SOIL MOISTURE SYSTEM USING IOT

A Project Report Submitted

In Partial Fulfillment of the Requirement for the Degree of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

by

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CERTIFICATE

Certified that ***Preeti Vishwakarma(2019042019), Priyanka kumari(2019042020), Gaurav Mathur(2019042011), and Bharat Kumar Sahani (2019042010)*** have carried out the project work presented in this report entitled *"**Soil Moisture System Using IOT**"* for the award of **Bachelor of Technology** in Electronics and Communication Engineering from **Madan Mohan Malaviya University of Technology (formerly Madan Mohan Malaviya Engineering College), Gorakhpur (UP)** under my supervision and guidance. The report embodies result of original work and study carried out by students themselves and the contents of the report do not form the basis for the award of any other degree to the candidate or to anybody.

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CANDIDATE’S DECLARATION

I declare that this written submission represents my work and ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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APPROVAL SHEET

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ACKNOWLEDGEMENT

It is matter of great pleasure and satisfaction for me to present this dissertation work entitled "**Soil Moisture System Using IOT**", as a part of curriculum for award of "Bachelor of Technology" from Madan Mohan Malaviya University of Technology, Gorakhpur (U.P.) India.

I am very grateful to my Head of the Department **Prof R.K Chauhan.** It has been truly reassuring to know that he is always willing to share his quest for new problem and new solutions forms a very challenging and rewarding environment with us. He provides all kind of academic as well as administrative support for smooth completion of my dissertation work. Without his valuable guidance, this work would never have been a successful one.

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ABSTRACT

This paper describes a real-time soil monitoring for the agriculture farmlands to provide optimal and integrated data collections. Real- time monitoring provides reliable, timely information of crop and soil status plays an important role in the decision making in the crop production improvement. Agriculture depends on many parameters as inter and intra variability's of plants to give better yields such as soil parameters, climatic parameters so on. Here the system is designed to collect the data set for major parameters such as temperature, humidity, soil pH, soil moisture, light intensity and carbon-dioxide of the fields. The system consists of an Arduino UNO, NODE-MCU, DHT11 Sensor, soil moisture sensor, LCD Display, I2C Module, DC motor, Relay, DC motor driver. Data sets collected were used for the analysis of selection of crops and their vulnerabilities for regulating the irrigation parameters which will be of help in the agricultural practices, it will make easy way for farmers to take decision on planting a crops, watering and fertilizing them by avoiding the interference of hydro geologists and soil scientists by giving precaution. The obtained results were compared with the standardized optimum values for the particular crops and based on the differences inputs for the crops are varied. The automated watering helps the crops to get flow of water to fields based on the parameters, which is controlled by the DC motor. Multi sensor implementation for acquiring primary parameters essential for plant growth is the main aim of the paper. Easily available sensors were a motivation for the development of this project.

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Agriculture is the backbone of the Indian economy and around 70% of the population depends on this field to run their livelihood. From time immemorial agriculture has been a part of the human civilization. It has transformed the way humans survive. The economy of a particular area was indirectly dependent on agriculture, and was a major thrust behind the industrial revolution. Advancements in the field of science and technology led to increased yield. Applying electronic monitoring systems is one of the technologies for analyzing important conditions required for optimum growth of plants. The conditions can be listed as temperature, humidity, carbon dioxide, and soil moisture and soil pH. There are valuable data that could decide the plant life cycle. Efficient use of these parameters increases the output per plant and minimizes crop loss. The quantum of steps taken to monitor never ends here, more data collection in turn increases the accuracy and by leaving no stones unturned efficiency of harvest and output increases. Agricultural stations have developed novel methods for monitoring the data, and programs to help the farmer generate more output. Integrating various sensors that are rugged and capable of generating the hard data in real time can augment further analysis. Currently geographical land use patterns, soil parameters are determined using satellites, and non invasive techniques that are sophisticated and generate precise data in real time.

Agricultural fields have taken shelter under the umbrella of these new age technologies. Real time monitoring systems have the advantage of being fast and time saving in the present context. Moreover making it user friendly allows the agriculturist act swiftly and takes preventive measures. Designing Real time monitoring systems are a challenging task as it is not always possible to cover the entire domain of growth parameters owing to the dearth of sensor technologies, new emerging technologies like Ion selective field effect transistor (ISFET), Internet of things (IoT), 5G, GSM, Wi-Fi, mechanized harvesting, Robotic assistance are recent trends in the field of analysis of data. Temperature and humidity are very important environmental elements that must be controlled for healthy plants. Humidity controls the rate of transpiration and how the nutrients are received by the plants. Ideal humidity levels in a grow room range between 50% to 70% in vegetative growth, and 50% to 60%for flowering plants. Plants grow well only within a limited temperature range. Temperatures that are too high or too low will result in abnormal development and reduce production. Warm-season vegetable and most flower s grow between 60^{o} and 75^{o} or 80^{o}F. Cool-season vegetables such as lettuce and spinach should be grown between 50^{o} and 70^{o}F.Soil moisture is one of the most important parameter influencing crop yields. It plays a crucial role for efficient photosynthesis, respiration, transpiration and transportation of minerals and other nutrients through the plant. Proper irrigation schedule is very critical to plant growth. If the moisture content of a soil is optimum for plant growth, plants can readily absorb soil water. Soil water dissolves salts and makes up the soil solution, which is important as medium for supply of nutrients to growing plants.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Development of agriculture using technology will be very much useful in cultivation. For a new agricultural area, without knowing or monitoring the important parameters of the soil, cultivation will be difficult and so the farmers suffer financial losses. This project thesis provides a brief overview of the soil monitoring system using sensors. Various soil sensors are used to measure temperature, moisture and light. The information from the sensors in the soil is sent to the Bluetooth module through Arduino microcontroller. This information received from the Bluetooth is viewed in the application of the Android mobile phone. Thus this advanced technology helps the farmers to know the accurate parameters of the soil thus making the soil testing procedure easier.

2.2Litrature Review

The continuous increasing demand of food requires the rapid improvement in food production technology. In a country like India, where the economy is mainly based on agriculture and the climatic conditions are isotropic, still we are not able to make full use of agricultural resources. The main reason is the lack of rains & scarcity of land reservoir water. The continuous extraction of water from earth is reducing the water level due to which lot of land is coming slowly in the zones of un-irrigated land. Another very important reason of this is due to unplanned use of water due to which a significant amount of water goes to waste. The existing system of manual irrigation is very inefficient in regard to solving these issues. In modern drip irrigation systems, the most significant advantage is that water is supplied near the root zone of the plants drip by drip due to which a large quantity of water is saved. At the present era, the farmers have been using irrigation techniques in India through manual control in which farmers irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which crops get dried. Water deficiency can be detrimental to plants before visible wilting occurs. Slowed growth rate, lighter weight fruit follows slight water deficiency. This problem can be perfectly rectified if we use automatic irrigation system in which the irrigation will take place only when there will be acute requirement of water.

All the lands to be irrigated manually are automatically irrigated by this system. When compared to the previous system where farmers need to frequently and constantly keep monitoring the field for signs of dryness, this system will reduce the time needed to be spent on monitoring the field. It greatly diminishes the need for manpower by a great value. This system will be able to function even when the owner is unavailable for a small period of time, hence ensuring proper irrigation even in the absence of people. Also water will not be wasted during traversal.

