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DEPARTMENT OF
MASTER OF COMPUTER APPLICATIONS

A Project Report on

"IoT Based Smart Agriculture Management System"

Submitted in the partial fulfillment in the requirements for
the IV *semester MCA Academic MinorProject -1 (18MCA46)*

MASTER OF COMPUTER APPLICATIONS

By

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Iot Based Smart Agriculture Monitoring System

R. V. COLLEGE OF ENGINEERING
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(Autonomus Institute under VTU, Belgavi)

CERTIFICATE

This is to certify that the project entitled **"IoT Based Smart Agriculture Monitoring System"** submitted in partial fulfillment of Minor Project -1 (18MCA46) of IV semester MCA is bonafide work carried out by **V. Vidya Priya (1RD19MCA26)** and **Kaviyashree. E (1RV19MCA40)** during the Acadamic year **2020-2021.**

Date :
Place: Bangalore

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1.1 STATEMENT OF THE PROBLEM

Agriculture is the main backbone of Indian economical growth. The most important barrier that arises in traditional farming is climate change. The number of effects of climate change includes heavy rainfall most intense storm and heat waves, less rainfall etc. due to these the productivity decrease to the major extent. Climate change also raises the environmental consequences such as the seasonal change in the life cycle of the plant. The scenario of decreasing water tables, drying up of rivers and tanks, unpredictable environment present an urgent need of proper utilization of water. Enormous growth of human population, rapid industrialization and expansion of habitable zones have led to the depletion of agricultural lands. The prolongation of these circumstances can be extremely alarming and urge nations like India for abundant food production.

Farming in India is done using the mundane ways. The fact that most of our farmers lack proper knowledge makes it even more erratic. A large portion of farming and agricultural activities are based on the predictions, which at times fail. Farmers have to bear huge losses and at times they end up committing suicide.

The existing method and one of the oldest ways in agriculture is the manual method of checking the parameters. In this method the farmers they themselves verify all the parameters and calculate the readings. Agribusiness required the devotion of numerous regular asset including, land, water, and ecological condition, The quality and amount of characteristic asset has debased throughout the years because of monetary issues related with expanded cost of info and diminishing ranch salary always declining land, laboir, resources, and environmental issue, for example, soil and water contamination putting the suitability without bounds horticulture operation at chance.

A large portion of farming and agriculture activities are based on the predections, which at times fail. To overcome this problem we can implement IoT technology.

With the adoption of IoT in various areas like industries, home and even cities ,huge potential is seen to make everything intelligent and smart. Even the agriculture sector is also adopting IoT technology these days and this in turn has led to the development of – Agricultural Internetof Things (IoT).

1.2 BRIEF DESCRIPTION OF THE PROJECT

The project aims at making agriculture smart using automation and IoT technologies.
The highlighting features of this paper includes :

- Smart irrigation with smart control based on real time field data.
- Temperture maintenance and other environmental parameters.
- The recommendation to farmer for smart agriculture.

In the field section, various sensors are deployed in the field like temperature sensor, moisture sensor and ultrasonic sensor.The data collected from these sensors are connected to Microcontroller. The values are generated in the web pages and the farmer gets the detailed description of the values.

This concept will surely accelerate their (user/farmer) business to reach new heights and also be more profitable. The implementation of the project largely depends upon the awareness among farmers, which will be easily created due to its numerous advantages.

Chapter 2 : LITERATURE REVIEW

2.1 Literature Survey

Sl.no	Author and Paper title	Details of Publication	Summary of paper
01	"Wireless Control System for Agriculture Motor", A.D. Kadage, J.D.Gawade	Date: 18 December 2009 Print ISSN : 2157-0477 Electronic ISSN : 2157-0485 DOI:10.1109/ICETET.2009.236 Publisher:IEEE ConferenceLocation: Nagpur,India	Describes about humidity, temperature sensor (working and variation)
02	"Monitoring and crop watering system through smartphones", M.S. Mohd, M.I. Jamallullail, N.A.Mostaman, N.M.Khalid	Date: 11 November 2020 Electronic ISSN : 2773-4773 DOI: https://doi.org/10.30880/mari.20 21.02.01.038 Publisher : IEEE Vol.2 No,1 (2021)	Describes various sensors used in IoT agriculture system. (workingof soil moisture sensor and dc motor, connectd to arduino)
03	"Environmental Smart AgricultureMonitoring System using Internet of Things", Jaideep Nuvvula, Srivatsa Adiraju, Shaik Mubin	Date: 2017 May ISSN: 1814-3395 Volume 115 no.6 2017	Description about moisture sensor, temperature sensor and connection of nodes
04	"Connecting Agriculture to the Internet of Things through sensor network", Junyan Ma, Xingshe Zhou, Zhigang Li	Year : 2011 Publications : IEEE ISSN: 978-0-7695-4580-6/11	A case study of agriculture live stimulation and security challenges. (humidity and temperature sensor)

Sl.no	Author and Paper title	Details of Publication	Summary of paper
05.	“The study and application of the IOT Technology in Agriculture”, Ji-chun Zhao, Jun-fenz Zhang Yu Feng, JianxinGuo	Year: 2010 Publication:IEEE ISSN : 978-1-4244-5540-9/10 2010	Yield monitoring, Forecasting and Harvesting
06.	“SASI : Smart Agriculture System based on IoT”, Venkata Reddy P.S, Nandini Prasad K.S, Puttamadappa C	Year: February 2014 Publication: IEEE ISSN : 978-1-4799-3826-1114 2014	Describes about humidity, temperature, solimoisture sensor (working and validation) connected to arduino and node mcu.
07.	“AgriSys: A Smart and Ubiquitous controlled EnvironmentAgriculture System” Aalaa Abdullah, Shahad Al Enazi, Issam Damaj	Year : 2016 Publication: IEEE ISSN : 978-1-4673-9584-7/16	A case study of agriculture security challenges and live simultion.
08.	“An overview of wireless networks in control and monitoring” G.W.Irwin, J Colandairaj, W.G.Scalon	Year:2016 vol.4114, pp. 1061-1072	Descripton about Moisture sensor,temperature sensor and connection of nodes.

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Sl.no	Author and Paper title	Details of Publication	Summary of paper
09.	“Implementation and study of greenhouse environment surveillance system based on wireless sensor network”, T. Chi, M. Chen, Q. Gao	Year: 2008 ISSN: 1674-3458 Volume 11 2018, pg.no: 145 -153	Describes about yield monitoring, forecasting and harvesting
10.	“Iot based Smart agriculture” Nikesh Gondchawar, Prof. Dr. R.Kawaitkar	Year : 2016 Publication:IEEE Vol.5 no.1(2016) pg.no: 374-379	Describes about variuos sensor used in IoT agriculture systems (i.e smoke detector,soil moisture sensor)
11.	“Survey on IoT and its Applications in Agriculture”, Priyanka Kanupuru;N. V. Uma Reddy	Publication :IEEE Year: 2018,Page(s):1-5 Cited by:Papers (1)	This paper summarizes the existing smart systems with Wireless Sensor Network based sensor monitoring techniques by considering environmental parameters such as temperature, moisture, humidity.his survey also helps in understanding the recent technological developments in Internet of Things for building an efficient smart agricultural system.

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Sl.no	Author and Paper title	Details of Publication	Summary of paper
12.	"Internet of Things (IoT): A Survey", M Divyashree;H G Rangaraju	Publication :IEEE Year: 2018,Page(s):1-6	This paper it is briefed regarding IoT, definition of IoT, characteristics of IoT, functional blocks of IoT, technology and protocols of IoT, applications of IoT, market opportunity of IoT, the perfect match of IoT, Big Data and Cloud computing also IoT today and potential employment of IoT.
13.	"Special section on new technologies for smart farming 4.0", Mumammad shoaib,shamla Riaz	Publication :IEEE Year: October 3,2019 ISSN : 976-1-4673-9584-7/17	This article presents many aspects of technologies involved in the domain of IoT in agriculture,further more ,the connection of IoT based agriculture system with relevant technologies including cloud computing,big data storage and analytics has also been presented.
14.	"Towards smart farming & sustainable agriculture with drones", Paolo Tripicchio	Publication:IEEE Year: februrary 2015 ISSN : 978-1-4244-9584-9/16	Monitoring field using arial Photography
15.	"Precision agriculture monitoring framework based on WSN", Yassine jiber	Publication:IEEE Year:November 2011 ISSN : 978-2-4673-8495-9/20	Study of iFarm online framework for farming
16.	"Using high-resolution airbone and satellite imaginary to access to crop growth and yield variability for precision farming", James Everitt	Publication:IEEE Year: March 2013 ISSN: 1674-3458	Study of different methodologies for crop field analysis using aerial photography

07

Sl.no	Author and Paper title	Details of Publication	Summary of paper
17.	"Research on the agriculture intelligent system based on Iot" , Fubing	Publication :IEEE Year:October 2014 ISSN : 978-1-4244-5540-9/10	Research and study of IoT based intelligent systems used for agriculture
18.	"A monopole-coupled RFID sensor for pervasive soil moisture monitoring", Azhar Hassan	Publication:IEEE Year:April 2013 ISSN : 978-1-4799-3826-1114	Design and implementation of soil moisture sensor
19.	"Smart Agriculture Monitoring System using Internet of Things", Srivatsa Adiraju	Publication:IEEE Year: 2017 May System ISSN: 1814-3395 Volume 115 no.6 2017	Descripton about Moisture sensor, temperature sensor and connection of nodes.
20.	"Application of the IOT Technology in Agriculture", Jun-fenz Zhang, Yu Feng	Publication:IEEE Year: 2010 ISSN : 978-1-4244-5540-9/10	Describes about humidity, temperature, solimoisture sensor (working and validation) connected to arduino and node mcu.

Summary :

By referring the above papers related to "Smart Agriculture Monitoring System", we analyse some of the information about soilmoisture sensor, humidity and temperature sensor, etc.

2.2. Existing and Proposed System

2.2.1. EXISTING SYSTEM

Agriculture is an important sector of Indian Economy as more than half of its population relies on Agriculture as principle source of income. Research and Extension systems play major role in generation and dissemination of Agricultural technologies aiming at enhancing the income of farmers. The existing system adopts series of extension methods such as Training, demonstration, exposure visit to transfer the technologies from lab to land. Majority of these extension efforts mainly focus on location and crop specific technologies, and mostly on solution to problem basis. However, there is a need for equipping the farmers with Basic knowledge of Agriculture in order to create a better knowledge platform at farmer level for taking appropriate farm management decisions and to absorb modern technologies.

LIMITATIONS OF EXISTING SYSTEM

The SMART agriculture based on IoT is basically of data intelligence collected from various sensors and various parameters to take accurate actions and to better predict the crop productivity and quality.

The limitations are not in the motive to use IoT in agriculture but it occurs in technicalities while implementing solutions. Following are the limitations/difficulties:

- Agriculture being a natural phenomenon relies mostly on nature, and man predict or control nature let it be rain,drought, sunlight availability, Pests control etc. So ever implementation IoT system agriculture is required.

