A

Project Report

On

AUTOMATED PLANT WATERING SYSTEM USING ARDUINO

Submitted to

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES, KADAPA

in partial fulfilment of the requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

M.PUJITHA **R191019**

Under the Guidance of

Devika mam

Assistant Professor

Department Of Electronics and Communication Engineering

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

RGUKT, RK VALLEY

(RGUKT KADAPA is approved by UGC, AICTE, established in 2008, provide Education opportunities for rural people)

Vempalli, Kadapa-516330

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CERTIFICATE

This is to certify that the project report entitled "AUTOMATED PLANT WATERING SYSTEM USING ARDUINO" a bonafide record of the project work done and submitted by

M.PUJITHA **R191019**

for the partial fulfilment of the requirements for the award of B.Tech Degree in **ELECTRONICS AND COMMUNICATION ENGINEERING,** RGUKT , Kadapa.

GUIDE	**Head of the Department**
M. DEVIKA MAM	Mohan RAJU SIR
Assistant Professor	Assistant Professor,
	Head of Department of ECE

DECLARATION

We hereby declare that the project report entitled “AUTOMATED PLANT WATERING SYSTEM USING ARDUINO” submitted to the Department of ELECTRONICS AND COMMUNICATION ENGINEERING in partial fulfilment of requirements for the award of the degree of **BACHELOR OF TECHNOLOGY**. This project is the result of our own effort and that it has not been submitted to any other University or Institution for the award of any degree or diploma other than specified above.

ACKNOWLEDGEMENT

We are thankful to our guide **M.DEVIKA MAM** for her valuable guidance and encouragement. Her helping attitude and suggestions have helped us in the successful completion of the project.

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We would like to thank our parents and friends, who have the greatest contributions in all our achievements, for the great care and blessings in making us successful in all our endeavors.

ABSTRACT

Now a days its a challenge to improve development of plant in respect of its growth and to reduce costs which leads to an innovative idea of using an automated irrigation system which will further help in better management of water and human resources. An automated irrigation system have been developed using sensors technology with Arduino to efficiently utilize water for irrigation purpose. The system has soil moisture sensor inserted into the soil of the plants and a water level sensor placed in a water container from where water will be pumped to plants for irrigation. An algorithm has been build out with threshold values of soil moisture sensor to control the water quantity in soil and also a water level sensor has been implemented to measure the water level in tank. This project requires Arduino board having inbuilt ATMega328 microcontroller.

This project is need of the hour to convert manual irrigation into an automated irrigation which with the help of soil moisture sensor will detect dankness content of soil leading to turn ON/OFF of pumping motor. Human efforts can be reduced using this technique and increase saving of water by efficiently irrigating the plants. The design has been made with better resource management and low power consumption. This project brings into play a micro-controller which is of 8051 family, this programmable micro-controller collects the input signals converted into values of moisture in the soil via soil moisture sensors. As the microcontroller starts obtaining the signals, it creates an output that forces a relay for running the water pumping motor.

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LIST OF ABBREVIATIONS

PV	Photovoltaic Cell
AC	Analog Current
DC	Direct Current
LDR	Light Dependent Resistor
ADC	Analog-to-Digital Converter
PWM	Pulse Width Modulation
GND	Ground
USB	Universal Serial Bus
VCC	Supply Voltage
IDE	Integrated Development Environment
MIPS	Alf and Vegard's RISC Processor
CMOS	Complementary Metal-Oxide-Semiconductor
SRAM	Static Random Access Memory
RISC	Reduced Instruction Set Computer
MIPS	Million Instructions Per Second
ICSP	In-Circuit Serial Programming
EEPROM	Electrically Erasable Programmable Read-Only Memory

CHAPTER -1

INTRODUCTION

1.1 INTRODUCTION

Agriculture is the important construction of critical food crop. Agriculture is represent as manufacture, dispensation, encouragement and division rural products. Agriculture play a important role in the entire life of a given nation. Agriculture is the spine of financial system of a given country. In this wireless sensor networks, it is a self configuring network of small sensor nodes communicating among themselves using broadcasting signal, and deploy in capacity to logic, observe and realize the purpose world.

85% of worldwide available water resources is used in agriculture and this percentage will not decrease keeping in mind the rate of population growth and hence leading to high demand of food [12]. Its high time to create and implement new methodologies using smart technologies for sustainable agriculture . In this electronics era, a smarter approach of leading a life should be carried out and thus we have made "Automated Plant Irrigation System" for smarter irrigation. Automated Irrigation System will regulate water flow in soil without much human intervention, while maintaining moisture of the plants.

This project automatically turns ON or OFF by detecting the water content in the soil. An automated irrigation system will not only minimize the excess wastage of water but also imply reduction of labour and other overheads. This project is a mini model for gardening purpose at home which contains two modules- one for measuring soil moisture content in soil and the other for detecting water level in tank.

1.2 WORKING PRINCIPLE

The logic of this system is very simple.