2.3Motivation

In India, agriculture is the need of most of the Indians livelihood and it is one of the main sources of livelihood. Agriculture also has a major impact on economy of the country. The consumption of water increases day by day that may leads to the problem of water scarcity. Now-a- days not only for crops, outdoor plant in home becoming quite difficult for them.

The farmers from the remote locations would need to go the soil lab for soil testing to know about the soil fertility and required ratio of essential parameter such as Nitrogen, Phosphorus, Potassium(NPK).

Overall farmers faced various Problems while growing the crops so keep this problem in mind we are working on this project.

CHAPTER 3

PROJECT DEVELOPMENT

3.1 HARDWARE REQUIREMENT

3.1.1 TYPES OF Development Board Used:

ARDUINO

an Arduino board is an open source platform used for building electronics projects. Arduino is a programmable circuit's board which we can write a program based on your projects. Arduino program will be uploading with IDE (Integrated Development Environment) software that runs on your computer, it is used to write and upload computer code to the Arduino physical board. Arduino language is merely a set of C/C++ functions that can be called from your code.

Figure 3.1 of Arduino Uno R3 board

NODE-MCU

NodeMCU stands for Node Microcontroller Unit. It is an open-source Lua-based firmware that is designed for IoT(Internet of Things) applications. The module that runs this firmware is ESP-12E and that module is based on 32-bit ESP8266 MCU. It has 2.4 GHz Wi-Fi that supports WPA/WP2. The ESP-12E comes with a programmer and a 3.3v SMPS unit. So, you do not need any external programmer to program this board and you can easily run this board directly on 5V from USB.

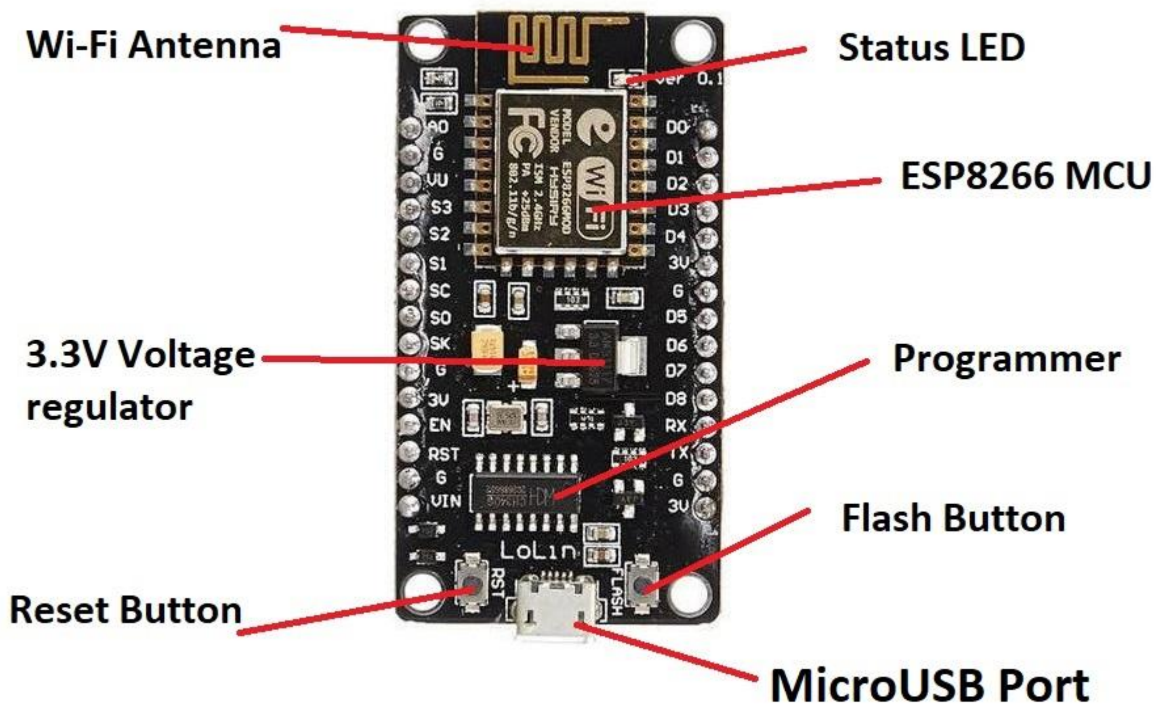


Fig 3.2 of Node-MCU

3.3 TYPES OF SENSOR USED:

• Humidity Sensor:

Humidity Sensor is the one of the most important devices that has been widely in consumer, industrial, biomedical, and environmental etc. This is used for measuring and monitoring Humidity. Humidity is defined as the amount of water present in the surrounding air(Environment). This water content in the air is a important factor in the wellness of mankind. For example, we will feel comfortable even if the temperature is 00C with less .

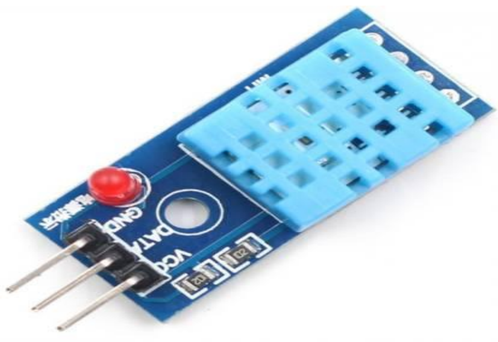


Fig3.3 of humidity sensor

Humidity Sensor humidity that is the air is dry . But if the temperature is 100C and the humidity is high that is the water content of air is high, then we will feel quite uncomfortable/unwell. Humidity is a major factor for operating sensitive equipment ex.- electronics, industrial equipment, electrostatic sensitive devices and high voltage devices or many more etc. Such sensitive equipment must be operated in a humidity environment that is suitable for the device project.

• Temperature Sensor

This sensor simplifies the temperature sensing and has three pins they are ground, data line and power supply. Here communication is done through data line. Power supply is 3V to 5.5V. Temperature range from -55˚C to +125˚C can be sensed. Resolution is from 9 bits to 12 bits. Scratch card memory is available where the converted data is stored from the sensor.

