A Project Report

On

'SMART SOIL IRRIGATION SYSTEM'

Submitted to the Department of

Electronics and Communication Engineering.

By

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KEC-554

B. tech 3rd year (odd semester)

Section: 3(A)

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ABSTRACT

The agriculture is one of the most fundamental resources of food production and plays a vital role in keeping the economy running of every nation by contributing to the Gross Domestic Production. But there are several issues related to traditional methods of agriculture such as excessive wastage of water during irrigation of field, dependency on nonrenewable power source, time, money, human resource etc. Water irrigation remains the biggest water usage globally and creates a lot of water wastage. With the advancement of technologies nowadays, several strategies are developed in order to minimize the negative impacts on the environment. Using renewable resources and IoT technology, it can generate a sustainable and responsible conservation system over time. This project aims to provide an IoT solution in automating the watering process using an Arduino-based microcontroller and sensors. It is an energy efficient and eco-friendly system. The watering process is driven by the moisture content of the soil using sensors. Threshold limit are set for soil moisture sensor to ensure efficient and effective use of water resource. The main microcontroller unit controls the system whenever the sensor is across threshold value. Also, the system has built-in temperature and humidity sensors to monitor the climate condition on the specific environment. The irrigation at remote location from home will become easy and more comfortable. In addition, it will not only protect the farmer from scorching heat & severe cold but also save their time for to and from journey to the field.

INTRODUCTION

Over the years, several development and innovation have come across to further minimize the rapid depleting of natural resources in the environment. Necessities such as food and water have an integral part of everyday lives on Earth. Water plays a significant role in the environment. Globally, 70% of water come from natural resources such as groundwater systems, lakes and rivers to support crop irrigations and feeding of livestock. With the irrigation systems, it is important to maximize plant productivity, efficient energy consumption and reduce water wastage. Several approaches have been done by the researchers on how to improve the irrigation systems. Agriculture is the backbone of all countries. It uses 85% of available freshwater resources worldwide and this percentage continues to be dominant in water consumption because of population growth and increased food demand. Due to this efficient water management is the major concern in many cropping systems in arid and semi-arid areas.

By improving the irrigation efficiency in agricultural sector, this industry become more competitive and sustainable. Also, in dry areas, where there is no sufficient rainfall, proper irrigation is not possible. Hence by using this irrigation system by monitoring the moisture content of soil we can analyze the water requirements necessary for the field. To save effort of farmers, the important considerations are water and time. In present condition, they need to wait until field is fully irrigated. This restricts them to do other activities. This idea is not only meant for farmers but also for household watering of the plants. In our present era, the farmers are irrigating their crops at regular interval of time. The traditional techniques they use consumes more water by creating water logging and results in wastage of water. This system that we designed will eliminate the stress of manual labor. Utilizing IoT technology on this era of evolving technology is a comprehensive approach in different types of applications including the irrigation methods.

OBJECTIVE & SCOPE

The main objective of this project is to create a device that can monitor the moisture content of the soil using Arduino microcontroller based upon which we can irrigate our crops and plants and can minimize the wastage of water.

Main objective of this project can be state as:

- Create a plant communicator device based on Arduino, Moisture, Temperature and light sensor
- Use Arduino IDE for coding in Arduino device and various dependencies.
- Proper research for Arduino device and its circuit.
- Proper circuit design for the project.
- Proper testing and debugging of the device configuration.

Scope, the performance of the system can be further improved in term of the operating speed, memory capacity and instruction cycle period of the microcontroller by using another high-end controller. The number of channels can be increased to interface a greater number of sensors which is possible by using advanced versions of controllers.

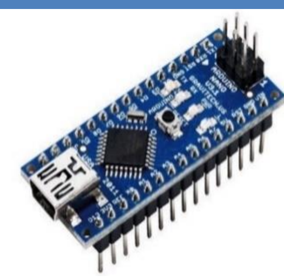
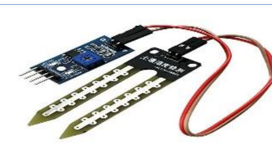
The system can be modified with the use of a data logger and a graphical LCD panel or using Things Speak API to show the measured sensor data over a period. This device can be made to perform better by providing the power supply with the help of renewable sources. Time bound administration of fertilizer, insecticides and pesticides can be introduced. A water meter can be installed to estimate the amount of water used for irrigation and thus giving a cost estimation and a solenoid valve can be used for varying then volume of water flow.

NEED OF THE PROJECT

- 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.
- **Modern Agriculture:** 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.
- **Save Money by Reducing Water Waste**: Most homeowners who use smart irrigation find that they can save up to 50% more water. This means you can cut that conventional water bill in half.
- **Increase Your Landscapes Health:** The number one cause of landscape loss is due to overwatering, not underwatering. This means by making the switch to smart irrigation, your landscape might in fact benefit. Smart irrigation systems can be adjusted to water your plants just the right amount. This green technology considers the soil type and is able to switch between cycles, soaking your yard in the perfect amount of time, and allowing water to be absorbed instead of running off.
- **Prepares You for The Future of Water:** Using a smart irrigation system will help you get ahead of the water cost curve and essentially help the planet by conserving its precious water.

