# ABSTRACT

In most regions of the world, population growth has resulted in water scarcity. Agriculture wastes a significant amount of water. Water logging during irrigation is the leading cause of water waste in this area. As a result, there is a need to convert to alternate irrigation methods. The Arduino board and a microcontroller are used in this study to suggest an autonomous plant irrigation system. It detects the moisture content of the soil and determines whether or not irrigation is required. It gives appropriate water to the crop after assessing the parameters. When the soil is dry, the pump automatically turns on and distributes water. Similarly, when the soil is wet, the pump shuts down and the crop receives no water. This not only saves water that would otherwise be wasted, but it also ensures that the crop receives only the amount of water it requires. The development of automation technologies has made life simpler and easier in every way. In the modern world, automatic systems are favoured over manual ones. A expanding system of ordinary objects called automatic systems While you're busy, an industrial machine may produce consumer products with additional activities. In irrigation process, most important parameter is monitoring of soil, so we have to monitor the soil condition, whether the soil is dry or wet. If it is dry, then by using pumping motor, water has to be pumped automatically. Now a day's water is becoming very precious due to scarcity in obtaining clean water for domestic purpose including irrigation. In order to optimize the use of water, mechanism to develop water conversation is the need of the hour. Also, automation in agricultural systems is a necessity to optimize water usage, reduce water wastage, and to implement modern technology in agriculture systems. Soil moisture sensor is a novel device which senses the moisture content in the soil, and with suitable mechanism allows water to be irrigated depending on the moisture content of the soil. This allows flow of water or stoppage of water to the plants by using an automated irrigation system. The device consists of an Arduino board, which is the micro controller which activates the water pump and supplies water to plants through Rotating Platform Sprinkler. A submersible motor pump is used for this purpose of pumping water. This system uses low power consumption and pumps water up to 100 litres. Necessary tunings for pumping and supplying water is arranged depending on the consumption of water. This involves a power supply of 2.5 V to 6 V. Soil moisture sensor is inserted in the soil which contains a probe to measure the moisture content of the soil.

# 1.INTRODUCTION

Efficient water management in agriculture fields is crucial for optimal crop yield. An automatic irrigation system that senses soil moisture content has gained attention as a resourceful solution. Automatic irrigation systems that utilize soil moisture sensors have become increasingly important for efficient water management in agriculture. In this research, we make use of an intelligent irrigation system that operates using the soil moisture sensing technique. An intelligent soil moisture sensed irrigation system is a system that is designed to operate autonomously. Using a valve mechanism, it automatically regulates the supply of water to plants on sensing the moisture level of the soil within the immediate surroundings of a soil moisture sensor. This type of system adapts the amount of water applied according to plant needs and actual weather conditions throughout the season, which translates not only into convenience for the manager but also into substantial water savings compared to irrigation management based on average historical weather conditions.

## 1.1 DESCRIPTION:

- An automatic irrigation system using soil moisture sensors aims to automate the irrigation process, reducing human intervention and saving water.
- The project title itself indicates that the system checks the moisture content in the soil, based on that pumping motor will automatically pumps the water into the field. Here we are using soil moisture sensor.
- By using this sensor, we can find whether the soil is wet or dry. If it is dry, pumping motor will pump the water. In this project, the main controlling device is AT89S52 microcontroller. Here soil sensor is placed inside the soil which senses the water content. If the water content in soil reduces and becomes dry the sensor will give the status of the soil to the microcontroller, based on that microcontroller will display the status of the soil on the LCD and switch on or off the pumping motor through relay. The pumping motor will pump the water into the field until the field is wet which is continuously monitor by the microcontroller by means of Soil moisture sensor.

## 1.2 METHODOLOGY

The major components used in this project are:

- Microcontroller based control system with regulated power supply
- Soil moisture sensor
- Electromagnetic relay to control the electrical motor (pump)
- Relay driver
- GSM modem attached to Microcontroller for remote communication LED Indicators

1.**Power supply**: As this electronic device is power operated, the controller and other devices used are low power devices. The voltage has to be step down to obtain a constant DC output.

2.The Arduino Uno: It is a microcontroller based board connected to the power supply.

**3.GSM Module:** It is used to send and store messages. It also alerts the user of any specific data. It is handy and can be carried anywhere easily.

**4.Relay:** A simple relay is used to open or close a circuit. It can energize and de-energize the system according to the inputs.

**5.LED:** It is a light emitting diode used as flash lights to emit light during operation and used as indicator.

**6. Moisture sensor**: It consists of a probe consisting of moisture sensors which can be inserted in the soil, in order to measure the moisture content of the soil. When the field is in dry condition, the sensor device senses the condition of the soil and the signal is transmitted to the microcontroller. which in response makes the motor ON. Now, the water is pumped and the irrigation is done at the dry places only. This is done by moisture sensor device. Where there is moisture present in the soil, irrigation process will stop and vice-versa. Soil moisture sensors measure the water content in soil.

