IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

AN ENHANCED IRRIGATION APPROACH IN AGRICULTURE USING IOT PLATFORM

Mr. Nilesh Jadhav[1], Mr. Omkar Bane[2], Prof. S. D. Sawant[3]
Student, ENTC, NBN Sinhgad School of Engineering/ SPPU, India[1,2]
Assistant Professor, ENTC, NBN Sinhgad School of Engineering/ SPPU, India[3]

Abstract: *Water is the important source in human life. Around 80 % to 90 % water used in agriculture field. As due to day-by-day growth in globalization and population water consumption is also increases. There is challenge in front of every country to reduce the farm water consumption and provide fresh and healthy food. Today automation is one of the important roles in human life. The system is not only providing comfort but also reduce energy, efficiency and time saving. Whenever there is a change in temperature, humidity and current status of rain of the surroundings these sensors sense the change in temperature and humidity and gives an interrupt signal to the raspberry pi. Now a day the industries are using an automation and control machines which are high in cost and not suitable for using in a farm & garden field. So, in this work we design a smart irrigation technology based on IOT using Raspberry pi. The system can be used to control the water motor automatically and can also monitor the growth of plant by using webcam. We can watch live streaming of farm on mobile phone using suitable application by using Wi-Fi network. Raspberry pi is the main heart of the overall system.*

I. INTRODUCTION

India is one among the biggest water users within the world, and our country uses great deal of water than alternative country. There's an out sized quantity of water employed in agriculture field instead of domestic and industrial sector. Sixty-fifth of total water is contributing as a groundwater. Nowadays water has become one among the necessary supply on the planet and most of employed in the agriculture field. As the soil-moisture sensor and temperature sensor are placed in the root zone of the plants, the system can distribute this information through the wireless network. The Raspberry Pi is that the heart of the system and is interfaced with via Wi-Fi Module. Python programming language is employed for automation purpose. The system is a network of wireless sensors and a wireless base station which can be used to provide the sensors data to automate the irrigation system.

The system is used the sensors such as soil moisture sensor and soil temperature sensor. The Raspberry Pi model is programmed such that if the either soil moisture or temperature parameters cross a predefined threshold level, the irrigation system is automated, i.e., the relay connected to the raspberrypi can activate or OFF the motor. This system presents economical, fairly low cost and straight forward machine- controlled irrigation system. This technique once installed it has less maintenance cost and is easy to use. Using the android application on mobile phone it is easily online monitoring the actual situation of the field and sensors such as soil moisture and temperature are used to provide the knowledge concerning changes happens within the field.

It is additional advantageous than the traditional agriculture techniques. Agriculture is the unquestionably the largest livelihood provider in India. With rising population, there is a need for increased agricultural production. In order to support greater production in farms, the requirement of the amount of fresh water used in irrigation also rises. Currently,agriculture accounts 83% of the total water consumption in India. Unplanned use of water inadvertently results in wastage of water. This suggests that there is an urgent need to develop systems that prevent water wastage without imposing pressure on farmers. Over the past 15 years, farmers started using computers and software systems to organize their financial data and keep track of their transactions with third parties and also monitor their crops more effectively.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

In the Internet era, where information plays a key role in people's lives, agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (e.g., sensors, faming machinery etc.) in order to become more efficient in production and communicating appropriate information. With the advent of open-source Arduino boards along with cheap moisture sensors, it is viable to create devices that can monitor the soil moisture content and accordingly irrigating the fields or the landscape as an when needed. The proposed system makes use of microcontroller ATMEGA328P on Arduino uno platform and IOT which enable farmers to remotely monitor the status of sprinklers installed on the farm by knowing the sensor values thereby, making the farmers' work much easier as they can concentrate on other farm activities.

II. BRIEF LITERATURE SURVEY

The new state of affairs of decreasing water, desiccation of rivers and tanks, unpredictable surroundings, present an urgent need of proper utilization of water. To cope up with this use of temperature and wet, sensors area unit placed at appropriate locations for observation the crops. Once analysis within the agricultural field, researchers found that the yield of agriculture is decreasing day by day use of technology within the field of agriculture plays a vital role in increasing the assembly additionally as in reducing the man power. The cloud computing devices create a whole computing system from sensors to tools that observe data from agricultural field and accurately feed the data into the repositories. This concept proposes a completely unique methodology for sensible farming by linking the sensing system and smart irrigation system through wireless communication technology.

