IoT Based Irrigation Remote Real-Time Monitoring And Controlling Systems

Tigist Hilemariam Senbetu, Kishore Kumar K, G.M. Karpura Dheepan

Abstract*: *Internet of Things (IoT) is a worldwide network of "smart devices" that can sense and interact with their environment by means of the internet for their communication and interaction with users and other systems. Farming plays key part in the growth of a country like Ethiopia. Problems about agriculture have been continuously delaying the growth of the country. The lone answer to this difficult is modern agriculture and technology for sustainable use of water by updating the present old-style methods of farming. Hereafter the planned method targets IoT enabled remotely real-time way of monitoring and controlling suitable irrigation systems. Arduino mega founded automatic irrigation IoT system is suggested for upgrading and it will allow having a better water management and treatment on irrigation systems. Hence, exploitation of water resource again improves productivity of the crop. The proposed system is developed such that the data sent from the sensors and predict the amount of water needed. The water flow controller, p^H sensor, water level monitoring sensor in the pond and temperature and soil moisture sensors are used to get information through External Wi-Fi. Finally it is been sent as a notification through mobile and computer. Based on the acquired value the proposed system calculates p^H, water level , temperature and Soil Moisture required for irrigation. The major advantage of the system is, the direct human intervention is avoided when implementing the system with variety of low cost sensors and Internet of Things (IoT). The stakeholders will attain greater productivity with saving time and money

Index Terms*: *IoT, Irrigation, Arduino,* p^H*,Sensor

I. INTRODUCTION

The Internet of Things (IoT) attempts to make daily objects smooth, giving them the skill to sense numerous situations of their environment or of their own action interconnect and reply to real-world events [8]. Farming uses 85% of accessible fresh water resources world-wide, and this proportion will continue to be leading in water intake because of population growth and bigger food demand. There is a crucial need to produce plans based on science and technology for bearable use of water, comprising technical, agronomic, administrative, and institutional improvements. Irrigation plays a significant role in agricultural does, and agricultural irrigation schemes are the largest user of water in the world [3].

Revised Manuscript Received on May 07, 2019.

Tigist Hailemariam Senbetu, PG Scholar in Department of Computer Science and Engineering

Mr. Kishore Kumar K, M.E Computer science and Engineering from Anna University

Dr. G.M. Karpura Dheepan, Ph.D Computer science and Engineering from Anna University

Irrigation can be well-defined as the use of water to the soil for raising the moisture content which is important for plant root-growth and development to prevent stress that may cause reduce the quantity of crop as well as the merit of the crops. The country Ethiopia is found in East Africa and hence agriculture is the base for people's basic achievement and the nation state is plentiful by water resource. Even if we have adequate amount of water still now rain-fed agriculture is more experienced than irrigation water use. Now 15 % of Farmers Starts Irrigation, we have seen that due to improper water utilization and due to erosion and cutting of canals, farmers suffer from irrigation problem and also when they go for the government offices then they have to wait for months for resolving the problem and hence it takes time, travel fatigue and also loss of money due improper convenience And still there are many problems of water management related to irrigation. The measured water parameter in this proposed system is p^H level by means of an analogy p^H sensor. The temperature is captured during p^H measurement by using an analogy temperature sensor and Wireless Water Level Indicator Using Ultrasonic sensor [5]. Some of water quality parameters to be measured are p^H Value of water and ambient temperature of water in addition Soil moisture measurement also influences the quality of agricultural production

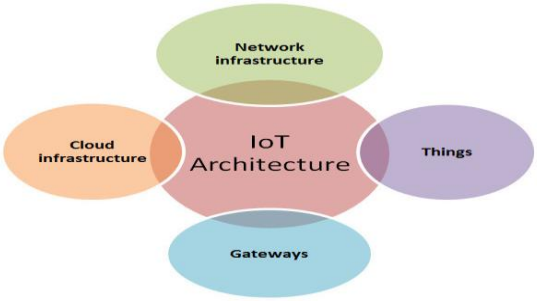

Fig 1 IoT (Internet of Things)

II. PROPOSED SYSTEM

The proposed system has been designed to overcome the unnecessary water flow into the farm or crop lands and prevent impurity that infliction to plants or crops without any impact increases the productivity by monitoring and controlling when irrigation start and stop the time remotely any ware in real time to give up immediate actions.

