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Study Analysis of IoT based Agriculture

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Abstract— This work explores the tools and technologies used in smart agriculture. Artificial Intelligence and Machine Learning techniques, including basic block models that are used to do smart agriculture. How can we use fuzzy logic and Artificial Neural Network, is also covered in this paper. We have explored some of the IOT based irrigation systems including crop prediction systems. The necessary hardware, software and sensors that can be used to make precision agriculture are also included. The main motto of this paper is to get a detailed literature review that is required for smart agriculture.

Keywords: ***Artificial Intelligence, Machine Learning, fuzzy logic, Artificial Neural Networ*k, *IOT, Precision Farming***

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I. INTRODUCTION

METHODS THAT ARE USED FOR AGRICULTURAL WORK traditionally ARE NOT much effective and convenient. It REQUIRES a lot of workforces and regular monitoring. So, to REDUCE the labor and increase productivity, we need to switch TO smart agriculture over traditional farming methods. A farmer in traditional methods of agriculture needs to focus on the parameters such as soil moisture, temperature monitoring, humidity, etc. So obviously labor cost is more and continuous monitoring is not possible all the time. We can use the Internet of Things to minimize the cost. IOT is the integration of various things like sensors, network objects, and devices that we use to automate data recording. By using IOT tools we can suggest actions required. Artificial Intelligence has also been widely used in many fields, be it medical science, education, finance, agriculture, industry, security, etc. AI trains machines so that they can take decisions in the same way humans take. Machine learning is the subdomain of AI. The main task involved in the process of machine learning is that we put the data in the machine that has come from past results and this data, is used by the machine to make further decisions. In fields like voice recognition, image identification, weather forecasting, etc, trained data is analyzed.

ML is a mathematical approach to build intelligent machines. With the advancements in AI, various other ideas and methods were invented and discovered which simplified the problem-solving task. Few methods are: 1. Fuzzy logic 2. Artificial neural networks (ANN) 3. Neuro-fuzzy logic 4. Expert systems

II. RELATED WORKS

A lot of things have been developed in the field of AI over the last many years because of its soundness in the application and since it is ubiquitous in almost every field. An example of it is agriculture which we have explored in this paper. Agriculture is the backbone of India and it also faces a lot of challenges every day. Factors that prevent the crop from developing are- • Poor water availability • Extreme temperature • Competition among plants for sunlight, nutrients, water or space • Uncontrolled use of chemicals • Fungal, bacterial or viral infection • Attack from insects or other organisms above or below ground • So our objective is to- • Automate monitoring and analysis task of farmers • Identify plant disease • Forecasting crops • Detection of larva activities • Monitoring intrusion of animal in fields • Maximizing yield using minimal resources 2.1 Basic block models for smart agriculture 2.1.1An event driven WSN for monitoring plant health and Larva activiies [4] • ARM Cortex A4 processor-based WSN for data collection (including Larva activities) from sensors has been used. This has been awakened by the base station. • Sensing nodes transmit data only in case when there is much difference in values that is going to automatically reduce the power consumption. • Extracted data from a group of sensing nodes is transmitted to the Base station by using wireless Zigbee protocol.

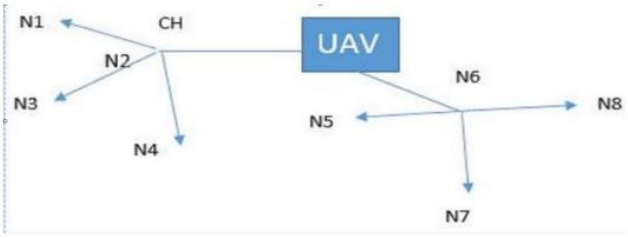

Fig 1. UAV routing protocol

• The base station is connected to the CPU via USB Liaison between CPU and Base station, and here we can see

all the collected data which we received from the sensors in the form of an ACI analysis and this analysis is done using Matlab.

• All sensors nodes are heterogeneous and can be different in size. Among these nodes, one node is chosen as a cluster head (CH). • To select CH, an algorithm is defined and the probability of each node participating in CH is calculated by the Bayesian classifier algorithm. • All the member nodes deliver data to CH using TDMA (Time Division Multiple Access) scheme. • CH will give data to UAV (unmanned aerial vehicle) (drone). • Simulation is done in OMNET ++ and the path of a drone is given in advance.