It proposes an occasional value and economical wireless sensing element network technique to accumulate the soil wet, Humidity, temperature from numerous locations of field and as per the requirement of crop water motor is enabled. It proposes a plan regarding however machine-driven irrigation system was developed to optimize water use for agricultural functions. B. Prabhu et.al builds wireless sensor network system which is reducing the evaporation of water by drip irrigation. In this system, collect information from sensor and send it to the base station. Now when sensor send data to base station as packet so to reduce impact a packet author set a sensor in bulk mode. Now if plant need water so base system start watering that plant using drip irrigation, these will save water as well reduce evaporation of water.

M. Ryu et.al build a system to make a smart farming by connecting farms based on Internet of Things (IoT). In this they are using various sensors like temperature sensor, humidity sensors and CO2 sensors. Now they are using REST APIs to transfer data, Mobius which is IoT supporting platform and Cube which is a middleware between physical devices i.e., sensor and Mobius. Data which is collected from sensors sends to Mobius using cube and end user send a request for particular farm using REST APIs to Mobius. End user can see result of request can see on Mobile Application. In Zulkifli, Noor's, a system with wireless sensor network using RFID. In this system, author put soil moisture on different location in the field i.e., farm or it can be a farm and each sensor have its unique ID. Now sensor sends a data to ZigBee at 2.45 GHz. Now sensor sends that data to base station and if soil is dry then pump station will start sprinkling water only on that portion of the field. R. K. Kodali et.al made a smart irrigation system based MQTT protocol.

They are using Esp8266 NodeMCU-12E, soil moisture sensor and water pump. In this system Message Queue Telemetry Transport Protocol (MQTT) is used for transfer the data between Esp8266 NodeMCU12E and the sensor. Soil moisture sends data to Esp8266 NodeMCU-12E, if soil is dry then Esp8266 NodeMCU-12E send instruction to water pump and water pump will start and after moisture goes up by some value it will off the water pump. They are used LCD to display the current state of soil and water pump. L. Bhaskar et.al builds a system to improve the quality of food and improve the productivity. This system measures various factors like temperature, humidity and also water level of soil and notify on LCD.

To monitor the data, they used monitor and send a message to the farmer to inform about current status about farm via SIM900 module on farmer's register mobile number. They are using sensors like Soil Moisture sensor, Temperature Sensor. This system is useful to that farmer who has a power failure and non-uniform distribution of water due to power failure.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

In A Remote Measurement and Control System for Greenhouse Based on GSM-SMS the proposed system introduced a GSM-SMS remote measurement and control system for greenhouse based on PC-based database system connected with base station. Base station is developed by using a microcontroller, GSM module, sensors and actuators. In practical operation, the central station receives and sends messages through GSM module. Criterion value of parameters to be measured in every base station is set by central station, and then in base stations parameters including the air temperature, the air humidity. Indu et al. (2013) mainly focuses on reviews in the field of remote monitoring and control, the technology used and their potential advantages.

The paper proposes an innovative GSM/Bluetooth based remote controlled embedded system for irrigation. The system sets the irrigation time depending on the temperature and humidity reading from sensors and type of crop and can automatically irrigate the field when unattended. Information is exchanged between far end and designed system via SMS on GSM network. A Bluetooth module is also interfaced with the main microcontroller chip which eliminates the SMS charges when the user is withinthe limited range of few meters to the designated system. The system informs users about many conditions like status of electricity, dry running motor, increased temperature, water content in soil and smoke via SMS on GSM network or by Bluetooth.

In, R. Suresh et al. (2014) mentioned about using automatic microcontroller-based rain gun irrigation systemin which the irrigation will take place only when there will be intense requirement of water that save a large quantity of water. These systems bring a change to management of field resource where they developed a software stack called Android is used for devices that include an operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Mobile phones have almost become an integral part of us serving multiple needs of humans. This application makes use of the GPRS feature of mobile phone as a solution for irrigation control system. This systemcovered lower range of agriculture land and not economically affordable. In IOT SMS alarm system based on SIM900A[7], an IOT alarm system based on SIM900A module of SIMCOM Company was designed for greenhouse. The system can gather environmental parameters such as air temperature and air humidity. Meanwhile, with the use of AT command, this system can also realize SMS automatic sending and receiving, environmental parameters overrun alarm and insufficient balance alarm. Through the system setting, the alarm message can be sent to the user-specified mobile phone automatically no matter what the users' location is. This system as a typical application of IOT in the agriculture has got some satisfactory results in the actual operation.

