

SMART IOT BASED PLANT MONITORING AND GROWING
UNDER LED LIGHT USING NODE MCU

A MAJOR PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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ABSTRACT

The project combines several aspects of electronics, computer Science, and IOT, providing hands-on experiences in designing and developing smart systems. The LEDs come with multiple colors lined up as a LED lamp with proper a heat sink, like red which helps to perform photosynthesis, Blue which helps to perform fruiting and flowering and yellow which helps to perform harvesting. Motor is used to supply the water to the plants. It comes with in-built Wi-Fi and it can be controlled from anywhere inside the house using it custom built easy to use application. The entire system needs to be controlled or monitored or updated remotely using the communication interface Blynk app. This Project Presents a Smart IOT plant growing system that utilizes LED lights and an ESP8266 microcontroller to provide a controlled environment for plant growth. The system is designed to optimize plant growth by monitoring soil moisture, temperature, and humidity levels and adjusting the LED lights and other peripherals as needed. The system collects data on the environment and plant growth, which can be analyzed and visualized to understand the efficiency of the System. The data collected can also be used to make decisions on when to water the plants and adjust the LED lights. The system can be controlled and monitored remotely using a web interface or mobile app. The Internet of Things (IoT) allows objects to be identified and controlled from a distance using existing network infrastructure, opening up new possibilities. greater efficiency, accuracy, and financial benefit through more direct contact between the actual and virtual worlds and computer-based systems. In order to maximize water consumption and maintain a green environment, it is important to irrigate more effectively as water supplies become increasingly scarce and polluted. The goal of this project is to create a smart houseplant watering and monitoring system that analyses and records environmental factors to help plants thrive.

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CHAPTER 1

INTRODUCTION

Indoor smart-farming based on artificial grow lights has become popular in the recent years. By using this process, we can grow the plants anywhere i.e., the place where there is no availability sunlight. The LEDs come with multiple colors lined up as a LED lamp with proper a heat sink, like red which helps to perform photosynthesis. Motor is used to supply the water to the plants. PWM pins in the Node MCU helps in dimming the four LED strips that we are using in the project. Pulse width modulation helps in changing the duty cycle of the signal, so that the time of on and off gets changed. Without changing the voltage to the LED strips. It comes with in-built Wi-Fi and it can be controlled from anywhere inside the house using it custom built easy to use application. The entire system needs to be controlled or monitored or updated remotely using the communication interface Blynk app.

There is a core with copper wire wrapped around it (the coil). Under normal conditions, the switch (armature) remains in contact with the normally closed (NC) terminal. An electromagnetic field is generated when power is applied to the coil, and the coil begins to function as a magnet, attracting the armature to the normally open terminal (NO). At their most fundamental level, relays are nothing more than that. Aside from that, there are a variety of other types of relays, such as solid state and thermal relays, all of which have distinct functioning processes but serve the same purpose. This portion is used to regulate the small dc pump, which is used to water the plants automatically, and the flow is regulated by a relay. Relays are used to switch control circuits that handle lower currents. Furthermore, it can manage even greater voltages and amperes with the assistance of amplification.

NodeMCU is an Internet of Things (IoT)-focused open-source Lua-based firmware and development board[9]. It includes software for Espressif Systems' ESP8266 Wi-Fi SoC as well as hardware for the ESP-12 module. The major argument for choosing this is that it is cheap and includes a built-in Wi-Fi module[10]. Because it is similar to Arduino, it can be programmed using the Arduino IDE software. It has ten General Purpose Input/Output pins for connecting to external devices. A standard NodeMCU, complete with pin numbers.

The objects to be identified and controlled from a distance using existing network infrastructure, opening up new possibilities. greater efficiency, accuracy, and financial benefit through more

direct contact between the actual and virtual worlds and computer-based systems. In order to maximise water consumption and maintain a green environment, it is important to irrigate more effectively as water supplies become increasingly scarce and polluted. The goal of this project is to create a smart houseplant watering and monitoring system that analyses and records environmental factors to help plants thrive. The sensors collect and evaluate data regarding changing weather and soil moisture levels before sending timely warnings to the user's Android phone.

It combines a temperature and humidity sensor, typically outputs either digital or analog data. It contains information about the temperature around the plant if it needs extra sunshine and the degree of humidity in the surrounding environment. Water vapor is detected by measuring the electrical resistance between the two electrodes. The humidity sensing component consists of the electrode and the substrate, which is responsible for retaining moisture while in contact with the surface. Ions are released by the substrate. The conductivity between the electrodes rises as soon as water vapour is absorbed by it. The calibration result of the dht11 sensor is quite accurate. Because of its small size and low power consumption, the DHT11 sensor has a wide range of uses. It can also transmit signals over a distance of up to 20 meters. The product we used was a four-pin single row pin box.

The Internet of Things (IOT) is the network of physical objects. It simply means to monitor a physical device or machine or it is inter-networking of physical devices which is embedded with electronics, sensors, software and network connectivity to enable it to achieve greater value and services by exchanging data with the manufacturer. IOT permits objects to be sensed or controlled remotely across the network infrastructure. The result improves accuracy, economic benefits, efficiency and reduces intervention of human. In this paper we are going to deal with basic and important concepts of IOT and its scope in upcoming future. This paper studies the need of IOT in day to day life for different applications and gives brief information about IOT. IOT contributes significantly toward revolutionary farming methods. So we are trying to demonstrate IOT in Automatic watering system. Automatic watering system monitors and maintains the approximate moisture content in soil. Arduino UNO is used as microcontroller to implement the control unit. The set up uses the temperature sensor, moisture sensor and humidity sensor which measure the approximate temperature, moisture and humidity in the soil.

1.1 NODE MCU

The IOT based Plant Parameters Monitoring System. Wireless Network is prepared by using NodeMCU board, Arduino UNO/Atmega interfacing board. This network helps with obtained data through Internet of Things. The planning of system is designed to locate the numerous needs of the plant parameters monitoring. The whole system consists of nodes which are situated at different part of the board. The data or the value from the sensors is collected by Arduino UNO/Atmega interfacing board and uploaded to cloud i.e. ThingSpeak Server through NodeMCU board. Plant plays a vital

role in maintaining the ecological cycle and forms the foundation of a food chain pyramid and thus to maintain the plant's proper growth and health adequate monitoring is required. Hence the aim at making plant monitoring system smart is using automation and Internet of Things (IOT) technology. This topic highlights various features such as smart decision making based on soil moisture real time data. The computerized water system framework with IOT is practically and financially sufficient for planning water resources for plantation (group of a plant). Adopting the automatic water system framework we can demonstrate that the utilization of water can be decreased for various plantations usages.

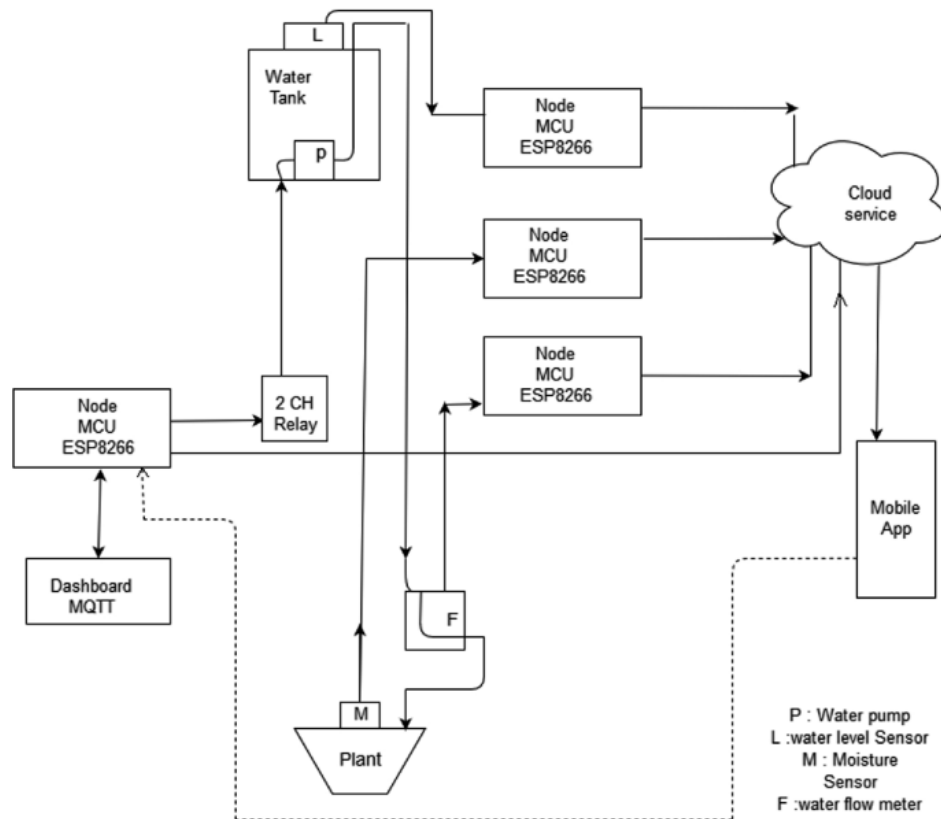
As mentioned earlier, it takes a great deal of money to convert these equipment if the machines are altered according to the farmer's point. At the other side, it will cost a lot of money to do the operation. As there are no higher profit levels for the agricultural industry, enormous investments are unlikely in this field. Even after altering the machinery, farmers may continue to operate the machinery improperly, causing harm or reparation. Because these devices are expensive now, it would cost a great deal of money to reparate or upgrade it. The value of natural occurrences can not be reversed while the smart systems are in place. In intelligent agriculture, there is a issue in which computers may have a detrimental effect on the environment. Because technology requires several computers, often the data will go wrong.

1.2 EXISTING METHOD

The objects to be identified and controlled from a distance using existing network infrastructure, opening up new possibilities. greater efficiency, accuracy, and financial benefit through more direct contact between the actual and virtual worlds and computer-based systems. In order to maximise water consumption and maintain a green environment, it is important to irrigate more effectively as water supplies become increasingly scarce and polluted. The goal of this project is to create a smart houseplant watering and monitoring system that analyses and records environmental factors to help plants thrive. The sensors collect and evaluate data regarding changing weather and soil moisture levels before sending timely warnings to the user's Android phone.

It provide a controlled environment for plant growth. The system is designed to optimize plant growth by monitoring soil moisture, temperature, and humidity levels and adjusting the LED lights and other peripherals as needed. The system collects data on the environment and plant growth, which can be analyzed and visualized to understand the efficiency of the System. The data collected can also be used to make decisions on when to water the plants and adjust the LED lights. The system can be controlled and monitored remotely using a web interface or mobile app. The Internet of Things (IoT) allows objects to be identified and controlled from a distance using existing network infrastructure, opening up new possibilities. greater efficiency, accuracy, and financial benefit through more direct contact between the actual and virtual worlds and computer-based systems. In order to maximize water consumption and maintain a green environment.

1.3 EXISTING BLOCK DIAGRAM



1.4 BLINKY

Blynk is a full suite of software required to prototype, deploy, and remotely manage connected electronic devices at any scale: from personal IoT projects to millions of commercial connected products. With Blynk anyone can connect their hardware to the cloud and build a no-code iOS, Android, and web applications to analyze real-time and historical data coming from devices, control them remotely from anywhere in the world, receive important notifications, and much more. Blynk is a multi-tenant solution. You can configure how users get access to the data by setting roles and configuring permissions. Applications made with Blynk are ready for the end-users. Whether it is your family member, an employee, or someone who has purchased your product, they will be able to download the app, connect the device and start using it. Blynk also offers a white-label solution (part of the Business Plan), which means that you can add your company logo, app icon, choose the theme, colors, and publish the app to App Store and Google Play under your company name. These apps will work with your devices.

It allows to you create amazing interfaces for your projects using various widgets we provide. Blynk Server responsible for all the communications between the smartphone and hardware. You can use the Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi. Blynk Libraries is for all the

popular hardware platforms - enable communication with the server and process all the incoming and out coming commands.

Blynk is an Internet of things (IoT) company which provides a platform for building mobile (IOS and Android) applications that can connect electronic devices to the Internet and remotely monitor and control these devices. Blynk platform is used by engineers to connect MCUs and prototyping development boards like Arduino, ESP8266 or SBCs like Raspberry Pi over Wi-Fi, Ethernet or the cellular to the Internet and build custom mobile applications to remotely monitor and control electronic equipment.