Arduino founded automatic irrigation IoT scheme is suggested to upgrading and a vast quantity of water is being misused because of unrestrained use and exploitation of water supply again improves output of the crop [10]. Here comparing our model to the existing model. IoT based irrigation remotely in real time monitoring and controlling is one of the best applications of Internet of Things (IoT). Governed big farm and small scale farmers can monitor the irrigation properly , water quality and take decisions accordingly from a remote place. This system used will be included both small agricultural land and large Farm such that government farm and will be useful to small farmers. This study discusses IoT based the design and current development of system having low cost to remotely monitor real time values and also to control the system. This system will be using Arduino mega connected with water level sensor, temperature sensor, p^H value sensor,Soil Moisture and External Wi-Fi module processes and send and receive data to cloud. The proposed system has been designed to overcome the unnecessary water flow into the farm or crop lands, Temperature to control environment, water level controlling water in the pond, p^H value water quality like pollution water and soil moisture also control the soil then, water controller readings are continuously monitored by using this sensors send the activities to Arduino it has continuously collects the data from sensors. Once the data was analyzed by the Arduino and all the requirement or conditions set for filling the purified water to connected and desired farm was satisfied ,aromatically the Arduino micro controller would release the purified water from water pond to the farm land by activating water pump (controller) that was displayed in the figure below through the rely connected to Arduino . This includes water level status, soil moisture status, temperature status, p^H value indicator and. The motor status indicates the current status of the pump.

III. MODULE DESCRIPTION

A. General Architecture

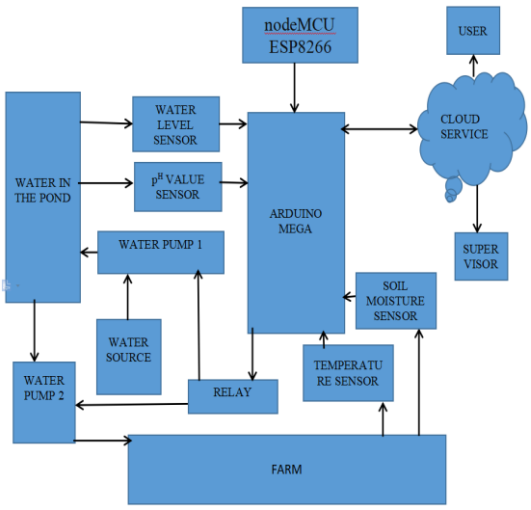

Fig 2 General Architecture

The above depicted a high level architecture of the proposed system include major components and modules required as well as how they would be integrated to become a full-doughty system. Water level controller, soil moisture sensor ,temperature and p^H value sensor to avoid water pollution readings are continuously monitored by using this sensors send the activities to Arduino it has continuously collects the data from sensors. Once the data was analyzed by the Arduino and all the requirement or conditions set for filling the purified water to connected and desire farm was satisfied aromatically the Arduino micro controller would release the purified water from water pond to the farm land by activating water pump (controller) that was displayed in the figure below through the rely connected to Arduino . This includes water level status, soil moisture status, temperature status, p^H value indicator and. The motor status indicates the current status of the pump. In order to design and implement the proposed system the Arduino micro controller was selected and deployed .it was acting like a brain of the entire system .all sensor and updater used four implementing the system was directly connected to it.this would enable those connected devises easily send as well as receive data from and to the micro controller furthermore the micro controller was responsible to receive examine and analyze the received data and with the much patterns predefined by the system .in addition to that it was also responsible to send a signal or data to the other connected modules .this would allow the system to automatically actuating or taking relevant and equivalent measurement based on the result analysis of the pre seated conditions.

