ABSTRACT

The world has changed a lot but some fields remains unchanged. The one of the such field is Agriculture. This project is to improve the consistency and efficiency of agriculture using Internet of Things. Internet of Things a technology in which electrical and electronical components interacts each other with the help of programming language which is responsible for communication and a database to store the details it collected. The major defect or missing thing in current system of agriculture is lack of details, guidance, marketing and information regarding the corps. It leads to corruption in many schemas and increase the production cost by over utilization of resources and intermediator issues. To overcome these issues this idea may work were the details of farmers, plantation get collected and stored in a database and the periodically the details about the plantation is collected by sensors and get stored and user receives alert by means of text. The details are available to agricultural officers, farmers, and consumers based on their need. After a certain period of time the data collected can be used as reference to improve the efficiency of farming and to increase the food production.

CHAPTER 1

INTRODUCTION

Smart Farming represents the application of modern Information and Communication Technologies into agriculture, leading to what can be called a Third Green Revolution by using Internet of Things, sensors and actuators, geo-positioning systems, Big Data, Unmanned Aerial Vehicles, robotics, etc. to improve the efficiency of farming and to increase the food production.

1.1 INTERNET OF THINGS (IOT)

The **Internet of things** (**IOT**) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013, the Global Standards Initiative on Internet of Things (IOT-GSI) defined the IOT as "the infrastructure of the information society". The IOT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IOT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

-1.2 ARDUINO AND SENSORS

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers [1]. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project. It is shown in Figure 1.1.

Figure 1.1 Arduino Board

Soil moisture sensor, itmeasures the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners. Soil moisture sensors typically refer to sensors that estimate volumetric water content.

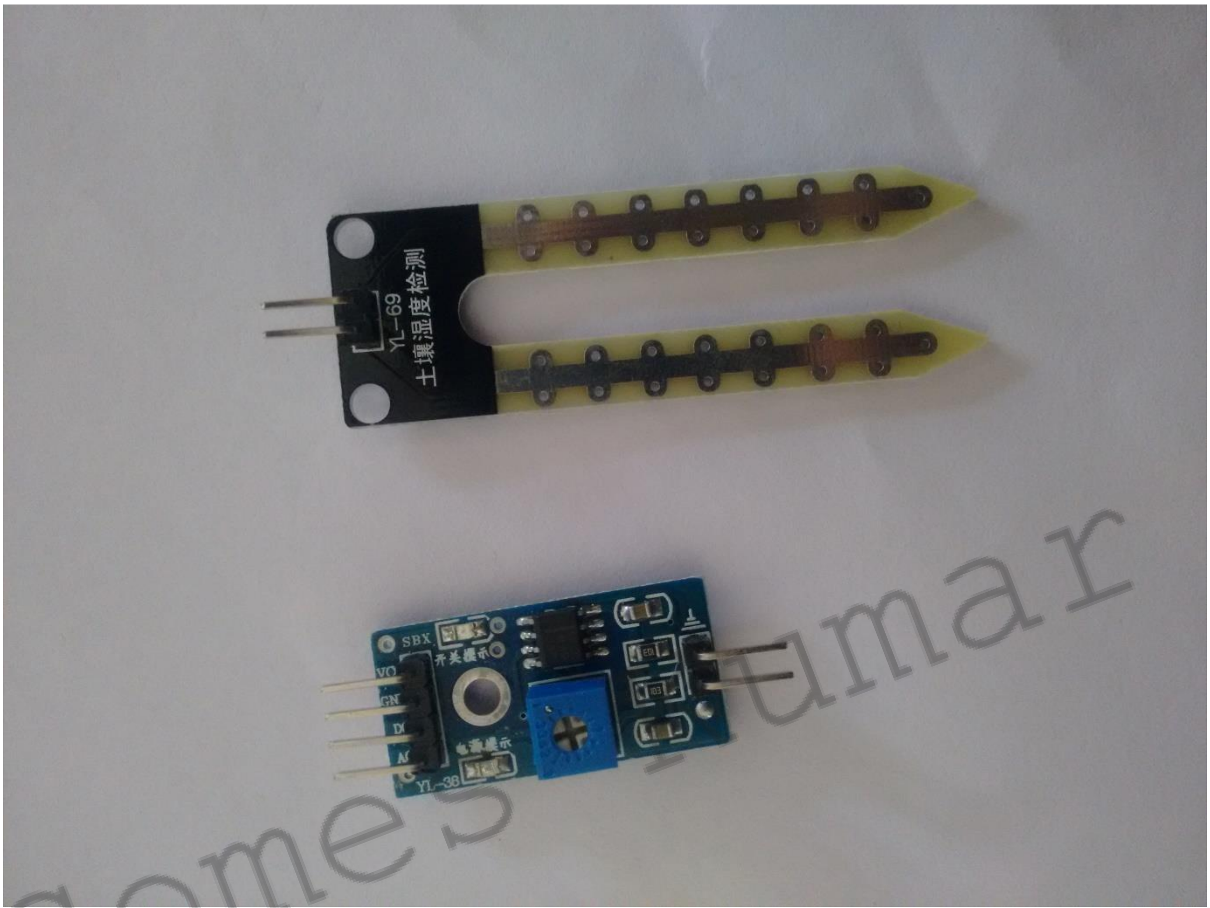

Figure 1.2 Soil Humidity Sensor

The **ESP8266** is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (microcontroller unit). The **ESP8285** is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

