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An IoT System Prototype for Implementation of Secure Smart Agriculture

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ABSTRACT

The Internet of Things (IoT) has the power to change our world. Agriculture is the backbone of the India. Development of IoT application is a must, for solving problems that are faced by farmers in the field of agriculture. Lack of proper information and communication leads to the loss in production. In the proposed system, we have automated the drip irrigation technology with the help of IoT and optimizing the usage of water level. In this paper, we are providing most secured MQTT protocol at the database level (Mongodb) and application level with the encryption technic for data security.

Keywords: IoT, MQTT , Security, Wireless Sensor Network, Drip Irrigation.

I. INTRODUCTION

The Internet of Things (IoT) is converting the agriculture sector and solving the major challenges faced by the farmer's todays in the field. The science for cultivating plants and livestock is agriculture. India ranks second in the world in farm outputs. As per 2021, Agriculture employed 58% of the Indian work force and contributed 20.19 % to country's GDP. The world is facing water crisis and In India it is more worst, where nearly 600 million people facing acute water shortage, and the government report says that death rate is about 200,000 people every year because of inadequate access to safe water. So, with the help of technology we need to come up with a solution, where we can reuse and save fresh water. About 70% populations are involved in Agriculture and use of water in agriculture has to be very accurate. Which can add up to solution of saving of

water to India? As world population is increasing day by day, we are facing shortage of water resources, shortage of land, difficulty in cost management, are part of problems. Because of global population it is expected to increase by 70% by the year 2050. The increasing population is impacting a lot to our farmer's livelihood. To overcome the problems, we design a IoT based system for monitoring the agriculture farm which continuously measure the level of soil moisture (water level) of the plants and automatically do watering to the plants without any intervention with minimum use of water. Also, the average use of water can be tracked and compared on the dashboard given to the farmers. With the alert the farmers if the moisture content of particular plants is low via SMS or an email.

In agriculture, despite large-scale funding and extension of irrigation services it is a serious concern that majority sectors are facing deficits in water management. Irrigation system is one of the major aspects to be enriched meeting the economic and sustainable challenges of the farmers. The area of Wireless Sensor Networks (WSN) have influenced a wide implementation of various applications in the area of precise agriculture.

1.1 PROBLEM STATEMENT:

Drip irrigation has been success for saving of lot of water in the farm. But drip irrigation is totally manual process, which makes things little difficult for the farmer. In the proposed system, we have used soil moisture sensor with the combination of Ardunio Mega and Raspberry Pi to form Wireless sensor network to automate the process of drip irrigation. In this system, we have kept two types of control for the water valve, first through mobile phone and second it can be kept automatic. SMS notification will be sent to the mobile indicating the requirement of water to the individual node as well as the graph of usage of water will be shown for analysis and management purpose. Also, as data will be continuously collected and transmitted from our IoT system to the public cloud database. For security purpose we have used MongoDB database, where data will be sent through an encryption technique to prevention from the DOS attack and then data would be securely sent to the cloud database. Also, in the application we will be providing with personalized login and password which would be encrypted to provide confidentiality and availability (i.e. prevention from the DOS attack) at the individual level in the mobile app. These will ensure the told security of our IoT system.

1.2 OBJECTIVES OF THE PROJECT

1. To provide optimum utilization of water in the farm.
2. To provide security for the IoT system.
3. System will also help to reduce utilization of resources in the farm like labors, nutrients etc.
4. To reduce Human intervention in agricultural field.
5. To control drip irrigation through mobile phone.
6. It provides a basic prototype, which will help to develop future many models of Wireless sensor network in different fields of IOT development models.

II. LITERATURE REVIEW

Konstantinos Demestichas et al(2020) : discussed about the security threats in Agriculture like Privacy, Confidentiality, Integrity, Availability and many more and also, did a survey on the secured smart farming. [1]. Emmanuel Abiodun Abioye et al(2021) : discussed about IoT based irrigation monitoring for the cultivation of Mustard Leaf Also, he has done and given the result of experiment carried for the same with the help of data. [2]. Angelita Rettore de Araujo Zanella et al(2020) : discussed about the security challenges of smart agriculture. Also, did analysis of the current state, key issues, and future directions for smart agriculture. [3]. Nelson Sales et al(2015) :