TOOLS AND TECHNOLOGIES

➢ Hardware Requirements

Sr No.	Component Name:	Component Specifications:	Application in project:	
1.	Microcontroller	Arduino Nano ATMEGA 328P	Empowers system designed to optimize the device for power consumption versus processing speed. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in a single instruction executed in one clock cycle. The resulting architecture is more code efficient	
2.	Soil Moisture sensor	3.3-5v	This sensor can be used to test the moisture of soil.	
3	Nodemcu (Wi-Fi module)	ESP8266	Use to transfer the data to cloud network through WI-FI so it can be accessible from anywhere	
4.	Relay	---	Relays are electrically operated switches that open and close the circuits by receiving electrical signals from outside sources. They receive an electrical signal from Arduino and send the signal to water pump by turning the switch on and off.	

5.	Lcd display module	2*16	Use to display data collected by soil moisture sensor.	
6.	DC Buck Converter	3.3 V-5V	Use to convert 5v dc vol to 3.3v dc vol for function of each device.	
7.	Water pump	R385 6-12V DC Diaphragm Based Mini Aquarium Water Pump	Water pump used to supply the water up to 1-2 liters/min.it is turned on by relay when inputted by Arduino board	

Other hardware requirements:

- Resisters
- LEDs
- Transistors
- Jumper wires and probs

➢ Software Requirements

Arduino IDE: Arduino IDE platform is used for coding purpose; the microcontroller is feed by the predefined code which then command the Nodemcu to start operating by switching On and Off the water pumps by comparing the moisture content of the soil and cutoff value.

