications are

i. Weeding Robots
ii. Machine Navigation
iii. Harvesting Robotics
iv. Material Handling
v. Computer imaging

## 5. CONCLUSION

The growth of world population increases the demand for food production. Furthermore, the demand of the workforce in the rural areas and the increase in production costs are challenges for food production now-a-days. Smart farming is a farm management concept that may use Internet of Things (IoT) to overcome the challenges of food production[13].. This offers automated farming techniques, useful data collection and high-rigor crop control. Focusing on smarter way of cultivation is crucial. The new technological developments allowed the use of data to prevent crop problems and to improve the accuracy of crop diagnosis. Technology like IoT helps them to simplified way of cultivation and monitoring crops by accessing information using internet. In farming, IOT helps in mitigating the shortage of food by demanding the existing land for stronger utilization at minimum cost[14]. All over the world researchers are exploring technological solutions to enhance the agricultural productivity. The topology which help to access to the farmers to enhance the crop productivity. Government has started patronizing IoT in agriculture. This research considers various security requirements for the better understanding of IoT technology. Many big organizations and farmers have invested and developing new techniques for farm management system using IoT .In addition, this article provides an extensive overview on current, continuing advances in IoT applications. We use wireless sensors, cloud, Bluetooth as discussed earlier. This article also aims to identify the network protocols, processing data technologies, main devices, platforms, and the applicability of smart farming with IoT[15] . Taking these factors into consideration, this paper highlights the major role of IoT technologies which makes the farming smarter to meet the expectations in future. In conclusion, for better cultivation and to reduce wastage of resources IoT technology is necessary. We

discuss about many important dimensions of IoT based agricultural including technologies, industries trends etc. In conclusion, Smart farming based on IoT technologies enables growers and farmers to reduce waste and enhance productivity.

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## REAL-TIME IOT AIR QUALITY ANALYSIS USING ARDUINO

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## ABSTRACT

With global attention, air pollution is believed to have adverse impacts on human health. The provision of air quality performance, therefore, becomes an important problem for people's well-being. Governments and people are increasingly concerned about air pollution since it impacts human health and sustainable development globally. As nations more industrialized, the pollution level in our environment rises, posing a serious threat to all living beings. Pollution levels rise quickly due to causes such as industry, urbanization, rising population, and automobile usage, all of which harm human health. With all those different pollutants available in the air, dangerous pollutant is Particulate matter PM2.5, which has a diameter of 2.5 micrometers or less and is easily inhaled, can travel deep into our lungs and bloodstream, causing serious health problems. This pollutant is emitted from a variety of sources, the most common of which being industry and automobiles. Air pollution is the most severe environmental issue which causes different diseases to the humans and contributes to global warming. To avoid such a negative imbalance in nature, a pollution monitoring system is critical. This model used to monitor the pollutant PM2.5 in the air which can be easily inhaled by the humans and it can travel deep into our lungs and bloodstream, causing serious health problems. The suggested design comprises a module such as dust sensor, as hardware using Arduino platform and software architecture for remotely monitoring pollution data through a single web-based graphical application which can be used in industrial areas and traffic places to monitor air quality level. Also air pollutant information must be displayed in public places, as every people can get awareness by knowing the pollutants level around them.

**Keywords:** Arduino, Dust Sensor, Air Quality, IOT, WIFI-Module.

## 1. INTRODUCTION

Air pollution is an important issue to deal with in the current scenario in many metropolitan cities in our country and around the world. Poor air quality, in particular, may create damage to the human respiratory health. Many studies have shown that exposure to chemical components such as particulate matter puts individuals at a higher risk of developing various health issues. Furthermore, many individuals in the present situation are spending more time inside. It is believed that most of them spend about 90% of their time inside[1]. Indoor air is more

contaminated than outside air, which should be cleansed naturally. According to the EPA, interior air pollutants may be 2 to 5 times harmful than outside air pollutants and sometimes more than 100 times higher [2,4].

Indoor air pollution affects children and the elderly in particular. The Internet of Things (IOT) is a configuration in which people have the capacity to transfer data across a network without the requirement for a two-way shake over between human beings, i.e. the source to the destination or the contact between people and their computers. In addition to conventional devices such as desktops and mobile computers, cell phones, Internet of Objects extends online properties into a broad variety of gadgets and ordinary objects, which provide embedded instruments to interact and interrelate with the external world through the internet. The Internet of Objects aims to offer "Ubiquity," which enables anything to be connected with anything, and by everyone at any time through any path/network and any service [1]. IOT characteristics, such as an ultra-large network of things, device and network heterogeneity, and many unplanned occurrences, will make it extremely challenging to create various applications and services. Usually, middleware facilitates the development process via the varied grouping of computer and communications equipment and enables interoperability across various applications and services[4].

Obtaining air quality information may therefore protect people from the health consequences of air pollution[5]. The quantity of data produced by environmental sensors has risen dramatically as IoT has grown. Using this data, governments and municipal stakeholders attempt to take measures against air pollution[7]. It is difficult to forecast and evaluate because air quality is affected by numerous variables such as temporal and geographical air dispersion. Outdoor air quality may be influenced by air pollution emissions, meteorological conditions, and traffic movement. At the same time, outside air conditions influence the air, but so do tenant behavior, lifestyle patterns, and ventilation habits. As a result, the variables that affect indoor air analysis must be investigated more thoroughly.

Analyzing air data provided by environmental sensors have been intensively researched to propose management strategies for air quality[4]. It is produced as a byproduct of human activities such as fossil fuels in cars, power plants, cooling systems, and other industrial operations. Many outdoor particle sources may contribute to air pollution. Some of the studies

looked at the causes of indoor air pollution. Indoor PM2.5 fluctuation tendency and impact variables were studied[10].

## 2. BACKGROUND STUDY

Choudhary, V. et al. [1] The AirQ platform was a low-cost air quality monitoring device in real time and location. Sensor calibration is so beneficial that the AirQ can provide a fraction of the cost of air Quality data that is correctly linked to the NEA air quality station. This means that the AirQ platform can build large, high-density monitoring networks of air quality for Smart Cities. Dissanayaka, A. D.et al.[2] this article provides a thorough method to determine air quality, to predict pollution levels at each location and to propose the best route for travel with the least contaminated air. The air quality monitoring device has been used to detect carbon monoxide and gas concentration in each zone every minute in the time period to transmit these sensor data to the database in a data packet that includes two concentration values and the device's terminal number. It was smaller, cheaper, easier to maintain, portable and may be fixed anywhere necessary.

Gao, K. et al. [3] Effective monitoring and quality forecasting have identified widespread environmental issues. It utilizes web-text analyses to assist parameters identify all the information related to this issue and determine an optimum quality and parameter collection framework. Grace, R et al. [5] Monitoring and analysis of air pollution at each location were required to monitor air pollution. Environmental quality was readily checked when devices for air quality were installed and environmental pollution was quickly controlled. The air quality equipment must be linked to send measured and processed data to users over the Internet. The quantity of contaminants in the air is measured by sensors and sensor data is processed via so called fuzzy c-means clustering techniques to improve accuracy. The suggested study and visualization of air quality in industrial and severely polluted regions has been extended. Kumar, A. et al. [6] A low-cost air quality monitoring system has been suggested to detect and warn individuals when the number of these components in real-time exceeds a specific limit and shows data in an easily understood manner in different parameters, such as smoke, carbon monoxide and particle matter (PM). More sensor nodes may be added in future to expand the system. This system's main benefit was that it was portable, compact and inexpensive. The solution suggested utilizes 'ThingSpeak' to show data graphically and also supports modern technologies like Nodes, Rubies and other technologies. In this article, the authors addressed the development of a low cost IoT-based air quality monitoring system. Besides being cheaper

and using less power, it takes less space, can be positioned anywhere and offers more efficiency and flexibility than conventional wired systems.

Son, J., & Son, Y.-S. [8] The authors investigate the interior environmental and air quality concentration and correlation coefficient by season and location using IoT. Indoor air quality in the spring was worse than in the winter, and the office hall location was worse than the entrance and window. Nevertheless, the mean air quality score indoors was lower than the WHO guideline. Due to the spring air conditioning test, indoor air quality is not usual and the average result is below the normal level. Fine and ultra-fine dust is related favorably to temperature in the spring and negatively linked to CO2.

Su, Y. [9] The gradient addition method predicts Beijing's air quality. The gradient improvement framework was utilized to build on all the models that predicted PM2.5 concentric, depending on environmental factors like temperature and wind speed, from 2010 to 2016 in Beijing. According to experimental results, Light GBM exceeded XGBoost in performance. The data points in this research were just 50,000. The bucket-splitting method of Light GBM will substantially reduce machine learning in real large data processing as the size of data gradually increases. Yu, C [11] From January 2013 to May 2016, the authors gathered daily air quality data from the Wuhan environment. The writers attempt to detect trends and hidden patterns by utilizing the technique of exploratory analysis. First, the authors analyzed air pollution trends and major pollutants using day-to-day air quality data. The authors subsequently found numerous interesting trends based on various temporal granularities, such as season, month and week. Finally, the authors attempt to explain the impact of human activities on environmental air quality by means of associated analyses.

