JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Iot Based Smart Agriculture Monitoring System using Arduino and Esp8266

[1]P.Siva Kumar, [2] K.Harsha Vardhana Reddy

[1]PG Scholar, Department of ECE, Sree Rama Engineering College, Tirupati, Andhra Pradesh, India.

[2]Associate Professor, Department of ECE, Sree Rama Engineering College, Tirupati, Andhra Pradesh, India

Abstract: **Agriculture is basic source of livelihood People in India. It plays major role in economy of country. Hence Automation must be implemented in agriculture to overcome the problems. The Traditional agriculture techniques require manual intervention. Continuous sensing and monitoring of crops by convergence of sensors with Internet of things (IOT) and making farmers to aware about crops growth, harvest time periodically and in turn making high productivity of crops and also ensuring correct delivery of products to end consumers at right place and right time. So, to overcome this problem we go for smart agriculture technique using IOT. IoT plays a key role in smart agriculture. Internets of Things (IoT) sensors are used to provide necessary information about agriculture fields. The main advantage of IoT is to monitor the agriculture by using the wireless sensor networks and collect the data from different sensors which are deployed at various nodes and send by wireless protocol. By using IoT system the smart agriculture is powered by ARDUINO and NodeMCU. It includes the humidity sensor, temperature sensor, moisture sensor, PIR Sensor and Flame sensor.**

Index Terms **– IoT, Soil, Moisture and Temperature sensors, Relay, Wi-Fi module ESP8266, Internet of things, ubidots etc.,**

1. INTRODUCTION

One of the largest livelihood providers in India is Agriculture. Agriculture plays an essential role in supporting human life. The rise in population is proportional to the increase in agriculture production. Basically, Agriculture production depends upon the seasonal situations which do not have enough water sources. To get beneficial results in agriculture and to overcome the problems, IoT based smart agriculture system is employed. Global and regional scale agricultural monitoring systems aim to provide up-to-date information regarding food production. In IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors like light, humidity, temperature, soil moisture, etc.

The farmers can monitor the field conditions from anywhere. IoT-based smart farming is highly efficient when compared with the conventional approach. The proposed IoT based Irrigation System uses ESP8266 NodeMCU Module and DHT11 Sensor. It will not only automatically irrigate the water based on the moisture level in the soil but also send the Data to ThingSpeak Server to keep track of the land condition

Due to the recent advances in sensors for the irrigation systems for agriculture and the evolution of WSN and IoT technologies, these can be applied in the development of automatic irrigation systems. The system will determine the parameters that are monitored in irrigation systems regarding water quantity and quality, soil characteristics, weather conditions, and fertilizer usage and provide an overview of the most utilized nodes and wireless technologies employed to implement WSN and IoT based smart irrigation systems. The difficulty faced by the farmers across the world in growing crops is now reducing because of the emerging technologies in agriculture. The major problems are unpredictable weather conditions and shortage of water. The quality of crops in traditional irrigation system depends on the amount of water supplied to the corps. These problems are solved by promoting the use of modern information technology in agriculture. This development in technology acts as a catalyst for the researchers and farmers to apply modern techniques in farming. This also provides opportunity for creating new technology and service development in IOT (internet of things) farming application. Smart irrigation system uses the emerging IoT technologies and sensors to develop a system that automatically supplies water according to environmental conditions like moisture value, temperature, etc. IoT is network of devices and devices are the things in IoT. The devices consist of embedded sensors. These devices send and receive data to and from the cloud and measurements can be monitored in time. If the soil moisture is detected low in a particular area, then the motor can be turned on. This forms the basis of smart agriculture. IoT is about the power of data and the world is digitally connected and data becomes critical asset. An emerging concept called smart farming refers to managing farms through the use of IoT, drones and AI helps to increase the quality and quantity of production while minimizing the human labor required for production. Data from the devices can guide farmers' decision and adapt to more quickly changing weather conditions. India is an