1.5 IOT PLANT MONITORING

Plants play a vital role in maintaining the ecological cycle, and thus, to maintain the plant's proper growth and health, adequate monitoring is required. Hence, the aim of the chapter is to create a smart plant monitoring system using automation and internet of things (IOT) technology. This topic highlights various features such as smart decision making based on soil moisture real-time data. For this purpose, sensors like soil moisture sensor, DHT11 sensor, level sensor, etc. are used. The soil moisture sensor measures the level of moisture (i.e., water content of different plants). The signal will be sent to Arduino board when the moisture level drops below the marginal value, which triggers the pumping of water into the plant by the pump. When the moisture level reaches absolute value, the pump is halted. The other condition for this process is level sensor. Level sensor senses the water level in the tank and sends the information of water level value to Arduino board and Arduino board to cloud. The whole data about the plant monitoring will be sent to the cloud server.

The computerized water system framework with IOT is practically and financially sufficient for planning water resources for plantation (group of a plant). Adopting the automatic water system framework we can demonstrate that the utilization of water can be decreased for various plantations (group of plants) usages. The system framework has an appropriated microwaves (wireless) chain of moisture content in the soil through soil moisture sensor, humidity and temperature sensor set in the root zone of the plants and level of water (ultrasonic) sensor is set in tank for checking the water level in tank. The data will gather from the sensors and send to the web server.

The signal will be sent to Arduino board when the moisture level drops below the marginal value, which triggers the pumping of water into the plant by the pump. When the moisture level reaches absolute value, the pump is halted. The other condition for this process is level sensor. Level sensor senses the water level in the tank and sends the information of water level value to Arduino board and Arduino board to cloud. The planning of system is designed to locate the numerous needs of the plant parameters monitoring. The whole system consists of nodes which are situated at different part of the board. The data or the value from the sensors is collected by Arduino UNO/Atmega interfacing board.

CHAPTER 2

LITERATURE SURVEY

Abhishek Gupta[1] This paper reviews Plant Monitoring System Mechanism. It gives the Information about the Temperature, Humidity and soil moisture. This can be done by using various sensors like DTH11 sensor, soil moisture sensor. It is suitable for plant which may help to start a better growth of plant and also it may support to control the usage of water. When the soil moisture is very less then motor ON and pump the water to the plant after that soil moisture increases and then motor OFF Automatically. Indoor plant monitoring system is a smart Houseplant Watering and Monitoring system that monitors and tracks environmental conditions, helping the plants thrive. The Garden Sensors gather and analyze data about changing weather and soil moisture conditions and then connects to the user's Android phone with timely alerts. Plant provides us with almost all the basic needs for survival but we are unable to provide plant with its basic needs like water, non-polluted oxygen and as a result plants are unable to survive.

Shailesh Kumawat[2] This paper explores the system includes an android application which runs on an android devices which can be used to monitor the plant's conditions at user's workplace. It continuously monitors the conditions and alerts the user to the changes that require immediate action. Unlike preset sprinklers, the Greves Water Valve automatically controls the existing water system based on data collected by the Garden Sensor and adapts to every change in the plant's requirements. perspective for developing this project is to make the managing of plants easy for the costumer using IOT and machine learning. In this scenario manpower will be reduced as there is no need for the customer to manually keep on checking the plants health. the other reasons like disease, climate changes which are equally important factors which should be prevented for the plants survival.

Shubham Garg[3] This paper reviews The sensors obtain ambient temperature, ambient humidity, soil moisture, and illuminance it to the cloud which is then displayed on the UI on the user android device. User interface basically interacts with the user and allows the user to view different aspects such as moisture condition, temperature, humidity of the plants environment. The user interface also provides option to add more than one plant and also to water the plants by one click button on app. The pretrained Alex Net model used in this study primarily consist of 5 convolutional layers(convolayers) and 3 fully connected layers. Here the user can check whether the plant is suffering

from the disease by clicking a pic of the plant's leaf and adding it to the trained model. In our project The Indoor Plant Monitoring System we have it developed as a IOT application. The system can be accessed from the android devices. To simplify the user interface, the software will also provide user manuals that will guide the customer to access the online portal.

T.Thamaraimanalan[4] This paper explores The latest advances in Neural Networks (NN) have produced complex classifiers without the need to analytically define the discriminating function. The latest advances in Neural Networks (NN) have produced complex classifiers without the need to analytically define the discriminating function. The latest advances in Neural Networks (NN) have produced complex classifiers without the need to analytically define the discriminating function. The latest advances in Neural Networks (NN) have produced complex classifiers without the need to analytically define the discriminating function. Using the system shown above we are able to collect all the data related to soil moisture, temperature of the environment around the plant and this data was then pushed to the fire base cloud. Then this data was use to take decision to water the plant our to give extra light automatic.

S.P.Vivekk[5] This paper reviews the pretrained Alex Net model used in this study primarily consists 5 convolutional layers (convlayers) and 3 fully connected layers[18]. Here the user can check whether the plant is suffering from the disease by clicking a pic of the plant's leaf and adding it to the trained model. This model performed with the accuracy of 96 percent. basic ideas which were intended to be implemented in the project. Indoor plant monitoring system consisting various operations like knowing plants health , watering the plant, checking plants health etc. was carried out successfully. This system reduces human labour, work load and is also time efficient.

G.Satheeshkumar[6] This paper explores The scope of Indoor Plant Monitoring System using IoT is vast. The main aim of this system is to obtain ambient temperature, ambient humidity, soil moisture, and illuminance from a set of sensors. The Indoor Plant Monitoring System using IoT will also provide recommendation to how to take care of plants, find out which disease it has by using AlexNet model; trained on the plant leaves data set and also water the plant using the android app . The scope of this project is never ending because every person in today's fast world will require a helping hand to look after the plant and provide status of plants health even if he or she is not present at the plant location. This same idea can be further used on a large scale for agricultural purpose on a huge acers of land which will eventually help farmers and reduce their job.

Shanthosh Kumar[7] This paper reviews The Physical Description of project can be represented. All Sensors are connected to the NodeMCU and DC Pump and Relay module is connected to Power Supply. Here we use the power supply as Battery. The Output can be shown in Blynk App. This app is used to Monitor and Control our Hardware project and Display the parameters in Web Dashboard of Blynk App. All the hardware components have been integrated to develop the system. The working of each and every module has been reasoned out with utter carefulness and they have been placed in such a way that they contribute towards getting the best results from the system. Hence, a working project is successfully designed and implemented giving the desired outputs.

B. Shri Hariprasad[8] This paper explores The Procedure is introduced by using NodeMCU that is connected by different Sensors and the data is transferred through a Wi-Fi module that is Available in ESP8266 Wi-Fi module. The data is transferred directly to the application by using power supply and Wi-Fi. The network part is the main point for Operating the device. DTH11 Sensor are used to detect the Exact status of heat and Humidity. Soil moisture detect the moisurity of soil. These two Sensors are used to Analyse the real time data of plants and this help us to get the overview of plant Environment. By using this information user can Detect which part of the plant is affected in the garden and recover the plant by these effects and improve the plant growth. Power supply is given to the circuit board through Battery then the circuit board that uses it transfer the dc power to sensors for working properly. The display unit can generate the output. Here we use Blynk IoT app for this project to the display outputs.

P.Saravanan[9] This paper explores The basic ideas which were intended to be implemented in the project. Indoor plant monitoring system consisting various operations like knowing plants health , watering the plant, checking plants health etc. was carried out successfully. This system reduces human labour, work load and is also time efficient. We have tested the system and carefully and closely observed the results achieved. thereafter. All the hardware components have been integrated to develop the system. The working of each and every module has been reasoned out with utter carefulness and they have been placed in such a way that they contribute towards getting the best results from the system. Hence, a working project is successfully designed and implemented giving the desired outputs.

Dr.Vimalathithan[10] This paper reviews First the sensors which are placed around the plant collect the data with respect to temperature, humidity, soil moisture and the light intensity. Now this data is been sent to the Node MCU which is acting as the central processing unit. Then this data is been pushed to the fire base (cloud). The data from the cloud is then displayed on the users phone via the application that is been created using MIT app inventor. The data is been updated on real time basis every second. From the application user can give commands to water the plant from any where in the world or else the ater will be given to the plant automatically using relay. In order to achieve this, a relay module is interfaced to Node MCU board at the receiver end while on the transmitter end, a set point on the soil moisture sensor is considered. If the moisture of the soil falls below the set-point, the relay switches on and allows the mini-dc pump to conduct and supply water to the plant fields. Once the required moisture level is reached, the soil moisture sends the signal to the relay module via Node MCU The relay switches off and thus switching off the mini –dc pump.

CHAPTER 3

PROJECT DESCRIPTION

3.1 SOFTWARE SPECIFICATIONS

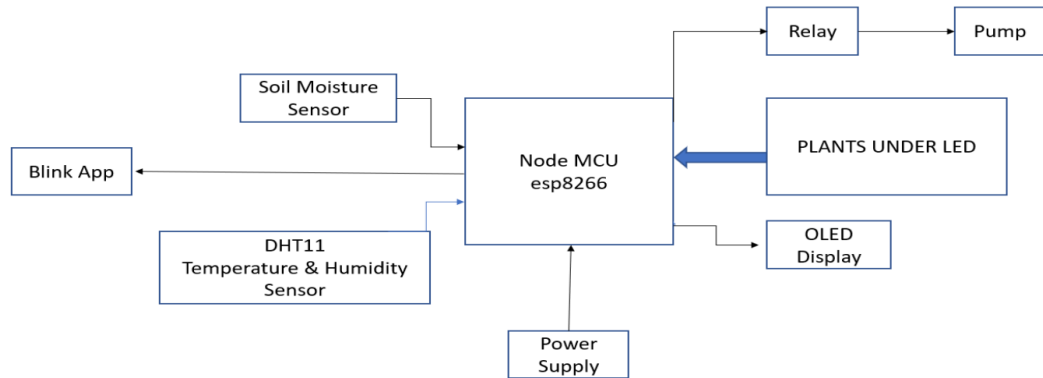
Software Specifications: Language: Embedded C

3.2 SYSTEM ARCHITECTURE

It is a smart IoT plant growing system involves the use of LED lights, an ESP8266 NODEMCU, and various sensors to create a controlled and optimized growing environment for plants. The system will monitor soil moisture, temperature, and humidity levels and adjust the LED lights and other peripherals as needed. The collected data will be analyzed and visualized to help understand the growth of the plants and the efficiency of the system. The system will be controlled and monitored remotely using a web interface or mobile app. The goal of the proposed work is to improve plant growth and health through precise and optimized growing conditions.

Now-a-days world is fully overtaken by the internet and internet of things. Internet is use for basic need of all human beings. The Internet of Things (IOT) is the network of physical objects. It simply means to monitor a physical device or machine or it is inter-networking of physical devices which is embedded with electronics, sensors, software and network connectivity to enable it to achieve greater value and services by exchanging data with the manufacturer Agriculture is the backbone of our country; most of the people depend on agriculture. The main issue in agriculture is water scarcity. The water resource is not used in an effective manner, so the water is wasted. In order to overcome this irrigation process can be automated. The use of Internet of things in this field will be helpful to reduce the wastage of water. So that the temprature as well as humidity and light are measured by means of sensors and depend up on the outcome further processing can be performed. We propose a system that will capture all the details about the soil and the temprature by means of different sensors IOT permits objects to be sensed or controlled remotely across the network infrastructure. The result improves accuracy, economic benefits, efficiency and reduces intervention of human. In this paper we are going to deal with basic and important concepts of IOT and its scope in upcoming future. This paper studies the need of IOT in day to day life for different applications and gives brief

information about IOT. IOT contributes significantly toward revolutionary farming methods. So we are trying to demonstrate IOT in Automatic watering system. Automatic watering system monitors and maintain the approximate moisture content in soil. Arduino UNO is used as microcontroller to implement the control unit. The set up uses the temperature sensor, moisture sensor and humidity sensor which measure the approximate temperature, moisture and humidity in the soil. This value enables the system to use appropriate quantity of water which avoids over/under irrigation.