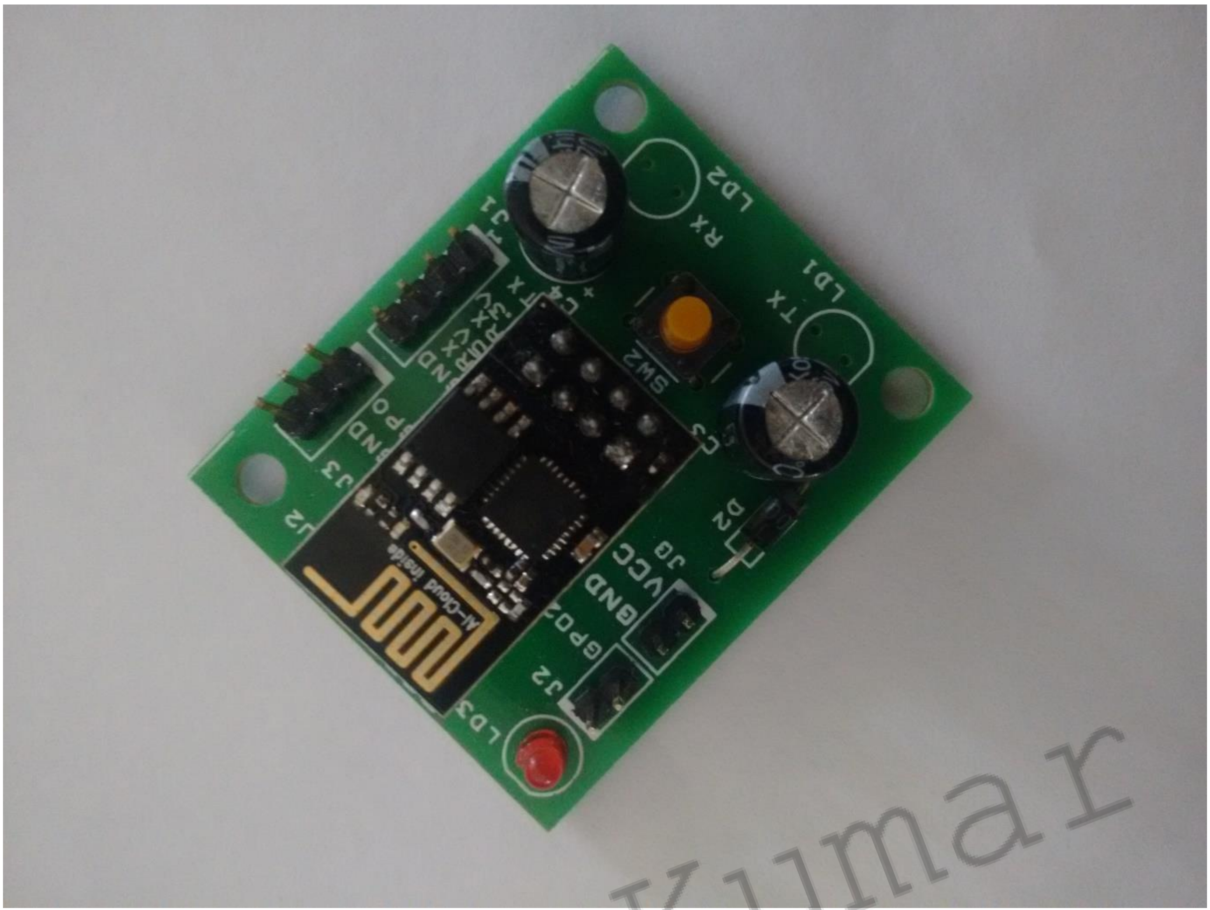

Figure 1.3 ESP 8266 with Base Board

1.3 USER INTERFACE

The User Interface is a graphical structure in which user monitor and control the Arduino sensor output and its functions. Here the user interface is built with HTML along with java script, CSS, and php [6].

Hypertext Markup Language (**HTML**) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS) and 1JavaScript it forms a triad of cornerstone technologies for the World Wide Web. Web browsers receive HTML documents from a webserver or from local storage and render them into multimedia web pages [6]. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.

HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects, such as interactive forms, may be embedded into the rendered page. It provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and other items. HTML elements are delineated by *tags*, written using angle brackets. HTML can embed programs written in a scripting language such as JavaScript which affect the behaviour and content of web pages. Inclusion of CSS defines the look and layout of content.

PHP is a server-side scripting language designed primarily for web development but also used as a general-purpose programming language. PHP code may be embedded into HTML or HTML5 Markup, or it can be used in combination with various web template systems, web content management systems and web frameworks. PHP code is usually processed by a PHP interpreter implemented as a module in the web server or as a Common Gateway Interface (CGI) executable. The web server software combines the results of the interpreted and executed PHP code, which may be any type of data, including images, with the generated web page. PHP code may also be executed with a command-line interface (CLI) and can be used to implement standalone graphical applications. PHP is a general-purpose scripting language that is especially suited to server-side web development, in which case PHP generally runs on a web server. Any PHP code in a requested file is executed by the PHP runtime, usually to create dynamic web page content or dynamic images used on websites or elsewhere. It can also be used for command-line scripting and client-side graphical user interface (GUI) applications. PHP can be deployed on most web servers, many operating systems and platforms, and can be used with many relational database management systems (RDBMS). Most web hosting providers support PHP for use by their clients. It is available free of charge, and the PHP Group provides the complete source code for users to build, customize and extend for their own use.PHP acts primarily as a filter, taking input from a file or stream containing text and/or PHP instructions and outputting another stream of data. Most commonly the output will be HTML, although it could be JSON, XML or binary data such as image or audio formats.

1.4 MySQL

A **database** is an organized collection of data. It is the collection of schemas, tables, queries, reports, views, and other objects. The data are typically organized to model aspects of reality in a way that supports processes requiring information. A **database management system** (**DBMS**) is a computer software application that interacts with the user, other applications, and the database itself to capture and analyse data. A general-purpose DBMS is designed to allow the definition, creation, querying, update, and administration of databases. MySQL Community Edition is the freely downloadable version of the world's most popular open source database. It is available under the GPL license and is supported by a huge and active community of open source developers.

The MySQL Community Edition includes: Pluggable Storage Engine Architecture. It is a freely available open source Relational Database Management System (RDBMS) that uses Structured Query Language (SQL).SQL is the most popular language for adding, accessing and managing content in a database. It is most noted for its quick processing, proven reliability, ease and flexibility of use. MySQL is an essential part of almost every open source PHP application. It is written in C and C++. Its SQL parser is written in yacc, but it uses a home-brewed lexical analyser. MySQL works on many system platforms, including Linux and Unix. And is fast, secure and available with lot of features. In addition, it comes with graphical user interface for effective usage and above all it is open source and available at no cost. As shown in Figure 1.4.

