Dissertation on

"IMPLEMENTING OF PRECISION AGRICULTURE MONITORING SYSTEM USING RASPBERRY PI AND CROP PREDICTION USING MACHINE LEARNING"

Submitted in partial fulfilment of the requirements for the award of degree of

Bachelor of Technology
in
Computer Science & Engineering

UE17CS490A – Capstone Project Phase - 1

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CERTIFICATE

This is to certify that the dissertation entitled

'IMPLEMENTING OF PRECISION AGRICULTURE MONITORING SYSTEM USING RASPBERRY PI AND CROP PREDICTION USING MACHINE LEARNING'

is a bonafide work carried out by

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in partial fulfilment for the completion of seventh semester Capstone Project Phase - 1 (UE17CS490A) in the Program of Study - Bachelor of Technology in Computer Science and Engineering under rules and regulations of PES University, Bengaluru during the period Aug. 2020 – Dec. 2020. It is certified that all corrections / suggestions indicated for internal assessment have been incorporated in the report. The dissertation has been approved as it satisfies the 7th semester academic requirements in respect of project work.

Signature Prof.Charan Raj B R Assistant Professor	Signature Dr. Shylaja S S Chairperson	Signature Dr. B K Keshavan Dean of Faculty

External Viva

Name of the Examiners	**Signature with Date**
1. _____	_____
2. _____	_____

DECLARATION

We hereby declare that the Capstone Project Phase - 1 entitled **"Implementation of Precision Agriculture Monitoring System Using Raspberry pi and Crop Prediction Using Machine Learning"** has been carried out by us under the guidance of Prof. CHARANRAJ B R, Assistant Professor and submitted in partial fulfilment of the course requirements for the award of degree of **Bachelor of Technology** in **Computer Science and Engineering** of **PES University, Bengaluru** during the academic semester August – December 2020. The matter embodied in this report has not been submitted to any other university or institution for the award of any degree.

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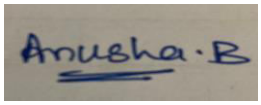
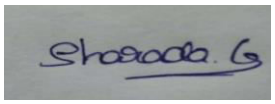
PES1201701061	**ANUSHA B**	
PES1201802412	**SHARADA G**	
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ABSTRACT

Project is to style a straightforward, low cost system to observe the worth of environmental parameters and that they are ceaselessly updated and controlled so as to attain optimum plant growth. There are numerous techniques obtainable for exactitude agriculture to observe and management surroundings for the expansion of the many crops. Due to the unequal distribution of rain water, it's terribly troublesome to full fill demand required by farmers to manage water equally, it needs some irrigation technique that are appropriate for any weather, soil varieties and type of crops. It's additional necessary to search out techniques that offer excellent analysing and dominant to develop correct surroundings. Agricultural observance is the best resolution to regulate and manage this downside. DHT11, soil moisture device, LDR device are the most sensors employed in this project that offer the precise price of temperature, humidity, water content in soil and light-weight intensity severally. A cooling fan, artificial light-weight and motor pump are connected to Raspberry-pi. Here we are going to use a Raspberry pi processor and IOT (Internet of Things). By victimization IOT we have a tendency to manage devices or any environmental wants anytime, anywhere. Supported the characteristics of correct perception, economical transmission and intelligent synthesis of the web of Things. This analysis focuses on developing a system that may mechanically live and monitor changes of temperature, strength, wetness and wetness level within the Agricultural observance. This project can split into 2 parts: programming a raspberry pi Python language to acts because the central hub that manages the assorted sensors like DHT11, soil moisture, LDR and making a app to permit the user to act with the Agricultural observance controller

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CHAPTER-1

INTRODUCTION

In olden days farming was the main occupation but people from the rural areas where shifting to urban areas for economy propose. In those days they used to predict climate conditions based on the previous day's soil moisture, water level, temperature, humidity etc. Farmer sometimes are away from the farm he may not the condition of the farm and need human effort he cannot be all time in farm to observer the condition

So to get an easy way out of this we can use sensors which gives us the above mentioned parameters details with accurate value. We also use WI-if module which then connects to cloud that is Thing speak. We use the graph to see the present change in the climate and temperature, humidity, soil wetness etc.