III. BACKGROUND OF STUDY

2.1.3Precision agriculture monitoring system using Green IOT[33] a) Requirement analysis - all the functional and non functional requirements are gathered. b) Specification level – specify the required devices based on requirements gathered and only those sensors will get activated, this will saves cost automatically. c) Architectural level – identify slave node and master node. All the slave nodes are responsible to provide the data to the corresponding master node. d) Component level- its duty is to perform all the functions in architectural level. Hardware components- devices and sensors Software components- BBB debian, cloud9IDE for programming editing, debugging python code e) Integration level- this level is responsible to connect all the components to form required architecture. f) Application level- results will be displayed on the application. 2.2IOT based Irrigation System In 2014, GPRS feature of a mobile phone was used to develop an irrigation system by R. Suresh et al. In this microcontroller-based rain gun irrigation system, water supply will be there only when there is acute water shortage. The sole purpose is to save water, but this system is not financially affordable. In 2017, ArifGori et al [5] suggested a system which uses mesh technology to place sensor nodes in agricultural areas. Base station (which is stationary) is responsible for collecting the data from these sensors (they are mobile). In the wake of gathering all the information base stations at that point procedure the information. PH sensors were utilized to check if the dirt was acidic or antacid in nature, the detected qualities from the pH sensor were sent to the android application and as needed choices were taken. GA Gines et al [15] used fuzzy logic in 2017 to classify rice and maize soil moisture sensor readings in the categories "too wet," "wet," "normal," "warm" and "too warm." Such readings can be used to evaluate the threshold value for these two crops which can be used to turn the motor pump on / off. In 2018, Ms. Swapnali B. Pawar et al [19] used raspberry pi which was attached to 3 sensors, namely a soil moisture sensor, a temperature sensor and an ultrasonic sensor. To test the irrigation system the Wi-Fi is linked to this platform. In 2018, Ankit Verma [3] suggested another model i.e. "Crop monitoring in wireless sensor network". This model gives SMS facility to farmers which tells the farmers about the soil condition i.e. whether the soil is dry or wet. So that they can provide effective irrigation and control the water wastage. In 2018, Shobha S. Kumbar et al [27] proposed a device that was divided into 3 sections-sensing part of humidity, section of control and section of production. Soil humidity is evaluated by using a YL 69 sensor, and the control unit is the Arduino platform based ATMega328 microcontroller. The sensor sends the sensed data to the microcontroller, which then works by flipping the motor pump on and off accordingly. 2.3Fuzzy logic in smart agriculture Fuzzy operators perform like a human driver and thus alter the interaction between input and output corresponding to previously defined series of membership functions and guidelines. A fuzzy skeleton is a linguistic-based control device, which tries to imitate a human expert's actions. Six inputs and two outputs appear in AgriSys [1]. They have used the multiple input to multiple-output (MIMO) type using the fuzzy logic library under LabVIEW. This system is deployed on a web server to allow remote access and controlled or observed via any smart device. • Five inputs with its specific minimum and maximum values are used in this system namely, humidity, temperature, PH, soil moisture and thermocouple. • Its function's specifications are as follows:

• Rectangular Humidity membership function is regarded dry if its sensor value is less than 55 and wet if its sensor value is more than 50. • Trapezoidal pH membership function is considered in either of the categories; Acidic, Normal, and Alkaline. • Triangular Environment Temperature membership function is categorized as Cold, Warm, and Hot. • Triangular Soil Temperature membership function is considered as Cold, Warm, and Hot. • Trapezoidal Soil Moisture (water level) membership function is considered as Unsaturated and Saturated. For siphon and the fan, the output membership functions are triangular, which oversees its ON or OFF status. The machine screen depends on the light just, and it closes during the daytime and opens around evening time. The derivation framework which was created depends on 25 principles. An example is suppose when the temperature is hot, humidity is wet, PH is alkaline, soil moisture is saturated, and soil temperature is hot; at that point the siphon is OFF with a switched ON fan. The framework has a simple to-update bank of derivation rules to manage the farming condition. This project, for the most part, takes a gander at inputs, for example, temperature, stickiness, and pH. Also, the framework manages desert-explicit difficulties, for example, dust, barren sandy soil, steady twist, exceptionally low stickiness, and the extraordinary varieties in diurnal and occasional temperatures. The framework gives expanded efficiency, improved security,