## III. SYSTEM MODEL

The primary purpose of this study is to develop a method for detecting pollutants in the air. The proposed system was constructed using an Arduino Uno, a WIFI module and a DUST sensor. This air quality detection and monitoring system offers data accessible in real time through PCs and mobile devices. Figure 2 shows a schematic block diagram of the system suggested.

### *(i) Arduino*

Arduino is a prototype platform based on easy to use hardware and software. It includes a programmable circuit board (referred to as a microcontroller) and ready-made software known as the Arduino IDE, which is used to generate and upload the physical board computer code.

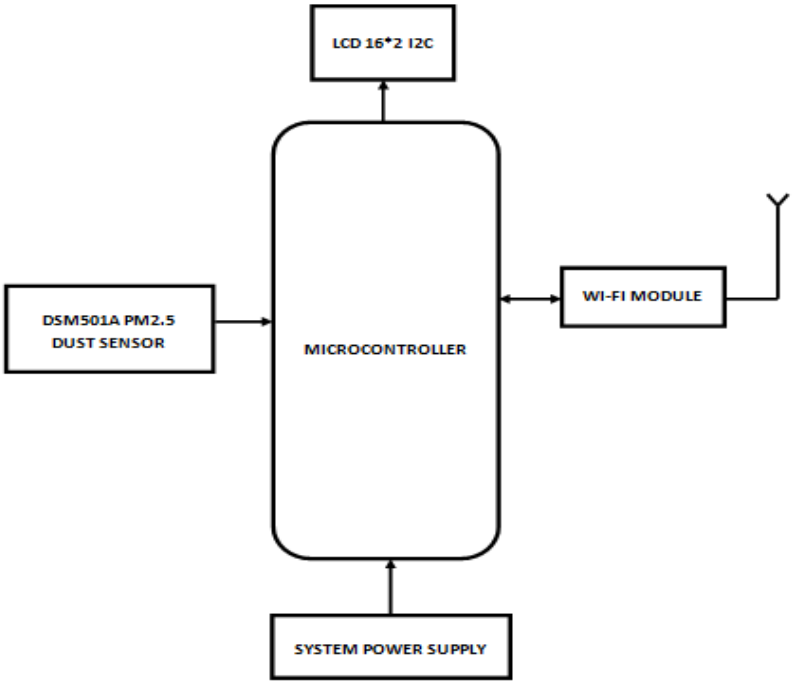


**Figure 1: Block Diagram for proposed Model**

***(ii) Liquid Crystal Display (LCD)***

LCDs use materials that combine fluid and crystal properties. Instead of a melting point, the molecules are almost as mobile as a liquid within a temperature range, but they are divided into a structure similar to a crystal. The LCD consists of two glass panels, with fluid crystal material in sand. The glass panels are coated with clear electrodes to indicate the character, symbols or patterns to be seen on the inner surface. There are polymer layers between electrodes and liquid crystal, which keeps the fluid crystal molecules at a constant angle. Each polarization is connected to the two glass panes outside. This would spin light beams at a solid angle in a certain direction. When the LCD is off, the two polarizes and the crystal fluid twist light rays, which unload the light rays from the LCD; the LCD is transparent.

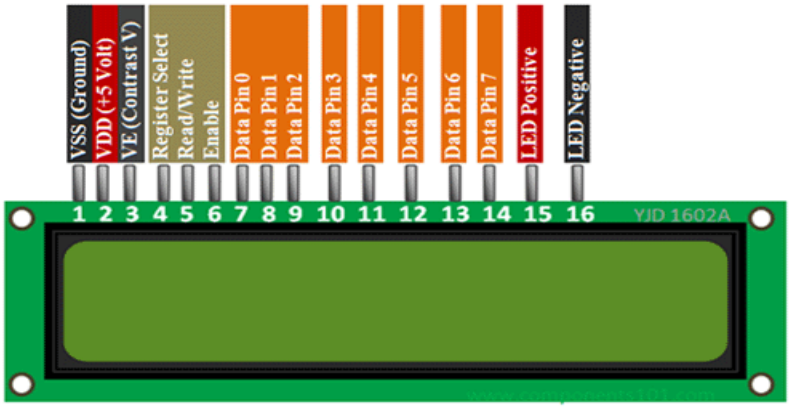


**Figure 2: LCD Display**

### *(iii) Power Supply*

A dependable power supply unit (PSU) is needed for electronic equipment or product. Almost all appliances at home, such as TV, Printer, Music Player, etc., consist of an integrated power supply system that transforms AC Network voltage at the appropriate DC level, voltage to operate for them. SMPS is the most popular kind of power supply circuit (Switching Mode Power Supply). It transforms AC Power supply to 12V DC. The system utilizes 12Volt as input for supply from Arduino Uno, and can also be transformed into two 5Volt outputs utilizing the IC7805 voltage regulators and filters. DUST SENSOR, WIFI MODULE, and LCD 16*2 are supplied using a 5V supply.

### *Fixed Voltage Regulators*

There is a class of ICs in the voltage regulators. Regulator IC used widely. Units are supplied with circuitry reference source, amplifier and control units and load protection. Everything in an IC unit adjusts a fixed positive voltage, a fixed negative voltage or an adjustable set stress. The regulators may be selected to operate with load currents from millennia up to 10 amperes corresponding to power rates from mill watts to tens of watts. A dc input voltage regulator unregulated, Vi is applied on the input terminal, a dc output voltage controlled, Vo on the second terminal and a third terminus connected to the ground.

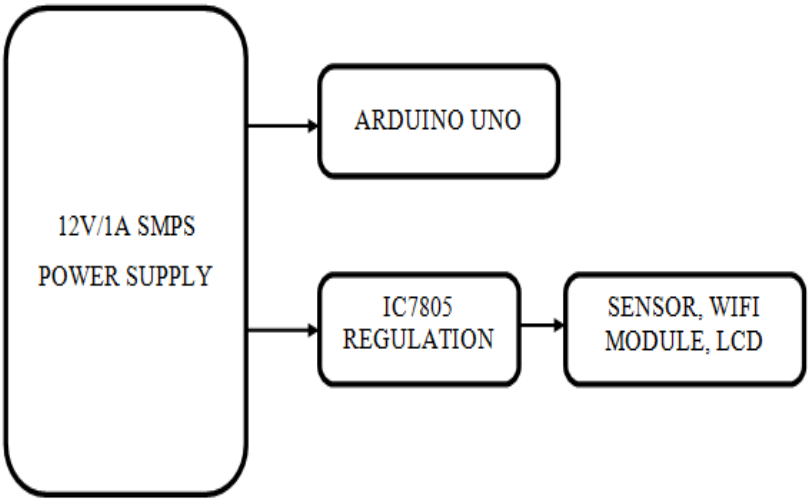


**Figure 3: Block diagram for Power Supply**

***(iv) ESP8266 - WI-FI Module***

The ESP8266 Wi-Fi is an independent SOC system with a built-in TCP/IP protocol stack that provides access to the Wi-Fi network to any microcontroller. The ESP8266 may either host an app or receive full Wi-Fi from another CPU. Each ESP8266 module is prepared by a firmware AT command set so that it may be connected to your Arduino device and Wi-Fi as much as a Wi-Fi Shield. The ESP8266 is a relatively affordable board with a growing community.

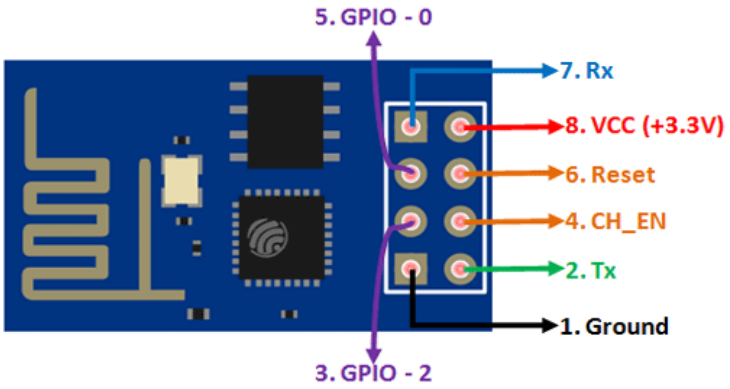


**Figure 4: WI-FI-Module**

With low-up programming and minimum loading during operation, this module provides powerful on-board processing and storage capacities for integrating sensors and other application-specific devices through its GPIOs. Its strong chip integration enables for minimal external circuitry for a little PCB area, including the front end module. The ESP8266 supports

APSD with VoIP and Bluetooth interfaces. It can function under all operating conditions and does not require extra RF components.