III. METHODOLOGY TO IMPLEMENTATION

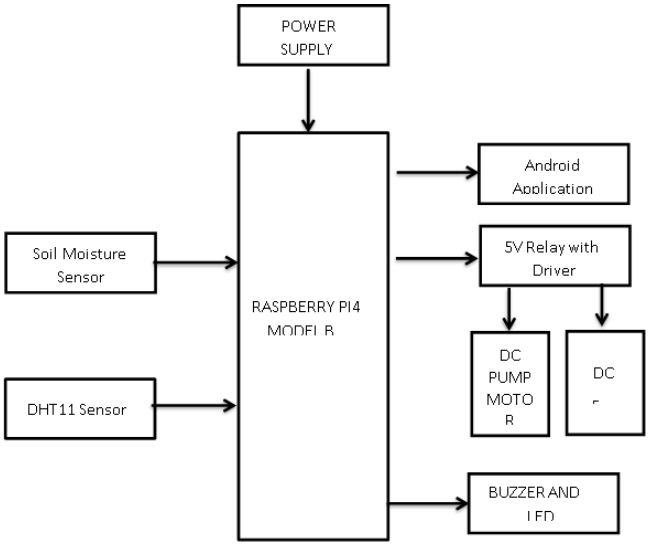

Figure: Block Diagram of Smart Irrigation System

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

The main blocks of this project are:

1. Raspberry PI 4 B Model
2. Humidity and Temp sensor (DHT11)
3. Soil Moisture Sensor
4. DC Pump Motor
5. Relay
6. Buzzer
7. D.C. Fan
8. Jumper Wires

Raspberry Pi

Raspberry Pi is used for making robot wireless and web based. Webcam is interfaced to the Raspberry Pi and then the videos are transmitted wirelessly from the robot to the user's monitor, from where the user can conveniently control the robotic vehicle's movement and also the data from sensors. Raspberry pi is connected with the Smartphone which enablesraspberry pi to transmit over the web network. Raspberry Pi uses an SD card for booting and for memory as it doesn't have an inbuilt hard disk for storage. Raspberry Pi requires 5-volt supply with minimum of 700-1000 mA current and it is powered through micro-USB cable. ARM11 only requires 3.3 volt of supply which it takes with the help of linear regulator.

5 volt is required for the USB ports. It operates at 1.2GHz (Roughly 50% faster than Pi2) we use python to write the code into the raspberry pi. It has a strong processing capability due to the Broadcom BCM2837 processor & Quadcore ARM Cortex-A53, 64Bit GPU ARM11 architecture and Linux-based system. In terms of interface and control,it has Video core IV Multimedia Co Processor, 802.11n wireless LAN (Wi-Fi) and Bluetooth 4.1, USB Ports, 4 x USB GPIOs 2 x 20 Pin Header. 2x I2C, 2x SPI, 2x UART which basically meet the control requirement. There are easy touse open-source peripheral driver libraries.

Humidity Sensor

The digital temperature and humidity sensor DHT11 is a composite sensor that contains a calibrated digital signal outputof temperature and humidity. The technology of a dedicated digital modules collection and the temperature and humiditysensing technology are applied to ensure that the product has high reliability and excellent long- t e r m stability. Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interactionwith neutrons, as a proxy for the moisture content.

The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners. Soil moisture sensors typically refer to sensors that estimate volumetric water content. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks.

Two YL-69 soil moisture sensors along with LM393 comparator modules were placed in different soil conditions for analysis. The sensor YL-69 is made up of two electrodes. It reads the moisture content around it. A currentis passed across the electrodes through the soil and the resistance to the current in the soil determines the soil moisture. If the soil has more water resistance will be low and thus more current will pass through. On the other hand, when the soilmoisture is low the sensor module outputs a high level of resistance. This sensor has both digital and analogue outputs. Digital output is simple to use but is not as accurate as the analogue output. Since the Atmega 328P-PU microcontroller used for the Arduino Uno contains an onboard 10-bit 6-channel

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

analog-to-digital (A/D) converter, the analog input pin of Arduino can read analog signals being sent from the sensor and return binary integers from 0 to 1023. Greater amountof output implies lesser moisture content.

DC PUMP Motor

The pumping of water is a basic and practical technique, far more practical than scooping it up with one's hands or liftingit in a hand-held bucket. This is true whether the water is drawn from a fresh source, moved to a needed location, purified, or used for irrigation, washing, or sewage treatment, or for evacuating water from an undesirable location. Regardless ofthe outcome, the energy required to pump water is an extremely demanding component of water consumption. All other processes depend or benefit either from water descending from a higher elevation or some pressurized plumbing system.

