AGRICULTURE MONITORING AND CROP DETECTION SYSTEM

[1]Akshaya S, [1]Deepaprema V, [1]Gopi K, [2]Nedunchelian R.

[1]Final year Students,

[2]Professor

Department of Computer Science and Engineering ,

Sri Venkateswara College OF Engineering, Sriperumbadur, Tamil Nadu

ABSTRACT

Internet of Things (IoT) has provided a promising opportunity to build powerful agriculture systems and applications by leveraging the growing ubiquity of wireless, mobile and sensor devices. A wide range of agriculture IoT applications have been developed and deployed in recent years. This paper summarizes the current state-of-the-art of IoT in agriculture systematically. With the advancement of Automation technology, life is getting simpler and easier in all aspects. In today's world Automatic systems are being preferred over manual system. Internet of things is a growing network of everyday object-from industrial machine to consumer goods that can share information and complete tasks while you are busy with other activities. This paper proposes that the agriculture monitoring by using Temperature sensor, Humidity sensor, Water sensor and Soil sensor values to read and monitor the values. It makes use of Raspberry Pi as a module for monitoring the crop fields. It provides automatic irrigation to the plants if the water level is low. This detailed information about the water, temperature, soil level values of the crop fields are notified to the owner in the form of an SMS or notification. This smart monitoring device for agriculture will definitely be a promising benefit for the automated future generations.

Key words: Agriculture monitoring, IOT, Rassberry pi, python

I.INTRODUCTION

The Internet of Things (IoT) is transforming the agriculture industry in recent years. The industry must overcome increasing water Shortages, limited availability of lands, difficult to manage costs. New innovative IoT applications are addressing these issues and increasing the quality, quantity, sustainability and cost effectiveness of agricultural production. The purpose of implementing IOT in agriculture industry is to design and develop an agricultural monitoring system using wireless sensor network to increase the productivity and quality of farming without observing it for all the time manually. Temperature, humidity and carbon dioxide levels are the most important factors for the productivity, growth, and quality of plants in agriculture. So this system periodically measures these parameters inside the fields, thus the farmers or the agriculture experts can observe the measurements from the web simultaneously. Moreover, when a critical change in one of the measurements occurs, then the farmer will be intimated via mobile text message and e-mail by an agriculture expert. With the continuous monitoring of many environmental parameters, the grower can analyze the optimal environmental conditions to achieve maximum crop productiveness, for the better productivity and to achieve remarkable energy savings. In spite of so many reforms and initiatives introduced by the government of India in the past decades, the quality of information provided to the marginalized farmer is uneven. Dangerous issues that infect Indian farming at hand are the data shortage and high risk because of the volatile nature of the factors involved, like, natural weather change. - Sajeeda Shikalgar et al[1] have developed a cross platform mobile expert system for agriculture task scheduling to help Indian farmers Lozoya et al[2] have reported the design and development of a modular data acquisition system for precision agriculture is described, capable to be adapted to different agricultural automation requirements.. The monitoring and control of crops in precision agriculture sometimes requires a high collection frequency of information (e.g., temperature, humidity and salinity) due to the variability in crops. Data acquisition and transmission are generally achieved thanks to wireless sensor networks. However, sensor nodes have limited resources. Thus, it is necessary to adapt the increase in sampling frequency for different crops, under application constraints (reliability, packet delay and lifetime duration).

Chieck Tidjane Kone et al [3] have properly tuned IEEE 802.15.4 MAC parameters (*mac MinBE* and *mac Max CSMABackoffs*) and the sampling frequency of deployed sensor nodes, and therby an analytical model of network performance was derived and used to perform the tuning of these trade-off parameters. In the present paper , we report execution of the internet of things and raspberry pi for creating an automated irrigation and agriculture monitoring system. Here, the different plants which are grown and the temperature, humidity level and water needed for each plant is maintained as the data set. The water sensor, temperature sensor, soil sensor and the humidity sensor are used to measure the soil and air conditions and these values are sent to the raspberry pi controller which predicts when to turn on and turn off the motor for automated watering of plants. The status of the farm is continually monitored wirelessly through a camera controller and the values are sent to the respective person in the form of a message.The main aim of this project is to realize the upcoming concept of Internet of Things where every "Thing" will be connected over a network for data acquisition for making better decisions in real-time environment. This agriculture monitoring system utilises information on weather condition and irrigation site condition to determine the quantity of watering based on real-time humidity measurement.