IV. MODULE IMPLEMENTATION

A. Water Level Identifier

Wireless Water Level Pointer By means of Ultrasonic sensor & Arduino is an astonishing and very beneficial project. The objective of this project is to inform the user the quantity of water that is existent in the upstairs water tank. This project can be more improved to control the water depth in the container by rotating it ON, when the water level is LOW, and rotating it OFF when the water level is HIGH.

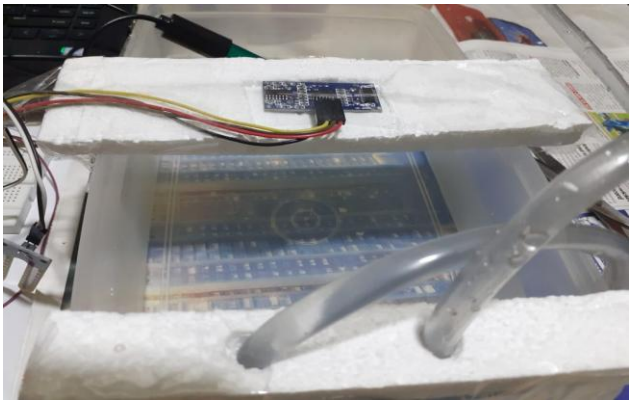

Fig.3. Water Level Identifier

B. P^H value Analyzer

pH is the unit of measure for the acidity of a solution. This module will helps to measures the hydrogen-ion concentration (or p^H) in a solution, showing its acidity or alkalinity. p^H is a measure of acidity or alkalinity of a solution, the p^H scale ranges from 0 to 14. The p^H shows the concentration of hydrogen [H] + ions present in certain solutions.

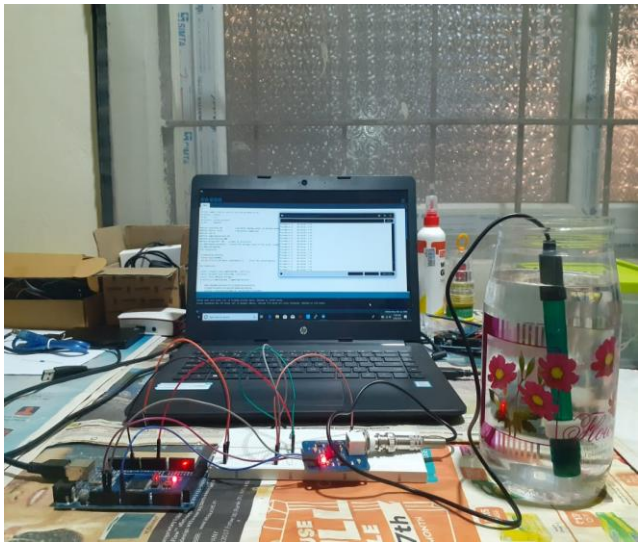

Fig.4. pH value Implemented

C. Temperature identifier

This is a water-resistant ds18b20 temperature sensor or thermometer. The probe uses original ds18b20 temperature sensor chip; It is waterproof, moisture proof and antirust with the first-rate stainless steel tube encapsulated; This identifier identifies the soil of temperature senses and send the message to Arduino controller.