In this project our main aim is to build the monitoring system using various sensors, such as:

- DTH Sensor
- Soil Moisture sensor
- LDR Sensor
- Colour sensor

These sensors help us to get the parameters details easily and though farmers can get the values manually but not accurately. Our project aim is to get the precision value of all the parameters.

CHAPTER-2

PROBLEM DEFINITION

Agriculture is the unpredictable way of yielding the crop where the farmers only test the soil such as moisture level, soil type, and soil moisture. Whenever the soil loses its moisture level, the water pump should be on immediately so the farmer should be on the pump. It takes the time for farmers to do manual work. The farmer uses pesticides to get the high yield of the crop, without knowing much about the pesticide and how much quantity should that be used. Framer should check the daily climate condition or the previous year's parameters he should go through for the present yielding purpose.

So to overcome these problems farmers can use the smart agriculture method, in that farmers can easily get the details of the farm as well as immediately get the accurate value of the parameters. The sensors are inserted in some part of the field and the data is sensed by the sensor and sent to the cloud and as well as to the framers mobile through GSM, he can get to the condition of the framer whenever he is far away from farmer.

CHAPTER-3

3.1 LITERATURE SURVEY -1

3.1.1 Abstract

Smart agriculture uses wireless sensors for monitoring the field. They use raspberry pi and ZigBee for monitoring the agriculture field. These are dependable and efficient to get parameters details. This helps the farmer with less human effort and gets the precision value. The sensor used to monitor the condition of the farm and the microcontroller used to control the farm.
If the farmer is away from the farm he can monitor the farm using these sensor and controller in greenhouse condition. In this iot is used that is Thing speak which can help the farmer to take a accurate value and decision by which he can get the good productivity

3.1.2 Introduction

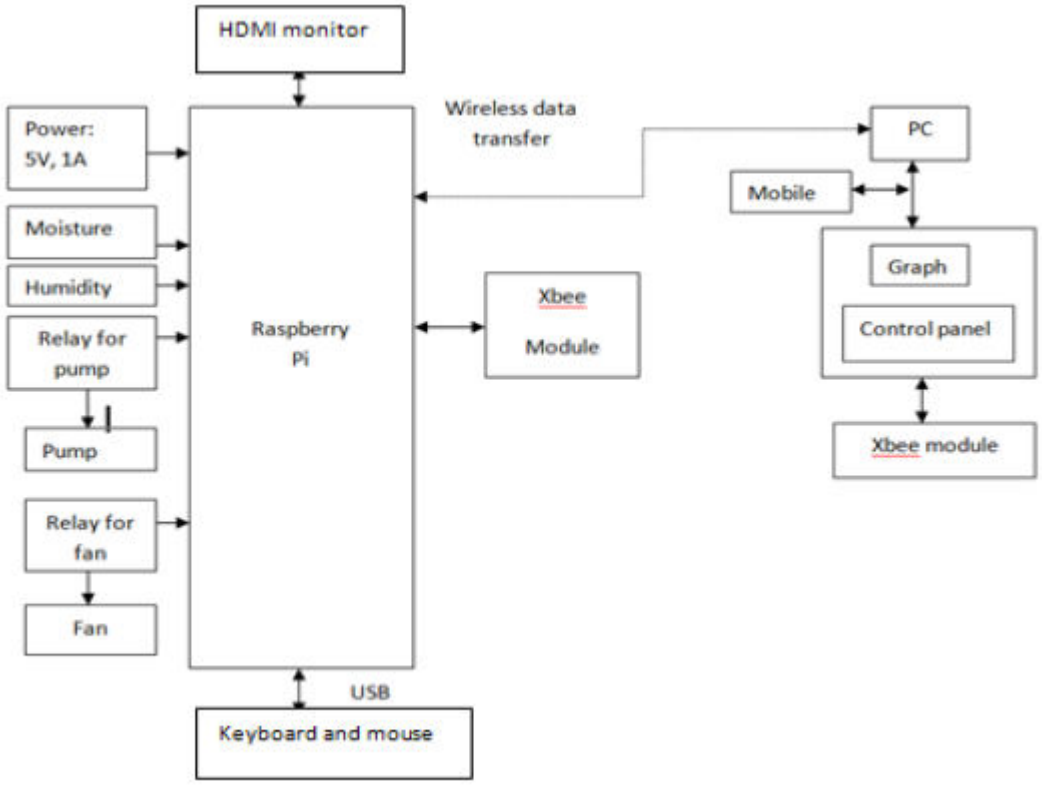
Precision agriculture has become a well-known method in the field of greenhouse effect. A wireless sensor network is independently distributed to monitor physical or environmental conditions that are humidity, pressure, temperature etc., and pass the collected data to the main location.