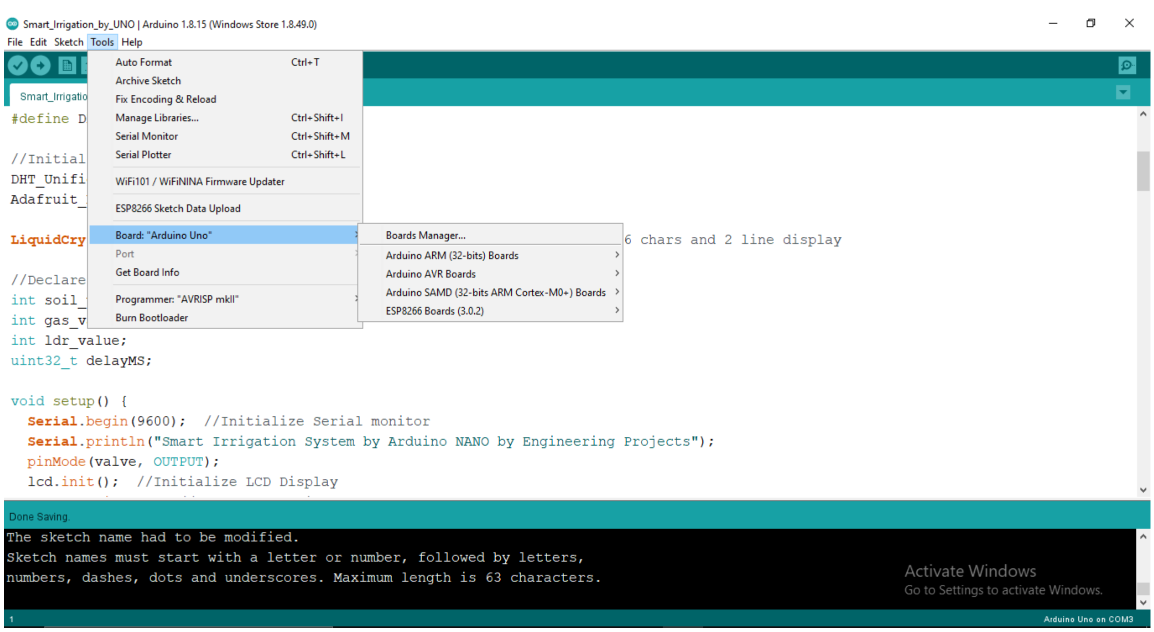


Figure 1: Arduino IDE

SYSTEM ARCHTITECTURE

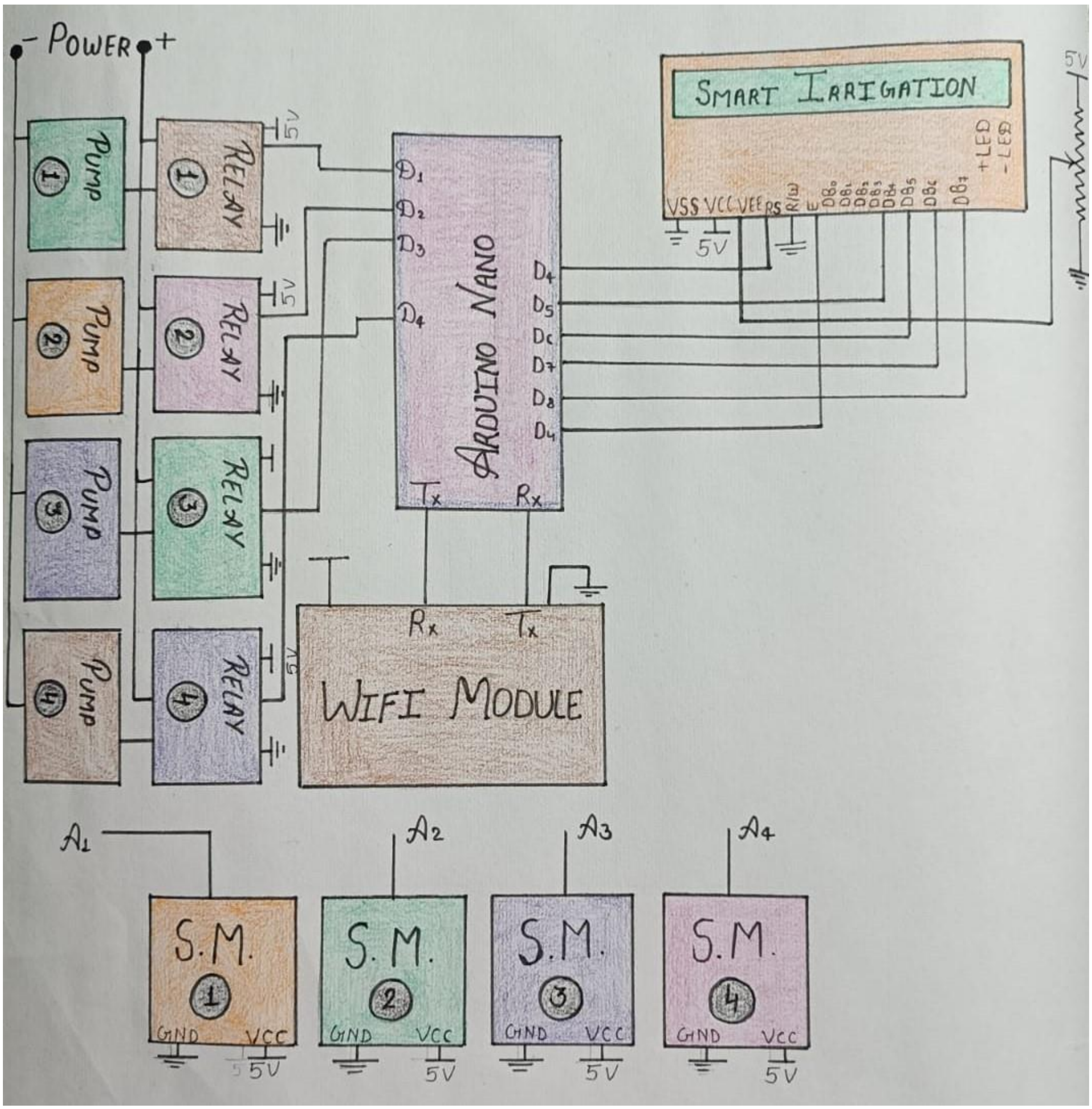


Figure 2: Architecture of Smart Irrigation System

METHODOLOGY

- As the system starts, the microcontroller initiates the Nodemcu to power ON the humidity sensor, the water level and soil moisture sensor to read all the sensor values and the readings are then shown on the LCD display.
- If the measured sensor values are less than the threshold value, then the microcontroller initiates the relay which in turn powers ON the water pumps.
- As the measured values becomes greater than or equal to the threshold value the relays are made to disconnect which in turn power OFF the water pumps.