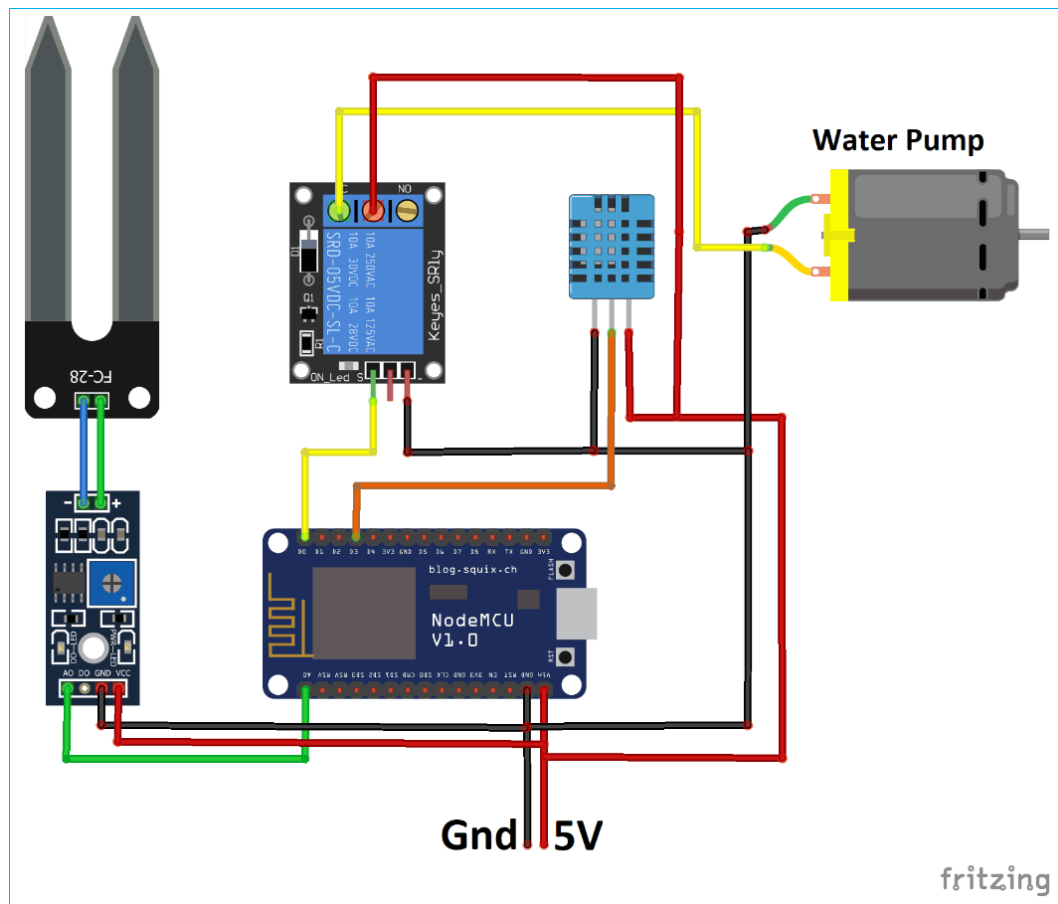
Plant plays a vital role in maintaining the ecological cycle and forms the foundation of a food chain pyramid and thus to maintain the plant's proper growth and health adequate monitoring is required. Hence the aim at making plant monitoring system smart is using automation and Internet of Things (IOT) technology. This topic highlights various features such as smart decision making based on soil moisture real time data.

The computerized water system framework with IOT is practically and financially sufficient for planning water resources for plantation (group of a plant). Adopting the automatic water system framework we can demonstrate that the utilization of water can be decreased for various plantations (group of plants) usages. The system framework has an appropriated microwaves (wireless) chain of moisture content in the soil through soil moisture sensor, humidity and temperature sensor set in the root zone of the plants and level of water (ultrasonic) sensor is set in tank for checking the water level in tank. The data will gather from the sensors and send to the web server (cloud).

The background of chapter highlights the study of IOT in the field of agriculture. This shows how we can implement the IOT technology to make our planting smart and reliable with the real time updated data. This chapter also helps the beginners to implement the IOT technology and learn the basics of this technology.

Internet of Things (IoT) plays an important role in most of the fields. The use of IoT increased because of the various advantages we can get from that. The agriculture is the area where a lot of improvement is needed because that is one of the essential needs and a large sector of people is involved in that. Most of the area the major problem is the water scarcity because of low rainfall and even though there is rainfall the water is wasted because of no proper arrangement for the storage of water. Many techniques are proposed in IoT in terms of providing a better irrigation to the crop. The IoT devices can also be used in home for monitoring the garden real time.

The Raspberry and Arduino plays an important role in processing the information that is received from various sensors. The cost of these devices will be affordable and the major issue is the usage of large amount of sensors and other devices. Much research focus is on finding the effect of these devices in the environment, if it causes any side effects to the humans. The Raspberry is used wherever a large amount of processing is required and Arduino in terms of interconnecting certain hardware devices and performs a little amount of processing. The installation of the sensors for finding the humidity level is one major factor to avoid the wastage of water.



In India about 35 percentage of land was under reliably irrigated. And the 2/3rd part of land is depending on monsoon for the water. Irrigation reduces dependency on monsoon, improves food security and improves productivity of agriculture and it offers more opportunities for jobs in rural areas. Farmers are facing problems related to watering system that how much water has to supply and at what time? Sometimes over watering causes the damage to crops and as well as waste of water. Hence for avoid such damage we need to maintain approximate water level in soil.

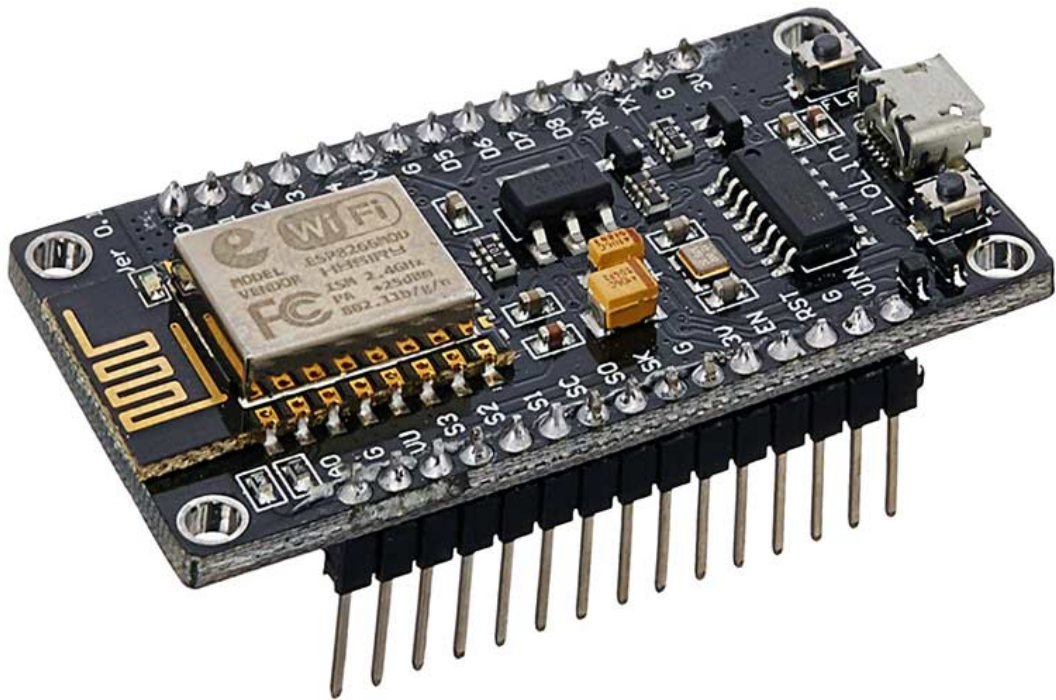
The humidity sensor, moisture sensor, temperature sensors placed in root zone of plant and gateway unit (ESP8266) handles the sensor information and transmit data to a android application. This application is developed for measure approximate values of temperature sensor, humidity sensor and moisture sensor that was programmed into a microcontroller to control water quantity.

CHAPTER 4

PROJECT COMPONENTS

4.1 NODE MCU

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). Strictly speaking, the term "NodeMCU" refers to the firmware rather than the associated development kits.



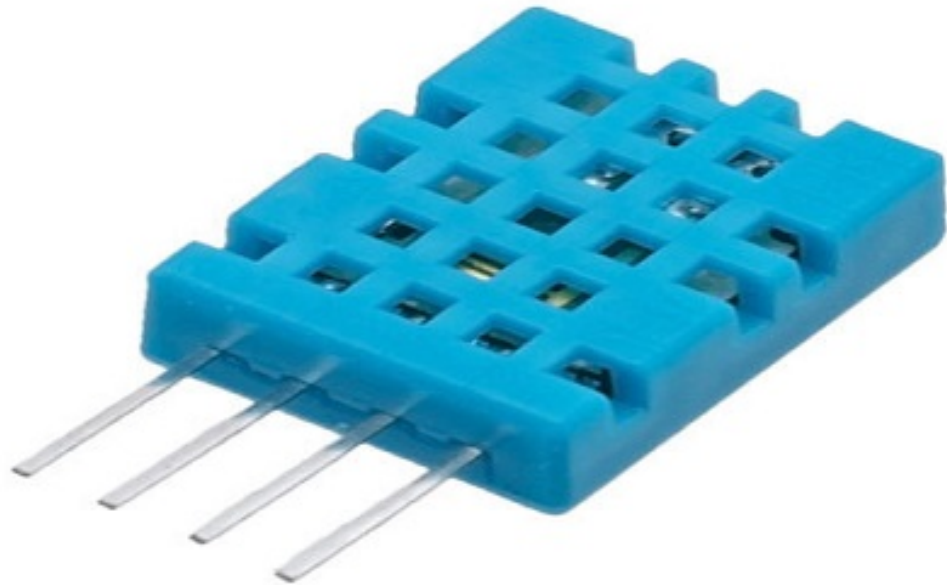
NodeMCU is a microcontroller development board with wifi capability. It uses an ESP8266 microcontroller chip. Whereas Arduino UNO uses an ATmega328P microcontroller. Besides the chip, it contains other elements such as crystal oscillator, voltage regulator. NodeMCU Dev Kit/board consist of ESP8266 wifi enabled chip. The ESP8266 is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. For more information about ESP8266, you can refer to the ESP8266 WiFi Module. There is available for NodeMCU Dev Kit NodeMCU Development Board v1.0 , which

usually comes in black colored PCB.

NodeMCU Development board is featured with wifi capability, analog pin, digital pins, and serial communication protocols. To get started with using NodeMCU for IoT applications first we need to know about how to write/download NodeMCU firmware in NodeMCU Development Boards. And before that where this NodeMCU firmware will get as per our requirement. There are online NodeMCU custom builds available using which we can easily get our custom NodeMCU firmware as per our requirement.

4.2 DHT 11

Humidity is the measure of water vapour present in the air. The level of humidity in air affects various physical, chemical and biological processes. In industrial applications, humidity can affect the business cost of the products, health and safety of the employees. So, in semiconductor industries and control system industries measurement of humidity is very important. Humidity measurement determines the amount of moisture present in the gas that can be a mixture of water vapour, nitrogen, argon or pure gas etc. . . Humidity sensors are of two types based on their measurement units. They are a relative humidity sensor and Absolute humidity sensor. DHT11 is a digital temperature and humidity sensor.



DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc. . . to measure humidity and temperature instantaneously. DHT11 humidity and temperature sensor is available as a sensor and as a module. The difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor.

DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The IC measure, process this changed resistance values and change them into digital form. For measuring temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with increase in temperature. To get larger resistance value even for the smallest change in temperature, this sensor is usually made up of semiconductor ceramics or polymers. The temperature range of DHT11 is from 0 to 50 degree Celsius with a 2-degree accuracy. Humidity range of this sensor is from 20 to 80 percent with 5 percent accuracy. The sampling rate of this sensor is 1Hz .i.e. it gives one reading for every second. DHT11 is small in size with operating voltage from 3 to 5 volts. The maximum current used while measuring is 2.5mA.

DHT11 sensor has four pins- VCC, GND, Data Pin and a not connected pin. A pull-up resistor of 5k to 10k ohms is provided for communication between sensor and micro-controller. This sensor is used in various applications such as measuring humidity and temperature values in heating, ventilation and air conditioning systems. Weather stations also use these sensors to predict weather conditions. The humidity sensor is used as a preventive measure in homes where people are affected by humidity. Offices, cars, museums, greenhouses and industries use this sensor for measuring humidity values and as a safety measure. It's compact size and sampling rate made this sensor popular among hobbyists. Some of the sensors which can be used as an alternative to DHT11 sensor.