moment mediations, and a propelled way of life. 2.4Artificial neural networks in agriculture ANN strategy was developed by remembering a similar idea of the working of the human cerebrum. ANN is an undertaking-based strategy which advises the framework to work dependent on some inbuilt errand instead of a regular computational modified assignment. The engineering of ANN comprises of 3 layers: 1 Input layer 2 Hidden (middle) layer 3 Output layer ANN model comprises numerous neurons, each delivering a grouping of genuine esteemed activations. At the point when sensors see condition varies, initial neurons will be actuated and different neurons will at that point get initiated through weights associations from already active neurons. Contingent upon particular issues and the topology used, these practices may need some computational work, where every one of the stages changes total actuation of the system. Deep learning permits computational models that are made out of different handling layers to speak to information with various degrees of reflection. Incredible enhancements of the strategy have been visible in many examination areas. The idea of Back Propagation Neural Network is the reason for some DL calculations. With enormous eagerness filling the DL field, extraordinary upgrades have been accomplished lately. DL has attracted a great deal of consideration for horticulture. One of its applications in agribusiness is picture acknowledgment, which has vanquished a ton of hindrances that break point quick improvement in mechanical and automated agro-industry and farming. These upgrades have been seen in numerous parts of agribusiness, for example, plant infection recognition, weed control, and plant checking. So as to give a comprehensive image of DL to scientists in agribusiness fields and upgrade present day shrewd farming turn of events, this work sums up BP and normal DL calculations (Convolutional Neural Networks (CNN), Recurrent Neural Networks

(RNN), and Generative Adversarial Networks (GAN)) and their applications in horticulture, with attention on applications distributed over the most recent years. Song (2005) [29] united expert system and ANN in forecasting the nourishment level in the yield. The entire framework is based on a solitary chip PC. Second, COTFLEX framework for the cotton was created by Stone and Toman (1989) [32]. The framework was designed as a shot at Pyramid 90× PC with UNIX as a working framework. The framework consolidated the field and homestead databases to give significant data in regards to the cotton yield to the rancher with the goal that it turns out to be simple for the cultivator to make basic and strategic choices. The framework was created in Texas, and it made recreation models and DB in the standard based master framework to enable Texan ranchers to make judicious financial and rewarding choices. After testing COTFLEX was imported to IBM microcomputer and was made open for use. A specialist framework PRITHVI by Prakash et al. [7] (2013) dependent on fuzzy and implemented on Matlab was created in Rajasthan, India for Soybeans crop. It accumulates its information from rural officers, distributed writing, specialists of soybean crops. Fuzzy rules were considered in contemplating the entire framework and exhorting the rancher as a specialist. This system was separated into 5 modules. The primary point of building up this master framework was to aid the ranchers in the enhancement of production. In 2016, a forecasting technique that recommends the utilization of ANN calculations for crop forecasting in smart phones had been effectively tried [24]. This framework had 3 layers. The efficiency of the model was reliant on the quantity of the concealed layers. The experimentation strategy was executed to pick the no. of shrouded layers. This can be a précised approach to investigate the choice of shrouded layers because the expectation framework's precision is subject to the quantity of concealed layers. It was also observed that if we want a more precise forecast than we should increase the no. of shrouded layers. A report in India that evaluates the significance of the expansion of ANN in a few methods of approximation of ET. Specialists assembled month to month atmosphere information for it. The techniques on which the calculations were performed were: 1. Penman-Monteith strategy 2. Levenberg-Marquardt backpropagation. It was seen that expanding the quantity of concealed layers in the framework brought about unsteadiness in the ET estimation. Along these lines, preparing capacity with an ideal experimentation technique is to be picked for the general advanced estimation of ET. It was seen that out of 6 preparing calculations of the ANN model, work preparing with 74% information provided in it was exact. ANN model was planned and created utilizing MATLAB. 6 calculations were summoned and surveyed. As evapotranspiration is of imperative significance in the water system and water the executives, this examination showed the prescient procedure of ANN structure whenever actualized accurately [23]. Moreover, a technique was made to segregate weeds from crops with the assistance of picture investigation and neural systems having precision of over 75% with no already plant data taken care of into the framework. Shahzadi et al. (2016) [2] created master frameworks based shrewd horticulture framework. The idea of IoT in this framework was to provide information to the server with the goal that actuators of the field ought to have the option to make proper choices. For that, the server ought to be sufficiently smart to make choices freely.