The very old technique is that the farmer personally gets the reading of the parameter values. This may be not that accurate. Another way is that the farmers get the SMS, through GSM services and communicate the farmer. In this system there will be less human effort and easily get the accurate values of the parameter by sensor. In this system, crops get a perfect greenhouse effect like environment. The sensed information can be used for the high yielding but with required conditions such as water content in soil and temperature, humidity, light etc.

3.1.3 Proposed Model

The proposed model is to build the smart system that gives the ideal environment for crops. The sensor gets the soil moisture, humidity level, this details will be sent to the ZigBee network to system. The system can control motors and humidity that are located in the field. This reduces the human effort much more, and to get the perfect environmental condition for crops.

BLOCK DIAGRAM



In above block diagram, they use raspberry pi as the microcontroller and sensor which are connected to it to get the accurate value such as moisture, humidity, and relay for pump, relay for fan, power of 5v, 1A, HDMI monitor as well as key board and mouse is connected to raspberry pi. The main ZigBee module is connected to raspberry pi also. The wireless data transfer to the system and mobile to get
the graph and the output of the model is displayed on the system. Another ZigBee module is connected to the system the transitive method

3.1.4 Implementation

In this model raspberry pi is the main while implementation. That is connected to external 5V power supply, keyboard and mouse is also connected to pi using USB. Soil moisture and humidity sensor are connected to get the accurate digital values. Those values are stored in the pi first and then it is transferred using ZigBee to another ZigBee module which is connected to the system the data is then converted to digital values such as 0's and 1's using serial communication.

- 0 value indicates that the value is less then defined threshold value then motor or fan will be switched on

This can also be controlled remotely within the span of ZigBee. This reduces human effort for prefect environmental condition for ideal growth of plants.

The soil moisture is inserted deep inside the soil to detect the moisture level and ZigBee is connected to sensor and the system which forms the transitive method, the sensed value is sent to system via transitive link which is displayed at the monitor.

3.1.5 WORKING PROCESS

The soil moisture sensor gets the moisture level. If the level is below predefined level, it notifies the user via GSM sending the SMS to farmers mobile so that to turn on the pump. The relay of the pump turns on the motor so that water can start to flow. The moisture sensor notes the values every minute as mentioned in the algorithm and algorithm checks the level of moisture which is required for the soil. When the soil gets its moisture level then pump automatically turns off and same is notified to farmer via SMS.

3.1.6 RESULT

The data which is sensed that are displayed in the user interface. And the graph is plotted using the digital values using moisture values and humidity values, temperature. To get the digital values we use communication port and enable that communication between ZigBee and system

3.2 LITERATURE SURVEY -2

3.2.1 Abstract

To build precision agriculture which help the farmer to get the data of soil moisture, water level and there general conditions of the field. The farmer can get general condition easily to make cultivation and irrigation well organized. The farmer can take better decision and save time and resource.

The climate change effect the filed a lot, also environmental parameters makes the farmers more complicated to take decision. Farmer get the parameters details accurately with these sensors.