II. EXISTING SYSTEM

Manually monitoring the irrigation

The existing system had the following features:

*Today's available smart irrigation systems are based on embedded systems and hence require a control/monitoring unit at every site individually.

*The control unit is kept locally with proprietary design and hardware modules.

*The moisture level of the soil was monitored through moisture sensors and was maintained through automatic watering systems.

*The temperature of the farm was monitored periodically by using the temperature sensors.

*Acidity level of the soil was not automatically monitored through any sensors.

* controlling system was developed by comparing current values but automated irrigation systems based on dataset is not used till date.

Disadvantages of the existing system

By using the GSM technology, it will take more time to get the exact situation.

*CCTV camera monitoring is possible but can't be able to sense the gas, temperature, water level, humidity and soil condition of the crop fields.

*Remote Monitoring of humidity is not possible. Data loss is high.

*Wireless Monitoring and controlling of the water level and the optimum temperature was not implemented in the existing systems.

*Not very efficient, since the control was not based on classification and prediction.

III PROPOSED SYSTEM

An IoT based approach is proposed for smart monitoring of agriculture. Block diagram if the proposed system is shown in figure 1.

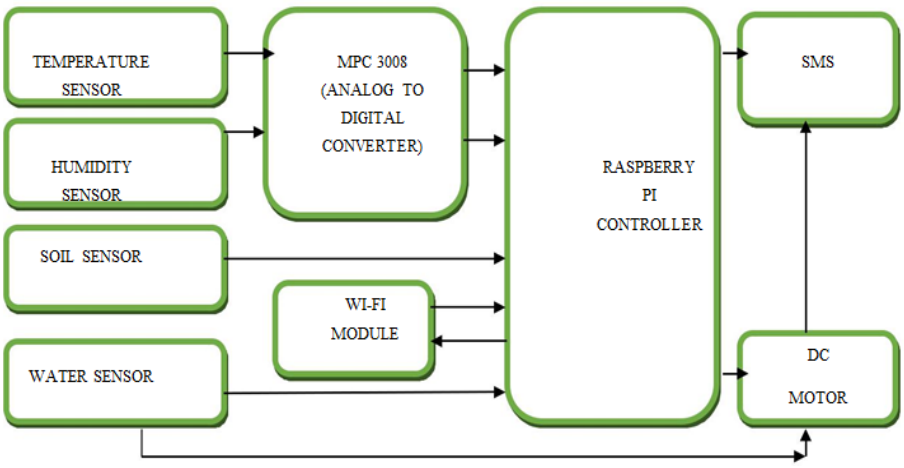

Fig.1 Block diagram

Figure 1 represents the block diagram of griculture monitoring and crop detection system. The temperature and the humidity sensor possess analog values that are converted to digital values using MCP3008 circuit converter. The water and the soil sensor provide output in the digital form. Since Raspberry Pi executes and displays only the digital values, the analog values are converted to digital. In addition to this, it reads the channel data and converts the volts into temperature (Celsius).The values are sent to the field owner in the form of a SMS. Raspberry Pi has an in-built Wi-Fi function that processes the values and sends in the form of a message. If the water level is low, the DC Motor turns on automatically, providing automatic irrigation to the crop fields. Monitoring the values and automatic irrigation of the plants helps improve the growth of the plants.

High lights of proposed system

The humidity and water sensing units will be connected to Monitoring system over a wireless TCP/IP network.

*It is also possible to place the monitoring system at a centralised place and serve multiple sites at different geographical locations by implanting IoT end units at sites and connect to server.

*Automotive network.

The moisture sensors measure the moisture content in the soil.

The temperature sensors measure the current temperature of the area. The water sensor is used to measure the water Level of the plants and alerts the user if the water level is low.

*The desired humidity level is checked using humidity sensor, and predicting the weather conditions.
*This values are processed by using raspberry pi controller (uses PYTHON as a programming language) and transmitted through SMS or Notification by using IoT to the respective person.
*User can monitor the status of his farm and the values are sent to the field owner in the form of a message.

Advantages

*More comprehensive interoperability and intelligence. No manual operation is needed.
*Provides accurate information about the crop fields. Alerts if something goes wrong.
*IOT Consumes less time and monitoring the exact situation of the crop fields.