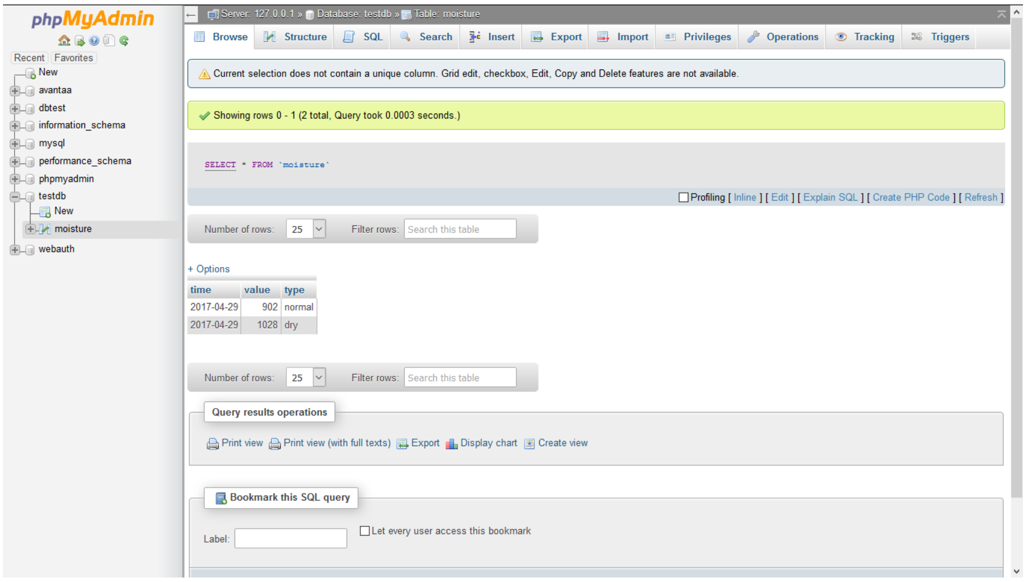

Figure 1.4 Graphical user interface of MySQL.

The moisture level of the soil which is collected using soil moisture sensor is transmitted to the arduino board where it is processed and it is moved into a database with the help of Wi-Fi module. This data can be used for soil analysis and testing purposes.

CHAPTER 2

EXISTING SYSTEM

These days only the sensor signals from the soil moisture sensor are taken as only alert signals and the humidity value of the soil is not stored in a database, hence when the alert signal from the sensor is received, the soil has to be examined by a resource person which s not required when the value is not stored n a database.

2.1 METHODOLOGY

The System that already exists was not implemented in India, but in the foreign countries widely adopted the system is mainly based on the automated monitoring and control.IOT is a technology in which electrical and electronical components interacts each other with the help of programming language which is responsible for communication and a database to store the details it collected.The IOT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. It mostly used for automated irrigation and maintaining temperature inside a green house. So, this made the system lack of many essential features [1].

In existing system, the sensor values are checked by the microprocessor with the values provided by the programmer and the decision is taken based on that value alone. And also, there is no data is stored, which can be used to get the absolute temperature, humidity required by the plants.

The data also is used for analysing which helps to identify the mistakes. And this system can’t adopt itself to different plants and temperature unless someone needs to reprogram it for that particular climate and plants. Representation is shown in Figure 2.1.