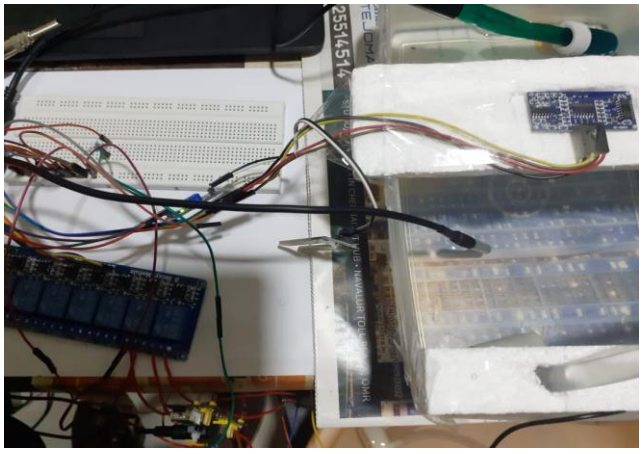

Fig.5. Temperature identifier Implemented

D. Soil Moisture Measurement

The Soil Moisture Sensor is used to measure the water content of soil. This makes it ideal for performing experiments in courses such as soil science, agricultural science, environmental science, horticulture, botany, and biology.The proposed system is used this system to identifying the program of water enter in to the farm when the soil is before the day that dry then immediately apply the water in the farm .The Soil Moisture Sensor uses capacitance to measure dielectric conductivity of the surrounding medium. The sensor creates a voltage proportional to the dielectric conductivity, and therefore to check the water content of the soil.

Fig.6. Soil Moisture Measurement Implemented

E. Water Controller (pump)

Micro dc 3-6v micro submersible pump which can be operated from a 2.5 ~ 6V power supply. It can take up to 120 liters per hour with very low current consumption of 220ma. Just connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the water level is always higher than the motor. This water pump is do the data was analyzed by the ardinuo and all the requirements or conditions set for filling the purified water to connected and desired farm was satisfied, automatically the ardinuo micro controller would release the purified water from water pond to the farm land by activating water pump (controller) that was displayed in the figure below through the rely connected to ardinuo

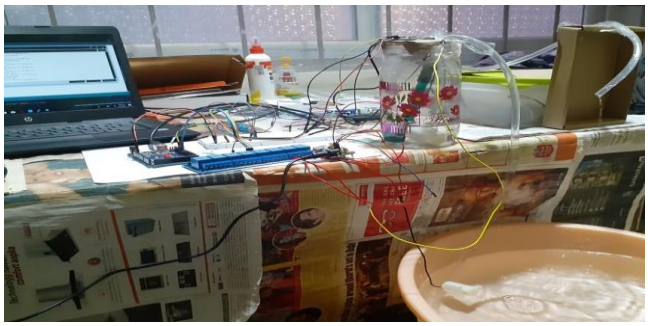

Fig.7. Water controller (pomp)

F. Node MCU ESP8266

It was known that Arduino micro controllers didn't have a built-in Wi-Fi in order to monitor and control them remotely over the internet. However, they can support other Wi-Fi shields to be integrated. This would enable them to be connected to the internet. Among the available external Wi-Fi enabled a module that makes possible the Arduino to be the part of the internet is the NodeMCU ESP8266.

It was a Wi-Fi enabled micro controller that allows the data to be goes and come to the internet. It also supports to write and upload an Arduino sketch using Arduino IDE. In addition to that, it also supports different types of communication and for that reason, it has some pin header through which the connection, as well as communication, was created between other available modules. Due to those major features, this module was used in this project to enable the central micro controller of the proposed system which is Arduino to interact with the global network (internet).

As already illustrated in the architectural diagram of the proposed system, including nodemcu esp8266 all the necessary modules would be directly connected to the arduino. most of the data collected from those modules or sensors would be sent to the arduino. but once the data reach the arduino it was not possible to send them to the cloud. so here we need to have a connection and communication between the nodemcu esp8266 and arduino.

So in order to achieve this, a serial communication would be created between the two modules through RX and TX of the two modules pin header using a jumper wire for connecting each RX and TX pin of the modules. Once the communication was created successfully all data sent to the Arduino from the connected sensors would also be available on nodeMCU. Since nodeMCU has a built-in Wi-Fi and it possible to send data to the cloud, the data incoming from the Arduino would be directly pushed to the cloud. In this project, the data would be sent to thing speak. Which is a cloud-based, open source an IoT API that enables us to store, retrieve, aggregate, analyze and visualize streams of live data.