- In this system, the moisture sensor senses the moisture level of the soil and when the sensor senses a low moisture level it automatically switches the water pump with the help of a microcontroller and irrigates the plant.
- After supplying sufficient water, the soil gets retains the moisture hence automatically stopping the pump.
- The working of this project is like, we will use a Soil Moisture sensor for measuring the moisture of Soil according to which water valves are controlled.
- When the moisture level gets below a threshold value, valves will open with the help of a relay or solenoid till the soil is well moisturized.

1.3 BASIC CIRCUIT DIAGRAM

An overview of the required circuit for the Smart Irrigation System using Arduino is shown here.

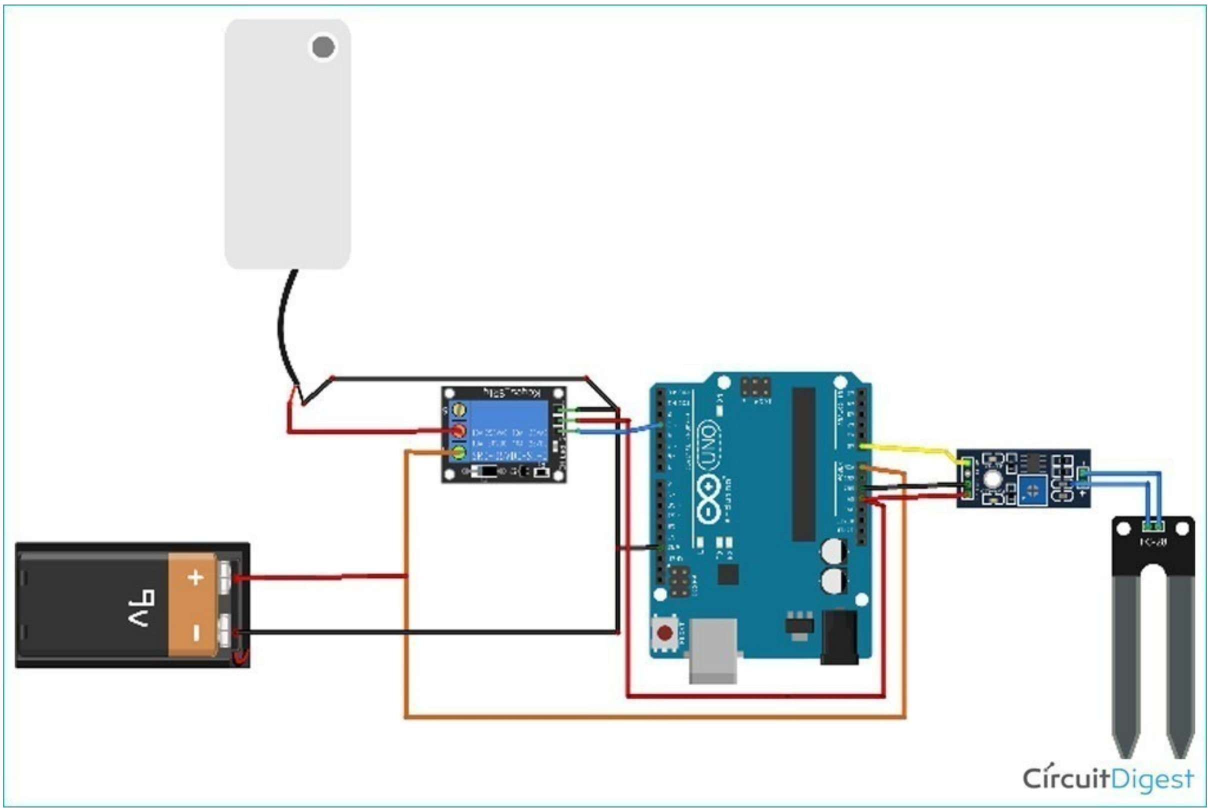


Fig 1.1: Smart Irrigation System Using Arduino.