- The smart agriculture need availability on internet continuously. Rural part of the developing countries did not fulfil these requirements. Moreover internet is slower.

- Fault sensor or data processing engines can cause faulty l decisions which may lead to over use of water, fertilizers and other wastage of resources.

- The smart farming based equipment require farmer to understand and learn the use of technology. This is the major challenge in adopting smart agriculture framing at large scale across the continues.

- It also has some issues which have to be tracked properly in order to attain the full benefit of it.

2.2.2. PROPOSED SYSTEM 09

In the field section, various sensors are deployed in the field like temperature sensor and moisture sensor. The data collected from these sensors are connected to the microcontroller. Other parameters like the temperature, humidity, moisture and the Ultrasonic sensors shows the threshold value and the water level sensor is used just to indicate the level of water inside a tank or the water resource.

In this, the system collects all the data from various sensors like temperature, humidity, moisture and other environmental factors and will do the analysis on the same. During analysis if gets better result of the combination of the data gathered from the various sensor then those data to all the volunteer for further use. The system will contain many module at various geographical position and all these modules will send the data to this platform, ,which will give some idea to focus on the environmental factor, which are good for the crop or farm.

ADVANTAGES OF PROPOSED SYSTEM

- **Data collected by smart agriculture sensors,** e.g. weather conditions, soil quality, crop's growth progress or cattle health. This data can be used to track the state of your business in general, as well as staff performance, equipment efficiency, etc.

- **Better control over the internal processes and, as a result, lower production risks.** The ability to foresee the output of your production allows you to plan for better product distribution. If you know exactly how much crops you are going to harvest, you can make sure your product won't lie around unsold.

- **Cost management and waste reduction thanks to the increased control over production.** Being able to see any anomalies in the crop growth or livestock health, you will be able to mitigate the risks of losing your yield.

- **Increased business efficiency through process automation.** By using smart devices, you can automate multiple processes across your production cycle, e.g. irrigation, fertilizing, or pest control.

- **Enhanced product quality and volumes.** Achieve better control over the production process and maintain higher standards of crop quality and growth capacity through automation.

Smart agriculture with the help of automation and sensor technology, benefits the society in the following ways

- Conservation of water
- Optimization of energy resources.
- Better crop yield
- Pollution prevention
- Eliminate human errors
- Time efficiency , accurate diagnosis of nutrient deficiency

2.3 Components / Sensors used :

Arduino UNO Board

The Arduino UNO is one of the most used microcontrollers in the industry. It is very easy to handle, convenient, and use. The coding of this microcontroller is very simple. The program of this microcontroller is considered as unstable due to the flash memory technology. The applications of this microcontroller involve a wide range of applications like security, home appliances, remote sensors, and industrial automation. This microcontroller has the ability to be joined on the internet and perform as a server too. Arduino also makes simpler the working process of microcontroller, but it gives some advantages over other systems for teachers, students and beginners.

- Inexpensive
- Cross-platform
- Simple, clear programming environment
- Open source and extensible software
- Open source and extensible hardware

Figure : Arduino Board

Soil Moisture Sensor

Soil moisture sensor is one kind of sensor used to detect the soil moisture content. This sensor has two outputs like the analog output as well as the digital output.

The digital output is permanent and the analog output threshold can be changed. The working principle of soil moisture sensor is open & short circuit concept. Here the LED gives an indication when the output is high or low.

- When the condition of the soil is dried up, the flow of current will not flow through it. So it works like an open circuit. Therefore the output will be maximized.
- When the soil condition is soaked, the flow of current pass from one terminal to the other. So it works like a closed circuit. Therefore the output will be zero.

Here sensor is coated with platinum, and anti-rust to make higher efficiency as well as long life. The sensing range is also high which will pay for the farmer at a minimum cost.

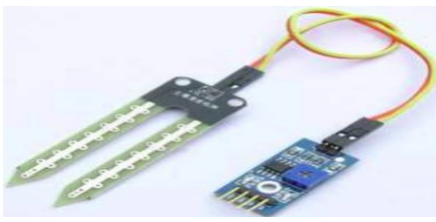


Figure : Soil Moisture Sensor

DHT11 **11**

The DHT11 is a commonly used Temperature and humidity sensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers.

The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%.

The DHT11 calculates relative humidity by measuring the electrical resistance between two electrodes. The humidity sensing component of the DHT11 is a moisture holding substrate with the electrodes applied to the surface. When water vapour is absorbed by the substrate, ions are released by the substrate which increases the conductivity between the electrodes. The change in resistance between the two electrodes is proportional to the relative humidity. Higher relative humidity decreases the resistance between the electrodes while lower relative humidity increases the resistance between the electrodes.

The DHT11 converts the resistance measurement to relative humidity on an chip mounted to the back of the unit and transmits the humidity and temperature readings directly to the Arduino

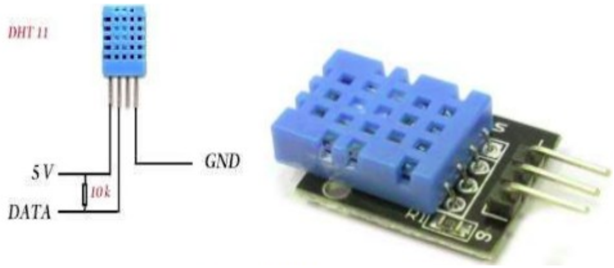


Figure : DH11 Sensor

JUMPER WIRES:

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

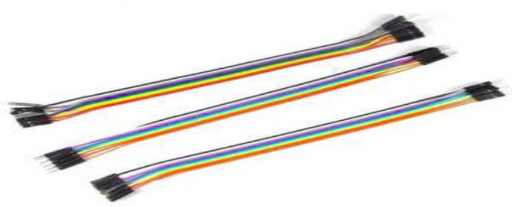


Figure : Jumper wires

MQ-135

Air quality sensor for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful gases. It is with low cost and particularly suitable for Air quality monitoring application.

Features:

- High Sensitivity
- High sensitivity to Ammonia, Sulfide and Benze
- Stable and Long Life
- Detection Range: 10 - 300 ppm NH3, 10 - 1000 ppm Benzene, 10 - 300 Alcohol
- Heater Voltage: 5.0V
- Dimensions: 18mm Diameter, 17mm High excluding pins, Pins - 6mm High

Figure : MQ-134

NodeMCU

The NodeMCU is a development board featuring the popular ESP8266 Wi-Fi chip. As it turns out, you can program the ESP8266 just like any other microcontroller. Its obvious advantage over the Arduino or PIC is that it can readily connect to the Internet via Wi-Fi. However, the ESP8266 breakout board has limited pins although the chip itself has a lot of output ports. The NodeMCU solves this problem by featuring 10 GPIO pins each capable of using PWM, I2C and 1-wire interface.

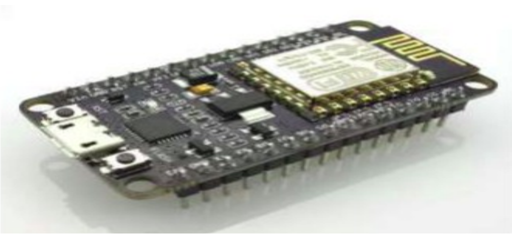


Figure: Node MCU

WATER MOTOR AND MOTOR DRIVER

Motor drives are circuits used to run a motor. In other words, they are commonly used for motor interfacing. These drive circuits can be easily interfaced with the motor and their selection depends upon the type of motor being used and their ratings (current, voltage).

For DC Motors :

The major motor drive components for DC motors are: a controller, a motor driver IC or a motor driver circuit, the desired DC motor being used, power supply unit and the necessary connections to the motor.

1. **Controller:** The controller can be a microprocessor or a microcontroller.

2. **Motor Driver IC or Motor Driver Circuits:** They are basically current amplifiers which accept the low current signal from the controller and convert it into a high current signal which helps to drive the motor.

3. **Motor:** Motor is defined as an electric or mechanic device that can create a motion. While interfacing with the controller; some of the motors like DC motor, stepper motor and brushless dc motor may require a driver IC or driver circuit. DC motor is a type of motor that can convert DC into a mechanical power. In a brushless DC motor, it consists of a DC power source, an inverter producing an AC signal to drive the motor. While stepper motor is a brushless DC electric motor that converts electrical pulses into discrete mechanical motions.

4. **Power Supply Unit:** Provides the required power to the motor drive.

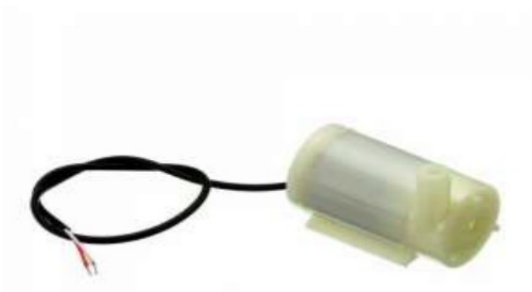


Figure: D C Motor

Figure: Motor Driver

Chapter 3: SOFTWARE REQUIREMENT SPECIFICATIONS

3.1 FUNCTIONAL REQUIREMENTS

The successive requirements specify the functions and units of the proposed system.
They characterize the behaviour of the system relating to necessity:

- Measure Temperature.
- Gauge Humidity.
- Quantify the water level.
- Estimate the light intensity.
- Display the sensor readings on the LCD screen
- Allow user to modify the optimal values for the sensor.
- Respond to sensor readings and send alerts to the user.

Temperature and Humidity Sensor:

- The DHT11 is a low-cost digital temperature and humidity sensor. This sensor takes input from surroundings and gives digital signal as output. It consists of thermistor and humidity sensor through. As the sensor is of small size, consumes low power and transmit signal up to 20-meter range.

- The DHT11 converts the resistance measurement to relative humidity on an chip mounted to the back of the unit and transmits the humidity and temperature readings directly to the Arduino Nano

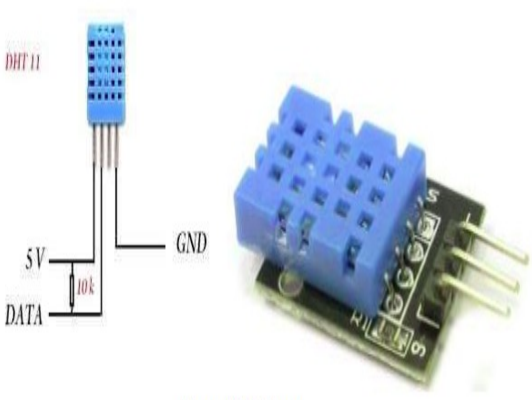


Figure : DHT11 Sensor

Sensor Model	DHT11
Voltage	+5V
Input	Temperature and humidity in surroundings
Output	Digital Signal
Units	Temperature in Celsius and Humidity in Percentage

Soil Moisture Sensor :

The Soil moisture Sensor uses capacitance to measure the water content in soil by measuring the di-electric permittivity of it. When we insert this sensor into the soil which is to be tested, then the water content present in the soil is reported in percentage.