The ancient concept of the aqueduct took simple and eloquent advantage of maintaining elevation of water for as long and far a distance as possible. Thus, as water moves over great distances, it retains a larger component of its potentialenergy by spending small portions of this energy flowing down a slight gradation. A useful aqueduct system ultimately depends on a fresh water source existing at a higher elevation than the location where the water can be ofuse. Gravity does all the work. In all other instances, pumps are necessary.

Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but otheroperating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit bya separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in longdistance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. 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". Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back.

Buzzer

Piezo buzzers are used for making beeps, tones and alerts. This one is petite but loud! Drive it with 3-30V peak-to-peak square wave. To use, connect one pin to ground (either one) and the other pin to a square wave out from a timer or Microcontroller.

Figure: Buzzer

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

For the loudest tones, stay around 4 KHz, but works quite well from 2 KHz to 10 KHz. For extra loudness, you can connect both pins to a microcontroller and swap which pin is high or low ('differential drive') for double the volume.

Circuit Diagram:

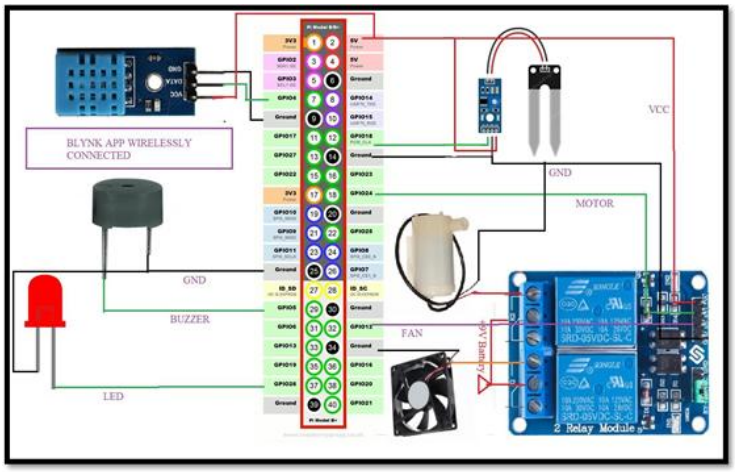

Figure: Circuit Diagram

IV. RESULT & DISCUSSION

This system consists of DHT11 module which is connected to GPIO4 pin of raspberry pi gives temperature and humidity of atmosphere around plants. As temperature and humidity is essential parameters for growth of plants, our system always monitors these parameters over IOT and readings broadcasts on Rasp Controller app in farmer's android mobile. Wen temperature value goes beyond 38 degrees Celsius then CPU fan which is connected to GPIO12 pin of raspberry pi and led which is connected to GPIO26 pin of raspberry pi should be turn on. Below 38 degrees Celsius, fan and led should beturn off.

Similarly, another parameter we are going to monitor in this project that is soil moisture level. As we know soil and water are very essential parts for any plant to live. We are continuously monitors soils moisture using soil moisture sensor which is connected to GPIO18 pin of raspberry pi. Its output is digital like 1 and 0. When module gives 0 output that means soil is well moisture and no need to turn on pump motor. when soil moisture sensor's output goes high (1), then pump motor which is connected on GPIO24 pin of raspberry pi will be turn on at the same time buzzer which is connected on GPIO5 pin of raspberry pi will be turn on, otherwise fan and buzzer should be remains off.

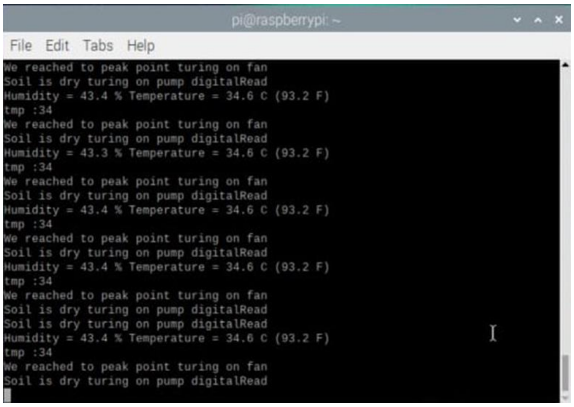

Figure Program Output

All these data and status of motor and led buzzer can be seen on Rasp Controller app on farmer's android mobile by using IOT technology. For this, raspberry pi has inbuilt WIFI module to connect to the Rasp Controller app wirelessly. By developing a Smart Wireless Sensor like humidity and temperature and by using IOT techniques a farmer can increase his profit by solving different problems that are faced by the farmer in his routine life from anywhere using mobile application with the help of raspberry Pi and internet.

