OPTIMIZING IRRIGATION WITH RASPBERRY PI: A SMART SOLUTION

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ABSTRACT

In India most of people is doing work related agriculture directly or indirectly. An economy of India is mostly affected by agriculture related activities. To check water level of well, farmer have to go to farm and start water pump. Sometimes he has to go in night. If fire is spread in farm how farmer can know? If he know about it, he cannot do anything about it because many plants burned .In this project, we will make one smart irrigation system which will notify farmer on his registered mobile device and email address, if the soil is dry and it need watering, using soil moisture sensor and also notify by glowing bulb and start motor which is attached with main controller. System is also measuring the water level of well and notify the farmer two times a day.

For fire detection we used flame detection sensor and if fire is there in farm system will notify the farmer and also buzzer will blow. The aim of this project is to develop a smart irrigation monitoring system using raspberry pi. Focus area will be parameters such as temperature and soil moisture. This system will be a substitute to traditional farming method. We will develop such a system that will help a farmer to know his field status in his home or he may be residing in any part of the world. It proposes an automatic irrigation system for the agricultural lands.

Currently the automation is one of the important role in the human life. It not only provide comfort but also reduce energy, efficiency and time saving. Now the industries use automation and control machine which is high in cost and not suitable for using in a farm field. So here it also to design a smart irrigation technology in low cost which is usable by Indian farmers.Raspberry pi is the main heart of the whole system. An automated irrigation system was developed to optimize water use for agricultural crops. Automation allows us to control appliances automatically. The objectives of this project were to control the water motor automatically, monitor the plant growth using webcam and we can also watch live streaming of farm on android mobiles by using wifi.

I. INTRODUCTION

1.1 INTRODUCTION TO SMART IRRIGATION

The importance of building an automation system for an office home or field is increasing day-by-day. Automation makes an efficient use of the electricity, water and reduces much of the wastage. Smart water sprinkler irrigation system makes an efficient use of water for the growth of plants. Heart of the system is Raspberry Pi 3 mini computer, shown in figure 1. Raspberry Pi model 3 has dedicated general purpose

input outputs (GPIO) pins. These all GPIO pins can be accessed for controlling hardware such as LEDs, sensors, and relays, which are examples of outputs. Need of automatic Irrigation

- Simpler and easy to install and configure.
- Saving energy and resources, so that it can be utilized in appropriate way.
- Farmers would be able to spread the proper quantity of water at the proper time by automating farm or nursery irrigation.
- Avoiding irrigation at the incorrect time of day, reduce runoff from overwatering saturated soils which will enhance crop/plant's performance.
- Automated irrigation system uses shower to turn motor ON and OFF.

Irrigation engineering comprises of a full knowledge of sources of irrigation water, their proper preservation and application of this water to the land after conveying it from the source through an irrigation system, consisting of canal and connected works. It also includes a working knowledge of different types of soils and the water requirements of various crops sown in them.

In this project work lot of importance is given for the drip irrigation, such that by sensing the soil humidity water supply can be controlled automatically. For this purpose relay is used, to energizing the pumping motor to supply water to the plants. The motor is energized automatically when the message is sent from the mobile to switch ON the motor. By sensing the soil sensitivity the motor will be switched OFF automatically when the soil is in wet condition. For sensing the soil condition copper electrodes are used.

Irrigation is usually required when the yearly rainfall is either insufficient or ill distributed or ill timed. Yield is much better where irrigation is practiced and fields are watered at the proper time. In countries like India and Egypt, Irrigation provides employment for large sections of people. It raises the standard of living and prosperity. Irrigation projects are successful only when sufficient quantities of water are available and the land is suitable to grow remunerative crops. No irrigation is normally required if the total annual rainfall is 100cms. Or more and takes place at correct times. When it is proposed to grow valuation and better types of crops like Rice, Sugar cane, Vegetables, Cotton etc., Irrigation is very essential.

The term Automation refers to means of control of electrical and mechanical operations without human interference. Definition of automation can be extended to field Automation which states "monitoring and control of various electrical equipments used for

modern drip irrigation to their predetermined levels without human interference". In real time application with one micro-controller we can process large number of micro-controller or other IC device to be tailored to implement a specific function. The application program executed by a micro-controller drives the system hardware in order to implement the desired system function for a given micro-controller, different application programs allow different systems function to be implemented within a range limited by the available system hardware. As the technology advances, changing lifestyles patterns and willingness to spend in crop improvement, fulfill the desire for intelligent, fully automated field. In a typical automated field various equipments can be used for various methods of irrigation.