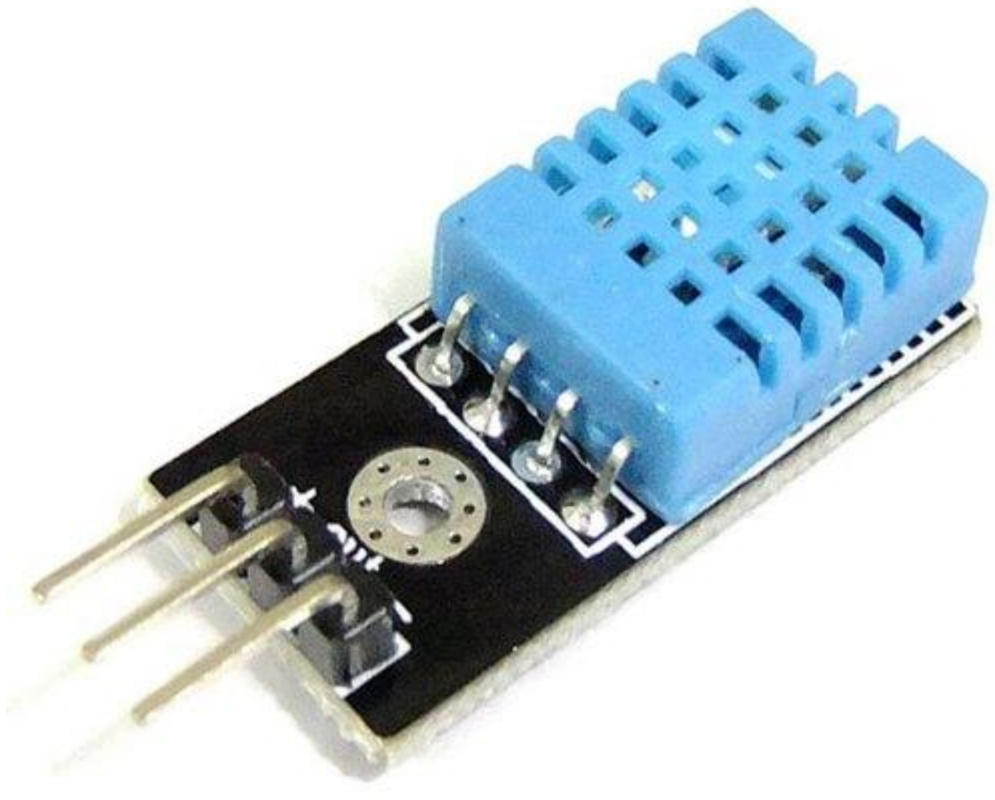


Fig3.4 of temperature sensor

• Soil moisture sensor

The Moisture sensor is used to measure the water content that is moisture of soil. when the soil is having less water, the module output is at high level, else the output is at low level. This sensor reminds the user to water their plants and also check the moisture content of soil. It has been widely used in agriculture for checking soil moisture , land irrigation and botanical gardening.

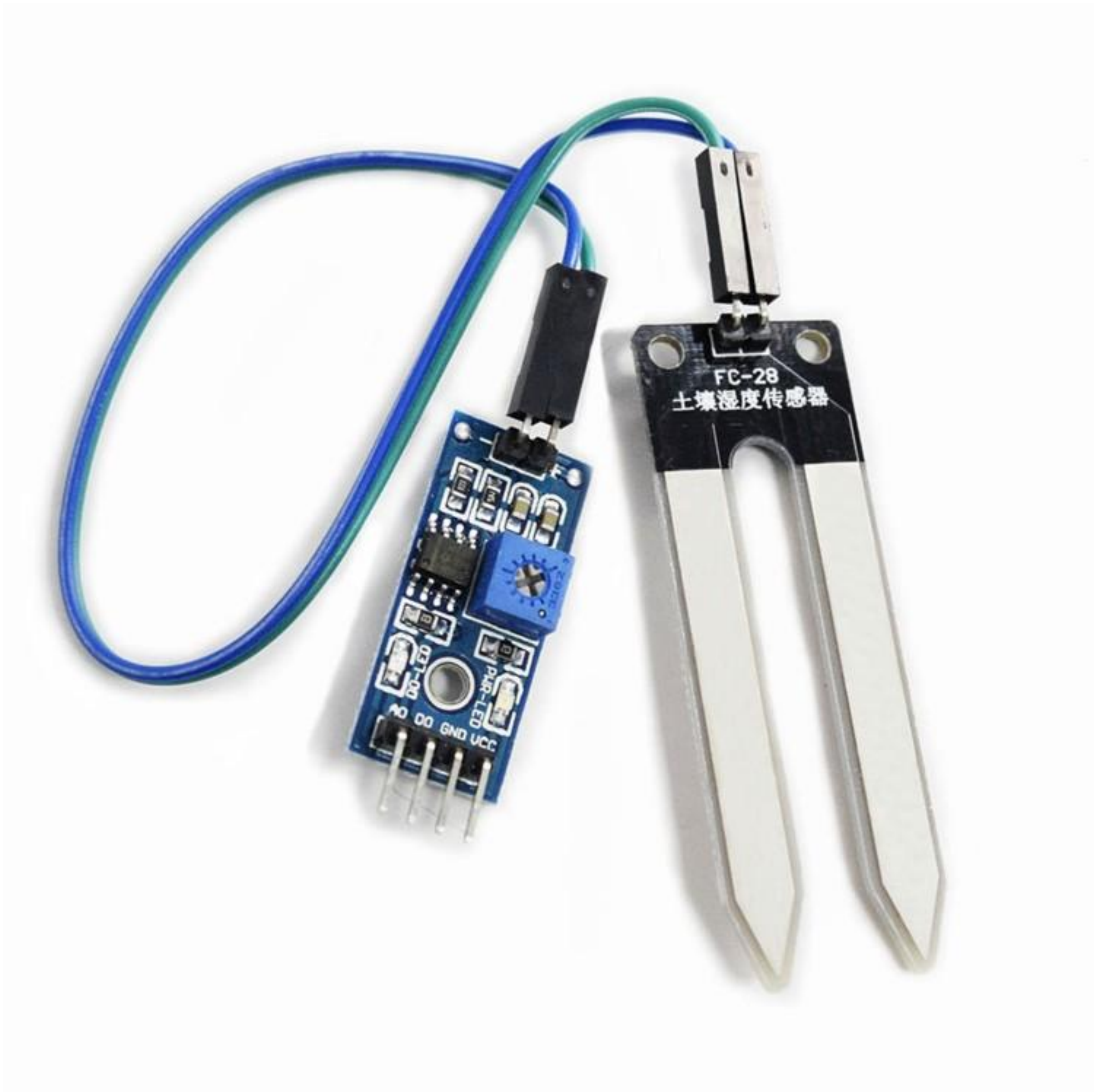


Fig 3.5 of soil moisture sensor

RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solidstate relays. Relays are used where it is necessary to control a circuit by a separate lowpower signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. Electromagnetic relays are those relays which are operated by electromagnetic action. Modern electrical protection relays are mainly micro-processor based, but still electromagnetic relay holds its place. It will take much longer time to be replaced the all electromagnetic relays by micro-processor based static relays.

Fig 3.6. of relay

DC MOTOR PUMP

A DC motor is any of a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. DC motors were the first type widely used, since they could be powered from existing directcurrent lighting power distribution systems. A DC motor's speed can be controlled over a 15 wide range, using either a variable supply voltage or by changing the strength of current in its field windings. A DC motor pump is essentially a DC Motor that is used to circulate water. The internal structure is the same. The DC motor is encased in a waterproof plastic casing and the shaft is used to drive an external arm that pumps water. The Pump requires a 5V supply, which can be easily provided by batteries or AC supply.

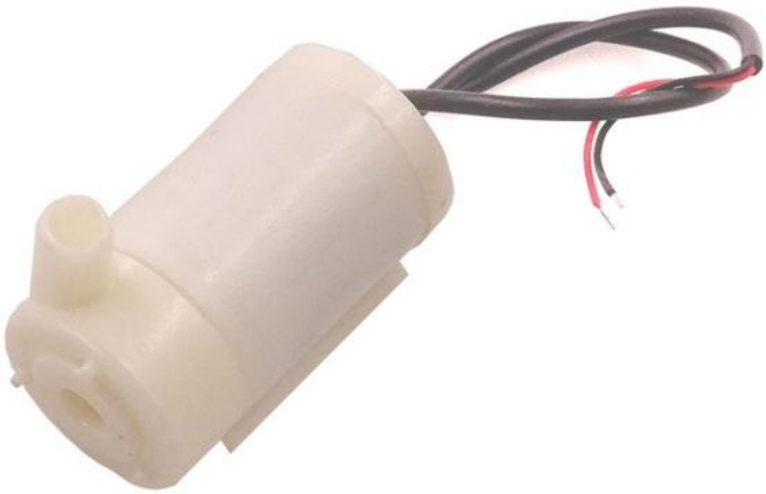


Fig 3.7.of dc motor

DC MOTOR DRIVER

DC motor drives are defined as amplifiers or power modules that interface between a controller and a DC motor. They convert step and direction input from the controller to currents and voltages compatible with the motor. These units are sometimes called variable speed drives, referring to a majority of DC motor drives which adjust shaft speed. In industry, a 'drive controller' is a motor drive which incorporates functions of a programmable logic controller (PLC) and drive interface to regulate the speed, torque, horsepower, and direction of a DC motor.