agricultural land. Farming has unendingly been India's most critical economical sector. While the greater part of India's population is indulged into farming, the farmers still experience numerous issues. Accordingly, interruption of creatures in local locations is being raised step by step which is influencing the human existence, property that makes struggle among human and creatures. Agriculture is the foundation of the economy, nevertheless, would bring about gigantic harvest misfortune due to creature interruption in agricultural land. Elephants and other creatures entering into people's place of residence has bought adverse consequence in different ways, for example, crop annihilation, harm to food stores, water supply, homes and other properties, injury and human demise. Struggle between human creatures may likewise be a difficult issue where huge amounts of cash are squandered and life is in danger. Farmers in India have been confronting genuine dangers from natural calamity, bugs and harm by creatures prompting lower yields. Conventional techniques trailed by farmers aren't much viable and it's not achievable to recruit monitors to focus an eye on the yields and prevent nature creatures. Consequently, this zone is to be checked consistently to forestall section of this sort of creatures or the other undesirable.

The aim of the project is to enable the smart agriculture which means to reduce the man power & problems in cropping or any agriculture farms. And the data is right away to the required place of need using the internet of things (IoT). The project uses a Arduino and Node MCU along with the wi-fi module with the capability of connecting to the network.

Fig.1 Smart Agriculture Farm

The NodeMCU is initialized and synchronized with different sensors and make a possible way to act like a mini system to control the Farm from any possibly anywhere in the world with the help of any smart device or tool by using the one of the cloud network named as Ubidots. The system enables ease of access to information that is to be immediately reached as well because we live in an era where internet is reaching the destination faster than a clock ticking for a second. So this enables sharing data easier and cheaper

The organizational framework of this study divides the research work in the different sections. The Literature review is presented in section 2. Further, in section 3 shown Concept of Internet of things, in section 4 shown the Methodology and section 5 shown the implementation work. Simulation Results work is shown in 6. Conclusion and future work are presented by last sections 7.

2. LITERATURE REVIEW

Comprises 3 phases together with exploration, analysis and execution. Preciseness agriculture addresses each monetary and environmental problem that edge production agriculture.

(1) A cloud to an internet platform for monitoring and activating electro valves of the irrigation network.

(2) sensing element inexperienced energy and sensible technology within the agriculture sector can notice higher productivity

(3) Soil humidness analysis is finished. The prediction helps to produce the correct amount of irrigation to the crops.

(4) The innovative advancement in Wireless sensing element Systems created it conceivable to use in observant and controlling of nursery parameter in exactitude gardening. when the exploration within the agriculture field, analysts discovered that the yield of business enterprise is decreasing day by day. Be that because it could, utilization of innovation in the field of gardening assumes significance job in increasing the creation even as in decreasing the extra labor endeavors.

(5) The good agriculture model main aim to avoid water wastage within the irrigation method. it's low price and economical system.

(6) Have planned the usage of drones for the betterment of crop quality. this might facilitate the farmers increase their production by detective work the loopholes beforehand. The crops might be managed by victimization specific cameras connected to the drones to sight water shortages and harmful pests.

(7) during this paper authors have given detail regarding implementation of Agriculture drone for automatic spraying mechanism. throughout this paper, they gave downside statement of World Health Organization where it estimates that their unit 3 million cases of chemical poisons in annually and up to 220,000 deaths, primarily in developing countries. throughout this paper they to boot create a case for what precautions the farmer need to have to be compelled to use to avoid harmful effects of pesticides and fertilizing effects conjointly as worth effective technology victimization components like PIC microcontroller for the management of agriculture robots.

(8) Modeling of carbon dioxide Temperature, humidity and hydrogen ion concentration with an artificial intelligence system to go to utterly totally different view of affairs and plans.