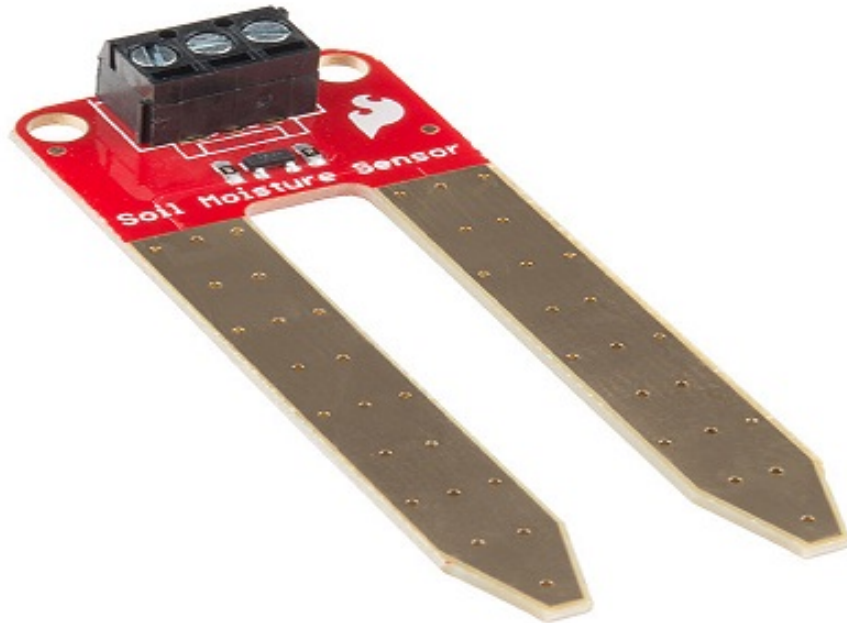
4.3 SOIL SENSOR

The moisture of the soil plays an essential role in the irrigation field as well as in gardens for plants. As nutrients in the soil provide the food to the plants for their growth. Supplying water to the plants is also essential to change the temperature of the plants. The temperature of the plant can be changed with water using the method like transpiration. And plant root systems are also developed better when rising within moist soil. Extreme soil moisture levels can guide to anaerobic situations that can encourage the plant's growth as well as soil pathogens.

The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil. As the straight gravimetric dimension of soil moisture needs eliminating, drying, as well as sample weighting. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content. The relation among the calculated property as well as moisture of soil should be adjusted may change based on ecological factors like temperature, type of soil, otherwise electric conductivity. The microwave emission which is reflected can be influenced by the moisture of soil as well as mainly used in agriculture and remote sensing within hydrology.

These sensors normally used to check volumetric water content, and another group of sensors calculates a new property of moisture within soils named water potential. Generally, these sensors are named as soil water potential sensors which include gypsum blocks and tensiometer. VCC pin is

used for power. A0 pin is an analog output. D0 pin is a digital output. GND pin is a Ground. This module also includes a potentiometer that will fix the threshold value, the value can be evaluated by the comparator LM393. The LED will turn on off based on the threshold value.



This sensor mainly utilizes capacitance to gauge the water content of the soil (dielectric permittivity). The working of this sensor can be done by inserting this sensor into the earth and the status of the water content in the soil can be reported in the form of a percent. This sensor makes it perfect to execute experiments within science courses like environmental science, agricultural science, biology, soil science, botany, and horticulture.

4.4 RELAYS

Relays are electrically operated switches that open and close the circuits by receiving electrical signals from outside sources. While we use normal switches to close or open a circuit manually, a Relay is also a switch that connects or disconnects two circuits. But instead of a manual operation, a relay uses an electrical signal to control an electromagnet, which in turn connects or disconnects another circuit.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional form of a relay uses an electromagnet to close or open the contacts, but relays using other operating principles have also been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated

operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.

Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects. Magnetic latching relays are useful in applications when interrupted power should not affect the circuits that the relay is controlling.



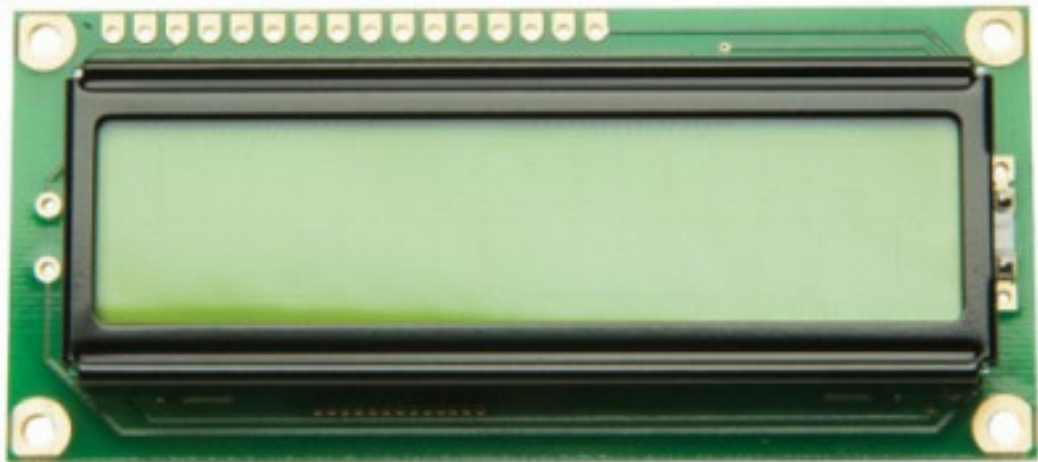
A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core (a solenoid), an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two contacts in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. The armature is held in place by a spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open. Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit board (PCB) via the yoke, which is soldered to the PCB.

When an electric current is passed through the coil it generates a magnetic field that activates the armature, and the consequent movement of the movable contact(s) either makes or breaks (depending upon construction) a connection with a fixed contact. If the set of contacts was closed when the relay was de-energized, then the movement opens the contacts and breaks the connection, and vice versa if the contacts were open. When the current to the coil is switched off, the armature is returned by a force, approximately half as strong as the magnetic force, to its relaxed position. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor

starters. Most relays are manufactured to operate quickly. In a low-voltage application this reduces noise; in a high voltage or current application it reduces arcing.

4.5 LCD DISPLAY

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly but instead use a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden. For instance: preset words, digits, and seven-segment displays, as in a digital clock, are all good examples of devices with these displays.



They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character

negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

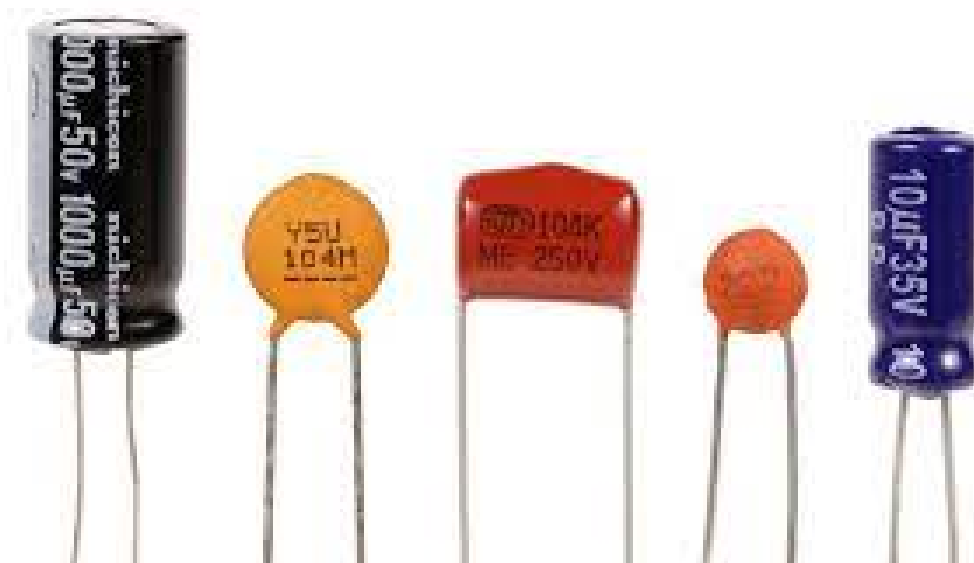
LCDs are used in a wide range of applications, including LCD televisions, computer monitors, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in LCD projectors and portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smartphones. LCD screens have replaced heavy, bulky and less energy-efficient cathode-ray tube (CRT) displays in nearly all applications. The phosphors used in CRTs make them vulnerable to image burn-in when a static image is displayed on a screen for a long time, e.g., the table frame for an airline flight schedule on an indoor sign. LCDs do not have this weakness, but are still susceptible to image persistence.

LCD screens are an array of small segments called pixels, which can be manipulated for information displaying. Such displays have several layers, where two panels, made of glass material free of sodium and called substrate, play a crucial role. The substrate contains a thin layer of liquid crystals between them. The panels have flutes that direct the crystals, giving them a distinctive orientation. Flutes are parallel on each panel but are perpendicular between the two of them. Longitudinal flutes are obtained as a result of placing on the glass surface thin films of transparent plastic, which are then processed in a particular way. In contact with the flutes, the molecules are oriented identically in all the cells. The liquid crystal panel is illuminated by a light source, depending on where it is located, as the LCD panels operate on reflection or light transmission. The plane of polarization of the light beam is rotated by 90° as one panel passes. When an electric field appears, the molecules are partially aligned along it, and the angle of rotation of the plane of polarization of light becomes different from 90° . By producing screens using LCD monitor technology, the backlight of the monitor is used to output a color image so that light is generated at the back of the LCD monitors. It is necessary to be able to have a picture with good quality, even if it is dark. The color is obtained using three filters, which distinguish three principal components from the radiation of a white light source. By combining the three primary colors for each pixel of the screen, you can reproduce any color.

4.6 CAPACITOR

A capacitor is a device that stores electrical energy in an electric field by virtue of accumulating electric charges on two close surfaces insulated from each other. It is a passive electronic component with two terminals. The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. The capacitor was originally known as the condenser,[1] a term still encountered in a few compound names, such as the condenser microphone.

The physical form and construction of practical capacitors vary widely and many types of capacitor are in common use. Most capacitors contain at least two electrical conductors often in the form of metallic plates or surfaces separated by a dielectric medium. A conductor may be a foil, thin film, sintered bead of metal, or an electrolyte. The nonconducting dielectric acts to increase the



capacitor's charge capacity. Materials commonly used as dielectrics include glass, ceramic, plastic film, paper, mica, air, and oxide layers. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dissipate energy, although real-life capacitors do dissipate a small amount (see Non-ideal behavior). When an electric potential difference (a voltage)

is applied across the terminals of a capacitor, for example when a capacitor is connected across a battery, an electric field develops across the dielectric, causing a net positive charge to collect on one plate and net negative charge to collect on the other plate. No current actually flows through the dielectric. However, there is a flow of charge through the source circuit. If the condition is maintained sufficiently long, the current through the source circuit ceases. If a time-varying voltage is applied across the leads of the capacitor, the source experiences an ongoing current due to the charging and discharging cycles of the capacitor.

A capacitor consists of two conductors separated by a non-conductive region. The non-conductive region can either be a vacuum or an electrical insulator material known as a dielectric. Examples of dielectric media are glass, air, paper, plastic, ceramic, and even a semiconductor depletion region chemically identical to the conductors. From Coulomb's law a charge on one conductor will exert a force on the charge carriers within the other conductor, attracting opposite polarity charge and repelling like polarity charges, thus an opposite polarity charge will be induced on the surface of the other conductor. The conductors thus hold equal and opposite charges on their facing surfaces, and the dielectric develops an electric field. An ideal capacitor is characterized by a constant capacitance C , in farads in the SI system of units.

A capacitance of one farad (F) means that one coulomb of charge on each conductor causes a voltage of one volt across the device. Because the conductors (or plates) are close together, the opposite charges on the conductors attract one another due to their electric fields, allowing the capacitor to store more charge for a given voltage than when the conductors are separated, yielding a larger capacitance.