1.4 FLOW CHART

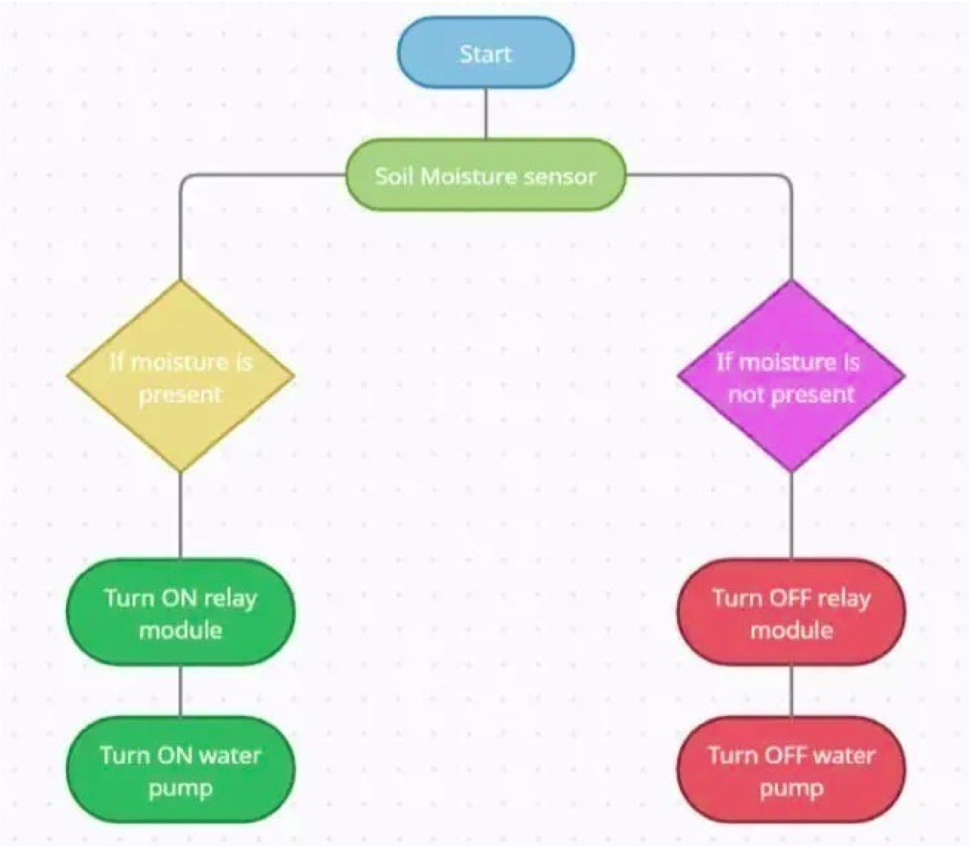


Fig 1.2: Flowchart of Smart Irrigation System using arduino

CHAPTER -2

EXISTING METHOD

2.1 EXISTING METHOD

Water management system is microcontroller based and web application using the concept of cloud and data mining is used to monitor and control the water management system from remote location. Whole system is in WSN infrastructure. Water management is done through sensor reading from farm. Web application provide easy monitor and control mechanism to farmer. Graph generated in web application make easy analysis. Cloud computing is a technique in which a large number of computers connected through a real-time communication network.

In this system sensor senses the data and sends the reading to the micro-controller. Then micro-controller sends those reading to the farm pc through serial communication. Then these readings get stored in the database that is connected to farm pc in which we use data mining concept. These readings will be displayed on the android phone and pc. The mobile and pc is connected to the database through cloud.

In this system we will be including data mining concept for the prediction of future outcomes. Data mining concept examine the large pre-existing data in order to produce the new information. We will be including the cloud computing concept for the communication between the pc and mobile. Cloud computing is a technique in which a large number of computers connected through a real-time communication network.

CHAPTER -3

HARDWRE MODEL REQUIREMENT

3.1 PROPOSED METHOD

Hardware Components

- Arduino Microcontroller
- Relay Module
- Water pump Motor and small tube
- Power supply (9 volts battery)
- Soil Moisture Sensor
- Jumper wires

Software Components

- Arduino IDE

Arduino UNO :

The Arduino is a microcontroller board. It is used to operate a Sensors, LCD, Bluetooth and also storage devices.

- Microcontroller UNO
- Operating Voltage 5V

Input/output pins

- Digital 0-13 (6 pins are PWM pins) PWM: 3, 5, 6, 9, 10, and 11.
- Analog 0-5v
- It comes with an open supply hardware feature that permits users to develop their own kit
- The software of the Arduino is well-suited with all kinds of operating systems like Linux, Windows, and Macintosh, etc.

The **Arduino Uno** is a microcontroller board based on the ATmega328. Arduino is an open-source, prototyping platform and its simplicity makes it ideal for hobbyists to use as well as professionals. The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 Analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Arduino Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 microcontroller chip programmed as a USB-to-serial converter.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Arduino Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

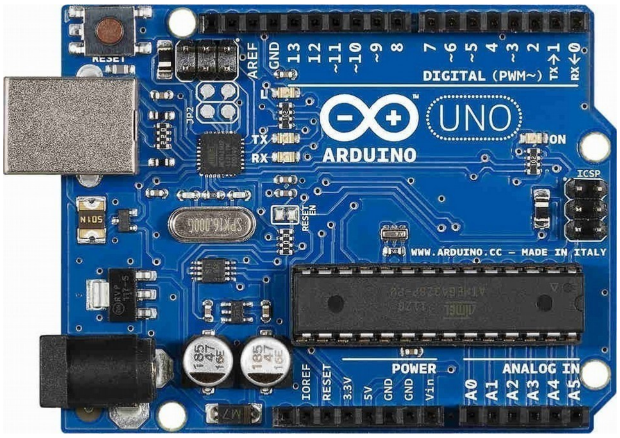


Fig 3.2.1:Arduino UNO

Soil Moisture Sensor :

The working of the soil moisture sensor is very easy to understand. It has 2 probes with exposed contacts that act like a **variable resistor** whose **resistance varies** according to the water content in the soil. This resistance is inversely proportional to the soil moisture which means that higher water in the soil means better conductivity and hence a lower resistance. While the lower water in the soil means poor conductivity and will result in higher resistance. The sensor produces an analog voltage output according to the resistance.