The concept is to switch on the lights in evening and switch off these lights in the early morning automatically. Now coming to the project work, the scope of the project work is to energize the lights or any other outdoor lights automatically by sensing the natural light. Solar outdoor lights are ideal in remote locations. The cost of extending a grid connection to remote security, street or parking lot lights is usually prohibitive. But because solar-powered lights eliminate the need to trench underground and dig up asphalt, they are affordable alternatives to grid-connections in many urban settings.

The entire system is designed with raspberry pi unit; the natural light sensing circuit designed using LDR is connected like an input to the controller. Depending on the information given to the micro controller about the status of the natural light, the controller automatically control the outdoor light through the relay. The detailed description is provided in the following chapters.

1.2 NEED OF SMART IRRIGATION SYSTEM

The development in smart environmental technology and the application of Wireless Sensor Networks (WSNs) creates a new way of research in the field of agriculture. Now-a day sensor technologies are very much helpful in creating the smart précised environment. Using this technique, the WSN deployments for various farming applications in the Indian as well as global scenario are surveyed. Also, the possibility of using this technique for the crop growth starting from its cultivation to harvesting is analysed. In this way, various parameters needed for particular crop maintenance is focused and the problems for improvement and future development are considered. Agriculture plays a vital role in the development of country"s economy.

The daily need for food shows the importance of agricultural development. Growing a particular crop in a particular region takes the privilege of monitoring the growth from cultivation till harvesting. One of the main challenges in agricultural activities is irrigation. As the global climate decreases the source of water throughout the world, it is necessary to take steps for preserving it.

However traditional irrigation management is done by the people itself. It requires the presence and continuous monitoring of irrigation by the farmers in the field area. The user must need to manually change the direction of water flow using large pipes in the field. It creates a need for more labour work R. Ilakkiya/2019 South Asian J. Eng. Technol, 2019, 19-24| 20 and maintenance. A little advancement in traditional system involves in establishing centralized control of irrigated land using wired architecture which will also leads to more cost and maintenance manually. Many researches are done in the field of agriculture and most of them signify the use of wireless sensor network that collect data from different sensors deployed at various nodes and send it through the IOT.

It monitors the environment and collects the information. When the temperature get change in the environment the DHT 11 sensor will sense the humidity PH level of soil and send the date to the raspberry pi then motor will be turn ON supply the water to agriculture land. Then water level sensor is used to sense water level and supply the water to the plant as per their requirement. Those all the process will be monitor and operate by an IOT with any manual operation. Two of the most common problems with farm irrigation systems have to do with irrigation scheduling. Irrigation scheduling is simply answering the questions of "When do I water?" and "How long do I water?". Starting an irrigation cycle too early and/or running an irrigation cycle too long is considered over watering.

At the very least this practice wastes water and money. However, over watering can cause crop damage if done on a prolonged basis. Likewise, starting an irrigation cycle too late or not running the system for a long enough period of time is considered under watering and can cause reduced yields and poor crop quality which can affect price. Looking at these problems in depth is the key to minimizing their financial and practical impact on crops. The two most common methods for dealing with these problems are evapo transpiration based control systems and soil moisture-based control systems.

II. COMPONENTS DESCRIPTION
2.1 RASPBERRY PI ZERO W

Raspberry Pi Zero is a cost-effective, small-to-medium-size board in the Raspberry Pi family. The initial version of the Raspberry Pi Zero was released at the end of 2015, and is now the new version V1.3, with an additional CSI camera connector compared to the initial version. Raspberry Pi Zero adopts the BCM2835 processor with ARM11 single-core, which is an economical choice for many Raspberry Pi enthusiasts. There are three versions of the Raspberry Pi Zero, the Raspberry Pi Zero is the simplified version without WiFi and Bluetooth; Raspberry Pi W is the network version with the onboard wireless network

card, that supports Bluetooth and WiFi; Raspberry Pi Zero WH adds a 40PIN pre-soldered GPIO header for users to debug and use.

Raspberry Pi zero W is an affordable and compact derivative of Raspberry Pi but if you attach Raspberry Pi zero W with monitor, keyboard, and mouse, it takes up a lot more space. There's no need to connect Raspberry Pi to a display or input devices if you're only trying to program it or using it to operate electronics like lights, motors, and sensors because you can control the system remotely using a VNC or SSH client on your primary computer.

This screen less Raspberry Pi zero W system is referred to as a headless setup.Before we get started, let us get acquainted with Raspberry Pi Zero W. It is the newest member of the Pi Zero family and comes with added wireless LAN and Bluetooth connectivity.

This board is specifically designed to get more benefits at affordable price. It provides great connectivity with 2 Micro USB Ports (1 port for Power and other for USB Connectivity), 1 mini–HDMI Port and 1 Micro SD Card Slot and has 512MB of RAM.