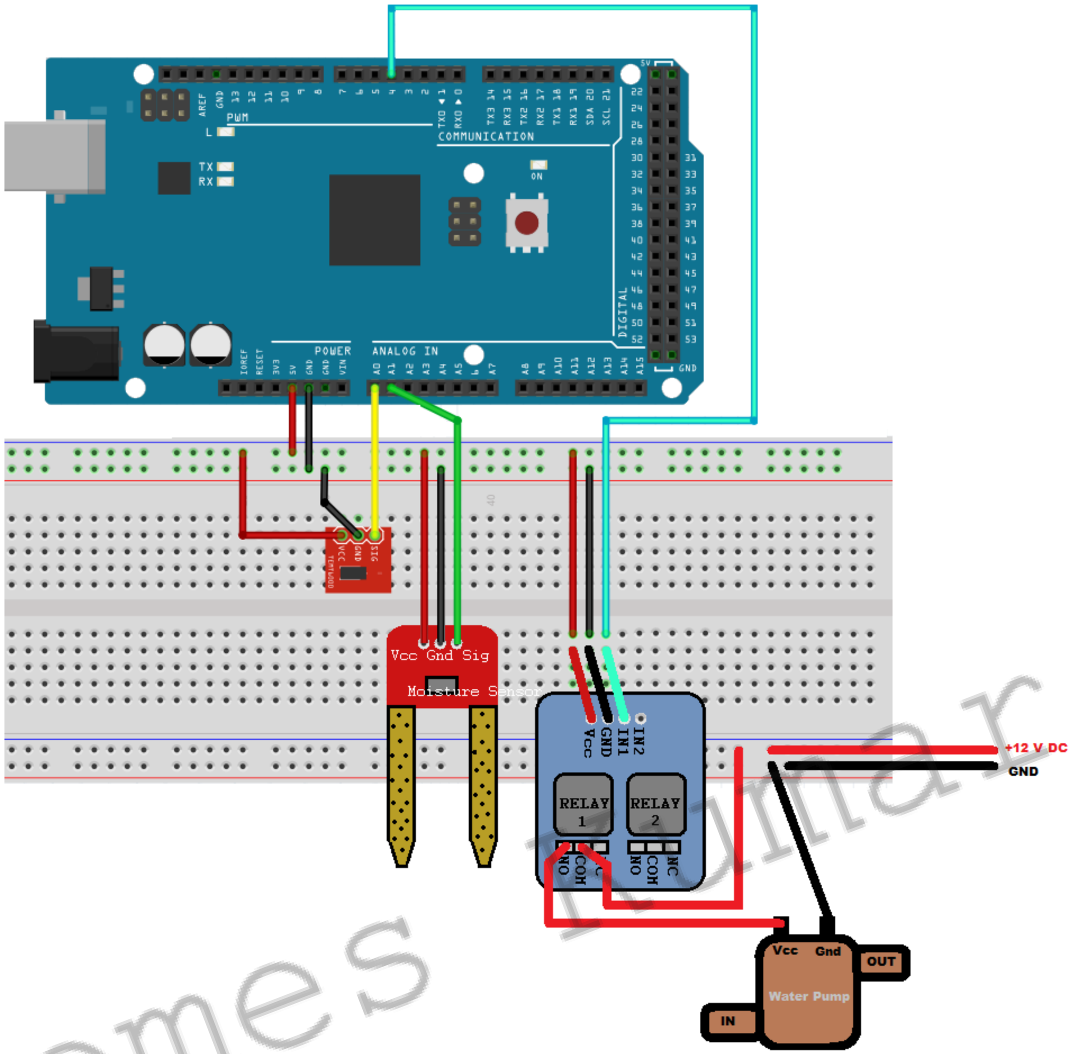

Figure 2.1 Pre-existing system overview

2.2 LIMITATIONS

The existing system does not store any data. So, there is no way to judge the most effective conditions in which the plant grow faster and produce more output. And this system can't adopt itself to various zones and plants. And also, it was not able to be prepared in advance for a day by using the various climatic data provided in the Internet. Though the pre-existing system lack few features, these features will reduce the effectiveness of that system.

CHAPTER 3

DESIGN METHODOLOGY

The limitations of the existing methodology such as storing of the moisture level in a database have overcome in our project with the help of a Wi-Fi module by transferring the value of the moisture to the database. and GSM module to send an alert.

3.1 PROBLEM DEFINITION

IOT is a technology in which electrical and electronical components interacts each other with the help of programming language which is responsible for communication and a database to store the details it collected. The major defect or missing thing in current system of agriculture is lack of details, guidance, marketing and information regarding the corps. So, this technology store the sensor data to a database which can be used later for research purposes and also it serves as a guide to new generation farmers. And also, data also be used for analysing which helps to identify the mistakes.

Further it used to find the most effective conditions in which the plant grow faster and produce more output at minimal cost because every plant have a certain temperature and humidity range in which it grow more effectively and efficiently but this temperature and humidity of plants can change due to mutations caused by climatic conditions and earth’s temperature.

So, with the help of the data collected by this system, one can effectively calculate the changes can be effectively made and new temperature for the upcoming harvests can be maintained. In this project, sensor values are used for calculating the values and in addition, it is used for storage [2].