The sensor comes with an electronic module that connects the probe to the Arduino. The module has an **LM393 High Precision Comparator** which converts the analog signal to a Digital Output which is fed to the microcontroller.

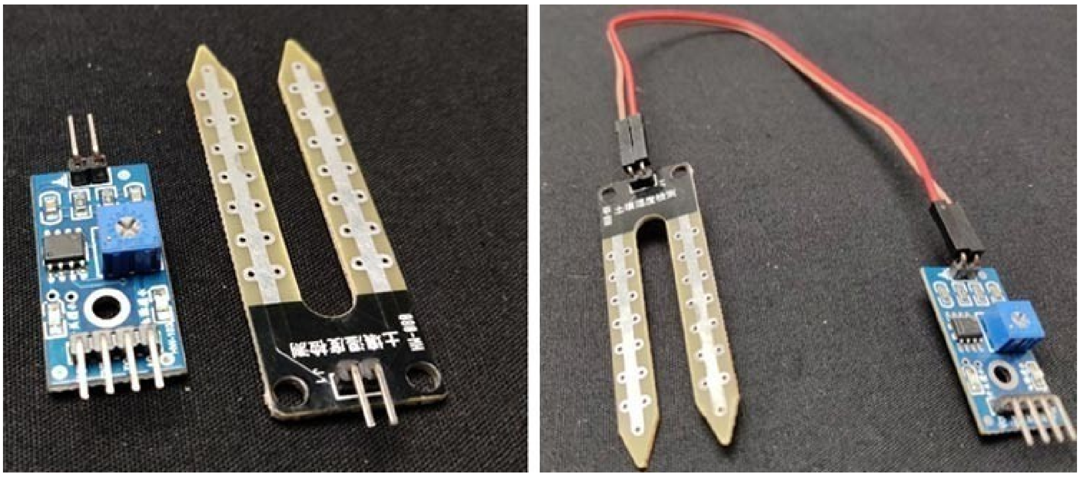


Fig 3.2.2:Soil Moisture Sensor

Water Pump Motor :

We need a small pump to irrigate the plant, but in the case of a garden, we need to drive a larger pump that can provide a higher volume of water depending on the size of your garden which can't be directly powered by an Arduino. So in case you need to operate a larger pump, a driver is necessary to provide enough current for the pump, to show that I am using a 5v relay. You can also use an AC-powered pump and use a suitable relay. The working will remain the same as shown in this project, you just have to replace the DC power input connected to the relay with an AC power input and have to power your Arduino with a separate DC power source.

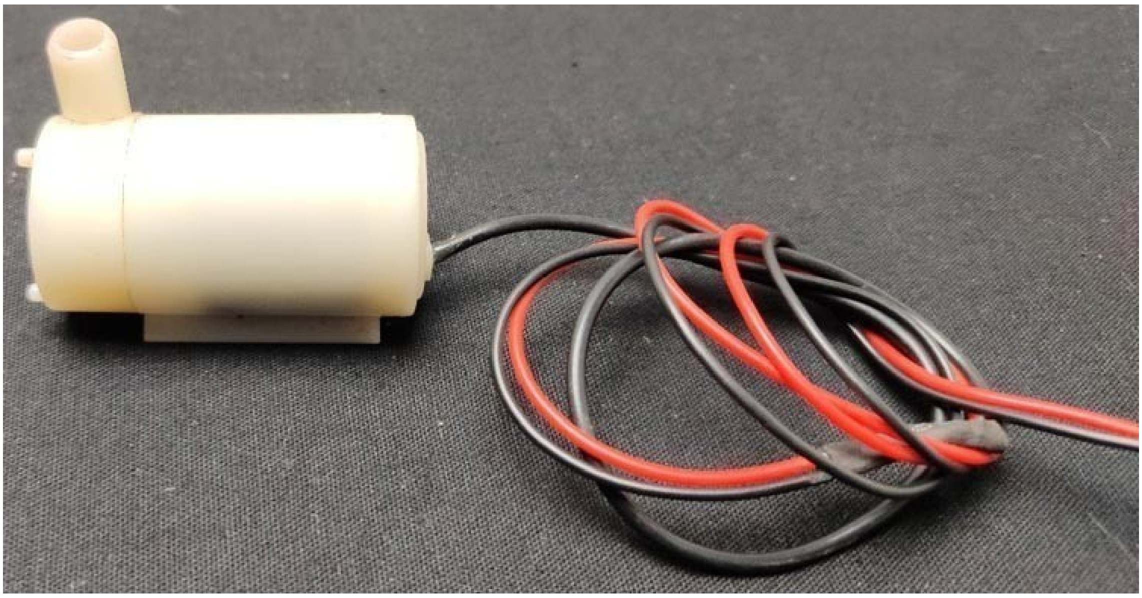


Fig 3.2.3: Water Pump Motor

Relay Module :

A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit.

A simple relay consists of wire coil wrapped around a soft iron core, or solenoid, an iron yoke that delivers a low reluctance path for magnetic flux, a movable iron armature and one or more sets of contacts.