***(v) Dust Sensor***

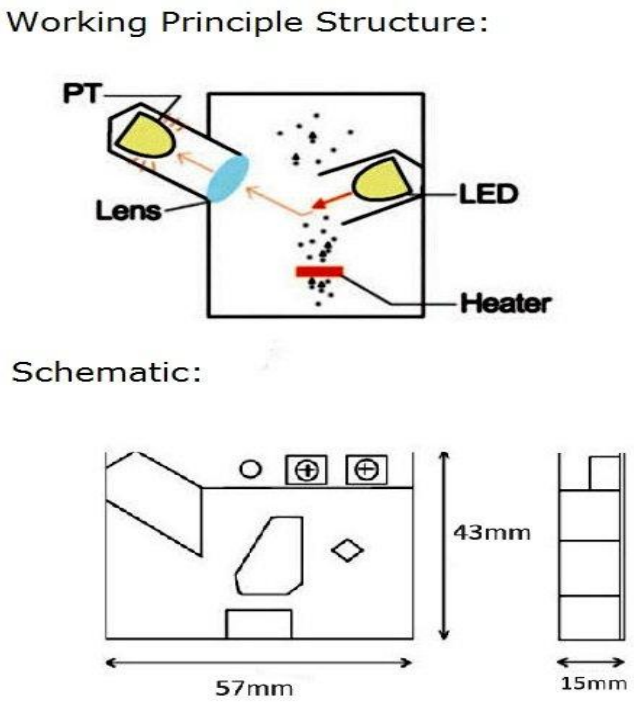


**Figure 5: Dust Sensor Working principle**

DSM501A Dust sensor Module senses the adjustable resistance of tobacco smoke and pollen, home dust, such as automated heating suction devices, to identify the size of the dust. The absolute number of particles per unit volume is detected using the same particle counter concept as the base.

## 4. RESULTS AND DISCUSSION

According to a recent Human Development Report, over 2.7 million people worldwide die due to air pollution every year, of which 90% die in developing countries[12]. Air pollution in houses producing smoke and hazardous gases such as carbon dioxide (CO2) is produced by charcoal, cow dung, and wood for heating and cooking reasons. These are used unabatedly in rural regions. Vehicles and industrial units are rapidly expanding, causing a similar pollution issue even in less developed nations. Moreover, vehicle pollution is becoming a serious issue, since cars' emission directly affects people on the roadways. In Indian cities, school children are

particularly susceptible to air pollution because they are in direct touch with harmful pollutants on the roadways. As a consequence, they have breathing difficulties, sleeplessness, etc.

People are aware of the harm caused to the atmosphere by the increase of industrialization. The SPM levels increased and led to almost 4,000 fatalities. Indoor air pollution is especially harmful to health since it is emitted near humans. A pollutant discharged inside is said to reach the lung several times more probable than it is released outside. A significant part of the population in underdeveloped nations depends on biomass for their energy needs. These include wood, charcoal, farm residues and animal manure. Open flames used for cooking and warmth are prevalent in rural and urban locations in the home. The stove frequently stands on the floor and increases the danger of accidents and hygiene.

Moreover, they typically do not have a chimney to remove the pollutants. Children and women are more often impacted in such houses since they spends more time at home. SPM is the principal contaminant in this environment. Death due to indoor air pollution, primarily due to particulate matter, is one of the highest pollutant in the rural regions of India. Acute respiratory infections cause many fatalities in children; others are caused by cardiovascular illnesses, lung cancer, and chronic breathing problems in adults. Household use of coal and biomass may seriously impact indoor air quality if emissions are significant and inadequate ventilation. In Indian cities, school children are particularly susceptible to air pollution because they are in direct touch with harmful pollutants on the roadways. As a consequence, they have breathing difficulties, sleeplessness, etc [12]

The impacts of dust on agriculture and the environment, depends on particulate size, deposition rate and atmospheric concentration. The effects on flora and fauna of particulate matter (PM) depend on the component of PM. PM10 dust decreases plant growth, total yield and reproduction. Particular emissions in the form of a greenhouse effect may also contribute to climatic change [13]. Dust air pollution and its impact on human health have been a severe global problem, with rising technology and fast industrialization to meet growing populations' demands.


**Figure 6: Data is transmitted to the system**

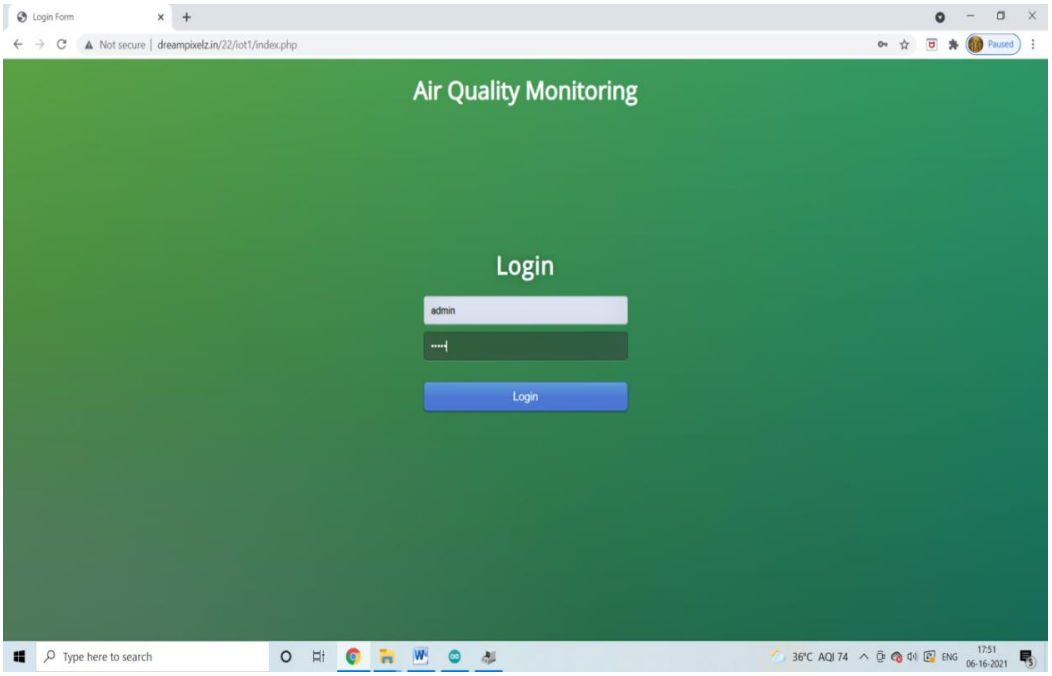


**Figure 7: Air Quality monitoring Output Screen Shot using Web View**

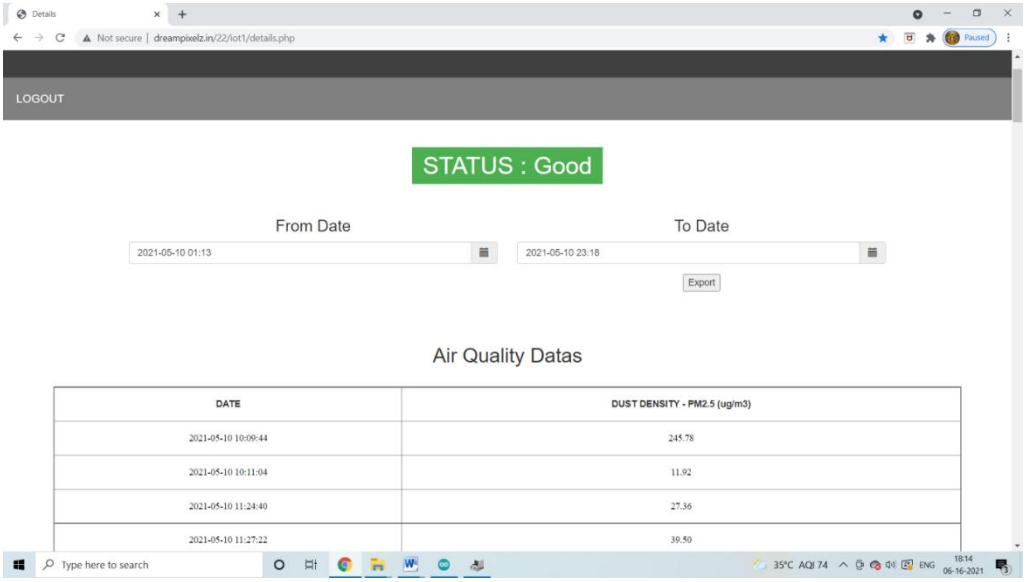


**Figure 8: Air Quality Data's for PM2.5**

## 5. CONCLUSION

Pollution is becoming a major issue for the population's health due to the rapid development of the industries that are the primary producers of pollutants. This technique of air quality monitoring and detection uses the Wireless Sensor Network to monitor air quality in various locations, producing data and data that can be accessed in near real-time through web-enabled pages. Air pollutants level must be displayed in public places, as every people can get awareness by knowing the concentration of pollutants around them. This research thus enables people to monitor the kind of air they breathe, particularly those with prior underlying problems of health. Additional data may be recorded using different sensors. Future enhancement to this device may include the system's resilience, the accuracy of the data from the sensors, and the device size.