4.7 LED LIGHTS

LED stands for light emitting diode. LED lighting products produce light up to 90 percent more efficiently than incandescent light bulbs. How do they work An electrical current passes through a microchip, which illuminates the tiny light sources we call LEDs and the result is visible light. To prevent performance issues, the heat LEDs produce is absorbed into a heat sink.

The useful life of LED lighting products is defined differently than that of other light sources, such as incandescent or compact fluorescent lighting (CFL). LEDs typically do not “burn out” or fail. Instead, they experience ‘lumen depreciation’, wherein the brightness of the LED dims slowly over time. Unlike incandescent bulbs, LED “lifetime” is established on a prediction of when the light output decreases by 30 percent.



LED lighting is available in a wide variety of home and industrial products, and the list is growing every year. The rapid development of LED technology has resulted in increased product availability, improved manufacturing efficiency, and lower prices. The high efficiency and directional nature of LEDs makes them ideal for many industrial uses. LEDs are increasingly common in street

lights, parking garage lighting, walkway and other outdoor area lighting, refrigerated case lighting, modular lighting, and task lighting.

Because LEDs are small and directional, they are ideal for lighting tight spaces such as countertops for cooking and reading recipes. Since there can be variation in light color and directionality, it is important to compare products to find the best fixture for your space. LEDs consume far less electricity than incandescent bulbs, and decorative LED light strings such as Christmas tree lights are no different. Not only do LED holiday lights consume less electricity.

LED lighting is available in a wide variety of home and industrial products, and the list is growing every year. The rapid development of LED technology has resulted in increased product availability, improved manufacturing efficiency, and lower prices. Below are some of the most common types of LED products.

4.8 MOTOR

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. An electric generator is mechanically identical to an electric motor, but operates with a reversed flow of power, converting mechanical energy into electrical energy. Electric motors can be powered by direct current (DC) sources, such as from batteries, or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators.

Electric motors may be classified by considerations such as power source type, construction, application and type of motion output. They can be powered by AC or DC, be brushed or brushless, single-phase, two-phase, or three-phase, axial or radial flux, and may be air-cooled or liquid-cooled. Standardized motors provide convenient mechanical power for industrial use. The largest are used for ship propulsion, pipeline compression and pumped-storage applications with output exceeding 100 megawatts.

Applications include industrial fans, blowers and pumps, machine tools, household appliances, power tools, vehicles, and disk drives. Small motors may be found in electric watches. In certain applications, such as in regenerative braking with traction motors, electric motors can be used in reverse as generators to recover energy that might otherwise be lost as heat and friction. Electric motors produce linear or rotary force (torque) intended to propel some external mechanism, such as a fan or an elevator. An electric motor is generally designed for continuous rotation, or for linear movement over a significant distance compared to its size. Magnetic solenoids are also transducers that convert electrical power to mechanical motion, but can produce motion over only a limited distance.

After many other more or less successful attempts with relatively weak rotating and reciprocating apparatus Prussian/Russian Moritz von Jacobi created the first real rotating electric motor in May 1834. It developed remarkable mechanical output power. His motor set a world record, which Jacobi improved four years later in September 1838. His second motor was powerful enough to drive

a boat with 14 people across a wide river. It was also in 1839/40 that other developers managed to build motors with similar and then higher performance.

In 1855, Jedlik built a device using similar principles to those used in his electromagnetic self-rotors that was capable of useful work. He built a model electric vehicle that same year. A major turning point came in 1864, when Antonio Pacinotti first described the ring armature (although initially conceived in a DC generator, i.e. a dynamo). This featured symmetrically-grouped coils closed upon themselves and connected to the bars of a commutator, the brushes of which delivered practically non-fluctuating current. The first commercially successful DC motors followed the developments by Zénobe Gramme who, in 1871, reinvented Pacinotti's design and adopted some solutions by Werner Siemens.

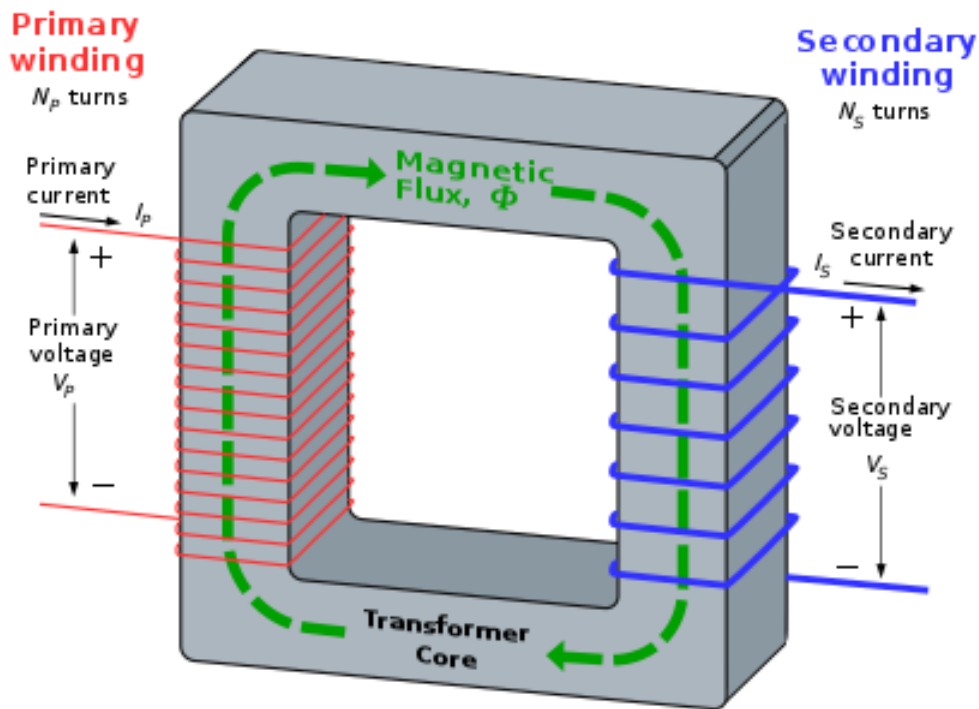


The stator surrounds the rotor, and usually holds field magnets, which are either electromagnets consisting of wire windings around a ferromagnetic iron core or permanent magnets. These create a magnetic field that passes through the rotor armature, exerting force on the windings. The stator core is made up of many thin metal sheets that are insulated from each other, called laminations. These laminations are made using electrical steel which has a specified magnetic permeability, hysteresis, and saturation. Laminations are used to reduce losses that would result from induced circulating eddy currents that would flow if a solid core were used. Mains powered AC motors typi-

cally immobilize the wires within the windings by impregnating them with varnish in a vacuum. This prevents the wires in the winding from vibrating against each other which would abrade the wire insulation causing it to fail prematurely. Resin-packed motors, used in deep well submersible pumps, washing machines, and air conditioners, encapsulate the stator in plastic resin to prevent corrosion and/or reduce conducted noise.

4.9 TRANSFORMER

A transformer is a passive component that transfers electrical energy from one electrical circuit to another circuit, or multiple circuits. A varying current in any coil of the transformer produces a varying magnetic flux in the transformer's core, which induces a varying electromotive force (EMF) across any other coils wound around the same core. Electrical energy can be transferred between separate coils without a metallic (conductive) connection between the two circuits. Faraday's law of induction, discovered in 1831, describes the induced voltage effect in any coil due to a changing magnetic flux encircled by the coil.



Transformers are used to change AC voltage levels, such transformers being termed step-up or step-down type to increase or decrease voltage level, respectively. Transformers can also be used to provide galvanic isolation between circuits as well as to couple stages of signal-processing circuits. Since the invention of the first constant-potential transformer in 1885, transformers have become essential for the transmission, distribution, and utilization of alternating current electric power. A wide range of transformer designs is encountered in electronic and electric power applications. Transformers range

in size from RF transformers less than a cubic centimeter in volume, to units weighing hundreds of tons used to interconnect the power grid.

The windings are wound around a core of infinitely high magnetic permeability so that all of the magnetic flux passes through both the primary and secondary windings. With a voltage source connected to the primary winding and a load connected to the secondary winding, the transformer currents flow in the indicated directions and the core magnetomotive force cancels to zero. According to Faraday's law, since the same magnetic flux passes through both the primary and secondary windings in an ideal transformer, a voltage is induced in each winding proportional to its number of windings. The transformer winding voltage ratio is equal to the winding turns ratio.

An ideal transformer is a reasonable approximation for a typical commercial transformer, with voltage ratio and winding turns ratio both being inversely proportional to the corresponding current ratio. The ideal transformer model assumes that all flux generated by the primary winding links all the turns of every winding, including itself.

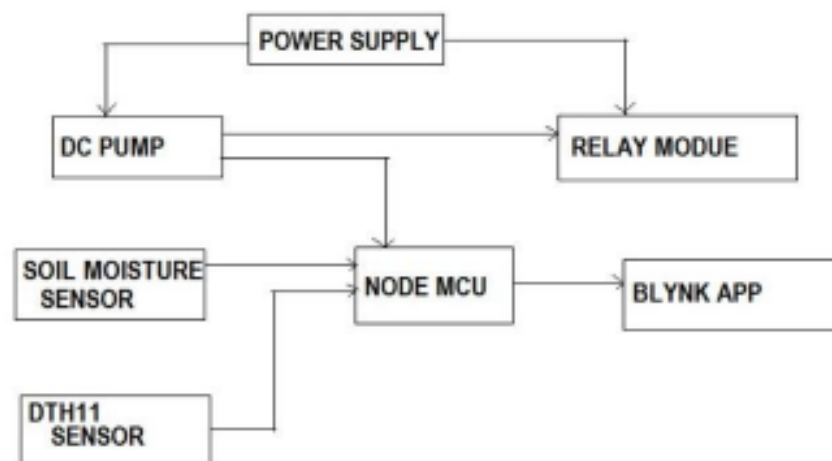
A dot convention is often used in transformer circuit diagrams, nameplates or terminal markings to define the relative polarity of transformer windings. Positively increasing instantaneous current entering the primary winding's 'dot' end induces positive polarity voltage exiting the secondary winding's 'dot' end. Three-phase transformers used in electric power systems will have a nameplate that indicate the phase relationships between their terminals. This may be in the form of a phasor diagram, or using an alpha-numeric code to show the type of internal connection (wye or delta) for each winding.

Operation of a transformer at its designed voltage but at a higher frequency than intended will lead to reduced magnetizing current. At a lower frequency, the magnetizing current will increase. Operation of a large transformer at other than its design frequency may require assessment of voltages, losses, and cooling to establish if safe operation is practical. Transformers may require protective relays to protect the transformer from overvoltage at higher than rated frequency. One example is in traction transformers used for electric multiple unit and high-speed train service operating across regions with different electrical standards. The converter equipment and traction transformers have to accommodate different input frequencies and voltage (ranging from as high as 50 Hz down to 16.7 Hz and rated up to 25 kV).

CHAPTER 5

METHODOLOGY

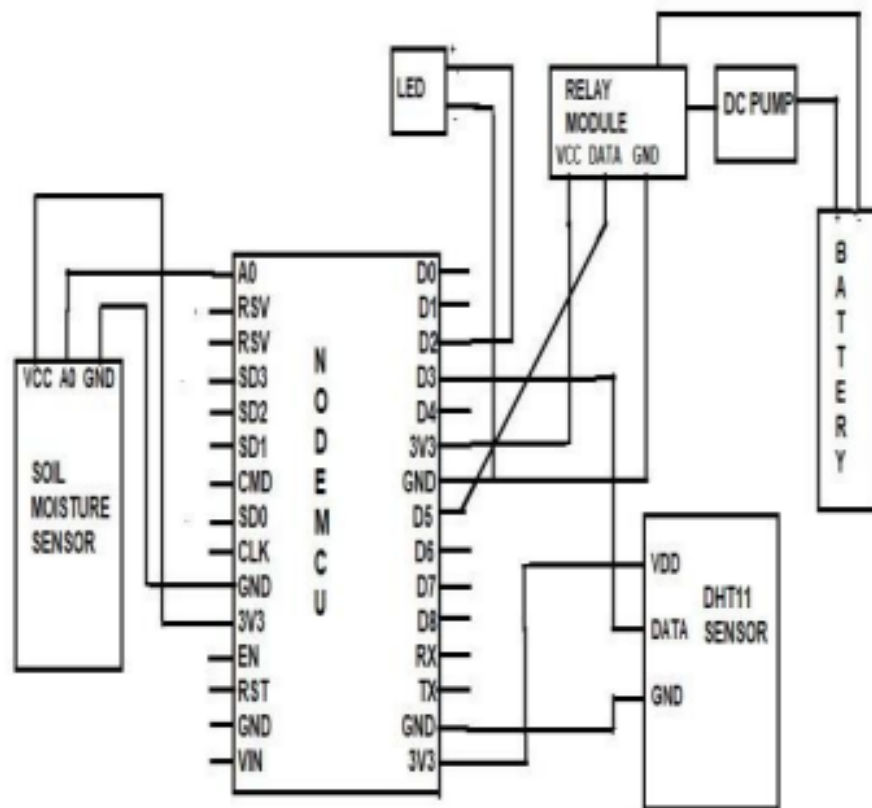
The Procedure is introduced by using Node MCU that is connected by different Sensors and the data is transferred through a WiFi module that is Available in ESP8266 WiFi module. The data is transferred directly to the application by using power supply and WiFi. The network part is the main point for Operating the device. DTH11 Sensor are used to detect the Exact status of heat and Humidity. Soil moisture detect the moisurity of soil. These two Sensors are used to Analyse the real time data of plants and this help us to get the overview of plant Environment. By using this information user can Detect which part of the plant is affected in the garden and recover the plant by these effects and improve the plant growth. Power supply is given to the circuit board through Battery then the circuit board that uses it transfer the dc power to sensors for working properly.