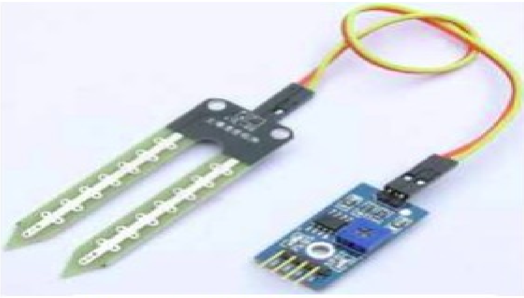


Figure : Soil Moisture Sensor

Sensor Model	SHT10
Voltage	+3.3V
Input	Water
Output	Analog Signal
Units	Percentage

Gas Sensor :

- The gas sensor uses a small heater inside with an electro-chemical sensor. It is sensitive for a range of gases and are used mainly indoors at room temperature. This sensor can be calibrated, but a known concentration of the measured gas or gases is needed for that calibration.
- Air quality sensor for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful gases. It is with low cost and particularly suitable for Air quality monitoring application.

Figure : MQ-135

Sensor Model	MQ135
Voltage	+3.3V
Input	Alcohol, dangerous gases like Carbon Monoxide (CO)
Output	Analog Signal
Units	Percentage

Wi-Fi (Node) Module :

The ESP8266 Wi-Fi Module is an independent system on chip with built-in TCP/IP protocol stack which allows the microcontroller to access the Wi-Fi network. The ESP8266 has the potential of either hosting an application or discharging the Wi-Fi networking functions entirely from an additional application processor.

Figure : NodeMCU

Model no	ESP8266
IEEE Protocol	802.11 b/g/n
Flash Memory	1 MB
Wakeup Time	<2ms
Bandwidth	Up to 300 Mbps

Arduino UNO Board :

The Arduino UNO microcontroller involve a wide range of applications like security, home appliances, remote sensors, and industrial automation. This microcontroller has the ability to be joined on the internet and perform as a server too.

Applications of Arduino UNO microcontroller are:

- Inexpensive
- Cross-platform
- Simple,clear programming environment
- Open source and extensible software
- Open source and extensible hardware

Figure : Arduino Board

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin : Input voltage to Arduino when using an external power source. 5V : Regulated power supply used to power microcontroller and other components on board. 3.3V : Supply generated by on-board voltage regulator. GND : ground pins.
Reset	Reset	Reset the micro-controller.
Analog Pins	A0-A5	Used to provide analog input in the range of 0-5V.
Input/Output pins	Digital Pins 0-13	Can be used as input/output pins.
Serial	0(Rx),1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2,3	To trigger an interrupt.
PWM	3,5,6,9,11	Provides 8-bit PWM output.

3.2 NON FUNCTIONAL REQUIREMENT

The non-functional requirements of this work access the following:

• Availability:
The proposed manoeuvred successfully all the time.

• Reliability:
The system has longer lifespan and the measurements are accurate.

• Maintainability:
The proposed system upgraded at ease by simply integrating components with enhanced features.

• Easy of use:
The proposed system is easy to comprehend and grasp. The usage of the system doesn't require any prior knowledge.

Chapter 4: SYSTEM DESIGN

4.1 System Perspective /Architectural Design

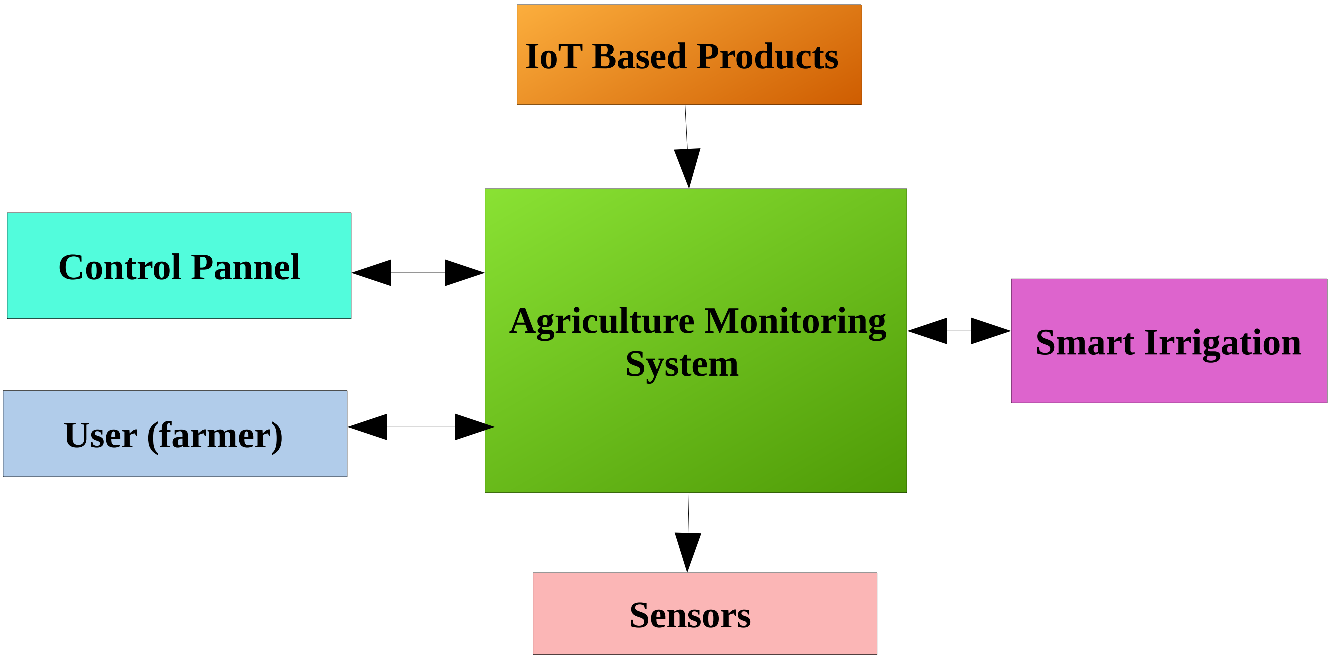


Figure 4.1 : Process Diagram

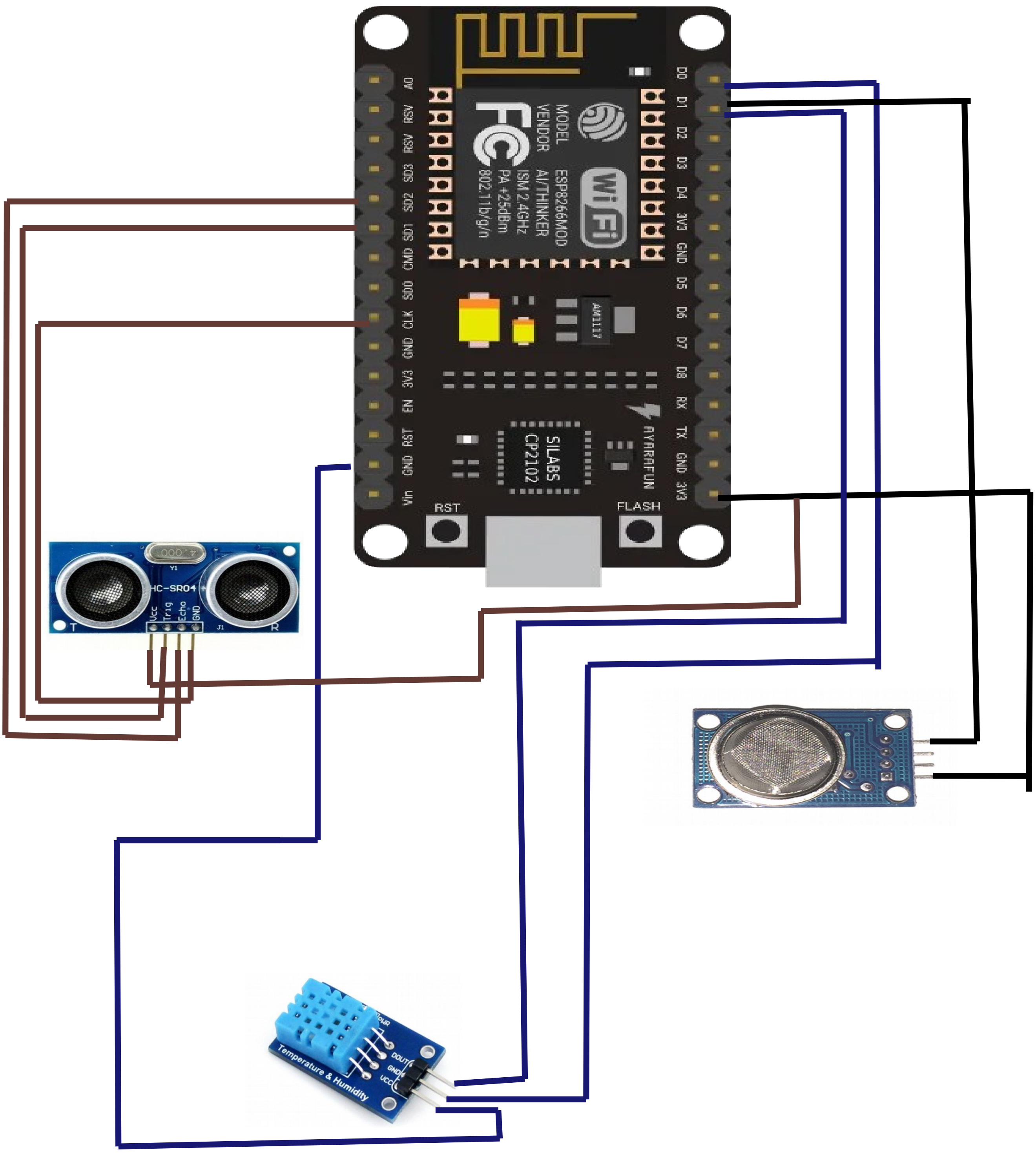


Figure 4.2: Block/Circuit Diagram

4. 2 CONTEXT DIAGRAM :

