KATHMANDU UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PROJECT REPORT

AUTOMATED DRIP IRRIGATION SYSTEM

A **Third year project report** submitted in partial fulfilment
of the requirements for the degree of
Bachelor of Engineering

by:
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CERTIFICATION

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ON
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ABSTRACT

In the present era, food scarcity and water scarcity occurs due to the increase in population. So to avoid this problem we have to promote the agriculture sector. But water wastage is more in this sector in the form of water logging while watering the agricultural fields through irrigation. Therefore an automatic plant irrigation system has to be designed for the proper water supply in the fields. This report deals with an automatic plant irrigation system which automatically senses the moisture content of the soil and decide whether irrigation is needed or not. This system uses aurdino. It is programmed to sense the moisture, temperature and humidity content . When the moisture content is less than the limit which is predefined, it will start supplying the desired amount of water till it reaches the limit. So when the soil is dry the pump will automatically water the fields and when the soil is wet the pump will automatically switch off. And when the temperature content is more the limit which is predefined, it will start the exhaust fan, there by eradicate the need of manpower and conserve the time.

Monitoring system in agriculture helps farmer to take note on the environmental condition of the crops. The project uses temperature, humidity, and soil moisture sensors attached with NodeMCU to send the temperature, humidity and soil moisture data to Blynk cloud.

ACKNOWLEDGMENT

On the very outset of this report, we would like to extend our sincere and heartfelt obligation towards all personages who have helped us in this endevour. Without their active guidance, help, cooperation and encouragement, we would not have completed this project.

We are ineffably indebted to Associate Proffesor Dr.Ram kaji Budhathoki for his valuable guidance and support on completion of this project.

We are extermely thankful to Department Of Electrical and Electronics for giving us this opportunity .

ABBREVIATIONS

Abbreviation	Full Form	First Used in Page
LoRa	Long Range	6
DC	Direct Current	13
MCU	Micro Controller Unit	6

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CHAPTER I : INTRODUCTION

Effective use of available water is essential and with the advancement in the technology and application of automation, the optimum utilization of water for irrigation can be achieved. Traditional methods of irrigation do not provide efficient use of water. Water scarcity and flooding both are the major problems farmers are facing using the traditional approach. Therefore, drip irrigation can play a significant role to address this problem. Drip irrigation is an efficient method of providing irrigation water directly into soil at the root zone of plants and thus, minimizes conventional losses such as deep percolation, runoff and soil erosion. It also permits the utilization of fertilizers, pesticides and other water-soluble chemicals along with irrigation water, resulting in higher yields and better-quality produce. Drip irrigation system is regarded as solution for many of the problems in dry land agriculture and improving the efficiency in irrigated agriculture. Keeping all these in view, the present study was designed to study the extent of benefits derived from drip irrigation in horticultural crops and to identify the constraints encountered by farmers in adopting the drip irrigation for horticultural crops. The results revealed that majority of drip irrigation farmers had expressed the advantages like saving of water, saving in labor cost for irrigation, increased yield, water saving, labor saving, increased quality of produce, reduced weed growth, extended self-life of produce and uniform application of water.

Apart from problem of water scarcity for agriculture another major problem for the field around forest is the intrusion of domestic or wild animals. Introduction of system that alerts the farmer and produces loud sound to scare away potential intrusion that may damage the crops.

1.1 Background

Agriculture in the modern age is changing rapidly. Greenhouse farming is the effective agricultural practice of growing crops within sheltered structures covered by a transparent, or partially transparent, material. The main purpose of greenhouses is to provide favourable growing conditions and to protect crops from unfavourable weather and various pests.

By using the concept of modern drip irrigation system, a farmer can save water up to 50%. Agriculture depends on the rain which is not sufficient source of water for whole irrigation for the agricultural crops. The irrigation system helps to supply water to fields according to the moisture level of soil. Rain plays a vital role in irrigation; water supply is required because of most of the fields are depends on the rain. In conventional system the farmer has to work properly and with a full care of water supply for watering the crops, which is depend on crops types. Insufficient or over irrigation of plants can decrease the yield of crops. To provide proper amount of water for different region and avert the water overflow at the sloppy areas and considering the situation of farmer, the drip irrigation system will be useful for efficient use of water for irrigation. The proper water supply system is the major examine in cropping system. An irrigation process is useful to reduce water use for agricultural crops which is a much-required process. The need of water irrigation system is to prevent over irrigation and under irrigation. Over irrigation occurs because of bad distribution of water and chemical which leads to water pollution. To overcome these problems and to minimize the manpower, drip irrigation system plays a vital role. In this irrigation technique, through which small amount of water is applied to the root zone of the plant. The plant soil moisture stress is cure by providing proper amount of water resources frequently by which the moisture condition of the soil will retain better growth. The traditional techniques like sprinkler or surface irrigation requires / uses nearly half of water sources. Even more precise amounts of water can be supplied for plants. The erosion of soil and wind is much reduced by the recent techniques when compared with overhead sprinkler systems.

Similarly, many projects and researches have been carried out to automate the greenhouse by studying its environmental parameters and adjusting them using various sensors and actuators controlled using microcontroller for the better yield of the fruits.

Along with proper growing conditions for plants their security from wild and domestic animals alike is also one of the major concerns. In traditional agriculture system farmers use scarecrow to try to keep animals and birds away from field but those method are becoming more and more ineffective. So, a simple alert and alarm system can be used to scare the animals and notify the farmers. Although this kind of intrusion is less likely to happen in green house but there is slight chance of these forceful entry so by implementing simple alert and alarm system the loss can be minimized.

