ANALYSIS AND SURVEY ON WIRELESS SENSOR NETWORK IN AGRICULTURE

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ABSTRACT - Wireless sensor network (WSN) is most challenging region to be worked with minimal effort applications in differentiated field produced for military just as public. Different applications of Wireless Sensor Network include environmental monitoring, catastrophic event prediction, home appliances covering numerous spaces like agriculture, and medicinal services, clustered databases and so on. The agricultural system is helpful for elderly folks individuals and typical persons who live far away from the agricultural field. This field faces a few issues such as how to limit the misfortunes, how to increase productivity and how to limit cost. In this paper, Random forest, Maximum likelihood classification algorithms are dissected. And likewise different applications of WSN are discussed.

Keywords: [Wireless sensor network, Random Forest algorithm, Maximum likelihood classification algorithm, Agriculture Environment.]

1. INTRODUCTION

Wireless sensor network (WSN) technologies have quickly created throughout the years. Ecological phenomena in a tremendous zone can be monitored utilizing unavoidable devices called bits or sensor hubs. Battery-controlled WSNs comprise a few sensors, processors, and radio frequency (RF) modules. The communication among sensor hubs relies upon the converging of differing sensors from straightforward (i.e., humidity, weight, and temperature) to complex. Accordingly, the sensing, stockpiling, processing, and communication capabilities of sensor hubs have continuously increased. WSNs have been utilized in various applications, such as military, agriculture, sports, medicine and industry. Agriculture

can be considered as one of the most great facilities for WSNs to improve nourishment crop yields and limit the weight of farmers. Wireless Sensor Networks (WSN) is a wireless network comprising of spatially passed on self-governing sensors to screen physical or natural conditions, for example, temperature, sound, weight, and so on. A WSN framework joins an entrance that gives wireless network back to the wired world and spread center points. To agreeably go their information through the network to an essential area. The more present day networks are bidirectional, in like manner engaging control of sensor movement. The headway of wireless sensor networks was prodded by military applications, for example, battle zone reconnaissance; today such

networks are used in various present day and purchaser applications, for example, mechanical procedure monitoring and control, machine prosperity monitoring, etc. At the point when conveyed in the field, the microprocessor automatically instates communication with each other hub in range, creating an ad hoc work network for handing-off information to and from the door hub. This refutes the requirement for costly and gawky wiring between hubs, instead depending on the adaptability of work networking algorithms to move information from hub to hub.
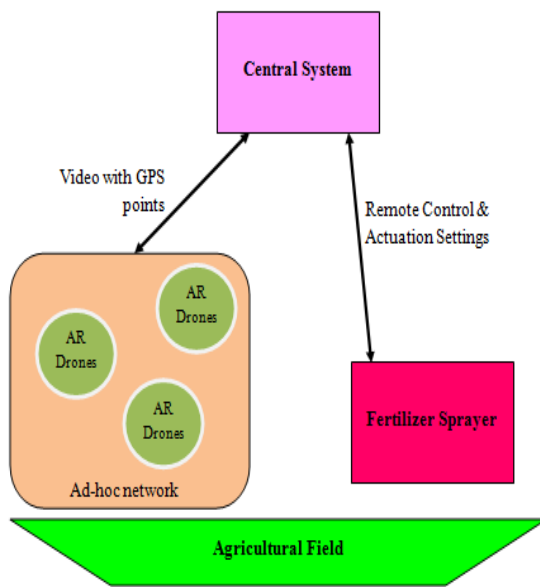

Figure 1: Wireless Sensor Network for Agriculture

Wireless sensor networks (WSNs), comprised by hundreds or perhaps thousands of ad-hoc sensor hub devices, working together to accomplish a common task. This design constrains are connected with the reason and the characteristics of the installation environment. The environment decides the size of the network, the sending technique and the network topology. Resources constrains are forced by little communication go, low throughput and reduced stockpiling and computing resources.