3.2.2 Introduction

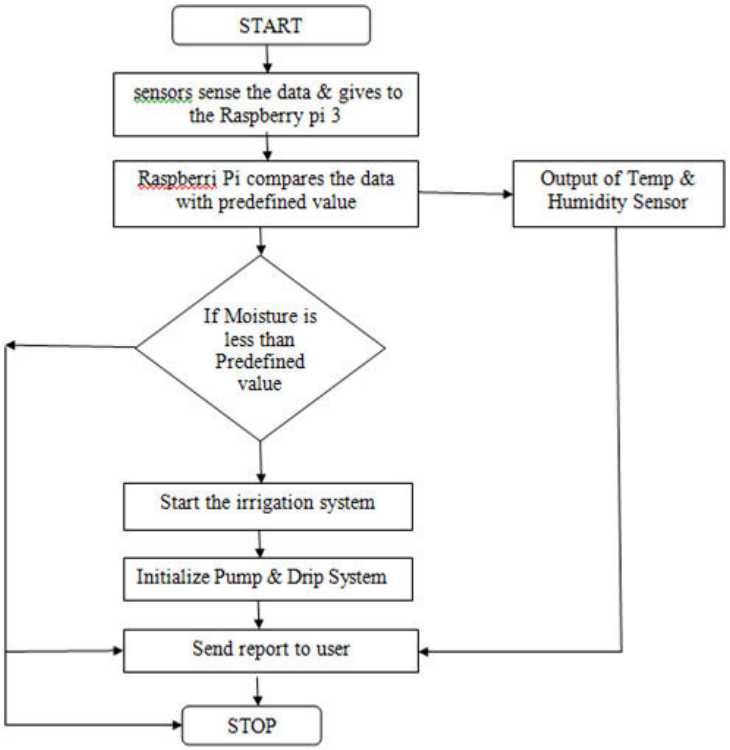
The Farmer migrating from the rural are and moving to urban area to get well settled life. Farmers faced problem related to the field and loss in the crop, productivity. The main aim is make use of the technologies, management crop and monitoring in order to increase the productivity.

The precision agriculture which relay on the wireless sensors, send the parameter details to the individual farmer about their filed. The sensor gets the accurate value of the parameters and send the data such as water level, soil moisture, and other parameters details of the field. In the farmer can expect that saving the time and less human efforts. The farmer can get the combined value a once the sensor are connected to system. So when the sensor is connected to the system it displays the parameters reading which are accurate and helpful for farmer. The sensor which is used to detect the temperature and humidity is DHT11, for soil moisture sensor used is check the water level in the soil these are connected to raspberry pi.

3.2.3 Component Descriptions:

1. **Power supply:** The raspberry is connected to external power supply of 5V using USB port. Core Voltage may be 3.3V, 2.5V, and 1.8V, these are for processor and Ethernet
2. **Sensors:**
    - The soil moisture sensor is used to check the volume of the water content in soil
    - DHT11 sensor used to get the temperature and humidity values.

3.2.4 Flow chart:



3.2.5 Algorithm for above flow chart:

1. Start
2. Sensor fetch the data and sends it to raspberry pi 3
3. Raspberry pi compares the data with in-built values
4. Output of temperature and humidity is given
5. If moisture level is less than the in-built value
6. Then pump should turns on
7. Further details are sent it to farmer
8. Stop

3.2.6 Applications

- The farmer can monitor the value and all the related activities of the field.
- The soil moisture senor uses to get the water level in the soil and also to maintain for good production.
- The growth of the plant can also be observed

3.2.7 Conclusion

Implementation of agriculture system is feasible and time saving, profitable. To enhance water Supply for agriculture. One can save the human effort by using this method.

CHAPTER-4

PROJECT REQUIREMENT SPECIFICATION

4.1 Introduction

In this section the detailed content of the project will be explained such as hardware components, software etc., and scope of the project, advantages and disadvantages. the assumptions, constraints

4.2 Scope

Our main aim in the project that to reduce the problems faced by the farmers and get a easy way out of it so that they will be human effort. So the farmer can get the accurate value of the parameters using sensors such as soil moisture sensor, temperature and humidity. The farmers collect the reading from the cloud that is things that speak in the CSV format so that he can get the visualization graph. He can get the assumption on the previous year's data.

4.3 Advantages

- Based on the exact value of humidity, temperature of their environment farmer can grow the crops.
- Farmers can water fields periodically, based on the soil moisture level by soil moisture sensor. By this sensor it waters to the field only when and where it is needed.
- It reduces the cost like labour costs.
- It provides the crop production in High Quality.
- We will get the data in real time from the cloud.
- Automatic process of watering the fields will be done.

4.4 Disadvantages

- There will be network issues in rural areas so there should be a proper network.
- Farmer should get to know about the usage of technology.
- There will be sudden fluctuating in climate changes or weather conditions it may effect to get exact humidity and temperature value.
- We should be aware of the working of sensor like is it working correctly or not.

4.5 Functional Requirements

The main functional are:

- When the water content decreases in the soil the system should automatically ON the pump for the flow of water.
- If detected water level is less than the predefined value then the system continuous the cycle of notifying the user, turning on the pump, then if it reaches its level the pump automatically turns off and same is notified to user.
- The temperature, humidity values are taken from the sensor which may be exact so that the farmer can get good yield by using this method.