IV. HARDWARE REQUIREMENTS :

1. RASPBERRY PI-

The Raspberry Pi 3 is the third generation Raspberry Pi. It replaced the Raspberry Pi 2 Model B in February 2016. Compared to the Raspberry Pi 2 it has A 1.2GHz 64-bit quad-core ARMv8 CPU 802.11n Wireless LAN and Bluetooth 4.1

Like the Pi 2, it also has, 1GB RAM 4 USB ports 40 GPIO pins , Full HDMI port Ethernet port,Combined 3.5mm audio jack and composite video Camera interface (CSI),Display interface (DSI),Micro SD card slot (now push-pull rather than push-push) Video Core IV and 3D graphics core

Raspberry Pi 3 - Model B Features

Figure 2: GPIO PIN Classification

Now **10x Faster** - Broadcom BCM2387 ARM Cortex-A53 Quad Core Processor powered Single Board Computer running at 1.2GHz!
1GB RAM so you can now run bigger and more powerful applications
Fully HAT compatible
40pin extended GPIO to enhance your "real world" projects.
Connect a Raspberry Pi camera and touch screen display (each sold separately)
Stream and watch Hi-definition video output at 1080.
Micro SD slot for storing information and loading your operating systems.
10/100 Base T Ethernet socket to quickly connect the Raspberry Pi to the Internet.

All models feature a Broadcom system on a chip (SoC), which includes an ARM compatible central processing unit (CPU) and an on-chip graphics processing unit (GPU, a Video Core IV). CPU speed ranges from 700 MHz to 1.2 GHz for the Pi 3 and on board memory range from 256 MB to 1 GB RAM. Secure Digital (SD) cards are used to store the operating system and program memory in either the SDHC or Micro SDHC sizes. Most boards have between one and four USBslots, HDMI and composite video output, and a 3.5 mm phone jack for audio. Lower level output is provided by a number of GPIO pins which support common protocols like I²C.

The Raspberry Pi 3 has an identical form factor to the previous Pi 2 (and Pi 1 Model B+) and has complete compatibility with Raspberry Pi 1 and 2.

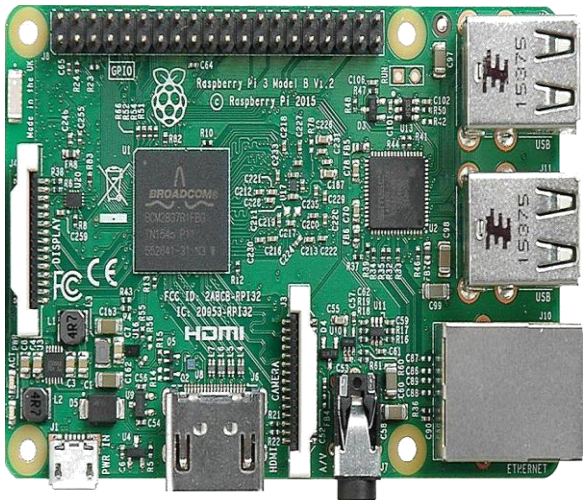

Figure 3: Raspberry Pi Controller

2.SOIL SENSOR and Temperature Sensor

Soil Estimates the soil volumetric water content based on the dielectric constant of the soil.

Temperature t uses 0.1 µF bypass capacitor on the input.This capacitor should be a ceramic type, have very short leads (surface mount would be

preferable), and be located as close a physical proximity to the temperature sensor supply pin as practical.

Since these temperature sensors operate on very little supply current and could be exposed to very hostile electrical environments, it is important to minimize the effects of RFI (radio frequency interference) on these devices.

3.HUMIDITY SENSOR and Water Sensor

A humidity sensor, or a hygrometer, measures and shows the relative humidity in the air. In other words, it measures both air temperature and moisture to get the ratio of actual moisture in the air to the highest amount of moisture air at that can contain. The most common type of humidity sensor is "capacitive humidity sensor" which uses capacity measurement. It depends on electrical capacitance, the ability of two paralleled electrical conductors to generate a electrical field between them.

To make the signals resistant to interference, this technology combines the sensor with the signal processing circuitry. Thus the weak analog sensor signals can be amplified and digitized with high precision directly where they are generated. In the present work HIH-4000 Series Humidity Sensors which are designed specifically for high volume OEM (Original Equipment Manufacturer) users are used .

Global Water's WL400 Water Level Sensor submersible pressure transducer consists of a solid state pressure sensor encapsulated in submersible stainless steel 13/16" diameter housing.

4.Analog to Digital Convertor-MCP 3008

The temperature and the humidity sensor possess analog values that are converted to digital values using MCP3008 circuit converter. The water and the soil sensor provide output in the digital form. Since Raspberry Pi executes and displays only the digital

values, the analog are converted to digital. In addition to this, it reads the channel data and converts the volts into temperature (Celsius).

