1.INTRODUCTION

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.

In recent times, the farmers have been using irrigation technique through the manual control in which the farmers irrigate the land at regular intervals by turning the water-pump ON/OFF when required. If they Switch ON any of the motor, there will be the sudden defuse in motor circuit. They may have to travel so far for SWITCHING ON/OFF the motor. They may be suffering from hot Sun, rain and night time too. After reaching their farm, they found that there is no power, so they quietly disappointed to it!! Is there any solution for it??? Let's check our solution.

1.2 BRIEF DESCRIPTION OF THE PROJECT

With the adoption of IoT in various areas like Industry, Homes and even Cities, huge potential is seen to make everything Intelligent and Smart. Even the Agricultural sector is also adopting IoT technology these days and this in turn has led to the development of "AGRICULTURAL Internet of Things (IoT)".The project aims at making agriculture smart using automation and IOT technologies. The highlighting features of this paper include smart irrigation with smart control based on real time field data. Secondly temperature maintenance, humidity maintenance and other environmental parameters. And finally 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 the Microcontroller. The values are generated in the web page and the farmer gets the detailed description of the values.

This concept will surely accelerate their business to reach new heights and also be more profitable. The implementation of the project largely depends upon the

awareness among farmers, which, we believe will be easily created due to its numerous advantages.

1. SYSTEM ANALYSIS

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.

2.2 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.

- 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.

2.3 PROPOSED SYSTEM

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 the this system collecting all the data from various sensors like temperature, humidity, lux, 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.

Baseline Situation Assessment conducted by Partnership farming in India, in Gujarat and Maharashtra, clearly indicated that farmers with access to technical knowledge on agriculture realized better income compared to others.

What is IoT?

The Internet of things also coined as internet of objects is a network of interconnected things that can communicate with each other with the help of sensors via internet, providing various services to the end users. IoT based technology can bring in advance improvement in the field of health care, education, transport, agriculture, home appliances etc. An IoT related environment and technology can change the life style of human. An IoT device that is developed much have some computing and decision making capability that can allow the device to perform better as per the users and requirement. It must be made available anywhere, anytime and to any user authenticated to use and interact with the IoT.

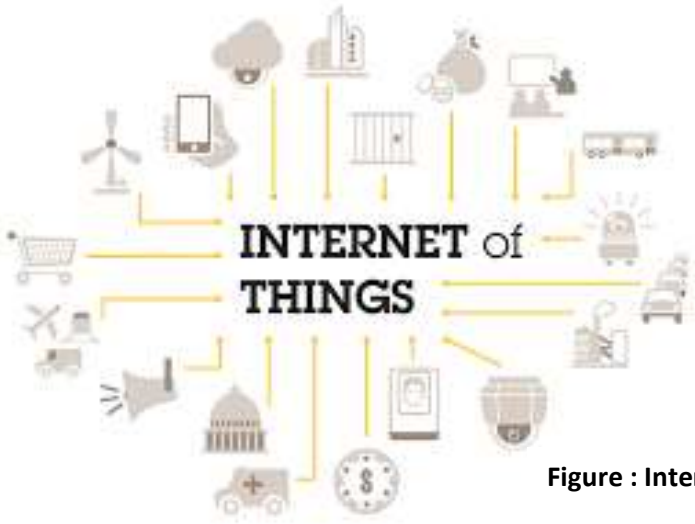


Figure : Internet of Things

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 o/p is permanent and the analog o/p 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 o/p 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 o/p 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.

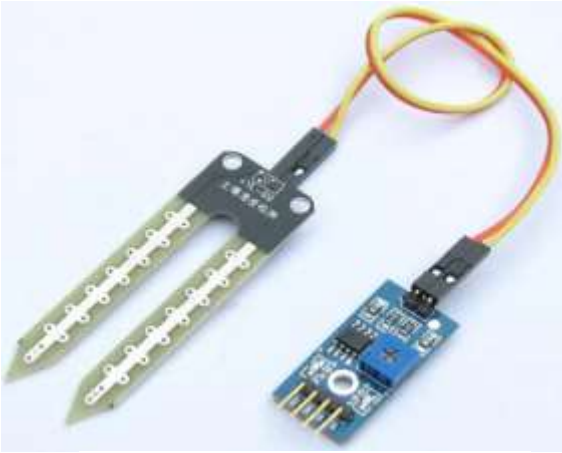


Figure : Soil Moisture Sensor

DHT11

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%. So if you are looking to measure in this range then this sensor might be the right choice for you.

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 Nano.

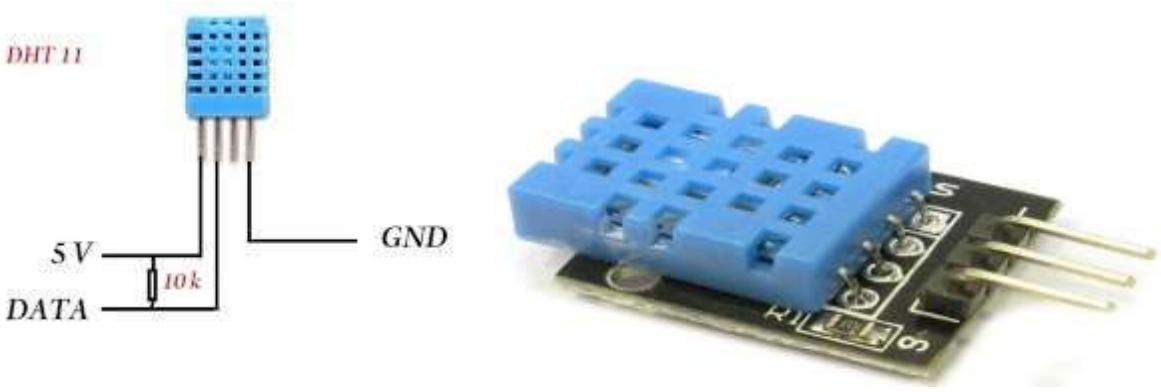


Figure : DHT11 Sensor

MQ-2

MQ2 Sensor is a gas module and it is suitable to detect Hydrogen, LPG, Smoke, CO, and Alcohol. It has high sensitivity and fast response time to measure and take the data. Sensitivity can be adjusted by potentiometer behind it:

The voltage that the sensor outputs changes accordingly to the smoke/gas level that exists in the atmosphere. The sensor outputs a voltage that is proportional to the concentration of smoke/gas.

In other words, the relationship between voltage and gas concentration is the following:

- The greater the gas concentration, the greater the output voltage
- The lower the gas concentration, the lower the output voltage

Working Mechanism

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
- Long life and low cost.

Figure : MQ-135

HC-SR04 Ultrasonic Sensor

HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module. Since we are using the Ultrasonic wave we know the universal speed of US wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken for the US wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance using a microcontroller or microprocessor.

Figure : Ultra Sonic Sensor

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 : NodeMCU

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. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

Though jumper wires come in a variety of colours, the colours don't actually mean anything. This means that a red jumper wire is technically the same as a black one. But the

colours can be used to your advantage in order to differentiate between types of connections, such as ground or power.

Figure : Jumper Wires

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 : DC Motor

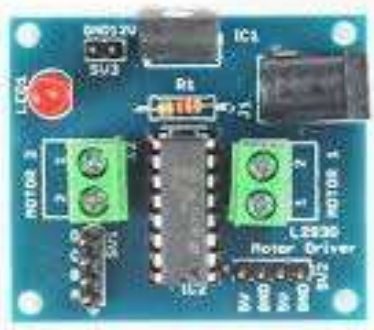


Figure : Motor Driver

2.4 ADVANTAGES OF PROPOSED SYSTEM

- **Data, tons of 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 • Automation with low power consumption components On the whole smart farming refers to data gathering, data processing, analyzing and automatic control system.

2.5 FEASIBILITY STUDY

A feasibility study is an analysis that takes all of a project's relevant factors into account—including economic, technical, legal, and scheduling considerations—to ascertain the likelihood of completing the project successfully. Project managers use feasibility studies to discern the pros and cons of undertaking a project before they invest a lot of time and money into it. Feasibility studies also can provide a company's management with crucial information that could prevent the company from entering blindly into risky businesses.