1.2 Motivation

Drip irrigation systems can be set so as to provide exactly the right amount of water for the plants. Such a system can be far less wasteful when it comes to water. Just the right amount of water will be released. (Unlike when water is supplied manually, when you can easily use more water than you need.). The water will be directed to exactly where it is needed. (Unlike with hand watering, when you can easily waste water by splashing it around where plants roots cannot retrieve it easily). An automatic shut off can help to keep water usage to a minimum. Saving water and agriculture in a water-wise way is one of the steps you can take towards a more sustainable agriculture system. If your water is metered, this can save you money too. One of the other main benefits of an automatic watering system is that it can save farmers a lot of time. In summer, watering by hand can be an extremely time-consuming process. You will usually need to water at least once a day, sometimes more, in hot weather.

As mentioned above, an automatic watering system will save water by making sure that the water is directed to where it really needs to be. A drip irrigation system delivers water right at soil level, where it can be taken up by plant roots Water is taken up through roots beneath the soil, and so watering from above can sometimes mean that plants do not get that water before it evaporates in the sun. By directing water to the base of your plants, you can ensure that less water is wasted and more can be taken up by your plants.

Another thing to bear in mind is that when you water erratically from above, you risk increasing the likelihood of certain plant diseases. For example, when the foliage of tomato plants gets wet, it is more likely to succumb to blight. Certain mildews can also be more likely to take hold if you water foliage rather than roots. In addition to making sure that plants get water where they need it, the right automatic irrigation system can also make it easier to make sure that plants get the quantity of water that they require. By delivering a consistent water supply for plants – not too much and not too little – such a system can increase the yield by creating the conditions necessary for optimal plant growth.

Watering by hand can often lead to inconsistency in plants' water supply. Watering too much can cause waterlogging or nutrient leach, while watering too little can increase plant stress. Both watering too much and watering too little can cause problems with the plants .Both can mean that they do not grow as well as they should, fail to thrive, or even die. An automatic irrigation system can cut out a range of such problems and make it easier to get a good harvest whatever the temperatures and conditions may be.

1.3 Problem Description

Agriculture is one of the most important industry for people around the world. For many developing countries it is also main economic background. Even though few degrees of automation have been introduced in developed countries it is yet to be implemented in developing countries where it is most needed. Most farmers in developing countries still depend upon frequent visit to their farm to check condition for the growth of crops and for the optimal harvest period of fruits. It requires manual time and energy for frequent visit of farm and additional resources to make the condition suitable for crops like soil moisture, temperature, humidity and other factors. Even after this farmer may miss optimal fruit ripeness for harvesting.

The growing and changing demands of agricultural products need to be met by an agriculture industry that is facing labour shortages and rising costs for farm work. Many farmers are facing a dilemma between wanting to produce more, higher-quality crops and finding the workers to plant, maintain, and harvest those crops. This tension isn't new in agriculture. For all of human history, increasing agricultural production has been a function of either adding more labourers or finding more efficient tools to do the job. Modern agriculture is no different. In the face of labour shortages, farmers are turning to technology to make farms more efficient and automate the crop production cycle.

Drip Irrigation is the most efficient water and nutrient delivery system for growing crops. It delivers water and nutrients directly to the plant's root zone, in the right amounts, at the right time, so each plant gets exactly what it needs, when it needs it, to grow optimally.
Another major concern for proper yield of crops is about their security for which alert and alarm system can be used that notifies farmer and prevents potential loss to greenhouse.

1.4 Objectives

The objectives of our project are:

- To measure field temperature, humidity and soil moisture periodically by deploying sensor.
- To transmit field data wirelessly for analysis.
- To irrigate the crops, based on soil moisture data.

1.5 Methodology

This report deals with an automatic plant irrigation system which automatically senses the moisture content of the soil and decide whether irrigation is needed or not. This system uses arduino. It is programmed to sense the moisture, temperature and humidity content . When the moisture content is less than the limit which is predefined, it will start supplying the desired amount of water till it reaches the limit. So, when the soil is dry the pump will automatically water the fields and when the soil is wet the pump will automatically switch off. And when the temperature content is more the limit which is predefined, it will start the exhaust fan.

The project uses temperature, humidity, and soil moisture sensors attached with NodeMCU to send the temperature, humidity and soil moisture data to Blynk cloud for monitoring the data.

When the soil was dry the pump automatically watered the fields and when the soil was wet the pump was automatically switched off. As the temperature content went above the predefined value the exhaust fan was operated and as the temperature went down the exhaust fan was turned off automatically with the help of relay.

The obtained data were sent form transmitting LoRa to receiving LoRa and to the Blynk cloud. And the sensor data were received and viewed in Blynk cloud.

1.6 Limitations

The Limitation of our project are as follows:

- Moisture level of individual plants cannot be controlled i.e. exact moisture of plants cannot be determined.
- Data can be transmitted up to only 8 km wirelessly.
- Data transmission rate will be comparatively low.

1.7 Organisation of Report

The report provides the detail information and describes the details of the project in a block of contents giving description of each part in detail. Chapter 1 gives the introduction of the entire project, problem statements, motivations, objectives and limitations as well. Chapter 2 takes us to the different projects based on the same technology in brief, survey on the similar task in similar fields and works along with the components used in completion of this task. Chapter 3 describes the methodology and the system overview of the project in detail. Chapter 4 is based on the system design; brief look on the project in addition to its performance. And at last, Chapter 5 concludes the report giving the light on the completed task, future plans on the project

CHAPTER II: LITERATURE SURVEY

As a plant grows it undergoes many changes, its development is solely dependent on the environmental conditions. This environment is made up of many different factors like temperature, soil moisture, humidity etc. Specific plants require typical conditions for their growth; thus, this project aims at providing an automated greenhouse monitoring and control system for the farmers in a very user-friendly way. All these parameters are directly related to the growth and development of plant. The greenhouse system is complex system; any significant change in one climate parameter could have an adverse effect on another climate parameter as well as the development process of plants. Therefore, continuous monitoring and control of these parameters is required for the proper growth of plants. Temperature, humidity, soil moisture are most common factors that most growers pay attention to. So now a day's farmers require more user-friendly platform to deal with issues that arise due to climate changes.

