Agricultural Weather Station

Project report submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

By

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UNDER THE GUIDANCE OF

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DECLARATION

We hereby declare that the work reported in the B.Tech Project Report entitled **“Agricultural Weather Station”** submitted at **Jaypee University of Information Technology, Waknaghat, India** is an authentic record of our work carried out under the supervision of Mr. Pankaj Kumar**.** We have not submitted this work elsewhere for any other degree or diploma.

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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Signature of the Supervisor
Name of the Supervisor
Date:

Head of the Department/Project Coordinator

ACKNOWLEDGEMENT

I would like to take the opportunity to thank and express my deep sense of gratitude to my mentor and project guide **Mr. Pankaj Kumar** for his immense support and valuable guidance. My friends and classmates without these people it would not have been possible to reach at this stage of our minor project.

Date: 20/04/2021

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LIST OF ACRONYMS AND ABBREVIATIONS

- IoT - Internet of Things
- AWS - Agricultural Weather System

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ABSTRACT

With the outstanding development of inhabitants, the UN Food and Agriculture Association says that we are required to deliver 70% more food in 2050, rural grounds are decreasing, and consumption of limited resources, the need to improve field yield has gotten basic.
Cramped accessibility of common assets, for example, water and fruitful land with the previous yield patterns in a few staple harvests, have additionally troubled the issue. Another blocking worry over the cultivation work is the moving construction of agrarian labor force. Also, rural work in the vast majority of the state has declined. Because of the declining rural labor force, selection of internet connectivity and farm data monitoring is required, to decrease the requirement for difficult manual work labour and increase the yield with minimum impact on economical health of producer and physical health of consumer.

CHAPTER 1

INTRODUCTION

1.1 Introduction

"If conservation of natural resources goes wrong, nothing else will go right" (M. S. Swaminathan). The demand and supply of food were never the same throughout history. With this exponential population growth, we will be left with less land to produce with more people to feed.

The world populace will touch 9.8 billion in 2050[1] nearly, a 25% increase. This increase will happen mainly in developing countries. With this rapid increase, people will tend to move towards urban areas. According to a UN report, 70% of the world population will be urban till 2050[2]. Urbanization will change the land usages of that area, farms and cultivable lands would get converted into buildings and parks that would result in less cultivable lands. With Urbanization, people will be likely to spend more on quality and nutritious food products. This increase in demand for quality, quantity, and nutritious food items will cause a strain on the already stressed food sector.

1.2 Agriculture

1.2.1 Statistic

Farming is the science, workmanship and practice of developing plants and domesticated animals. Agribusiness area in India utilized about 60% (2017) of the labor force and contributed 16% of Gross domestic product in 2016-17[2].India is the 2nd biggest producer of fruits and vegetables on the earth. Absolute region under green yields is 25.43 million ha (2017-18) and production is 311.71 million tons (2017-18). Fruits and vegetables contribute about 90% of the complete green creation in the country[2].Rice, wheat, cotton, oil seeds, jute, tea, sugarcane, milk and potatoes are the major horticultural wares delivered. All the more significantly, more than 60% of the nation's populace, involving a few million small farmers, relies upon agribusiness as a chief pay source and land keeps on being the principle resource for job security.

1.2.2 Agriculture and Water

The most valuable resource we got to sustain life on planet Earth is water. About 97% of Earth's water is salt-water held by seas and oceans and just the leftover 3% is freshwater—more than two-third is frozen in the types of icy masses and polar ice covers[3][4]. Just 0.5% of the thawed new water is over the ground, as the rest lies underground [5].In short, we rely on this 0.5% to fulfill all our requirements and to maintain the ecosystem.

The horticulture industry utilizes roughly 70% of this open water[6]. India has 18% of the world's population, having 4% of the world's freshwater, 80% is used in agriculture[7]. According to UN convention to combat desertification (UNCCD) estimates in 2013 show that there are 168countries affected by desertification and by 2030, almost half of the world population will be living in areas with water shortage. As per UN convention to combat desertification (UNCCD) estimates in 2013 show that there are 168 nations influenced by desertification and by 2030, practically 50% of the the total populace will be living in zones with a lack of water.

CHAPTER 2

INTERNET OF THINGS

2.1 IoT

Internet of Things is defined as a mess of different physical objects that connect and communicate with each other while collecting, sending, and analyzing data. It’s a mess of sensors and actuators that help in monitoring and performing the functionality according to the data gained.

2.1.1 Applications

Smart Home

Elder Care

Medical and healthcare

Transportation

2.2 IoT in Agriculture

Figure 2.1: IoT in Agriculture

IoT connects various devices together which are equipped with sensing, processing, and communicating with network capability. In agriculture, there are many aspects to consider from soil health to water, pests, and weeds. Balancing all these variables gives a proper output. But the proper output is not the case required in this modern time, fields are required to maximize their yield without compromising the health of the plant and that of the consumer. This requires a systematic and sustainable approach towards precision farming.

CHAPTER 3
WEATHER STATION

3.1 Weather Station

A facility on land or in sea responsible to collect and measure the atmospheric condition in or around the area where system is installed.It helps us to take precaution against destructive natural disaster caused due to heavy rain, winds and other atmospheric activities.

3.2 Weather and Agriculture

Agriculture directly depends upon the Weather and Climate of that locality. Among the many parts involved in agriculture like water and soil health, the weather act as a moderator in between them. It brings rain, cools the temperature, but can cause drought and conditions that can cause severe damage to the crop.