The display unit can generate the output. Here we use Blynk IoT app for this project to the display outputs. When we give the power supply the NodeMCU activate. Then also sensors get ON. When sensors are ON It reads the data from soil and also from Surroundings. Based on the values which are detected by Sensors motor will be turn to ON/OFF State. The value of Threshold is less than the Moisture then the Motor turned ON. If it Detects high moisture level the motor is in

OFF positive. The Sensor only collects all the values and sends it to ESP8266 Wi-Fi protocol. The Information Display on the Blynk App. Then the user can easily control the motor by using Blynk App.

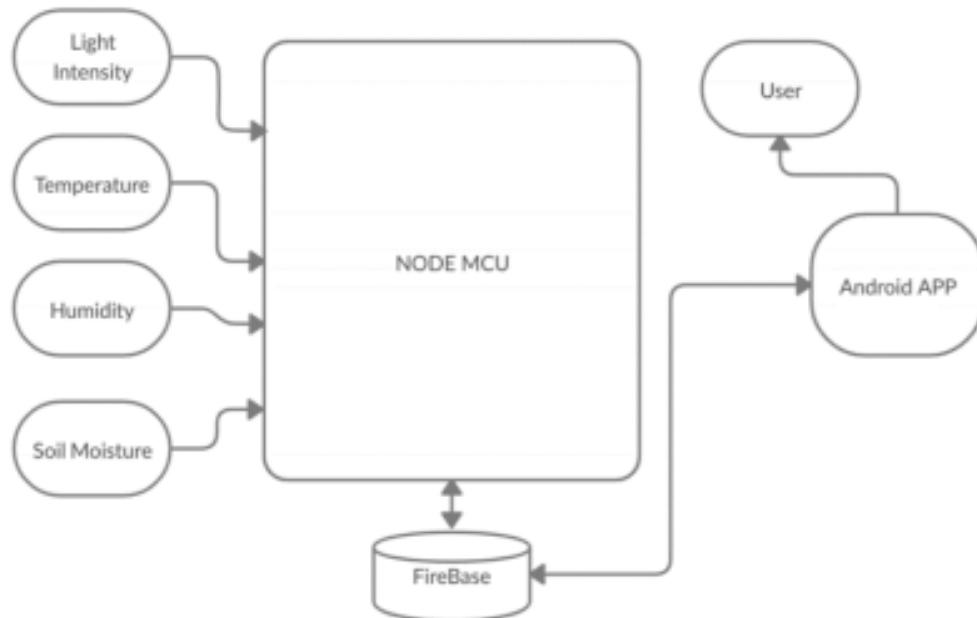
In Node MCU we use D3, D2, D5 and A0 along with VCC and GND Pins. DTH11 Sensor consist of Three pins the data pin is connected to D3 of MCU and Supply and Ground pin is connected to VCC and GND respectively. Soil moisture sensor signal pin is connected to A0 and remaining two pins one is connected to supply and another is ground. LED positive is connected to D2 whereas negative is grounded. Relay Module data pin is connected to the D5 and Supply and Ground is connected to VCC and GND Respectively. DC Pump Relay Module is connected to the Battery. DC pump Operates based on the Relay and Battery. When we give Power Supply to Node MCU 5V or 9V then the user program in flash memory is enables and display the outputs. According to the displayed information we overcome the Soil Moisture related problems then we improve the Soil Moisture by giving the proper water supply to plant through motor. Then Automatically the we improve plant growth and also reduce the wastage of water. When moisture level is high then the motor is in off position.



Blynk IoT is main Software Tool of Our Project. It can be Installed by using Following Steps: First we have to install the Blynk IoT App from play store. After Create Account on Blynk App by using Mail Id. Then go to Developer mode and Create New Template According to our project. After creation of Template we have to go to DataStream's and create Separate Data stream for each parameter. In our project we take Four Data Streams like Temperature, Humidity and Soil Moisture

along LED. After Create Web Dash Board for Displaying parameters purpose. In Web Dash Board we take three Gauges for measuring Temperature Humidity and Soil Moisture and take Switch as LED for ON/OFF.

The perspective for developing this project is to make the managing of plants easy for the costumer using IOT and machine learning. In this scenario manpowerwill be reduced as there is no need for the customer to manually keep on checking the plants health. This will also save time of the customer. As customers will interact with the AI chatbot he or she can clear all their doubts and also automatically water the plant if moisture in the soil is less. The customer.interacts with the android application and the sensors fixed around the plants will update the current condition of the plants environment. .The sensors obtain ambient temperature, ambient humidity, soil moisture, and illuminance it to the cloud which is then displayed on the UI on the user android device. User interface basically interacts with the user and allows the user to view different aspects such as moisture condition, temperature, humidity of the plants environment. The user interface also provides option to add more than one plant and also to water the plants by one click button on app. The pre-trainedAlexNet model used in this study primarily consist of 5 convolutional layers (convlayers) and 3 fully connected layers.Here the user can check whether the plant is suffering from the disease by clicking a pic of the plant's leaf and adding it to the trained model. In our project The Indoor Plant Monitoring System we have it developed as a IOT application. The system can be accessed from the android devices. To simplify the user interface, the software will also provide user manuals that will guide the customer to access the online portal.



CHAPTER 6

IMPLEMENTATION

6.1 EMBEDDED C CODE

It allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer – based systems, and resulting in improved efficiency, accuracy and economic benefit. As water supplies become scarce and polluted, there is an urgent need to irrigate more efficiently in order to optimize water use to support green environment. This project explains a smart Houseplant Watering and Monitoring system that monitors and tracks environmental conditions, helping the plants thrive. The sensors gather and analyze data about changing weather and soil moisture conditions and then connects to the user's Android phone with timely alerts. Indoor plant monitoring system is a smart Houseplant Watering and Monitoring system that monitors and tracks environmental conditions, helping the plants thrive. The Garden Sensors gather and analyze data about changing weather and soil moisture conditions and then connects to the user's Android phone with timely alerts. Also, the system includes an android application which runs on an android devices which can be used to monitor the plant's conditions at user's workplace. It continuously monitors the conditions and alerts the user to the changes that require immediate action. Unlike preset sprinklers, the Greves Water Valve automatically controls the existing water system based on data collected by the Garden Sensor and adapts to every change in the plant's requirements. The paper describes the architecture and methodology used to integrate different platforms together to develop a working system using Cloud Computing. It integrates Android, Node MCU, Deep learning module (AlexNet) and firebase Cloud together to work intandem making the system achieve its set goals.

```
define BLYNK_TEMPLATE_ID "TMPLgIyIUvLA"
```

```
define BLYNK_TEMPLATE_NAME "plantmonitoringsystem"
```

```
define BLYNK_AUTH_TOKEN "9Px4m7VPTwDARf2wI_eNVIDJvtbXVntg"
```

```
include <LiquidCrystal_I2C.h>
```

```
LiquidCrystal_I2C lcd(0x27, 16, 2);
```

If your LCD has a PCF8574 chip from Texas Instruments, its default I2C address is 0x27Hex.

If your LCD has a PCF8574 chip from NXP semiconductors, its default I2C address is 0x3FHex.

```

D2 Pin ( SDA ) SDA Pin
D1 Pin ( SCL ) SCL Pin
#include <DHT.h> // Including library for dht
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
char auth[] = "9Px4m7VPTwDARf2wI_eNVIDJvtbXVntg";
char ssid[] = "V2036";
char pass[] = "11111111";
#define SOIL D0
#define DHTPIN D3
#define RLY1 D4
#define RLY2 D5
#define RLY3 D6
#define RLY4 D7
#define RLY5 D8
DHT dht(DHTPIN, DHT11);
float h;
float t;
WidgetLED led1(V7);
BLYNK_WRITE(V0) int pinValue = param.asInt(); //assigning incoming value from pin V1 to a variable
if(pinValue==1) Serial.println("PUMP ON");
digitalWrite(RLY1,HIGH);
delay(100); if(pinValue==0) Serial.println("PUMP OFF");
digitalWrite(RLY1,LOW);
delay(100); BLYNK_WRITE(V1) int pinValue1 = param.asInt(); //assigning incoming value from pin V1 to a variable
if(pinValue1==1) Serial.println("FAN ON");
digitalWrite(RLY2,HIGH);
delay(100);
if(pinValue1==0) Serial.println("FAN OFF");
digitalWrite(RLY2,LOW);
delay(100);
BLYNK_WRITE(V2) int pinValue2 = param.asInt(); //assigning incoming value from pin V1 to a variable
if(pinValue2==1) Serial.println("LED1 ON");
digitalWrite(RLY3,HIGH);
delay(100);

```

```

if(pinValue2==0)
Serial.println("LED1 OFF");
digitalWrite(RLY3,LOW);
delay(100);
BLYNK_W RITE(V3)
int pinValue3 = param.asInt(); // assigning incoming value from pin V1 to a variable
if(pinValue3==1)
Serial.println("LED2 ON");
digitalWrite(RLY4,HIGH);
delay(100);
if(pinValue3==0)
Serial.println("LED2 OFF");
digitalWrite(RLY4,LOW);
delay(100);
BLYNK_W RITE(V4)
int pinValue4 = param.asInt(); // assigning incoming value from pin V1 to a variable
if(pinValue4==1)
Serial.println("LED3 ON");
digitalWrite(RLY5,HIGH);
delay(100);
if(pinValue4==0)
Serial.println("LED3 OFF");
digitalWrite(RLY5,LOW);
delay(100);
void setup()
lcd.begin();
lcd.clear();
lcd.backlight();
// Make sure backlight is on
lcd.setCursor(0,0);
lcd.print("TEMPERATURE: 00C");
lcd.setCursor(0,1);
lcd.print("SOIL: HUM:00
Serial.begin(9600);
Blynk.begin(auth, ssid, pass);
pinMode(SOIL, INPUT);
pinMode(RLY1, OUTPUT);
pinMode(RLY2, OUTPUT);