(9) "Precision agriculture victimization remote observation systems in Brazil.", IEEE international Humanitarian Technology Conference (GHTC), [2017]. Have mentioned regarding connect in Nursing IoT device that's utilized to look at varied agricultural parameters. The device uses a network of sensors for activity the soil

temperature, humidity, wet etc. The take a glance at was disbursed in metropolis, Brazil. Reference climate data was taken to support varied choices on crop life and its property.

(10) The stage has already been used for development of good spraying and irrigation, valuation of the marine surroundings and fish/mussel farm observation.

(11) to optimize water, use for agricultural purpose. The system contains of distributed wireless detector network of soil wet, and temperature sensors mounted among the crop field.

Zigbee protocol is utilized to control the detector information and water quantity programming victimization algorithmic rule with threshold values of the sensors that are sent to a microcontroller for irrigation system. Arduino Uno aboard Raspberry Pi. (12)

3. INTERNET OF THINGS TECHNOLOGY

The Internet of Things (IoT) is an ecosystem connected of physical devices that are accessible through the internet. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. The concept Internet of Things (IoT), each device can be connected to the internet or intranet, or to other devices on the network. This enables the collection of a variety of information from the devices, including data on operations, configuration, energy consumption, and the power factor. The IoT enables devices to make smart decisions based upon analytical rules that serve the purpose of the devices best. The devices can send, receive, store, and control information, sending the information individually to another device or broadcasting it to all devices..

4. METHODOLOGY

The aim of the project is to enable the smart agriculture which means to reduce the man power & problems in cropping or any agriculture farms. And the data is right away to the required place of need using the internet of things (IoT). The project uses a Arduino and Node MCU along with the Wi-Fi module with the capability of connecting to the network.

The whole Arduino, Node MCU, PIR Sensor , Soil moisture sensor, Flame Sensor, Temperature and humidity sensor (DHT 11). Soil condition detector measures condition content of the soil. An infrared detector is a device that emits to sense some aspects of the surroundings. AN IR detector will live the warmth of AN object similarly as detects the motion. Flame detector is used to find the fire in the field. Fire is an unexpected event that causes a huge loss for farmers. Agricultural fields in India are highly on alert during summer. The purpose system uses a group of sensors to detect the fire in the field including Flame sensor and Arduino and alert the user using the buzzer. When a fire is detected the automated system triggers only if no action is taken by the user.

.

5. IMPLEMENTATION

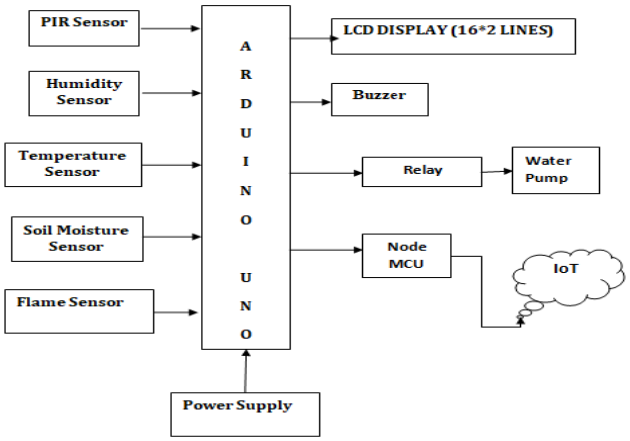

Fig.2 Proposed Block diagram

Fig 2 shows the proposed system. To make a farmer understand the working of big labor machines and tech-devices we valuable and realistic technology for monitoring. The working flow of the proposed system shown in figure 3.