4.6 Non Functional Requirements

- **Maintainability:**

  If the water level reduces to less than the minimum level, then the soil losses its moisture level the sensor notifies the user through GSM so user can maintain the moisture level.

- **Reusability:**

  The previous dataset can be reused for the improvement of the yield. The dataset will be stored in the cloud by this we can collect the dataset.

- **Portability:**

  Here the the things like sensors are fixed we cannot carry the sensors from one place to another place.

- **Performance:**

  We have a two parameters called Temperature and Humidity then we will get a values of these parameters based on this farmer will grow the crop and the dataset will be stored in cloud we can fetch the data from the cloud by using Thing speak.

CHAPTER-5

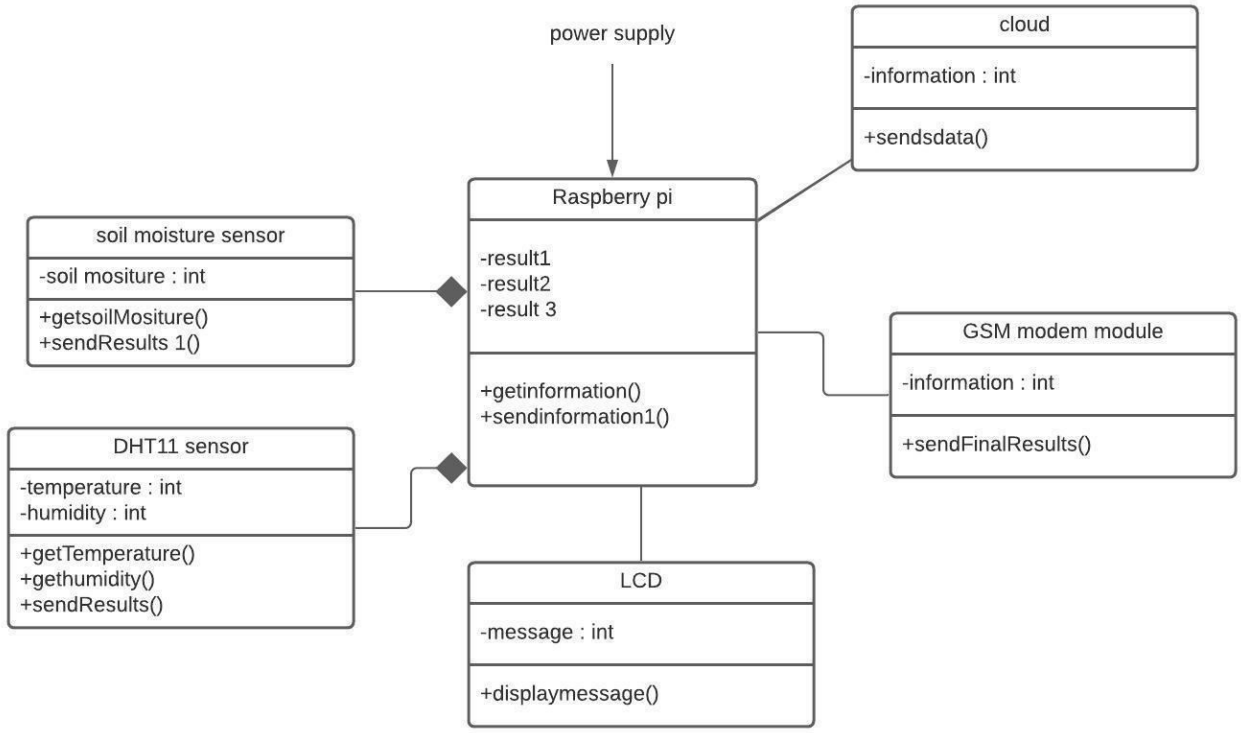
SYSTEM REQUIREMENTS SPECIFICATIONS

5.1 Introduction

In system requirements specification, we defined the detailed info of the system working model of the system. Class diagram is explained in the reference of the project. The block diagram explains the brief model of the system in which the raspberry pi is the main processor further connected with some sensors that are temperature, humidity, soil moisture sensor etc. The external power supply of 5V, and key board, mouse is also connected with pi. Whenever the temperature increases automatically fan turns on to control the temperature. Similarly, when the soil loss its moisture level it notifies the farmer through SMS. If the moisture level is below the minimum level, then pump will be turned on.