DC motors tend to be less complex than AC motors and are normally less expensive for most horsepower ratings. They are capable of providing large startup torques exceeding 400% of the rated continuous torque. They have a long history of use in variable speed applications with a wide range of options available for this purpose.

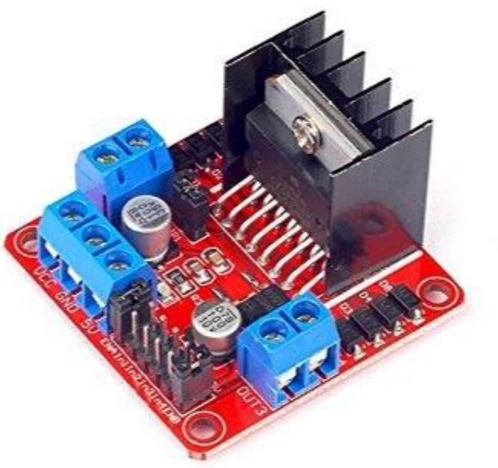


Fig 3.8 of dc motor driver

LIQUID CRYSTAL DISPLAY

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

Command register stores various commands given to the display. Data register stores data to be displayed. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. In your arduino project Liquid Crystal Library simplifies this for you so you don't need to know the low-level instructions. Contrast of the display can be adjusted by adjusting the potentiometer to be connected across VEE pin.

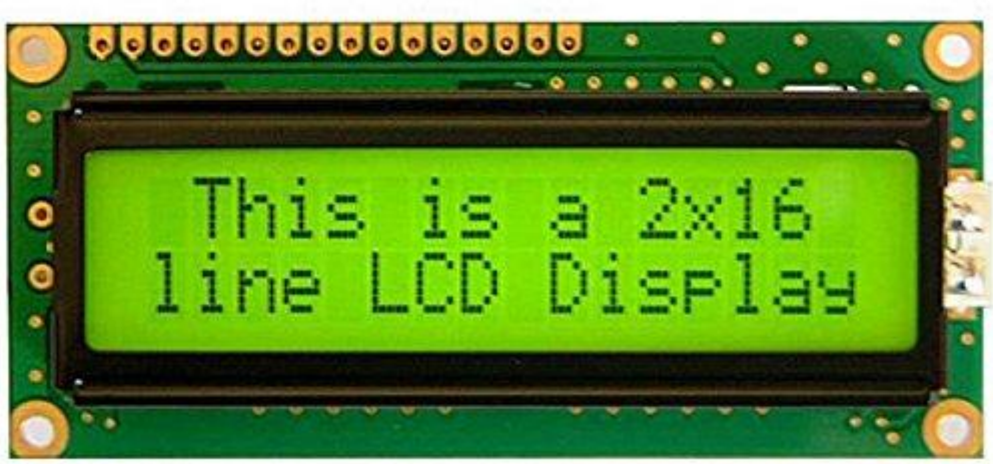


Fig3.9 of LCD display

I2C_LCD is an easy-to-use display module, It can make display easier. Using it can reduce the difficulty of make, so that makers can focus on the core of the work.

We developed the Arduino library for I2C_LCD, user just need a few lines of the code can achieve complex graphics and text display features. It can replace the serial monitor of Arduino in some place, you can get running informations without a computer.

More than that, we also develop the dedicated picture data convert software (bitmap converter)now is available to support PC platform of windows, Linux, Mac OS. Through the bitmap convert software you can get your favorite picture displayed on I2C_LCD, without the need for complex programming.

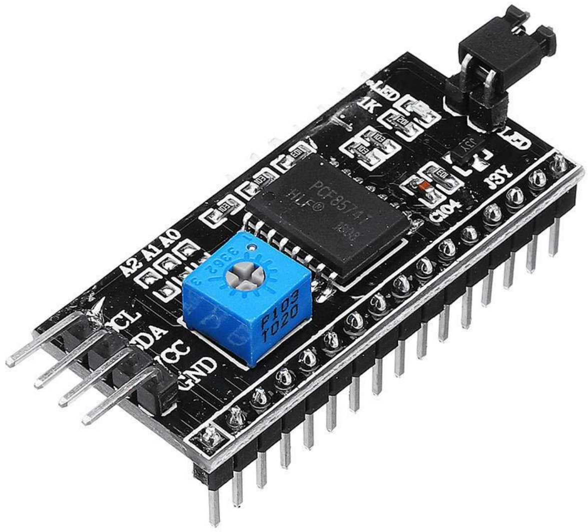


Fig3.10 of I2C module

AC to DC Converter

An AC-DC Converter is a device that converts an AC voltage to DC voltage. Electricity supplied to homes is typically 100v or 200v AC. On the other hand, most electronic devices operate at 3.3V or 5V DC. Consequently it is necessary to convert from AC to DC voltage.

One motor and lamp can be driven with AC voltage, but for motors that include control circuitry(i.e.MCUs)and lamps that have to switched to energy-saving LEDs, AC-DC conversion is required.

Fig 3.11 of AC to DC converter

JUMPER WIRE

A **jump wire** (also known as **jumper**, **jumper wire**, **DuPont wire**) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Fig3.12 of jumper wire

BREADBOARD

A breadboard is used to build and test circuits quickly before finalizing any circuit design. The breadboard has many holes into which circuit components like ICs and resistors can be inserted. A typical breadboard is shown below: The bread board has strips of metal which run underneath the board and connect the holes on the top of the board. The metal strips are laid out as shown below. Note that the top and bottom rows of holes are connected horizontally while the remaining holes are connected vertically. To use the bread board, the legs of components are placed in the holes. Each set of holes connected by a metal strip underneath forms a node. A node is a point in a circuit where two components are connected. Connections between different components are formed by putting their legs in a common node. The long top and bottom row of holes are usually used for power supply connections. The rest of the circuit is built by placing components and connecting them together with jumper wires. ICs are placed in the middle of the board so that half of the legs are on one side of the middle line and half on the other.