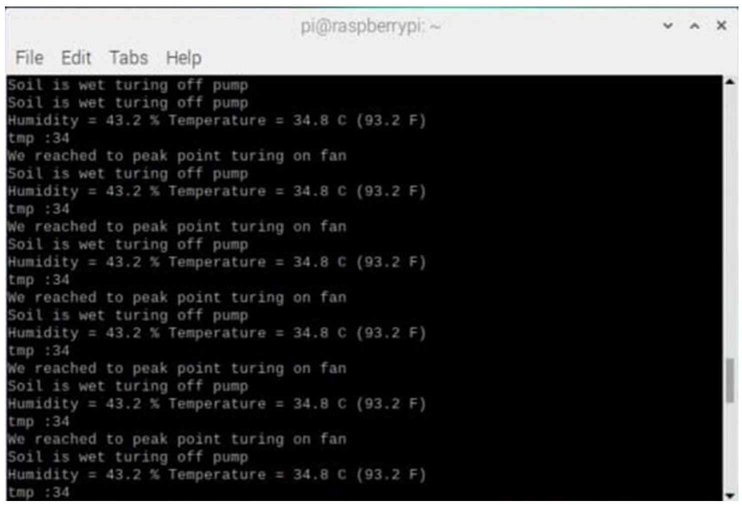

Figure: Program Output

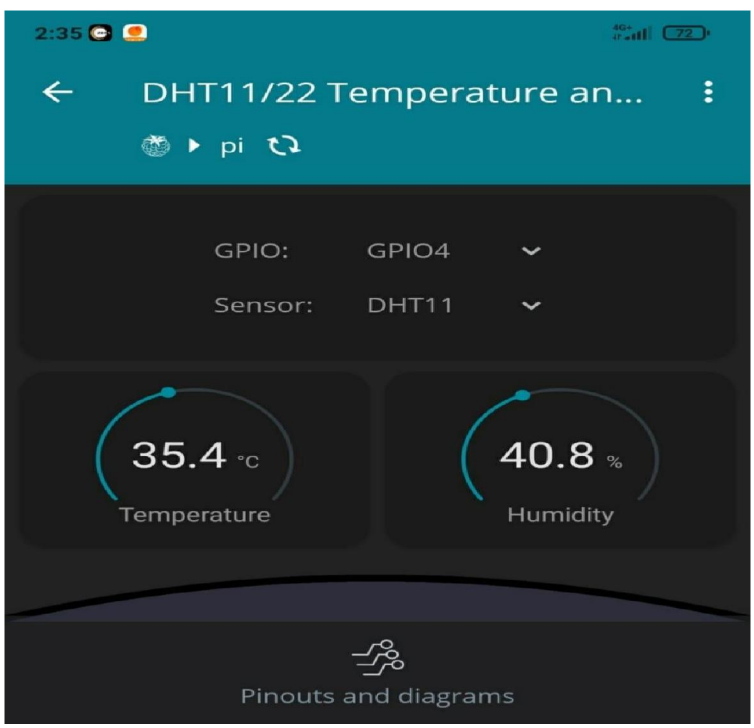

Figure: Output of Android APP (Rasp Controller)