The project feasibility study is a document containing a detailed description of the project, followed by a set of different feasibility areas. These are aspects of the project that will drive the success or failure of the project. This study will provide the necessary information so that you can decide whether or not your project will begin or whether it has a shot at success.

The scenario of decreasing water tables, drying up of rivers and tanks, unpredictable environment present an urgent need of proper utilization of water. To cope up with this use of temperature and moisture sensors at suitable locations for monitoring of crops is implemented .An algorithm developed with threshold values of temperature and soil moisture can be programmed into micro controller based gateway to control water quantity. The system can be powered by Photo voltaic panels and can have duplex communication link based on cellular – Internet interface that allow data inspection and irrigation scheduling to be programmed through web page.

2.5.1 TECHNICAL FEASIBILITY

Technical feasibility study is the complete study of the project in terms of input, processes, output, fields, programs and procedures. It is a very effective tool for long term planning and trouble shooting. The technical feasibility study should most essentially support the financial information of an organization.

Technical feasibility is a broad concept. It can equally be applied to a software development project, civil engineering (bridges, tunnels, dams,..) or a manned mission to Mars, and everything in between. Each will have different standards of feasibility. They could include

- the design is correct and will meet the given requirement
- the products needed to build it are available
- the materials and techniques to implement it are known to work
- doesn't violate some law of physics (say, needs information to travel faster than light)
- doesn't violate a mathematical principle (needs to compute an intractable function)

It may be evaluated as a matter of degree. One might report that a proposal is 80%, 95%, 99.9% feasible (but not often 100%). "Feasibility" is usually qualified with "technical" mainly to distinguish it from "financial viability", "political acceptability" or whatever other hurdles a proposal might need to clear.

The aim of this project is to introduce the latest technology into the agriculture business and better crop production by collecting real-time status of crop and informing the farmers about it.

The technological development in open source software and hardware make it easy to develop the device which can make better monitoring and wireless sensor network made it possible to use in monitoring and control of irrigation in precision agriculture.

2.5.2 ECONOMIC FEASIBILITY

As no paper is required so it reduces cost. It would be beneficial because only one time development efforts required. All people are aware of technologies so on special skills required to run the system. Analysis of a project's costs and revenues in an effort to determine whether or not it is logical and possible to complete. The overall cost of the Sensors are also feasible.

2.5.3 OPEARTION FEASIBILITY

We believe that our concept will be a benchmark in the agribusiness due to its reliability and remote monitoring. Our idea tries to digitalize farming and agricultural activities so that the farmers can check on the requirements of the crops and accurately predict their growth. This concept will surely accelerate their business to reach new heights and also be more profitable. The implementation of our project largely depends upon the awareness among farmers, which, we believe will be easily created due to its numerous advantages.

3. SYSTEM DEVELOPMENT STRATEGY

3.1 SYSTEM ENGINEERING

Systems engineering is an interdisciplinary field of engineering and engineering management that focuses on how to design and manage complex systems over their life cycles. At its core, systems engineering utilizes systems thinking principles to organize this body of knowledge. The individual outcome of such efforts, an engineered system, can be defined as a combination of components that work in synergy to collectively perform a useful function.

3.2 SYSTEM DEVELOPMENT ENVIRONMENT

A software development environment (SDE) is an environment that automates or augments the routines involved in a software development cycle. This includes programming-in-the-many tasks like team and project management as well as programming-in-the-large tasks like configuration management.

4.SYSTEM DESIGN

The software development life cycle (SDLC) is a framework defining tasks performed at each step in the software development process. SDLC is a structure followed by a development team within the software organization. It consists of a detailed plan describing how to develop, maintain and replace specific software. The life cycle defines a methodology for improving the quality of software and the overall development process.
SDLC consists of following activities:

Planning: The most important parts of software development, requirement gathering or requirement analysis are usually done by the most skilled and experienced software engineers in the organization. After the requirements are gathered from the client, a scope document is created in which the scope of the project is determined and documented.

Implementation: The software engineers start writing the code according to the Clients requirements.

Testing: This is the process of finding defects or bugs in the created software.

Documentation: Every step in the project is documented for future reference and for the improvement of the software in the development process. The design documentation may include writing the application programming interface (API).

Deployment and maintenance: The software is deployed after it has been

approved for release.

Maintaining: Software maintenance is done for future reference. Software improvement and new requirements (change requests) can take longer than the time needed to create the initial development of the software.

Software Development Life Cycle (SDLC) is extremely vast and full of various development and testing activities, methodologies, techniques, **tools**, and more. It involves intense planning and management, calculation and preparation. It is only after combining all these efforts of the software engineers that a software or application is successfully developed. **Iterative Model** is too a part of Software Development Life Cycle.

It is a particular implementation of a software development life cycle that focuses on an initial, simplified implementation, which then progressively gains more complexity and a broader feature set until the final system is complete. In short, iterative development is a way of breaking down the software development of a large application into smaller pieces.

An **iterative life cycle model** does not start with a full specification of requirements. In this model, the development begins by specifying and implementing just part of the software, which is then reviewed in order to identify further requirements. Moreover, in iterative model, the iterative process starts with a simple implementation of a small set of the software requirements, which iteratively enhances the evolving versions until the complete system is implemented and ready to be deployed. Each release of Iterative Model is developed in a specific and fixed time period, which is called iteration.