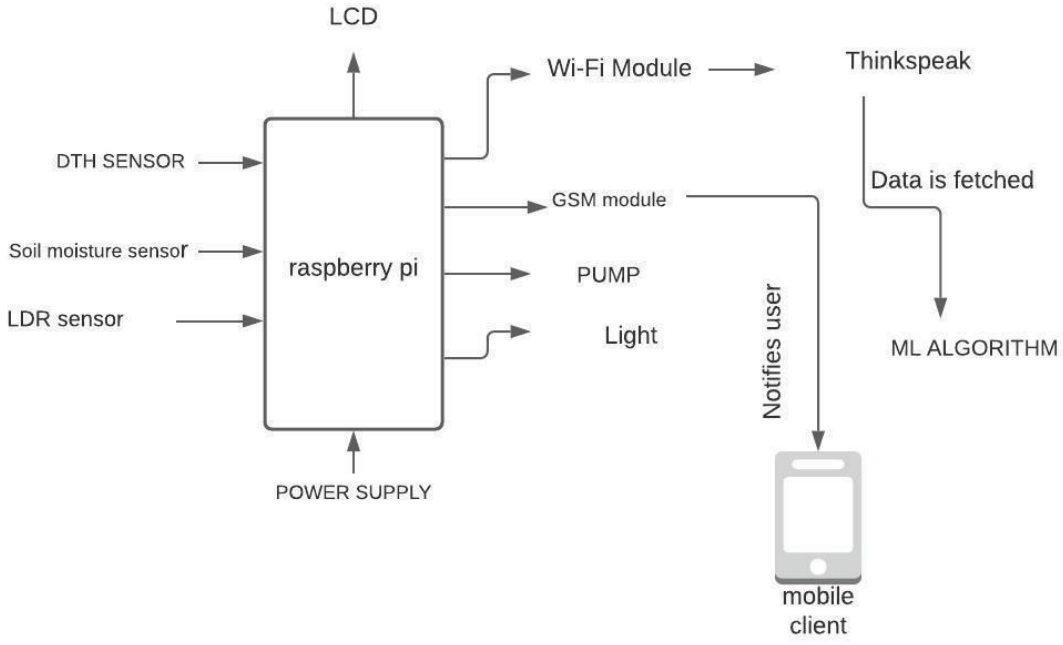
The data which is fetched from the system is stored in the cloud using IOT that is thing speak. Which helps the farmer to get the details of the field easily and also the visualization graph of the data is given in IOT. We convert the soil moisture readings to digital values such as 0's and 1's, using ADC (analogy to digital convert). With those values graph can be plotted that is visualization graph.

5.2 Class Diagram



In the above class diagram it explains the operation performed by each system, which can help to get the parameter values. Such as sending messages and display message, type of the operation performed. Sending the info of the result to the cloud.

5.3 Block Diagram



As we can see the above block diagram, in that we are using 3 sensors which gives us the information of temperature, humidity, soil moisture etc, those are connected to raspberry pi and the data which we receive will be stored in the cloud using Wi-Fi model and message notification also will be sent to the mobile using GSM. The stored data will be fetched in CSV format and then used in machine learning algorithm (Svm, Knn, Naive Bayes, Ann).

5.4 Software Requirements

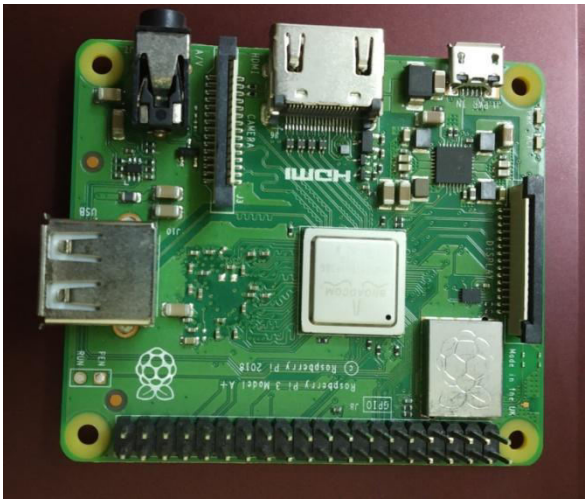
The Software that are required for our project are:

- **Thing speak**: It is used for cloud storage which the dataset are used for future purpose and for visualization graphs.
- **GSM**: Global system Mobile Communication.
- **Pycharm IDE**: It provides code analysis, a graphical debugger.