3.2.1 Use of Weather forecast

Agronomic activities require the weather to sow and irrigate the plants or if conditions are not good, then delay its sowing process. A few parts of climate gauges for horticulture are very unmistakable from succinct climate figures. In concise meteorology, the beginning and withdrawal of the rain are identified with changes in wind dissemination designed in the upper climate and relative changes in the precipitable water droplet of air in the lower layers. Planning of fields for planting the harvest with a satisfactory amount of seed growth, soil dampness requires extensive downpours.

3.2.2 Components of AWS

- Cloud Cover
- Rainfall
- Maximum and Minimum Temperature
- Relative Humidity
- Wind Speed
- Heatwave
- Low and High pressure
- Solar Radiation

- Bright hour of day light
- Soil Dampness

3.2.3 Types of AWS

- Now cast
- Very short range forecast
- Short range forecast
- Medium range forecast
- Long range forecast

Table 3.1: AWS types and utility[8]

Types	Accuracy
Now cast	Very high
Very short range	Very high
Short range	High
Medium Range	Moderate
Long	Very low

Table 3.2: Weather Requirement for farming operations[9]

Farming	Weather Condition	Soil	Air Temperature
Land Preparation	Clear or Cloudy day	Moist	15°C ---- 40°C
Seeding	Clear or Cloudy	Moist	15°C ---- 33°C
Relocating seedlings	Clear or cloudy day	Wet	15°C ---- 40°C
Cultivating	Clear to partly cloudy	Moist or dry	15°C ---- 40°C
Irrigation	clear or cloudy day	moist or dry	Above 14°C
Spraying	Clear	moist or dry	15°C ---- 33°C
Threshing	Clear to partly cloudy	dry	Above 14°C

Table 3.2 shows the optimum temperature and condition required for the growth of plants. This result is briefly discussed in Guide to Agricultural Meteorological Practices,2010,Chapter 5.

CHAPTER 4
SMART AGRICULTURE

4.1 Smart Agriculture

Agriculture is the practice of growing eatable items. Different aspects are involved in this process, from soil to seed, from field to feast. Managing these processes through sensors and actuators leads to micromanagement with reduced environmental effects. This way of Agriculture is Smart Agriculture.

4.1.1 Smart Agriculture and IoT

With the increase in demand for food, it is required to produce more with a sustainable approach, taking care of each natural resource. Upon taking the above facts and figures of the requirement to monitor plant health and environment, IoT plays a crucial role. IoT-based Smart Agriculture: Towards Making the field Talk[10] discusses the use of IoT in agriculture it emphasizes more intelligent, better, and more productive harvest developing techniques needed to meet the developing food request of the expanding total populace even with the consistently contracting arable land. The advancement of a new technique for improving harvest yield and taking care of, one can promptly see at present: innovation weaned, creative more youthful individuals embracing cultivation as a calling, horticulture as a method for autonomy from petroleum derivatives, following the harvest development, wellbeing and nourishment marking, organizations between producers, providers, retailers, and purchasers.All these angles and featured the job of different advances, particularly IoT, to make horticulture more brilliant and more effective to meet future assumptions. For this reason, remote sensors, UAVs, Cloud-registering, correspondence innovations are talked about altogether. Moreover, a more profound knowledge into late exploration endeavors has given. Furthermore, different IoT-based designs and stages had given concerning agribusiness applications. A synopsis of current difficulties confronting the business and future assumptions is leading to control analysts and designers. In light of this, it very well may be inferred that every last trace of farmland is indispensable to augment crop creation. Notwithstanding, to manage each inch as needs be, the utilization of maintainable IoT-based sensors and correspondence innovations are most certainly not discretionary—it is fundamental

CHAPTER 5
AGRIWEATHER

5.1 PROJECT OVERVIEW

The increase in demand for food, food products, and climate changes causing an issue related to the production and health of crops. Planned agriculture is required to tackle these issues with effectiveness. The solution must be farmers friendly, cost-effective with minimum moving, and time taking functionality with an accurate and precise result.

Upon reviewing the problems that occurred in the farming procedure, overuse of fertilizers and water, a cost-effective and robust solution necessary to improve the yield with minimum impact on the environment.

AgriWeather stands for Agricultural Weather Station is the solution provided to tackle the issues of monitoring Weather Data of that particular field area. AgriWeather is a device that can record temperature of that area, temperature of Soil, Humidity of that area, Humidity of the Soil, daylight intensity, air pressure and sends this data to a remote server which acts as a display where user can see and analyse the data.