Previous researchers have used sensors such as leaf temperature and leaf wetness sensor in conjunction with ambient temperature sensor and humidity sensors to investigate greenhouse's status. These methods were found to be impractical as wetness varies from leaf to leaf and by location of plant in greenhouse. In general, the greenhouse system can be divided into two main components that interact in more or less strong way: internal atmosphere and soil conditions. Most of the growers and researches are interested in internal atmosphere of greenhouse and often neglect the importance of soil conditions. The absorption and transportation of water and nutrients are dependent on the condition of soil. Therefore, it is very essential to maintain the temperature and moisture level in the soil at an optimum level in order to keep the plant healthy. Additionally, inside the greenhouse, crops will be protected against damages caused by rain, wind or other weather conditions. System maintains the reference values taken from built in crop growing condition. Temperature influences most plant development process including photosynthesis, transpiration, absorption, respiration and flowering. In general, growth of any crop plant is significantly affected by temperature. Each species of plant has a different temperature range in which they can grow. Below this range, processes necessary for life stop, ice forms within the tissue, tying up water necessary for life processes.

Irrigation water is applied to the root areas of a crop by using different irrigation methods, one of which is drip irrigation (Yildirim and Demirel 2011). The current trend is toward switching from a manual system to automatic operations in a pressurized system. Energy savings, reduced labor cost and control in fertilizer application are among some of the major advantages in adopting automated techniques in drip irrigation systems. Automated irrigation systems provide high crop yield, save water usage compared with conventional systems (M.Yıldırım 2016), facilitate high frequency and low volume irrigation and also reduce human error (M. 1992). In order to increase irrigation efficiency in automated irrigation systems, a number of research studies have been carried out. Shull and Dylla (1980) used gypsum resistance block as a soil moisture sensor to activate the sprinkler irrigation system. developed an electronic switching system to control pumping time for the irrigation system (D.J. and J.I. 1991). Controlled the common lines of various irrigation systems by using a soil moisture sensor. Many methods have been described and sensors developed to manage irrigation systems objectively (Avishai, et al. 1995).Also, recent irrigation technologies used sophisticated equipment to supply water to the root area of plants as they need it. However, use of these sophisticated methods is not possible for all growers. Therefore, when developing an automatic irrigation system, it needs to be designed so it can be adapted by most growers. Abraham et al. (2000) developed an automated irrigation system based on soil electrical conductivity (Abraham, N., and P.S., 2000).

In recent years, intelligent sensor techniques have achieved significant attention in agriculture (Lakhiar, et al. 2018). It is applied in agriculture to plan the several activities and missions properly by utilising limited resources with minor human interference. Currently, plant cultivation using new agriculture methods is very popular among the growers. However, the green house is one of the methods of modern agriculture, which is commonly practiced around the world. In the system, plant cultivates under complete control conditions in the growth chamber by providing a small mist of the nutrient solution in replacement of the soil. During the plant cultivation, several steps including temperature, humidity, soil require proper attention for flourishing plant growth. Therefore, the object of this review study was to provide significant knowledge about early fault detection and diagnosis in green house using intelligent techniques (sensors). So, the farmer could monitor several parameters without using laboratory instruments, and the farmer could control the entire system remotely. Moreover, the technique also provides a wide range of information which could be essential for plant researchers and provides a greater understanding of how the key parameters of greenhouse correlate with plant growth in the system. It offers full control of the system, not by constant manual attention from the operator but to a large extent by wireless sensors. Furthermore, the adoption of the intelligent techniques in the greenhouse system could reduce the concept of the usefulness of the system due to complicated manually monitoring and controlling process.

2.1 Godawari Field Visit

On the visit to Godawari knowledge park practical implementation of drip irrigation was found. It consisted of a tank maintained at a certain level of height and water was dripped using small pipes at root of each plant. It was found that some typical plants require such conditions for proper growth.

Figure 1:Drip irrigation implementation in field

CHAPTER III: METHODOLOGY

3.1 System Overview

A system is developed to provide the plants inside the greenhouse with the suitable conditions to grow using various sensors and microcontrollers which helps in adjusting the conditions with help of actuators. Automated drip irrigation will be used to irrigate the plants inside the greenhouse.

Our project can mainly be divided into 3 working sections, one is automated agriculture with drip irrigation based on different sensors. Next is transmission and receiving of data using LoRa and other uploading data to cloud for monitoring the environmental condition of plant growth.

3.1.1 Automated Agriculture Using Drip Irrigation

In this section, various parameters like temperature, humidity and soil moisture will be monitored and soil moisture is adjusted where drip irrigation will be used for irrigation. Here temperature sensor, humidity sensor and soil moisture sensor will be used to record the various parameters and then these data are fed to the microcontroller and then they operate the actuators based upon the values received. Example, if the moisture of the soil of a particular plant falls below its threshold value set in the microprocessor, then the motor placed to supply water to the drip irrigation valves will be switched on and water will be dripped at the root of each individual plant.

Water is delivered across the field in pipes called ‘driplines’ featuring small units known as ‘drippers. Each dripper emits drops containing water and fertiliser, resulting in the uniform application of water and nutrients direct to each plant's root zone, across an entire field.

Figure 2:Drip irrigation

Other than controlling drip irrigation, controlling of other different parameters also were done using different actuators. For example: exhaust fan was controlled to maintain temperature parameter.

3.1.2 Transmitting and receiving data using LoRa

The parameters received through sensors are transmitted using a LoRa transmitter and microcontroller are received using LoRa in receiver mode. LoRa is a low power, long range and secured data transmission method. This device is perfect for usage scenarios like that of ours. The received data can be stored, displayed or manipulated as we desire. In our usages we use LoRa and aas transmission and LoRa and ESP 8266 at the receiving end. Further processing is done using ESP 8266 which now has data from the field.