1. WOKING FLOW

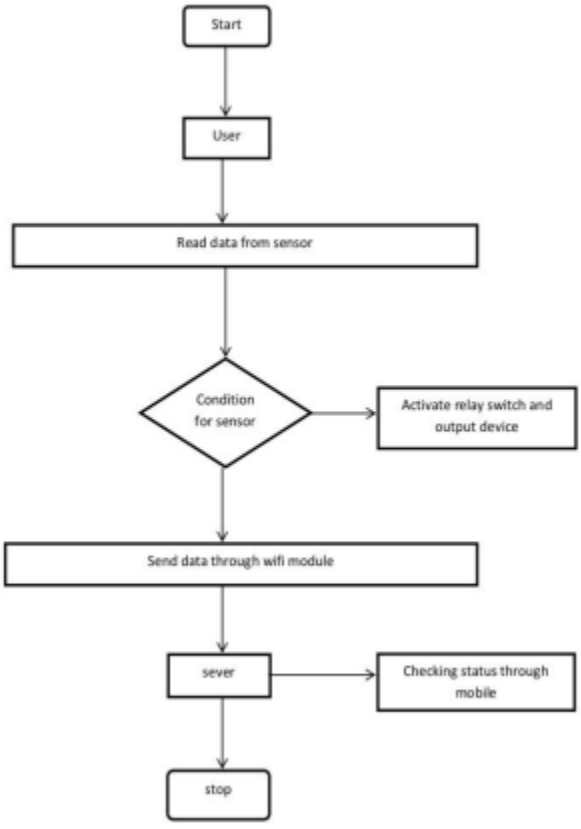

Fig.3: Working Flow Diagram

Step1: First we Write the code in Arduino IDE then upload the code to Arduino board. Based on the behavior of sensors arduino transfer the data to the cloud server called ubidots server.

Step2: Then we Connect all the sensors, esp8266 wifi module, relay switch, and buzzer with arduino board.

Step3: While connecting arduino board and IDE (Integrated Development Environment) through a data cable where this cable helps in providing the voltage required to run the hardware Arduino Board and also to see the serial output.

Step 4: Then once the data is uploaded to arduino hardware and connected to a Arduino IDE, The project starts to work
.
Step 5: Then based on the behavior of the Sensor, arduino board starts working, following are the functionalities of all the sensor once the board is activated.

2. HARDWARE REQUIREMENTS:

A. Arduino Uno:

Arduino Uno shown in figure 4 is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller.

Fig.4 Arduino Microcontroller

B. Node MCU

The NodeMCU (ESP8266) shown in Figure 5 is a microcontroller with an inbuilt Wi-Fi module. The total pins on this device are 30 out of which 17 are GPIO (General Purpose Input/ Output) pins which are connected to various sensors to receive data from the sensors and send output data to the connected devices.

Fig.5: Node MCU

C. Temperature and Humidity Sensor

Initially Once the board is activated, instantly it will start showing the exact temperature and humidity in that particular place. Hence this sensor helps in detecting the temperature and humidity. Shown in figure 6.

Fig.6 Temperature and Humidity Sensor

D. Soil Moiture sensor

Soil Moisture sensor shown in figure 7, This sensor helps in providing the exact moisture content in the soil. If the moisture content is below 40% then automatically motor will get started.if the moisture is more than that motor will stop automatically. Soil moisture is basically the content of water present in the soil. This can be measured using a soil moisture conducting probes that act as a probe.

Fig.7 Soil Moisture Sensor

E. Fire Sensor:

Once the surrounding temperature reach 37* this sensor starts working by providing necessary information to the user and if the fire detects the output would be 1 else 0. In case of forest fires, when the temperature of the surroundings increases its sensed by the flame sensor, through the relay switch the water pump is turned on. When there is no flame, the water pump stops functioning. Shown in figure 8.

Fig.8: Fire Sensor

F. Water pump

The DC 3-6V Mini Micro Submersible Water Pump shown in Figure 9 is a low cost, small size Submersible Pump Motor. It operates with a 2.5 to 6V power supply. It can pump up to 120 litres per hour with a very low current consumption of 220mA. Just connect the

tube pipe to the motor outlet, submerge it in water, and power it.

Fig.9: Submersible Water Pump

G. Relay

A relay is used as electrically operated switch which is shown in Figure 10. It has a set of input terminals for a single or multiple control signals and a set of operating contact terminals. The switch may contain number of contacts in multiple contact forms which make contacts or break contacts. Relay is used to turn on the water pump in order to maintain the moisture level of the crop.