A tiny Raspberry Pi that's affordable enough for any project - now with WiFi and Bluetooth. The Raspberry Pi Zero W is one of the smallest members of the Raspberry Pi family but still packs a LOT of features including WiFi, Bluetooth, mini-HDMI, a micro-USB port and a camera connector.

Fig 1 Raspberry Pi Zero W

Raspberry Pi is nothing but a computer and it has ARM processor which is very powerful and light weight. It also has USB ports, Wi-Fi modules (Raspberry Pi 3 Model B), HDMI port and Ethernet Port. Raspberry Pi has its own OS like Raspbian, Ubuntu MATE, Snappy Ubuntu, Pidora, Linutop, SARPi, Arch Linux ARM, Gentoo Linux, Free BSD, Kali Linux, RISC OS Pi [18]. It is like small computer it has multimedia application support. It is because of HDMI and graphics support. But it has also some limitation it doesn't have Hard Disk Drive (HDD) or Solid State Drive (SSD) but we

can put Micro SD card in it so we can boot the OS of Raspberry Pi.
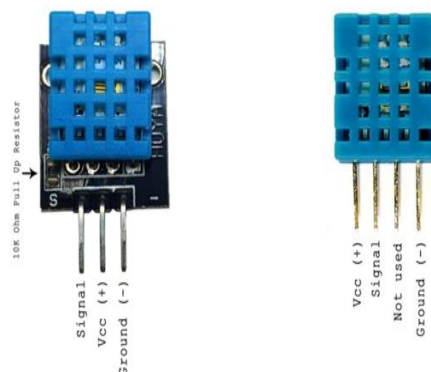
2.2 Soil/Moisture sensor

Fig 2.Soil moisture 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.
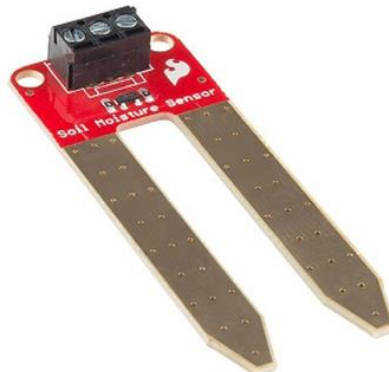

Fig 3. soil-moisture-sensor-device

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.

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Soil Moisture Sensor Applications

The applications of moisture sensor include the following.

✧ Agriculture
✧ Landscape irrigation
✧ Research
✧ Simple sensors for gardeners
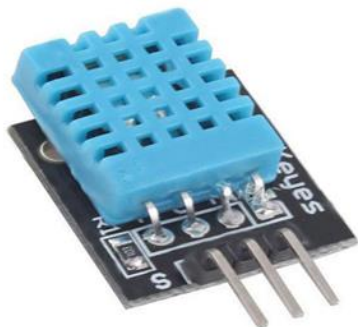
2.3 Temperature/Humidity Sensor (DHT11)

Fig .4 Temperature/Humidity Sensor (DHT11)

The DHT11 humidity and temperature sensor makes it really easy to add humidity and temperature data to your DIY electronics projects. It's perfect for remote weather stations, home environmental control systems, and farm or garden monitoring system Here are the ranges and accuracy of the DHT11:

• Humidity Range: 20-90% RH
• Humidity Accuracy: ±5% RH
• Temperature Range: 0-50 °C
• Temperature Accuracy: ±2% °C
• Operating Voltage: 3V to 5.5V

The DHT11 Datasheet:

The DHT11 measures *relative humidity*. Relative humidity is the amount of water vapor in air vs. the saturation point of water vapor in air. At the saturation point, water vapor starts to condense and accumulate on surfaces forming dew.

The saturation point changes with air temperature. Cold air can hold less water vapor before it becomes saturated, and hot air can hold more water vapor before it becomes saturated.

$$RH = (\frac{\rho_w}{\rho_s}) \; x \; 100\%$$

RH : *Relative Humidity*
ρ_w : *Density of water vapor*
ρ_s : *Density of water vapor at saturation*

Relative humidity is expressed as a percentage. At 100% RH, condensation occurs, and at 0% RH, the air is completely dry.

The DHT11 detects water vapor by measuring the electrical resistance between two electrodes. The humidity sensing component is a moisture holding substrate with electrodes applied to the surface. When water vapor is absorbed by the substrate, ions are released by the substrate which increases the conductivity between the electrodes. The change in resistance between the two electrodes is proportional to the relative humidity. Higher relative humidity decreases the resistance between the electrodes, while lower relative humidity increases the resistance between the electrodes.