3.1.3 Data transfer to cloud for monitoring of various parameters

The data received at Node MCU ESP 8266 through LoRa is now uploaded to the cloud(Blynk) and the data then can be stored or displayed in the Blynk or others channel based on IoT platform.

3.2 Block Diagram

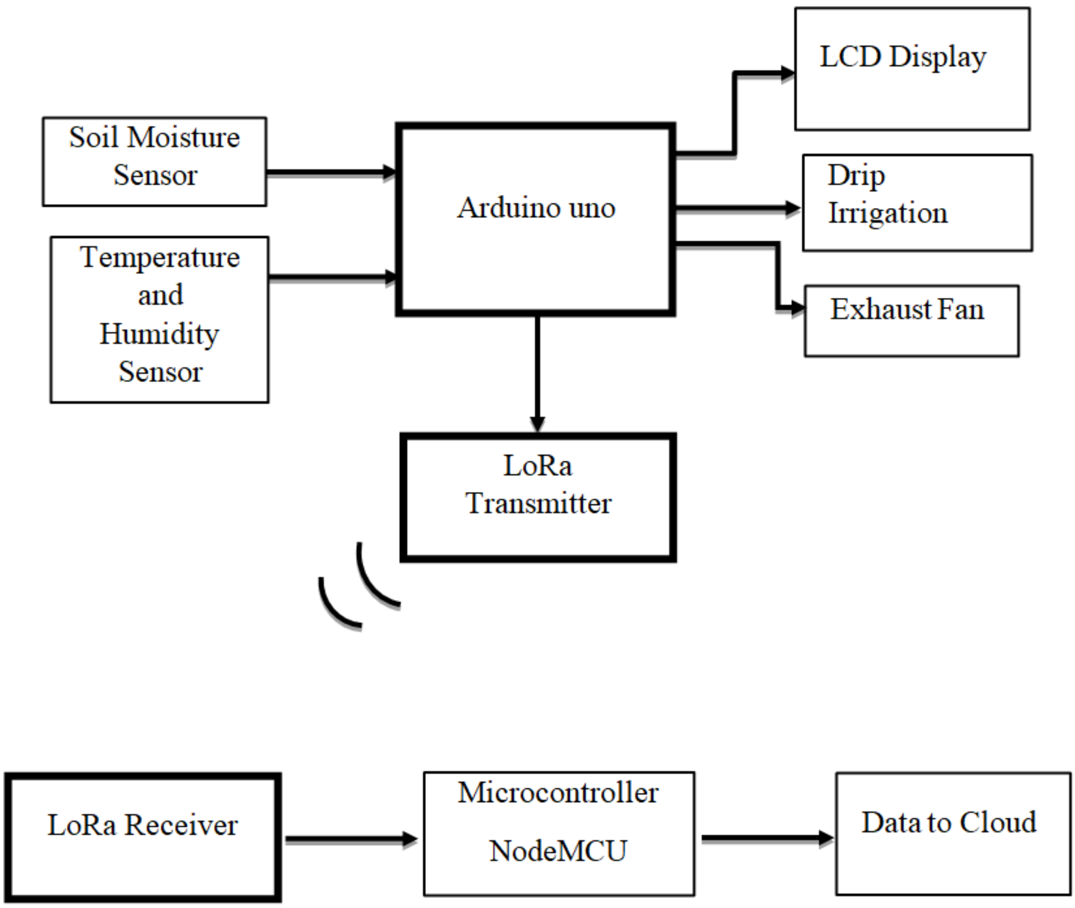

Figure 3:Block Diagram

3.3 Hardware Components

The hardware components to be used in our project are briefly introduced below:

3.3.1 Temperature and humidity sensor

The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermostat to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It’s fairly simple to use, but requires careful timing to grab data.

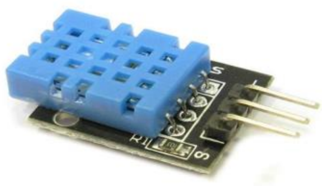

Figure 4: DHT11

3.3.2 Soil moisture sensor

The Capacitive Soil Moisture Sensor Module determines the amount of soil moisture by measuring changes in capacitance to determine the water content of soil. This can be used in an automatic plant watering system or to signal an alert of some type when a plant needs watering. It gives analog output. Soil moisture sensors measure the water content in the soil and can be used to estimate the amount of stored water in the soil horizon. Soil moisture sensors do not measure water in the soil directly. Instead, they measure changes in some other soil property that is related to water content in a predictable way.

Figure 5:Soil moisture sensor

3.3.3 DC water pump

DC water pump is a machine that transports liquid or pressurizes liquid. When the water pump is working, the coil and commutator rotate, but the magnetic steel and carbon brushes do not rotate. The alternating current direction of the coil is changed by the commutator and brushes that rotate with the motor.

Figure 6: DC water pump

3.3.4 Relay

Relays are electric switches that use electromagnetism to convert small electrical stimuli into larger currents. These conversions occur when electrical inputs activate electromagnets to either form or break existing circuits.

Figure 6: relay

3.3.5 NodeMCU

NODEMCU ESP8266 is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added.

Figure 7: node MCU

3.3.6 Exhaust fan

The exhaust fan is used to throw the hot air accumulated in the greenhouse. The fan used here is that of the processors used in the CPU. It works on the simple DC voltage.

Figure 8:Exhaust fan

3.3.7 LoRa(SX-1278)

The LoRa SX-1278 transceivers feature the LoRa, long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.