```

```

pinMode(RLY3, OUTPUT);
pinMode(RLY4, OUTPUT);
pinMode(RLY5, OUTPUT);
digitalWrite(RLY5, LOW);
digitalWrite(RLY1,LOW);
digitalWrite(RLY2,LOW);
digitalWrite(RLY3,LOW);
digitalWrite(RLY4,LOW);
dht.begin();
void loop()  Blynk.run();
h = dht.readHumidity();
t = dht.readTemperature();
Blynk.virtualWrite(V5, t);
Blynk.virtualWrite(V6, h);
lcd.setCursor(13,1);
lcd.print(h);
lcd.setCursor(15,1);
lcd.print("
lcd.setCursor(13,0);
lcd.print(t);
lcd.setCursor(15,0);
lcd.print("C ");
if(digitalRead(SOIL)==LOW)
lcd.setCursor(5,1);
lcd.print("WET");
led1.off();
else
lcd.setCursor(5,1);
lcd.print("DRY");
led1.on();

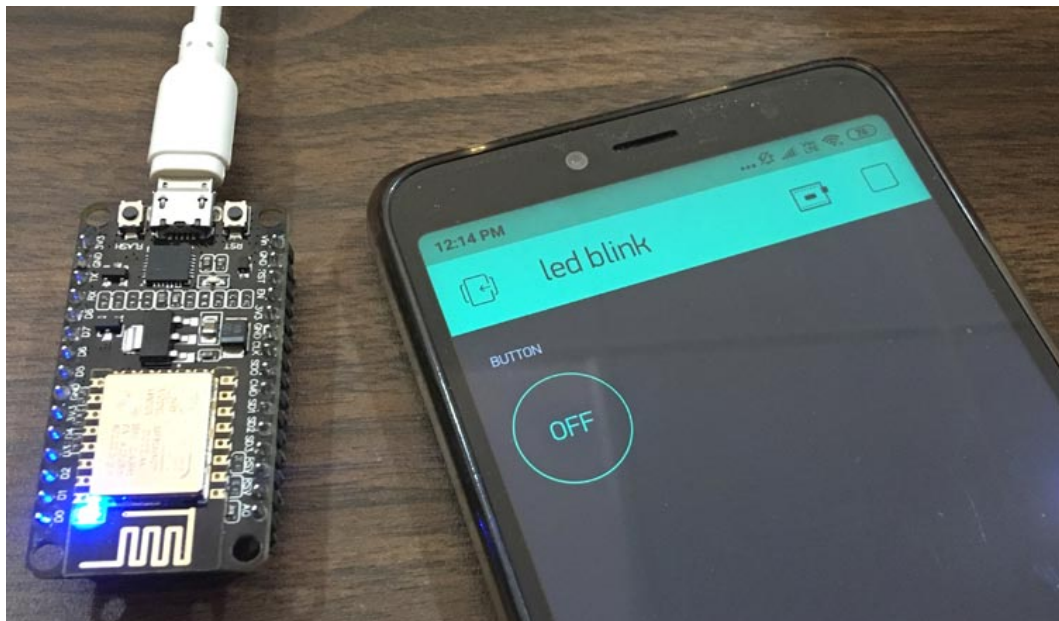
```


CHAPTER 7

TESTING

7.1 NODE MCU TESTING

NodeMCU is Open Source IoT Platform. It is the key Component of our project.MCU means micro control unit.it is 32 bit MCU and it has ESP8266 Wi-Fi protocol. It is 17 pin GPIO(General purpose input output).It has a inbuilt Wi-Fi through this Wi-Fi the data can be transmitted. In NODE MCU the user program can be external flash memory. It uses low power.



7.2 SOIL SENSOR TESTING

Soil Moisture Sensor is used to Measure the Volumetric Content of soil. It is sensitivity adjustable it is capacitance to measure dielectric permittivity of the surrounding medium. In soil Dielectric Permittivity is function of water content.It has operating voltage of +5v dc. It is used in many applications like agriculture and landscape irrigation.Soil Moisture Sensor is a simple breakout for measuring the moisture in soil and similar materials. The soil moisture sensor is pretty straight

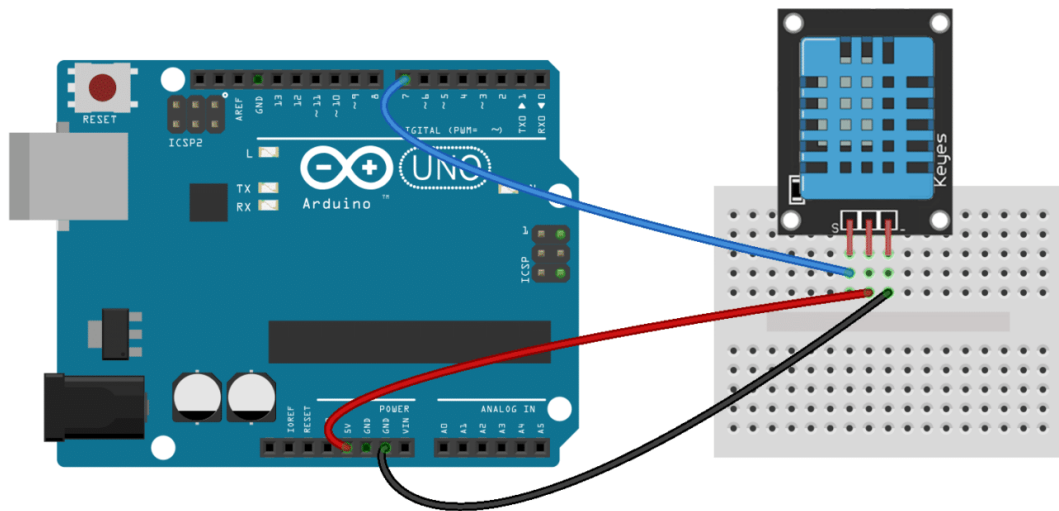
forward to use. The two large exposed pads function as probes for the sensor, together acting as a variable resistor. The more water that is in the soil means the better the conductivity between the pads will be and will result in a lower resistance, and a higher SIGout. It is generally used in greenhouses to control water supply and other enhanced bottle Biology experiments to monitor the content of water in the soil.



7.3 DHT11 TESTING

Digital Temperature and Humidity Sensor It has capability to measure Temperature and Humidity. It gives Calibrated Digital Output. It uses 3-5 V. It is good For 0 to 50 C Temperature readings with ± 2 accuracy. It is also good for 20 to 90 percent of Humidity readings with 5 percent Of accuracy. It consists of 3 pins with 0.1 spacing.

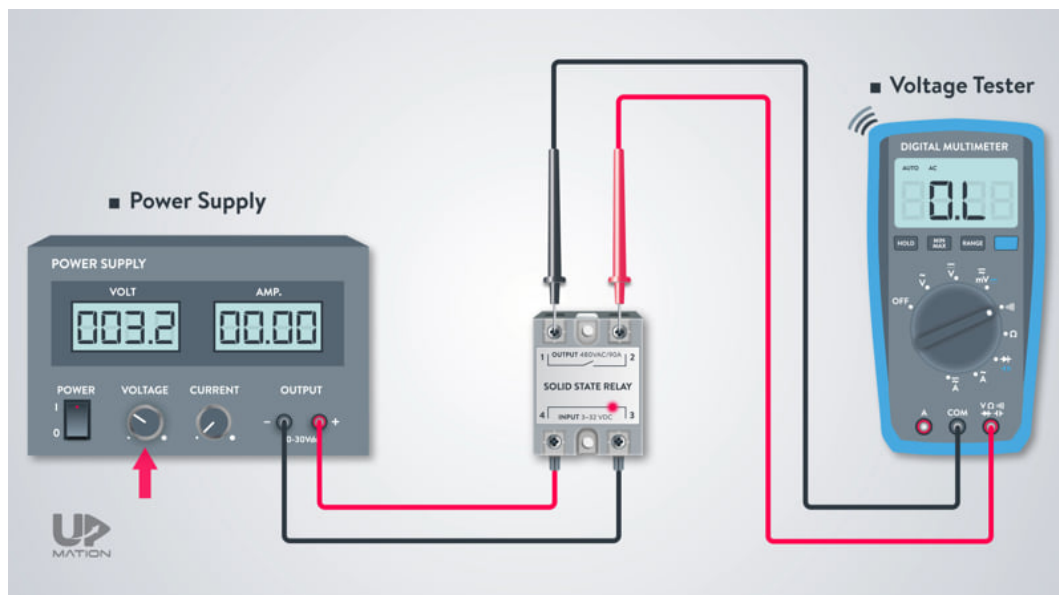
The dht11 sensor, a combination of temperature and humidity sensor generally gives digital or analog output. It includes information about the temperature around the plant whether it requires more sunlight or not as well as It deals with the humidity present in the environment around the plant. The electrical resistance in between the two electrodes is used to detect the water vapor. The electrode along with the substrate which is responsible for holding moisture when in contact with the surface acts as the humidity sensing component, which results in a rise in conductivity between the electrodes as soon as water vapor is absorbed by it. The result calibrated by the dht11 sensor is quite accurate.



The DHT11 sensor has a lot of applications owing to its small size and lower power, also it has a wide range for the transmission of the signal which is up to 20 m. The product which we have used is a 4 pin single row pin package thereby making it appropriate for the breadboard connections. The dht11 sensor is available in two alternatives, either the sensor or the module.

7.4 RELAY TESTING

It is an Electrical switch it opens and closes Under control of another electric circuit. Relay Uses the power supply for opening and closing Switch contacts. The supply voltage range from 3.75 to 6V. Operating time is 10ms.

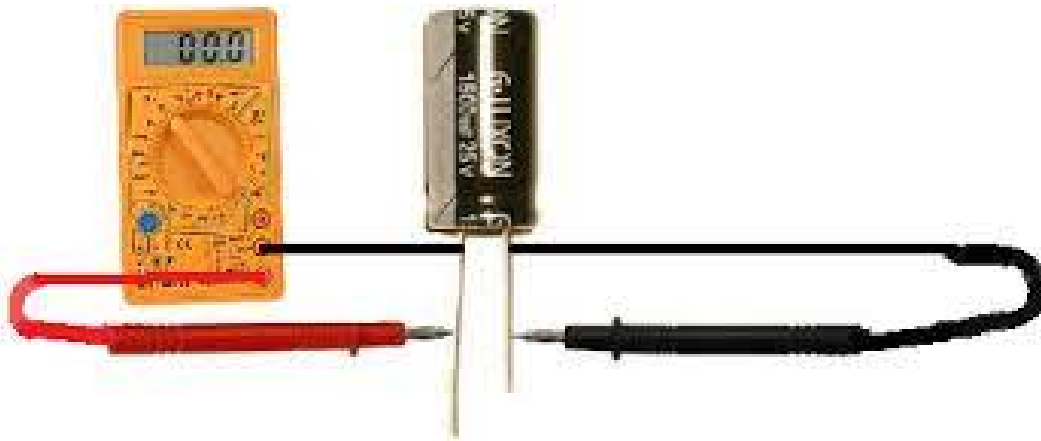


Inside a relay, there is a core with copper wire wound around it (the coil). Under normal conditions, the switch (armature) remains in contact with the normally closed (NC) terminal. But when voltage is applied through the coil, an electromagnetic field is generated and the coil starts to act

as a magnet, pulling the armature towards itself to the normally open terminal (NO). That's all there is to relays at the most basic level. Other than that there are many other types of relays, such as solid state and thermal relays, with different operating mechanisms, but all of them have the same common purpose. Here this part is used to control the mini dc pump for automatically watering plants and the flow is controlled by relay. In general, control circuits handling smaller currents are switched by relays.

7.5 CAPACITOR TESTING

A capacitor is a device that stores electrical energy in an electric field by virtue of accumulating electric charges on two close surfaces insulated from each other. It is a passive electronic component with two terminals. The effect of a capacitor is known as capacitance.



The device for storing electrical energy, consisting of two conductors in close proximity and insulated from each other. A simple example of such a storage device is the parallel-plate capacitor.