**7.Submersible pump:** This is a low cost, small size Submersible Pump Motor which is operated from a 2.5 V to 6 V power supply. It is used to deliver about 100 litres of water per hour. The pipe tubings are connected to the motor outlet and submerged in water. Power is activated when water is to be pumped. Care is taken to ensure the level of water is higher than the motor.

## 1.3 IRRIGATION

Little water is lost to deep percolation if the proper amount is applied. Drip irrigation is popular because it can Irrigation system uses valves to turn irrigation ON and increase yields and decrease both water requirements and OFF. These valves may be easily automated by using labor. Controllers and solenoids. Automating farm or nursery Drip irrigation requires about half of the water needed by irrigation allows farmers to apply the right amount of sprinkler or surface irrigation. Lower operating pressures water at the right time, regardless of the availability of and flow rates result in reduced energy costs. International Journal of Research Publication and Reviews Vol (2) Issue (8) (2021) Page 714-720 715 A higher labor to turn valves on and off. In addition, farmers using degree of water control is attainable. Automation equipment are able to reduce runoff from over Plants can be supplied with more precise amounts of watering saturated soils, avoid irrigating at the wrong time water. Disease and insect damage is reduced because plant of day, which will improve crop performance by ensuring foliage stays dry. Operating cost is usually reduced. Adequate water and nutrients when needed. Automatic Federations may continue during the irrigation process Drip Irrigation is a valuable tool for accurate soil moisture because rows between plants remain dry. The capacity of soil to retain water is a function of soil texture and structure. When removing a soil sample, the soil being evaluated is disturbed, so its water-holding capacity is altered. Indirect methods of measuring soil water are helpful as they allow information to be collected at the same location for many observations without disturbing the soil water system. Content without any need for soil density determination. The new soil moisture sensor uses Immersion Gold which protects he nickel from oxidation. Electrodes nickel immersion Fig. 1 Overview of Automated Irrigation System gold (ENIG) has several advantages over more conventional (and cheaper) surface plating such as The above fig 1 explains about important parameters to be HASL (solder), including excellent surface planarity measured for automation of irrigation system are soil (particularly helpful for PCB's with large BGA packages), moisture. The entire field is first divided into small good oxidation resistance, and usability for untreated sections such that each section should contain one contact surfaces such as membrane switches and contact moisture sensor. These sensors are buried in the ground at points required depth. Once the soil has reached desired moisture a soil moisture sensor can read the amount of level the sensors send a signal to the micro controller to moisture present in the soil surrounding it. It's a low tech turn on the relays, which control the motor. Sensor butideal for monitoring an urban garden, or your. In proposed system, automated irrigation pet plant's water level. This is a must have tool for a mechanism which turns the pumping motor ON and OFF connected garden. On detecting the dampness content of the earth. In this sensor uses the two probes to pass current through domain of farming, utilization of appropriate means of the soil, and then it reads that resistance to get the irrigation is significant. The benefit of employing moisture level. More water makes the soil conduct these techniques is to decrease human interference. Electricity more easily (less resistance), while dry soil this automated irrigation project, the soil sensor senses conducts electricity poorly (more resistance). The moisture content by giving input signal to an Arduino board which operates on ATmega328 microcontroller, is programmed to collect the input signal of changeable dampness circumstances of the earth via dampness detecting system. Because this method is based on ultimately profit. , it is the standard with which all other methods are compared.

## 1.4 SOIL MOISTURE

Soil moisture is an important component in the Atmospheric water cycle, both on a small agricultural scale and in large- scale modelling of land/atmosphere interaction. Vegetation and crops always depend more on the moisture available at root level than on precipitation occurrence. Water budgeting for irrigation planning, as well as the actual scheduling of Irrigation action, requires local soil moisture information. Knowledge of the degree of soil wetness helps to forecast the risk of flash floods, or the occurrence of fog. Fig. 2 Block diagram of the system Soil water content is an expression of the mass or volume. The above fig 2 shows Microcontroller based irrigation of water in the soil, while the soil water potential is a system proves to be a real time feedback control system expression of the soil water energy status. The relation which monitors and controls all the activities of drip between content and potential is not universal and depends irrigation system efficiently. The present proposal is a on the characteristics of the local soil, such as soil density model to modernize the agriculture industries on a small and soil texture. Scale with optimum expenditure. Using this system, one the basic technique for measuring soil water content is the can save manpower, water to improve production and gravimetric method. Because this method is based on ultimately profit. Direct measurements, it is the standard with which all other methods are compared.