Figure 9:LoRa(sx-1278)

3.4 Chapter IV: Result and Analysis

4.1 *Circuit Simulation*

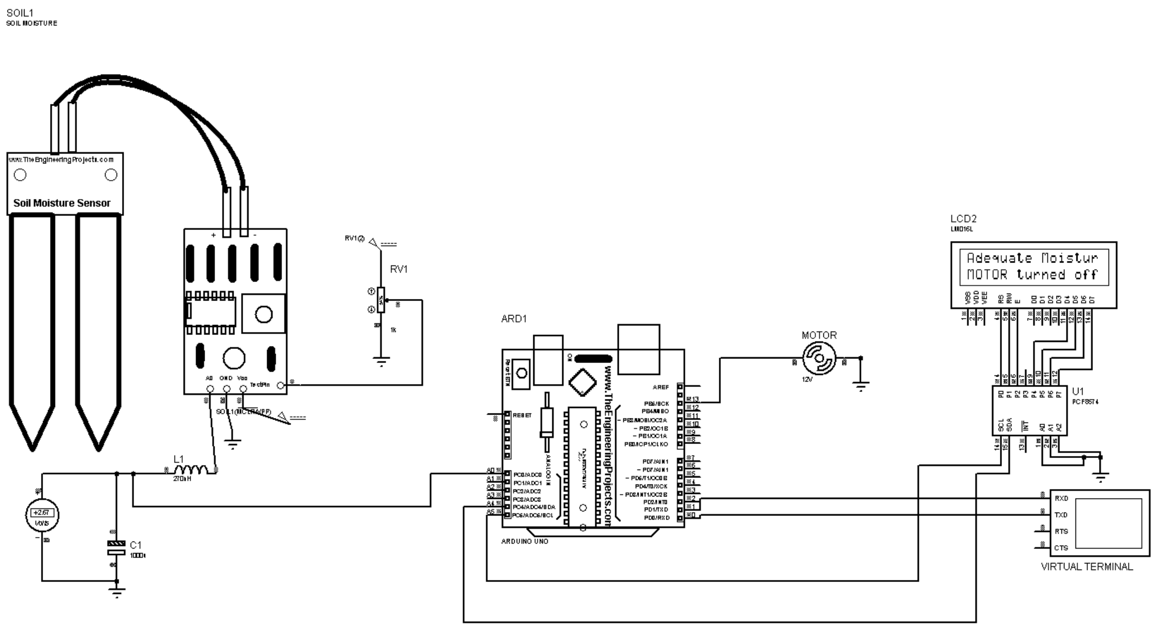

Figure 10: Simulated circuit diagram

Simulation was done in proteus with available components which were required in our project. Microcontroller was designed using arudino. The data of temperature, humidity, soil moisture were acquired using sensors and the data obtained were used to control various actuators like DC water pump, exhaust fan which control parameters according to programmed conditions in micro controller.

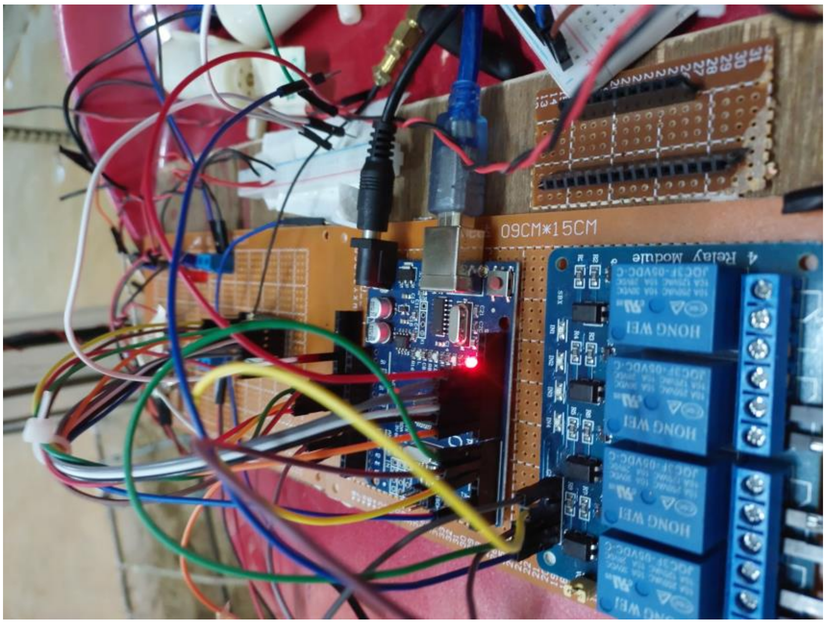

Figure 11: Obtaining data from sensor and transmitting data through LoRa

4.2 Reciving and Transmissing data through LoRa

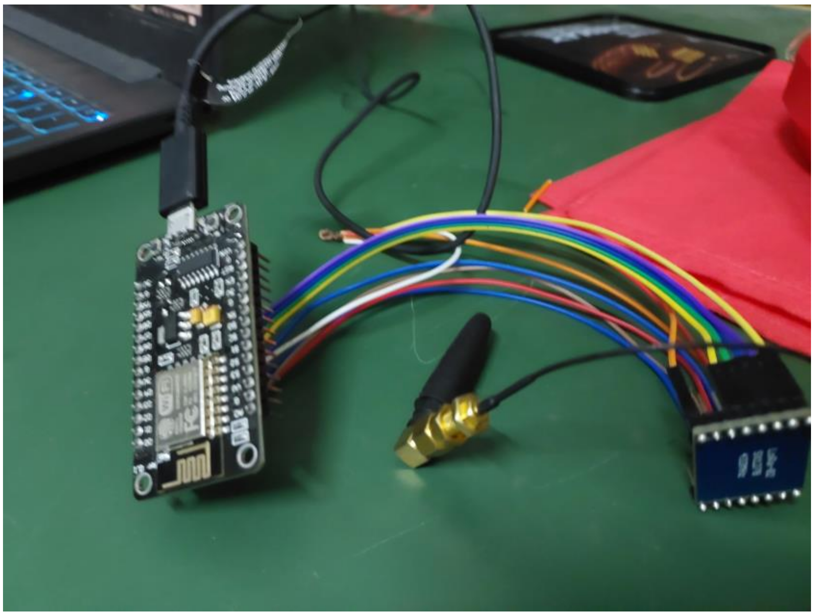

Figure 12:Reciving data through LoRa

The various sensors like DHT11, soil moisture are connected to the aurdino and all the data are obtained on the microcontroller. The data from the sensors are transmitted by LoRa transmitter which is recieved by LoRa reciever and the recieved data are uploaded to Blynk cloud through the ESP8266.