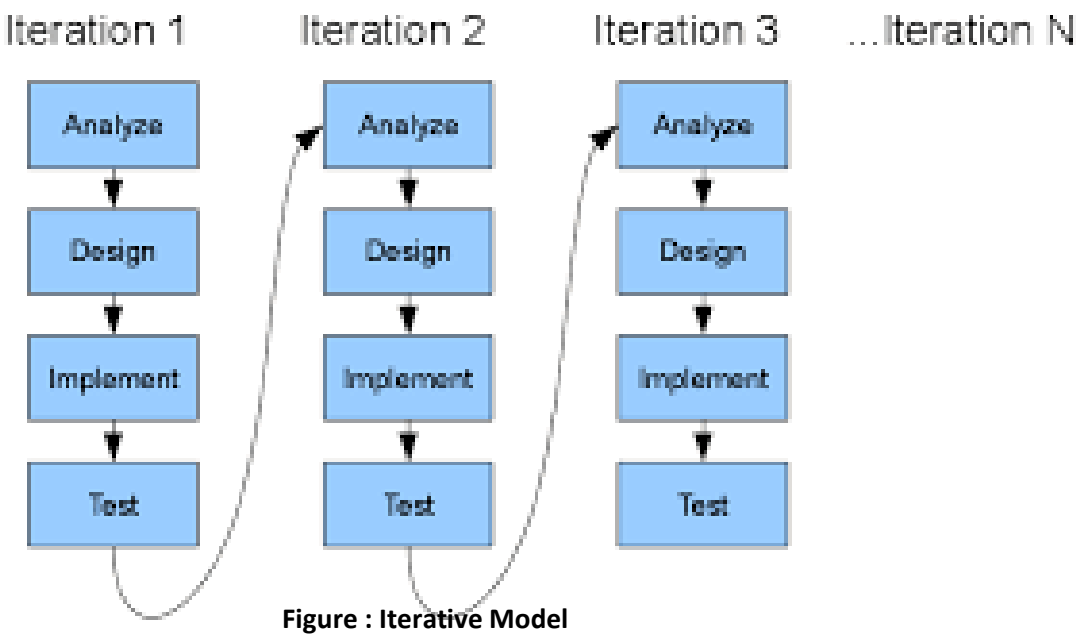


Figure : Iterative Model

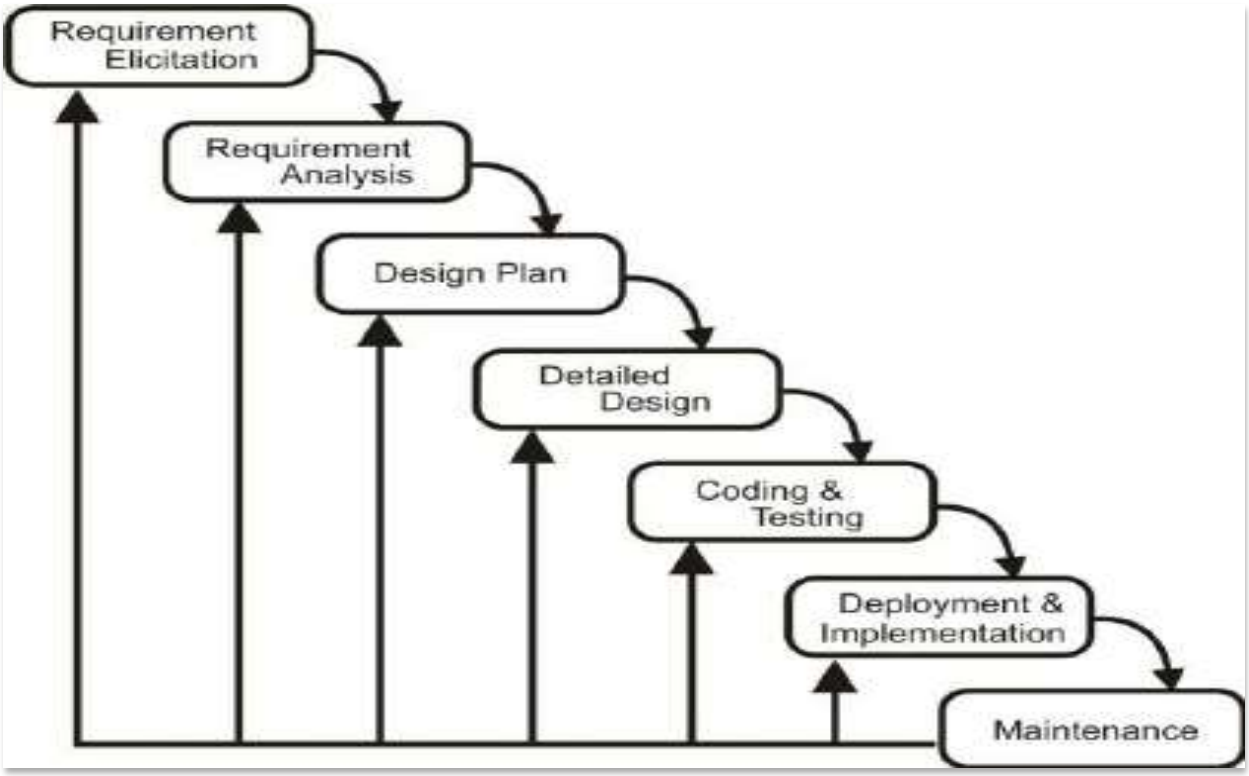


Figure : Iterative Waterfall Model

4.1 HIGH LEVEL DESIGN(ARCHITECTURAL)