5.5 Hardware Requirements

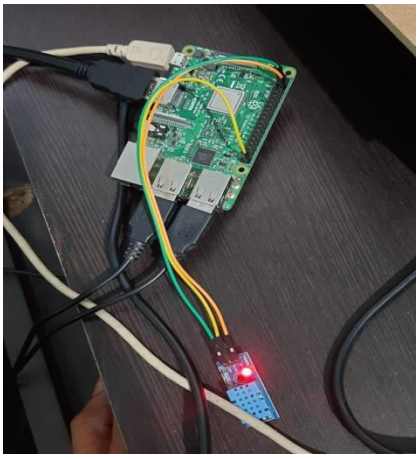
- **Raspberry Pi**: It is like a computer it plugs into a tv or desktop and also keyboard and mouse will also be connected. Python programming language is used.
- **Sensors:** Soil moisture, Humidity, Temperature are used. Soil moisture is used to check the moisture level of water in fields. We will get to know the Humidity, Temperature values of weather conditions.
- **LCD:** It is used to display the output.
- **Pump:** It is the device through which the water flows.

Raspberry pi: this is the main processor which is used in this project.



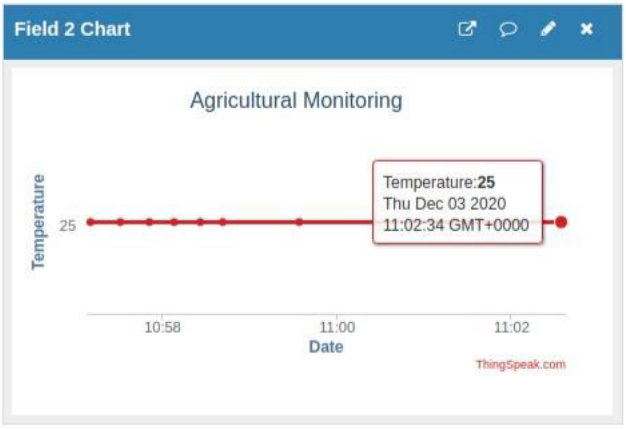
TEMP AND HUMIDITY:

This is the hardware which is connected to temperature and humidity sensor, and also key board and mouse are connected with raspberry pi.

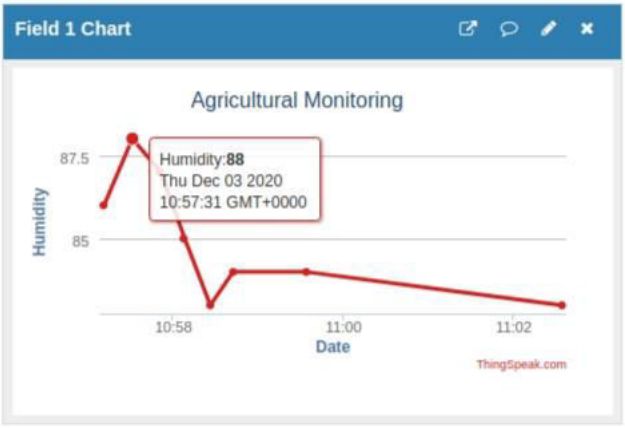


Visualization:

Temperature



Humidity


Field 1 Chart
Agricultural Monitoring
Humidity:88
Thu Dec 03 2020
10:57:31 GMT+0000
87.5
85
Humidity
10:58
11:00
11:02
Date
ThingSpeak.com

PH:


