Smart Irrigation System; Water Resource Management

Group Members

Mohammed Saad Khan	**2019250**
Husnain Ali	**2019178**
Malik Munib	**2019225**

Faculty of Computer Sciences and Engineering

Ghulam Ishaq Khan Institute of Engineering Sciences and Technology

2023

TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

The objective of this project is to develop and install smart irrigation systems that reduce water consumption, fertilizer use, and significantly increase crop yields through water efficiency. The project uses an Arduino microcontroller, GSM900a, soil moisture sensor, DHT22, rainwater sensor, buck converter, and a mechanical assembly that supports a 1/2- inch ball valve driven by a 25 kg RC servomotor to deliver irrigation water work in a efficient manner cutting down the water wastage, use of excess fertilizer and improving crop yield..

To determine the amount of water required at any given time for irrigation, the system must be able to measure accurate real-time data on soil moisture, temperature, and humidity. This consists of a soil moisture sensor, a DHT22, and a rainfall sensor.

To monitor the moisture content, temperature, and humidity of the air, respectively, the system uses a soil moisture sensor and a DHT22 sensor. The system decides whether to start the watering procedure based on the readings. A raindrop sensor is also included to detect rain so that irrigation can be adjusted appropriately.

In addition, the system features a GSM900a module that remotely transmits the real-time data collected by sensors to Thingspeak, an IOT analytics platform that allows users to view data in the cloud.

ACKNOWLEDGEMENTS

In our work, we had the support of Dr. Farhan Khan, Assistant Professor, Faculty of Computer Science and Engineering, Ghulam Ishaq Khan Institute of Engineering Sciences and Technology. We would like to express our gratitude to Dr. Farhan for his valuable suggestions, inspiration, and support in our project. His expertise, suggestions, and constructive criticism were important in the direction and selection of our project. He was excellent and willing to go above and beyond his responsibilities as a supervisor because of his patient, dedicated nature. We consider ourselves fortunate to have the opportunity to work under his guidance and are confident that the knowledge and skills gained will assist us in our many future goals.

The technicians at FME helped install the project hardware and provided their invaluable guidance that helped us achieve successful implementation of the project.

We would also like to extend our heartfelt gratitude to Dr. Dur-e-Zehra Baig Assistant Professor Faculty of Electrical Engineering at Ghulam Ishaq Khan Institute for her mentorship in solving the problems encountered in electric circuit design e.g., power distribution for the components, sensor interfacing and testing of hardware.

Chapter No. 1

Introduction

Millions of people throughout the world depend on the agriculture industry for their livelihood. Technology advancements have had a significant impact on the agricultural industry since they have boosted crop yields, reduced prices, and enhanced efficiency. Irrigation systems are one area where technology has advanced significantly. Traditional irrigation methods can reduce soil fertility and are ineffective and costly. Our team created a smart irrigation system that automates watering while retaining soil fertility and minimizing the use of excessive fertilizer to address these problems.

The smart irrigation system keeps track of the soil moisture levels and adjusts the watering procedure as necessary using a combination of sensors, microcontrollers, and communication technologies. Data is gathered by the system from a soil moisture sensor, a rain sensor, and a DHT22 temperature and humidity sensor using an Arduino microcontroller. The GSM900a connection module on the microcontroller then communicates this data to Thingspeak, a cloud-based platform. The watering procedure is efficiently automated since the device steps down the power from 12 volts to 5 volts using a buck converter.

The main advantage of smart irrigation systems is their ability to change valve opening depending on the amount of soil moisture required. By doing so, you can ensure crops receive the right amount of water, reduce waste, increase agricultural productivity, and keep water costs down. The approach, too It reduces the need for fertilizer, which can damage the earth's crops.

The system is perfect for farmers of all sizes due to its ease of installation and use. Communication module with the microcontroller. The irrigation system and sensors are embedded in the soil. The power supply of the system is a 12V DC unit which is converted to 5V DC by a buck converter. Once the system is installed, the farmer can monitor soil temperature, humidity and humidity using a computer or smartphone.

In general, smart irrigation technology can dramatically change the agricultural industry. Technology can improve agricultural production, reduce water and fertilizer costs, maintain soil fertility through automated irrigation, and monitor soil moisture so the system can be easily modified and scaled to meet the needs of farms of different sizes. A unique innovation, smart irrigation has the potential to dramatically increase agricultural productivity and sustainability, potentially fundamentally changing the way we grow our food.