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

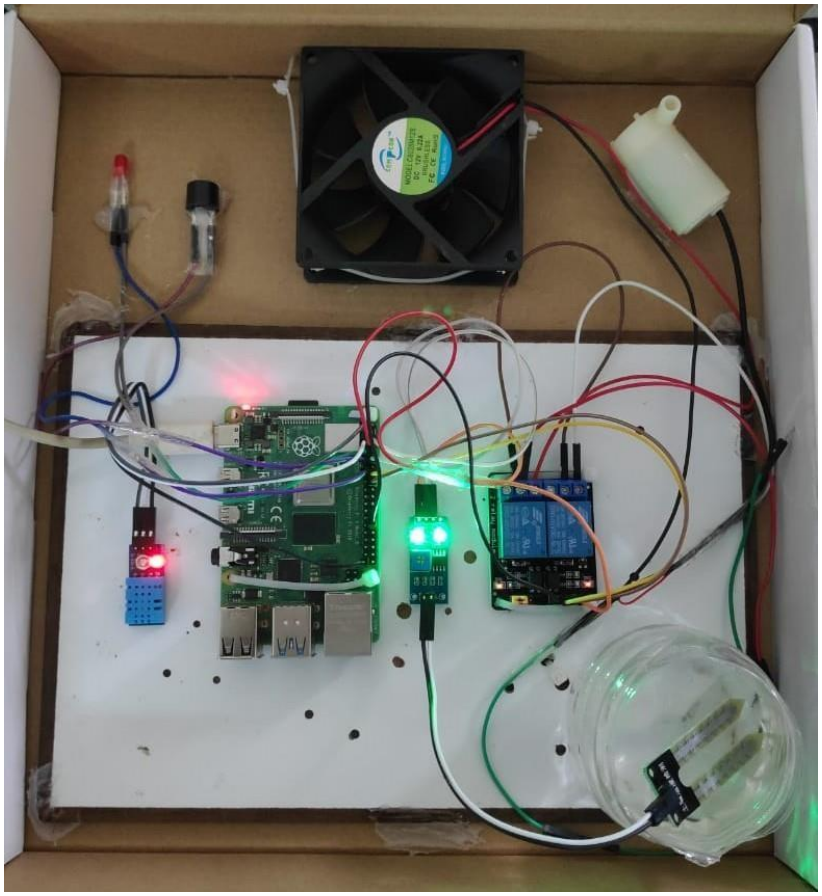

Figure: Hardware Connections

V. CONCLUSION & DISCISSION

The automated irrigation system has been designed and implemented this way. The system developed is beneficial and works in cost effective manner. It reduces the water consumption to a greater extent. It needs minimal maintenance the power consumption has been reduced very much. The System is very useful in areas where water scarcity is a major problem. The crop productivity increases and the wastage of water very much reduced using this irrigation system. The developed system is more helpful and gives more feasible results. By developing a Smart Wireless Sensor like humidity and temperature and by using IoT techniques a farmer can increase his profit by solving different problems that are faced by the farmer in his routine life from anywhere using mobile application with the help of raspberry Pi and internet.

A system to monitor moisture levels in the soil was designed and the project provided an opportunity to study the existingsystems, along with their features and drawbacks. The proposed system can be used to switch on/off the water sprinkleraccording to soil moisture levels thereby automating the process of irrigation which is one of the most time-consuming activities in farming. Agriculture is one of the most water-consuming activities. The system uses information from soil moisture sensors to irrigate soil which helps to prevent over irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through a website. Through this project it can be concluded thatthere can be considerable development in farming with the use of IOT and automation. Thus, the system is a potential solution to the problems faced in the existing manual and cumbersome process of irrigation by enabling efficient utilization of water resources.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

Advantages

- Increase in productivity.
- Reduced water consumption.
- No man Power Required.
- Require smaller water sources.

Disadvantages

- Internet facility is needed for wireless Monitoring.
- Security might be concern.

ACKNOWLEDGMENT

NCCC 2022 Team of NBN Sinhgad School of Engineering, Pune

REFERENCES

[1] J. Patel, E. Patel, P. Pati.2019 Sensor and Cloud Based Smart Irrigation System with Arduino in: IJEAST, Volume 3, Issue 11.
[2] S. S. Singh. 2019 Smart Irrigation System using IOT In: IJITEE, Volume 8 Issue 12S.
[3] P. Naik, A. Kumbi, K. Katti, N. Telkar.2018 AUTOMATION OF IRRIGATION SYSTEM USING IoT In: IJEMC, Volume 8, Number 1.
[4] A. Kumar, A. Kumar, P.K. Sharma.2017 Smart Irrigation System using IoT: SIS In: IJERT, Volume 6, Issue 6.
[5] G. Parameswaran, K. Sivaprasath 2016 Arduino Based Smart Drip Irrigation System Using Internet of Things In:IJESC, Volume 6 Issue No. 5.
[6] D. Rane, P. Indurkar and, D.M. Khatri 2015 System based on Automatic irrigation system on RF module In IJAICT Volume 1, Issue 9.
[7] K. Kansara, V. Zaveri, S. Shah, S. Delwadkar, K. Jani 2015 Sensor Based Automated Irrigation System with IOT In IJCSIT, Vol. 6.
[8] C. Sahu, P. Behera. 2015 A Low-Cost Smart Irrigation Control System IEEE Sponsored 2nd International Conference on Electronics and Communication System (ICECS).
[9] S. Jadhav, S. Hambarde. 2013 Automated Irrigation System using Wireless Sensor Network and Raspberry pi, International Journal of science and research (IJSR).