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# A SURVEY ON ISSUES AND CHALLENGES OF MARINE COMMUINCATION USING BIG DATA

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## ABSTRACT

The "Big Data" is often very flattering. Some companies and maritime institutions have already tried to use big data to improve maritime safety and environmental protection. Encouraging this put into practice to raise the common and imperative challenges of the entire maritime industry with regard to big data use and related solutions; First, when reviewing the definitions of big data, three key factors are identified: Big data takes the electronic form, is available with a variety of sensors, and is difficult to process. There are four elements: volume, speed, variability and accuracy. In view of these factors, the size of the manuscript such as electronic data is single-minded by the expedition. Big Data Analytics poses a grand challenge on the design of exceedingly scalable algorithms and system to integrate the data and uncover large hidden values from datasets that are diverse, complex, and of a massive scale. Probable breakthrough includes new methodologies, systems and applications in Big Data Analytics that find out useful and hidden knowledge from the Big Data efficiently and effectively. DNV-GL, Lloyd's Register Foundation and IMO e-navigation framework have been selected as such. As a result, four main areas of difficulty in the use of bulky data sets are identified. Due to the strong competitive environment, directions should be provided with rights and obligations when handling large data. With regard to staff, governments are expected to demonstrate their strategy to raise the need for professionals and encourage collaboration with professionals and related industries. Supporting research and enlargement assistance programs and measures the style of relevant data sets. The issue of security requires deep-rooted legislation and a secure and valuable system to combat cyber attacks.

**Keywords:** Big Data, E-Navigation, Data Security, Globalization, Security

## 1. INTRODUCTION

The exaggeration of the shipping industry has greatly increased shipping volume. To make sure seamless communication and other services, it's important that each one vessel within the water preserve proper maritime haulage1. Moving forward can reduce errors while maintaining the smoothness of transportation3. It also facilitates proclamation between ships and therefore the coast4. In excess of the years, various sorts of communication are used: Morse, traffic lights, flags and radio. With the advancement of technology, it's important that the announcement system on the ship must even be updated. Satellite communication may be a new and evolving communication method that has proven to be extremely useful and well-located7. Satellite communications have different guiding principle. However, there are confident necessities for the installation of satellite communications.

## 2. SATELLITE COMMUNICATION REQUIREMENTS

Satellite communication services could do with motionless satellites to connect and recital by broadcast and receiving signals. Relying on the type of satellite communication structure that has been chosen, there is a necessity for the relevant paraphernalia. This includes:

- VHF: Intolerably High Frequency or VHF transceiver for universal communication or to commence distress alerts.
- HF: High Frequency or HF transmitter for broad communication and a way superior parameter for distress alerts, i.e., worldwide distress alert.
- MF: frequency or MF transceiver for a symbol up to a medium vary and general communication.
- Navtex: Provides data and regular weather updates, alerts, forecasts, and diverse maritime safety information concerning hazards, obstacles, etcetera
- SART: These are positioning systems that identify the location of indication exploitation radar and other systems. Satellite communication allows the crew aboard ships to be able to inform other ships and groups of the changes happening in real-time, reducing errors and thereby increasing efficiency.

## 3. SATELLITE COMMUNICATION TRENDS

### (i) *E-Navigation*

International Maritime Organization (IMO) urbanized the e-navigation strategy to require care of higher communication among ships and ship-to-shore. It too facilitates larger data and knowledge swap between ships10. E-navigation reduces the margin for human error and failure by implementing a better performance programme consisting of increased guidance tools and electronics. It includes variety of reorganized systems that are ample utilized within the maritime industry, such as, Automatic Identification System (AIS), world Maritime Distress Safety System11 (GMDSS), Long vary Identification and trailing

Systems (LRIT), Automatic measuring system Plotting Aids13 (ARPA), Integrated Bridge System (IBS), Integrated Navigation Systems14 (INS) and Electronic Chart show and information system (ECDIS).

**(ii)** ***Arctic communication***

The renunciation of ice within the Arctic has accrued marine traffic within the region for trade, research, associated different purposes. The extreme climate creates the Arctic an undiscovered area, wherever communication choices there are extraordinarily limited. In such conditions, satellites play an important role in providing economical suggests that of communication and guarantee a graceful exchange of data. The maritime dealing has been developing sort of systems to watch and guide vessels within the region. Radio-based communication systems for shorter distances are expected to be helpful for in sequence and knowledge transfer. Unmanned aerial vehicles and satellites are the only choices which can provides a forceful enough association to require care of announcement within the Arctic.

***(iii) Autonomous Ships***

The thought of autonomous ships aims to make ships self-driven, to increase ability and productivity therefore sanctioning swish functioning of tasks. It reduces the manpower needed within the operations of the ship, minimizing human errors. Such kinds of ships are presently being experimented on; however they seem shows potential for the longer term16. These ships are in receiving of to be principally unmanned and prepared with many new and upgraded items of technology, akin to pursuit systems, advanced sensors to avoid obstacles; a position system to keep informed them concerning alternate routes, management systems thus that the ships could also be operated from groups on the shore if necessary18. These ships connect perpetually with the team onshore and thus need advanced instrumentation and systems.

***(iv) Evolutions of GMDSS***

The world Maritime Distress and Safety System, or GMDSS, could also be a system that has been in agreement on internationally. It consists of set safety procedures, communication protocols, and instrumentation to help ships in distress. Initially, the GMDSS administrated ship-to-ship communication via Morse due to an lack of technical progression. Introduction of radio systems, ships current creating use of radio signals combined with Morse as a kind of distress call. It helped save varied lives over the years17. The launch of HF and MF signals, the United Nations agency issued how that better maritime distress communication significantly. The GMDSS provides a sort of an enquiry and rescue plan, that each one the nations within the planet are currently implementing. It's supported a mix of radio services on ground and colony signals, facultative the rescue operations to be ship-to-shore18. The GMDSS provides distress info beforehand, alerting operators and ships within the area, repeatedly preventing a disaster from

occurring within the first place. The system as well needs USA to endow all the ships with NAVTEX and different GMDSS equipment20. The advancement in communication technology has diode to fast globalization and an increase in international coordination.

***(v) Globalization and Communication***

Globalization has brought the earth nearer and has so formed it vital to stay up robust associates with everyone. Communication aboard ships has improved drastically in excess of the past few years, although the modification has been a slow one. Some years ago, smaller ships and vessels that did not need to be compelled to voyage such a lot had to be operating physically. Since there was a restricted crew aboard such ships, there was no want for computers and different technology for communication. However, process has opened the doors for trade across the planet and it's thus become essential for ships to be equipped with the newest sorts of communication and technology.

Shoppers stipulate quicker service and knowledge regarding each event that's happening. Radio, internet, and satellite telephones have expedited this instant exchange of knowledge. These economical resources of communications confirm that the journey goes swimmingly and conjointly encourage be extraordinarily helpful for the security of ships. Maintaining sturdy communication is probably the foremost required a neighbourhood of guaranteeing the safety of vessels within the maritime business. Over the years, mariners have taken many measures to make certain that maritime communication happens with none obscurity. With the modernization in technology, we would like to form varied updates to the pre-existing equipment, so on upgrade the industry and assurance higher limit productivity.

## 4. CHALLENGES AND ISSUES IN MARITIME

Today, most seafarers working on ships belongs to countries cherish Philippines, Ukraine, China, Bangladesh, Pakistan, and Sri Lanka , and are used on flags of countries like Central American nation, Marshal Islands etcetera one of the foremost problems round-faced by the shipping trade nowadays is that the Emergency of registries like Belize and Marshal Islands. All of North American nation would have seen advertisements claiming to concern COC and agency of Belize and Marshal Islands expeditiously. However, it's to note that the accomplishment and training of seamen has been vitiated thanks to the emergence of such registries. Advertisements in outstanding newspapers concerning accomplishment of seafarers from unknown and improperly registered entities are increasing. Beneath the Maritime Shipping (MS) Act, it's our duty to eradicate such unscrupulous recruiters, trainers, and issuers of documents; however it's quite evident that we've a bent to be failing miserably.

Some countries cherish Philippines and Ukraine has started taking this issue seriously then their seafarers are

being benefited by increased quality coaching provided to them. Sadly, Indian institutes don't seem to be paying enough attention on talent development and are those lacking in quality of seafarers. Altogether probability that's conjointly the reason that fresh deck cadets and junior engineers don't seem to be obtaining jobs easily.