Chapter No. 2

Literature Survey

Smart irrigation systems are becoming yields, singly popular as a way to reduce fertilizer use, increase crop yields and conserve water. These systems use sensors to monitor soil moisture levels, weather conditions and other characteristics so that irrigation systems can be automatically changed to meet crop needs. One example of smart irrigation is the project described by Rana et al. (2019) no. This project uses soil moisture sensors, temperature and humidity sensors and a microcontroller to automate irrigation for agriculture The system is designed in such a way that it becomes economical and relatively easy to they will be installed initially and can be managed through a smartphone app. The system has a function that alerts the user to problems associated with irrigation. Wang et al. (2020) have used a similar sensor-based approach for automation. Irrigation systems. The project uses soil moisture sensors, temperature, and humidity sensors. Adjust the irrigation schedule. The system also includes a smartphone app to remotely control and monitor data and a data analytics feature to help users simplify water management. The work of Das et al (2018) is the third example of smart irrigation provision. This project uses soil moisture sensors, temperature and humidity sensors and a raspberry pi to automate the water processing. The system is designed to be inexpensive and easy to configure and configure, and also provides a web-based interface that allows the user to remotely monitor and manage irrigation systems While there are many similarities between projects, there are also some differences based on products and processes.

The work of Rana et al. (2019) has developed a rainfall sensor to detect rainfall and adjust irrigation systems, in contrast to Wang et al. (2020) and Das et al. (2018) (2018) no. A flow sensor is also included in Wang et al. (2020) developed a project to measure water consumption, while the other two projects do not. Another unique feature of these projects is the use of a microcontroller. Rana and so on. (2019) use an Arduino in their work, but Das et al. (2018) and Wang et al. (2020) using a Raspberry Pi microcontroller. Since both types of microcontrollers have advantages and disadvantages, the choice will depend on the specific requirements of the user.

Chapter No. 3

Design (System Requirements/Specifications)

In order to successfully design and implement the smart irrigation system that aims to optimize water flow for better natural resource utilization and reduced water and fertilizer consumption, the following components are essential system requirements:

1. Hardware:

The system must include a microcontroller to which the soil moisture sensor, DHT22, rain drop sensor must be interfaced. There also has to be a mechanism for wireless transmission of real time sensor data. For this purpose, we have used GSM sim900A to send weather data on Thingspeak. Other system requirements include servo motor and ball valve clamped on metal plate, power supply and jumper wires.

In addition to these initiatives, there are several other examples of automated irrigation systems that use sensors. By integrating soil moisture sensors, a microcontroller, and a smartphone app for remote monitoring and control, the idea proposed by Patil et al. (2021) automates irrigation. Similar techniques are used in the work by Abid et al. (2020), but the pH sensor is also used to monitor the acidity of the soil.

Smart irrigation systems that automate watering through the use of sensors are generally gaining popularity. These technologies may significantly reduce the need for fertilizers, agricultural output, and water consumption.

While many projects share strategies and methodologies with one another, there are also many differences in the specific features and technologies.

used. The choice of irrigation system will depend on the size of the farm, the crops being grown, and the technology and resources available.

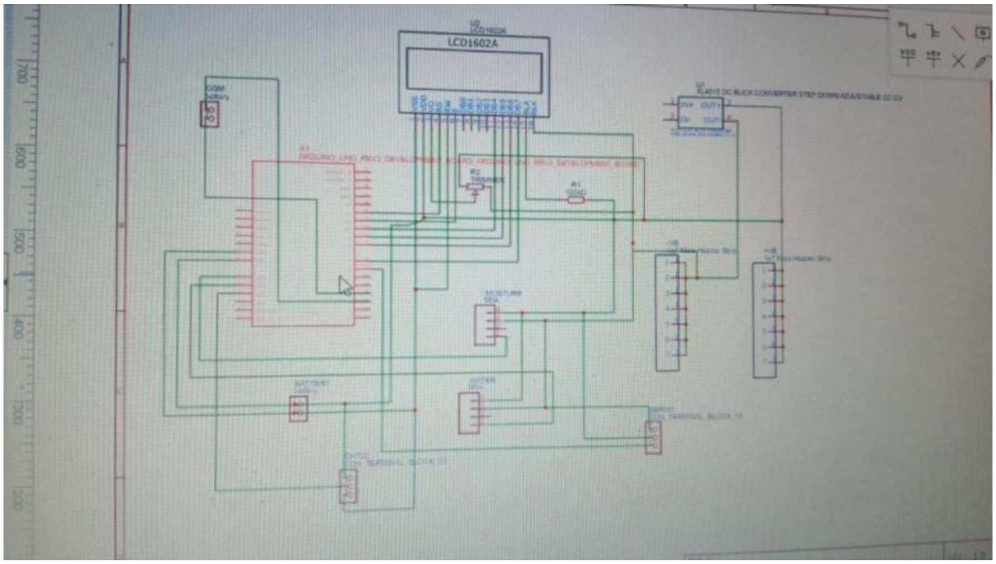
In contrast to Khan (2020)'s idea, which utilizes a pH sensor in addition to the soil moisture sensor, our method includes a rain drop sensor and a DHT22 sensor to monitor humidity and temperature in the air, which can help determine the best time for irrigation.