elaborated about Wireless Sensor and Actuator System for Smart Irrigation on the Cloud. In this paper the author has given about the development of a system for smart irrigation and its benefit from the knowledge of the soil and water dynamics. All other areas where the system can be used such as storage of historical information on the cloud concerning an agriculture field. The availability of a large amount of valuable data on the cloud enables the creation of intelligent services with very high potential, such as data correlation between different cultures and/or fields, plant disease estimation through the application of machine learning techniques, or determination of the most appropriate land cultivation according to soil conditions.[4] V.Vijay hari ram et al(2015) : discussed regarding Regulation of Water in Agriculture Field Using Internet of Things. In this paper author has worked upon the concept of the IoT to its extent and improve the functioning of the device. By using this IoT devices, the agriculture farm fields can be monitored continuously through sensors and necessary measures will be taken without human power. Thus agriculture production percentage will increase without any loss of water. [5] Aarush Gedam et al(2022):discussed aboutSmart Agriculture can improve and increase the quantity and quality of crop harvest through Soil Moisture Counter in Smart Farming [16]. Prathibha S R et al(2017) : described about IoT Based Monitoring System in Smart Agriculture. In this paper author has discussed about the IoT technology use for agriculture monitoring system and it will serves as a reliable and efficient system and corrective action can be taken. Also, use of Wireless monitoring of field reduces the human power and it also allows user to see accurate changes in crop yield. It is cheaper in cost and consumes less power. The smart agriculture system has been designed and synthesized. The developed system is more efficient and beneficial for farmers. Tracking of parameters such as temperature, humidity of the air in agricultural field through MMS to the farmer, if it fallout from optimal range. Also, solar power source usage can be used for low powered devices. [6] Antonis Tzounis et al(2017) : discussed regarding Internet of Things in agriculture, recent advances and future challenges. In this paper authors have mainly discussed about the IoT technology using RFID in agriculture. They have discussed about the brief about the IoT layers. Also, about how IoT WSN would optimize the production by many means. On the other hand, food supply chains, equipped with WSN and RFID equipment, will be able to monitor each stage in the life of a product, make automatic reasoning, in case of a faulty product and increase consumer's feeling of safety, through a transparent product lifecycle information system. All the above is the optimistic approach of the IOT integration in Agriculture. [7] Lei Zhang et al(2018) : discussed regarding Internet of Things Applications for Agriculture. In this paper author has discussed and told IOT as the second green revolution, which is largely built on the IoT and related 522 18 Internet of Things Applications for Agriculture technologies. IoT-based PA promises to make the farm of the future more productive and efficient with less labor work needed. It is grounded on the use of data to form more efficient and effective farming practices and drive associated environmental and social benefits. Also, other many related technologies developed to serve this purpose, for example, CWSI, NDVI, RTK approaches and advanced sensors. These technologies and associated applications enable farmers to treat crops and animals more precisely. [8] Fu Bing et al(2016) : elaborated about the Research of loT of Agriculture based on Three Layers Architecture. In this This project uses IoT technology in agriculture, gathering crops growth environmental parameters in a fixed place or with the method of mobile sensor group, to help farmers find problems in time. In The system development composes three parts: the server, Android client and PC client to achieve scalability, high reliability, security, compatibility of technical requirements. Here some of the research results are adopted in greenhouse watermelon planting and