V. SOFTWARE REQUIREMENTS-

1.Raspbian jessie os

Raspbian is a Debi an-based computer operates insystem for Raspberry Pi. It is now officially provided by the Raspberry Pi Foundation, as the primary operating system for the family of Raspberry Pi single-board computers.
Raspbian was created by Mike Thompson and Peter Green as an independent project.

The initial build was completed in June 2012.

The operating system is still under active development.

Raspbian is highly optimized for the Raspberry Pi line's low-performance ARM CPUs.

Raspbian uses IXEL, Pi Improved Xwindows Environment, Lightweight as its main desktop environment as of the latest update.

It is composed of a modified LXDE desktop environment and the Open box stacking window manager with a new theme and few other changes.

It also includes a version of Mine craft called Mine craft Pi andincludes a Pi-enhanced version of Chromium as of the latest version.

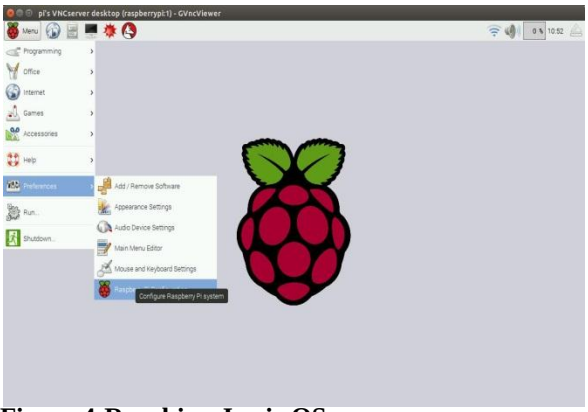

Figure 4:Raspbian Jessie OS

2.PYTHON

Python, is one of the most popular languages in the world and has been around for more than two decades. It is heavily used in academic environments and is a widely supported platform in modern applications, especially utilities, and desktop and Web applications. Python is highly recommended as a language that is easy for newcomers to program. With its easy-to-read syntax, the introduction is gentle and the overall experience much better for a newbie.

The latest version of the Raspbian OS comes bundled with both Python 3.3 and Python 2.x tools. Python 3.x is the latest version of the Python language and is recommended by the Raspberry Pi Foundation too.

3.Raspberry Pi and Python

The combination of Raspberry Pi and Python can be used for multiple purposes. Some of the popular items include:

- Learning how to program with Python
- Connecting your Raspberry Pi to multiple sensors and receiving data from them or control hardware—for example, home automation, environment monitoring via temperature sensors, etc.
- Using your Raspberry Pi as a Web server with the program written in Python
- Writing various utilities in Python and using your Pi as a server for monitoring and tracking multiple applications, services, etc.

These are just some of the things that you can do. You have the full power to convert your ideas to reality using Raspberry Pi along with Python.

VI METHODOLOGY

The modles like SMS Module,Analog to Digital Conversion,Motor Module,Sensor Module,Control Module were made operational in sequence as follows.

In SMS module The SMS is sent using Way2SMS through a wireless network. The username and password of the sender is registered initially. The message states the status of the field by describing the temperature and humidity. It also alerts if a water

level is low and also the status of the motor. The message is sent to the receiver's number.

Analog to digital conversion Modlue: The temperature and the humidity sensor possess analog values that are converted to digital values using MCP3008 circuit converter. The water and the soil sensor provide output in the digital form. Since Raspberry Pi executes and displays only the digital values, the analog are converted to digital. In addition to this, it reads the channel data and converts the volts into temperature (Celsius).

Motor module: The DC Motor is connected in the Raspberry Pi for automatic irrigation purposes if the water level is low. A relay is used in fitting the motor to reduce the current and voltage levels. Voltage, Vcc, Ground is connected to the motor. A power source is connected to a motor.
Sensor module: In this module SOIL , Temperautre, Humidity and water sensors are used.-

Initially the soil sensor Estimates the soil volumetric water content based on the dielectric constant of the soil. Soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The values are sent as digital values to the Raspberry Pi. The soil sensor displays the values in the digital form.Then the temperature shown by LM35 series temperature sensor which is an analog sensor is converted into digital and then converted into millivolts to display the Celsius value.