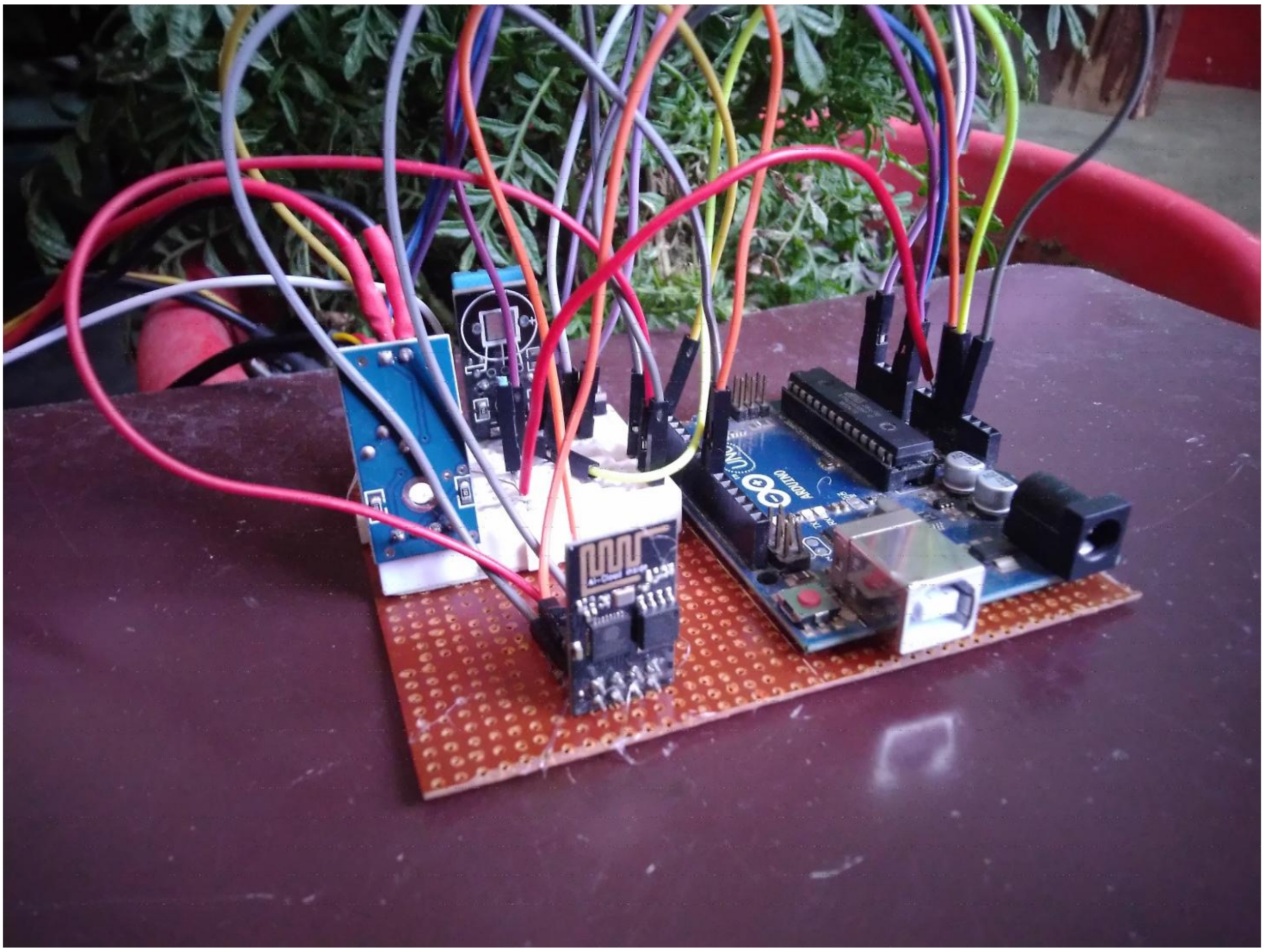


Figure 5.1 : AgriWeather System

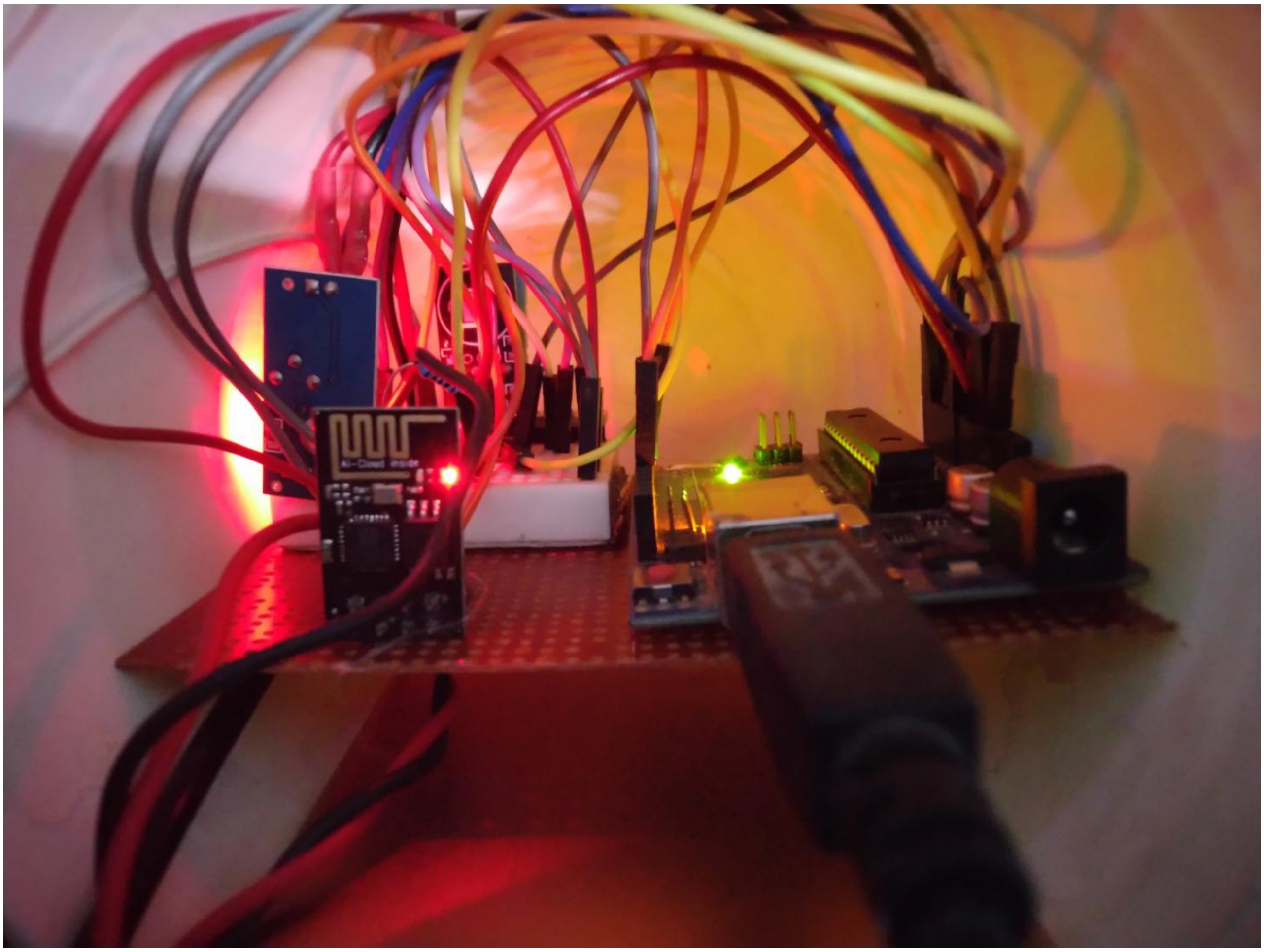


Figure 5.2: AWS installed in a box

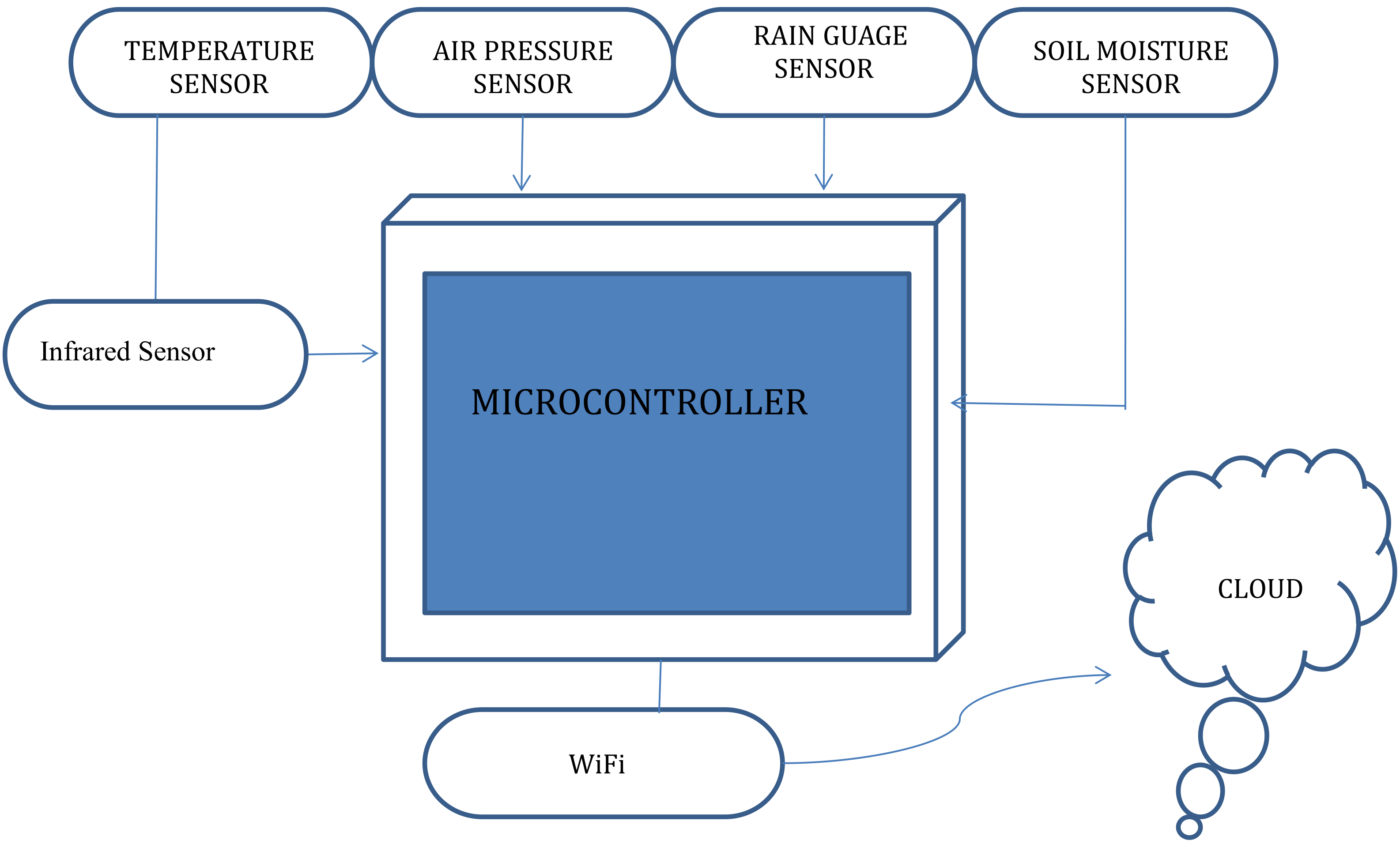
Figure 5.3: AWS reading plant data

5.2 Working of AWS

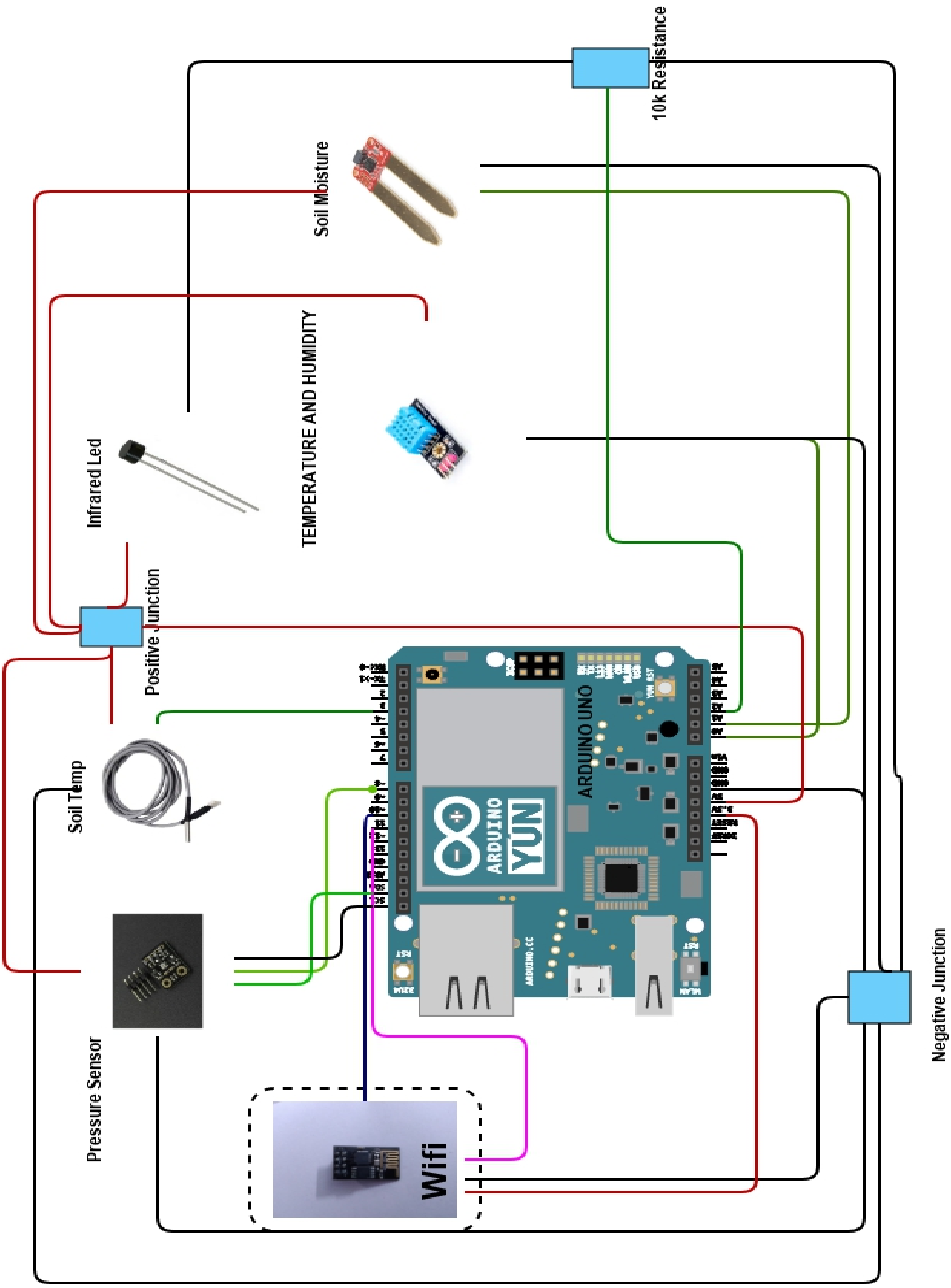
The data given in Table 3.2 give us the impression of measuring temperature and air pressure to get the best fit time for performing farming activities. This system can monitor Temperature with DHT11 Sensor, Air pressure BMP280 Sensor, Temperature of Soil DS18B20, and daylight with Infrared Sensor, Soil Moisture with Soil Moisture Sensor.

Device act as a read and write NowCast System showing the real time data to the user through ThinkSpeak Server.

5.3 Schematic and flow chart



5.4 Circuit Diagram



5.5 Component and Uses

- Arduino UNO Microcontroller
- ESPN8266 WiFi Module
- BMP280 Pressure Sensor
- Soil Moisture Sensor
- DS18B20 Soil Temperature Sensor
- DHT11 Temperature and Humidity

5.5.1 Arduino UNO Microcontroller

Figure 5.4 Arduino UNO

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 can provide PWM output)

- UART protocol: 1
- I2C protocol: 1
- SPPI: 1
- Analog Input Pins in Arduino: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

Farm lands are located far from cities and have few to no power supply units. So Arduino Uno is the best suited mircrocontroller for using in low power supply zone with maximum output.