2. LITERATURE SURVEY

Divya Upadhyay, Ashwani Kumar Dubey, and P. Santhi Thilagam (2018) Proposed an Energy-efficient Static Multi-hop (ESM) routing convention for wireless sensor network in agriculture. Proposed an energy efficient course determination convention for multi-jump network with static link for sending in the field of agriculture. The proposed convention is planned for multi-bounce network with static links. It uses a determination capacity to discover the course between the hubs and the sink. The determination capacity finds the parent hub to direct speak with the sink hub. This parent hub is chosen reliant on the rest of the energy of the hub and the separation of that hub from the sink. The routing protocols must be arranged subject to performance metrics packet misfortune, energy exhausted, network lifetime and various regions of utilization. The problematic routing prompts curtail network lifetime by increasing energy utilization. In this way, unique routing protocols were planned to streamline the energy utilization and increase network lifetime. Jeromina J, Dr. K. V. Anusuya (2016) Proposed an essentialness efficient cluster formation algorithm and sink relocation algorithm for exactness agribusiness. a clustering and sink relocation scheme of an accuracy horticulture mastermind that improves the system lifetime of the network. The sending scheme of the WSN for an exactness cultivating application, algorithm for cluster head election and rotation, sink relocation algorithm and message directing. exactness agribusiness applications, where the detecting of ecological parameters is done to improve the yield of the farmland, the WS Nodes are sent by the rancher physically and an ordinary case of conveying hubs causes the ranchers to put the WS Nodes at different situations in the field. Right when any center point in a system is made alone its presentation estimations gets debased soon. A gathering mechanism is required to give the systems

administration development. Clusters are formed to constrain the imperativeness required by all of the hubs to transmit and get information. A cluster head is chosen reliant on the remaining imperativeness level of the people from the cluster. A cluster formation algorithm is expected to manufacture the system lifetime. The battery of the remote sensor center can be partitioned into four levels. Where the cluster head exhausts off a level of essentialness, at that point it is moved to the following neighbor. Tomoya MORIBE, Hiraku OKADA, Kentaro KOBAYASHI, Masaaki KATAYAMA (2018) Proposed a blend of a wireless sensor network and drone using infrared thermometers for keen cultivating. proposed a WSN that utilizations both a drone and sensor hubs that are furnished with infrared thermometers. The drone gauges the leaf temperature over the entire ranch. The sensor hubs are set close to the yields in a piece of the homestead consistently and measure the topical leaf temperature. The leaf temperature estimated by the drone is calibrated subject to sensor center point estimations as the ground truth. the best strategy to decrease battery utilization to postpone the lifetime of thesensor hubs, and propose a communication protocol. To survey the exhibition of the communication protocol through a model. Nidhi S Meda, Thejas Gubbi Sadashiva, Sanjeev Kaushik Ramani, and S.S.Iyengar (2017) Proposed assembling the temperature, humidity, soil moisture and precipitation data in genuine time. Mobile testbeds are planned to decrease the task done by various static test beds to accumulate these data. Later, the consolidated data is dissected and suitable outcomes are drawn from the assembled data. On the off chance that the plant is inclined to any malady, it is identified with the assistance of picture processing. Hence demonstrating the wellbeing monitoring system for the plants. The detection of infection and its name for a specific plant by using picture getting ready techniques. Record terms: Mobile test bed,

Forecasting with regression, Bilateral sifting, Canny edge detection, Contour strategy. Arranging and programming the convenient WSN test beds. Social occasion the data from the territories wherever the compact testbed is found. Joining the assembled data and breaking down the data accumulated. Anticipating the perfect factors and contrasting and constant data. Recognizing the plant infection by capturing picture of the leaf. Tuan Dinh Le, Dat Ho Tan (2015) Proposed to design and send a wireless sensor network for accuracy agriculture. proposed a WSN Management Framework for Precision Agriculture, called MFPA, which comprises of 3 modules: data prediction module, data collection module and controller module. First, to proposed WSN framework architecture for accuracy agriculture. Second, proposed and executed WSN management framework called MFPA for exactness agriculture sent the framework. Finally, to evaluated the exhibition of the Data Prediction Module, which uses the dynamic Bayesian network for the two regular parameter predictions: temperature and humidity. The WSN Management Framework for Precision Agriculture called MFPA in detail. To address the flexibility issue, MFPA utilizes hierarchical management architecture. MFPA comprises of 3 modules: Data collection, Controller, and Data Prediction Modules. The framework has been conveyed and worked, which promises to carry critical advantages to the provincial field.