Fig.10: Relay Module

H. Buzzer

A 5V Active Alarm Buzzer Module compatible with Arduino Uno is an audio based device , which can be mechanical, electromechanical, or piezoelectric. it's 5V DC Buzzer Module. Using high quality material, it's durable in use. Shown in figure 11.

Fig.11: Buzzer

I.PIR Sensor

An infrared detector is a device that emits to sense some aspects of the surroundings. AN IR detector will live the warmth of AN object similarly as detects the motion. Shown in figure 12.

Fig.12: PIR Sensor

E.LCD Display

LCD stands for liquid crystal display, which is used to show the status of an application, displaying values, debugging a program, etc.A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data. Shown in fig 13.

Fig.13: 16x2 LCD Display

3. SOFTWARE REQUIREMENTS:

•*ARDUINO IDE*

Arduino IDE Arduino IDE is an open source software that makes to write the code in easy manner and helps to upload it into the Arduino board and the uploaded code contains the program that describes the working of the process. The main advantage is the software can be used in any Arduino board. The Arduino can control and interact with a wide variety of sensors like temperature, accelerometer and heart beat sensor.

- *UBI DOTS*

The basics components of any Internet of Things application powered by Ubidots are: Devices, Variables, Synthetic Variables Engine, Dashboards, and Events. Within this article we will address each of these concepts as they relate to Ubidots IoT Development and Deployment Platform and how you can better organize your Ubidots Apps to best connect with the users.

6. EXPERIMENTAL RESULTS

The main aim of this project is to implement the modern technology in required fields like agriculture. Using IoT technology in agriculture, this system makes agriculture monitoring easy. The benefits as mentioned like water saving and labor saving are required the maximum in current agricultural state of affairs. Consequently, using the sensor network in fields of agriculture makes clever irrigation. The information from IoT is sent to the client using cloud. Consequently, any changes inside the crop may be identified effortlessly and early analysis is achieved as such. The developed hardware kit of the proposed model is shown in Figure 14.

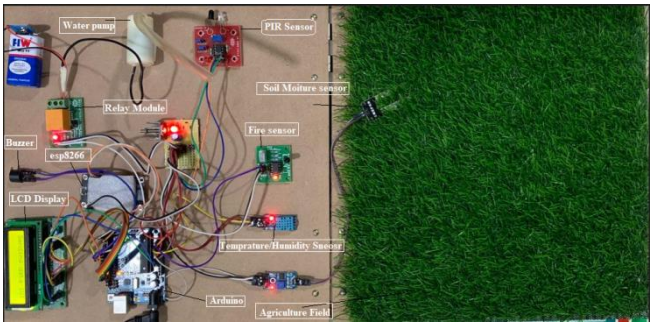

Fig.14: Experimental Hardware setup

The measured and monitored parameters like temperature, humidity and moisture in soil and Flame sensor and data sending to IoT are shown in figures Figure 15 to Figure 20 respectively.