Mindless Security Measures at Ports: Until some years back, before the International ship and port facility security (ISPS) code, it absolutely was terribly convenient for ship's crew to finish the work by late afternoon so simply withdraw to refresh them ashore. However, currently with mindless security the freedom of a mariner to travel ashore has been well curtailed.

Lack of correct Training: within the matter of seafarer coaching, larger stress needs to tend to on-board training involving marine instrumentation makers and work personnel. Shore-based training by conventionally certified Masters and Chief Engineers although smart isn't enough associated even useless if such instruction is being imparted in an improperly registered faculty travel by people that haven't set their feet aboard ships in last few decades. Lately, good ship maintenance work movies are developed and firms need to guarantee that they are shown on board with regularity and honesty. Staying faraway from Family, Untimely Sign-Offs: the most important emotional challenge which each and each sailor must face is that they have to live apart from their friends, loved ones and family. Longing might be a continuing worry that overpowers the sailor most of the days. To beat these fear sailors to bond with crew on the ship or the officers operating with him and treat them like family.

Ship Safety in impulsive Weather: Maneuvering of the ship is typically a challenge regardless of be the weather either calm or severe. However the degree of challenge will increase with severe weather associated build it tough for the sailor to sail the ship in stormy weather. Also, the weather turns from smart to unhealthy unpredictably, that it why weather is typically a mendacious challenge for the ocean farer.

Never-ending Pirates and Piracy: We detected the stories of sea pirates from the times of our forefathers. However its extent is reduced in recent years but not eradicated completely. As per a report, annually thirteen to sixteen bucks are lost from marine revenue because of piracy. Not solely piracy however the ocean pirates cause nice threat to the lives of the crew on a ship, as they're equipped with tons of advanced and dangerous weapons.

Maintaining social Relationship – dealing with Politics: once we tend to measure faraway from our cherished ones or family for a protracted amount of some time it becomes tough for us to stay up those self same feelings of affection and lookout of them we tend to urge connected with shipmates and feel nearer to them than to

our circle of relatives. Thus maintaining interpersonal relationships with one's marital partner or with other members of his family is additionally a big challenge.

Monotony and Lack of Extra-curricular activities: it's that the main challenges that a Jack-tar utilized on identical regular routes need to face. They feel impassive in seeing identical views and also an equivalent faces to the moon and back. however to beat this drawback Jack-tars got a midway and work on their temperament improvement, completely different dressing themes, encourage themselves for work and keep them totally engaged in ship help or alternative involved works. This monotonous feeling makes the lifetime of seafarer agitated and faded their social circle.

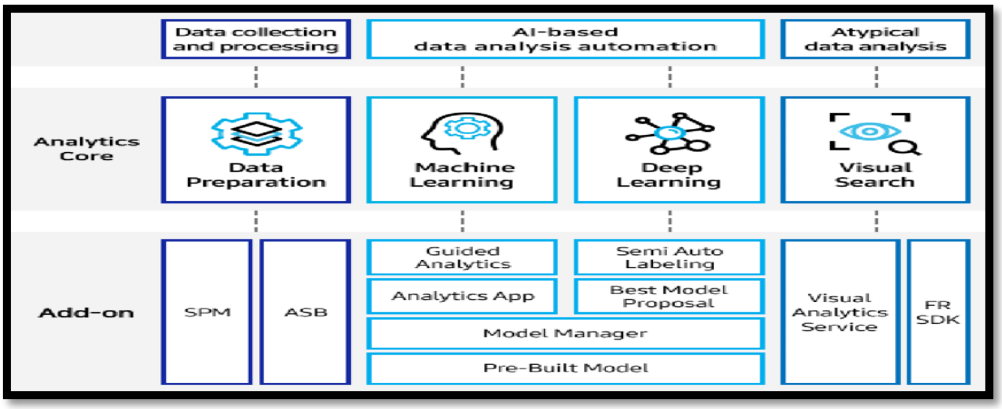


**Figure 1: Architecture of marine communication using Big Data model**

## 5. SOLUTIONS TO BEAT THE PROBLEMS OF MARITIME COMMUNICATION

In today's digital age, competition is fierce in an exceedingly sort of industries, also because the maritime industry, and corporations are perpetually finance in solutions which can facilitate them increase productivity whereas lowering overall costs. Consequently, the demand for advanced solutions like marine in sequence psychotherapy is growing at a formidable rate among business shippers and different finish users. Within the shipping industry, massive data is used to manage sensors on a ship and to perform prognosticative analysis to avoid delays and improve efficiency19. Increased higher process through big data analytics is being actively implemented to avoid and predict extra prices and could be used all the way through the lifetime of a ship. The Port of Hamburg (Germany), the Port of Cartagena (Colombia), the Port of metropolis (the Netherlands) and variety of other ports in geographical area are actively victimization massive information analytics solutions for his or her port and terminal operations.

Predictive analytics solutions have the potential to transform the shipping business by up overall shipping operations, enhancing ship safety and protective the environment. Additionally, the high level of customization offered by these solutions, relying on the precise wants of any port or company, is predicted to fuel demand over the forecast period. With the expansion of globalization, the demand for freight transport will increase

considerably within the approaching back years. Consequently, the demand for advanced processing and prognosticative analytics will grow among maritime corporations to maximize time potency and price savings.

These factors are driving the demand for marine analytics around the world. The distribution business might be a sophisticated network of individuals, countries, agencies and authorities. These embody ship owners, port authorities, maritime authorities, classification societies, freight traders, oil corporations and trade organizations to call however a couple of issues20 . This makes the business a really world enterprise. For instance, a ship in-built South Korea, owned by a Greek man of affairs registered in Panama, manned by a crew from the Philippines, Singapore and Norway, may carry cargo owned by a USA global company from a port in China to a port in Europe. Passing through the waters of a dozen different countries. The need to trace economic flows during this global offer chain whereas eliminating any legal nightmares has led to thorough business record keeping. Variety of those includes:

1.Each ship incorporates a loading manifest and a crew manifests
2. Each ship additionally maintains a captain's log, a ships log and alternative logs that record the inner and external condition of the ship, also as instrumentation and environmental conditions.

Ports, canals and waterways have several forms that you simply just need to fill bent collect info regarding the vessel, voyage and cargo transported. Supplementary records are maintained by shipping agents, companies, traders, marine insurers, certification agencies, etc. Finally, ships generate vast amounts of electronic data like AIS, LRIT, radar, etcetera Electronic data is additionally generated by separate instrumentation on board as IoT sensors become additional prevalent21. Given the variability and volume of data generated, huge information in maritime and marine data analytics could also be roughly divided into three groups: Vessel administration mistreatment data offered in numerous logs, manifests, system parameters, bunker statistics, etc. this might embody economical bunkering, higher vehicle maintenance using digital twins, crew management, etc. Port and cargo management mistreatment information command by port authorities, freight forwarders, commercialism houses, etcetera this might embody economical loading handling, pursuit goods, optimizing port facilities, etc.

Analysis of spatial mind's eye using data from position tracking systems like AIS and LRIT, pictures from ships, coastal and house radars, optical sensors, etc. this might include efficient routing, fleet tracking, pattern analysis, and anomaly detection. Until lately, records were largely unbroken for short-run dealings history or for autopsy within the event of any incident. Trendy analysis ways currently enable US to use this information to predict and provide info to reinforce the system and stop future disruptions.

## 6. CONCLUSION

To adapt to the persistently changing data and software atmosphere, there's still tons of labor to be prepared. A bit like the web 20 years ago, data analysis and therefore the Internet of Things will change the planet around us. No business can do another one. Smart technology decisions and funds are the key to digital renovation. Collaborative innovation will support the event of today's industry and steel oneself against future development. The COVID-19 crisis is developing rapidly and poses a serious challenge to logistics, supply chain, transportation and transportation. During this case, it's expected that data analysis and technology introduction will develop into more and more important within the post-COVID phase, which can stabilize the maritime industry and promote its development.