5.5.2 ESPN8266 Wifi Module

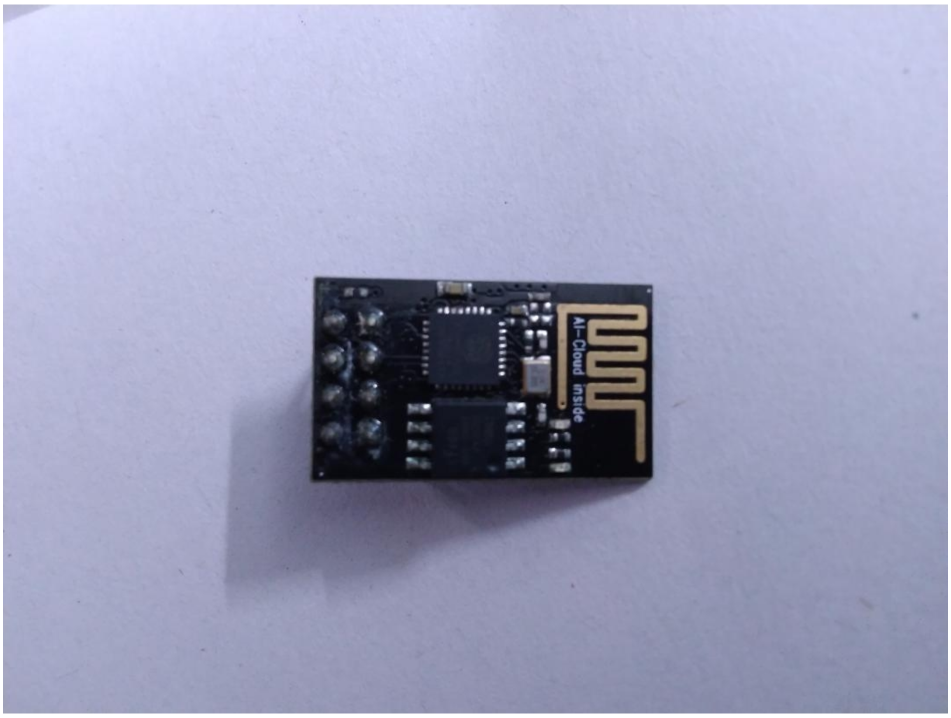


Figure 5.5 ESPN8266 WiFi

Features:

Low power supply 3.3v

Compact design

Flash memory 512kb

Support Station and Access Point mode

2.4 GHz Wifi

I2C Communication

While dealing with network infrastructure using wifi to send data, helped in saving on the costs and maintainability of this project.

In project Wifi pins are connected to pin 10 -Rx and pin 11 to Tx

Power supply pin with Ch_pd to 3.3v

And ground Pin to Ground

5.5.3 BMP280 Pressure Sensor

- It contains a capacitive plate connect with the atmosphere
- The deformation in diaphragm results in detection of Atmospheric pressure.
- Lower the pressure, lower the movement of diaphragm and vice-versa, which results the value of barometer.
- Lower barometer reading means decrease in air pressure it indicates higher chances of rain
- Increased in reading indicates clear or dry air sky.

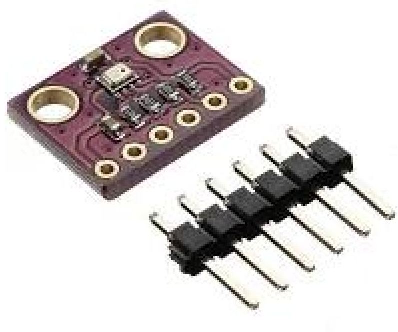


Figure 5.6 BMP8266 Pressure Sensor

5.5.4 Soil Moisture Sensor

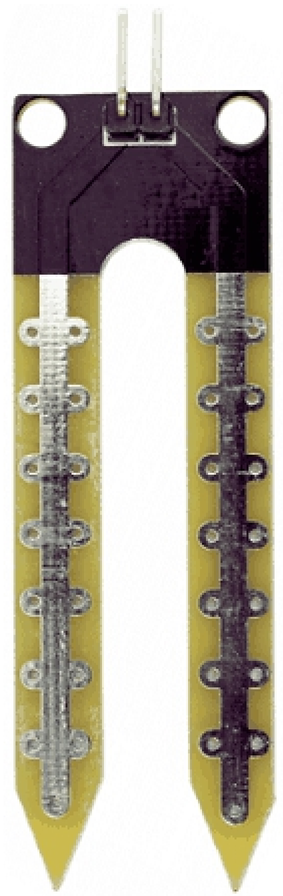


Figure 5.7 Soil Moisture Sensor

Soil dampness sensor has two leading plates. First plate is associated with the +5Volt supply through arrangement resistance of 10K ohm and second plate is associated straightforwardly to the ground.

It just goes about as a voltage divider network, and yield is taken straightforwardly from the main terminal of the sensor pin.

The yield will change in the scope of 0 – 5 Volt, in extent with change in substance of water in the dirt.

Preferably, when there is zero dampness in soil, the sensor goes about as open circuit for example endless obstruction. For this condition, we get 5V at the yield.

5.5.5 DS18B20 Soil Temperature Sensor

Figure 5.8 DS18B20 Soil Temperature Sensor

Programmable Temperature Sensor
One Wire Communication
Temperature Range : -55°C to +125°C
Output: 9 to 12 bit
Conversion duration: 750ms

The DS18B20 is a 1-wire programmable Temperature sensor.Used in condition where ordinary sensors are not that useful or cannot get through.The built of sensor is robust and water resistance.

Temperature Measurement - 55°C to +125° with error ±5°C.

It uses one wire for communication.