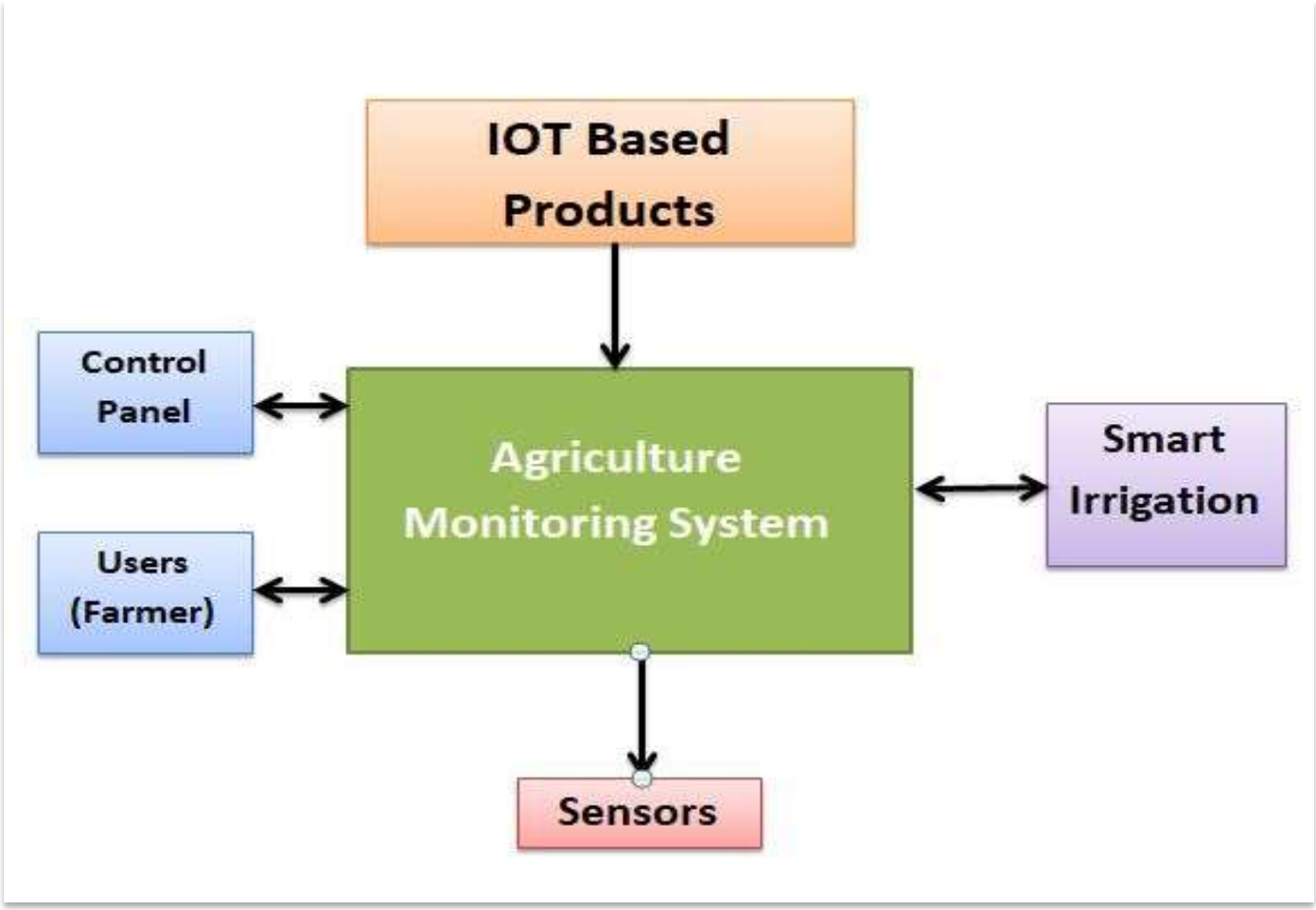


Figure : Process Diagram

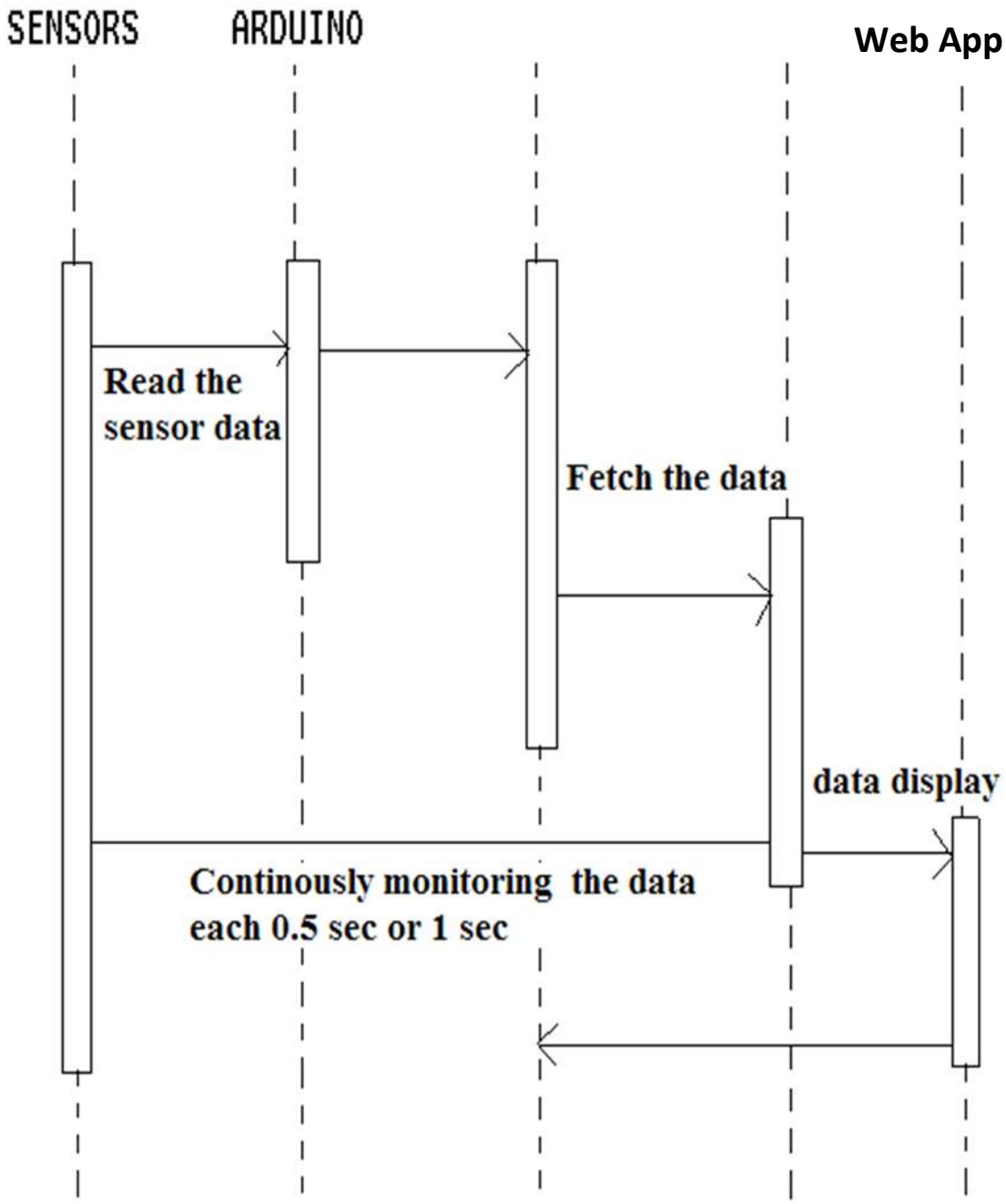


Figure : Sequence Diagram

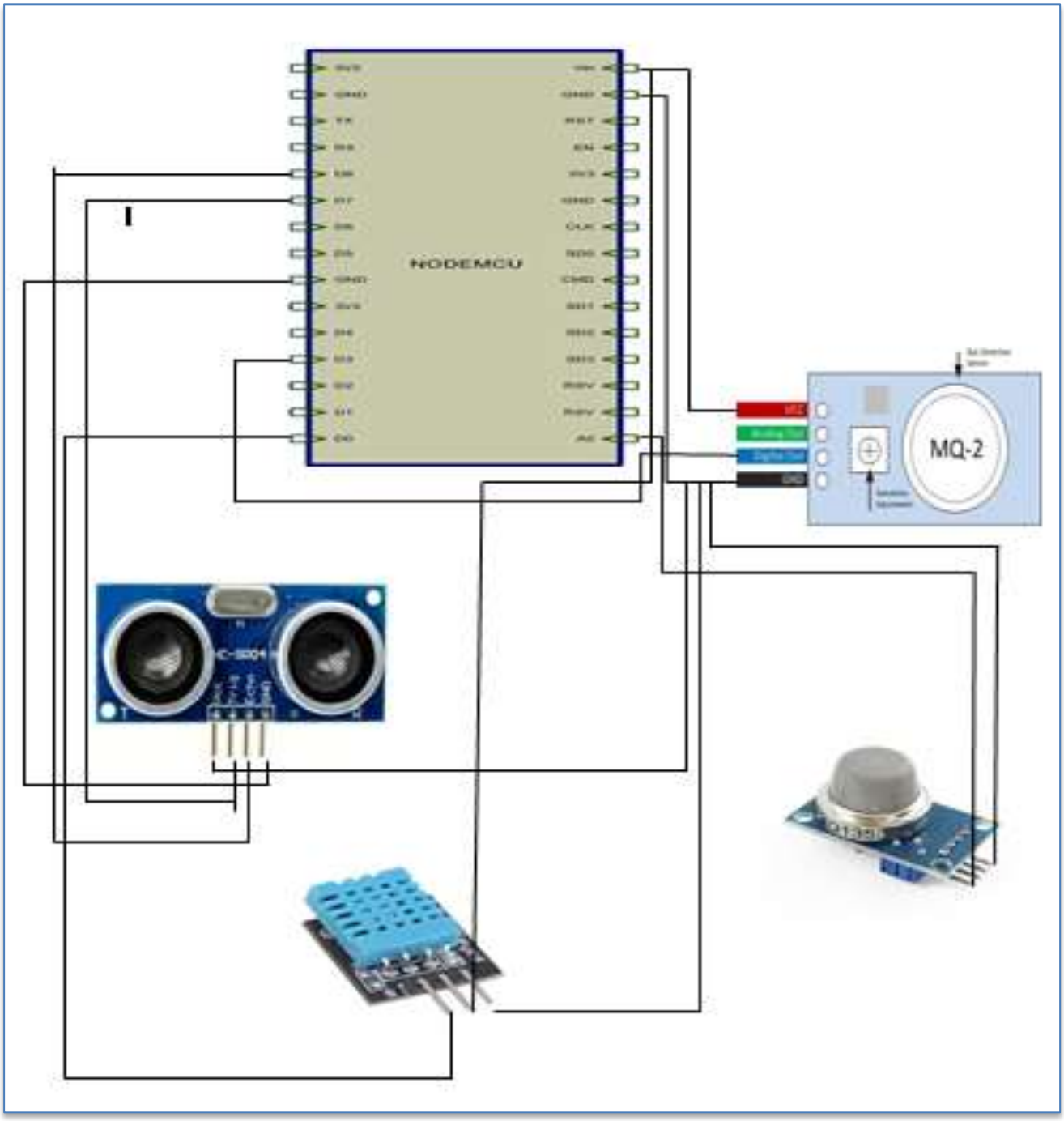


Figure : Block/Circuit Diagram