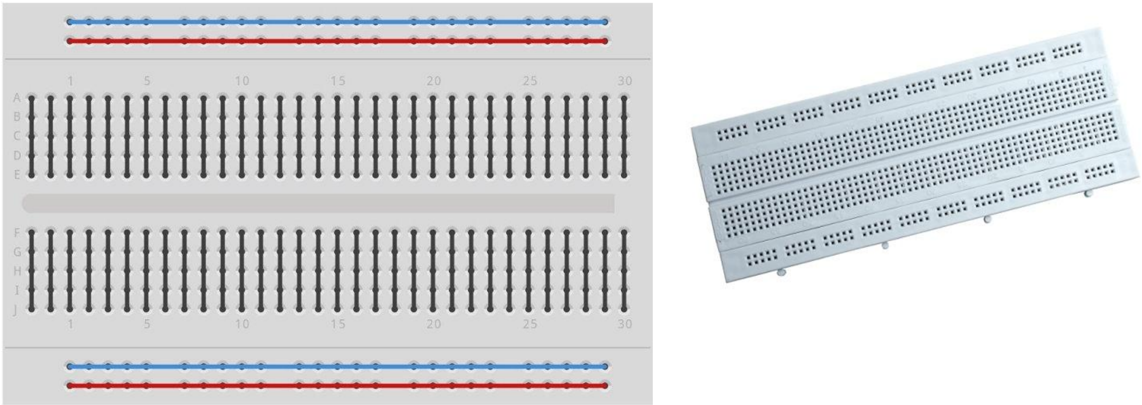


Fig3.34 of breadboard

SOFTWARE USED

The open-source Arduino Software(IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board. Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

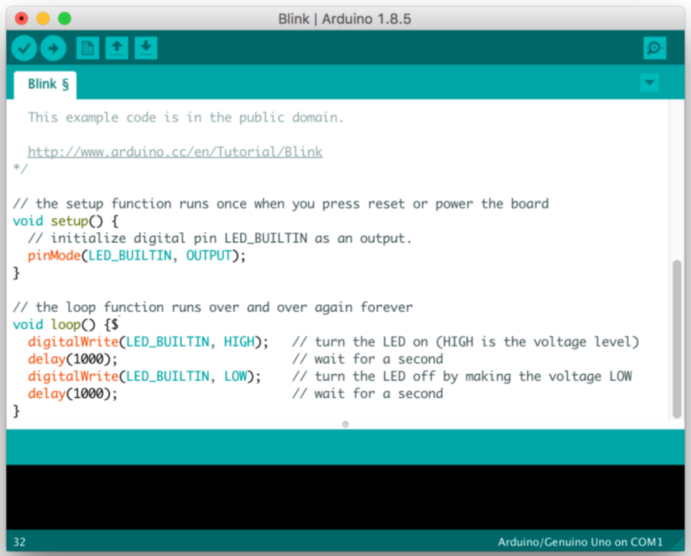
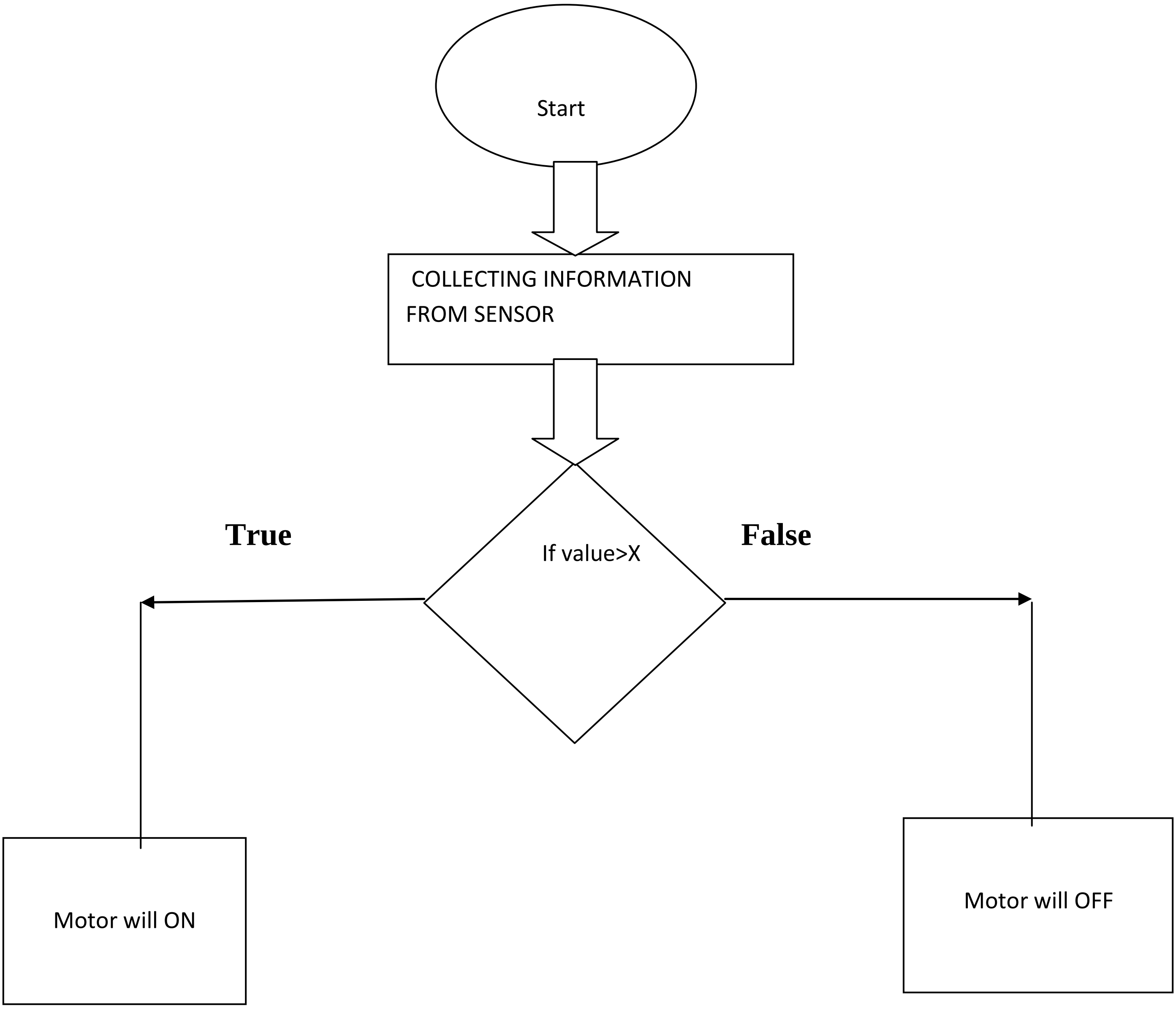