## 1.5 INTRODUCTION TO EMBEDDED SYSTEM

Many embedded systems have substantially different design constraints than desktop computing applications. No single characterization applies to the diverse spectrum of embedded systems. However, some combination of cost pressure, long life-cycle, real¬-time requirements, reliability requirements, and design culture dysfunction can make it difficult to be successful applying traditional computer design methodologies and tools to embedded applications. Embedded systems in many cases must be optimized for life-cycle and businessdriven factors rather than for maximum computing throughput. There is currently little tool support for expanding embedded computer design to the scope of holistic embedded system design. However, knowing the strengths and weaknesses of current approaches can set expectations appropriately, identify risk areas to tool adopters, and suggest ways in which tool builders can meet industrial needs. If we look around us, today we see numerous appliances which we use daily, be it our refrigerator, the microwave oven, cars, PDAs etc. Most appliances today are powered by something beneath the sheath that makes them do what they do. These are tiny microprocessors, which respond to various keystrokes or inputs. These tiny microprocessors, working on basic assembly languages, are the heart of the appliances. We call them embedded systems. Of all the semiconductor industries, the embedded systems market place is the most conservative, and engineering decisions here usually lean towards established, low risk solutions. Welcome to the world of embedded systems, of computers that will not look like computers and won't function like anything we are familiar with.

### 1.5.1 CLASSIFICATION

Embedded systems are divided into autonomous, realtime, networked & mobile categories.

**1.Autonomous systems**

They function in standalone mode. Many embedded systems used for process control in manufacturing units& automobiles fall under this category.

**2.Real-time embedded systems**

These are required to carry out specific tasks in a specified amount of time. These systems are extensively used to carry out time critical tasks in process control.

**3.Networked embedded systems**

They monitor plant parameters such as temperature, pressure and humidity and send the data over the network to a centralized system for on line monitoring.

**4.Mobile gadgets**

Mobile gadgets need to store databases locally in their memory. These gadgets imbibe powerful computing & communication capabilities to perform realtime as well as nonrealtime tasks and handle multimedia applications. The embedded system is a combination of computer hardware, software, firmware and perhaps additional mechanical parts, designed to perform a specific function. A good example is an automatic washing machine or a microwave oven. Such a system is in direct contrast to a personal computer, which is not designed to do only a specific task. But an embedded system is designed to do a specific task with in a given timeframe, repeatedly, endlessly, with or without human interaction. Good software design in embedded systems stems from a good understanding of the hardware behind it. All embedded systems need a microprocessor, and the kinds of microprocessors used in them are quite varied. A list of some of the common processors like:

**microprocessors families are:** ARM family, The Zilog Z8 family, Intel 8051/X86 family, Motorola 68K family and the power PC family. For processing of information and execution of programs, embedded system incorporates microprocessor or micro- controller. In an embedded system the microprocessor is a part of final product and is not available for reprogramming to the end user. An embedded system also needs memory for two purposes, to store its program and to store its data. Unlike normal desktops in which data and programs are stored at the same place, embedded systems store data and programs in different memories.

This is simply because the embedded system does not have a hard drive and the program must be stored in memory even when the power is turned off. This type of memory is called ROM. Embedded applications commonly employ a special type of ROM programmed or reprogrammed with the help of special devices.

### 1.5.2 DESIGN PROCESS

Embedded system design is a quantitative job. The pillars of the system design methodology are the separation between function and architecture, is an essential step from conception to implementation. In recent past, the search and industrial community has paid significant attention to the topic of hardware-software (HW/SW) codesign and has tackled the problem of coordinating the design of the parts to be implemented as software and the parts to be implemented as hardware avoiding the HW/SW integration problem marred the electronics system industry so long. In any large scale embedded systems design methodology, concurrency must be considered as a first class citizen at all levels of abstraction and in both hardware and software. Formal models & transformations in system design are used so that verification and synthesis can be applied to advantage in the design methodology. Simulation tools are used for exploring the design space for validating the functional and timing behaviors of embedded systems. Hardware can be simulated at different levels such as electrical circuits, logic gates, RTL e.t.c. using VHDL description. In some environments software development tools can be coupled with hardware simulators, while in others the software is executed on the simulated hardware. The later approach is feasible only for small parts of embedded systems.
Design of an embedded system using Intel's 80C188EB chip is shown in the figure. In order to reduce complexity, the design process is divided in four major steps: specification, system synthesis, implementation synthesis and performance evaluation of the prototype.

### 1.5.3 SPECIFICATION

During this part of the design process, the informal requirements of the analysis are transformed to formal specification using SDL.

### 1.5.4 SYSTEM-SYNTHESIS

For performing an automatic HW/SW partitioning, the system synthesis step translates the SDL specification to an internal system model switch contains problem graph& architecture graph. After system synthesis, the resulting system model is translated back to SDL.