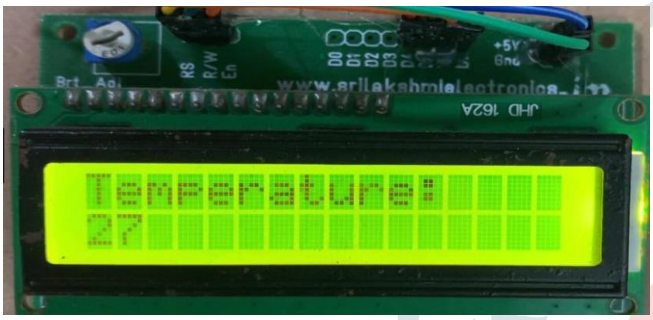

Fig.15: LCD Shows that Temperature Value

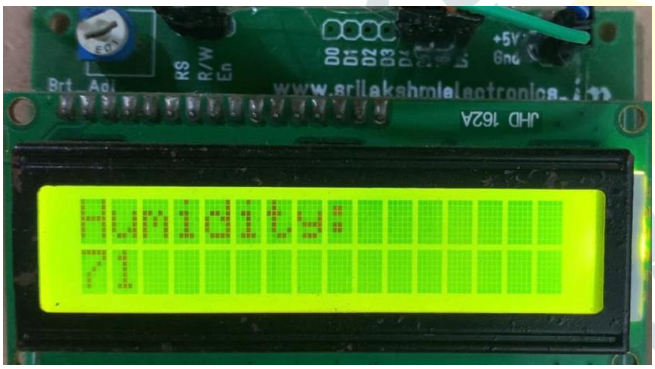

Fig.16: LCD Shows that Humidity Value

Fig.17: LCD shows that Water pump ON When Soil Dry

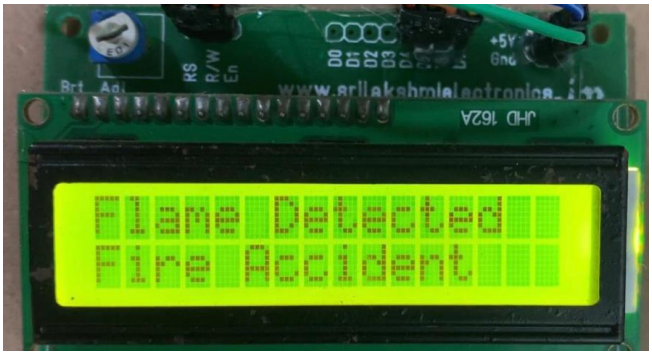

Fig.18: LCD Shows that Flame sensor detected when Fire accident

Fig.19: LCD Shows that Intruder Detect when fencing break

Fig.20: LCD Shows that Data sending to IoT

The below figure 21 and 22 depicts the output of the Flame sensor when there is Flame detected in the field and notification received from ubidots.

Flame alert!!

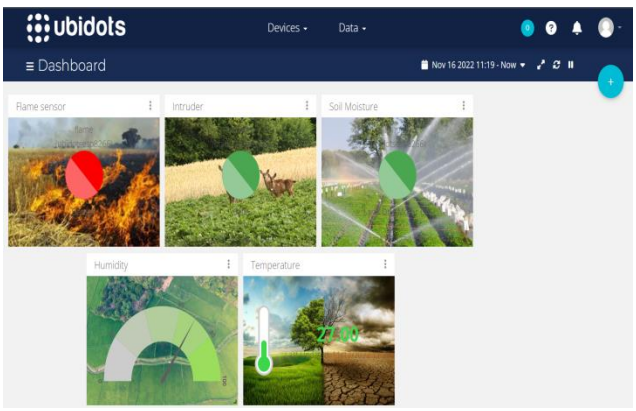

Fig.21: Shows that Flame sensor alerts in ubidots.

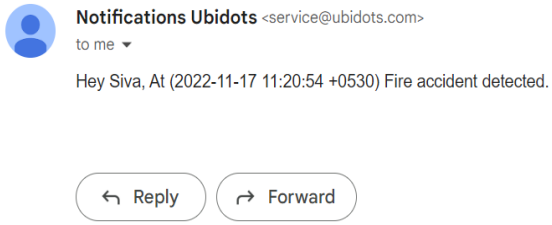

Fig.22 Shows that received fire sensor notification from ubidots

The below figure 23 and 24 depicts the output of the moisture sensor when there is soil dry in the field and notification received from ubidots

Soil Moisture

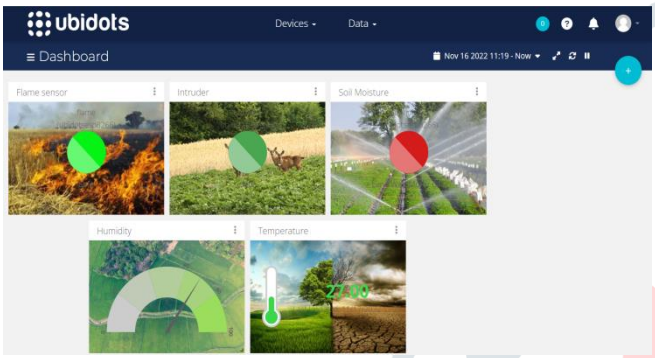

Fig.23: Shows that moisture sensor alerts in ubidots.