Fig.8. Node MCU ESP8266

G.Notification

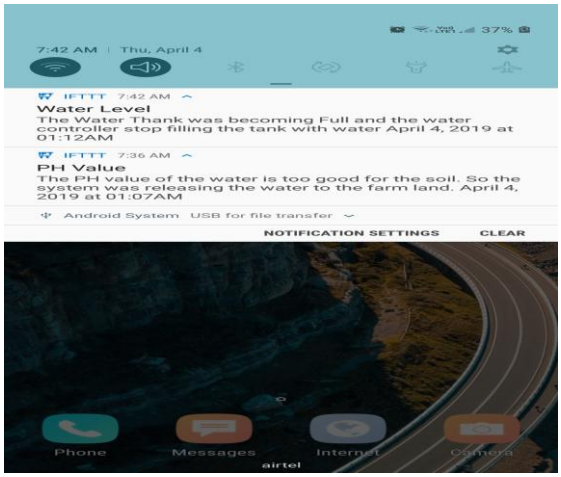

Fig.9. shows notification through mobile

This notification as shown in above Fig .9. through mobile the system when the water in the tank is full or half the ultrasonic sensor sense the water and the system would automatically send the notification to the supervisor,also the system examine and analyzing the p^H value water inside the water tank and if the result was satisfied or the p^H value was neutral (7-9) the system would automatically send the notification message to the supervisor , like that the other sensors sense own tasks ,after that he /she was informed the water tank was full a purified water and the system was starting to filling or realizing the farm land with the water coming from the water tank.

Result and discussion

The proposed system hardware and the real time results of four sensors are also revealed in the figure below. The information get from sensors are kept in the cloud and can be observed by agriculturalist through his mobile/ PC. The system exact values which really occur from the system are perceived remotely by agriculturalist; without his interference at his farm fields the irrigation ran automatically. The Arduino administered and linked information found from four different sensors checks at every time to the threshold values. Here calibration of the sensors system is so important. The system displays pH value, water level and temperature condition of soil moisture, based on the four sensors conditions. The status of the system can able to check at a remote real time monitoring and controlling.

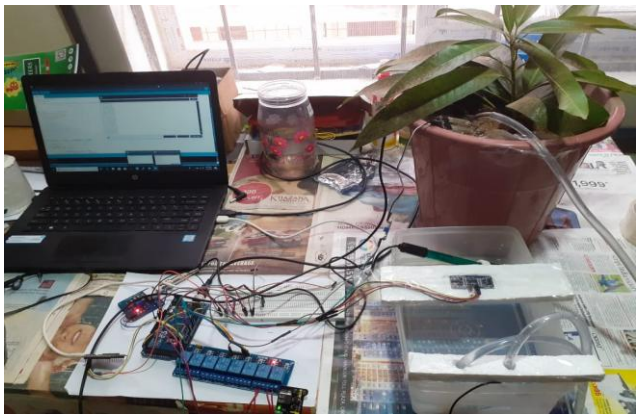

Fig.10. System hardware

Lastly the communication was created successfully all data sent to the Arduino from the connected sensors would also be available on nodeMCU. Since nodeMCU has a built-in Wi-Fi and it possible to send data to the cloud, the data incoming from the Arduino would be directly pushed to the cloud.

In this project, the data would be sent to thing speak. Which is a cloud-based, open source an IoT API that enables us to store, retrieve, aggregate, analyze and visualize streams of live data

According to this the data will be store and retrieve from things by using of HTTP protocol inter changing information in real time through the internet.