A humidity sensor measures both air temperature and moisture to get the ratio of actual moisture in the air to the highest amount of moisture air at that can contain. It depends on electrical capacitance, the ability of two paralleled electrical conductors to generate a electrical field between them. It makes all the sensor chips (including humidity and temperature sensor) precise and stable sensing of the target physical parameters, for instance, relative humidity, temperature, or mass flow.

A Global Water's WL400 Water Level Sensor was used for the present study. It is a submersible pressure transducer which consists of a solid state pressure sensor encapsulated in submersible stainless steel 13/16" diameter housing..Each of Global Water's pressure transducers has a two-wire 4-20 mA high level output, five full scales ranges, and is fully temperature and barometric pressure compensated.

A CONTROL MODULE is a DC MOTOR.A **DC motor** is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy.

Use case Diagram

The sequence of action of our project is explained by the use case diagram shown in fig.5.It consists of Raspberry Pi microcontroller which controls all the modules like, Sensors, Water Level and DC Motor.

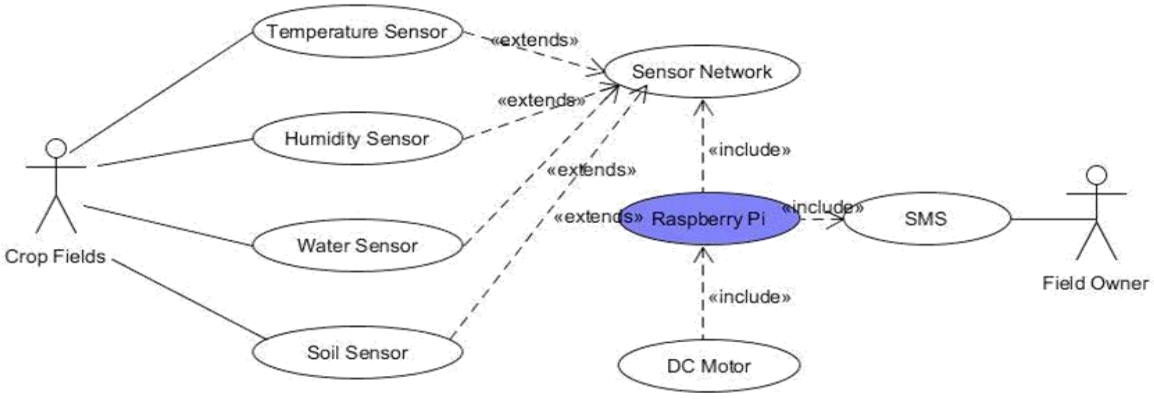

Figure 5: Use case Diagram describing the working of our system

Sensors control all the sensors available in our system like Temperature sensor, Soil sensor, Water sensor and Humidity sensor. The motor driver controls the DC Motor in the system. This system controls the wireless monitoring and controlling of the system. Screen shot of Program execution is shown in fig.6

VII CONCLUSION

The device is used for monitoring and controlling the agriculture and irrigation systems through IoT. The smart monitoring device for agriculture will definitely be a promising benefit for the automated future generations.In this we have implemented details of the sensed data and other alerting messages to get displayed in the system within the region of the crop fields under consideration. The future work will break this restriction to allow the automation being viewed even from any far away location more easily and effectively with improved algorithms.