The movable armature is hinged to the yoke and linked to one or more set of the moving contacts. Held in place by a spring, the armature leaves a gap in the magnetic circuit when the relay is de-energized. While in this position, one of the two sets of contacts is closed while the other set remains open.

When electrical current is passed through a coil, it generates a magnetic field that in turn activates the armature. This movement of the movable contacts makes or breaks a connection with the fixed contact. When the relay is de-energized, the sets of contacts that were closed, open and breaks the connection and vice versa if the contacts were open. When switching off the current to the coil, the armature is returned, by force, to its relaxed position. This force is usually provided by a spring, but gravity can also be used in certain applications. Most power relays are manufactured to operate in a quick manner.

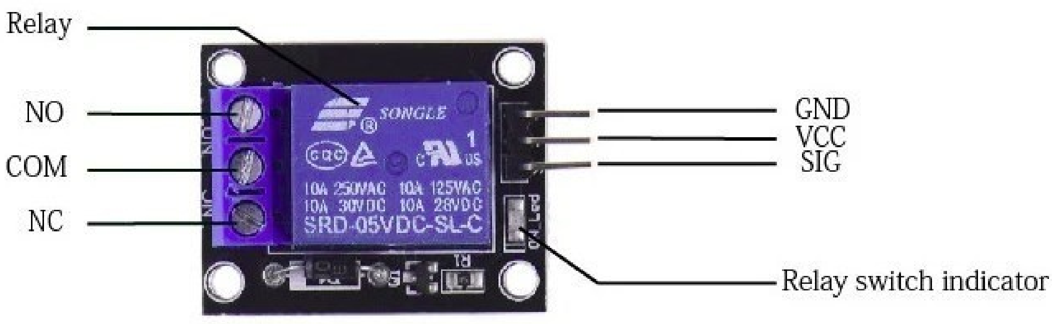


Fig 3.2.4:Relay Module

Jumper Wires :

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

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Generally, jumpers are tiny metal connectors used to close or open a circuit part. They have two or more connection points, which regulate an electrical circuit board. Their function is to configure the settings for computer peripherals, like the motherboard. Suppose your motherboard supported intrusion detection. A jumper can be set to enable or disable it.

Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering. You can use jumper wires to modify a circuit or diagnose problems in a circuit. Further, they are best used to bypass a part of the circuit that does not contain a resistor and is suspected to be bad. This includes a stretch of wire or a switch. Suppose all the fuses are good and the component is not receiving power; find the circuit switch. Then, bypass the switch with the jumper wire. Although jumper wires come in a variety of colours, they do not actually mean anything. The wire colour is just an aid to help you keep track of what is connected to which. It will not affect the operation of the circuit. This means that a red jumper wire is technically the same as the black one. Even so, the colours can be used to your advantage to differentiate the types of connections. For instance, red as ground and black as power. Literally, what works for you.

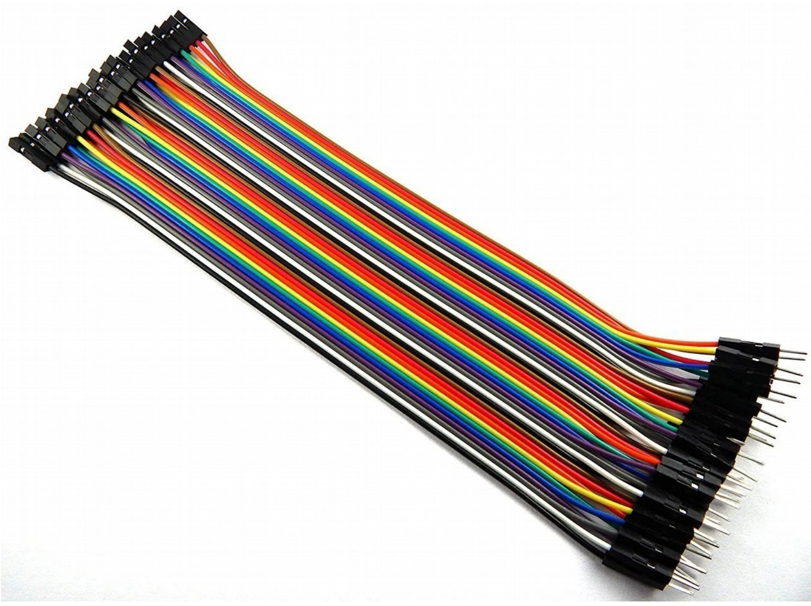


Fig 3.2.5:Jumper wires

Power Supply :

The **nine-volt battery**, or **9-volt battery**, is an electric battery that supplies a nominal voltage of 9 volts. Actual voltage measures 7.2 to 9.6 volts, depending on battery chemistry. Batteries of various sizes and capacities are manufactured; a very common size is known as PP3, introduced for early transistor radios. The PP3 has a rectangular prism shape with rounded edges and two polarized snap connectors on the top. This type is commonly used for many applications including household uses such as smoke and gas detectors, clocks, and toys.