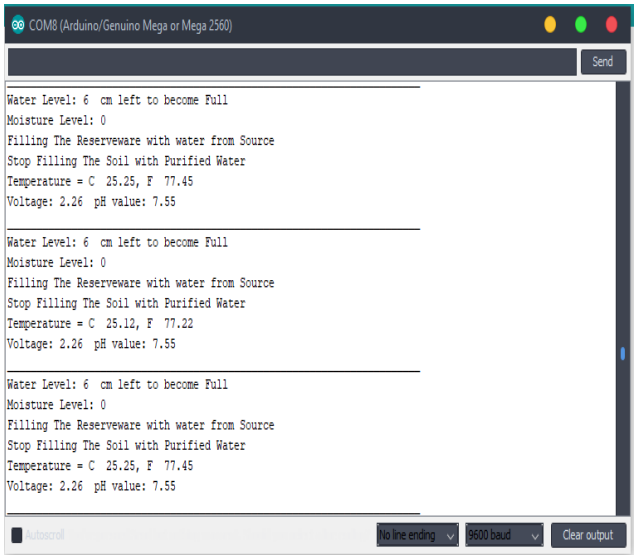

Fig.11. Snapshot of all sensor in operation

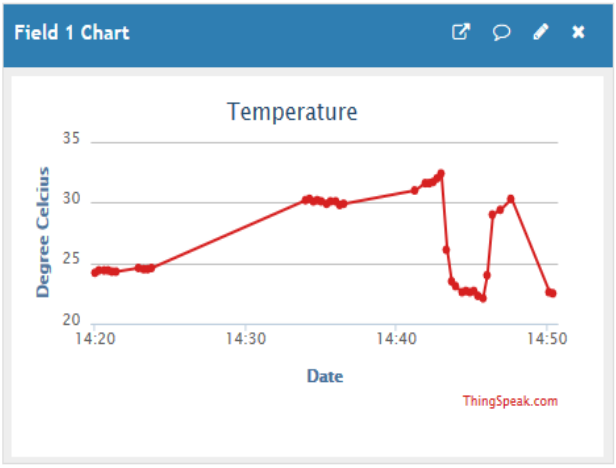

Fig.12. Snapshot of temperature in Thing Speak

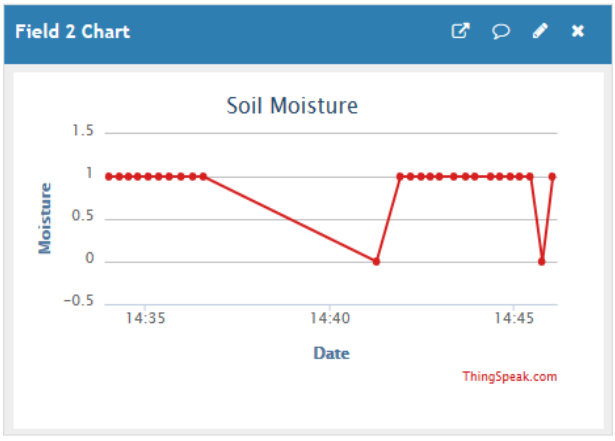

Fig.13. Snapshot of Soil Moisture in Thing Speak

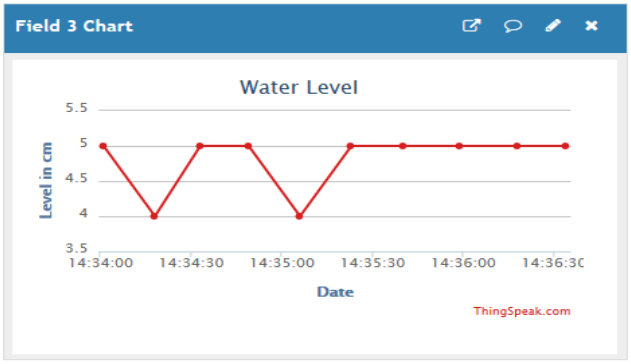

Fig.14. Snapshot of Water Level in Thing Speak

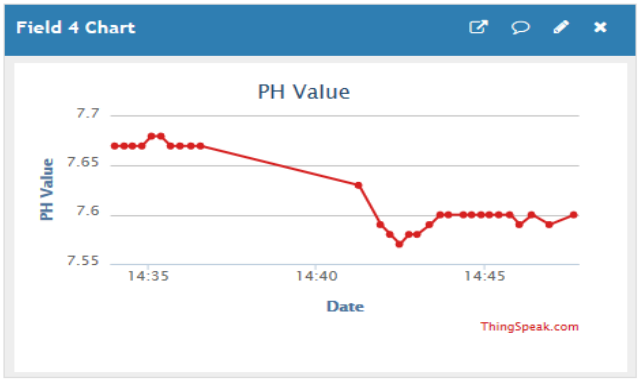

Fig.14. Snapshot of pH value in Thing Speak

V. CONCLUSION

In this work, IoT based irrigation system by examining the p^H value, of the water accumulated in the pond and Soil Moisture in the soil to make it more innovative, risk minimize, user friendly, time saving and more efficient than the existing system. The IoT based irrigation system shows to be a beneficial system as it systematizes and controls the sprinkling without any labor-intensive interference. The farmers are fronting major difficulties in sprinkling their agriculture land because, they have no appropriate idea about when the present technology accessible so that they can pump water. The p^H value sensor, Water level sensor and temperature sensor measure the water in the ponds respectively and soil moisture sensor water enter in to the farm when the soil is before the day that dry then immediately send the message to controller. The above sensors out put are found to be below the desired level, the sensor sends the signal to the Arduino and directs an alert message which alerts the Water Pump to turn ON and supply the water to respective farm. Also with out go to the farm area the