The DHT11 measures temperature with a surface mounted NTC temperature sensor (thermistor) built into the unit. To learn more about how thermistors work and how to use them on the Arduino, check out our

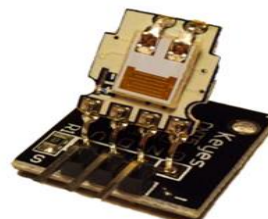With the plastic housing removed, you can see the electrodes applied to the substrate:

Fig 5. Front view with cover removed

An IC mounted on the back of the unit converts the resistance measurement to relative humidity. It also stores the calibration coefficients, and controls the data signal transmission between the DHT11 and the Arduino:
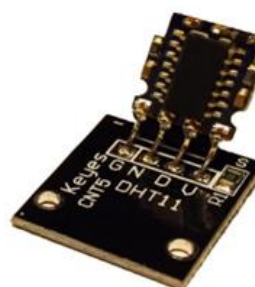

Fig 6. Rear view with cover removed

The DHT11 uses just one signal wire to transmit data to the Arduino. Power comes from separate 5V and ground wires. A 10K Ohm pull-up resistor is needed between the signal line and 5V line to make sure the signal level stays high by default (see the datasheet for more info).

There are two different versions of the DHT11 you might come across. One type has four pins, and the other type has three pins and is mounted to a small PCB. The PCB mounted version is nice because it includes a surface mounted 10K Ohm pull up resistor for the signal line.

FLAME DETECTION SENSOR

Fig 7 FLAME DETECTION SENSOR

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Flame detection sensor is used to detect flame and also responds accordingly. It used for detecting fire. To detect fire there two more sensor is there heat detector sensor and smoke detector sensor. After detection of fire, responding is depends on the how installation is done. For ex. Some installation have alarm or buzzer to notify user, if it is implemented in fuel line then it is deactivating it. A device which can detect a fire, and provide a signal to an alarm circuit. Fire detectors can be operated by smoke, flames, and heat, or any combination of these factors. Flame detectors are rarely used on board ships these days. Heat detectors are used in places such as the galley and laundry. Smoke detectors are used in machinery spaces, accommodation areas and cargo holds.

Technology for fire detecting depends on the fire's location and nature. In this review, the application and implementation status of alarm systems, advantages of the latest technologies, as well as their limitations and shortcomings are explained. Over a period of time, numerous fire detecting technologies have evolved. Some of these methods are still in use today, while others are becoming obsolete. A brief timeline of the development of fire sensors is given in Figure3.5.2. The key five detecting methods, comprising heat, gas, flame, smoke, and graphene oxide (GO) based sensing, as well as other fire sensing technologies and current research, are explained in depth. In fire detection based on heat sensing, most current fire detection systems use electronic and distributed optical thermal detectors based on thermistors. Thermal sensing based on infrared is a helpful technique, especially appropriate for thermal detection of the targeted location.

Compared with non-visual methods, visual approaches for smoke and flame detecting are attracting research focus because of their rapid response time and low imprecision output rate. The great algorithmic capability of existing digital systems has opened up new research prospects for deep learning of complicated neural network-based technologies. Among different gas sensing technologies, gas sensors based on semiconductor metal oxides have been useful in practice due to their great sensibility, small size and reduced cost. However, they have problems with stability, which require more study to resolve.

Currently, research is also underway in the field of carbon nanotube-based gas sensing for fire detection. Microwave radiometer-based fire sensing is one of the most important contemporary approaches due to its key benefit of fire detection across barriers such as walls. For fire detection, the multi-sensor fusion method based on wireless sensor networks (WSNs) and the Internet of Things (IoT) is suitable. The new emerging technique of graphene oxide (GO) based sensing has shown an outstanding short response time. Given the combustible materials, the property of fire-resistant and fire sensing can certainly reduce fire incidents, but further work still has to be done for its practical implementation. These current fire sensing techniques are illustrated in Figure 3.5.3.

2.4 LDR

Fig 8. Light Dependent Resistor

LDR (Light Dependent Resistor) as the name states is a special type of resistor that works on the photoconductivity principle means that resistance changes according to the intensity of light. Its resistance decreases with an increase in the intensity of light. It is often used as a light sensor, light meter, Automatic street light, and in areas where we need to have light sensitivity. It is also called a Light Sensor.

LDR are usually available in 5mm, 8mm, 12mm, and 25mm dimensions.