### 1.5.5 IMPLEMENTATION-SYNTHESIS

SDL specification is then translated into conventional implementation languages such as VHDL for hardware modules and C for software parts of the system.

### 1.5.6 PROTOTYPING

On a prototyping platform, the implementation of the system under development is executed with the software parts running on multiprocessor unit and the hardware part running on a FPGA board known as phoenix, prototype hardware for Embedded Network Interconnect Accelerators.

### 1.5.7 APPLICATIONS

Embedded systems are finding their way into robotic toys and electronic pets, intelligent cars and remote controllable home appliances. All the major toy makers across the world have been coming out with advanced interactive toys that can become our friends for life. ‘Furby’ and ‘AIBO’ are good examples at this kind. Furbies have a distinct life cycle just like human beings, starting from being a baby and growing to an adult one. In AIBO first two letters stands for Artificial Intelligence. Next two letters represents robot. The AIBO is robotic dog. Embedded systems in cars also known as Telematic Systems are used to provide navigational security communication & entertainment services using GPS, satellite. Home appliances are going the embedded way. LG electronics digital DIOS refrigerator can be used for surfing the net, checking e-mail, making video phone calls and watching TV.IBM is developing an air conditioner that we can control over the net. Embedded systems cover such a broad range of products that generalization is difficult. Here are some broad categories.

### ARUDINO:

The Arduino is a family of microcontroller boards to simplify electronic design, prototyping and experimenting for artists, hackers, hobbyists, but also many professionals. People use it as brains for their robots, to build new digital music instruments, or to build a system that lets your house plants tweet you when they’re dry. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller — essentially a complete computer with CPU, RAM, Flash memory, and input/output pins, all on a single chip. Unlike, say, a Raspberry Pi, it’s designed to attach all kinds of sensors, LEDs, small motors and speakers, servos, etc. directly to these pins, which can read in or output digital or analog voltages between 0 and 5 volts. The Arduino connects to your computer via USB, where you program it in a simple language (C/C++, similar to Java) from inside the free Arduino IDE by uploading your compiled code to the board. Once programmed, the Arduino can run with the USB link back to your computer, or stand-alone without it — no keyboard or screen needed, just power.

# 2.LITERATURE REVIEW

A literature survey on automatic irrigation systems with soil moisture content control reveals key advancements:

## 2.1 Technologies and Sensors:

* Soil Moisture Sensors:

Capacitive and resistive types are common, with wireless sensor networks (WSNs) enhancing data collection.

* IoT Integration: loT devices enable real-time monitoring and control of irrigation.

## 2.2 Control Systems:

* Automated Controllers: Devices like Arduino and Raspberry Pi automate irrigation based on sensor data.

* Feedback Mechanisms:

Closed-loop systems dynamically adjust irrigation to maintain optimal soil moisture.

## 2.3 Efficiency and Water Conservation:

* Precision Agriculture: Ensures precise water application, reducing waste and enhancing crop growth.

* Water Management: Automated strategies like deficit and drip irrigation improve efficiency.

## 2.4 Case Studies and Field Trials:

* Field Experiments: Show the effectiveness of automatic systems in improving crop yield and water use efficiency.

# 3.ANALYSIS AND DESIGN

## 3.1 ANALYSIS OF SOIL MOISTURE

Soil moisture is an important component in the atmospheric water cycle, both on a small agricultural scale and in large-scale modelling of land/atmosphere interaction. Vegetation and crops always depend more on the moisture available at root level than on precipitation occurrence. Water budgeting for irrigation planning, as well as the actual scheduling of irrigation action, requires local soil moisture information. Knowledge of the degree of soil wetness helps to forecast the risk of flash floods, or the occurrence of fog. Soil water content is an expression of the mass or volume of water in the soil, while the soil water potential is an expression of the soil water energy status. The relation between content and potential is not universal and depends on the characteristics of the local soil, such as soil density and soil texture. The basic technique for measuring soil water content is the gravimetric method. Because this method is based on direct measurements, it is the standard with which all other methods are compared. Unfortunately, gravimetric sampling is destructive, rendering repeat measurements on the same soil sample impossible. Because of the difficulties of accurately measuring dry soil and water volumes, volumetric water contents are not usually determined directly.

## 3.2 OBJECTIVES

An automation of irrigation systems has several positive effects. Once installed, the water distribution on fields or small-scale gardens is easier and does not have to be permanently controlled by an operator. There are several solutions to design automated irrigation systems. Modern big-scale systems allow big areas to be managed by one operator only.

Sprinkler,drip or subsurface drip irrigation systems require pumps and some high techcomponents andif used for large surfaces skilled operators are also required. Extremely hightech solutions also exist using GIS and satellites to automatically measure the water needs content of each crop parcel and optimize the irrigation system. But automation of irrigation can sometimes also be done with simple, mechanical appliances: with clay pot or porous capsule irrigation networks or bottle irrigation.