Agricultural Monitoring
Ph:5
Wed Mar 31 2021
09:30:11 GMT+0530
7.5
5
Ph
09:28
09:30
09:32
Date
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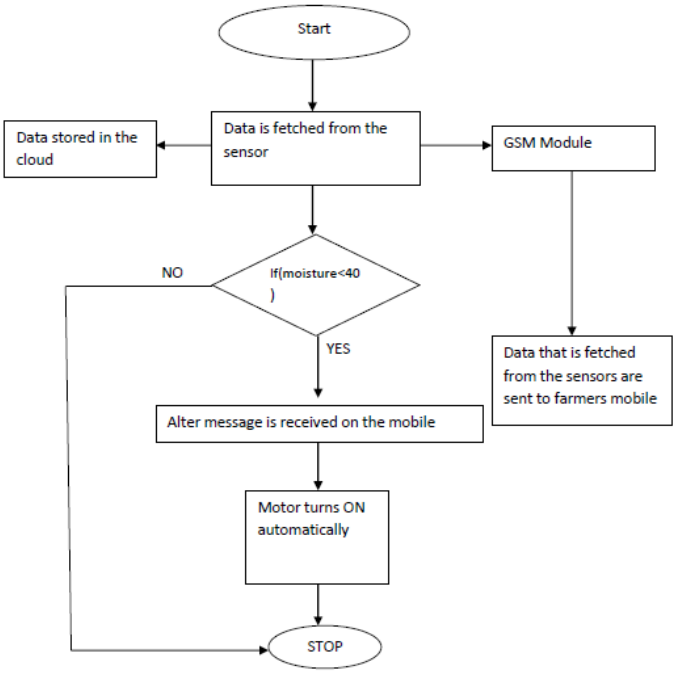
CHAPTER-6

SYSTEM DESIGN



In the above system diagram it shows the implementation flow, when the data is fetched from the sensor it sends the details to the farmer through GSM and also stored in Thing speak and get the visualization of the data which is stored in it.

The main aim is to get the moisture level of soil using the senor and when it sense the moisture level is shows the result as no water detected and water detected using the ADC(analogy to digital converter)these values is converted to digital values and then it gives us the clear visualization of the parameter. Similarly, temperature and humidity values we will get.

CHAPTER-7

CONCLUSION OF CAPSTONE PROJECT PHASE – 1

In phase 1, precision agriculture monitoring system using raspberry pi in which we see the problem faced by the farmers while yielding the crop farmers manually take the parameters reading like temperature and humidity soil moisture which is suitable for the field and the crop for good productivity .

So overcome these problems faced by the farmer can use the sensors and less human effort can get the parameter reading easily. Soil should have a minimum moisture level, the soil moisture sensor senses the moisture level and sends the details to farmers using GSM and as well as to clouds where we can store the values for further use. Similarly we can get the temperature and humidity values also. In the phase1 we have done literature survey on some of published papers, where we got the clear picture of the project. As the flow chart explains the detail of the project implementation how that works

In this we have implemented the both sensor (temperature, humidity, soil moisture) and remaining sensor work and working model will be done in the next phase

CHAPTER-8

PLAN OF WORK FOR CAPSTONE PROJECT PHASE - 2

In the phase 2, we will use the machine learning algorithm to predict the crop using the colour sensor and light sensor the values which we have collected and stored in the cloud will be fetched in CSV format and inserted in to the algorithm. The complete working model will be presented in phase2.

The remaining two sensors will be used in phase 2 colour sensor and light sensor, the colour sensor is used to detect the colour of the leaf and light sensor is used to detect the light content present in the leaf. In this phase mainly it is focused on algorithm

REFERENCES/BIBLIOGRAPHY

- http://www.siesgst.edu.in/teacher/uploads/publication574020.pdf
- Agricultural Crop Monitoring Sensors using IoT –A Study International Journal of Engineering Research & Technology(IJERT)2018
- Nikesh Gondchawar , Prof.Dr.R.S.Kawitkar, "IoT based Smart Agriculture" International Journal of Advanced Researching Computerand Communication Engineering Vol.5,Issue6,ISSN (Online)2278-1021ISSN(Print)23195940,June2016
- S.Sivachandran, K.Balakrishnan, K.Navin, "Real Time Embedded Based Soil Analyser", International Research Journal of Engineering and Technology(IRJET). Volume:3Issue3| March2014
- https://www.ijert.org/agricultural-crop-monitoring-sensors-using-iot-a-study

APPENDIX A DEFINITIONS, ACRONYMS AND ABBREVIATIONS

Abbreviations:

- **GSM: G**lobal **S**ystem for **M**obile Communication.
- **GPS:** Global Positioning System.
- **LDR:** Light Decreasing Resistance.
- **ADC:** Analog to digital converter.