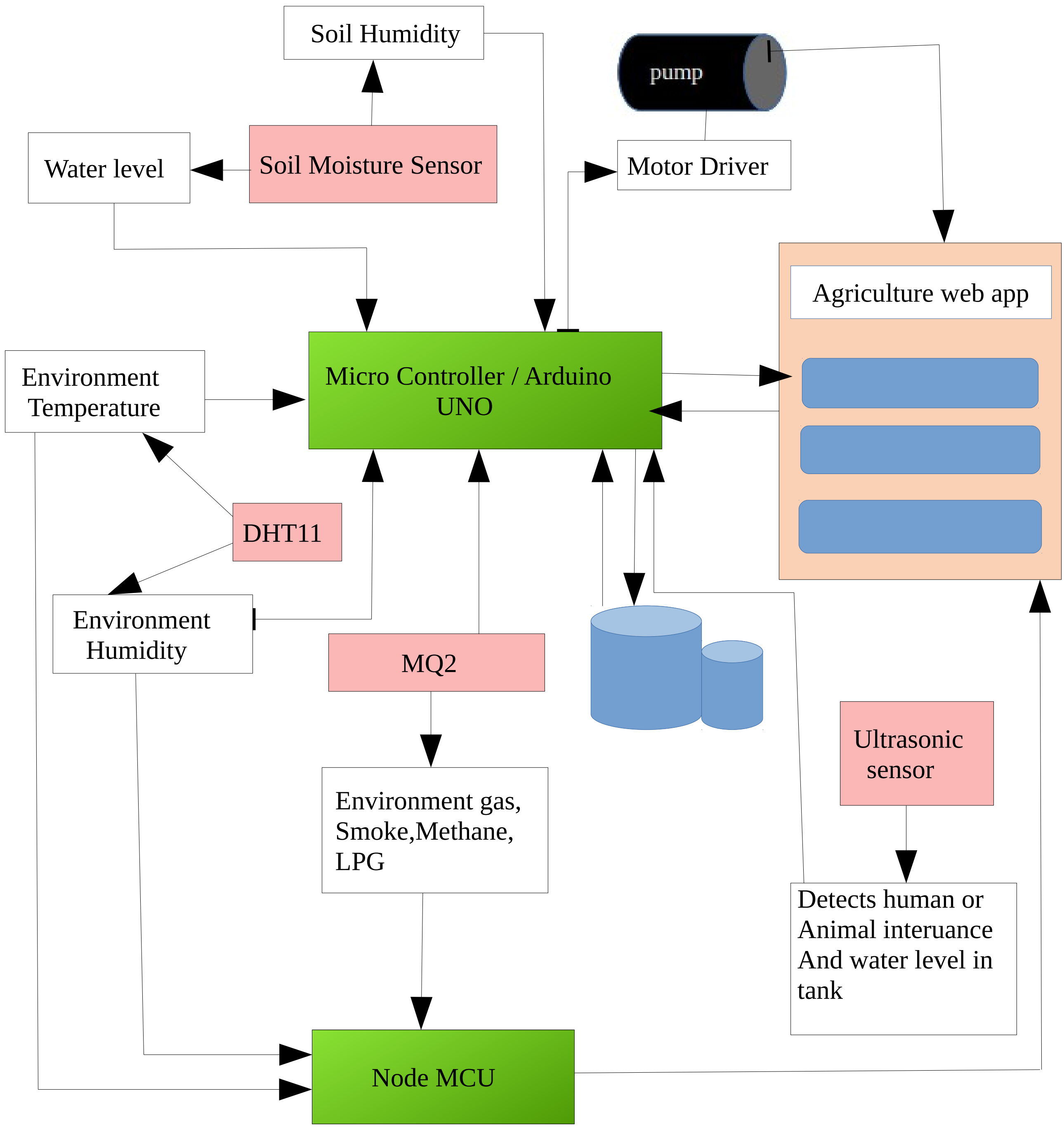


Figure 4.3: Context diagram

Chapter 5: DETAILED DESIGN

5.1 System Design

Objectives:

- **To enable farmers with technology :**

  If the farmers are well learned and have great knowledge about the advantage of using particular technologies,then they will have more interest in using technologies and doing farming work. They will educate others too about this thing and the user will also be increase gradually. Therefore, there is high chance of reducing the rural-urban migration which has many advantages such as solution for water crisis, solution for environmental problems (pollution, soil erotion ,drought etc.,)

- **Stabilize growth :**

  Stabilize growth means to maintain stable agricultural and other farming activities . Since there are high probability of facing food crisis, environment crisis and most probably the ecoonomy crisis.Farmers can stay stable and face such crisis if they have proper technical knowledge and methods to do farming.
  With the help of IoT farmers can overcome and solve many problems.

- **Sustain farming:**

  Sustain farming means the system of plant and animals production that will last for the long term having minimal side effects.
  For example: to satisfy human basic needs we need to enhance environmental quality and natural resources but without any technologies and system it is quite tough to meet the requirements.
  So IoT helps in meeting demand of the sustain farming.

5.1.1 Object Modeling

CLASS DIAGRAM

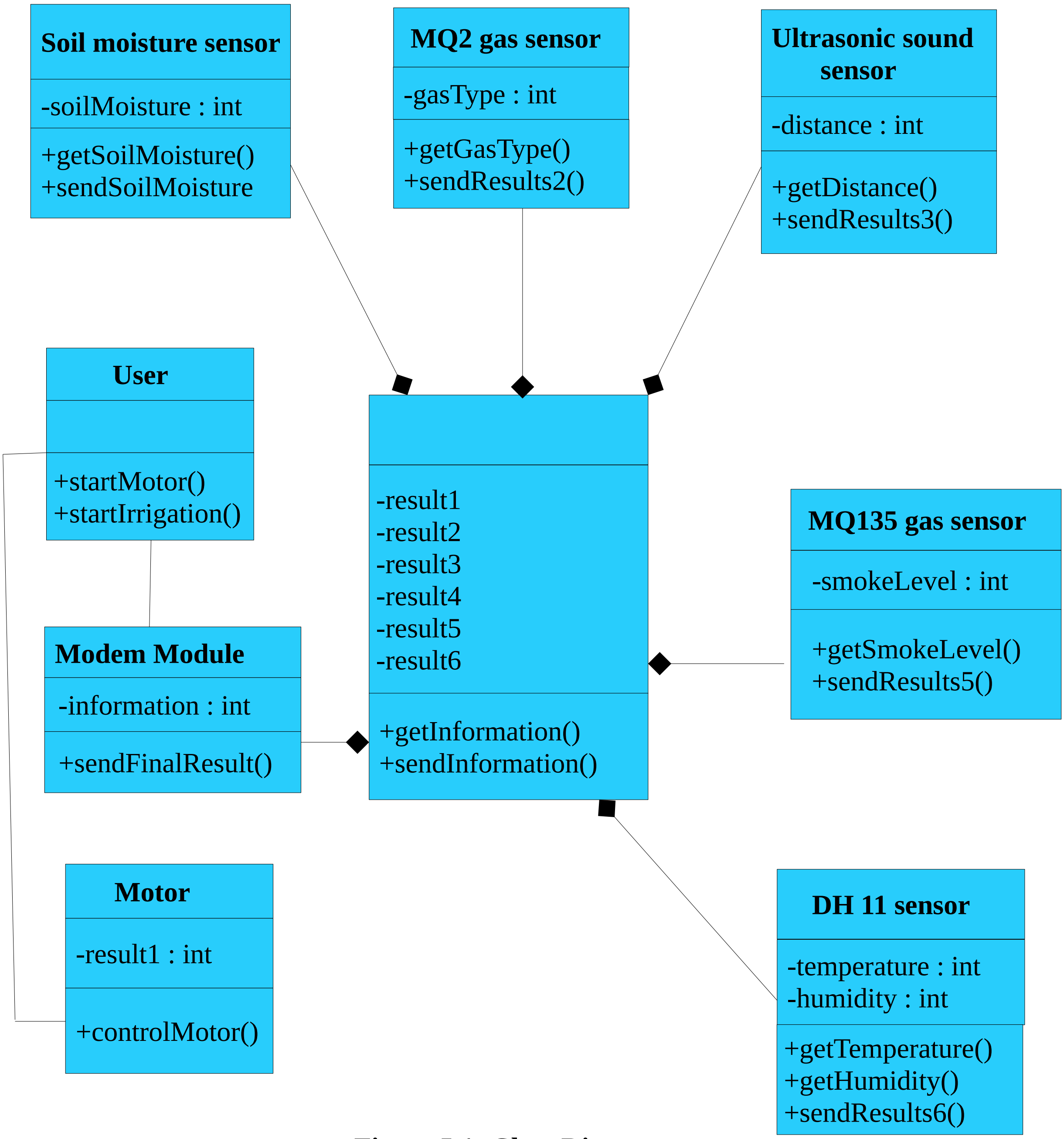


Figure 5.1: Class Diagram

5.1.2 DYNAMIC MODELING

USE CASE DIAGRAM :

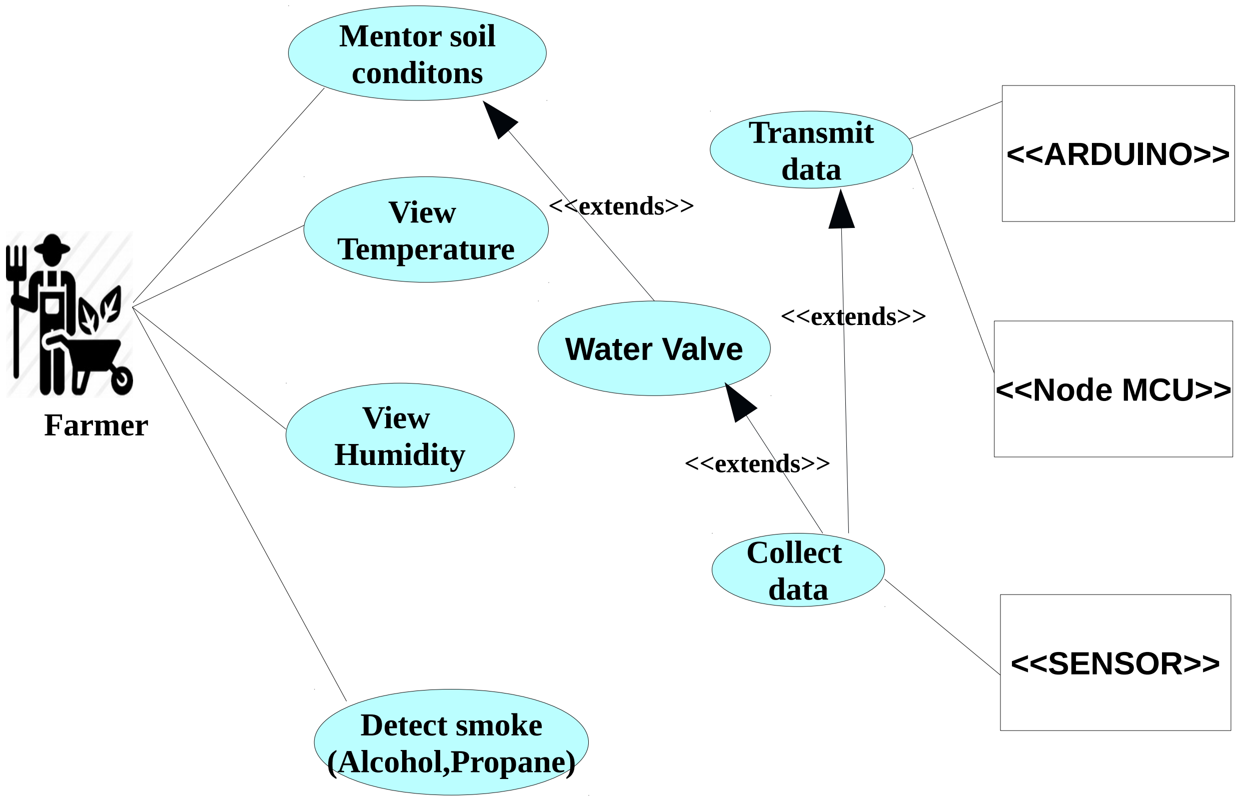


Figure 5.2: Usecase Diagram

ACTIVITY DIAGRAM :