The nine-volt PP3-size battery is commonly available in primary zinc carbon and alkaline chemistry, in primary lithium iron disulfide and lithium manganese dioxide (sometimes designated CRV9), and in rechargeable form in nickel Cadmium (Ni–Cd), nickel-metal hydride (Ni–MH) and lithium ion.Mercury batteries of this format, once common, have been banned in many countries due to their toxicity.Designations for this format include *NEDA 1604* and *IEC 6F22* (for zinc-carbon) or *MN1604 6LR61* (for alkaline). The size, regardless of chemistry, is commonly designated **PP3**—a designation originally reserved solely for carbon-zinc, or in some countries, *E* or *E-block*.A range of PP batteries was produced in the past, with voltages of 4.5, 6, and 9 volts and different capacities; the larger 9-volt PP6, PP7, and PP9 are still available. A few other 9-volt battery sizes are available: A10 and A29.

Fig 3.2.6: 9volts Battery

3.3 ABOUT CONNECTED COMPONENTS

Take a soil moisture sensor and connect its VCC pin to the 5V pin of the Arduino UNO board.

- Connect the GND pin of the sensor to the GND pin of the Arduino UNO board.
- Connect the analog data pin of the sensor to the A0 pin of the Arduino UNO board.
- Now, take a 5V relay module and take a 9V battery.
- Connect the positive wire of the battery to the COM terminal of the relay module.
- Take a water pump and connect the positive wire of the water pump to the NO pin of the relay module.
- Connect the negative wire of the battery to the negative wire of the motor.
- Connect the VCC pin of the relay module to the 5V pin of the Arduino UNO board.
- Connect the GND pin of the relay module to the GND pin of the Arduino UNO board.
- In the last connect the signal pin of the relay module to the D3 pin of the Arduino UNO board.

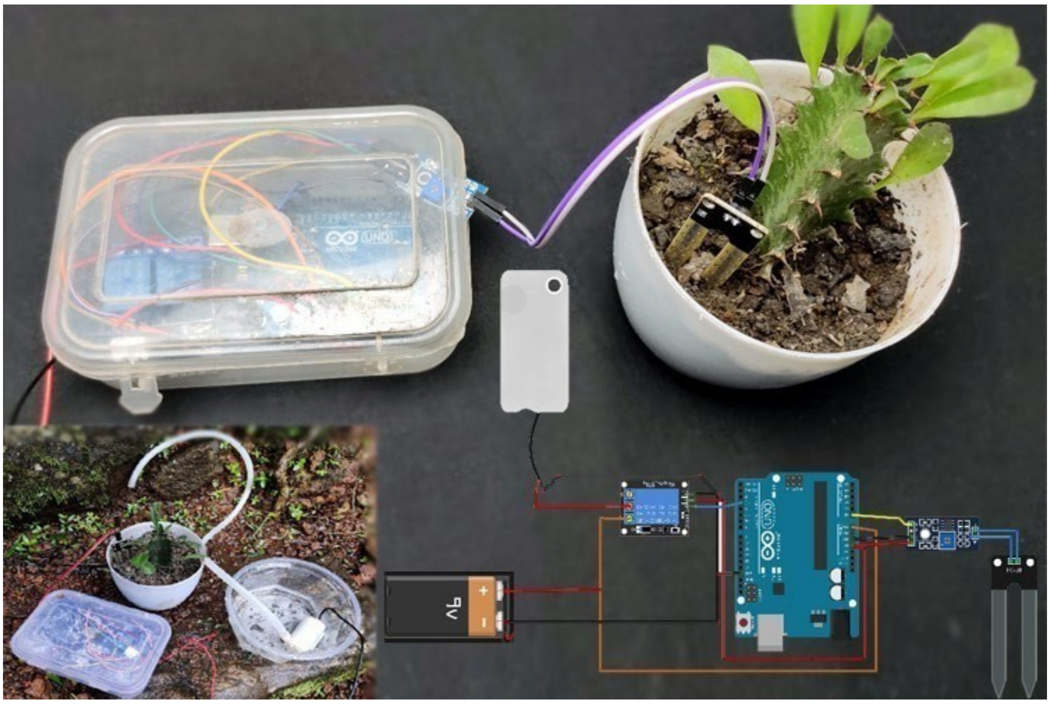


Fig 3.3.1 :Hardware Output Diagram

CHAPTER-4

HARDWARE MODEL

4.1.CIRCUIT DESCRIPTION

DESIGN ALGORITHM :

The **Soil Moisture Sensor** values depends on the resistance of the soil. The **LM393** Driver is a dual differential comparator which compares the sensor voltage with fixed 5V supply voltage .

The value of this sensor varies from 0- 1023. 0 being most wet condition and 1023 being very dry condition.

The **LM35** is a precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius temperature. The LM35 is operates at -55˚ to +120˚C.

The **Water level Switch** Contains a Reed-Magnetic Switch surrounded by a floating magnet. When water is available it Conducts.

The **Arduino** reads the status of the soil using Soil Moisture Sensor. If the Soil is DRY it does the following Operations....

1) Checks for the **availability of water** using water level sensor.