4.2 LOW LEVEL DESIGN

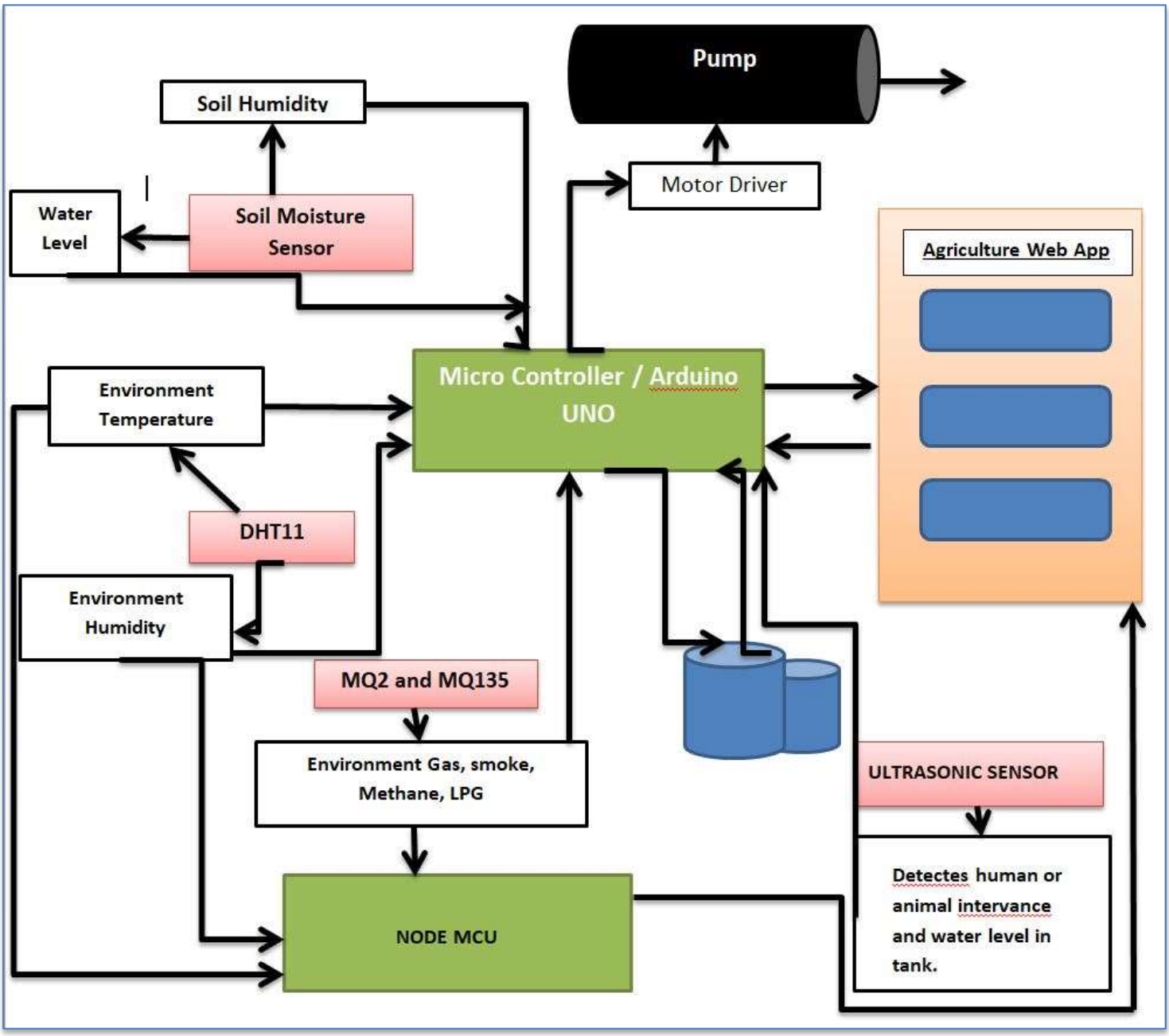


Figure : Low level Diagram

CLASS DIAGRAM

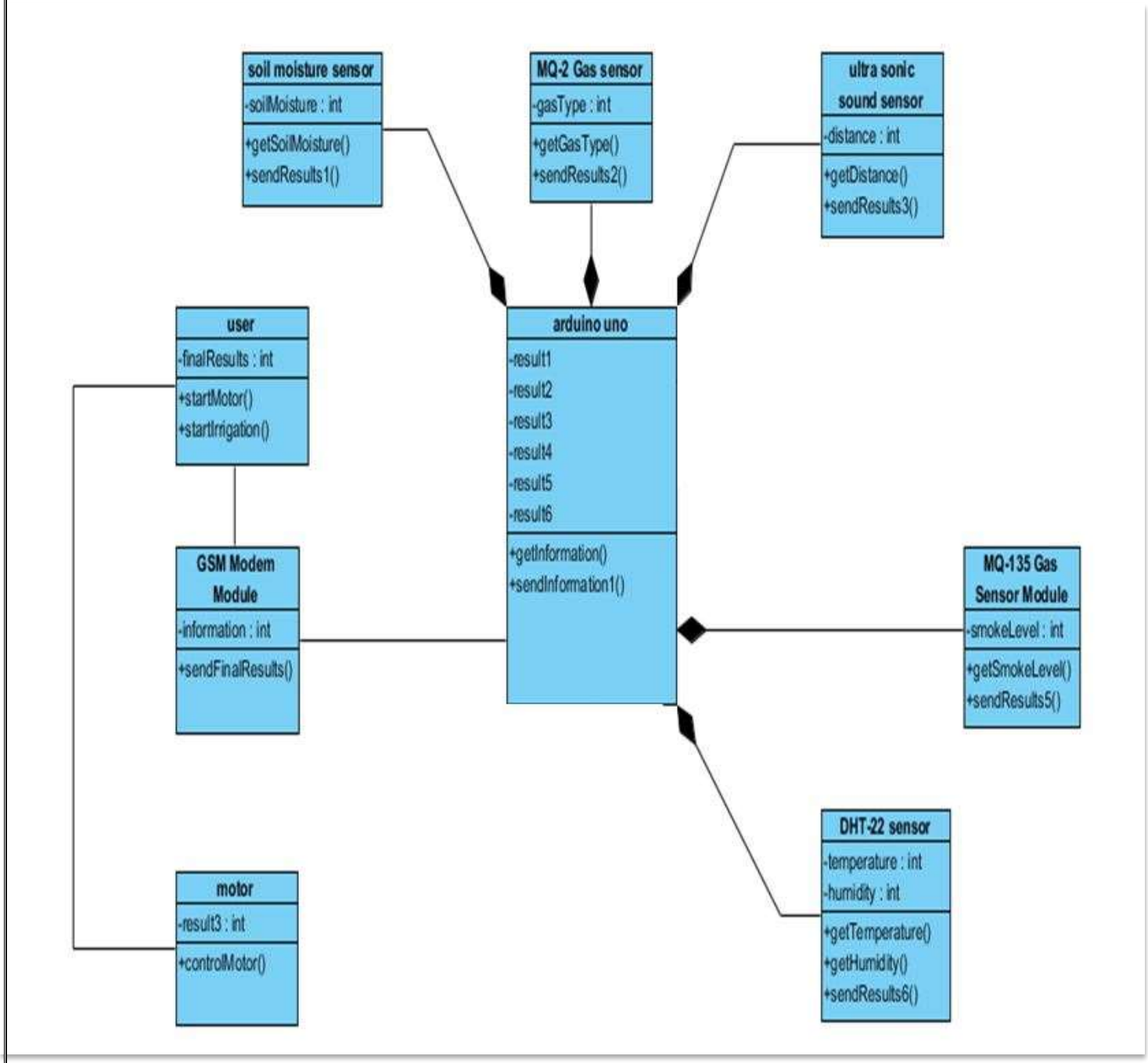
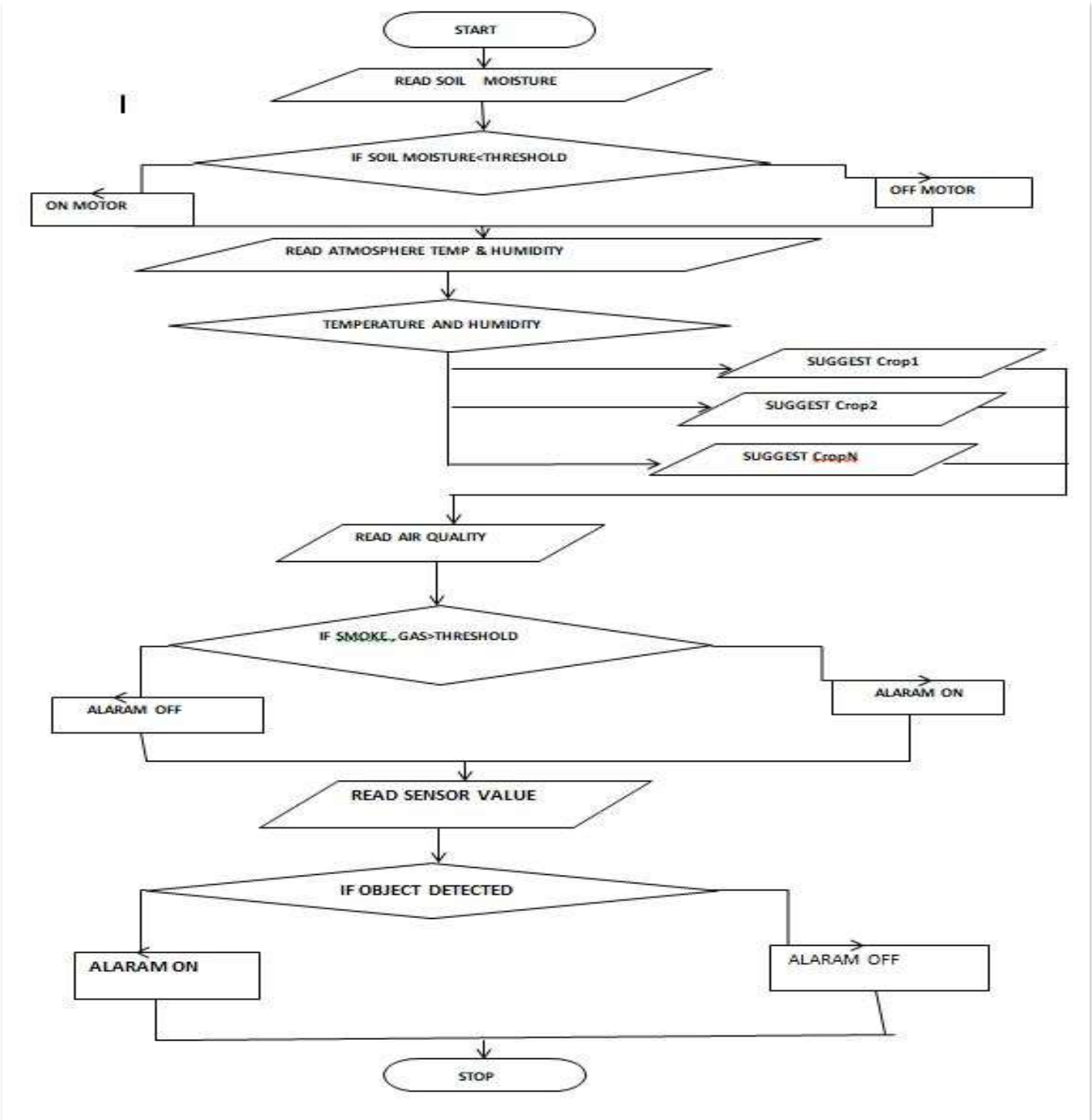