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# TRACKING VACANT BEDS FOR COVID-19 USING REAL TIME GEOLOCATION

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## ABSTRACT

Web applications are getting used all around the world to create and establish unique forms of structures to both useful resource organizations in addition to users. Many new web technologies are ruling the world of web application development trends nowadays and much more is yet to return. Due to this contemporary pandemic scenario, the web-based application turns more essential to do many such things as online purchasing, and so forth. This perspective offers a framework for the application of digital technologies in pandemic control and reaction, highlighting approaches wherein successful countries have followed those technologies for pandemic planning, surveillance, testing, contact tracing, quarantine, and health care. The second wave of the COVID-19 virus has wreaked destruction in India. Everyone has been seeing a steep rise in the range of active COVID-19 cases day by day. Hence in this pandemic situation, finding vacant beds, oxygen cylinders, and ICU support throughout this time of emergency could be very essential for a person. To triumph over this problem, advanced internet-based software is proposed that can be very beneficial to this pandemic kingdom. The main objective of this paper is to establish and develop a web utility that can assist users to understand the severity of COVID-19 along with the kinds of precautions one needs to take to be able to protect them from this plague. In this proposed work, the users can identify their metropolis and they might make sure the availability of a mattress, oxygen, and ICU wards with that health facility's name by using of real-time vicinity. The platform also brought four categories excessive times, slight times, and mild times for patients. The users can become aware of those categories primarily based on their necessities hence the application fetches hospitals in their metropolis in real-time.

**Keywords:** Covid_19 platforms, Bed vacancy, Hospitalization, Web development interfaces

## 1. INTRODUCTION

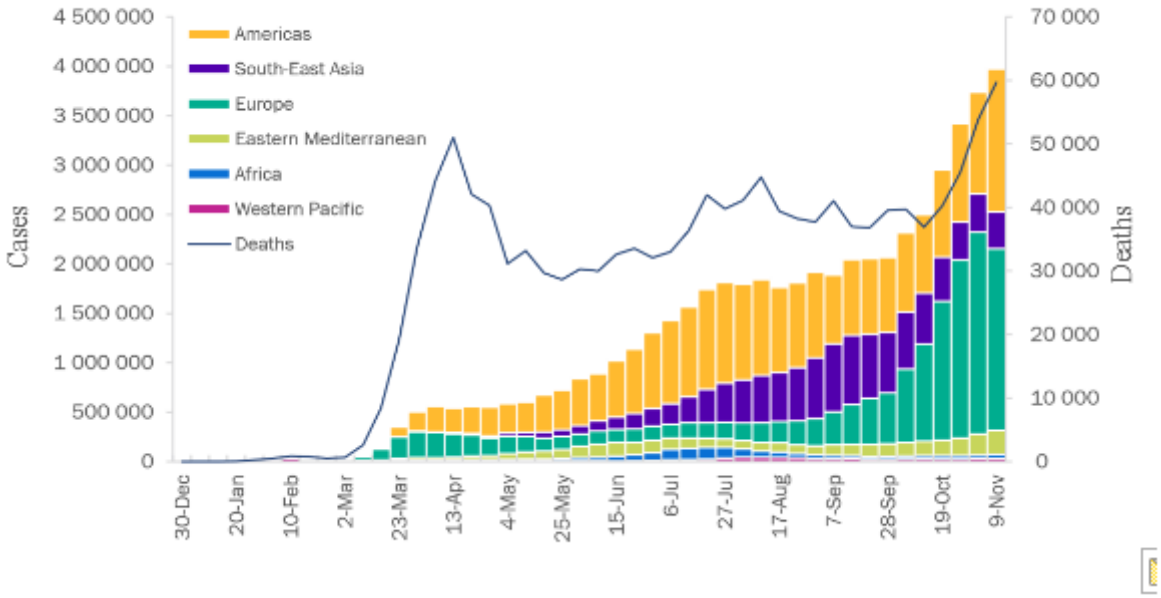



**Figure 1: Global Covid-19 cases and Deaths during March 2021**

Coronavirus disorder 2019 (COVID-19), additionally called the coronavirus, or COVID is a contagious disorder as a result of intense acute respiration syndrome coronavirus. The primary recognized case was diagnosed in (Wuhan, China, in December 2019) [14] the disorder has since unfolded international, main to pandemic people with COVID-19 have had a huge range of symptoms said – starting from moderate symptoms to intense contamination. The symptoms of COVID-19 may also seem 2-14 days after exposure to the virus so that every person can have moderate to intense signs. Human beings with those signs may have COVID-19 (Fever or chill, Cough Shortness of breath or difficulty breathing, Fatigue, Muscle or body aches, Headache, New loss of taste or smell, Sore throat, Congestion or runny nose, nausea or vomiting, Diarrhea)[15]. This list does not include all possible symptoms. The following Fig.1. shows the COVID affected and death rate in international inside the first wave of COVID-19.

The second wave has been commenced in India. Due to this many people are affected and death rate incremented tremendously each day. In India, the second wave assaults the categorical state vigorously which might be Maharashtra, Kerala and Tamil Nadu whereas in Tamil Nadu up-to-date (June 2021) wide variety of cases are 20.7 lakhs and the loss of life price is 24000. The spreading of the covid cases statistical measure is depicted in Fig.2. (https://www.statista.com/statistics/1143336/india-tamil-nadu-covid-19-cases-by-type/)

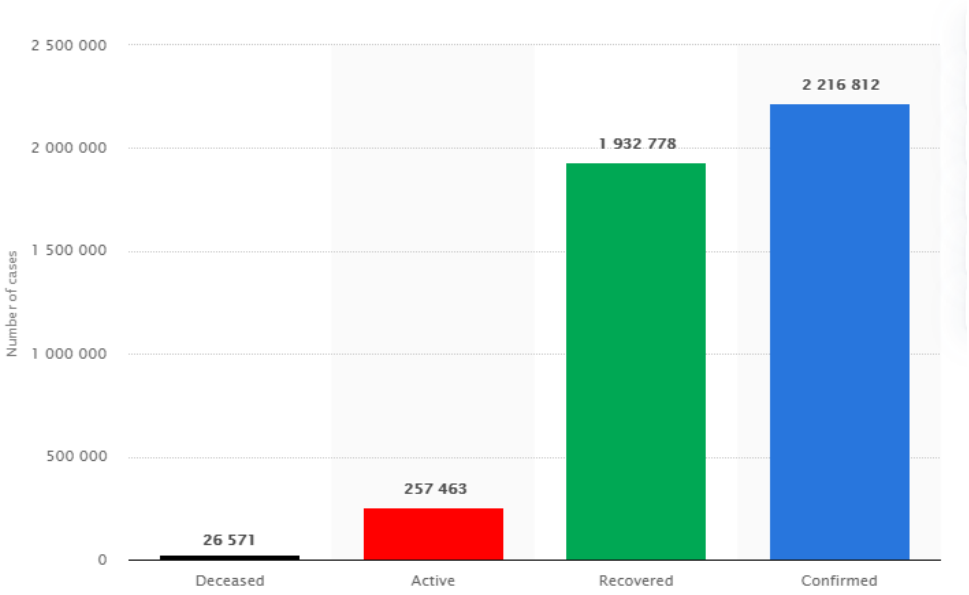



**Figure 2: Statistics of New Cases and Deaths in Tamil Nadu**

In Tamil Nadu the second wave of COVID-19 has been wreaking havoc in India, many people are left prone with no bed availability, oxygen, plasma for treatment. Many have held on to social media, seeking help from people around for any update as they bumble to seek out medical resources for his or her relations. After almost a month of people hope for various information on detecting hospital beds, oxygen cylinders beyond medicines, organizing for extreme surges in demand for hospital care of patients requiring urgent life-saving treatment for COVID-19, Is one of the most demanding tasks facing healthcare commissioners and caregivers during the pandemic. With the expected patient numbers lacking care, as well as evolving needs day by day, planning hospital capacity is exciting. Health systems that are provident for the pandemic can better cope with large and sudden changes in demand by implementing a plan of action to ensure adequate access to care. Thereby this reduces the spreading of the disease and saves many lives.

The article approaches a platform that will permit users to find supreme leads the hospital systems are supervision the pandemic and whether there are competent beds and staff to heed of hospitalized patients. Having scuffles in finding slots on Covid WIN? Bed tracking systems offer promise, but more must be done to know the because of invasion their dormant and to more widely implement lessons learned[11]. This data liberate makes it feasible to examine whether metro and non-metro areas are experiencing Covid-19 hospitalizations and capacity in different ways and whether certain districts are particularly strained even though the larger state or metro area may not be. This COVID-19 coordination centre access doctors to regulate and maintain all information to more effectively coordinate patient care and transport during the pandemic. Furthermore, the regular district offices must continuously report back to the state and federal authorities what percentages of COVID-19 hospital beds are available within the region, with and without ventilation options. The coordination centre handles this transfer of accurate information in real-time using the newly developed framework. The COVID-19 coordination centre is the central contact point for all needs-

based management of COVID-19 in-patients. Using the framework, doctors have a real-time overview of available capacities in the entire Tamil Nadu area so that patients can be easily assigned according to availability and receive the simplest care within the fastest feasible way. The incipient framework avails to ascertain that the essential data is always available and up-to-date

## 2. RELATED WORK

The paper emphasises the Covid-19 hospital navigation system which identifies the bed availability, especially in Tamil Nadu. The cognate work proposed by many of the researchers for this framework are as follows.