2) If the water is **available**, the Pump is turned **ON** and is automatically turned OFF when sufficient amount of water is supplied.

The Pump is Driven by a Relay driver circuit.

3) If the Water is Unavailable, you will be notified with a sound.

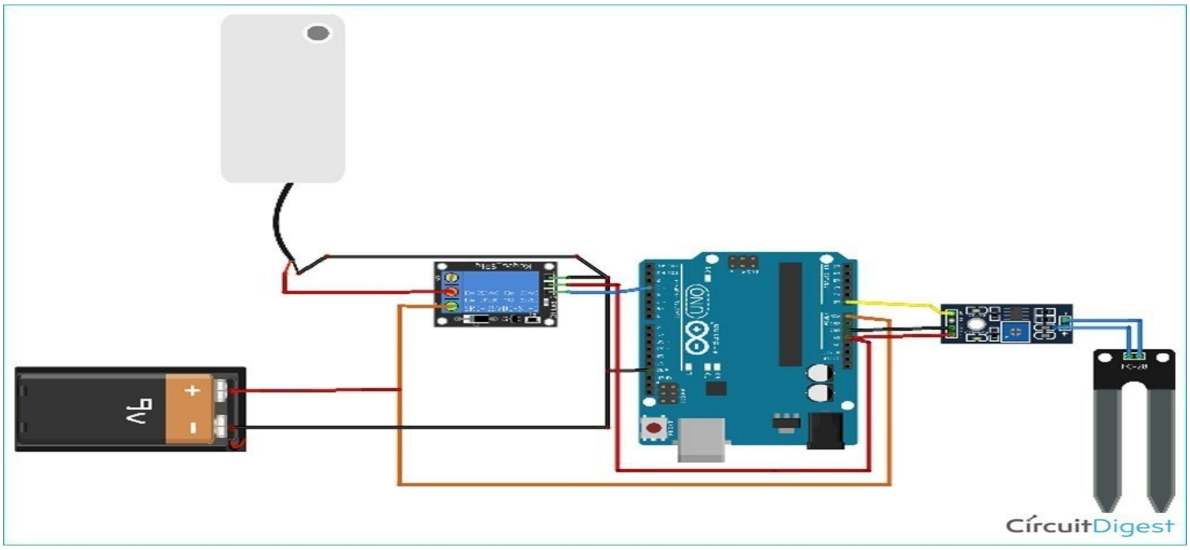


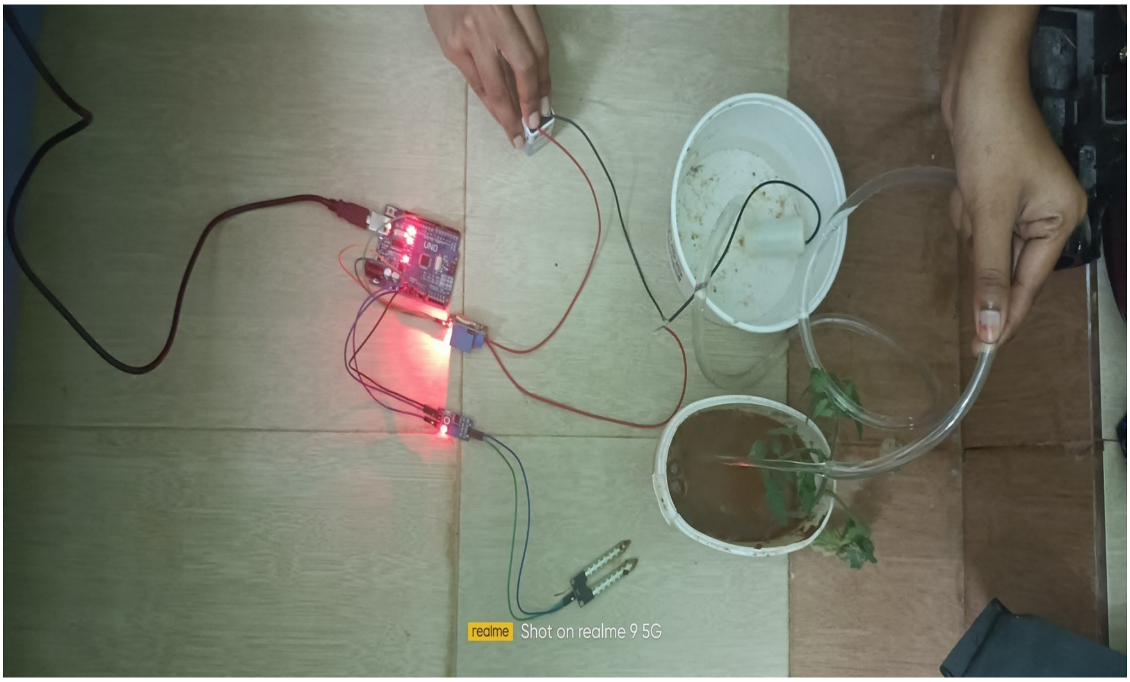
Fig 4.1.1:Circuit Diagram

4.2 PROGRAMMING CODE :

```
int water; //random variable
void setup() {
  pinMode(3,OUTPUT); //output pin for relay board, this will sent signal to the relay
  pinMode(6,INPUT); //input pin coming from soil sensor
}
void loop() {
  water = digitalRead(6);  // reading the coming signal from the soil sensor
  if(water == HIGH) // if water level is full then cut the relay
  {
  digitalWrite(3,LOW); // low is to cut the relay
  }
  Else
  {
  digitalWrite(3,HIGH); //high to continue proving signal and water supply
```

```
}
  delay(400);
}
```