5.5.6 DHT11 Temperature and Humidity

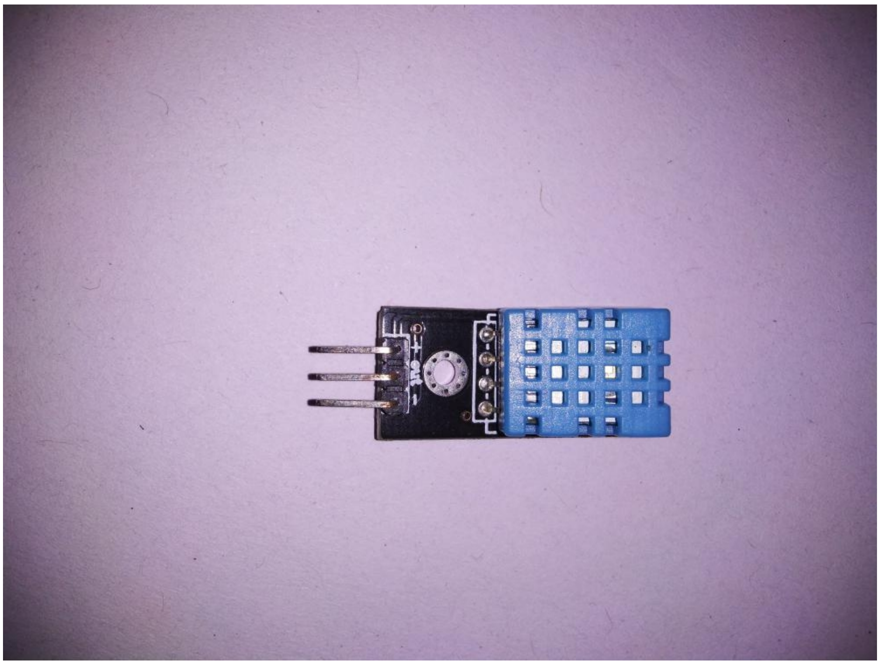


Figure 5.9 DHT11 Temperature and Humidity

Humidity is measured by the help of two electrode with moisture holding electrode in between them. With change in humidity the conductivity changes so the resistance changes. The change in resistance is measure and processed by IC and feed to microcontroller.

While temperature is measured by a NTC temperature sensor thermistor, it is a variable resistor which changes with change in temperature.

5.6 Result

The reading of Sensors is sent to ThinkSpeak Server with the help of TCP/IP connection. ThinkSpeak Shows the result to the user in graphical format as shown.