3.2 SYSTEM OVERVIEW

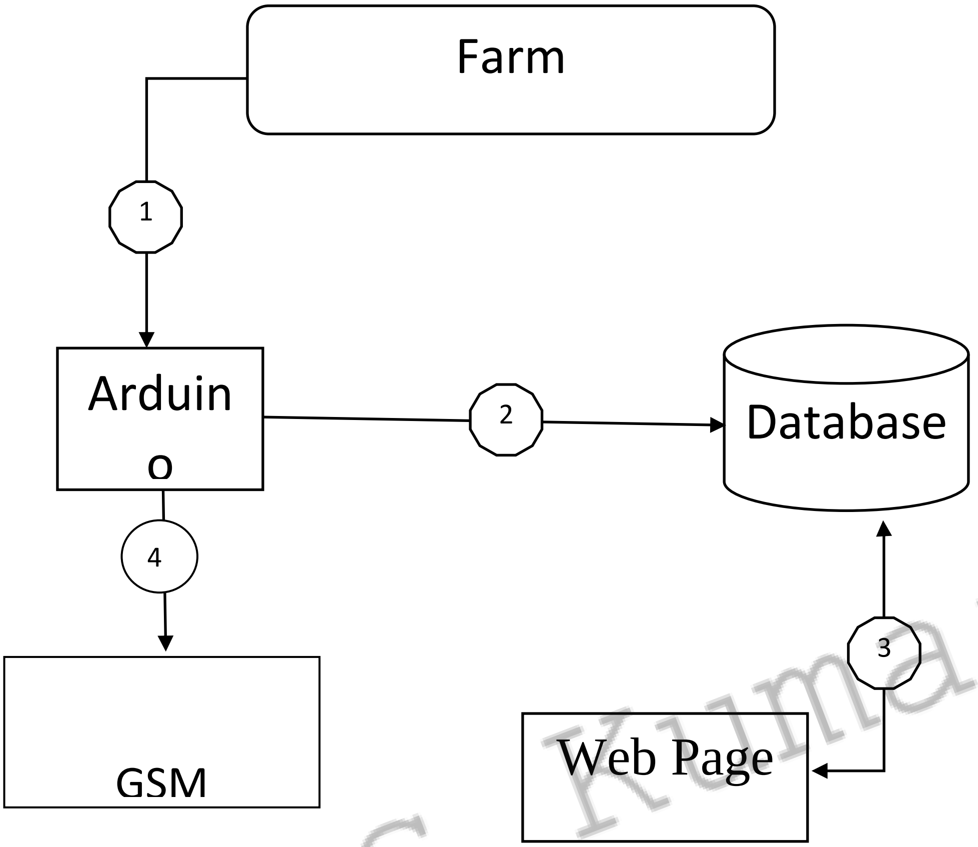

Figure 3.1 System Overview

01 Sensor sends values from the farm to the board.

02 Arduino sends data to the MySQL database

03 Web page retrieves the data from the database

04 Arduino sends alert to the GSM module.

3.3 CIRCUIT DIAGRAM

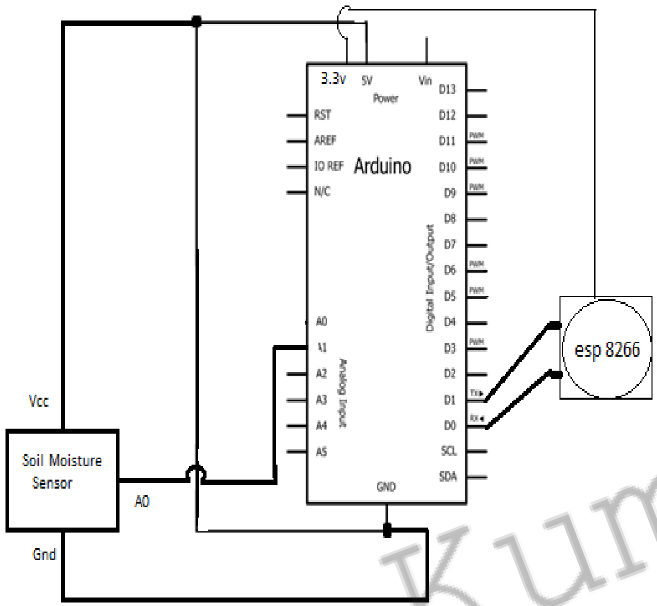

Figure 3.2 Arduino circuit connections

The Arduino two different power supply. The pin of 3.3v Vcc gets connected with the Vcc pin of the Soil moisture sensor. The Analog input pin A0 of the Arduino gets input from the Soil moisture sensor's output A0 [3]. The sensor is grounded by connecting its ground pin to the Arduino's ground pin. The ESP 8266 module is used for both transmitting and receiving the data. So, the transmitting pin TX of ESP 8266 is connected with the receiving pin RX of the Arduino and the receiving pin RX of the ESP 8266 is connected with the transmitting pin TX of the Arduino. For the power supply the 3.3v pin of the Arduino gets connected with the Vcc pin of the ESP 8266 and for grounding the ground pin of the ESP 8266 is connected with ground pin of the Arduino.

From the farm, various sensors collect the physical data and convert it into electrical pulses and send it to the Arduino board. Then the Arduino board receives the signal from the sensors and convert into digital format (i.e.) 0’s and 1’s. These signals get transferred to the server here localhost through Wi-Fi network. And gets stored in the database. When user want a data, it retrieves from the database and display it in the webpage. Alert is send when the moisture level goes very less are too high [4].

3.4 MODULE DESCRIPTION

3.4.1. HARDWARE IMPLEMENTATION

The electrical components are decided and sensors are chosen. The sensors and the Arduino board are checked for its proper functioning and the typical code is implemented and the output of the sensor at various conditions is noted. It is shown in Figure 3.3.

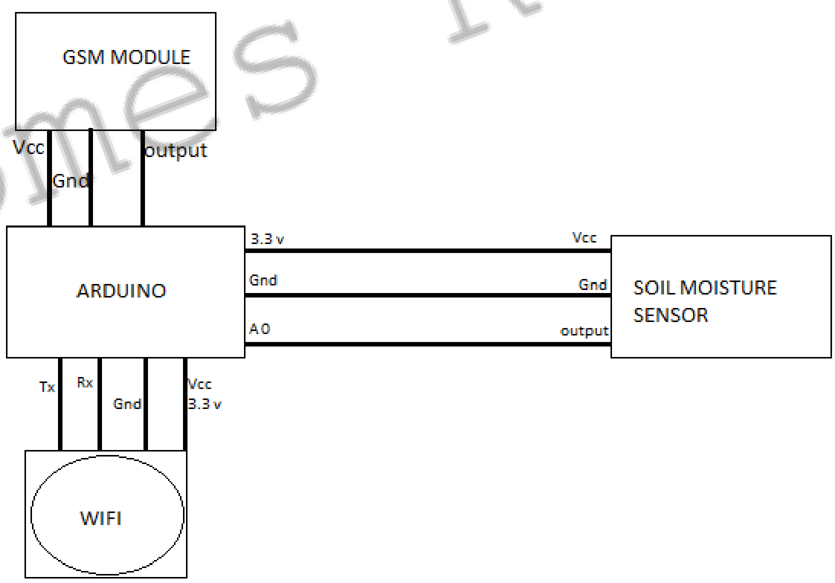

Figure 3.3 Hardware implementation overview.

3.4.2. DESIGINING USER INTERFACE AND DATABASE

The User Interface is designed and its code get implemented and the database get designed and connected to the User Interface.It is shown in Figure 3.4.

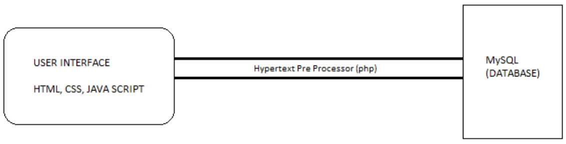

Figure 3.4 User Interface and Database overview.

3.4.3. CONNECTING USER INTERFACE AND THE HARDWWARE

The Arduino code get modified into final format. The data is transmitted to the database via Wi-Fi and retrieved in the webpage. It is represented in Figure 3.5.

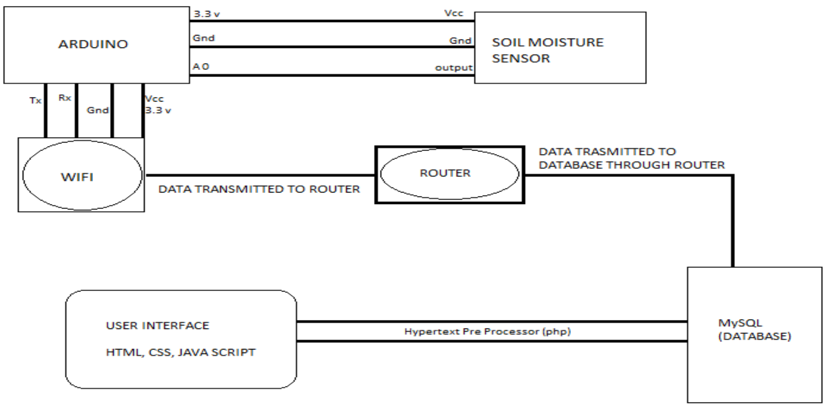

Figure 3.5 Complete system overview.