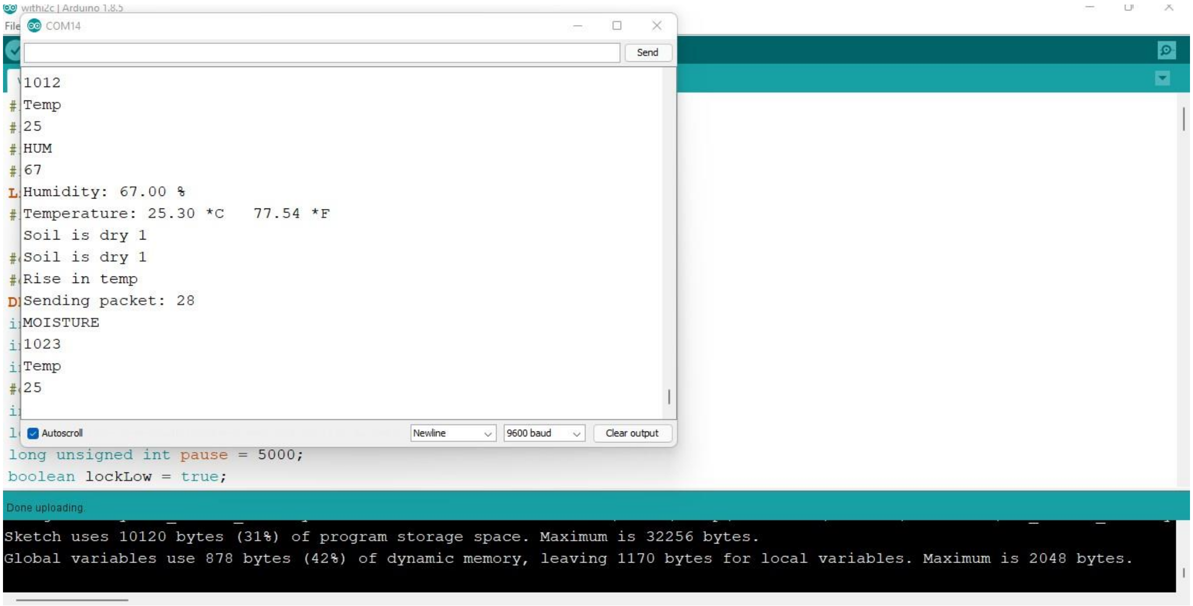

Figure 13:Sending data obtained from the sensor

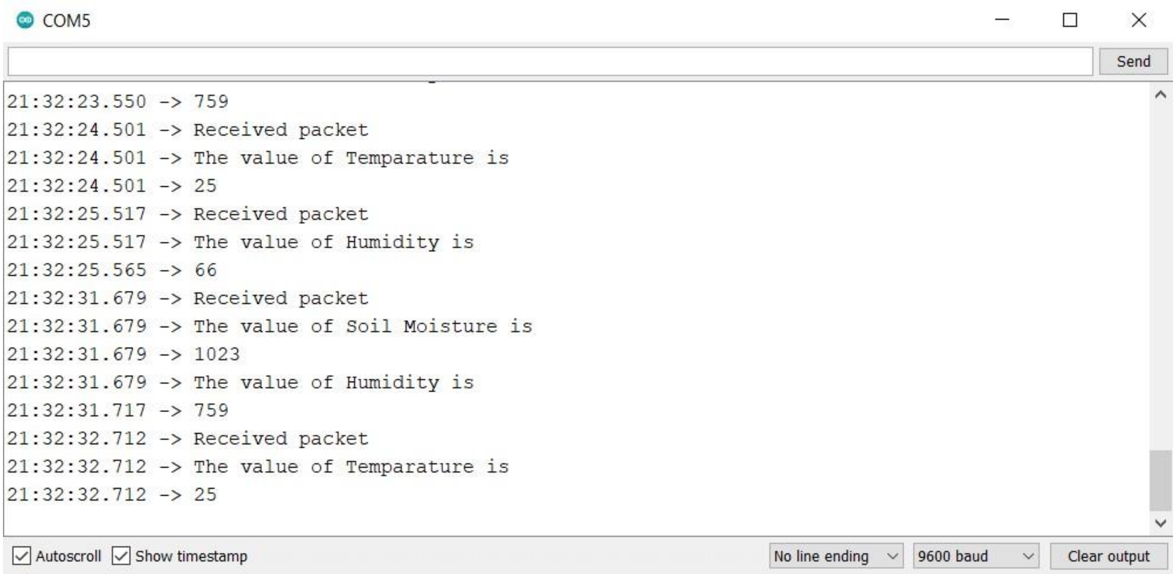

Figure 14:reciving data which was transmitted by he sensor

4.3 Data uploaded to Blynk cloud

The data from the sensors are transmitted by LoRa transmitter which is recieved by LoRa reciever and the recieved data are uploaded to Blynk cloud through the ESP8266.