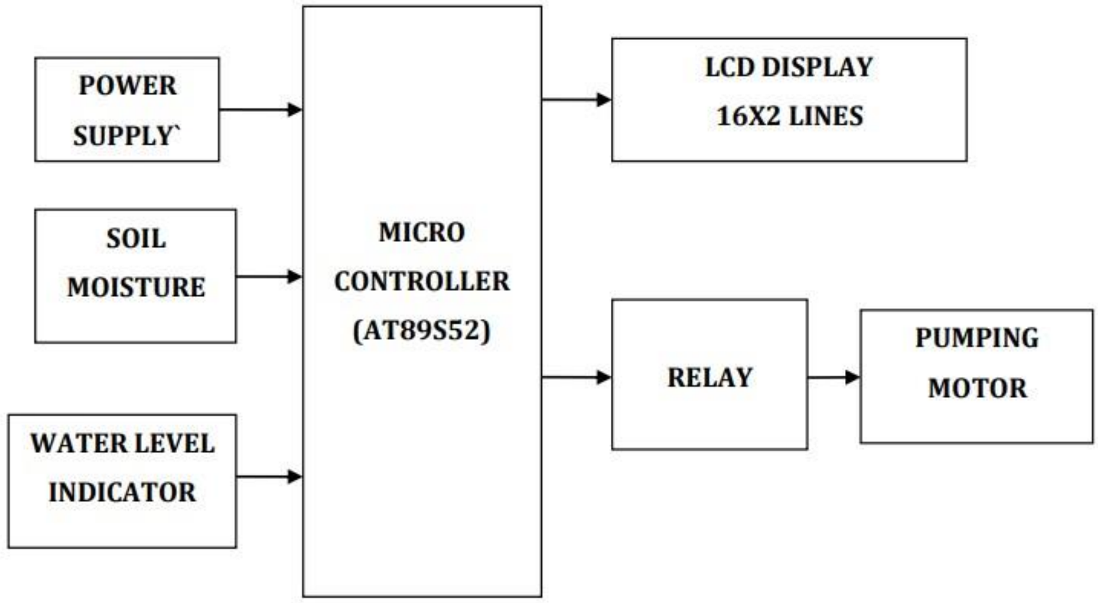
1)The main objective of this work is to control the water application.
2)As well saving our time is major purpose.
3)To save the plants from being dry and improve their lifetime.

## 3.3 MOTIVATION

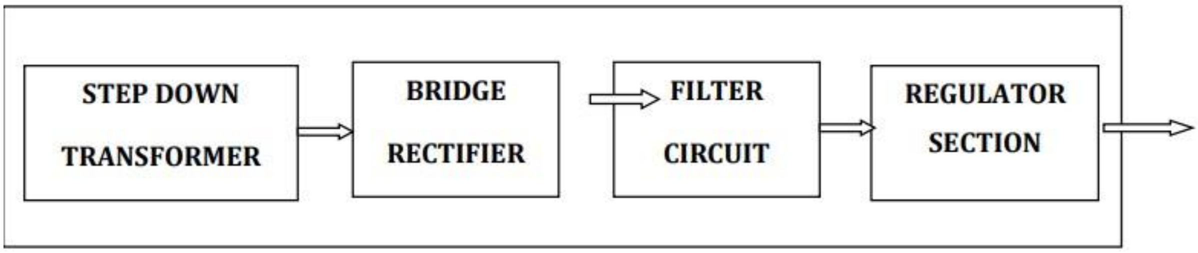
In the current situation, water shortage due to increased exploitation has urged to develop a new technology which can save water from wasting and therefore there will be a smart way to check the loss of water. The purpose of this idea is to make the water planting system smart, autonomous, and efficient, to optimize the water supply to the plants to decrease manual intervention. It observes soil, climate, dehydration conditions and plant water consumption and automated adjustment of the water schedule. Irrespective of human presence the plant survives on its own. Therefore, smart water planting system has become a major concern so that a smart device can be given to the owner who can maintain productivity of plants.

## 3.4 BLOCK DIAGRAM

**CROP FIELD SECTION:**




**POWER SUPPLY:**




## WORKING PRINCIPLE OF THE CIRCUIT

1.The objective of the my project is implement an automatic irrigation system by sensing the moisture of soil or sand. The working of the above circuit is follows.

2.Soil moisture sensor is inserted in the soil. Depending on the quality of the sensor, it must be inserted near the roots of the plant. The soil moisture sensor measures the conductivity of the soil.

3.Wet soil will more conductive than dry soil. The soil moisture sensor module has a comparator in it.

4. The voltage from the prongs and the predefined voltage are compared and the output of the comparator is high only when the soil condition is dry.