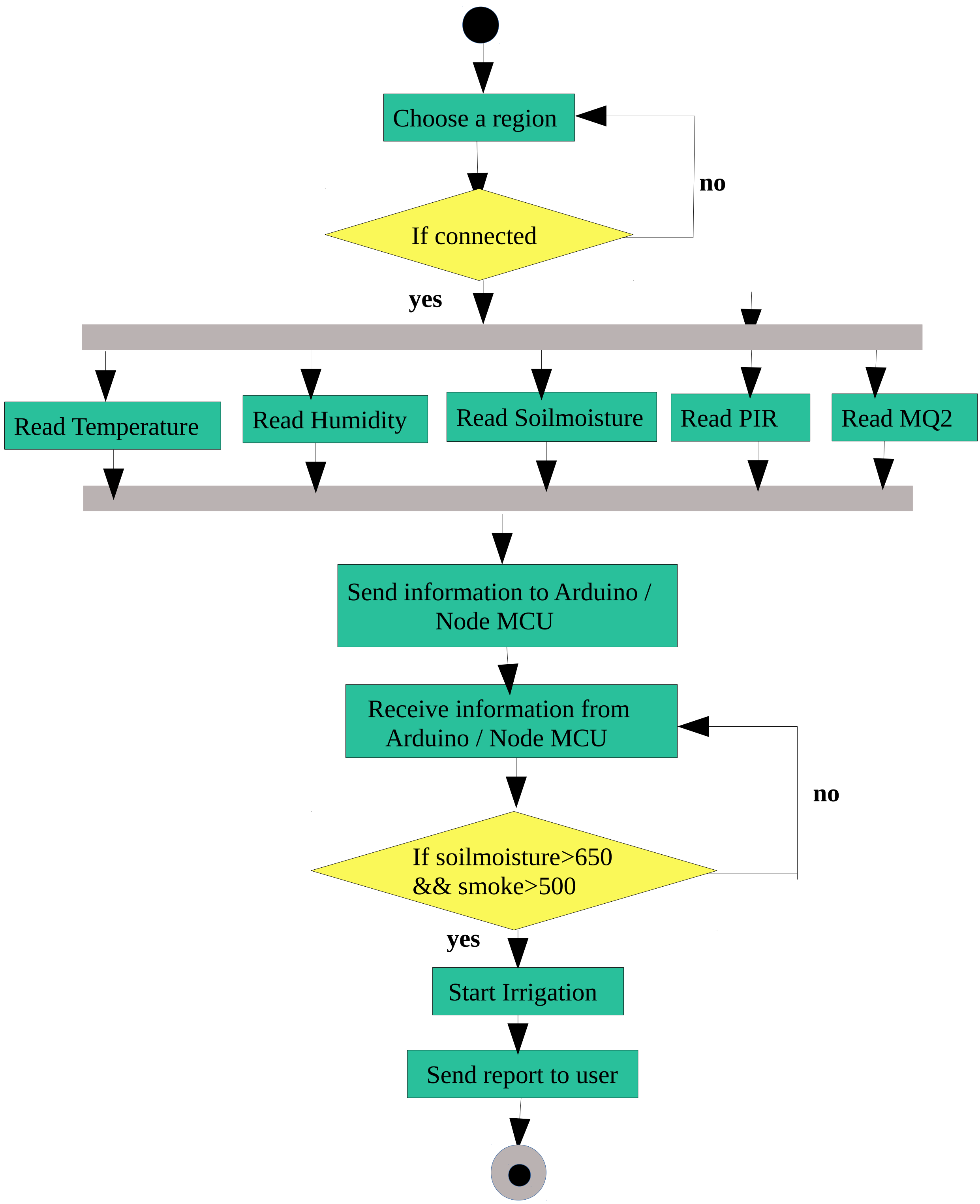


Figure 5.3: Activity Diagram

SEQUENCE DIAGRAM :

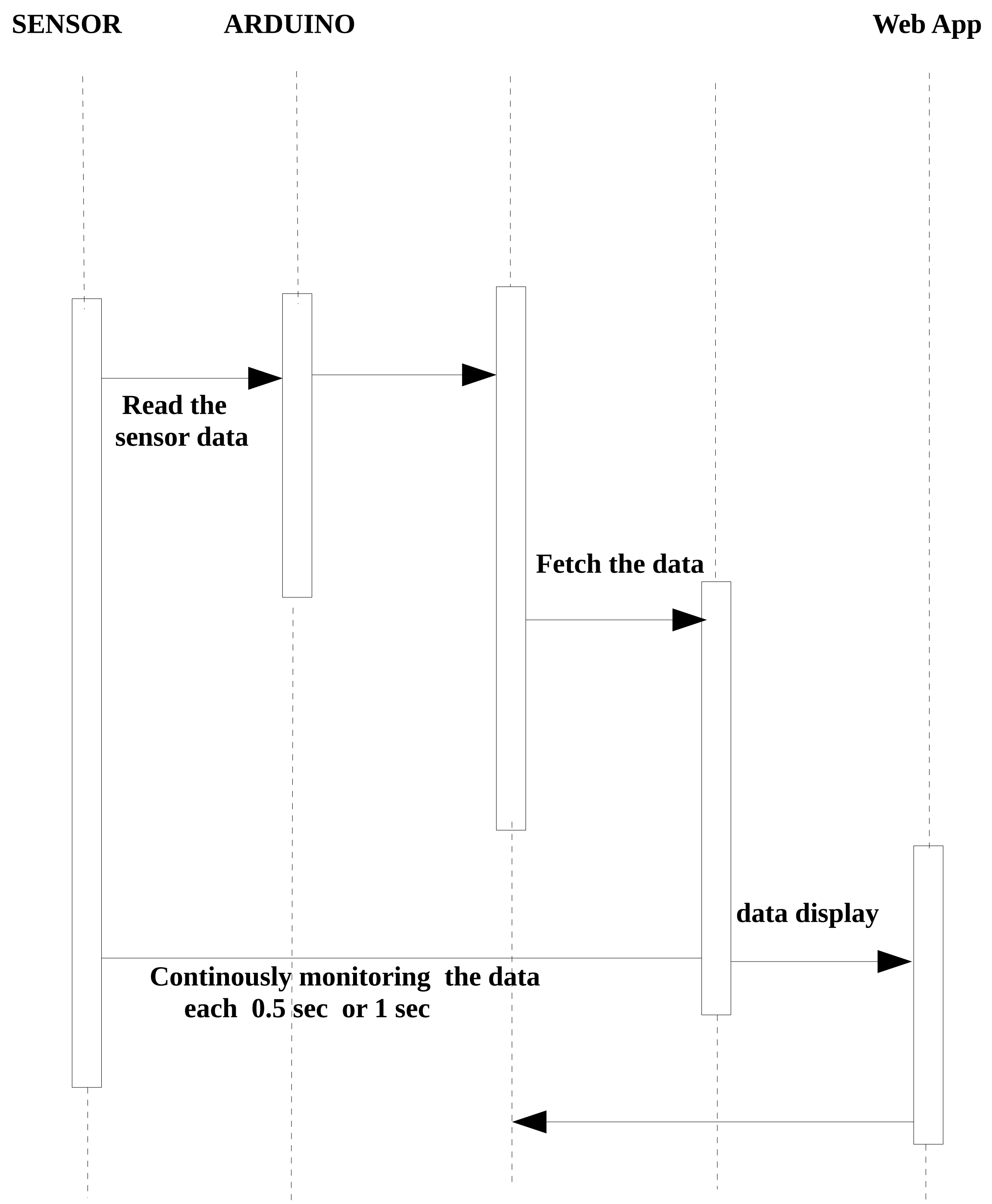


Figure 5.4 : Sequence Diagram

5.1.3 FUNCTIONAL MODELING :

DATA FLOW DIAGRAM :