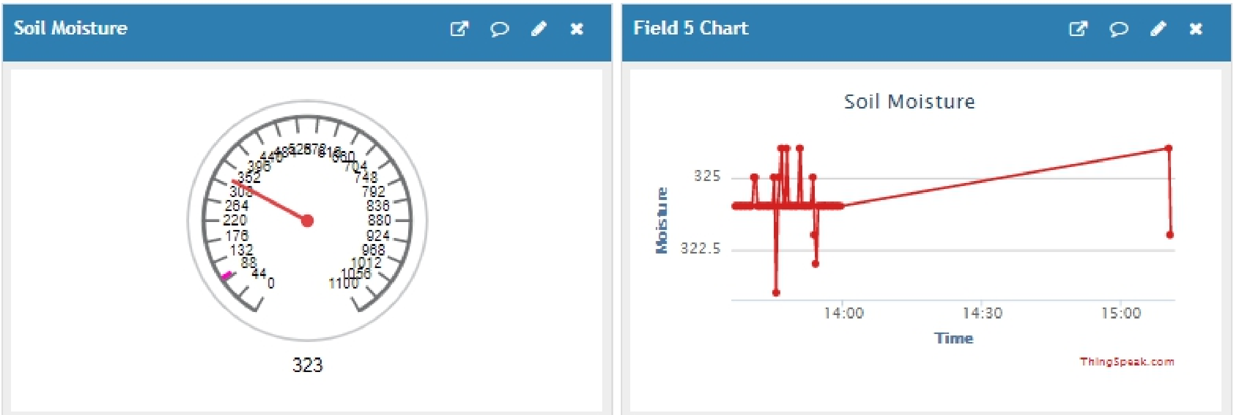


Figure 5.10 Soil Moisture

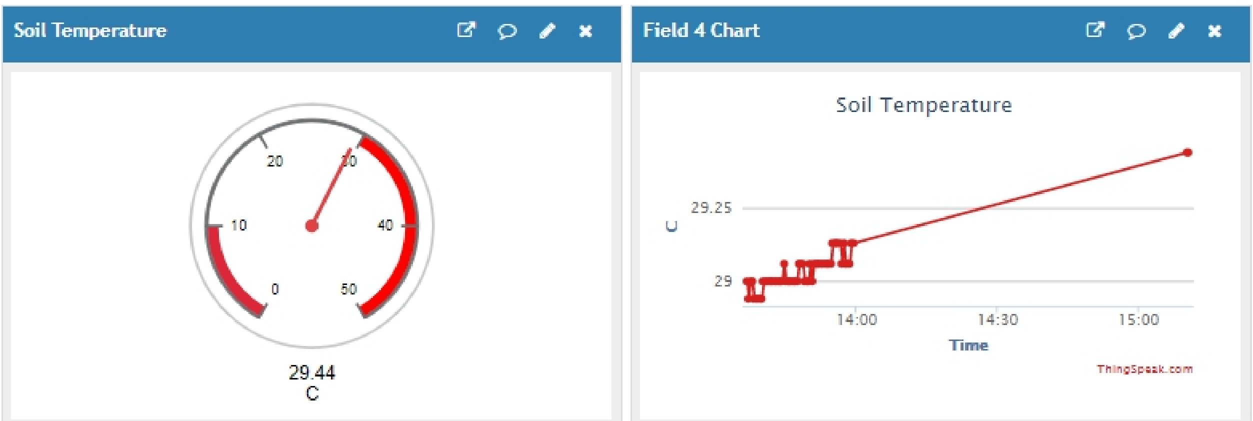


Figure 5.11 Soil Temperature

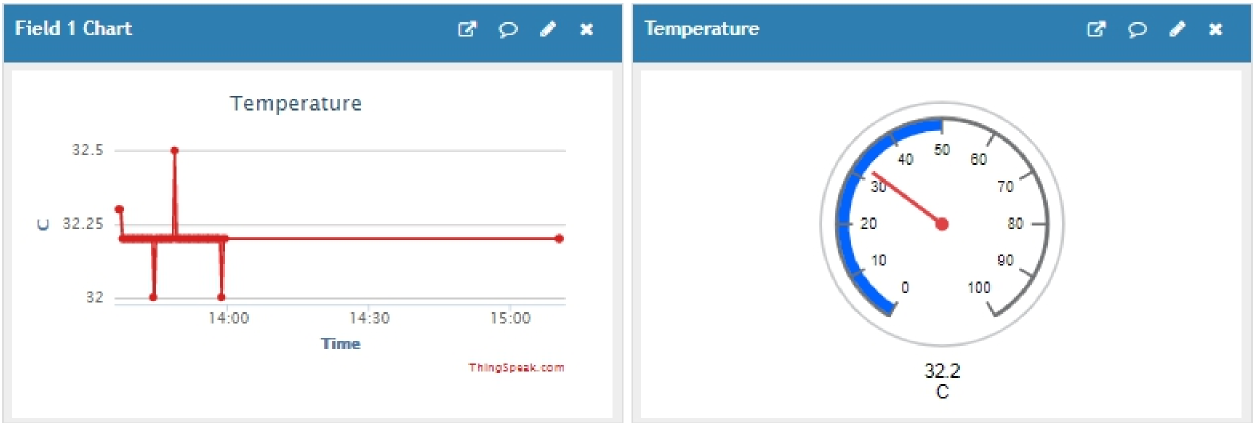


Figure 5.12 Area Temperature

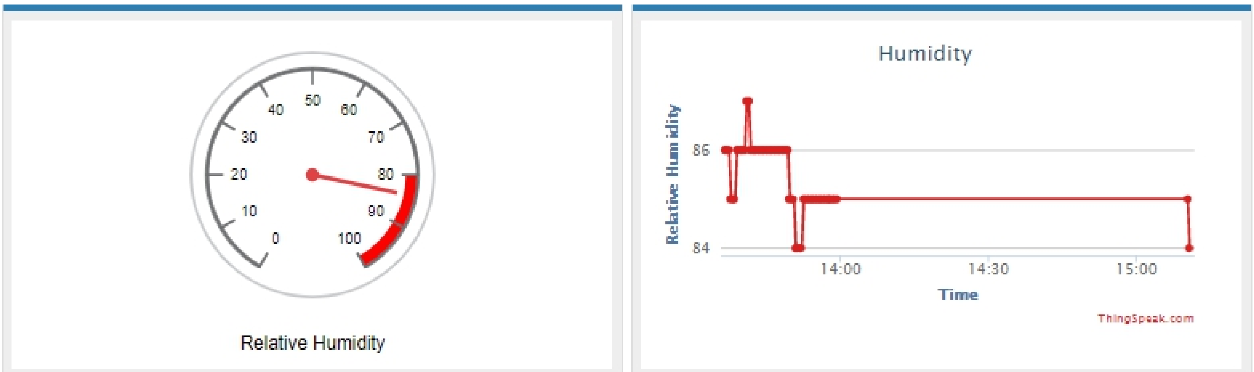


Figure 5.13 Humidity

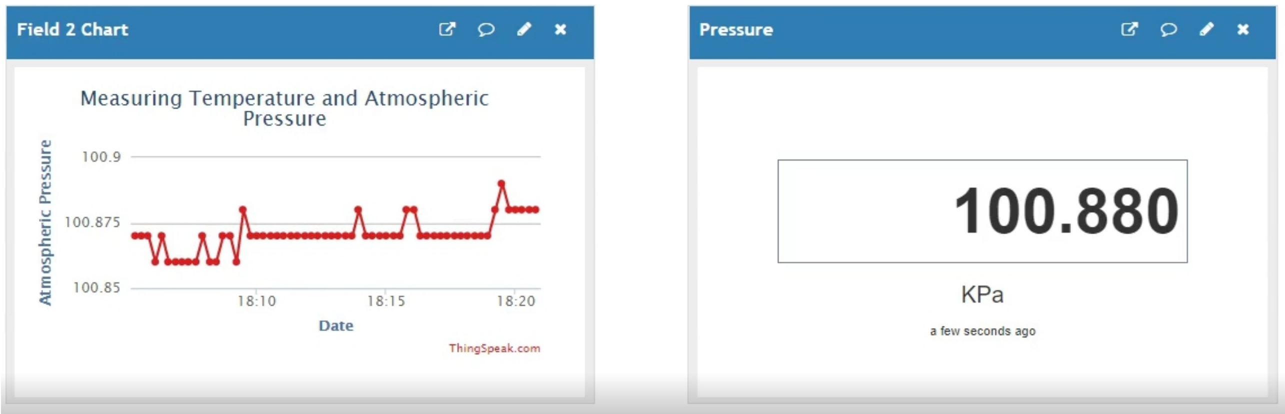


Figure 5.14 Pressure Sensor

CHAPTER 6
CONCLUSION

6.1 Conclusion

With the rapid growth of population and demands, these types of applications are the need of the time to help farmers, especially in India to increase their productivity without much of the labor work. As the industry is growing with rapid race, the involvement of youth is the key factor to drive the growth of the agricultural industry. Based on the problems and research done in this field this type of products is the dire need of today's world so that we can tackle the issues of growth and demand while taking the necessary step to lower the overuse of resources and increasing the production with a sustainable and suitable approach.

CHAPTER 7
FUTURE WORK

7.1 Future Work

This project is in development phase the first step was to implement the sensors and hardware to work as Weather Station. These data shown here are raw data of the environment.The next phase of this project will be to gain data of a particular crop. Make this device more robust. And to implement satellite data of that area along with the on site data and compare and predict the outcomes as according to the past and present data of that area with the help of Machine Leaning Algorithms.

Using a third party server is not that efficient as it does not provide the ability to process the data as users need so we will try to implement a server based project that stores, process and show results to the user without involvement of any third party application.

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