Fig3.14 of Arduino IDE

CHAPTER 4

SYSTEM DESIGN

4.1 FLOW CHART



Where,   x-threshold moisture level

4.2 FLOW DIAGRAM

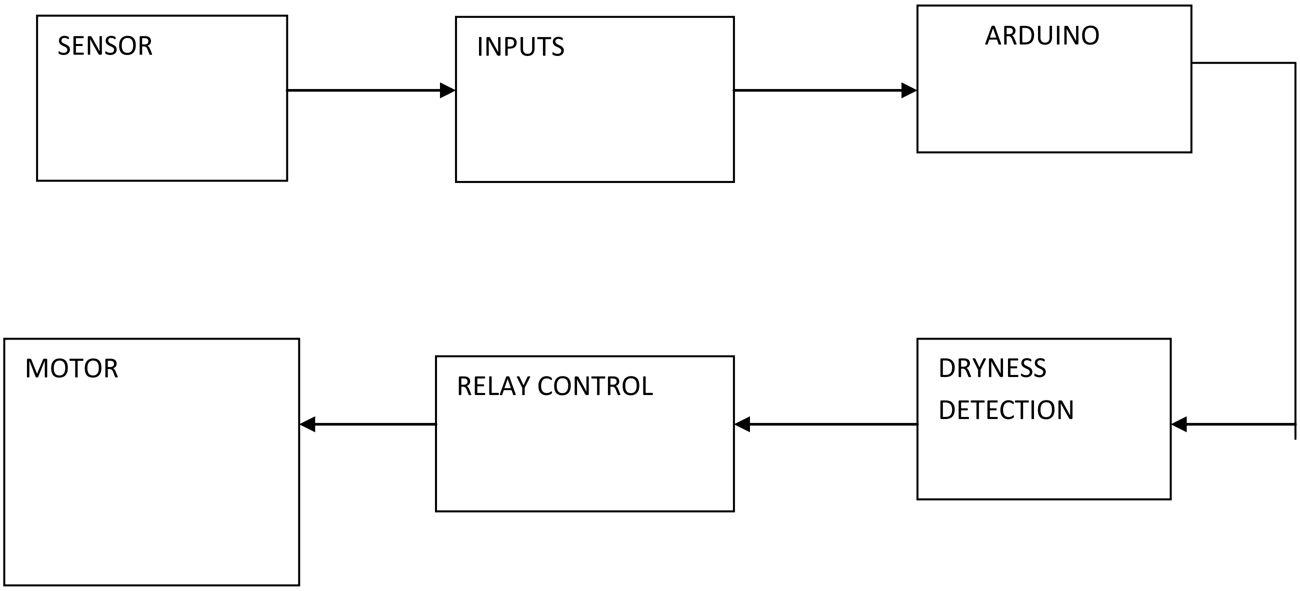


Fig.4.2.1 Flow diagram of the circuit

4.3 CIRCUIT DIAGRAM

SOIL IRRIGATION CIRCUIT

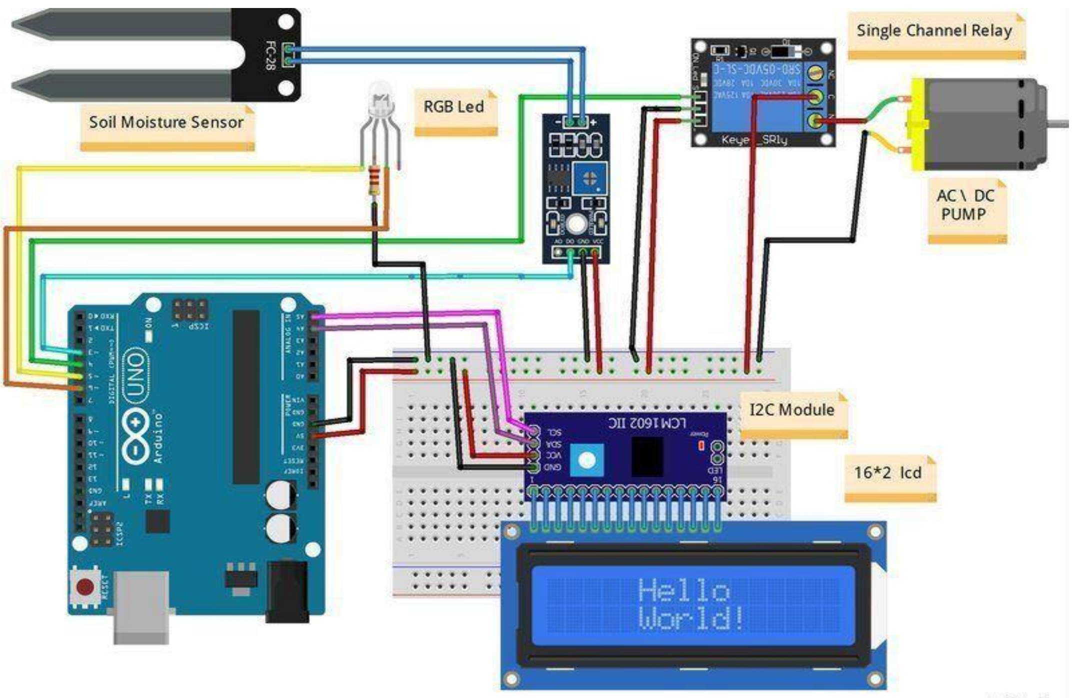


Fig 4.3.2 of irrigation system

SIOL PARAMETER MONITORING CIRCUIT(HUMIDITY & TEMP.)