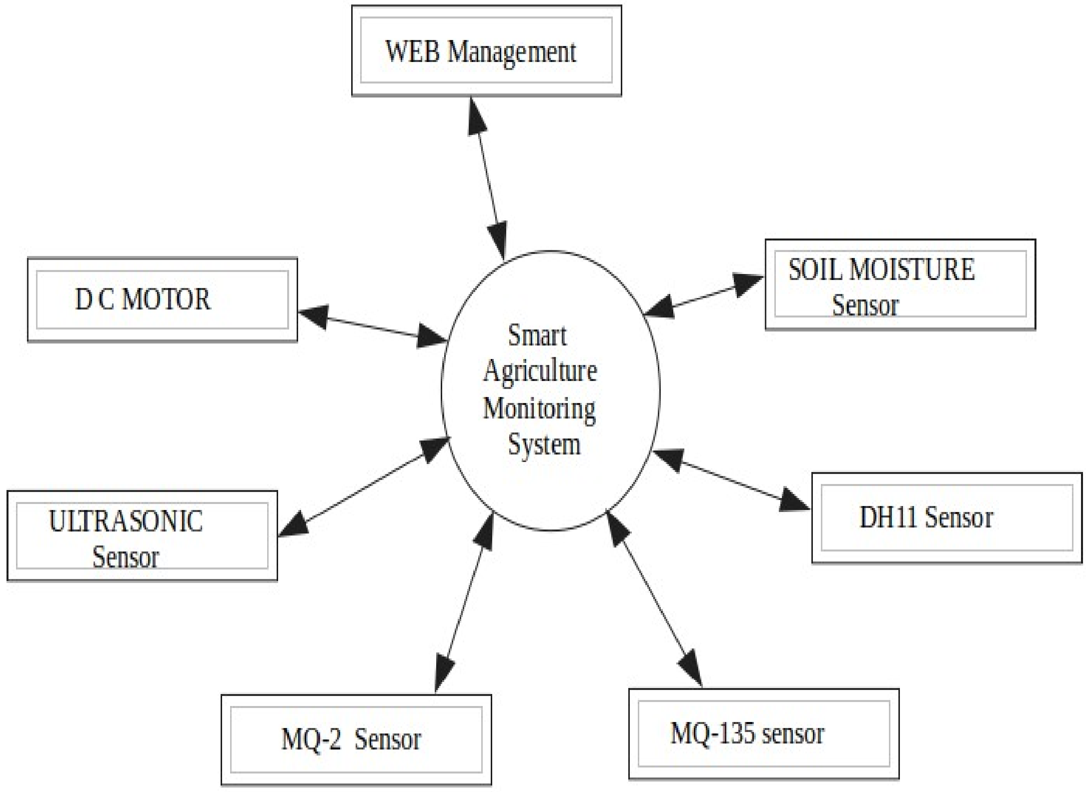


Figure 5.5: Zero Level DFD – Smart Agriculture Monitoring System

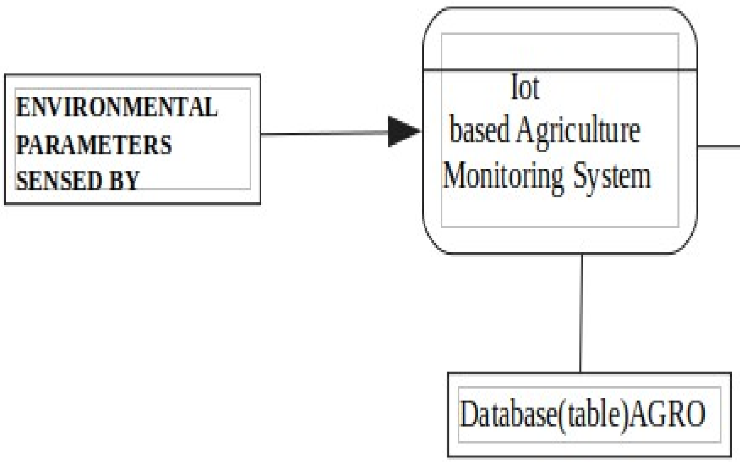


Figure 5.6: First Level DFD – Smart Agriculture Monitoring System

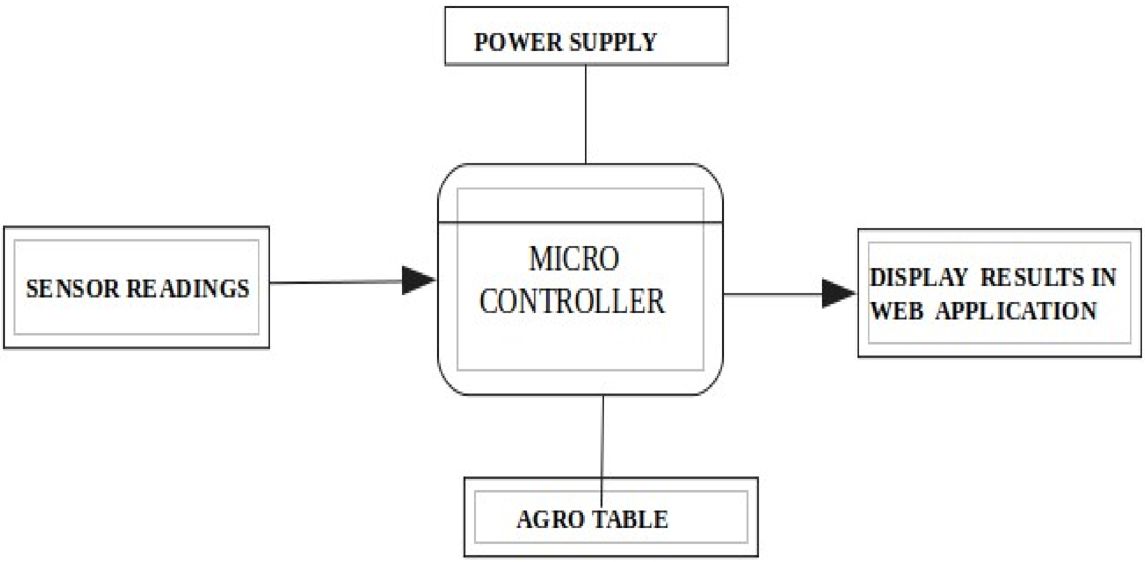


Figure5.7: Second Level DFD – Smart Agriculture Monitoring System

Chapter 6 : IMPLEMENTATION

6.1 CODE SNIPPET :

Arduino Code

```
const int trigPin=9;
const int echoPin=10;
long distance;
int duration;
void setup() {
        pinMode(trigPin,OUTPUT);
        pinMode(echoPin,INPUT);
        Serial.begin(115200);
                }
void loop() {
        digitalWrite(2,LOW);
        Serial.println("======================================================");
        Serial.println("");
        digitalWrite(trigPin,LOW);
        delayMicroseconds(2);
        digitalWrite(trigPin,HIGH);
        delayMicroseconds(10);
        digitalWrite(trigPin,LOW);
        duration=pulseIn(echoPin,HIGH);
        distance=duration*0.034/2;
        Serial.println("Duration :");
        Serial.println(duration);
        Serial.println("Distance :");
        Serial.println(distance);
        Serial.print(" Soil moisture is : ");
        Serial.println(analogRead(A1));
        if (analogRead(A1)>=650)
        {
                Serial.println("The motor is turned on.");
                digitalWrite(3,HIGH);
                digitalWrite(7,LOW);
        }
        else
        {
                Serial.println("The motor is turned off.");
                digitalWrite(3,LOW);
                digitalWrite(7,HIGH);
        }
        delay(4000);
```

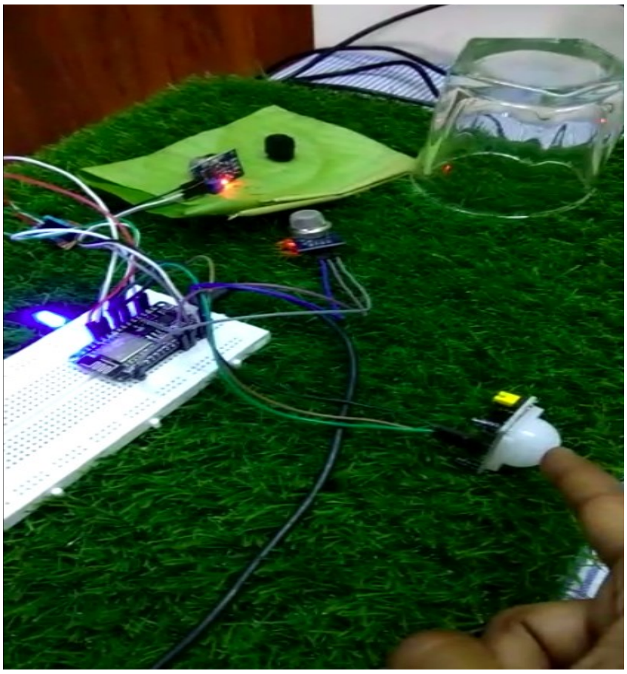
Node MCU

```
#include<ESP8266WiFi.h>
#include “DHT.h”
#define DHTPIN D1
#define DHTTYPE DHT11
const int echoPin=D7;
long distance;
int duration;
const char* ssid = "admin123";
const char* password = "Admin@123";
const char* host = "agro-smart.000webhostapp.com";
DHT dht(DHTPIN, DHTTYPE);
void setup() { Serial.begin(115200);
delay(100);
dht.begin();
Serial.println();
Serial.println();
Serial.print("Connecting to ");
Serial.println(ssid);
WiFi.begin(ssid, password);
while (WiFi.status() != WL_CONNECTED)
    {
delay(500); Serial.print(".");
}
        Serial.println("");
        Serial.println("WiFi connected");
        Serial.println("IP address: ");
        Serial.println(WiFi.localIP());
        Serial.print("Netmask: ");
        Serial.println(WiFi.subnetMask());
        Serial.print("Gateway: ");
        Serial.println(WiFi.gatewayIP());
}
void loop()
{
        duration=pulseIn(echoPin,HIGH);
        distance=duration*0.034/2;
        Serial.println("Duration :");
        Serial.print(duration);
        int digitalSensor2=digitalRead(D3);
        Serial.println("Air Sensor : ");
        Serial.print((digitalRead(D3)));
```

```
    if (digitalRead(D3) == 0)
    {
            Serial.println("\n Gas detected");

    }
     else if(digitalRead(D3)==1)
    {
            Serial.println("\n Atmosphere is safe");
    }

int analogSensor135=analogRead(A0);
    Serial.print("Air Sensor : ");
    Serial.print((analogRead(A0)));
    if (analogRead(A0) > 880)
    {
            Serial.println("\n Gas detected");
     }
    else
    {
            Serial.println("\n Atmosphere is safe");
    }
    float h = dht.readHumidity();
    float t = dht.readTemperature();
    f (isnan(h) || isnan(t))
    {
            Serial.println("Failed to read from DHT sensor!");
            return;
    }
    Serial.print("connecting to ");
    Serial.println(host);
    WiFiClient client;
    const int httpPort = 80;
    if (!client.connect(host, httpPort))
    {
      Serial.println("connection failed");
   return;
     }
    String url = "/api/weather/insert.php?temp=" + String(t) + "&hum="+ String(h);
    Serial.print("Requesting URL: ");
    Serial.println(url);
    client.print(String("GET ") + url + " HTTP/1.1\r\n" + "Host: " + host + "\r\n" + "Connection:
    close\r\n\r\n");
    delay(500);
    while(client.available())
```

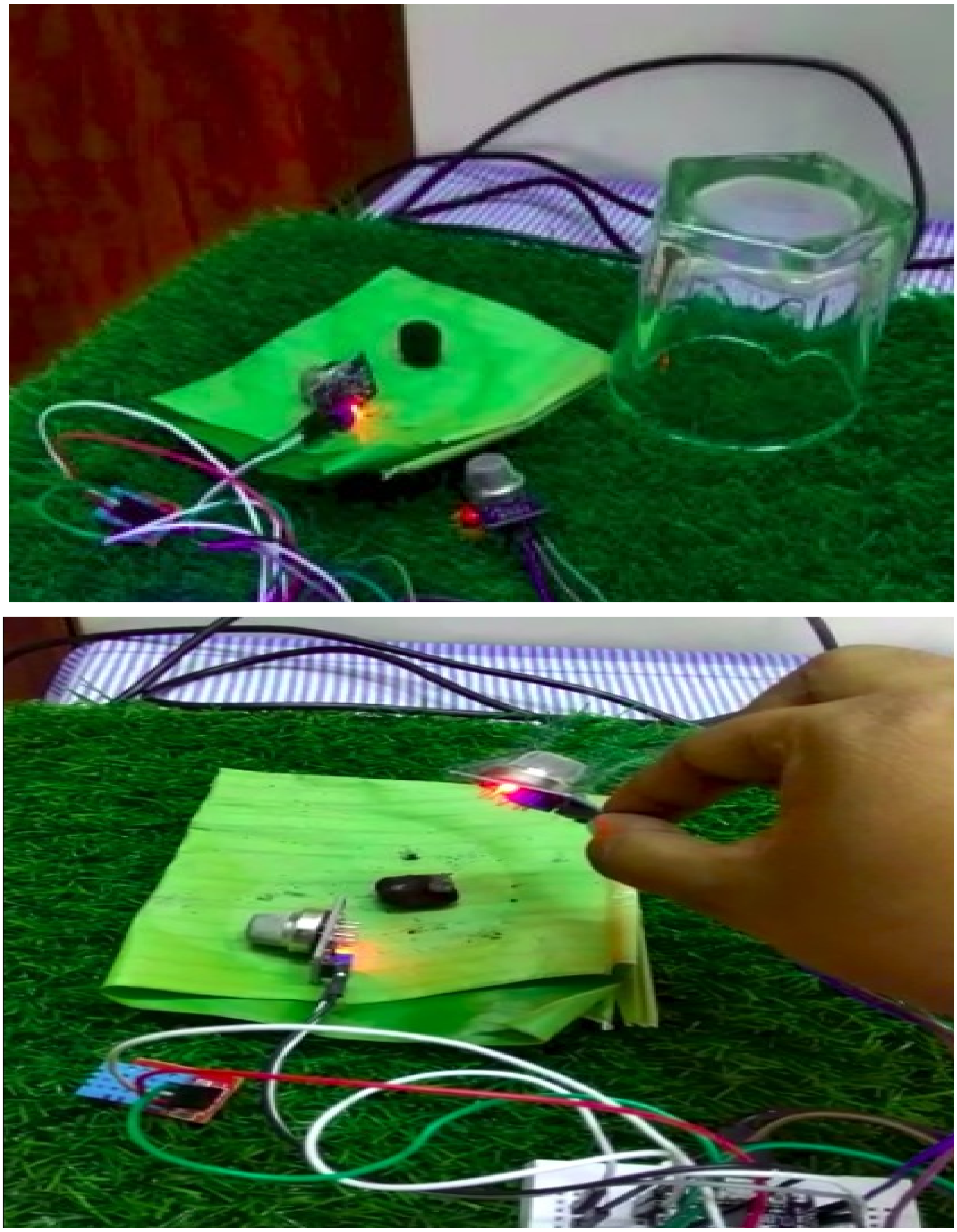
```
        {
                String line = client.readStringUntil('\r');
                Serial.print(line);
        }
        Serial.println();

        Serial.println("closing connection");
        Serial.println("Motor Status");
        Serial.print(digitalRead(D6));
        delay(5000);
}
```