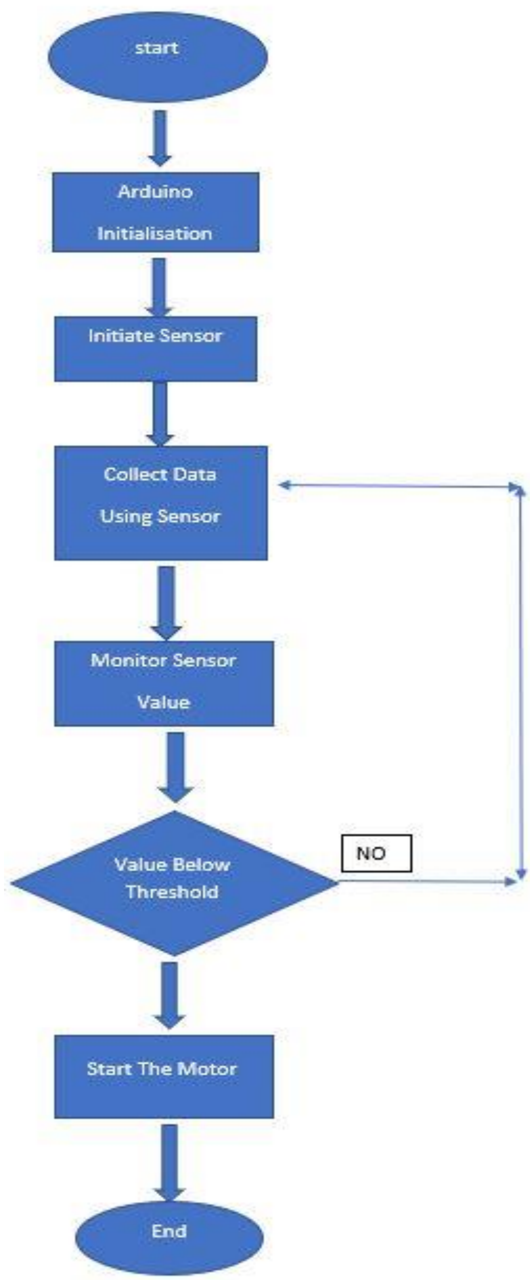


Figure 3: Flow Chart of Smart Irrigation System

COST ANALYSIS

S. No.	Hardware Components	Specification	Quantity	Cost (in Rs)
01	Microcontroller	Arduino Nano	01	600
02	Soil Moisture sensor	3.3-5V	04	150
03	Nodemcu	ESP8266	01	400
04	Relays	-	04	50
05	LCD display	2*16 display	01	50
06	DC Buck Converter	3.3-5V	04	50
07	Water Pump	R385 6-12V DC	04	100
08	Others	Resistors, transistors, Capacitors, LEDs, Jumper Wire	-	50

REFERENCES

[1] Cardenas-Lailhacar, B., M. D. Dukes, and G. L. Miller. 2008. Sensor-based automation of irrigation on bermudagrass, during wet weather conditions. *Journal of Irrigation and Drainage Engineering*. 134(2): 120-128.

[2] Cardenas-Lailhacar, B. and M. D. Dukes. 2008. Expanding disk rain sensor performance and potential savings. *Journal of Irrigation and Drainage Engineering*. 134(1):67-73.

[3] Cardenas-Lailhacar, B., M. D. Dukes, and G. L. Miller. 2010. Sensor-based automation of irrigation on bermudagrass, during dry weather conditions. *Journal of Irrigation and Drainage Engineering*. 136(3): 184-193.

[4] Davis, S. L., M. D. Dukes, and G. L. Miller. 2009. Landscape irrigation by evapotranspiration-based controllers under dry conditions in southwest Florida. *Agriculture Water Mgmt*. 96(12): 1828-1836.

[5] Devitt, D. A., K. Carstensen, and R. L. Morris. 2008. Residential water savings associated with satellite-based ET irrigation controllers. *Journal of Irrigation and Drainage Engineering*. 134(1): 74-82.

Appendix 1

Source Code:

```
#include <Servo.h>                    // servo library

Servo myservo;

int m=0;

int n=0;

int pos = 0;

void setup()

 {

  // put your setup code here, to run once:

pinMode(A0, INPUT_PULLUP);         // Soil Moisture Sensor 1 PIN A0

pinMode(A1, INPUT_PULLUP);         // Soil Moisture Sensor 1 PIN A1

pinMode(8,OUTPUT);                   // Relay Module PIN D8

Serial.begin(9600);                  //  Sensor Baud Rate

myservo.attach(9);                    //  Servo PIN D9

digitalWrite(8, HIGH);              // Relay Normally Hight for OFF condition

}

void loop()

{

// put your main code here, to run repeatedly:

int m= analogRead(A0);               // Soil Moisture Sensor 1 PIN A0

int n= analogRead(A1);                // Soil Moisture Sensor 1 PIN A1

Serial.println(m);

delay(10);
```

```
Serial.println(n);
delay(200);
if (m>=980)
{
 myservo.write(90);                    // tell servo to go to position in variable 'pos'
 digitalWrite(8, LOW);                 // Relay ON
  delay(1000);
  }
else if(m<=970)
{
 digitalWrite(8, HIGH);                  // Relay ON
 }
if (n>=980)
{
myservo.write(0);                      // tell servo to go to position in variable 'pos'
digitalWrite(8, LOW);                  // Relay ON
 delay(1000);
 }
else if(n<=970){
digitalWrite(8, HIGH);                 // Relay OFF
  }
else{
digitalWrite(8, HIGH);               // Relay OFF
  }
}
```