Figure : Class Diagram

4.3 FLOWCHARTS



4.4 DATAFLOW DIAGRAM

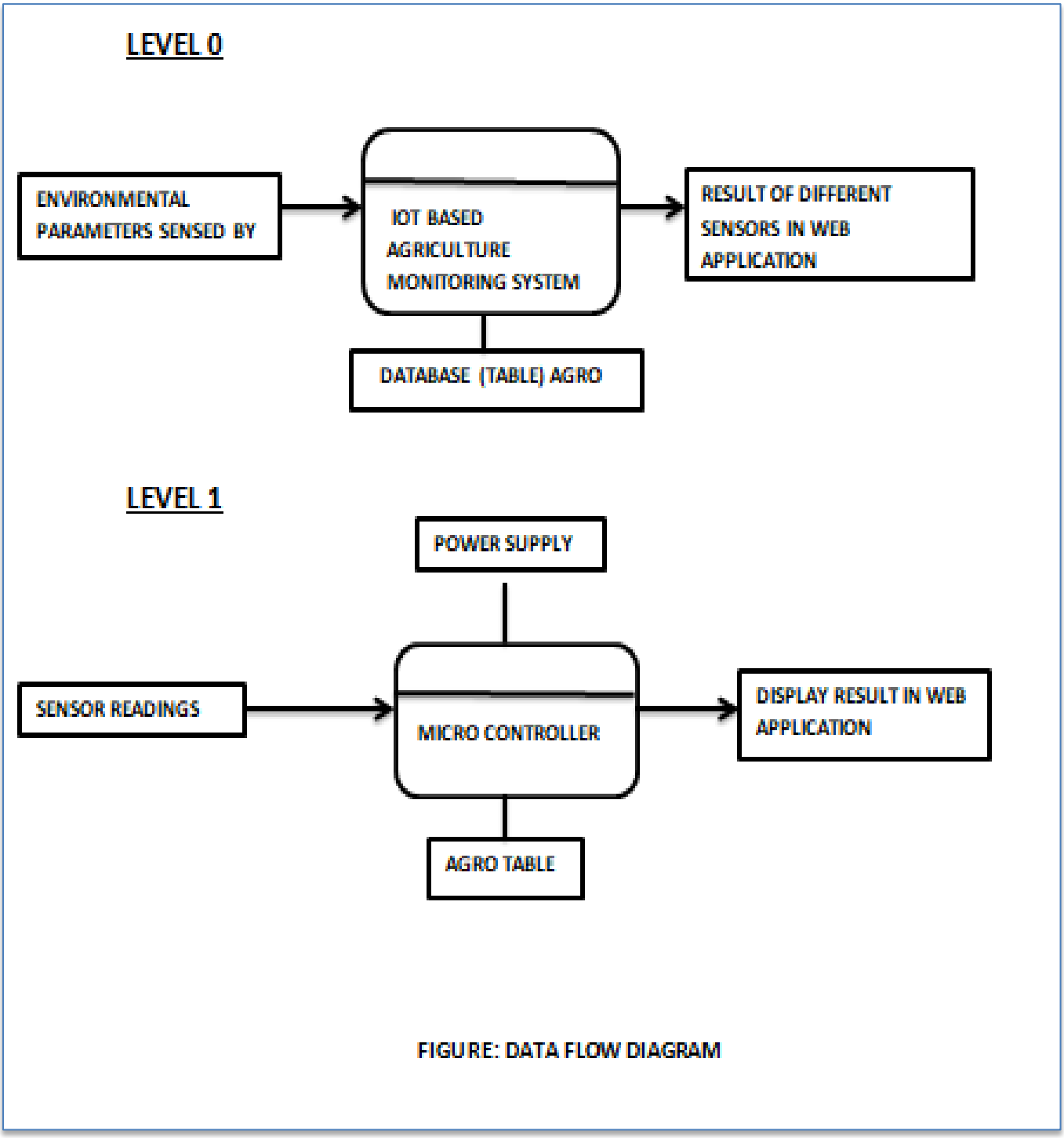
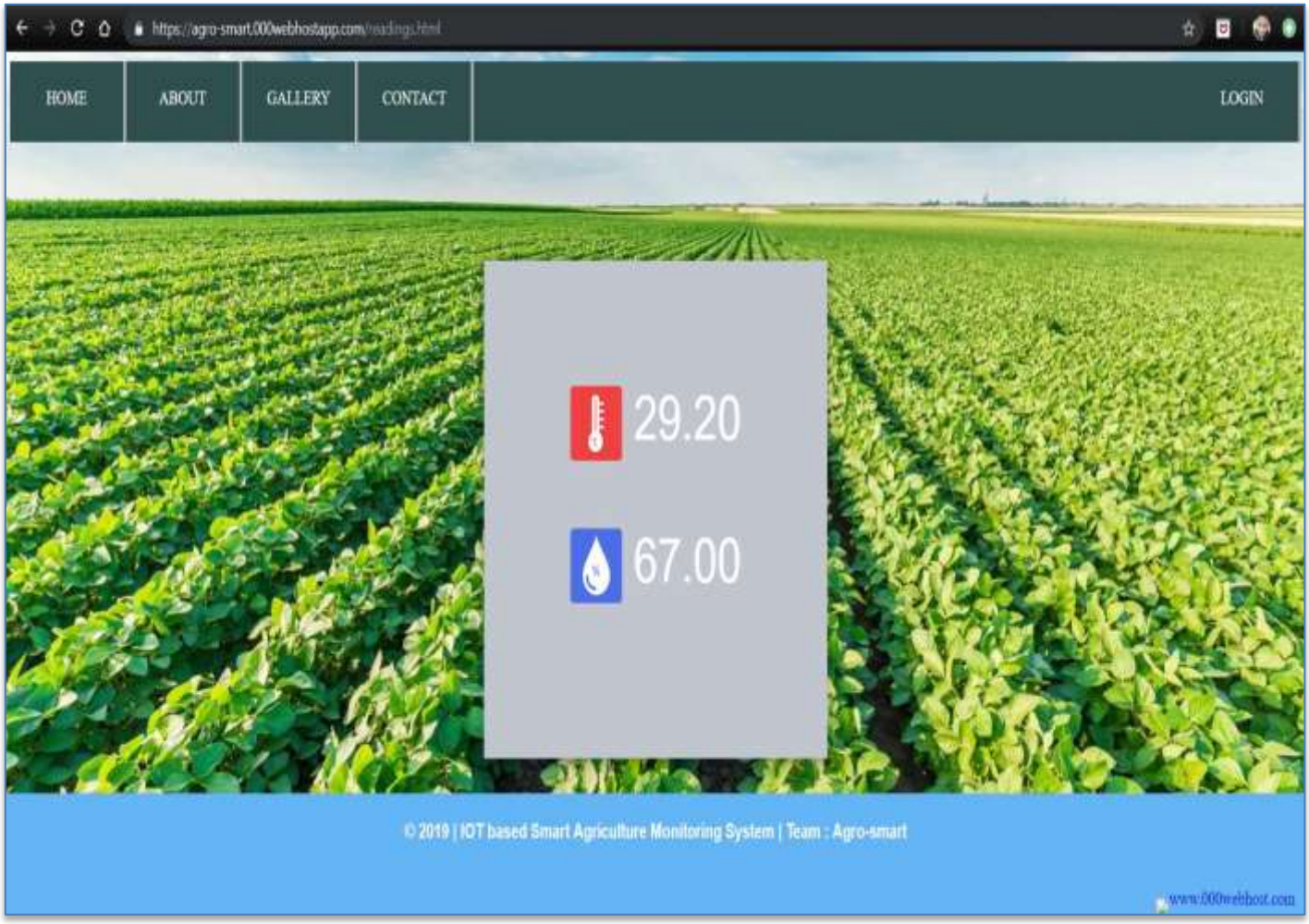