farmer or supervisor will get the status of the p^H value, water level, Temperature,soil moisture and motor notification on mobile. This Value Can be notify in the future integrate a highly interactive and responsive user interface to facilitate the interaction it b/n the end users and system .In addition Integrate security future so as to only relevant and authorized users can access the system.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

ACKNOWLEDGMENT

First and utmost, I thank God for his abundant blessings

I am so much indebted to My Husband Mr.Getachew Cherenet, My Daughter Bamilak Getachew, parents,
I thank you Government of ETHIOPIA and INDIA

I express my deepest gratitude to my respected Founder Chancellor and President Col. Prof. Dr. R. RANGARAJAN B.E. (EEE), B.E. (MECH), M.S (AUTO). DSc., Chancellor and Foundress President Dr. R. SAGUNTHALA RANGARAJAN M.B.B.S., Chairperson Managing Trustee and Vice President.

I record indebtedness to our Head of the Department. Dr. N. MALARVIZHI., Ph.D., for immense care and encouragement towards me throughout the course of this project.

A special thanks to our Project Coordinator Dr. G.M.KARPURA DHEEPAN, Ph.D., for their valuable guidance and support throughout the course of the project.

I also take this opportunity to express a deep sense of gratitude to Our Internal Guide Mr.KISHORE KUMAR for his cordial support, valuable information and guidance, he helped me in completing this project through various stages.

I thank friends for their helping and guidance to complete this project.