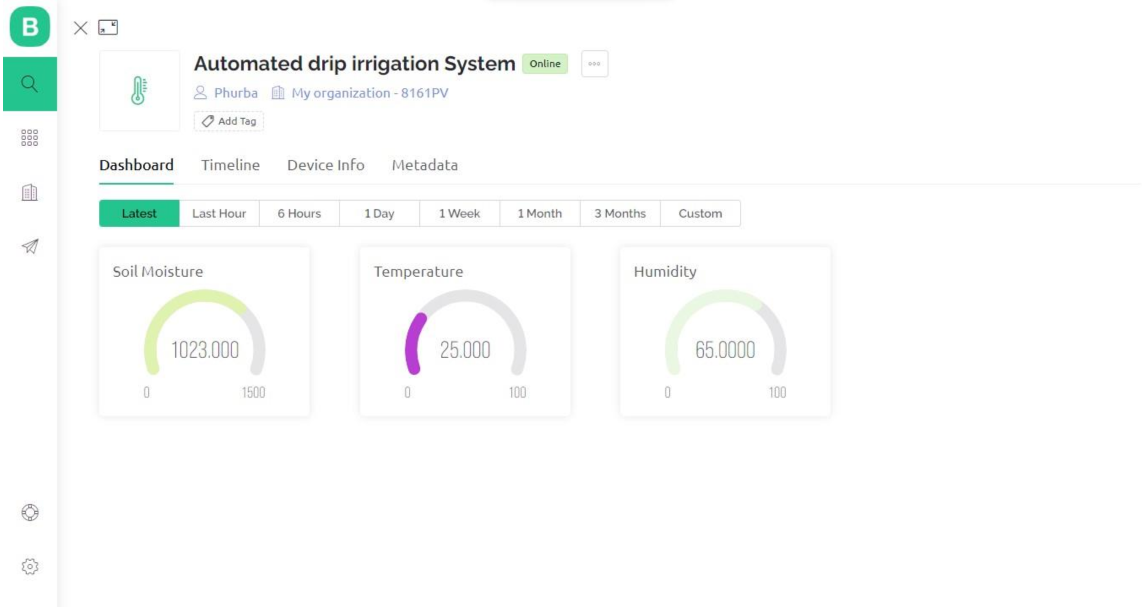

Figure 15:Data uploaded to the Blynk cloud

CHAPTER V: CONCLUSION

Automatic drip irrigation helps to maintain the various parameters and environmental conditions in a balanced mode as required for the proper growth and development of the plant. Use of various sensors that feds the real time data of the various parameters like temperature, humidity and the moisture in the soil to the microprocessor which is programmed to control various actuators like DC water pump and exhaust fan to make the parameters suitable for the plants to grow the crops. Similarly, Monitoring system in agriculture helps farmer to take note on the environmental condition of the crops.

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APPENDIX

A. NodeMCU

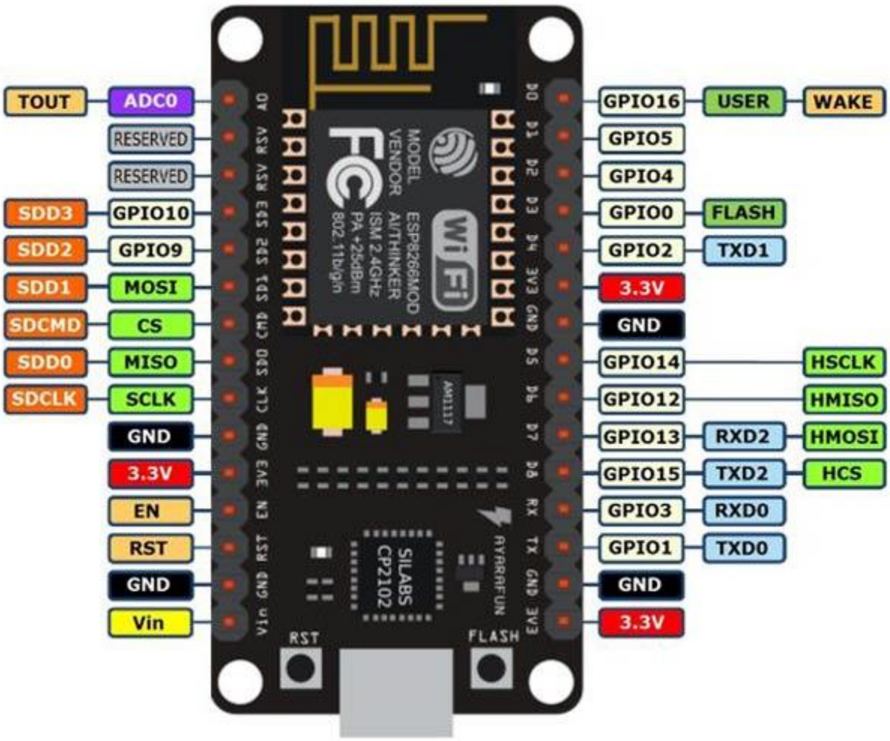

Figure 16:NodeMCU pin out

Pin Category	**Name**	**Description**
Power	Micro-USB, 3.3V, GND, Vin	**Micro-USB:** NodeMCU can be powered through the USB port **3.3V:** Regulated 3.3V can be supplied to this pin to power the board **GND:** Ground pins **Vin:** External Power Supply

Control Pins	**EN, RST**	The pin and the button resets the microcontroller
Analog Pin	A0	Used to measure analog voltage in the range of 0-3.3V
GPIO Pins	GPIO1 to GPIO16	NodeMCU has 16 general purpose input-output pins on its board
SPI Pins	SD1, CMD, SD0, CLK	NodeMCU has four pins available for SPI communication.
UART Pins	TXD0, RXD0, TXD2, RXD2	NodeMCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.
I2C Pins		NodeMCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C.