5. The output from the soil moisture sensor is given to the analogue input of the microcontroller.

6.When the moisture in the sand or soil is above the set point, the microcontroller displays a Message telling the same and the motor is off.

7.When the output from the soil moisture sensor is high the moisture of the soil is less. This will trigger the microcontroller and displays an appropriate message on the LCD and the output of the microcontroller, which is connected to the base of transistor id high.

8.When the transistor is turned on, the relay coil gets energized and turns on the motor. The LED is also turned on and acts as an indicator.

9.When the moisture of the soil or sand or etc. reaches the threshold value the output of the soil moisture sensor is low and the motor is turned off.

## 3.5 LIMITATIONS

Here are some potential limitations for automatic soil irrigation moisture content control:

1. Sensor accuracy: Inaccurate sensor readings can lead to over or under irrigation.

2. Soil variability: Different soil types and structures can affect sensor readings and irrigation needs.

3. Root depth: Sensors may not accurately represent moisture levels at root depth.

4. Weather extremes: Heavy rainfall or droughts can overwhelm the system.

5. Power outages: System failure during power outages can lead to overwatering or underwatering.

6. Maintenance: Sensor calibration, cleaning, and replacement require regular maintenance.

7. Cost: Initial investment in sensors, controllers, and irrigation infrastructure can be high.

8. Limited adjustability: Inflexibility in adjusting irrigation schedules based on changing weather patterns.

9. Soil salinization: Overirrigation can lead to soil salinization, reducing soil fertility.

10. Data interpretation: Requires expertise to interpret sensor data and adjust irrigation schedules accordingly.

These limitations highlight the need for careful system design, installation, and maintenance to ensure effective and efficient automatic soil irrigation moisture content control.

## 3.6 ADVANTAGES

Automatic soil irrigation moisture content control has several advantages, including:

1.Optimized water usage: The system ensures that the soil receives the right amount of water, reducing waste and conserving this valuable resource.

2. Improved crop health: By maintaining optimal soil moisture levels, crops receive the necessary water for healthy growth, reducing stress and disease.

3. Increased yields: Automatic irrigation control can lead to increased crop yields and better fruit quality.

4. Reduced labor costs: Automation eliminates the need for manual monitoring and irrigation, freeing up labor for other tasks.

5. Enhanced soil fertility: The system prevents overwatering, which can lead to soil erosion and nutrient depletion.

6. Real-time monitoring: Many systems come equipped with sensors and monitoring software, providing real-time insights into soil moisture levels and irrigation performance.

7. Customizable: Automatic irrigation control systems can be tailored to specific crop needs and soil types.

8. Water conservation: By optimizing irrigation, the system helps reduce water consumption, which is especially important in areas with water scarcity.

9. Reduced energy consumption: Automatic control systems can optimize energy use by only pumping water when needed.

10. Environmental benefits: By reducing water waste and preventing soil erosion, automatic irrigation control contributes to a more sustainable and environmentally friendly farming practice.

By leveraging these advantages, farmers and gardeners can create a more efficient and sustainable irrigation system that benefits both their crops and the environment.

## 3.6 DISADVANTAGES

While automatic soil irrigation moisture content control offers many benefits, there are also some potential disadvantages to consider:

1. High initial investment: Installing an automatic irrigation control system can be expensive, especially for large-scale farming operations.

2. Complexity: The system requires sensors, software, and hardware, which can be complex to install, calibrate, and maintain.

3. Sensor accuracy: Soil moisture sensors may not always provide accurate readings, which can lead to overwatering or underwatering.

4. Power outages: Automatic systems rely on electricity, which can be disrupted by power outages, affecting irrigation schedules.

5. Maintenance requirements: The system requires regular maintenance to ensure proper function, which can add to labor costs.

6. Limited flexibility: Automatic systems may not be able to adapt to sudden changes in weather or soil conditions.

7. Dependence on technology: Over-reliance on automation can lead to decreased human observation and understanding of soil conditions.

8. Potential for overwatering: If the system malfunctions or is incorrectly calibrated, it can lead to overwatering, wasting water and potentially harming crops.

9. Limited compatibility: Some systems may not be compatible with all types of soil, crops, or irrigation systems.

10. Data security: Connected systems may pose cybersecurity risks, potentially compromising sensitive farm data.

It's essential to weigh these disadvantages against the benefits and consider factors like farm size, crop type, and resources when deciding whether to implement an automatic soil irrigation moisture content control system.