CHAPTER 8

RESULTS AND DISCUSSION

8.1 ORIGINAL DATA

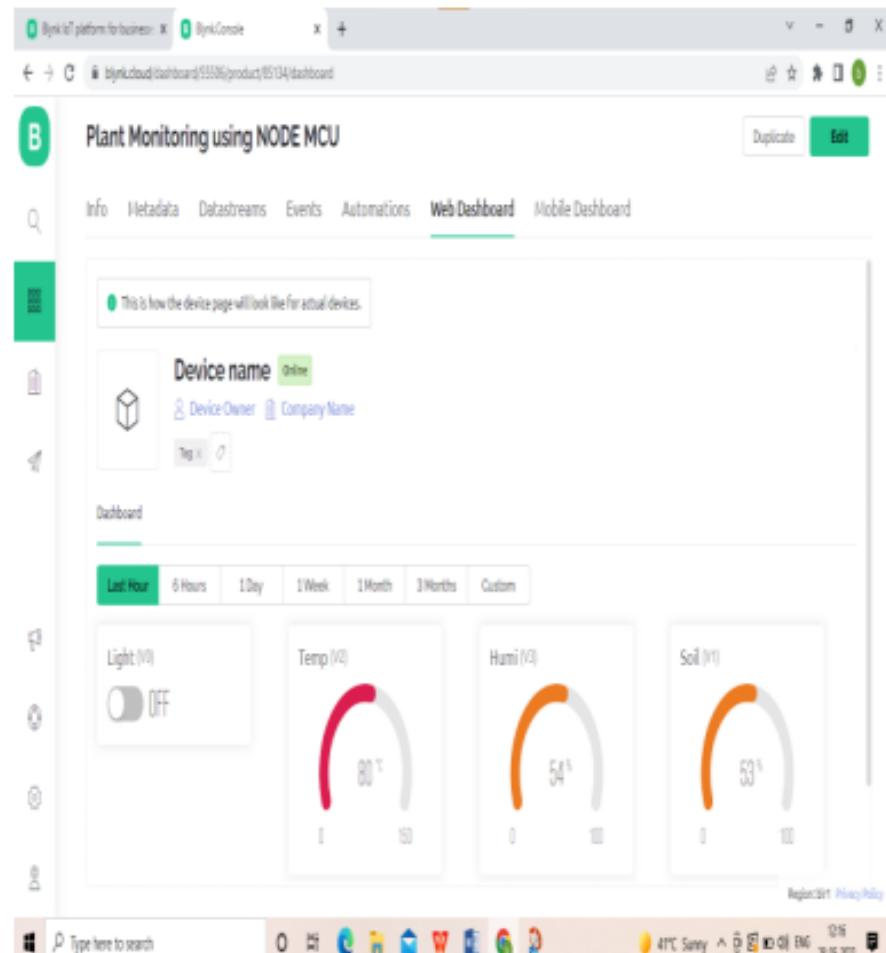
Experimental Results have been obtained after the successful implementation of the circuitry. It shows the output sensed by the sensors on the application developed on the MIT app inventor which was then installed on the Smartphone of the user. It monitors the humidity, temperature, soil moisture and the light intensity. The screenshots of the app as well as of the image of the Alex Node output of the disease have been shown in order to validate the results obtained.

8.2 BLINK APP

The real time results on Blynk App web dashboard Screen.it displays the Exact Temperature Humidity and Soil Moisture Readings.

The Blynk application is connected to Wi-Fi. Through this Wi-Fi the App can show the Readings in any Android Device. Blynk is an Internet of things (IoT) company which provides a platform for building mobile (IOS and Android) applications that can connect electronic devices to the Internet and remotely monitor and control these devices. In NodeMCU we use D3, D2, D5 and A0 along with VCC and GND Pins. DTH11 Sensor consists of Three pins the data pin is connected to D3 of MCU and Supply and Ground pin is connected to VCC and GND respectively. Soil moisture sensor signal pin is connected to A0 and remaining two pins one is connected to supply and another is ground. LED positive is connected to D2 whereas negative is grounded. Relay Module data pin is connected to the D5 and Supply and Ground is connected to VCC and GND Respectively. DC Pump Relay Module is connected to the Battery. DC pump Operates based on the Relay and Battery. When we give Power Supply to NodeMCU 5V or 9V then the user program in flash memory is enabled and displays the outputs. According to the displayed information we overcome the Soil Moisture related problems then we improve the Soil Moisture by giving the proper water supply to plant through motor. Then Automatically we improve plant growth and also reduce the wastage of water. When moisture level is high then the motor is in OFF position.

When we give Power Supply to NodeMCU 5V or 9V then the user program in flash memory



is enables and display the outputs. According to the displayed information we overcome the Soil Moisture related problems then we improve the Soil Moisture by giving the proper water supply to plant through motor.

8.3 PLANT MONITORING

1. When we give the power supply the NodeMCU activate. Then also sensors get ON.
2. When sensors are ON It reads the data from soil and also from Surroundings.
3. Based on the values which are detected by Sensors motor will be turn to ON/OFF State.
4. The value of Threshold is less than the Moisture then the Motor turned ON.
5. If it Detects high moisture level the motor is in OFF position.
6. The Sensor only collects all the values and sends it to ESP8266 Wi-Fi protocol.
7. The Information Display on the Blynk App.
8. Then the user can easily control the motor by using Blynk App.

The Procedure is introduced by using NodeMCU that is connected by different Sensors and the data is transferred through a Wi-Fi module that is Available in ESP8266 Wi-Fi module. The



data is transferred directly to the application by using power supply and Wi-Fi. The network part is the main point for Operating the device. DTH11 Sensor are used to detect the Exact status of heat and Humidity. Soil moisture detect the moisturity of soil. These two Sensors are used to Analyse the real time data of plants and this help us to get the overview of plant Environment. By using this information user can Detect which part of the plant is affected in the garden and recover the plant by these effects and improve the plant growth. Power supply is given to the circuit board hrough Battery then the circuit board that uses it transfer the dc power to sensors for working properly. The display unit can generate the output. Here we use Blynk IoT app for this project to the display outputs.

CHAPTER 9

CONCLUSION

By this project we Conclude that we reduce the Effect of daily Watering of plants and we can Improve the growth of the plant and health also Improved. . Indoor plant monitoring system consisting various operations like knowing plants health , watering the plant, checking plants health etc. was carried out successfully. This system reduces human labour, work load and is also time efficient. We have tested the system and carefully and closely observed the results achieved thereafter. All the hardware components have been integrated to develop the system. The working of each and every module has been reasoned out with utter carefulness and they have been placed in such a way thatthey contribute towards getting the best results from the system. Hence,working project is successfully designed and implemented giving the desired outputs.It is used in plenty of applications. Improper Supply of Water can effect both Soil and Plants. This problem can be overcome using this project .In this Project, IoT is employed to create a Smart Monitoring System for Plants. In this Project we mainly used the components are NODEMCU, DTH11 Sensor, and Soil Moisture Sensor. In this project we Measure the parameters like Temperature Humidity, soil Moisture.allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunitiesfor more direct integration between the physical world and computer – based systems, and resulting in improved efficiency, accuracy and economic benefit. As water supplies become scarce and polluted, there is an urgent need to irrigate more efficiently in order to optimize water use to support green environment. This project explains a smart Houseplant Watering and Monitoring system that monitors and tracks environmental conditions, helping the plants thrive. The sensors gather and analyze data about changingweather and soil moisture conditions and then connects to the user's Android phone with timely alerts. Indoor plant monitoring system is a smart Houseplant Watering and Monitoring system that monitors and tracks environmental conditions, helping the plants thrive.

CHAPTER 10

FUTURE SCOPE

The Future Scope of this Project never be ended Because in today fast World every person will Require a helping hand to take care of plant and Plant health status. This is Further used for large Scale of Agriculture Purpose to increase the CropRate and help farmers to reduce man power.The scope of Indoor Plant Monitoring System using IoT is vast. The main aim of this system is to obtain ambient temperature, ambient humidity, soil moisture, and illuminance from a set of sensors. The Indoor Plant Monitoring System using IoT will also provide recommendation to how to take care of plants, find out which disease it has by using AlexNet model; trained on the plant leaves dataset and also water the plant using the android app . The scope of this project is never ending because every person in today's fast world will require a helping hand to look after the plant and provide status of plants health even if he or she is not present at the plant location. This same idea can be further used on a large scale for agricultural purpose on a huge acers of land which will eventually help farmers and reduce their job.

CHAPTER 11

REFERENCES

[1] Satyam Kumar Sinha, Bhupendra Singh, Aashish Kumar Gupta "IOT Based Smart Garden Monitoring System" "International Journal of Scientific Engineering Research Volume 8, Issue 10, ISSN 2229- 5518 the Plant Monitoring System Mechanism. It gives the Information about the Temperature, Humidity and soil moisture. This can be done by using various sensors like DTH11 sensor, soil moisture sensor. It is suitable for plant which may help to start a better growth of plant and also it may support to control the usage of water(2017).

[2] Devika, C. M., K. Bose, and S. Vijayalekshmy. "Automatic plant irrigation system using Arduino." IEEE International Conference on Circuits and System (ICCS), Thiruvananthapuram, India 20-21 When the soil moisture is very less then motor ON and pump the water to the plant after that soil moisture increases and then motor OFF Automatically. The parameters Temperature, Humidity, Soil Moisture can Display on Blynk IoT App (2017).

[3] R. Vagulabranan, M. Karthikeyan and V. Sasikala, "Automatic Irrigation System on Sensing Soil Moisture Content," Int. Res. J. Eng. Technol. Soil Moisture Sensor is used to Measure the Volumetric Content of soil. It is sensitivity adjustable it is capacitance to measure dielectric permittivity of the surrounding medium. In soil Dielectric Permittivity is function of water content. It has operating voltage of +5v dc. It is used in many applications like agriculture and landscape irrigation.(2015).

[4] A. Stesel and A. Osanlou, "A Sustainable Indoor Plant Production Management System with Wireless Internet Access," Young Researchers in Electrical and Electronic Engineering (EICon-Rus), 2018 IEEE Conference of Russian IEEE Moscow, Russia capability to measure Temperature and Humidity. It gives Calibrated Digital Output. It uses 3-5 V. It is good For 0 to 50 C Temperature readings with ± 2 accuracy. It is also good for 20 to 90 of Humidity readings with 5 Of accuracy. It consists of 3 pins with 0.1 spacing. (2018).

[5] Boonsit Yimwadsana, Pichamon Chanthapeth, Chanyanuch Lertthanyaphan, Antika Pornvechamnuay, "An IoT Controlled System for Plant Growth", International Journal For Technological Research In Engineering Volume 4, Issue 4, pp.668- 671 power supply for opening and closing Switch contacts. The supply voltage range from 3.75 to 6V. Operating time is 10ms(2016).

[6] Arul Jai Singh, Raviram, Shanthosh Kumar, "Embedded Based Green House Monitoring system using pic Microcontroller", IEEE Trans. Syst, Man, Cybern. Systems and Humans, vol. 41, no. 6, pp.1064-1076 Wi-Fi module that is Available in ESP8266 Wi-Fi module. The data is transferred directly to the application by using power supply and Wi-Fi. The network part is the main point for Operating the device. DTH11 Sensor are used to detect the Exact status of heat and Humidity. Soil moisture detect the moisturity of soil. These two Sensors are used to Analyse the real time data of plants and this help us to get the overview of plant Environment.(2011).

[7] K.Lokesh Krishna ,J.Madhuri and Dr.K.Anuradha, "A ZigBee based Energy Encient Environmental Monitoring Alerting and Controlling System",IEEE Trans.g,vol.3,no.1 By using this information user can Detect which part of the plant is affected in the garden and recover the plant by these effects and improve the plant growth. Power supply is given to the circuit board through Battery then the circuit board that uses it transfer the dc power to sensors for working properly. The display unit can generate the output.(2006).

[8] B. Shri Hariprasad,Dr.Vimalathithan Rathinasabapathy, "A smartIoT system for monitoring solar PV power conditioning unit",World Conference on Futuristic Trends in Research and Innovation for Social Welfare (WCFTR '16) Vol. 3,Issue 2 e Physical Description of project can be represented by the above Fig 5. All Sensors are connected to the NodeMCU and DC Pump and Relay module is connected to Power Supply. Here we use the power supply as Battery. The Output can be shown in Blynk App. This app is used to Monitor and Control our Hardware project and Display the parameters in Web Dashboard of Blynk App.(2008).

[9] Abhishek Gupta, Shailesh Kumawat, Shubham Garg, "Automated Plant Watering System", Vol-2, Issue-4, 2016 ISSN: 2454- 1362.Automated Plant Watering System", LLC, pp.59-69 data pin is connected to D3 of MCU and Supply and Ground pin is connected to VCC and GND respectively. Soil moisture sensor signal pin is connected to A0 and remaining two pins one is connected to supply and another is ground. LED positive is connected to D2 whereas negative is grounded. Relay Module data pin is connected to the D5 and Supply and Ground is connected to VCC and GND Respectively.(2008).

[10] Georgantopoulos, C.Constantinopoulos, D.Kosmopoulos "Tomato Disease Classification using AlexNet" Conference: ICCSP At: Bali, Indonesia.September DC pump Operates based on the Relay and Battery. When we give Power Supply to NodeMCU 5V or 9V then the user program in flash memory is enables and display the outputs. According to the displayed information we overcome the Soil Moisture related problems then we improve the Soil Moisture by giving the proper water supply to plant through motor. Then Automatically the we improve plant growth and also reduce the wastage of water. (2011).