Ensheng dong, Hongru Du has proposed an interactive web-based dashboard to track COVID-19 in actual time. It was developed to offer researchers, public health authorities, and the majority with a user-friendly tool to track the outbreak as it unfolds. The dashboard reviews cases at the province stage in China and the metropolis stage inside America and many others. To identify incipient instances, they reveal various Twitter victuals, online information accommodations, and direct conversations sent via the dashboard. They orchestrated to retain hosting and dealing with the implement during the entirety of the COVID-19 outbreak and to build out its competencies to establish a status implement to exhibit and report on destiny outbreaks [3].

The COVID-19 Hospital Navigation System Using Web Technology was proposed by many. This utility will allow users to check in themselves and search for COVID-19 facilities inside their surroundings. As soon as the centres had been located the user could be capable of further book a bed within the health facility while viewing all the information associated with their requirements. Ultimately the usage of this framework is people from the nearby authorities also can attain out to those who have implemented for beds inside COVID-19 facilities to constantly stay in touch with them and assist them to recognize how to face the cutting-edge situations [10].

Andreas Holzinger and Maximilian Errath have developed a mobile pc web application layout in medicine. The authors discuss their reports in the course of the layout and improvement of a utility for medical research, which turned into a design for each mobile and personal desktop computer. Their experimental consequences and studies in design and improvement offer a few beneficial indications on how web content can be changed to make it greater handy, in a generic access perspective, to end-users of mobile computers [5].

In this framework, it lets in to conduct an affected person questionnaire, save consequences, review the entire database of patients, pick a prediction model, construct a category model and calculate predictable values, visualize the statistical calculations. Their proposed framework is in particular aimed toward fixing the trouble of predicting the sickness of patients, especially, liver failure, in keeping with diagnostic criteria [7].

It helps the COVID-19 analysis and quickens the screening technique. M-health solutions can enhance healthcare provider safety (via reducing their direct exposure to infected cases) and promote social distancing through transportable biosensors, mobile continuous telemetry display screen units, and transportable screening systems. Mobile health has focused on the prevention, early detection, screening, education, and treatment of infected patients [1].

R. Anzbock, S. Dustdar, introduced Modeling Medical Web services, BPM Conference on Business Process Management. This framework enables the Service-oriented architectures (SOAs) to have been suggested as a design and technology strategy for complex business application environments [12].

Health informatics—Medical data interchange: HIS/RIS-PACS and HIS/RIS Modality Interface — ENV SOA describes the practices and frameworks that enable the functionality and information of applications to be provided and consumed as services interfaces [2].

In Smart Healthcare Applications, the proposed work monitors the patient's voice using the optimal Speech Recognition Module. The various parameter used to measure the accuracy of the proposed system[6]. Also McCabe, et.al., introduced a novel method for adapting hospital capacity to meet changing demands during the COVID-19 pandemic[8].

## 3. METHODOLOGY

Through the development of this web application, there were various hurdles. However, this project is split into three major sections as these three phases of this proposed work are the most crucial parts towards the establishment of this web application as represented in Fig.3.

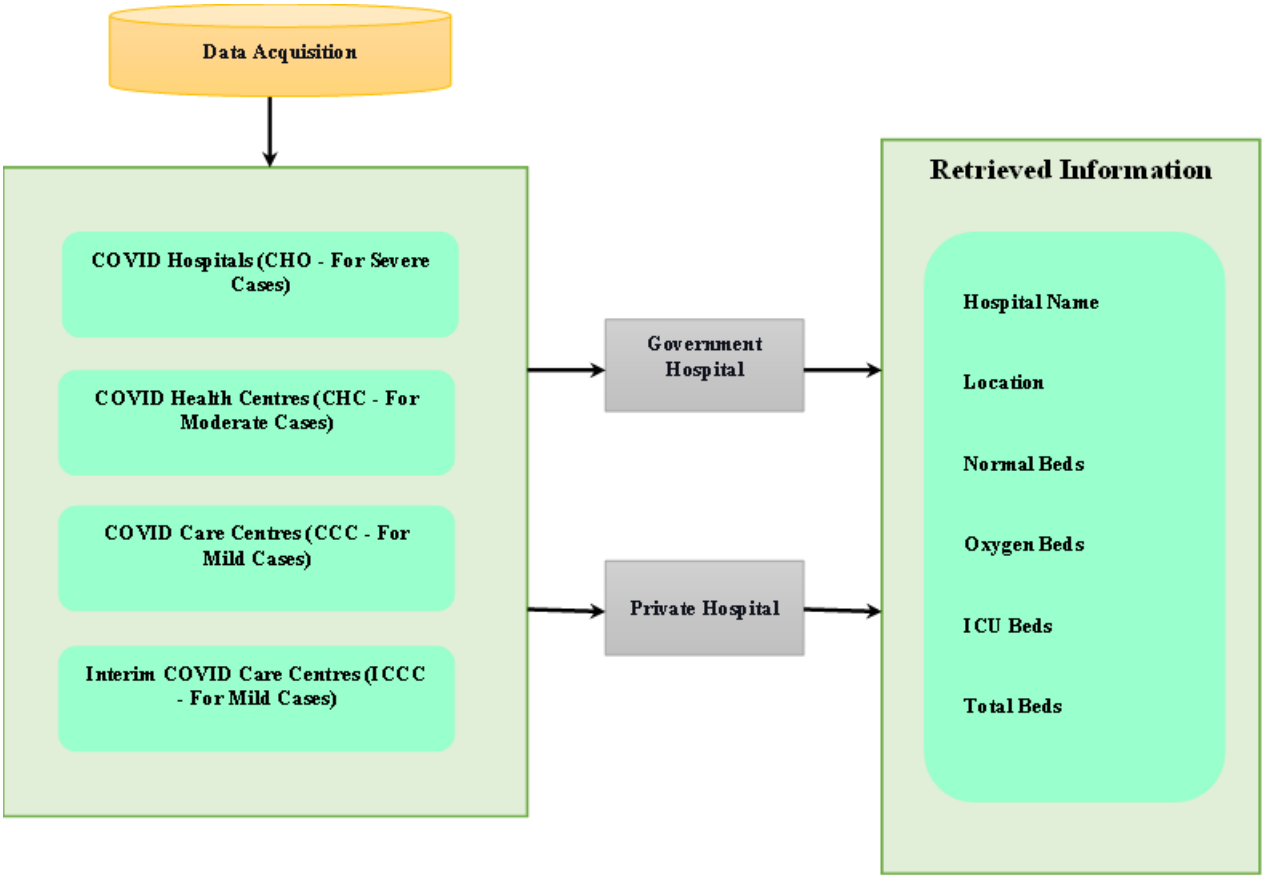



**Figure 3: Architecture diagram**

***(i) Data Acquisition***

The initial phase of this proposed work focused upon obtaining all the requirements which are essential to developing a web application. On gaining complete knowledge of the structure and how this software could be maintained it is easy to now begin to gather those inside the 2nd category which consist of the various software and applications. On setting up information of the shape of the utility, the point of interest should be upon growing and gathering all the software's as well as packages required within the additional phases of this project. The statistics of the bed details get from legit government API from tncovidbeds.tnega.org[13].

***(ii) Establishment of Web Application***

Now on obtaining all the requirements as well as an idea upon this web application, the focus will be upon developing this application from the bottom up. In this phase of this project, HTML along with CSS is utilized to engender the sundry web pages within this project. One must also ensure that the traversal between the various web pages is both efficient as well as simple to use, the users should not find any process complicated to use or understand. Furthermore, care must be taken to ensure that all the required images and files used within this application are stored within the same repositories so they can be recalled within the files whenever adequate.

***Features:***

- Users are able to see the available covid beds in hospitals by district wise inside Tamil Nadu.
- Users can search with User district names.
- Users can choose Government Hospital or Private Hospital or both.

***Users can filter:***

- COVID Hospitals (CHO - For Severe Cases)
- COVID Health Centres (CHC - For Moderate Cases)
- COVID Care Centres (CCC - For Mild Cases)
- Interim COVID Care Centres (ICCC - For Mild Cases)

***(iii) Working Methodology***

**Step 1 :** In the home page it will ask for permissions to access the User location to get the User district name.

**Step 2:** First it will get User location coordinates and then pass them to **locationiq.com** API to convert coordinates to district names.

**Step 3:** It will get the ID of that district by sending a request to tncovidbeds.tnega.org API.

**Step 4:** It will get vacant bed details from tncovidbeds.tnega.org by passing id as a parameter. It will return the details of the Covid vacant beds.

**Step 5:** While selecting filter options (like Government, private, CHC, CHO, CCC, ICCC) It will make another request to filter details from tncovidbeds.tnega.org API.