The Light-dependent resistors made with photosensitive semiconductor materials like Cadmium Sulphides (CdS), lead sulfide, lead selenide, indium antimonide, or cadmium selenide and they are placed in a Zig-Zag shape as you can see in the pic below. Two metal contacts are placed on both ends of the Zig-Zag shape these metal contacts help in creating a connection with the LDRs.
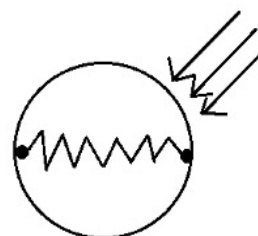

Fig 9 LDR Symbol

Now, a transparent coating is applied on the top so that the zig-zag-shaped photosensitive material gets protected and as the coating is transparent the LDR will be able to capture light from the outer environment for its working.

2.5 BUZZER

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

The **pin configuration of the buzzer** is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+'

symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal.

Fig 10.Buzzer Pin Configuration

2.6 LED

Light-emitting diode (LED) is a widely used standard source of light in electrical equipment. It has a wide range of applications ranging from your mobile phone to large advertising billboards. They mostly find applications in devices that show the time and display different types of data.
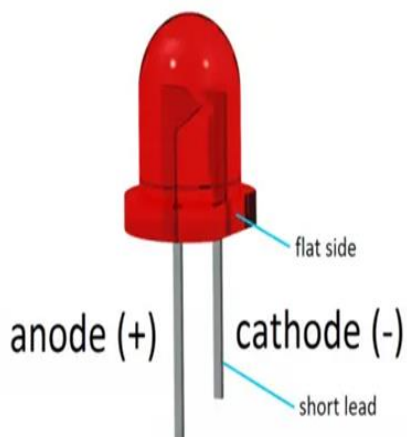

Fig 11 Light-emitting diode

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction.

Light-emitting diodes are heavily doped p-n junctions. Based on the semiconductor material used and the amount of doping, an LED will emit coloured light at a particular spectral wavelength when forward biased. As shown in the figure, an LED is encapsulated with a transparent cover so that emitted light can come out.

Fig 12 Symbol of Light Emitting Diode

2.7 BATTERY

A **battery** is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices. When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells; however, the usage has evolved to include devices composed of a single cell.

A battery is a device that stores energy and then discharges it by converting chemical energy into electricity. Typical batteries most often produce electricity by chemical means through the use of one or more electrochemical cells. Many different materials can and have been used in batteries, but the common battery types are alkaline, lithium-ion, lithium-polymer, and nickel-metal hydride. Batteries can be connected to each other in a series circuit or a parallel circuit.

There is a wide variety of batteries that are available for purchase, and these different types of batteries are used in different devices. Large batteries are used to start cars, while much smaller batteries can power hearing aids. Overall, batteries are extremely important in everyday life.

Primary (single-use or "disposable") batteries are used once and discarded, as the electrode materials are irreversibly changed during discharge; a common example is the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Examples include the lead–acid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptops and mobile phones.

Fig 13. Battery

2.8 DC Cooling Fan

Raspberry Pi single-board computers, especially Pi 4 models, can get quite hot. While passive cooling options are often good enough to avoid overheating and thermal throttling, at some point you'll need to think about using a cooling fan. The Raspberry Pi's GPIO pins don't supply enough current to power even a small fan, but there are several ways to power and control a fan with the Pi.

To run a simple 2-wire fan continuously, connect it to the 5V and ground pins, or you can instead hook it up to 3.3V for lower speed and noise. Either is slightly wasteful power-wise, and potentially annoying.

Fig 14 DC Cooling Fan

III. WORKING OF SMART IRRIGATION SYSTEM

3.1 SYSTEM DESIGN

Figure 4.1 shows hardware part of project. Here we will be considering connections in our project. Here Raspberry pi is the controller of the project. Here we have two comparator circuits which are connected to the soil moisture sensors. Relay is connected to ON/OFF of the system. LDR is used for automatic control of light.

This project requires three different sensors which consists of soil moisture sensor , temperature and humidity sensor , and flame detecting sensor. These sensors are connected to Raspberry Pi for machine learning process and send the data gathered from the sensors to firebase database. Finally, the data from the database will be given to user to monitor the process.