Fig.24: Shows that received moisture sensor notification from ubidots

The below figure 25 and 26 depicts the output when there is intruder detected in the field and notification received from ubidots

Intruder Detected

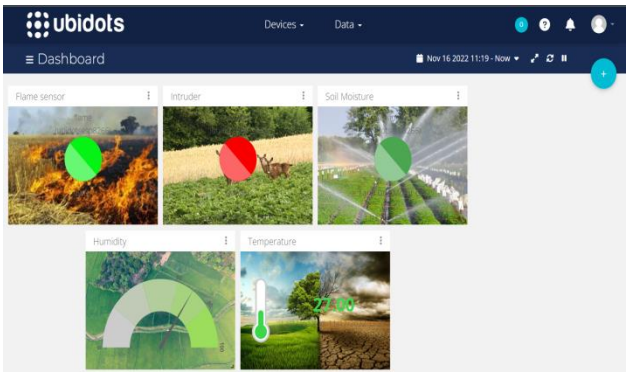

Fig.25: Shows that intruder alerts in ubidots.

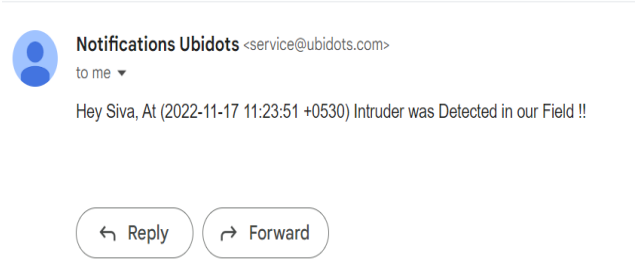

Fig.26: Shows that received intruder notification from ubidots

The below figure 27 and 28 depicts the output of the Temperature sensor when there is temperature detected in the field and notification received from ubidots

Temperature alert

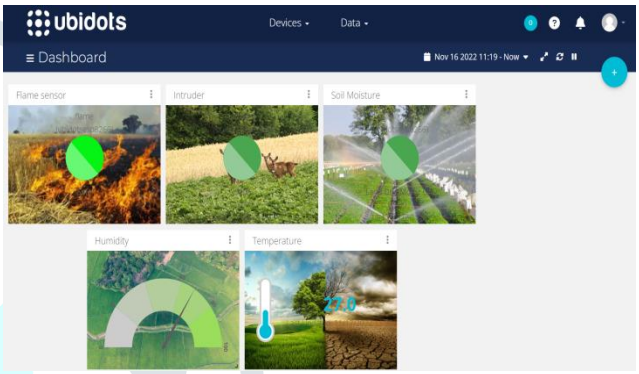

Fig.27: Shows that Temprature sensor alerts in ubidots.

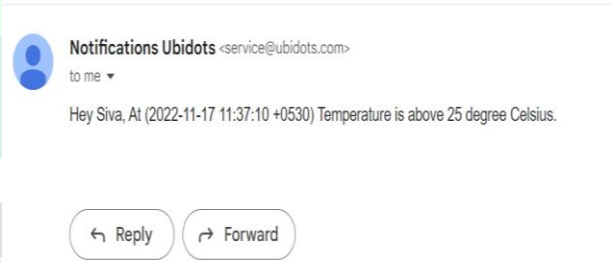

Fig.28: Shows that received temperature sensor notification from ubidots

7. CONCLUSION AND FUTURESCOPE

IoT will help to enhance smart farming. Using IoT the system can predict the soil moisture level and humidity so that the irrigation system can be monitored and controlled. IoT works in different domains of farming to improve time efficiency, water management, crop monitoring, soil management and control of insecticides and pesticides. This system also minimizes human efforts, simplifies techniques of farming and helps to gain smart farming. Besides the advantages provided by this system, smart farming can also help to grow the market for farmer with single touch and minimum effort.