NodeMCU Specification

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1

- Clock speed: 80 MHz

B. Arduino Uno

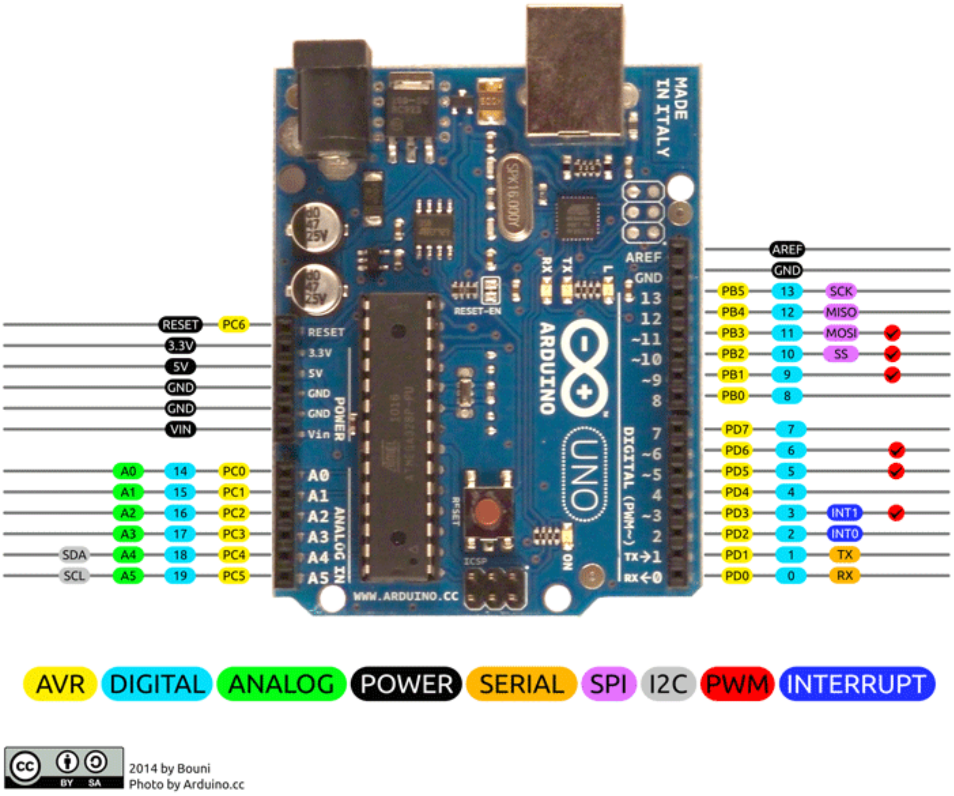

Figure 17: Arduino uno pintouts

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage

		regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

Arduino Specification

- Microcontroller: ATmega328P – 8 bit AVR family microcontroller
- Operating Voltage: 5V

- Recommended Input Voltage: 7-12V
- Input Voltage Limits: 6-20V
- Analog Input Pins: 6 (A0 – A5)
- Digital I/O Pins:14
- DC Current on I/O Pins: 40 mA
- DC Current on 3.3V Pin: 50 mA
- Frequency (Clock Speed): 16 MHz

C. Soil Moisture sensor

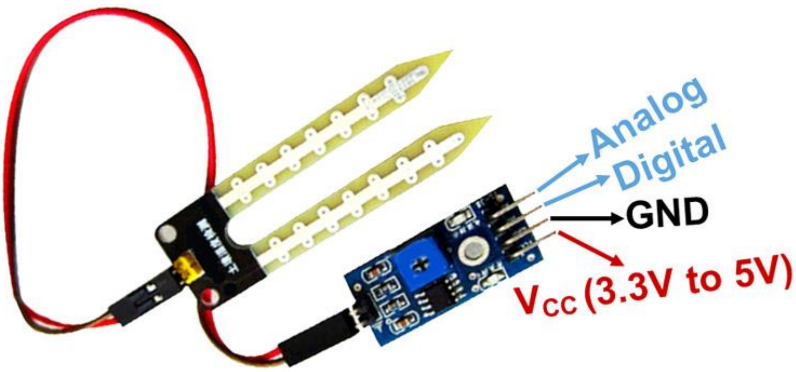

Figure 18: soil moisture pinouts

in Name	**Description**
VCC	The Vcc pin powers the module, typically with +5V
GND	Power Supply Ground
DO	Digital Out Pin for Digital Output.

AO	Analog Out Pin for Analog Output

Soil moisture Specifications

- Operating Voltage: 3.3V to 5V DC
- Operating Current: 15mA
- Output Digital - 0V to 5V, Adjustable trigger level from preset
- Output Analog - 0V to 5V based on infrared radiation from fire flame falling on the sensor
- LEDs indicating output and power
- PCB Size: 3.2cm x 1.4cm
- LM393 based design

D. DHT11

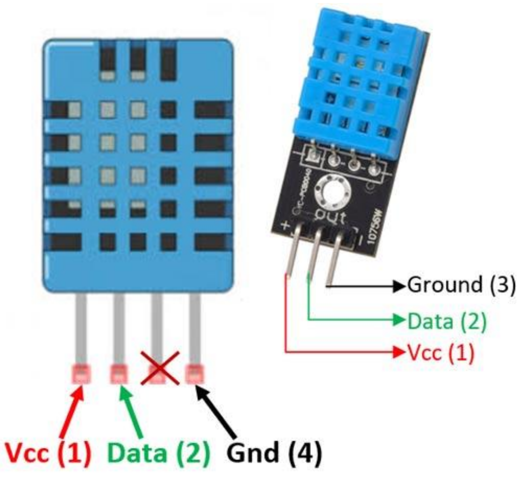

Figure 19:DHT11 pinouts

1	Vcc	Power supply 3.5V to 5.5V
2	Data	Outputs both Temperature and Humidity through serial Data

3	Ground	Connected to the ground of the circuit

DHT11 Specifications

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%