cultivation of grapes. Growers submit questions and they are able to receive answers timely from the experts in this platform. It has solved some problems of stopping watermelon virus disease, plant blight and so on, which enables farmers to achieve benefits. [9] Rashi Chaudhary et al(2015) : discussed reagrding the Embedded with Internet of Things, Smart Agriculture vision is analyzed in this case study. Smart Farming techniques offered by leading Agriculture Company AGCO's Fuse Technology's 'Connected Farm Services' is under study. Study presents a future projection of smart connected agriculture objects and processes and the scope of the internet driven applications in agriculture field. SWOT analysis has been used to analyze the issue under study. Case has been explained in majorly five portions, introduction, Smart farming operational Fundamentals, Smart Agriculture by AGCO, SWOT Analysis, Conclusion. [10] Rama Chidambaram RM et al(2017) : described about Automation in drip irrigation using IoT devices.In these paper author has automated the drip irrigation as well as they are health of the crop is analyzed through an image processing system. [11] Maohanraj I et al(2017) : discussed about Intelligent Drip Irrigation and Fertigation Using Wireless Sensor Networks. Author has automated the drip irrigation using Penman-Monteith FAO-56 model. It also check the water overflow and fault in drip irrigation. [12]. Abhijith H V et al(2017) : discussed regarding Intelligent Agriculture mechanism using Internet of Things. In this using Internet of things, Sensors and Data mining in Agriculture, we can help farmers to understand the timely requirements of the crop. With this, better yield can be generated. Different sensors are used to detect content from the soil as well as farm environment. The usability of the proposed work is shown through the simulation. The action of deploying sensors in the agriculture land to sense the data and mining the data to identify the parameters required for better growth of crop is shown through simulation. Also, Prediction of specific diseases with respect to Sugarcane crop is considered for future enhancement. [13] Nurzaman Ahmed et al(2018) : presented about the Internet of Things (IoT) for Smart Precision Agriculture and Farming in Rural Areas. In this paper it has been presented an IoT-based control system for advancement in agriculture and farming of rural areas. Different components and enhancements of the control system are discussed and analyzed in all aspects including testbed evaluation. Proposed fog computing solution takes action with lesser delay and saves bandwidth in the network. The proposed system has used of modern technologies like IoT with low cost and scalable solutions are very important. And to reduce congestion in the proposed large-scale network, along with the routing and fog computing solution, technologies like IEEE 802.11n/ac/ah having more physical data rate capacity. [14] Tanmay Baranwal et al(2016) : discussed regarding Development of IoT based Smart Security and Monitoring Devices for Agriculture . In this paper IoT is used for collecting information through connecting devices. The writer has designed a system which can do identification of rodents in the grain. Also, After collecting and analyzing the data, algorithm is designed to provide accuracy in notifying user and activation of repeller. Also, device can be enabled to collect more information about surroundings and presence of threats so that implementation of machine learning is achieved for better result of agriculture and farming. [15]

III. METHODOLOGY

3.1 PROPOSED SYSTEM

In the current proposed Model, we have used the following:

System Implementation: Requirement for setup:

i. Raspberry Pi 3
ii. Ardunio Mega with ESP8266 WiFi
iii. Sensors
iv. Wires
v. Smart Phones with Android

vi. WIFI connection
vii. Database: Cloud
viii. Protocol used MQTT
ix. Language : Python & C

3.2 Algorithm:

Step 1: Connect to the Internet through Wi-Fi.
Step 2: If not connected to the Wi-Fi, attempt reconnection.
Step 3: Else print the IP address of the device, on the serial monitor.
Step 4: Sensors will send the data to Ardunio mega borad, it will collect data from all the sensor in that gateway and take the average value.
Step 5: If the average value of the moisture is less than the threshold value it will send a message to the relay through Mongodb database.
Step 6: The relay will ON the motor value of that Node of the field. It means watering is started as soon as quantity of water gets more than the required amount of water. It will again follow the step 4 & 5 and it relay will get the signal from the board to stop the water valve.
Step 7 At the same time data will be sent to Raspberry Pi module (the main gateway of the Filed) will continuously keep on collecting the data from all the local gateway of the agriculture field.
Step 8: The data collected will be stored on Mongodb on local server as well as on the cloud.
Step 9: These data can be seen to the user through a Dashboard created. Where they can view all the gateways and sensor details. Which can be used for controlling the node and analysis purpose.
Step 10: In the current dashboard water used by each gateway can be seen. Also, notification if any over or under usage of water will be sent.