REFERENCES

1. A. Rau, J. Sankar, A. Mohan, D. Das Krishna and J. Mathew, "IoT based smart irrigation system and nutrient detection with disease analysis", 2017 IEEE Region 10 Symposium (TENSYMP), 2017.
2. D. Mishra, A. Khan, R. Tiwari and S. Upadhay, "Automated Irrigation System-IoT Based Approach", 2018 3rd International Conference On Internet of Things: Smart Innovation and Usages (IoT-SIU), 2018.
3. G. Arvind, V. G. Athira, H. Haripriya, R. A. Rani, and S. Aravind, Automated irrigation with advanced seed germination and pest control,‖ 2017 IEEE Technological Innovations in ICT for Agriculture and Rural Development (TIAR), 2017.
4. J. Boobalan, V. Jacintha, J. Nagarajan, K. Thangayogesh and S. Tamilarasu, "An IOT Based Agriculture Monitoring System", 2018 International Conference on Communication and Signal Processing (ICCSP), 2018.
5. K. Ammour, "Factory automation and irrigation control in an IoT environment", 2018 15th Learning and Technology Conference (L&T), 2018.
6. K. Krishna, O. Silver, W. Malende and K. Anuradha, "Internet of Things application for implementation of smart agriculture system", 2017 International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), 2017.
7. K. Patil and N. Kale, "A model for smart agriculture using IoT", 2016 International Conference on Global Trends in Signal Processing, Information Computing and Communication (ICGTSPICC), 2016.
8. L. Yashaswini, H. Vani, H. Sinchana and N. Kumar, "Smart automated irrigation system with disease prediction", 2017 IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI), 2017.
9. M. Monica, B. Yeshika, G. Abhishek, H. Sanjay and S. Dasiga, "IoT based control and automation of smart irrigation system: An automated irrigation system using sensors, GSM, Bluetooth and cloud technology", 2017 International Conference on Recent Innovations in Signal processing and Embedded Systems (RISE), 2017.
10. M. Rajkumar, S. Abinaya and V. Kumar, "Intelligent irrigation system — An IOT based approach", 2017 International Conference on Innovations in Green Energy and Healthcare Technologies (IGEHT), 2017.
11. M. Uddin, A. Mansour, D. Le Jeune and E. Aggoune, "Agriculture internet of things: AG-IoT", 2017 27th International Telecommunication Networks and Applications Conference (ITNAC), 2017.
12. M. Vinoth and G. Vithiya, "Farm field monitoring and irrigation automation using IOT", International Journal of Engineering & Technology, vol. 7, no. 226, p. 53, 2018.
13. N. Kabilan and M. Selvi, "Surveillance and steering of irrigation system in cloud using Wireless Sensor Network and Wi-Fi module", 2016 International Conference on Recent Trends in Information Technology (ICRTIT), 2016
14. N. Sales, O. Remedios and A. Arsenio, "Wireless sensor and actuator system for smart irrigation on the cloud", 2015 IEEE 2nd World Forum on Internet of Things (WF-IoT), 2015.
15. R. Agale and D. Gaikwad, "Automated Irrigation and Crop Security System in Agriculture Using Internet of Things", 2017 International Conference on Computing, Communication, Control and Automation (ICCUBEA), 2017.
16. R. Andrew, R. Malekian and D. Bogatinoska, "IoT solutions for precision agriculture", 2018 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2018.
17. R. Rao and B. Sridhar, "IoT based smart crop-field monitoring and automation irrigation system", 2018 2nd International Conference on Inventive Systems and Control (ICISC), 2018.
18. S. Prathibha, A. Hongal and M. Jyothi, "IOT Based Monitoring System in Smart Agriculture", 2017 International Conference on Recent Advances in Electronics and Communication Technology (ICRAECT), 2017.
19. S. Rajeswari, K. Suthendran and K. Rajakumar, "A smart agricultural model by integrating IoT, mobile and cloud-based big data analytics", 2017 International Conference on Intelligent Computing and Control (I2C2), 2017.
20. S. Saraf and D. Gawali, "IoT based smart irrigation monitoring and controlling system", 2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2017.
21. S. Vaishali, S. Suraj, G. Vignesh, S. Dhivya, and S. Udhayakumar, ―Mobile integrated smart irrigation management and monitoring system using IOT,‖ 2017 International Conference on Communication and Signal Processing (ICCSP), 2017.

AUTHORS PROFILE

Tigist Hailemariam Senbetu, PG Scholar in Department of Computer Science and Engineering at Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.

Mr. Kishore Kumar K, He had completed M.E Computer science and Engineering from Anna University in the year of 2013, and currently working as a Assistant Professor and Pursuing Ph.D in Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai. His area of research is focuses on Internet of Things for smart Agriculture.

Dr. G.M. Karpura Dheepan, He had completed Ph.D Computer science and Engineering from Anna University in the year of 2017, and currently working as a Assistant Professor in Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai. His area of research is focuses on Computer Networks and Internet of Things.