3. AGRICULTURE USING WSN ALGORITHMS
3.1. RANDOM FOREST ALGORITHM
Random woods are based on outfit learning technique for classification (and regression) that operate by constructing a multitude of decision.At the point when an example to be classified is entered, the last classification result is controlled by the vote of the yield of a solitary decision tree. Random forest overcomes the over-fitting issue of decision

trees, has great tolerance to commotion and peculiarity esteems, and has great scalability and parallelism to the issue of high-dimensional data classification. In addition, random timberland is a non-parametric classification strategy and driven by data. It trains classification governs by learning given examples, and doesn't require earlier knowledge of classification.

The random forest model is based on K decision trees. Each tree decides on which class a given free factor X belongs to, and only one vote is given to the class it considers generally fitting.

The means to generate a random forest are as per the following:

The technique for random continued examining is applied to randomly extract K tests from the first preparing set as self-service test set, and then K classification regression trees are generated.

Assuming that the first preparing set has n highlights, m highlights are randomly selected at each hub of each tree (m≤n). By calculating the measure of information contained in each component, an element with the most classification capacity is selected among the m highlights for hub parting.

Every tree develops to its most extreme with no cutting.

The generated trees are composed of random woods, and the new data is classified by random timberland. The classification results are dictated by the quantity of votes of the tree classifiers.

The comparability and correlation of decision trees are significant highlights of random woodland to reflect generalization performance, while generalization mistake reflects generalization capacity of the system. Generalization capacity is the capacity of the system to make correct decisions on new data with a similar distribution outside the preparation test set. Littler generalization mistake can make the system show signs of improvement performance and stronger generalization capacity.
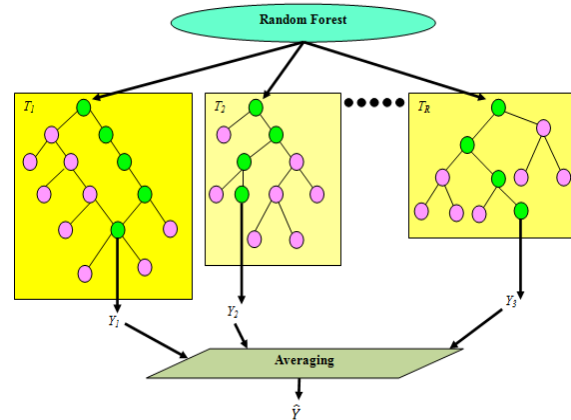

Figure 2: Random forest algorithm

3.2. Maximum likelihood classification algorithm (MLC algorithm)

Maximum likelihood classification accept that the statistics for each class in each band are ordinarily circulated and calculates the probability that a given pixel belongs to a specific class. Each pixel is doled out to the class that has the most elevated probability (that is, the greatest likelihood). In the event that the most elevated probability is littler than a limit you specify, the pixel stays unclassified. ML is a regulated classification strategy which is based on the Bayes hypothesis. Class mean vector and covariance grid are the key contributions to the function and can be evaluated from the preparation pixels of a particular class.

ENVI executes greatest likelihood classification by calculating the accompanying discriminant functions for each pixel in the image:

$$g_i = 1np(\omega_i) - {}^1\!/_2\, 1n|\textstyle\sum_i| \\ - {}^1\!/_2\,(x - m_i)^T \sum_i (x - m_i)_i^{-1}$$

Where:
i = class
x = n-dimensional data (where n is the number of bands)
$p(\omega_i)$ = probability that class ω_i occurs in the image and is assumed the same for all classes

$|\Sigma_i|$ = determinant of the covariance matrix of the data in class ω_i

Σ_i^{-1} = its inverse matrix

m_i = mean vector

4. APPLICATIONS OF WSN USING AGRICULTURE

WSN can monitor diverse physical qualities: temperature, humidity, light, weight, clamor, soil composition, object motion (detection, and tracking), objects weight, size, etc. The sensors additionally can transmit and advance sensing data to the base station. Most current WSNs are bi-directional, empowering two-way communication, which could collect sensing data from sensors to the base station just as scatter commands from base station to end sensors. The advancement of WSNs was propelled by military applications such as combat zone surveillance; WSNs are generally utilized in mechanical environments, private environments and natural life environments. Structure wellbeing monitoring, healthcare applications, home automation, and creature tracking are a portion of the delegate WSNs applications.