# 4.IMPLEMENTATION

## 4.1 HARDWARE COMPONENTS

1. Microcontroller (AT89S52)
2. LCD Display(16x2 LINES)
3. Soil Moisture Sensor
4. Relay
5. Pumping Motor

## 4.2 SOFTWARE COMPONENTS

1. Keil uvision
2. Express PCB
3. ISP

## 4.3 CODE

```
#include <LiquidCrystal.h>
#include <stdio.h>
```

```
LiquidCrystal lcd(6, 7, 5, 4, 3, 2);



int mos    = 8; int
lvl1   = 10; int
lvl2   = 11; int
pump   = 9; int
buzzer = 13;



int tempc=0;

int hbtc=0,hbtc1=0,rtrl=0,rtr2=0; int
temps=0,hums=0,alcs=0,eyes=0,buttons=0;

 unsigned char rcv,count,gchr='x',gchr1='x',robos='s';

 char rcvmsg[10],pastnumber[11];

 char gpsval[50]; // char
dataread[100] = "";
// char lt[15],ln[15];

int i=0,k=0,lop=0;
int   gps_status=0;
float latitude=0;
float logitude=0;
String Speed="";
```

```
String gpsString=""; char
*test="$GPRMC";


//int hbtc=0,hbtc1=0,rtrl=0;

unsigned char gv=0,msg1[10],msg2[11];
float lati=0,longi=0; unsigned int
lati1=0,longi1=0; unsigned char
flat[5],flong[5]; unsigned char
finallat[8],finallong[9];


 int ii=0,rchkr=0;



String inputString = "";         // a string to hold incoming data boolean
stringComplete = false;  // whether the string is complete void
okcheck()
{
  unsigned char rcr;
do{      rcr =
Serial.read();
   }while(rcr == 'K');
}
```

```
 void sound()
 {
  digitalWrite(buzzer,LOW);delay(1500);digitalWrite(buzzer,HIGH);
 }

void setup()
{
 Serial.begin(9600);//serialEvent();


  lcd.begin(16, 2);lcd.cursor();
lcd.print("  Aut  Irrigation");
lcd.setCursor(0,1);
lcd.print("    Soil  Moisture");
delay(1500);

    lcd.clear();
lcd.setCursor(0,0);
lcd.print("Mos:");    //4,0
lcd.setCursor(0,1);
lcd.print("Lvl:");    //4,1
}

int lvlv=0; void
loop()
{
  if(digitalRead(mos) == LOW)
```

```
   {
     lcd.setCursor(4,0);lcd.print("Wet ");
   }
  if(digitalRead(mos) == HIGH)
   {
     lcd.setCursor(4,0);lcd.print("Dry ");
   }

  if(digitalRead(lvl1) == HIGH && digitalRead(lvl2) == HIGH)
   {
     lcd.setCursor(4,1);lcd.print("Empty ");
lvlv=0;
   }
  if(digitalRead(lvl1) == LOW && digitalRead(lvl2) == HIGH)
   {
     lcd.setCursor(4,1);lcd.print("-1    ");
     lvlv=1;
   }
  if(digitalRead(lvl1) == LOW && digitalRead(lvl2) == LOW)
   {
     lcd.setCursor(4,1);lcd.print("Full  ");
lvlv=2;
   }

  if(digitalRead(mos) == HIGH || (lvlv >= 0 && lvlv <= 1))
   {
     digitalWrite(pump, HIGH);
```

```
   }
else
   {
     digitalWrite(pump, LOW);
   }
delay(100);
}
```


# 5.TESTING AND DEBUGGING/RESULT

Testing and debugging are crucial steps in ensuring the effectiveness and reliability of automatic soil irrigation moisture content control systems. Here are some aspects to consider:

**Testing:**

1. Sensor calibration: Verify that soil moisture sensors are accurately calibrated and providing reliable data.
2. System integration: Test the integration of sensors, controllers, and irrigation systems to ensure seamless communication.
3. Irrigation scheduling: Validate that the system is irrigating according to the scheduled plan and adjusting for weather and soil conditions.
4. Moisture level monitoring: Monitor soil moisture levels to ensure they are within the desired range.
5. Fault detection: Test the system's ability to detect and respond to faults, such as sensor malfunctions or irrigation system failures.

**Debugging:**

1. Data analysis: Analyze data from sensors and controllers to identify trends, anomalies, and potential issues.
2. System logs: Review system logs to diagnose issues and troubleshoot problems.
3. On-site inspections: Perform physical inspections of the system to identify any issues or malfunctions.

**Results:**

1. Optimized irrigation: The system optimizes irrigation schedules, reducing water waste and ensuring crops receive the right amount of water.
2. Improved crop yields: Crops benefit from optimal soil moisture levels, leading to improved yields and quality.
3. Water conservation: The system reduces water consumption, minimizing the environmental impact of irrigation.
4. Reduced labor costs: Automation minimizes the need for manual monitoring and irrigation, freeing up labor for other tasks.
5. Real-time monitoring: The system provides real-time insights into soil moisture levels and irrigation performance, enabling data-driven decisions.

6. Increased efficiency: The system streamlines irrigation management, reducing the complexity and time required for irrigation decisions.