6.2 IMPLEMENTATION :

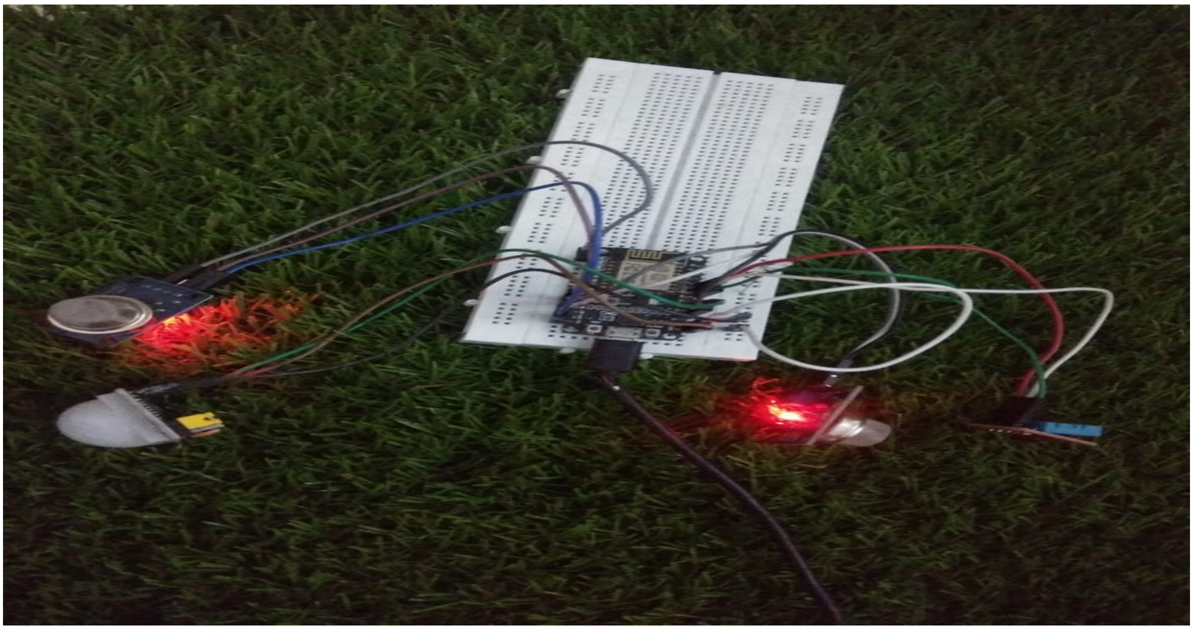


Ultrasonic sensor detecting the Intruder and alert the user by The led light.

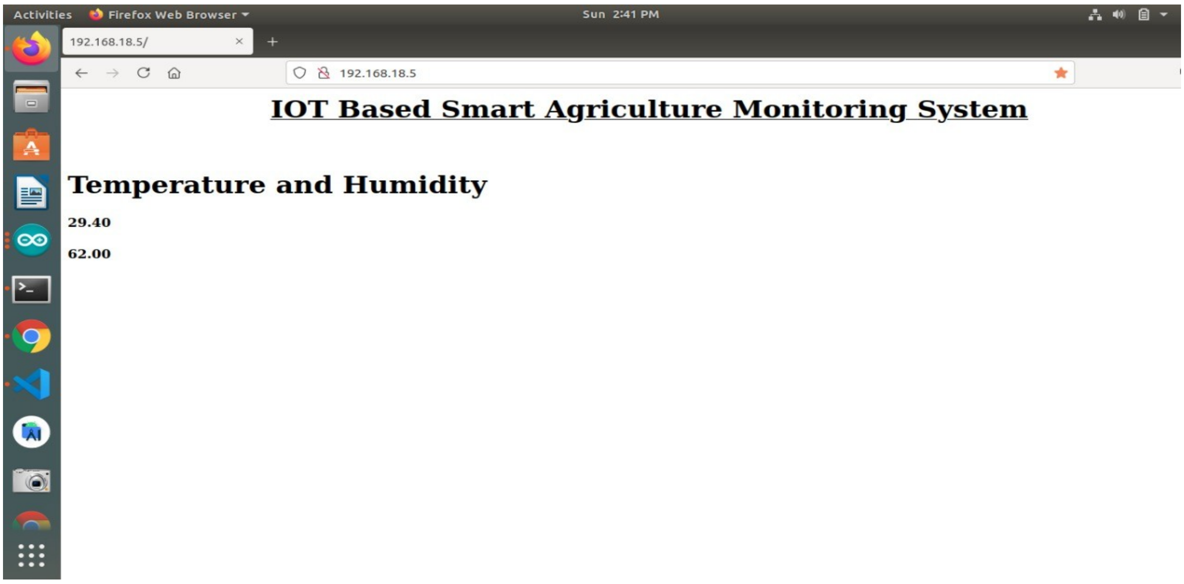
Ultrasonic sensor(HC -SR04) when there is no Intruder.