CHAPTER 4

IMPLEMENTATION AND RESULTS

The current supply is given to the arduino board which is connected to the Wi-Fi module in one end and soil moisture sensor in the other end. The signals from the sensor is sent to the Arduino board which process the signal and sent it to the database through the Wi-Fi module and alert is send to user by GSM module.

4.1 IMPLEMENTATION

When the board is provided with a power supply its starts to execute its program. Which in turn send a signal to the soil moisture sensor. Which in turn replies by sending the voltage drop due to its electrical resistance caused by the water content in the soil. These data are converted into digital format and transmitted via Wi-Fi network to the database runs over the local server and gets stored and get retrieved when the user needs it again. Also, an alert is send when the moisture level goes very less are too high.

4.1.1IMPLEMENTING HARDWARE

The electrical components are decided and sensors are chosen. The sensors and the Arduino board are checked for its proper functioning and the typical code is implemented and the output of the sensor at various conditions is noted. It is shown in Figure 4.1 and Figure 4.2

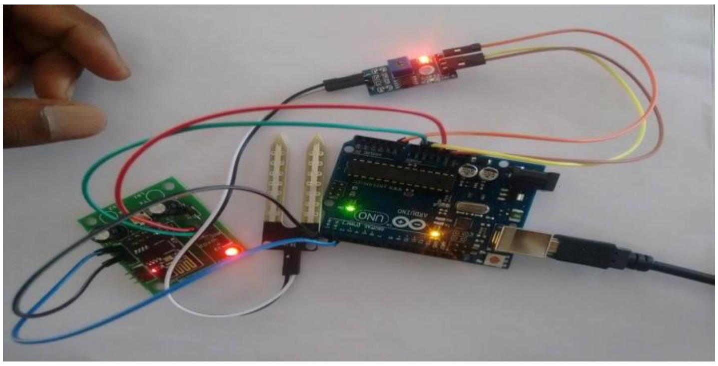

Figure 4.1 Arduino and sensors.

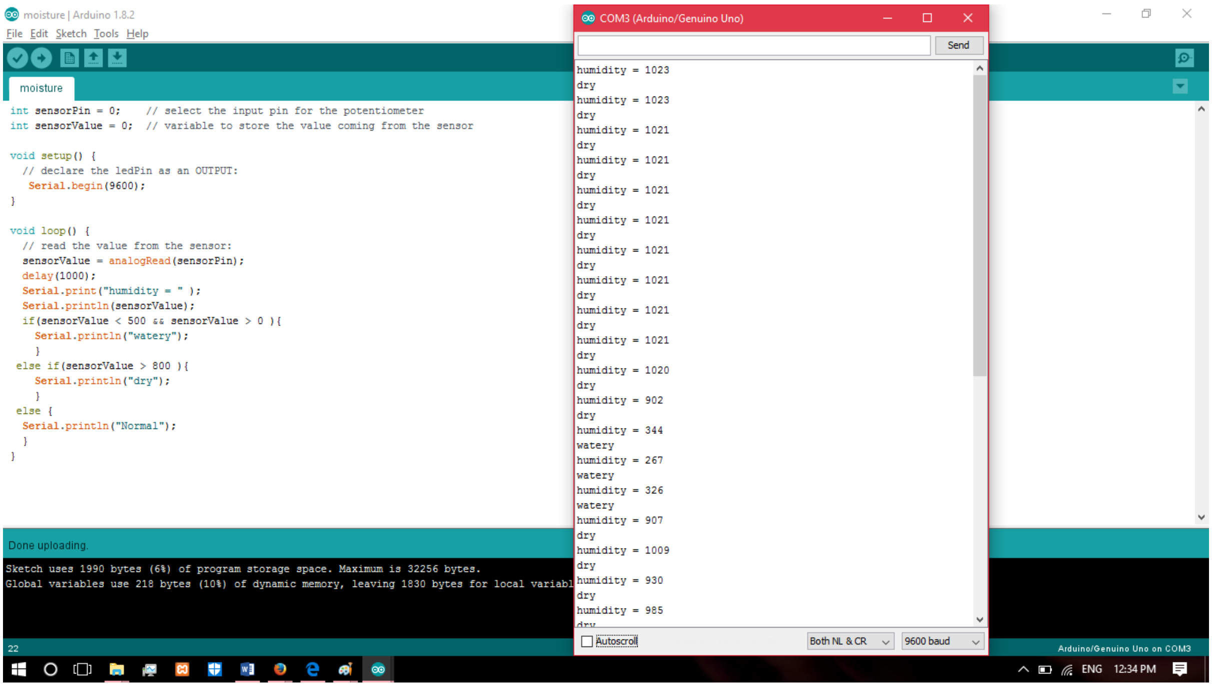

Figure 4.2 Sample output values and code.

4.1.2DESIGINING USER INTERFACE AND DATABASE

The User Interface is designed and its code get implemented and the database get designed using phpMyAdmin which is a graphical user interface of the MySQL database and connected to the User Interface. It is shown in Figure 4.2 and Figure 4.3

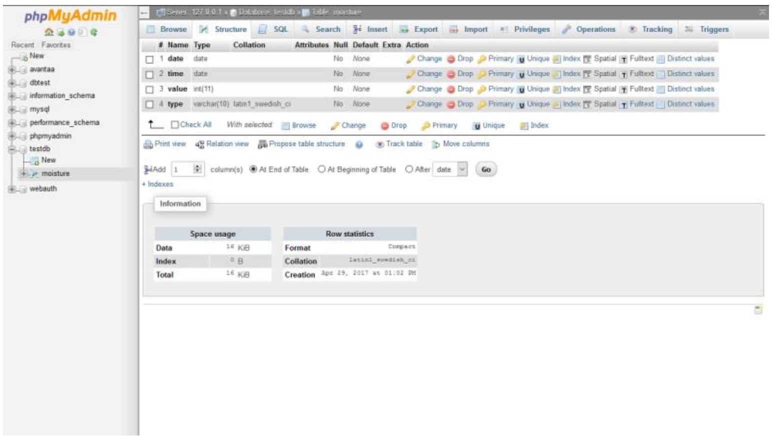

Figure 4.3 MySQL Graphical Interface.