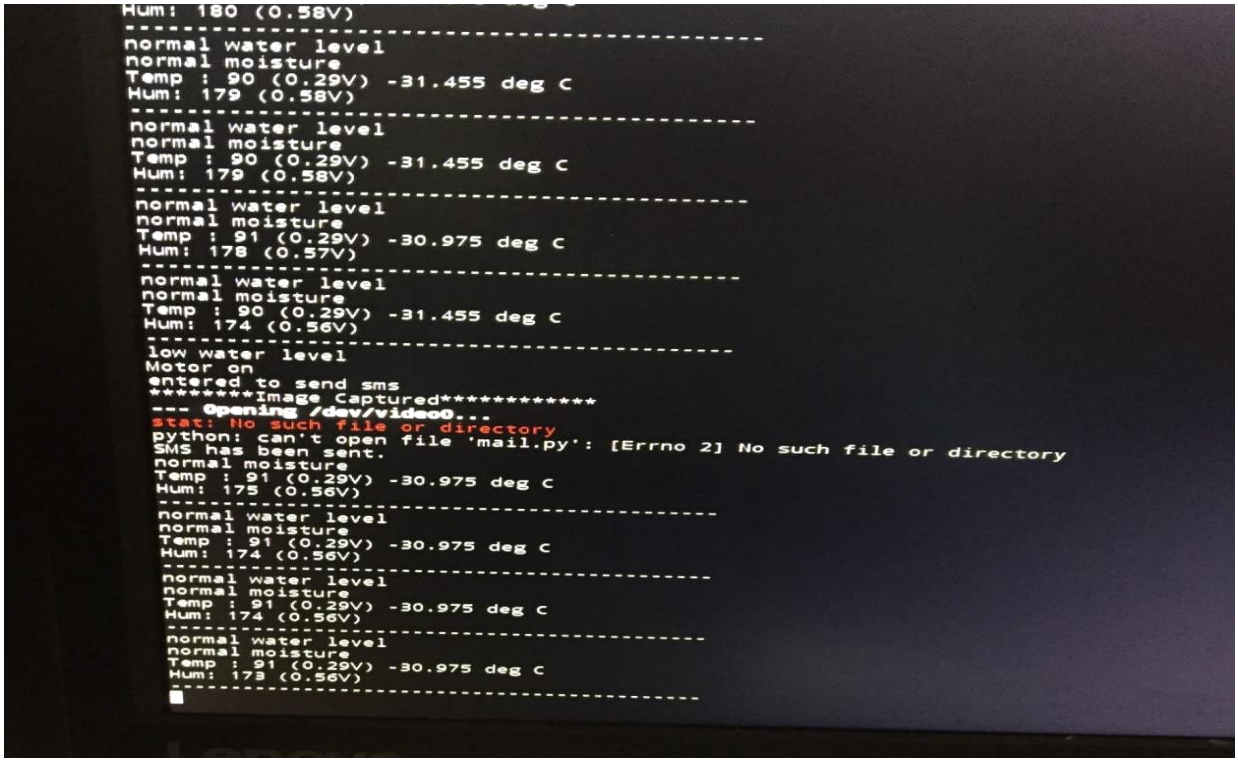

Figure 6: Screenshot

REFERENCES:

1 A Cross Platform Mobile Expert System for Agriculture Task Scheduling by (Sajeeda Shikalgar, Niketa Bhalerao, Mamata Kolhe, Saurabh Pansare, Shubham Laddha, **IEEE *Xplore*:** 16 January 2017 **INSPEC Accession Number:** 16598827

2. Service Oriented Design Approach for a Precision Agriculture Data logger by (C. Lozoya, A. Aguilar and C. Mendoza, year 2016 IEEE Latin America Transactions 14(4):1683-1688 · April 2016

3.Performance management of IEEE 802.15.4 wireless sensor network for precision agriculture, Chieck Tidjane Kone, Abdelhakim Hafid, Mustapha Boushaba , IEEE Sensors Journal 15, Issue: 10,2015)

4.Ahmad Nizar Harun, Ibrahim Mat, Mohamed Rawidean Mohd Kassim, **Precision Agriculture Applications using Wireless Moisture Sensor Network**, **2015** IEEE 12th Malaysia International Conference on Communications (MICC).

5.Alberto E. Cerpa, Daniel A. Winkler, Francois Blanchette, Miguel Carreira-Perpi and Robert Wang, **MAGIC: Model-Based Actuation for Ground Irrigation Control, 2016**, IEEE.

.

6.Alka Kalra, Rajiv Chechi and Dr. Rajesh Khanna, **Role of Zigbee Technology in Agriculture Sector, 2010**, National Conference on Computational Instrumentation, CSIO.

7.Anil Babu.A, Sirisha.D, Srikanth.M and Venkatesvaramma.B,**Wireless Sensor Based**

9.Gieling.T.H, **Control of water supply and specific nutrient application in closed growing systems, 2014**, PhD Thesis - Wageningen University.

10..Prof. Davande.V.M, Prof. Mulani.J.J and Prof. Patil.S.S, **SmartWireless Sensor Network for Monitoring an Agricultural Environment, 2014**, International Journal of Computer Science and Information Technologies.

11.Sakthipriya.N, **An Effective Method For Crop Monitoring Using Wireless Sensor Network, 2014**, Middle-East Journal of Scientific Research 20 (9).

Remote Controlled Agriculture Monitoring System Using ZigBee, 2015, SSRG International Journal of Electronics and Communication Engineering (SSRG-IJECE) volume 2 Issue 4.

8.Fernandes .H, Fortunato.J, Santos.M, Balula.S and Torres.A, **Turning the internet of (my) things into a remote controlled laborator, 2016,** IEEE.