4.3 HARDWARE OUTPUT CIRCUIT DIAGRAM :



CHAPTER – 5
RESULTS AND ANALYSIS

5.1 MERITS AND DEMERITS OF SMART IRRIGATION SYSTEM

MERITS

➨One of the greatest advantages of a smart irrigation system is its ability to save water.

➨Generally speaking, traditional watering methods can waste as much as 50% of the water used due to inefficiencies in irrigation, evaporation and overwatering. Smart irrigation systems use sensors for real-time or historical data to inform watering routines and modify watering schedules to improve efficiency.

➨There are two important aspects of smart irrigation: control types -- the way the irrigation is controlled -- and delivery types -- the type of water delivery systems used.

➨There are also two basic types of control for smart irrigation systems, weather-based and soil-based, each varying in its technical method of sensing and supplying information.

➨Weather-based smart irrigation systems use local weather information drawn from reliable weather sources, sensors or historical data to support informed decisions about watering schedules. A weather-based irrigation system is also called an evapotranspiration, or ET, system, referring to the loss of water through evaporation from the land and transpiration from plants. Water schedules are determined using an analytical assessment of the combination of local temperature, humidity, insolation and wind.

➨Soil-based smart irrigation systems use local soil moisture data drawn from sensors in the ground to support informed decisions about watering schedules. Users can configure these systems to manage irrigation on demand, for example, when a particular land area is too dry and starting an irrigation routine or to stop irrigation when a particular saturation point is met because a soil moisture level has been reached. Controlling these two set points reduces the amount of water used by linking it to the moisture level needed in the soil for a particular crop.

➨One of the other major advantages of a smart irrigation system is that precesion watering in smart irrigation also deals with efficiencies in the delivery of the water. There are generally four types of delivery: surface, sprinklers, trickle and subsurface methods.

➨Surface irrigation is the most traditional method, and it distributes water through irrigation ditches, letting gravity do the work. Sprinklers distribute water through the air like rain and can be fixed or mobile. Trickle irrigation spreads water very locally to the ground surface. Subsurface methods are buried next to the plant's root zone and apply water below the ground. Trickle systems and subsurface methods generally save the most water given their ability to reduce loss to evaporation.

DEMERITS:

+It requires initial evaluation of site specific conditions before selection of appropriate moisture sensor.

➨It requires probe to be inserted in the soil. It requires labor to collect the data and maintain the measurement processes.

➨The measured values depend on properties of various materials. The correct interpretation and use of moisture data is needed.

➨Watermark sensors provide less accuracy in sandy soils due to large particles.

➨Watermark sensors are required to be calibrated for each soil types. Tensiometers also require periodic service.

5.2 RESULT

The smart irrigation system was tested on a garden plant. The plant's water requirement is 600-800mm a day and temperature requirement of the soil ranges from 50oC- 100oC. In the Arduino code, the moisture and temperature range were set as 300-700 and 450-800 respectively (which delineates the corresponding resistance value in digital format). Moreover this system proves to be cost effective and proficient in conserving water and reducing its wastage.

When watering a plant manually by assuming the approximate quantity without using sensor based technique and when using the automatic irrigation system based on arduino. By analysing fig.4 it can be concluded that the traditional method of watering plants consumes more water than its required for good yield of a plant and hence water wastage is performed. On the other hand by using arduino project for irrigating plants right amount of water is provided by calculating moisture content of plant soil therefore no water wastage at all.

Based on the moisture of the soil, water will be sprinkled to the field thus the effective utilization of water is performed. Also, the smart irrigation system overcomes the tedious process in manual irrigation system and also **prevents soil erosion and nutrient runoff due to excessive water flow in field**.

5.3 CONCLUSION:

In this study, an intelligent irrigation system based on a microcontroller was developed.The microcontroller circuit has been made with few components and the circuit is highly reliable. This circuit consisted of Arduino UNO, relay, soil moisture sensor, motor (12 v) and battery. We guarantee the success of this project after checking the soil dryness data shown on the computer. This system uses information from soil moisture sensors to irrigate the soil, which helps prevent excessive irrigation and insufficient irrigation. This system works as a potential solution to the problems faced in manual irrigation in the plant. This intelligent irrigation system was designed for flood saturation and irrigation.

5.4 FUTURE SCOPE:

It can provide high accuracy water supply and avoid water from wastage. Due to automatically handling, user requires less man power. With the help of the sensors, it can accurately determine the soil moisture levels. It can easily detect and control the temperature, humidity, solar radiation using sensors.

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.

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