Environmental monitoring:

There are numerous applications in monitoring environmental parameters like Air pollution monitoring, Forest flame detection, Landslide detection, Water quality monitoring, and Natural debacle prevention. In this different sensors are spread over the trees in the timberland regions. These sensors report to the current climate sensing station and the temperature of the woodland is accounted for to the climate sensing station which continuously communicates with the satellite and the satellite is connected to the flame monitoring station. As the temperature exeeds a specific edge esteem, the control centers are cautioned and necessary action is taken to give assistance to the required place.

Acoustic detection:

It is the science of utilizing sound to decide the distance and direction of something. Location can be done actively or latently, and can take place in gases, fluids, and in solids. Active acoustic location includes the creation of sound so as to produce an echo, which is then broke down to decide the location of the object in question. Latent acoustic location includes the detection of sound or vibration created by the object being detected, which is then broke down to decide the location of the object in question.

Seismic Detection:

Seismic waves produced by explosions or vibrating controlled sources are one of the essential strategies for underground exploration. Controlled-source seismology has been utilized to guide salt arches, anticlines and other geologic snares in oil bearing rocks, shortcomings, rock types, and long-covered.

Medical monitoring:

The medical applications can be of two kinds: wearable and embedded. Wearable devices are utilized on the body surface of a human. The implantable medical devices are those that are embedded inside human body. Body-territory networks hence framed can collect information from wearable and embedded medical devices about a person's wellbeing, wellness, and energy use.

Security & Surveillance:

The focus of surveillance missions is to acquire and check information about adversary capabilities and positions of threatening targets. Such missions often include a high component of risk for human personnel.

5. EXPERIMENTAL RESULTS

Detection Ratio

Random Forest	MLC

67.2	70
69.7	73
70.8	77
72.6	81
75	90

Table 1: Comparison table of Detection Ratio

37.7	45
42.6	49
50.4	55
55.23	58

Table 2: Comparison table of Accuracy Ratio

The Comparison table of Detection ratio of Random forest and MLC shows the different values. While comparing the random forest and MLC the MLC is better than the random forest algorithm. The random forest value starts from 67.2 to 75 and MLC values starts from 70 to 90. Every time the MLC value gives the great results.
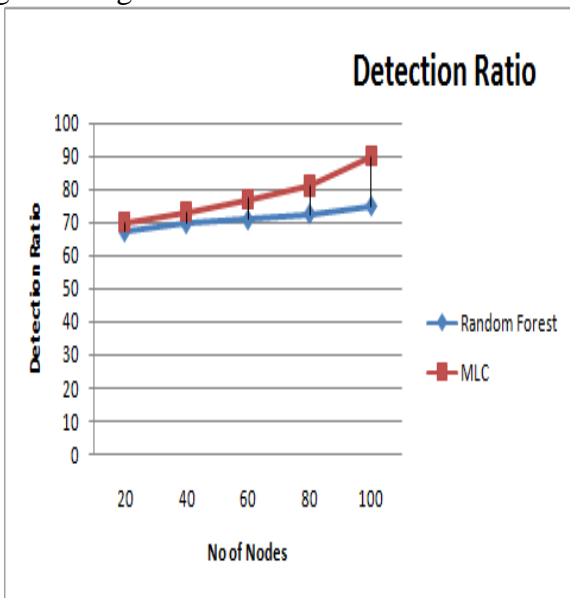
The Comparison table of Accuracy ratio of Random forest and MLC shows the different values. While comparing the random forest and MLC the MLC is better than the random forest algorithm. The random forest value starts from 31.9 to 55.23 and MLC values starts from 39 to 58. Every time the MLC value gives the great results.