Future Work

The project has vast scope in developing the system and making it more user friendly and the additional features of the system like:

- By installing a webcam in the system, photos of the crops can be captured and the data can be sent to database.
- Speech based option can be implemented in the system for the people who are less literate.
- GPS (Global Positioning System) can be integrated to provide specific location of the farmer and more accurate weather reports of agriculture field and garden.
- Regional language feature can be implemented to make it easy for the farmers who are aware of only their regional language.

ACKNOWLEDGEMENT

The satisfaction that accompanies with the successful completion of the model would be put incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crown all the efforts with success.

REFERENCES

1. Abdul Hakkim V. M.,Abhilash Joseph E, Ajay Gokul A. J. and Mufeedha K., "Precision Farming: The Future of Indian Agriculture", Journal of Applied Biology & Biotechnology, Vol. 4 (06), pp. 068-072, Nov-Dec. 2016.
2. Alessandro Massaro, Giacomo Meuli, Nicola Savino and Angelo Galiano,"A PRECISION AGRICULTURE DSS BASED ON SENSOR THRESHOLD MANAGEMENT FOR IRRIGATION FIELD", International journal on Signal & Image Processing, Vol.9, No.6, December 2018.
3. Amandeep, Arshia Bhattacharjee and Paboni Das, "Smart Farming Using IOT", In the Proceedings of 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference, 3-5 October, 2017, 978-1-5386-3371- 7/17/$31.00, 2017
4. Ibrahim khider Eltahir, Khalid Hamid Bilal Abdalla, and Elhassan Mohammed Elhassan Ahmed, "Farm Automation based on IoT", International Conference on Computer, Control, Electrical, and Electronics Engineering (ICCCEEE) 2018.
5. JoaquínGutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta-Gándara, "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module",IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, 0018-9456,2013.
6. Jyostsna. K, Vanaja, Aala Suresh, Srilatha S, Vijay Kumar.K, Bharath .M
7. Marthinus Reinecke -, "The influence of dronemonitoring on crop health and harvest size.", 1st InternationalConference on Next Generation Computing Applications (NextComp), [2017].
8. Mone P. P., Chavhan Priyanka Shivaji, Jagtap Komal Tanaji, Nimbalkar Aishwarya Satish has published a paper entitled "Agriculture Drone for Spraying fertilizer and Pesticides". The published paper is available at IJRTI, Volume 2, Issue 6, 2017.
9. Rob Dolci, "IoT solutions for precision farming and food manufacturing", IEEE 41st Annual Computer Software and Applications Conference, 2017. 0730-3157/17 $31.00 © 2017 IEEE DOI 10.1109/COMPSAC.2017.157
10. Rodrigo Filev Maia - "Precision agriculture using remote monitoring systems in Brazil.", IEEE Global Humanitarian Technology Conference (GHTC), [2017].
11. Tomo Popovic, Nedeljko Latinovic, Ana Pešic, ZarkoZec evic, BozoKrstajic and Slobodan Djukanovic, "Architecting an IoT-enabled platform for precision agriculture and ecological monitoring: A case study", Computers and Electronics in Agriculture, pp.255–265, 2017.
12. Vidya. V, Devi, G., Meena Kumari, "Real- Time Automation and Monitoring System for Modernized Agriculture", International Journal of Review and Research in Applied Sciences and Engineering (IJRRASE) Vol3 No.1. PP 7-12, 2013.