As Raspberry Pi has only digital pin, we can only detect 0 or 1 means HIGH or LOW signal from sensor. So when a High signal is encountered on Pi pin 8, it means there is no moisture in the soil. It is so because soil moisture sensor works on inverting output circuit op-amp. Using this circuit reverses the output on the digital data pin of soil moisture sensor.
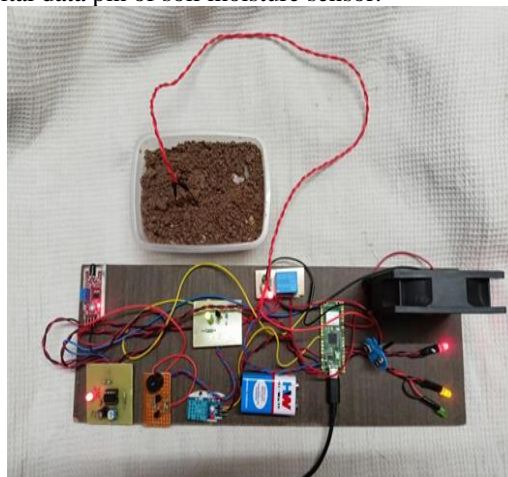

Fig 15 Smart Irrigation system kit

3.2 WORKING PRINCIPLE

Raspberry Pi is the heart of the overall existing system. The Raspberry Pi Model Zero W incorporates a number of enhancements and new features. Improved power consumption, enlarged connectivity and greater IO are among the improvements to this powerful, small and lightweight GPIO(General Purpose Input Output) pins. The Raspberry Pi cannot directly drive the relay. It has only zero volts or 3.3 V. We need 12V to drive electromechanical relay. In that case we need a driver circuit .The driver circuit takes the low level input and gives the 12V amplitude to drive the relay which operates at 12V .We are using here 2 relay to switch on Water motor , sprinkler. Soil moisture sensor, humidity sensor, temperature detection sensor are connected to Raspberry Pi board through comparator circuit.

Soil moisture sensor gives a resistance variation at the output. That signal is applied to the comparator and signal conditioning circuit. The signal conditioning circuit (LDR) has potentiometer to make a decision the moisture level above which the output of comparator goes high. That digital signal is given to the raspberry pi board. If the soil moisture value is above the moisture level and humidity is high at the given value and also if the temperature is high then the water motor will be on, whereas if the moisture level, humidity, temperature is low the motor will be off through the relay.LDR is used for controlling light automatically, at night light will be ON automatically so that we can observe our farm at night also using mobile phones. The android app will have a GUI which will show all the data to user. The modes as specified can be selected by the user on the app itself.
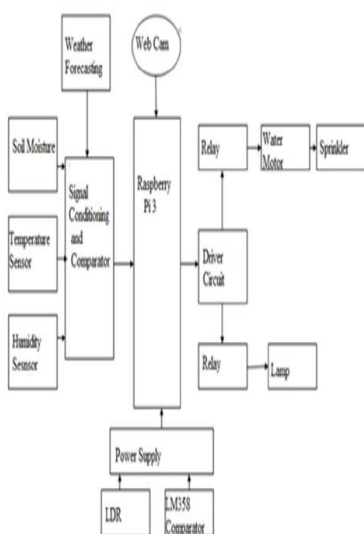
Fig 16. Block diagram

3.3 METHODOLOGY

In this system, we used raspberry pi, soil moisture sensor, flame detection sensor,LDR, buzzer and servo motor. Raspberry pi is a heart of the system i.e. main controller of the system. In this system we used raspberry pi which has number of new feature. It has improved IO, also increased connectivity as compare to older version of pi. Soil moisture is directly connected to raspberry pi. Now when sensor sense data, it will transfer that data to raspberry pi.

Raspberry pi reacting as per data received from soil moisture sensor. If soil is dry i.e. sensor isn't detecting moisture it will sends message to farmer's registered mobile number and registered email address and also glowing LEDs and start the motor. Flame detection is used for detect fire in a farm. Flame detection sensor takes data from field and send it to raspberry pi. Now if fire is there we will send message to farmer's registered mobile number and registered email address. Simultaneously we blow up buzzer. With ultra-sonic sensor we are measuring water level in well. Now for measure water level in well, we will take depth of and radius of well from farmers. Now with ultra-sonic sensor we will measure the current water level in the well and calculate water level from the bottom of the well and also calculate how much water is there in well. After that we will send it to farmer's registered mobile number and registered email address.
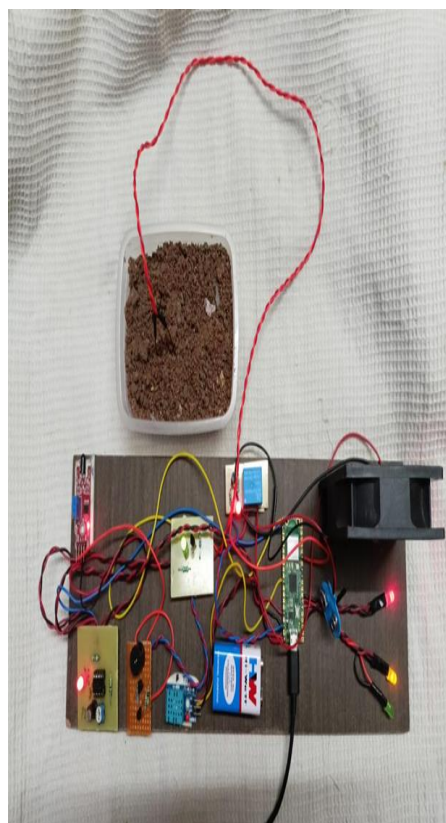
IV. RESULTS
4.1 SMART IRRIGATION SYSTEM KIT