***(iv) Integration with Google Maps:***

One of the consequential functionalities within this project is the faculty for the user to utilize their current location to find nearby COVID-19 facilities. To establish this type of functionality within this application one must ascertain that the Google Maps API is integrated within the source code so that it can both retrieve as well as exhibit the data. Once the API has been prosperously integrated into the source code, the location should be accurately traced and withal should be able to integrate hospital to the map by taking access to the applications system**.**

## 4. RESULTS AND DISCUSSION

The following technology is used to develop the proposed web application such as Node.js.(Platform to run React.js), React.js.(Library to create Websites and Web Applications) and MongoDB.(To Store data)[4,9]. Initially, the utilizer visits the web application in order to access to user current location the users can cull the district to view the bed details.


**Figure 4: Home-Page of Web Application**

The users can view the specific information's of hospital name, where it is located, how many available beds based on ICU, Normal Bed and Oxygen Bed. That detail contains the last updated date and time, contact details and etc,. By using the above details user can able to navigate to the hospital location in real-time. Fig.4 depicts the Home page of the web application.

The sample output of Chennai district Government Hospitals, Private Hospitals, COVID Hospitals, COVID Health Centres and COVID Care Centres as shown in Fig.5, Fig.6, Fig.7, Fig.8 and Fig.9 respectively. The sample output of Coimbatore Interim COVID Care Centres is represented in Fig.10. The sample output of Sivagangai Hospitals List is shown in Fig.11. The Location Navigation using Google Map Integration of respective hospitals is represented in Fig.12.

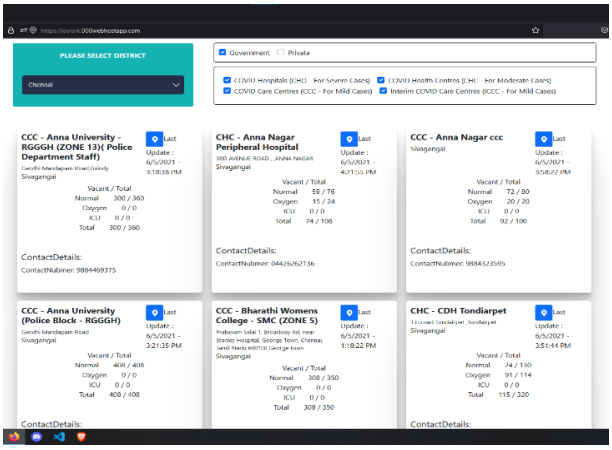


**Figure 5: Output of Chennai Govt. Hospitals**

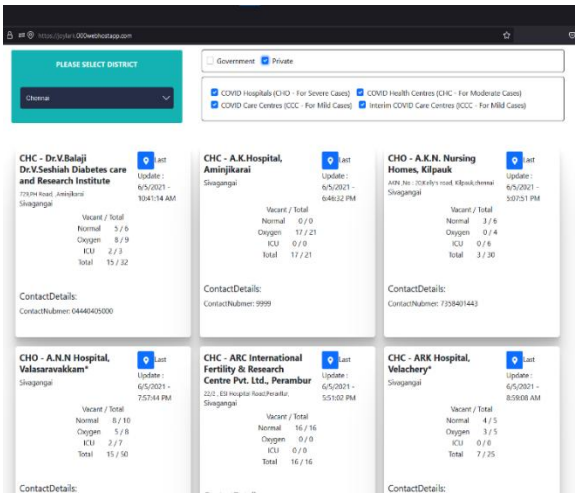
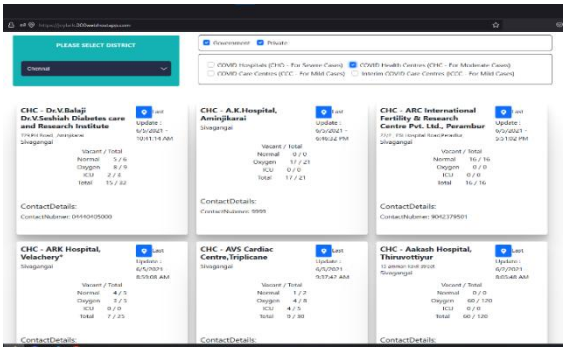


**Figure 6: Output of Chennai pvt. hospitals**



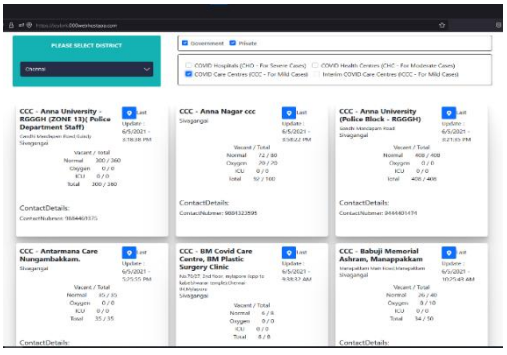
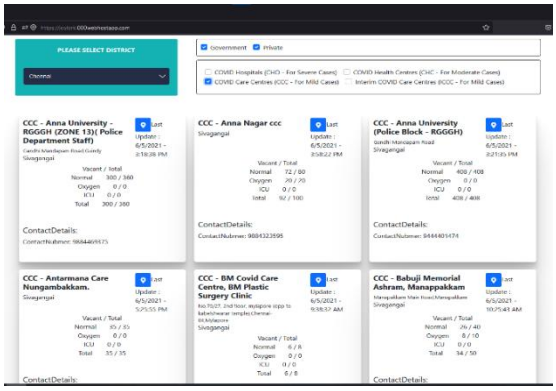


**Figure 7: Output of Chennai Covid hospitals  Figure 8: Output of Covid health centres**



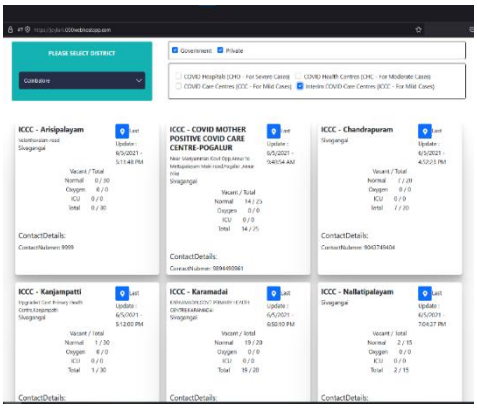


**Figure 9: Output of Chennai Covid Centres  Figure 10: Coimbatore Interim Covid Care**

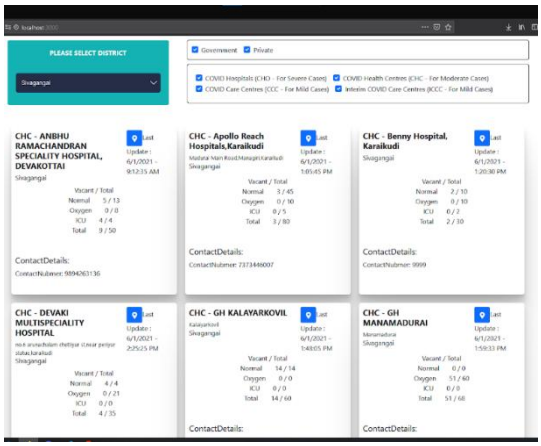


**Figure 11. The Sample Output of Sivagangai Hospitals List**

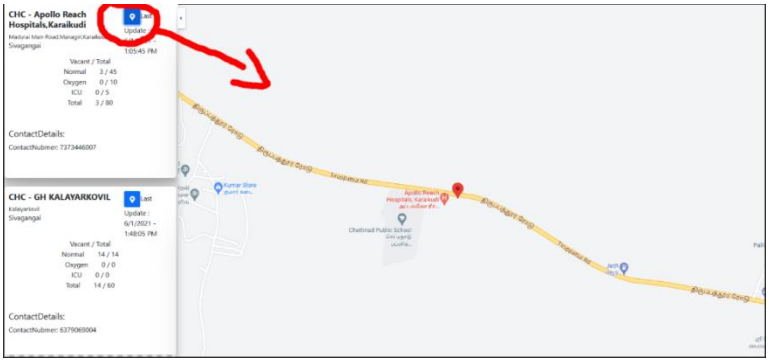


**Figure 12: Location Navigation Using Google Map Integration**

## 5. CONCLUSION AND FUTURE WORK

This framework will assist and alternate the lives of many people.  As Covid-19 grows increasingly riskier every single day, many people are dying and struggling without beds and oxygens. To streamline this

procedure, we can use this application to offer out information on Covid mattress availability in real-time. Information is a great weapon to prevent or fight the virus. This web utility consists of all of the data one may require upon the plague at the side of what they ought to anticipate if one is infected together with the types of precautions one needs to take. The proposed work efficiently detects and tracks the updated number of beds, oxygen availability, and provides people with contact numbers. Many states are already having reliable websites and apps to present those. This will very beneficial for people and could safe many lives. In destiny the frame work can be prolonged to the Android application and can be well advanced to the future. This is further utilized by the people easily and get complicated in destiny

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