2.4.1Convolutional Neural Network in smart agriculture Plant sickness discovery is tedious when it is done physically. Luckily, with the advancement of man made consciousness, plant sickness recognition can be cultivated through IP. Plant infection acknowledgment systems are the most dependent on leaf image classification and pattern

recognition [37]. An epic DL structure was utilized to construct a plant disease identification structure. This structure can perceive 13 unique sorts of plant illnesses, with the capacity to recognize plant leaves from their environmental factors. In an examination of utilizing Deep Learning in the location of plant ailments, the general precision may arrive at 95.7% after 100 preparing emphasis and might be improved to 96.4% after further tweaking. The outcomes are in reality superior to manual location. All these demonstrated that DL has noteworthy execution in recognizing plant maladies. AlexNet [36] which is used for plant classification is actually a pretrained convolutional neural network. Results of this model in 2017 propose that the CNN engineering beats AI calculations that depend on available created highlights for the segregation of phenological stages. One more investigation, self arranging Kohonen maps (SOMs) were utilized for optical image segmentation and resulting in rebuilding of lost information in a period arrangement of satellite symbolism. This strategy included a post-preparing step that incorporated a few sifting calculations dependent on the accessible data and geospatial investigation. A precision of 84.9% was accomplished for characterization of significant harvests [28]. In any case, there are difficulties that have hindered the utilization of CNN for plant grouping. Organic product checking is significant for yield forecasting. The customary manual tallying or portable camera checking can't give acceptable outcomes and are tedious. A blob detection technique has been demonstrated to be helpful [10], which has suggested to go with a fully CNN. The underlying advance of the structure is to assemble manmade created names from a lot of organic product pictures. At that point, this method fully convolutional network (FCN) was prepared to perform picture division. From that point, the check convolutional organizer was prepared to take the segmented picture and output the estimation of the number of fruits. Our last goal is to map the number of fruits counted initially with the final number of fruits counted manually by training a linear regression equation. This methodology utilizing Deep Learning with blob detection improved the exactness as well as the productivity of checking. Satellites, UAV are not generally utilized to research different assets [17] dependent on deep CNN (DCNN) and transfer learning (DTCLE). A characteristic identification technique dependent on DCNN had been utilized to find out cultivated land data. Lastly, this extracted information were ended by the DTCLE and e-Cognition for cultivated land information extraction (ECLE). The general accuracy of both are around 90%, yet as far as integrity and continuity is concerned, DTCLE beat ECLE. The use of UAVs grants securing high resolution pictures. To find out any object i.e. detection of any item is a quickly developing domain in Deep Learning. In the horticulture area, detection is additionally significant for ranchers, particularly when exceptionally self ruling machines have been progressively utilized. So as to work these tools securely but not to oversight, these machines should be highly reliable with automatic real time risk detection [12]. A system with accuracy of 99.8% in crops and 90.7% in grass is there when image classification is done with AlexNet and DCNN. It has improved the performance also and is also far better than traditional methods[31]. 2.4.2 Recurrent Neural Network in smart agriculture

IV. CONCLUSION

the supply voltage of 0.6V. The output waveform of comparator the supply voltage of 0.6V. The output Field monitoring is the obviously a required lessening people intercessions. Agribusiness observing is the very important factor on which we should focus as it helps with the decrease of work and augmentation of creation. Artificial Intelligence has been executed in choosing the best yield and to assist the ranchers in the decision of the composts. With the assistance of the database which the customer has aggregated and resolved to the structure, the machine talks about among themselves to pick which yield is sensible for gathering and moreover the composts which advance the greatest turn of events. DL has a wide reach and its application in the business has gotten an extraordinary progression. With the use of DL, it is an extra good situation over AI and it adds profundity to AI. This, at long last, helps the country in generally speaking advancement as food is the chief need of any person. IOT meant its monstrosity to help in the continuous perception of the data. IOT is fundamentally utilized in a smart watering framework. Since practical use of the open freshwater is significant, and with progress in development and utilization of innovation, the emergency identified with water can be tackled. Both water lack and flooding are the difficult issues farmers face by utilizing traditional methods.

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