7. Enhanced decision-making: The system provides valuable data and insights, enabling farmers and gardeners to make informed decisions about irrigation and crop management.

By thoroughly testing and debugging the automatic soil irrigation moisture content control system, users can ensure it operates effectively and efficiently, leading to improved crop yields, water conservation, and reduced labor costs.

## 5.1 FUTURE ENHANCEMENT

Here are some potential future enhancements for automatic soil irrigation moisture content control:

1. Artificial Intelligence (AI) Integration: AI algorithms can analyze soil data, weather forecasts, and crop requirements to optimize irrigation schedules.

2. IoT (Internet of Things) Connectivity: Integration with IoT devices enables real-time monitoring and control of irrigation systems remotely.

3. Advanced Sensor Technologies: New sensor types, such as hyperspectral sensors, can provide more accurate and detailed soil moisture data.

5. Big Data Analytics: Large-scale data analysis can identify trends and patterns to improve irrigation efficiency.

6. Cloud-Based Services: Cloud-based platforms can provide secure data storage, analysis, and access to irrigation data.

7. Integration with Other Farming Systems: Integration with precision agriculture systems, farm management software, and other farming technologies.

8. Advanced Water Saving Technologies: Integration with technologies like drip irrigation and precision sprinklers to minimize water waste.

9. Soil Type and Crop Specific Algorithms: Development of algorithms tailored to specific soil types and crop requirements.

10. Energy Harvesting: Using renewable energy sources, like solar or wind power, to power irrigation systems.

11. Real-time Weather Integration: Integration with real-time weather data to adjust irrigation schedules accordingly.

12. Automated Maintenance Scheduling: Systems that can detect potential issues and schedule maintenance automatically.

13. Multi-Factor Decision Making: Systems that consider multiple factors like soil moisture, temperature, and crop stress to make irrigation decisions.

14. Open-Source Platforms: Open-source platforms that allow developers to create custom applications and integrations.

15. Edge Computing: Processing data closer to the source, reducing latency and improving real-time decision-making.

These enhancements will continue to improve the efficiency, accuracy, and sustainability automatic soil irrigation moisture content control systems.

## 5.2 APPLICATIONS

Automatic soil irrigation moisture content control has numerous applications across various industries:

1.Agriculture: Optimizes crop yields, reduces water consumption, and enhances farm efficiency.

2. Greenhouses: Precise control of soil moisture ensures optimal growing conditions for plants.

3. Landscaping and Turf Management: Automatically irrigates lawns, golf courses, and parks, reducing water waste.

4. Gardening: Helps home gardeners optimize watering schedules for their plants.

5. Nurseries: Ensures optimal soil moisture for young plants and trees.

6. Research and Development: Scientists use automatic irrigation control to study soil-plantwater relationships.

7. Environmental Monitoring: Helps monitor soil moisture in wetlands, forests, and other ecosystems.

8. Erosion Control: Prevents soil erosion by maintaining optimal soil moisture.

9. Water Conservation: Reduces water waste and minimizes the environmental impact of irrigation.

10. Precision Agriculture: Integrates with precision agriculture technologies to optimize crop management.

11. Orchards: Optimizes soil moisture for fruit and nut trees.

12. Vineyards: Precise irrigation control for grapevines.

13. Sports Turf: Automatically irrigates sports fields, ensuring optimal playing conditions.

14. Public Spaces: Irrigates parks, gardens, and other public areas efficiently.

15. Hydroponics: Controls soil moisture in hydroponic systems.

By applying automatic soil irrigation moisture content control, these industries can improve water efficiency, reduce labor costs, and enhance crop yields and quality.

# 6.CONCLUSION

The main objective of this project is to improve an automatic irrigation system using the soil moisture sensor so saving water and saving money and time of farmers. It is to benefit from the most efficient and use by taking advantage of the presentation of technology to us. The use of these irrigation systems and control devices or centralized control aids in the optimum water management. Traditional and commonly used farm land irrigation techniques to require manual intervention. With soil moisture automatic irrigation technology human intervention can be minimized. Automatic soil irrigation based on moisture content control is an essential technique for efficient water use in agriculture. the automatic soil irrigation system based on moisture content control has proven to be an effective and efficient way to manage soil moisture levels. By using sensors to monitor soil moisture and automatically irrigating when levels fall below a certain threshold, we have been able to Improve crop yields and quality, Reduce water consumption and minimize waste ,Enhance soil health and fertility ,Decrease labor costs and time spent on manual irrigation, Provide real-time monitoring and data analysis for informed decision-making This system has the potential to revolutionize agriculture and horticulture practices, especially in areas where water resources are limited. Future developments could include integrating weather data, soil type, and crop specific requirements to further optimize the system. Overall, our project demonstrates the potential of technology to improve sustainability and productivity in agriculture."

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