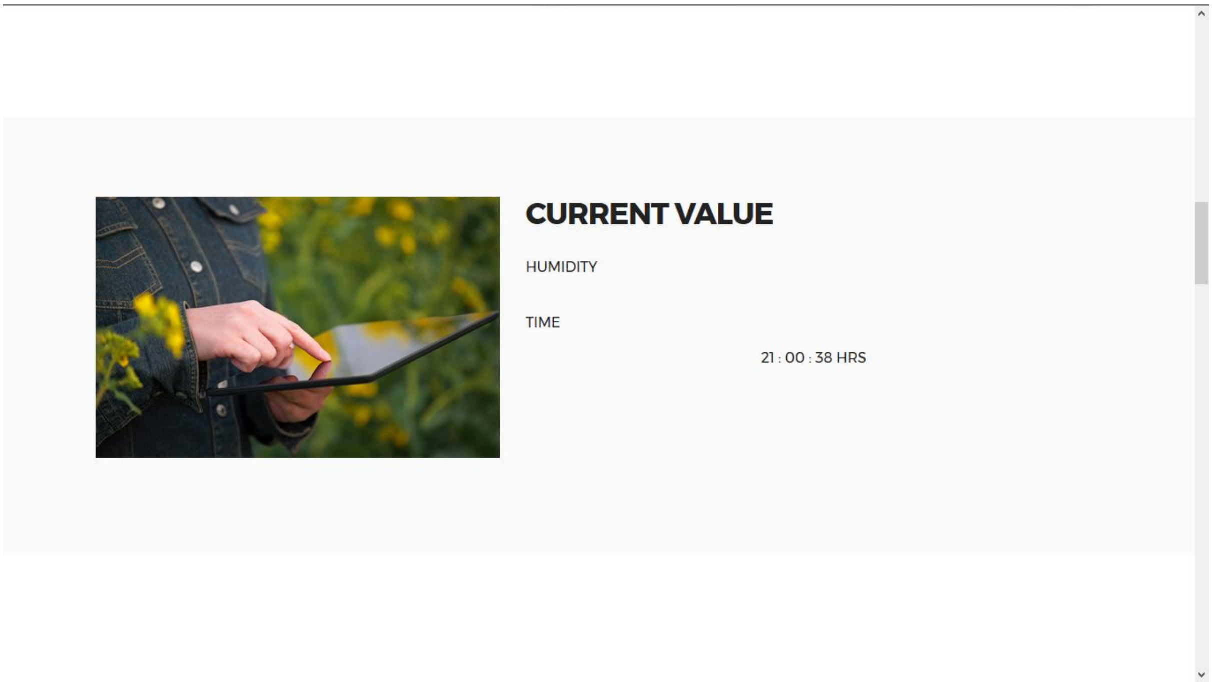

Figure 4.4 User Interface Structure.

4.1.3 CONNECTING USER INTERFACE AND THE HARDWWARE

The Arduino code get modified into final format. The data is transmitted to the database via Wi-Fi and stored in it and retrieved in the webpage and alert is send to the user as shown in Figure 4.5 and Figure 4.6.

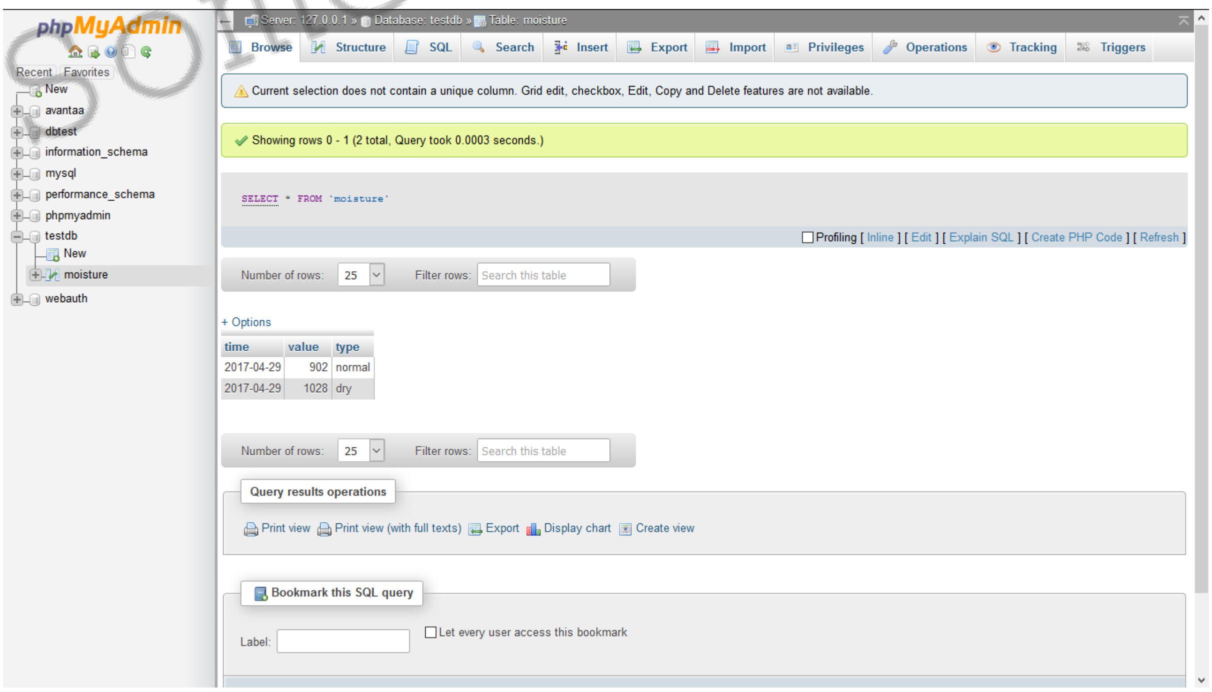

Figure 4.5. Table overview.