Figure 3: Comparison Chart of Detection Ratio

Figure 4: Comparison Chart of Accuracy ratio

The comparison Chart of Detection ratio of Random forest and MLC demonstrates the different values. No of nodes in x axis and Detection ratio in y axis. The MLC is better than the random forest algorithm. The random forest value starts from 67.2 to 75 and MLC values starts from 70 to 90. Every time the MLC value gives the great results.

The comparison Chart of Accuracy ratio of Random forest and MLC demonstrates the different values. No of nodes in x axis and accuracy ratio in y axis. The MLC is better than the random forest algorithm. The random forest value starts from 31.9 to 55.23 and MLC values starts from 39 to 58. Every time the MLC value gives the great results.
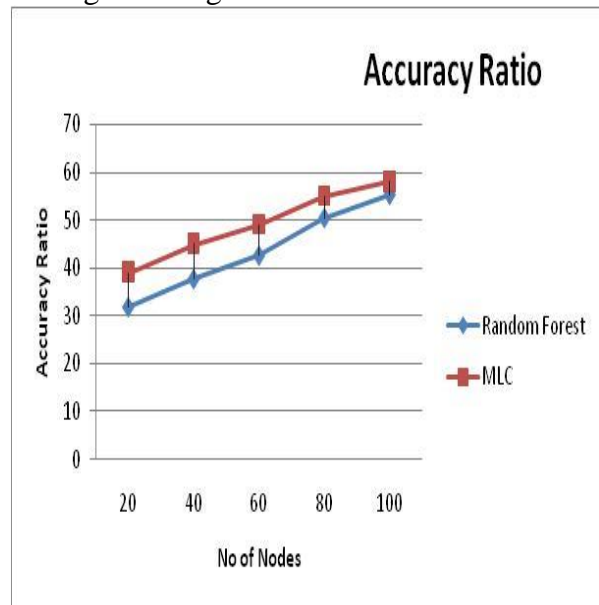
Accuracy Ratio

Random Forest	MLC
31.9	39

Classification Ratio

Random Forest	MLC
33	55

39	58.6
42	62.3
48.6	68.9
50.76	72

Table 3: Comparison table of Classification Ratio

The Comparison table of Classification ratio of Random forest and MLC shows the different values. While comparing the random forest and MLC the MLC is better than the random forest algorithm. The random forest value starts from 33 to 50.76 and MLC values starts from 55 to 72. Every time the MLC value gives the great results.
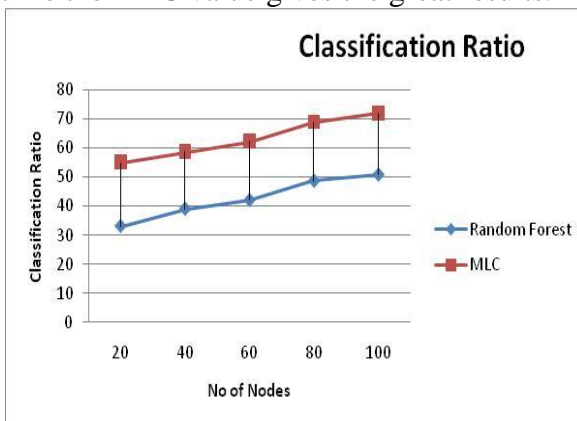

Figure 5: Comparison Chart of Classification Ratio

The comparison Chart of Classification ratio of Random forest and MLC demonstrates the different values. No of nodes in x axis and Classification ratio in y axis. The MLC is better than the random forest algorithm. The random forest value starts from 33 to 50.76 and MLC values starts from 55 to 72. Every time the MLC value gives the great results.

CONCLUSION

There is currently colossal research potential in the field of WSN. Sensors are already all over the place. Be that as it may, most sensors utilized today are enormous and costly. They lack the intelligence to examine and just report for remote processing. Brilliant, wireless networked sensors will soon be surrounding us, collectively processing tremendous measure of data that will work on different applications such as in agriculture monitoring, medical monitoring, environmental monitoring, security and surveillance. In this paper, Random forest, Maximum likelihood classification algorithm and different applications of WSN are discussed.

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