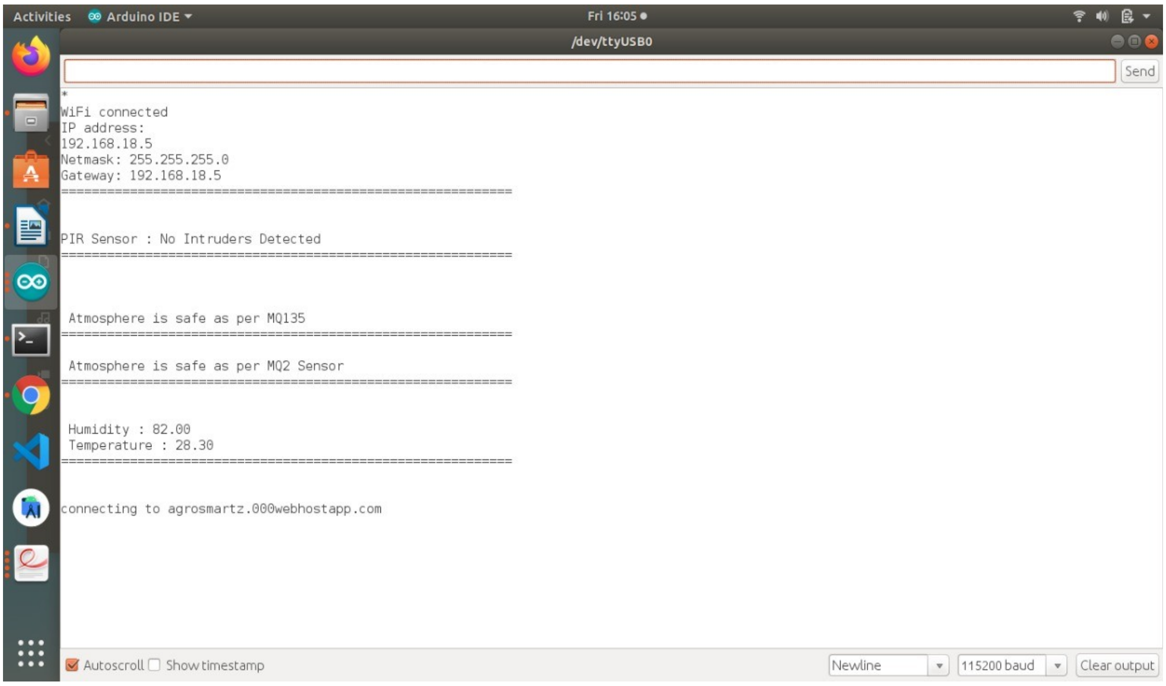
MQ2 sensor detecting the smoke

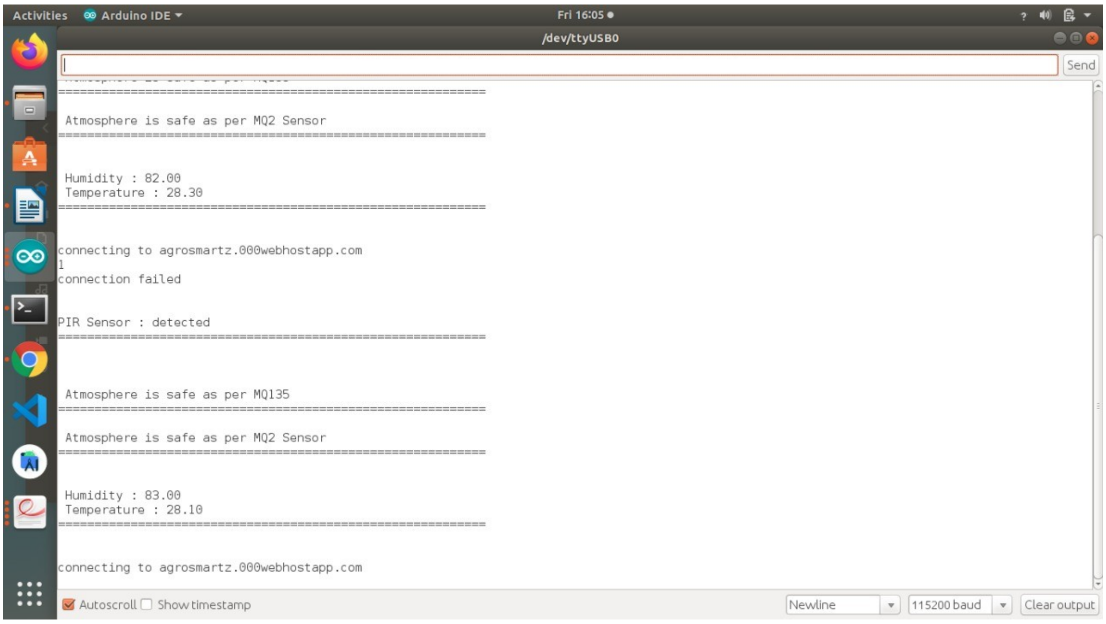


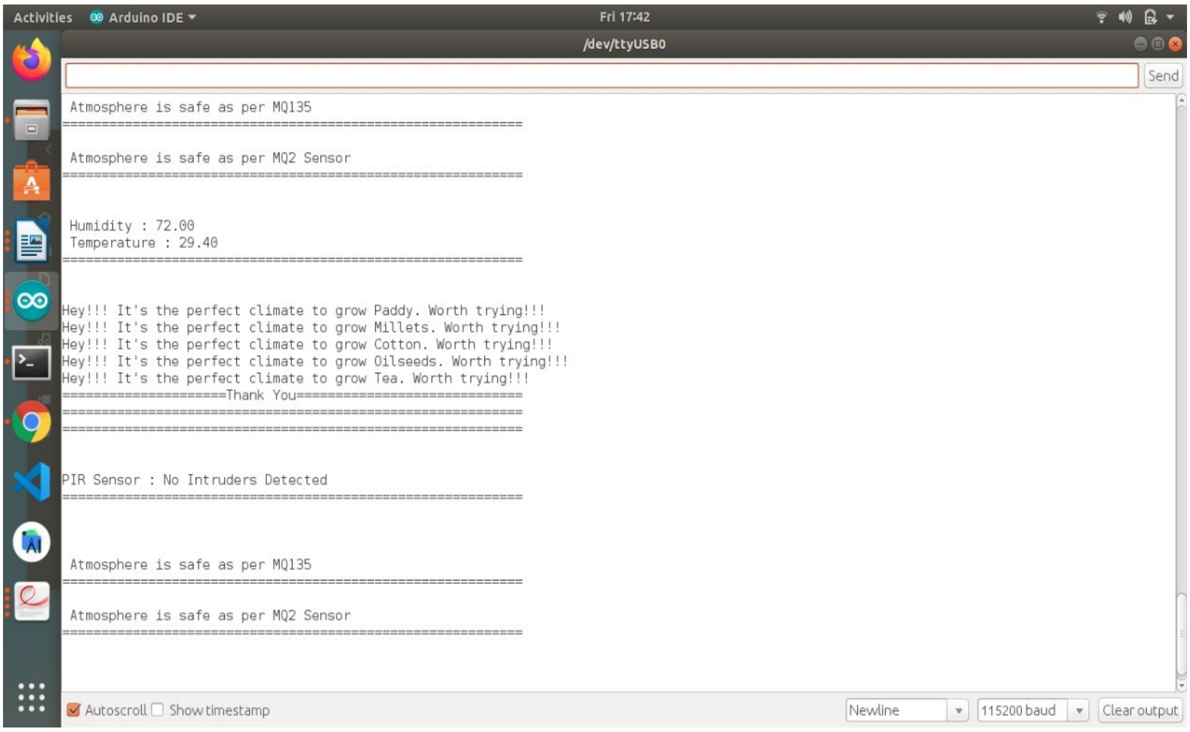
Sensors connected to the nodemcu and arduino UNO



Reading of Temperature and Humidity at web app


Activities
Arduino IDE
Fri 16:05
/dev/ttyUSB0
Send
WiFi connected
IP address:
192.168.18.5
Netmask: 255.255.255.0
Gateway: 192.168.18.5
PIR Sensor : No Intruders Detected
Atmosphere is safe as per MQ135
Atmosphere is safe as per MQ2 Sensor
Humidity : 82.00
Temperature : 28.30
connecting to agrosmartz.000webhostapp.com
Autoscroll
Show timestamp
Newline
115200 baud
Clear output


Activities
Arduino IDE
Fri 16:05
/dev/ttyUSB0
Send
Atmosphere is safe as per MQ2 Sensor
Humidity : 82.00
Temperature : 28.30
connecting to agrosmartz.000webhostapp.com
1
connection failed
PIR Sensor : detected
Atmosphere is safe as per MQ135
Atmosphere is safe as per MQ2 Sensor
Humidity : 83.00
Temperature : 28.10
connecting to agrosmartz.000webhostapp.com
Autoscroll
Show timestamp
Newline
115200 baud
Clear output


Activities
Arduino IDE
Fri 17:42
/dev/ttyUSB0
Send
Atmosphere is safe as per MQ135
Atmosphere is safe as per MQ2 Sensor
Humidity : 72.00
Temperature : 29.40
Hey!!! It's the perfect climate to grow Paddy. Worth trying!!!
Hey!!! It's the perfect climate to grow Millets. Worth trying!!!
Hey!!! It's the perfect climate to grow Cotton. Worth trying!!!
Hey!!! It's the perfect climate to grow Oilseeds. Worth trying!!!
Hey!!! It's the perfect climate to grow Tea. Worth trying!!!
Thank You
PIR Sensor : No Intruders Detected
Atmosphere is safe as per MQ135
Atmosphere is safe as per MQ2 Sensor
Autoscroll
Show timestamp
Newline
115200 baud
Clear output

Chapter 7 : SOFTWARE TESTING

7.1 TEST CASES :

UNIT TESTING :

DH 11 Sensor:

SL.NO	DESCRIPTION	INPUT DATA	EXPECTED DATA	ACTUAL DATA	STATUS
01.	To check power supply	voltage on the POWER pin, 3.3V or from 5V.	Power ON	Power ON	Pass
02.	To check whether the DHT11 detects temperature and Humidity	The readings reflects the room temperature and humidity	Temperature and Humidity value	Temperatue and Humidity value	Pass

MQ-2 Sensor:

SL.NO	DESCRIPTION	INPUT DATA	EXPECTED DATA	ACTUAL DATA	STATUS
01.	To check whether MQ-2 detects gas.	If gas detected the result digital value is 1.	Signaled if LPG gas is detected.	Signal if LPG gas is detected	Pass

Soil Moisture Sensor:

SL.NO	DESCRIPTION	INPUT DATA	EXPECTED DATA	ACTUAL DATA	STATUS
01.	To check the soil sensor is testing the moisture level the soil testing.	When the sensor analog reading is >650	Moisture sensed in soil is low and the motor is turned ON.	Moisture sensed and the motor is turned ON	Pass

PIR Sensor:

SL.NO	DESCRIPTION	INPUT DATA	EXPECTED DATA	ACTUAL DATA	STATUS
01.	To check the power supply	PIR sensor should be powered with 5v	Power on	Power on	Pass
02.	To check if an intruder enters the farm using Ultrasonic Sensor	The digital input is 1 when an intruder passes by farm/area.	The result is 1, when the object is detected.	The result is 1, when the object is detected.	Pass

INTEGRATION TESTING :

Soil moisture sensor:

S.LO	DESCRIPTIVE	INPUT DATA	EXPECTED DATA	ACTUAL DATA	STATUS
1.	To check power supply	voltage on the POWER pin, 3.3V or from 5V.	Powered ON	Powered ON	Pass
2.	To check the soil sensor is testing the moisture level in the soil	When the sensor analog reading is >650	Moisture sensed in soil is low and the motor is turned ON.	Moisture sensed and the motor is turned ON	Pass
3.	To check the soil sensor is testing the moisture level in the soil	When the sensor analog reading is <650	Moisture sensed in soil is high and the motor is turned OFF	Moisture sensed in soil is high and the motor is turned OFF	Pass

PIR Sensor:

Sl. no	DESCRIPTIVE	INPUT DATA	EXPECTED DATA	ACTUAL DATA	STATUS
1.	To check power supply	voltage on the POWER with 5V.	Powered ON	Powered ON	Pass
2.	To check if an intruder enters the farm using Ultrasonic Sensor.	The digital input is 1 when an intruder passes by.	The result is 1, when the object is detected.	The result is 1, when the object is detected.	Pass
3.	To check if an intruder enters the farm using Ultrasonic Sensor.	The digital input is 1 when an intruder passes by.	The result is 1, when the object is detected and LED ON.	The result is 1, when the object is detected and LED ON.	Pass
4.	To check if an intruder enters the farm using Ultrasonic Sensor.	The digital input is 0 when an intruder not found.	The result is 0, when the object is not detected.and LED OFF	The result is 0, when the object is not detected and LED OFF.	Pass

SYSTEM TESTING :

Sl.no	Descriptive	Input data	Expected data	Actual data	Status
1	To check the power supply	Battery and Driver Motor 5V, 12V	Powered ON.	Powered ON.	Pass
2	To check the soil sensor is testing the moisture level in the soil	When the sensor analog reading is>650	Moisture sensed in soil is low and the motor is turned ON.	Moisture sensed and the motor is turned ON	Pass
3	To check whether the DHT11 detects temperature and Humidity	The readings reflects the room temperature and humidity	Temperature and Humidity value	Temperature and Humidity value	Pass

4	To check whether MQ-2 detects gas.	If gas detected the result digital value is 1.	Signaled if LPG gas is detected	Signal if LPG gas is detected	Pass
5	To check whether MQ-2 detects gas.	The threshold value should exceed 830.	Signaled if smoke is detected	Signaled if smoke is detected	Pass
6	To check if an intruder enters the farm using Ultrasonic Sensor.	The digital input is 1 when an intruder passes by.	The result is 1, when the object is detected.	The result is 1, when the object is detected.	Pass
7	Test arduino and Node MCU for proper working.	Inputs all the sensor data.	Sensor readings in correct values.	Sensor readings in correct values.	Pass

BOUNDARY VALUE TESTING :

S.LO	DESCRIPTIVE	INPUT DATA	EXPECTED DATA	ACTUAL DATA	STATUS
01	To check the soil sensor is testing the moisture level in the soil.	When the sensor analog reading is > 650	Moisture sensed in soil is low and the motor is turned ON.	Moisture sensed in soil is low and the motor is turned ON	Pass
02	To check whether MQ-2 detects gas.	The threshold value should exceed 830.	Signaled if smoke is detected.	Signaled if smoke is detected.	Pass

Chapter 8 : CONCLUSION

Conclusion

The project developed will help in bringing a drastic change in the field of technology and agriculture. The idea not only tries to mitigate the primitive techniques related to agriculture but also serve the community by opening new avenues for employment. The applications are extensive with easy implementation. The foremost function of the project is to monitor the crop growth using digital means. This will provide the accurate values of various parameters upon which the growth depends. Besides this, it will help the farmer to monitor more than one agricultural land at the same time. Since most of the monitoring is done remotely, it will help the farmer to gain information which is crucial for the business during his/her spare time. The project is planed to make it user-friendly by involving a simple web GUI. Since monitoring through the system requires less manpower, people with physical disabilities can be employed for the monitoring of fields. Overall, the project idea is feasible, which can easily be implemented and has a wide scope in terms of its application.

Outcome

- Farmers can visualize production levels, soil moisture and remotely to accelerate decision making process.
- Secondly temperature maintainance,humidity maintainance and other environmental parameters and finally the recommendation to farmers for smart agriculture.
- The outcome of this project will surely help farmers to determine what crops to be grown next and since it’s all automated,the farmers need not waste a lot of time monitoring the fields frequently.

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