FIGURE: DATA FLOW DIAGRAM

4.5 TABLE DESIG

Attribute Name	DataType
Temperature	Float
Humidity	Float
Gas Senor 1	Numeric
Gas Sensor 2	Numeric
Ultrasonic Sensor	Numeric
Motor	Numeric

4.6 INPUT/OUTPUT INTERFACE DESIGN


HOME
ABOUT
GALLERY
CONTACT
LOGIN
29.20
67.00
© 2019 | IOT based Smart Agriculture Monitoring System | Team : Agro-smart

5. CODING

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     = "Shilpitha";
const char* password = "Shilpitha";
```

```
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);
        Serial.println("Distance :");
        Serial.print(distance);
        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);
}
```

Index.html

```
<!DOCTYPE html>
<html lang="en">
   <head>
          <meta charset="UTF-8">
     <meta name="viewport" content="width=device-width, initial-scale=1.0"/>
     <meta name="Vikkey" content="Vivek Gupta & IoTMonk">
          <meta http-equiv="Access-Control-Allow-Origin" content="*">
         <!-- If you are opening this page from local machine, uncomment belwo line -->
         <!-- If you are opening this page from a web hosting server machine, uncomment belwo line -->
         <script type="text/javascript">
                document.write([
                      "\<script src='",
                      ("https:" == document.location.protocol) ? "https://" : "http://",
                      "ajax.googleapis.com/ajax/libs/jquery/1.2.6/jquery.min.js' type='text/javascript'>\<\/script>"
                ].join(''));
         </script>
     <title>IOT based Smart Agriculture Monitoring System</title>
```

```
<style>
.p {
    font-size:100px;
    font-style:Times New Roman;
    color:white;
}
ul {
  list-style-type: none;
  margin: 0;
  padding: 0;
  overflow: hidden;
  background-color: #2F4F4F;
}
li {
  float: left;
   border-right:3px solid #bbb;
}
.menu:hover {
  width: 300px;
  background-color: #FFA500;
```

```
  }
 /*text enlarge*/
.menu {
 width: 100px;
 height: 25px;
 display: block;
 color: white;
 float: left;
 text-align: center;
 padding: 20px 16px;
 text-decoration: none;
 -webkit-transition: width 2s; /* For Safari 3.1 to 6.0 */
 transition: width 1s;
}
  .menu:hover {
      width:150px;
  }
        .footer{
                background:#64B5F6;
                width:100%;
```

```
            height:100px;
            position:absolute;
            bottom:0;
            left:0;
        }
    .center {
            height: 400px;
            width: 400px;
            background: #c0c5ce;
            position: fixed;
      box-shadow: 0 4px 8px 0 rgba(0, 0, 0, 0.2), 0 6px 20px 0 rgba(0, 0, 0, 0.19);
            top: 50%;
            left: 50%;
            margin-top: -180px;
            margin-left: -200px;
        }
        .form{
            padding-top: 10px;
            padding-right: 30px;
            padding-bottom: 50px;
```

```
                padding-left: 30px;
        }
  .iip{
                background-color: #ffffff; /* Green */
                border: none;
                color: black;
                padding: 16px 32px;
                text-align: center;
                text-decoration: none;
                display: inline-block;
                font-size: 100px;
                margin: 4px 2px;
                -webkit-transition-duration: 0.4s; /* Safari */
  }
    </style>
  </head>
        <body background="dark_field.jpg">
           <ul>
<li><a href="#"><div class="menu">HOME</div></a><br></li>
<li><div class="menu">ABOUT</div><br></li>
```

```
  <li><div class="menu">GALLERY</div><br></li>

  <li><div class="menu">CONTACT</div><br></li>

    <li style="float:right" border-left=3px solid=#bbb><a href="readings.html"><div
class="menu">LIVE READINGS</div></a><br></li>

</ul>

    <center>

        <br>

        <br>

        <br>

        <br>

        <p><div class="p"><u><b>IOT based Smart Agriculture Monitoring System</b></u></div>

    </center>

                <footer class="footer">

                <center>

                        <h4 style="font-family: Helvetica;color: white;">&copy; 2019 | IOT based
Smart Agriculture Monitoring System | Team : Agro-smart </h4>

                </center>

          </footer>

    </body>

</html>
```

Readings.html

```
<!DOCTYPE html>
<html lang="en">
   <head>
        <meta charset="UTF-8">
     <meta name="viewport" content="width=device-width, initial-scale=1.0"/>
     <meta name="Vikkey" content="Vivek Gupta & IoTMonk">
        <meta http-equiv="Access-Control-Allow-Origin" content="*">
        <!-- If you are opening this page from a web hosting server machine, uncomment belwo line -->
        <script type="text/javascript">
            document.write([
                "\<script src='",
                ("https:" == document.location.protocol) ? "https://" : "http://",
                "ajax.googleapis.com/ajax/libs/jquery/1.2.6/jquery.min.js' type='text/javascript'>\<\/script>"
            ].join(''));
        </script>
    <title>Real Time Readings</title>
        <style>
```

```
            ul {
  list-style-type: none;
  margin: 0;
  padding: 0;
  overflow: hidden;
  background-color: #2F4F4F;
}
li {
  float: left;
    border-right:3px solid #bbb;
}
    .menu:hover {
  width: 300px;
  background-color: #FFA500;
    }
       /*text enlarge*/
 .menu {
  width: 100px;
  height: 25px;
  display: block;
```

```
  color: white;
  float: left;
  text-align: center;
  padding: 20px 16px;
  text-decoration: none;
  -webkit-transition: width 2s; /* For Safari 3.1 to 6.0 */
  transition: width 1s;
}
    .menu:hover {
        width:150px;
    }
            .footer{
                    background:#64B5F6;
                    width:100%;
                    height:100px;
                    position:absolute;
                    bottom:0;
                    left:0;
            }
              .center {
```

```
            height: 400px;
            width: 400px;
            background: #c0c5ce;
            position: fixed;
box-shadow: 0 4px 8px 0 rgba(0, 0, 0, 0.2), 0 6px 20px 0 rgba(0, 0, 0, 0.19);
            top: 50%;
            left: 50%;
            margin-top: -180px;
            margin-left: -200px;
    }
    .form{
            padding-top: 10px;
            padding-right: 30px;
            padding-bottom: 50px;
            padding-left: 30px;
    }
     </style>
     </head>
    <body background="farm.png">
       <ul>
```