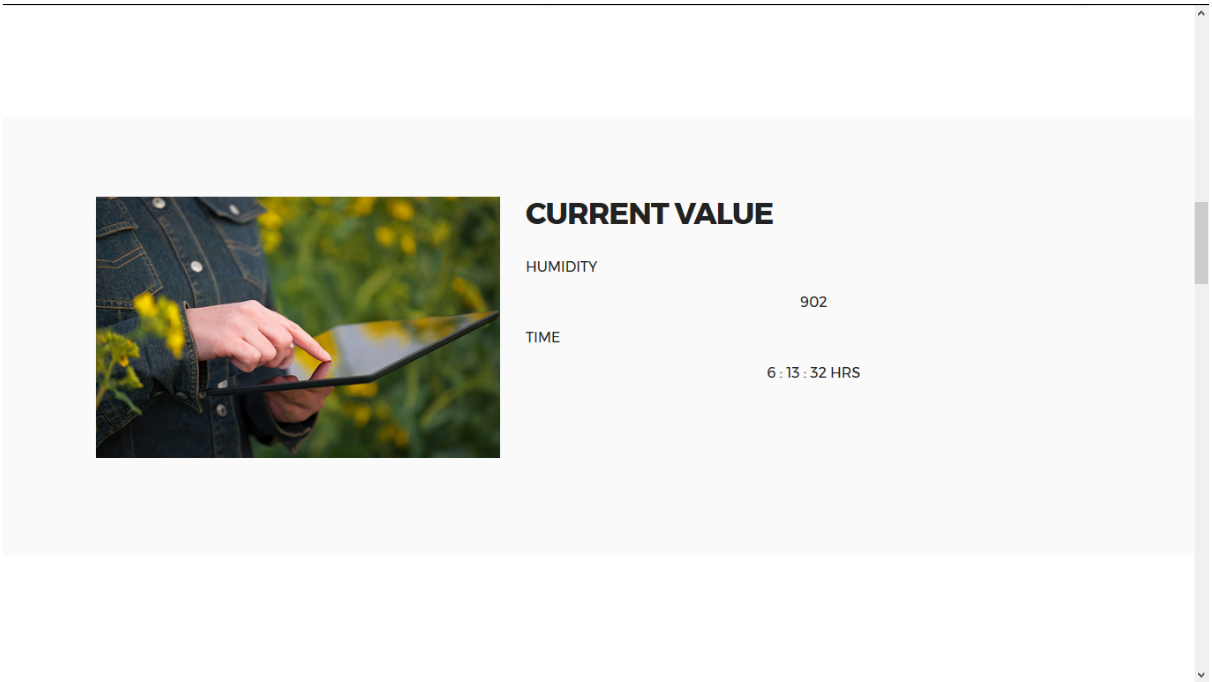

Figure 4.6 User Interface with data.

ARDUINO CODE

CODE FOR SOIL MOISTURE SENSOR

```
int sensorPin = 0;    // select the input pin for the potentiometer
int sensorValue = 0;  // variable to store the value coming from the sensor

void setup() {
  // declare the ledPin as an OUTPUT:
   Serial.begin(9600);
}

void loop() {
  // read the value from the sensor:
  sensorValue = analogRead(sensorPin);
```

```
  delay(1000);
  Serial.print("humidity = " );
  Serial.println(sensorValue);
  if(sensorValue > 250){
    Serial.println("high");
    }
  if(sensorValue < 250){
    Serial.println("Low");
    }
}
```

CODE FOR WIFI

```
#include<SoftwareSerial.h>
SoftwareSerial client(2,3); //RX, TX

String webpage="";
int i=0,k=0;
String readString;
int x=0;

booleanNo_IP=false;
String IP="";
char temp1='0';
void setup()
{
   Serial.begin(9600);
client.begin(9600);
wifi_init();
   Serial.println("System Ready..");
```

```
}
void wifi_init()
{
connect_wifi("AT",100);
connect_wifi("AT+CWMODE=3",100);
connect_wifi("AT+CWQAP",100);
connect_wifi("AT+RST",5000);
}
        void sendwebdata(String webPage)
{
  int ii=0;
   while(1)
   {
    unsigned int l=webPage.length();
    Serial.print("AT+CIPSEND=0,");
client.print("AT+CIPSEND=0,");
}
void Send()
{
    webpage = "<h1>Welcome to Circuit Digest</h1><body bgcolor=f0f0f0>";
sendwebdata(webpage);
    webpage=name;
    webpage+=dat;
}
void loop()
{
 k=0;
 Serial.println("Please Refresh your Page");
 while(k<1000)
}
```

CHAPTER 5

CONCLUSION AND FUTURE ENHANCEMENT

Hence the moisture values of the soil s stored in the database which can be retrieved easily whenever needed, the data can be used for analysing which crop should be planted in the field and also for the agricultural officers for the soil testing purposes.

5.1 CONCLUSION

Thus, the data is transmitted to the server and stored in the database and from the database to overcome these issues the details of farmers, plantation get collected and stored in a database and the periodically the details about the plantation is collected by sensors and get stored and the alert is sent. The details are available to agricultural officers, farmers, and consumers based on their need. After a certain period of time the data collected can be used as reference to improve the efficiency of farming and to increase the food production.

5.2 FUTURE ENHANCEMENT

In future, this method can be developed for multiple sensors and the data collected can be used for efficient agriculture and increased food production. Further the data can be used to analyse the area which is most suitable for a particular crop. And also, the minimum water requirement, temperature, light for the growth of the plant. So, the efficiency of the plantation can be increased. And by creating accounts for the industry people the demand can be known and the harvested crop can be marked with ease. The data after few years can be used to predict the approximate value and pre-instruct the users. Further the farm can be completely monitored and maintained by resource people like regional agricultural officers and users.

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