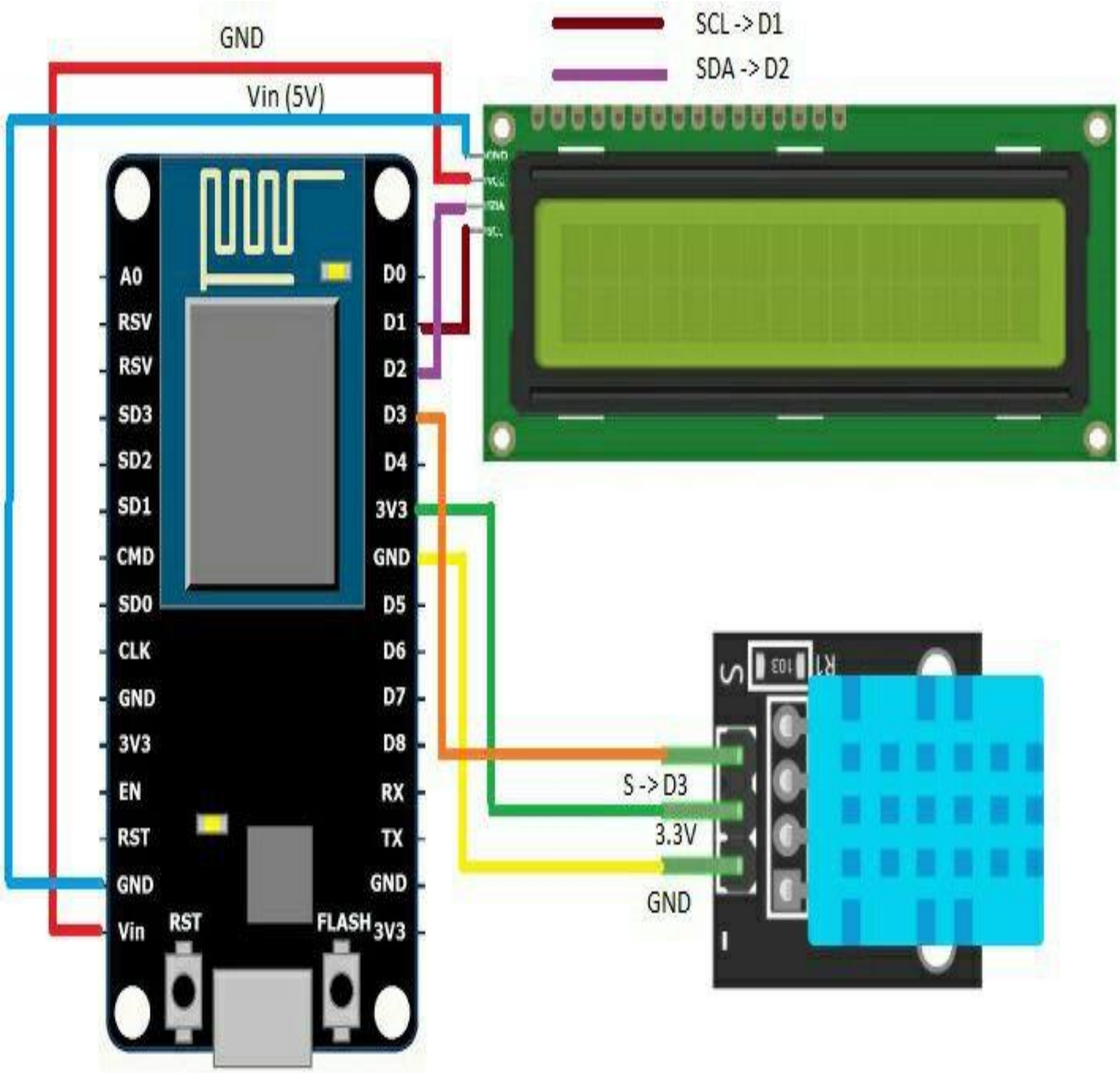


Fig.4.3.3 circuit diagram

CHAPTER 5

SYSTEM IMPLEMENTATION

5.1 METHODOLOGY

Implementation of the project required the design of the system developed in the design phase of the project to be carefully implemented. The extensive implementation of automated systems in agriculture has proven to successfully reduce cost. The operation of automated agricultural system could potentially revolutionize the irrigation process and the way it has impacted the commercial & industrial sectors. Thus, this project has been an expert or non-expert-system-based method of field monitoring for detecting dryness & treatment of the field. The prototype system food and beverage industry has the potential to be useful for the industry, seeking ways to make agriculture cost effective. Furthermore, the ultimate beneficiaries of the project are the farmers who are the backbone of an agricultural economy.

5.2 PROJECT PLAN

The Objective of the project planning is to provide a framework that enables an owner to make reasonable estimate of the resources, cost and schedule. The project leader is responsible for designing the system precisely according to the requirement specified by the owner/ customer. He is also responsible for maintenance of the system for certain period of time, since in most cases, cost of maintenance is much higher than cost of developing the system. Thus to reduce development and maintenance cost and to provide the system within planned time, proper planning of system is necessary.

5.2.1. INITIAL INVESTIGATION OF DESIGN: The most crucial phase of managing system projects is planning to launch a system investigation, we need a master plan detailing the steps to be taken, the people to be questioned, and outcome expected. The initial investigation has the objective of determining whether the user's request has potential merits the major steps are defining user requirements, studying the present system and defining the performance expected by candidate system to meet user requirements. The first step in the system development life cycle is the identification of need. There may be a user request to change, improve or enhance an existing system. The initial investigation is one way of handling these needs. The objective is to determine whether the request is valid and feasible before a 22 recommendation is reached to do nothing, improve or modify the existing system, are to build a new one. Thus for an effective test and written paper follow-up data resulting from different circumstances, it is vital to design the APIS.

5.3 WORKING

This project consists of two sections:

Soil parameter monitoring like measurement of nitrogen ,phosphorus, potassium, temperature, humidity and second is soil irrigation system. This project consists of two sections: the external sensor unit, and the inbuilt processing unit. In the external sensor unit, the basic requirement of sensing the moistness of the sand or soil through capacitive reactance is performed, the arms of the sensor are able to detect resistance and provide input to the IC. When the soil becomes dry, it produces large voltage drop due to high resistance, and this is sensed by the soil moisture sensor, and this resistance causes the operational amplifier to produce an output that is above the threshold value required. This causes the relay to change from normally open to closed condition – The relay becomes on. When the relay is turned on, the valve opens and water through the pipes rushes to the crops. When the water content in the soil increases, the soil resistance gets decreases and the transmission of the probes gets starts to make the operational amplifier stop the triggering of the relay. Finally the valve which is connected to the relay is stopped. Op-amp is configured here as a comparator. The comparator monitors the sensors and when sensors sense the dry condition then the project will switch on the motor and it will switch off the motor when the sensors are in wet. The comparator does the above job it receives the signals from the sensors. A transistor is used to drive the relay during the soil wet condition. 5V double pole – double through relay is used to control the water pump. LED indication is provided for visual identification of the relay / load status. A switching diode is connected across the relay to neutralize the reverse EMF. This project works with 5V regulated power supply for the internal blocks and uses regulated 12V power supply for the relay board. Power on LED is connected for visual identification of power status. First, the sensor probes are inserted in the soil at specific locations in the field, at a depth of 5cm from the soil surface at regular intervals in the field. The wiring is made with 23 protective covering so that it is not harmed by any unexpected factors like rocks in the field. Since wet soil is more conductive than dry soil, the soil moisture sensor module has a comparator in it. The voltage from the prongs and the predefined voltage are compared and the output of the comparator is high only when the soil condition is dry. When the moisture in the soil is above the threshold, the relay will be turned on. The relay coil gets energized and turns on the motor. The LED is also turned on as an indicator. The soil begins to get supplied with water, and the water content of the soil increases. When the moisture content of the soil increases and reaches the threshold value, the output of the soil moisture sensor is low and the motor is turned off. This prevents a case of over-watering.

5.3.1. WORKING MODEL STRUCTURE

Fig 5.1 of Project

5.4 RESULT

- By using Temperature and humidity sensors which help to improve agricultural processes.
- Plants need four things to survive: light, water, soil and air. However, to raise healthy plants, the most important element is the effect of water. Water is *crucial* in regard to relative humidity.
- Relative humidity is a measure of how much water the air can hold at any given temperature. This means that say the air is at 60% humidity at 20 degrees, then the air is at 60% of its total moisture capacity for that temperature.
- Most flowering plants prefer the same daytime temperature range, but grow best when nighttime temperatures range from 55 degrees to 60 degrees F.
- We can protect our crop or agriculture field by low and high temperature and humidity which create the bad effect on agriculture field.
- We can also connect the NPK sensor in the SOIL PRAMETER MONITORING SYSTEM with DHT-11 and NODE MCU which can help to know the ratio of NPK in the Soil. According to the NPK ratio in soil we can also recommended FERTILIZERS for enhancing the overall growth of Crop and maintain Soil Fertility.
- By using this System Farmers are no need go to the soil lab for soil testing.

crops	**Temperature in celcius**	**Humidity in %**
tomato	**18-28**	**50-95**
cabbage	**15-30**	**30-85**
Carrot	**18-26**	**40-90**
Pumpkin	**21-30**	**35-80**

Table 5.4.1 shows dataset of temp and humidity

We can change the threshold value(In programming part) of the Soil Irrigation System according the given bellow table of the water requirement(mm) for the different types of Crops

Crop	Water requirement(mm)
Rice	**1200**
Wheat	**450-650**
Maize	**500-800**
Potato	**500-700**
Sugarcane	**1500-2500**
Cotton	**700-1300**
Tomato	**600-800**

Table 5.4.2 shows dataset of moisture level soil

5.5 BOM(BIL OF MATERIAL COST)

Components	Cost(Rs.)
Arduino Uno	749/-
Node MCU	170 /-
Temp. And Humidity Sensor	100 /-
Soil Moisture Sensor	100/-
I2C Module	150 /-
Single channel Relay	120/-
LCD Display 16*2	300 /-
Mini DC submersible Pump	150 /-
Voltage Regulator	150 /-
Box and Board	200 /-
Wires	200 /-
Total cost	2389/-

5.6 ADVANTAGES

- The main advantage of this project is that it has faster execution when compared to¬ manual execution of the process.
- It is simple, portable and provides high performance.
- It consumes less power
- Dryness can be easily detected in soil.
- Permits a non- expert to do the work of an expert.