```
  <li><a href="index.html"><div class="menu">HOME</div></a><br></li>
  <li><div class="menu">ABOUT</div><br></li>
  <li><div class="menu">GALLERY</div><br></li>
  <li><div class="menu">CONTACT</div><br></li>
    <li style="float:right"><a href="#"><div class="menu">LOGIN</div></a><br></li>
</ul>
<div class="center">
            <div align="center" class="form">
          <br><br>
          <p style = 'line-height: 60px;font-family: Helvetica;color: #fff;font-size: 50px;'
id="temperature">
             <img src = 'temperature.png' height="60px" width="60px" style='vertical-align: middle'
/> 00.00
          </p>
          <p style = 'line-height: 60px;font-family: Helvetica;color: #fff;font-size: 50px;'
id="humidity">
             <img src = 'humidity.png' height="60px" width="60px" style='vertical-align: middle' />
00.00
          </p>
        </div>
          </div>
```

```
<footer class="footer">
        <center>
            <h4 style="font-family: Helvetica;color: white;">&copy; 2019 | IOT based Smart Agriculture Monitoring System | Team : Agro-smart </h4>
        </center>
    </footer>
    <script>
        window.onload = function() {
    loaddata();
  };
        function loaddata(){
            var url = "https://agro-smart.000webhostapp.com/api/weather/read_all.php";
            $.getJSON(url, function(data) {
         var val= data;
        var humid=(data['weather'][(Object.keys(data['weather']).length)-1]['hum']);
         var temper=(data['weather'][(Object.keys(data['weather']).length)-1]['temp']);
         document.getElementById("temperature").innerHTML = "<img src = 'temperature.png' height=\"60px\" width=\"60px\" style='vertical-align: middle' />  " +temper;
         document.getElementById("humidity").innerHTML = "<img src = 'humidity.png' height=\"60px\" width=\"60px\" style='vertical-align: middle' />  "+humid;
```

```
        console.log(data['weather'][(Object.keys(data['weather']).length)-1]['temp']);
                                    });
    }
    window.setInterval(function(){
    loaddata();
        }, 5000);


        </script>
        </body>
        </html>
```

Db_connect.php

```
<?php
class DB_CONNECT {
    // Constructor
    function __construct() {
        // Trying to connect to the database
        $this->connect();
    }
```

```
// Destructor
function __destruct() {
    // Closing the connection to database
    $this->close();
}
// Function to connect to the database
function connect() {
    //importing dbconfig.php file which contains database credentials
    $filepath = realpath (dirname(__FILE__));
    require_once($filepath."/dbconfig.php");
                // Connecting to mysql (phpmyadmin) database
    $con = mysql_connect(DB_SERVER, DB_USER, DB_PASSWORD) or die(mysql_error());
    // Selecing database
    $db = mysql_select_db(DB_DATABASE) or die(mysql_error()) or die(mysql_error());
    // returing connection cursor
    return $con;
}// Function to close the database
function close() {// Closing data base connection
    mysql_close();
}
```

```
}

?>
```

Db_Config.php

```
<?php

/*****************************************************/

/************** Created by : Vivek Gupta ************/

/***************     www.vsgupta.in     *************/

/***************     www.iotmonk.com     *************/

/*****************************************************/


define('DB_USER', "id9983719_agrosmart");     // Your database user name

define('DB_PASSWORD', "Shilpitha@123");                    // Your database password
(mention your db password here)

define('DB_DATABASE', "id9983719_agrosmart"); // Your database name

define('DB_SERVER', "localhost");                  // db server (Mostly will be 'local' host)


?>
```

Insert.php

```
<?php

header("Access-Control-Allow-Origin: *");

header("Content-Type: application/json; charset=UTF-8");
```

```
//Creating Array for JSON response
$response = array();
// Check if we got the field from the user
if (isset($_GET['temp']) && isset($_GET['hum'])) {
    $temp = $_GET['temp'];
    $hum = $_GET['hum'];
    // Include data base connect class
    $filepath = realpath (dirname(__FILE__));
        require_once($filepath."/db_connect.php");
    // Connecting to database
    $db = new DB_CONNECT();
    // Fire SQL query to insert data in weather
    $result = mysql_query("INSERT INTO weather(temp,hum) VALUES('$temp','$hum')");
    // Check for succesfull execution of query
    if ($result) {
        // successfully inserted
        $response["success"] = 1;
        $response["message"] = "Weather successfully created.";
        // Show JSON response
        echo json_encode($response);
```

```
    } else {
        // Failed to insert data in database
        $response["success"] = 0;
        $response["message"] = "Something has been wrong";
        // Show JSON response
        echo json_encode($response);
    }
} else {
    // If required parameter is missing
    $response["success"] = 0;
    $response["message"] = "Parameter(s) are missing. Please check the request";
    // Show JSON response
    echo json_encode($response);
}
?>
```

Real_all.php

```
<?php
header("Access-Control-Allow-Origin: *");
header("Content-Type: application/json; charset=UTF-8");
//Creating Array for JSON response
```

```
$response = array();


// Include data base connect class
$filepath = realpath (dirname(__FILE__));
require_once($filepath."/db_connect.php");
// Connecting to database
$db = new DB_CONNECT();
  // Fire SQL query to get all data from weather
$result = mysql_query("SELECT *FROM weather") or die(mysql_error());
// Check for succesfull execution of query and no results found
if (mysql_num_rows($result) > 0) {
        // Storing the returned array in response
    $response["weather"] = array();
        // While loop to store all the returned response in variable
    while ($row = mysql_fetch_array($result)) {
        // temperoary user array
        $weather = array();
        $weather["id"] = $row["id"];
        $weather["temp"] = $row["temp"];
                $weather["hum"] = $row["hum"];
```

```
                    // Push all the items
        array_push($response["weather"], $weather);
    }
    // On success
    $response["success"] = 1;
    // Show JSON response
    echo json_encode($response);
}
else
{
    // If no data is found
            $response["success"] = 0;
    $response["message"] = "No data on weather found";

    // Show JSON response
    echo json_encode($response);
}
?>
```

6. TESTING

IOT testing is a type of testing to check IOT devices. Today there is increasing need to deliver better and faster services. There is a huge demand to access, create, use and share data from any device. The thrust is to provide greater insight and control, over various interconnected IOT devices. Hence, IOT testing framework is important.

Figure : Stages of testing

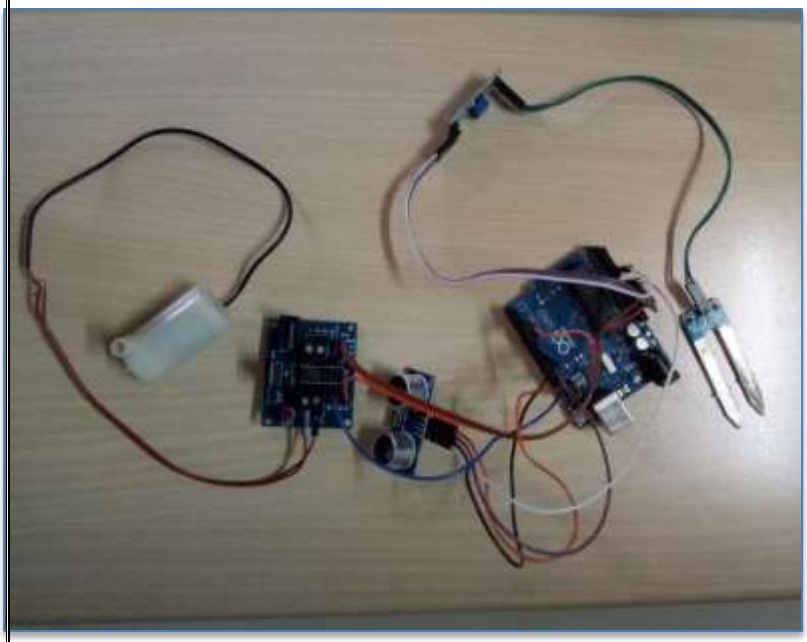
IoTSecurity:

In IoT, devices are equipped with IP Addresses and has the ability to transmit data over the network. When network comes into picture then security should be the first priority. From a testing standpoint, we need to check if the data is encrypted when getting transferred from one device to the other. In case of UI, set password protection in ON mode.

Table : Test Cases

Sl No	Descriptive	Input data	Expected output / data	Actual output / 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 shoud 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

7. SNAPSHOTS



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.

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