Fig 17 Smart Irrigation system Kit
4.2 IP ADDRESS OF PROGRAM

Fig 18 IP address of the program
4.3 OUTPUT OF PROGRAM SHOWING HUMIDITY

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Fig 19 Humidity Output

4.4 OUTPUT OF PROGRAM SHOWING TEMPERATURE
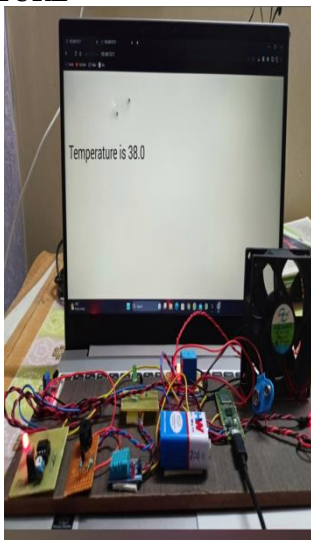

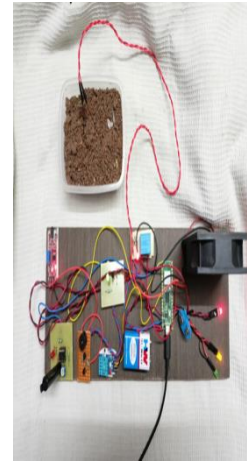**Fig 20.Temperature output**
4.5 LDR OUTPUT

Fig 21 LDR output
4.6 FIRE SENSOR OUTPUT

Fig 22 Fire sensor output

4.7 Advantages of smart irrigation system using raspberry pi

There are several advantages of using a smart irrigation system with Raspberry Pi:

1. Water conservation
2. Cost savings
3. Automaion and convinience
4. Improved plant health and growth
5. Scalability and flexibility
6. Data driven insights
7. Environmental sustainability
8. Integration with other systems

4.8 Disadvantages of smart irrigation system using raspberry pi

While smart irrigation systems using Raspberry Pi offer numerous advantages, there are a few potential disadvantages to consider:

Complexity and technical expertise: Setting up and configuring a smart irrigation system with Raspberry Pi may require some technical knowledge and skills.

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Users need to be familiar with programming, hardware setup, and troubleshooting to ensure the system functions properly. This complexity can be a barrier for individuals with limited technical expertise.

Initial cost: Implementing a smart irrigation system with Raspberry Pi can involve upfront costs for the hardware components, such as Raspberry Pi boards, sensors, valves, and actuators. While the long-term savings in water and maintenance costs can offset these expenses, the initial investment might be a deterrent for some users.

Reliance on electricity and connectivity: Smart irrigation systems powered by Raspberry Pi rely on a continuous supply of electricity to function. In the event of a power outage or disruption, the system may temporarily stop working, potentially affecting irrigation schedules. Additionally, a stable internet connection is required for remote monitoring and control, so any connectivity issues could impact system functionality.

4.9 Applications of smart irrigation system using raspberry pi

Smart irrigation systems using Raspberry Pi have a wide range of applications across various sectors. Here are some notable examples:

Residential gardens and landscapes: Smart irrigation systems can be implemented in residential settings to automate and optimize watering for gardens, lawns, and landscapes. Raspberry Pi-based systems can adjust watering schedules based on weather conditions, soil moisture levels, and plant water requirements, ensuring efficient water usage and maintaining healthy vegetation.

Commercial landscaping: Businesses, parks, golf courses, and other commercial landscaping projects can benefit from smart irrigation systems. Raspberry Pi enables precise control and monitoring of irrigation across large areas, reducing water waste, and maintainingvisually appealing landscapes.

Agriculture and farming: Smart irrigation systems using Raspberry Pi have significant applications in agriculture. By integrating sensors, weather data, and crop-specific requirements, these systems can deliver water directly to plant roots based on real-time needs. This improves water efficiency, crop yield, and reduces manual labor in irrigating vast agricultural fields.