- Improves productivity by increasing work output and improving efficiency.
- Saves time in accomplishing specific objective.
- This system ensures that the plants do not endure from the strain or stress of less and over watering.
- This system saves labour cost and water up to 70%. The working of this irrigation¬ system covers over 40 crops spanning across 500 acres.

5.7 APPLICATIONS OF PROJECT

We propose an application to detect water deficiency state in soil based exclusively on sensor-provided data.

In an Automated Irrigation System, the most significant advantage is that water is supplied only when the moisture in soil goes below a pre-set threshold value. This system can be used in roof gardens in highly populated areas where¬ land is expensive and gardening on rooftops seems like the only viable option left. The lawns of houses and public buildings can be maintained by these¬ systems, thereby reducing the need for human monitoring. The greatest application is in agricultural lands, where farmers are assisted¬ greatly by this. There is no need for the farmer to actually be present during operation. Gardens that need to be monitored in the absence of home owners require¬ systems like APIS. Home gardens that are maintained with large effort by home owners require proper observation and maintenance. This system can be used in the field of pisciculture. Fish farming or¬ pisciculture involves raising fish commercially in tanks or enclosures, usually for food. It is the principal form of aquaculture, while other methods may fall under mariculture. The fishes need to be in a depth of 1m in the aquarium and this depth is maintained. The appropriate threshold value is assigned and the circuit is operated. Irrigation in parks needs to be done even when people are not there to¬ maintain the grass or trees. Detection in this manner is cheap, non-invasive and can be applied on a¬ population-wide scale. The presence of technology in all aspects of life has enabled solutions to real life problem that were either difficult or unfeasible.

5.8 LIMITATIONS

- The system requires two different power supplies. While implementing in large fields, industrial supply can be used to run the motor. In small gardens this may seem like a large wastage.
- Needs a large amount of sensing equipment for very large irrigation areas. The system is not 100% reliable.
- Unexpected factors can cause errors, and it may¬ in some cases cause loss. Despite being good, it needs to be manually checked and maintained once every few weeks.

CODING

Soil irrigation system

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup() {
  Serial.begin(9600);
  lcd.init();
  lcd.backlight();
  lcd.clear();
  pinMode(2, OUTPUT);
  digitalWrite(2, HIGH);
  delay(1000);
  lcd.setCursor(0, 0);
  lcd.print("IRRIGATION");
  lcd.setCursor(0, 1);
  lcd.print("SYSTEM IS ON ");
    lcd.print("");
    delay(3000);
  lcd.clear();
}

void loop() {
```

```
  int value = analogRead(A0);
  Serial.println(value);
  if (value > 950) {
    digitalWrite(2, LOW);
    lcd.setCursor(0, 0);
    lcd.print("Water Pump is ON ");
  } else {
    digitalWrite(2, HIGH);
    lcd.setCursor(0, 0);
    lcd.print("Water Pump is OFF");
  }

  if (value < 300) {
    lcd.setCursor(0, 1);
    lcd.print("Moisture : HIGH");
  } else if (value > 300 && value < 950) {
    lcd.setCursor(0, 1);
    lcd.print("Moisture : MID ");
  } else if (value > 950) {
    lcd.setCursor(0, 1);
    lcd.print("Moisture : LOW ");
  }
}
```

Soil parameter monitoring

```
// include the library code:


#include "DHT.h"

#include <LiquidCrystal_I2C.h>




// initialize the library by associating any needed LCD interface pin

LiquidCrystal_I2C lcd(0x27,16,2);    // set the LCD address to 0x27 for a 16 chars and 2 line display

DHT dht(D3, DHT11);                  // set the GPIO Pin no and Type of DHT sensor

void setup() {

  lcd.init();                        // initialize the lcd

  lcd.backlight();

  Serial.begin(9600);

  Serial.println(F("DHT11 Started!"));

  // For Writing the Welcome screen on the LCD

  // Print a message to the LCD.

  lcd.setCursor(4,0);

  lcd.print("WELCOME");

  lcd.setCursor(7,1);

  lcd.print("TO");

  delay(1000);

  lcd.setCursor(2,0);

  lcd.print("TEMPERATURE");

  lcd.setCursor(4,1);

  lcd.print("MONITOR");
```

```
  delay(2000);
  dht.begin();
}

void loop() {
  delay(2000);
  // Reading temperature or humidity takes about 250 milliseconds!
  // Sensor readings may also be up to 2 seconds 'old' (its a very slow sensor)
  float h = dht.readHumidity();
  // Read temperature as Celsius (the default)
  float t = dht.readTemperature();
  // Read temperature as Fahrenheit (isFahrenheit = true)
  float f = dht.readTemperature(true);

  // Check if any reads failed and exit early (to try again).
  if (isnan(h) || isnan(t) || isnan(f)) {
    Serial.println(F("Failed to read from DHT sensor!"));
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("Not Found");
    return;
  }

  // Compute heat index in Fahrenheit (the default)
  float hif = dht.computeHeatIndex(f, h);
  // Compute heat index in Celsius (isFahreheit = false)
  float hic = dht.computeHeatIndex(t, h, false);
```

```
  // for Output in Serial Monitor
  Serial.print(F("Humidity: "));
  Serial.print(h);
  Serial.print(F("%  Temperature: "));
  Serial.print(t);
  Serial.print(F("°C "));
  Serial.print(f);
  Serial.print(F("°F  Heat index: "));
  Serial.print(hic);
  Serial.print(F("°C "));
  Serial.print(hif);
  Serial.println(F("°F"));
  // set the cursor to column 0, line 1
  // (note: line 1 is the second row, since counting begins with 0):
  // Print Values to the LCD.
  lcd.setCursor(0, 0);
  lcd.print("Temp  : ");
  lcd.print(t);
  lcd.print((char)223);// for Degree(°)
  lcd.print("C   ");
  lcd.setCursor(0, 1);
  lcd.print("Humid : ");
  lcd.print(h);
  lcd.print("%");

}
```

CHAPTER 6

CONCLUSION & FUTURE SCOPE

The project can be used as a base for realizing a scheme to be implemented in other projects of great level such as weather forecasting, temperature updates, device synchronization, etc.The project itself can be modified to achieve a complete home automation.

Pesticides and fertilizers can be added automatically in the water. GSM can be added for sending SMS to the concerned person in case of any problem. To provide protection from insects attack for better yield. Focused on the prevention of crops from insect attack which damages the crop leaves and roots so it automatically affects the crop yield.

To observe other parameters for better yield. Climate condition also affect the growth of crops, like temperature increases the water requirement also increases so it can also be monitored.

Recommendation system for crops and soil based. This application beneficial to the farmers in terms of crop production. This application is user friendly so everyone can use it easily. We have developed a movable kit that can be used by the farmers easily in their farms. Also the Android Application designed is user friendly and give clear and crisp information to farme

Irrigation becomes easy, accurate and practical with the idea above shared and can be implemented in agricultural fields in future to promote agriculture to next level. The output from moisture sensor and level system plays major role in producing the output. Thus the "AUTOMATIC PLANT IRRIGATION SYSTEM" has been designed and tested successfully. It has been developed by integrating all the features of all the hardware components used. Presence of every module has been reasoned above and placed carefully in order to contribute to the best working of the unit. The system has been tested to function automatically, and to the best of its ability. The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the operational amplifier which triggers the DC Motor pump to turn ON and supply the water to respective field area. When the desired moisture level is reached, the system halts on its own and the DC Motor pump is turned OFF. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

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