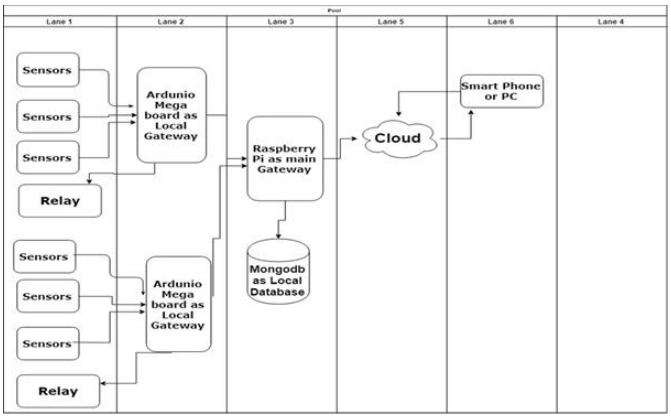

Figure 1 : Flow of the system

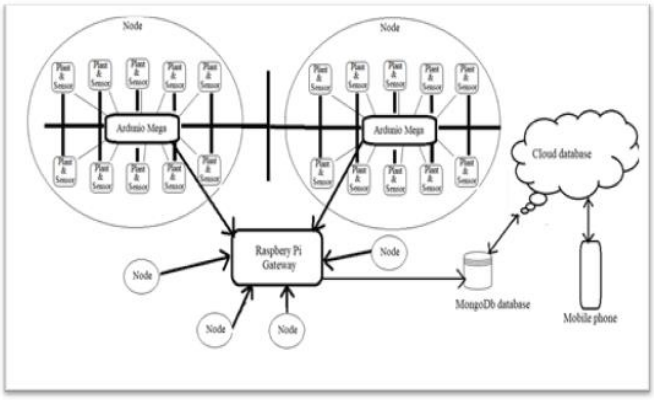

Figure 2 : Architecture Layout

IV. RESULTS

1. N – Number of sensor connected to the local gateway or local broker reduces the overhead of traffic of internet bandwidth.
2. Error finding of any sensor or client device becomes easy.
3. Addition of new nodes or client becomes easy with low resources usage.
4. Water is saved up to a great extent and is used only as per the optimum requirement.
5. It can be scalable to any field there is no restriction on anatomy of the field.
6. It will give best and better yield of crop which ultimately benefits to the farmer in terms of more income and less loss of field. This will ultimately increase the GDP of the country.
7. Due to encryption technique data transmitted is secure with the use of MQTT protocol.

8. Secured connection has been established so that no data loss. Data is transferred in encrypted form through API to maintain security of farmers data.

V. REFERENCES

[1]. K. Demestichas, N.Peppes, T. Alexakis, "Survey on Security Threats in Agricultural IoT and Smart Farming" MDPI ,2020.

[2]. E.Abioye, M. Abidin, M.Azimi ,"IoT-based monitoring and data-driven modelling of drip irrigation system for mustard leaf cultivation experiment", Elsevier , 2021.

[3]. A. Zanella, E.Silva, L.Albini,"Security challenges to smart agriculture: Current state, key issues, and future directions", Elsevier,2020.

[4]. N. Sales, O.Remédios, A.Arsenio, "Wireless Sensor and Actuator System for Smart Irrigation on the Cloud", IEEE ,2015.

[5]. V.ram,H.Vishal,S.Dhanalakshmi,P.Vidya, "Regulation of Water in Agriculture Field Using Internet Of Things ", International Conference on Technological Innovations in ICT for Agriculture and Rural Development, IEEE , 2015.

[6]. Prathibha S, Anupama Hongal , Jyothi M P , "IoT Based Monitoring System in Smart Agriculture",International Conference on Recent Advances in Electronics and Communication Technology, 2017.

[7]. A.Tzounis ,N.Katsoulas, T.Bartzanas, C. Kittas, "Internet of Things in agriculture, recent advances and future challenges" , Elsevier, 2017.

[8]. Lei Zhang, Ibibia K. Dabipi, Willie L. Brown Jr, "Internet of Things Applications for Agriculture", The Institute of Electrical and Electronics Engineers, Inc. Published,John Wiley & Sons, Inc. 2018.

[9]. Fu Bing, Umg,"The Research of lOT of Agriculture based on Three Layers Architecture" 2nd International Conference on Cloud Computing and Internet of Things (CCIOT), 2016.

[10]. Rashi Chaudhary, Prakhar Pandey, Jalaj Ranjan Pandey, Pulkit Chaudhary "Case study of Internet of Things in area of Agriculture, 'AGCO's Fuse Technology's 'Connected Farm Services", IEEE, 2015.

[11]. Rama Chidambaram RM, Vikas Upadhyaya ,"Automation in drip irrigation using IOT devices" IEEE , 2017.

[12]. Mohanraj I, Gokul V, Ezhilarasie R, Umamakeswari ,"Intelligent Drip Irrigation and Fertigation Using Wireless Sensor Networks" IEEE,2017.

[13]. Abhijith H V, Darpan A Jain, Adithya Athreya Rao U, "Intelligent Agriculture mechanism using Internet of Things" IEEE,2017.

[14]. Nurzaman Ahmed, Debashis De, Senior Member, Md. Iftekhar Hussain, "Internet of Things (IoT) for Smart Precision Agriculture and Farming in Rural Areas, IEEE 2018.

[15]. Tanmay Baranwal, Nitika, Pushpendra Kumar Pateriya, "Development of IoT based Smart Security and Monitoring Devices for Agriculture", IEEE,2016.

[16]. Aarush Gedam, "Soil Moisture Counter in Smart Farming", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), 2022.

[17]. Madhuri N. Gedam, Varshapriya J. N., Bandu B. Meshram, "Proposed Secure Content Modeling of Web Software Model", International Journal on Emerging Trends in Technology (IJETT), NCRIEST – 2019.

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