CONCLUSION

The sensors are successfully interfaced with raspberry pin and wireless communication is achieved. All observations and experimental tests prove that this project is a complete solution to the field activities irrigation problems. Implementation of such a system in the field can definitely help to improve the yield of the crops and aids to manage the water resources effectively reducing the wastage.

Using this system, one can save manpower, water to improve production and ultimately increase profit. □

The automated irrigation system is feasible and cost effective for optimizing water resources for agricultural production. □ The system would provide feedback control system which will monitor and control all the activities of plant growth and irrigation system efficiently.

In the present era, people use various irrigation techniques through manual control, in which a person has to irrigate a garden/land at regular time intervals. This process seems to consume more water and results in water wastage. Moreover in some garden areas where there is inadequate rainfall or watering plants, irrigation becomes difficult. Hence we require an automated system that will precisely monitor and control the water requirement in the garden .Installing smart irrigation system in smart garden saves time and ensures efficient use of water. Moreover this architecture uses Raspberry pi which promises many features for growing plants perfectly.

8.2 FUTURE SCOPE

This system is provides very huge future scope. It can be comprehend in many ways. One way is to add camera module to it. When flame sensor detect fire, camera module click picture and put it in website or send it in mail. And take input from user that there is fire or not if it is there send message to fire bridge. Another way is attach different type of sensor like humidity sensor, measuring fertilizer and also attach temperature sensor to generate more data about soil.

Another way is to join water pump to the system and when moisture goes down system will atomically start the motor. This type of agriculture application of Internet of things in the real world environment is necessary to know the effect of the environment on such system. So is always better to know the risks beforehand.

Irrigation is a process of providing the desire amounts of water to the agricultural land. This process is very beneficial in minimizing runoffs or drought situations for the croup's cultivation.

Due to alarming changes in the climate, farmers cannot rely on natural rainwater.Irrigation is important to yield good quality crops in the seasonable or non-seasonable period.For modern agriculture, a smart irrigation system is one of the best techniques that give more production in minimum duration. To many extend, this smart irrigation system is designed and fully automated to minimize manual handling in agriculture.

And one of the good things is that it is very comfortable for users (or farmers) to understand the concept of IoT and sensors for smart irrigation.It can help you to learn how various sensors can be deployed and utilization of their data to generate events and control irrigation systems.

Here, we are listed the few components which are inbuilt in the smart irrigation system.

➤ soil moisture sensor
➤ soil temperature sensor
➤ Fire sensor

- Cooling fan
- Relay
- LDR

Each component plays a specific role in the automatic irrigation system. Also, it requires some technical components such as switch,relay, actuator, battery, , buzzer, 10 DIN socket, voltmeter, ammeter, software, interface software modules (like USB, Wi-Fi, Zigbee), etc.

Our project can be improvised by using a sensor to note the soil ph value such that usage of unnecessary Fertilizers can be reduced. A water meter can be installed to estimate the amount of water used for irrigation and thus giving a cost estimation. Further, it also reduces the investment of farmers.

8.3 REFERENCES

1. M. Grant, S. Boyd, and Y. Ye. CVX: Mat lab software fordisciplined convex programming,2008.

2. T. Harter and J. R. Lund. Addressing nitrate in California"s drinking water.Technical report, University of California, Davis, 2012.

3. M. E. Jensen, R. D. Burman, and R. G. Allen. Evapotranspirationand irrigation water requirements. ASCE,1990.

4. E. Kalnay. Atmospheric modeling, data assimilation, and predictability. Cambridge university press,2003.

May -Jun.2015)

5. Kim, R. Evans, and W. Iversen. Remote sensing and control of an irrigation system using a distributed wireless sensor network. IEEE Transactions on Instrumentation and Measurement, 57(7):1379–1387, July2008.

6. E. Play´an, R. Salvador, C. L´opez, S. Lecina, F. Dechmi, and. Zapata. Solid-set sprinkler irrigation controllers driven by simulation models: Opportunities and bottlenecks. Journal of Irrigation and Drainage Engineering, 140(1):04013001,2013.

7. R.H.Reichel,D.B.McLaughlin,andD.Entekhabi. Hydrologic data assimilation with the ensemble

8 E.Sowmiya, S.Sivaranjani "Smart System Monitoring on Soil Using Internet of Things (IOT)" International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 02 | Feb (2017)

9 Ch Sumaliya, C Bharatender Rao "Smart Farm Monitoring Using Raspberry Pi and Arduino", International Journal of Management Studies (IJMS), Volume: 01 Issue: 11 | Nov (2016)

10 S. Darshna, T.Sangavi,Sheena Mohan, A.Soundharya, Sukanya Desikan "Smart irrigation System" IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) , Volume 10, Issue 3, Ver. II (