Second, although Das et al.'s (2018) approach employs a Raspberry Pi to complete the same task, our solution uses an Arduino microcontroller to receive input from the sensors and regulate the valve opening.

Thirdly, unlike the Internet of Things (IoT)-based projects discussed by Wang et al. (2020) and Patil et al. (2021), which connect to the internet using Wi-Fi and Bluetooth, respectively, our project sends data to the cloud using GSM900a.

Finally, we have included a buck converter that steps down 12V to 5V which is helpful for reducing energy consumption.

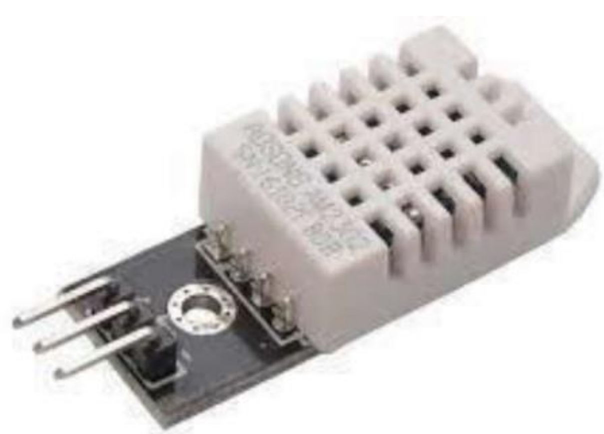
Overall, despite similarities to other projects in the literature survey, our smart irrigation system project stands out from the competition due to a unique combination of sensors, microcontroller, connectivity, and power management.



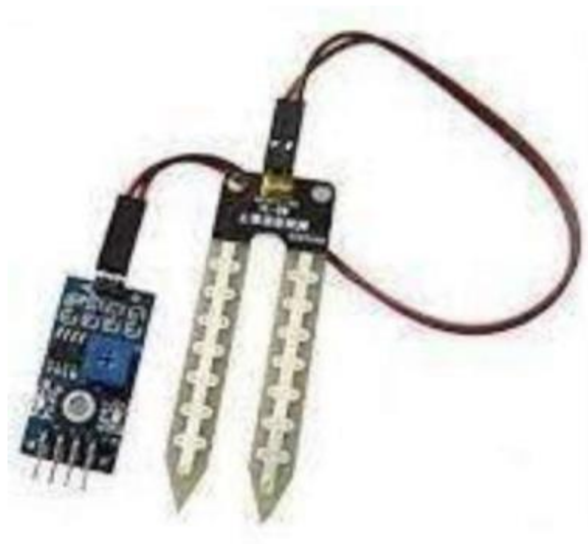
Circuit Diagram Fig 3.1

2. Sensors:

The soil moisture sensor, rain drop sensor and DHT22 must be interfaced with Arduino and be able to send accurate real time data with as little delay as possible.



DHT 22 Fig 3.2



Soil Moisture Sensor Fig 3.3

3. Connectivity:

The GSM sim900A has to be able to provide a reliable connection to the internet to allow transmission of sensor data so that the valve can be automated to open in stages to control water flow accordingly.

GSM 900A Fig 3.4

4. Power Management:

Having the right power distribution for all the components in the system is crucial to this project's successful practical implementation. It ensures that all the components get the required power input to work. The power supply used is 12v 5A, which is stepped down using buck converter to 5v 5A to power all the components. Power loss has to be minimized.

Buck Converter Fig 3.5

5. User interface:

An IOT analytics interface must be used that can display the sensor data so that it can then be remotely accessed. The interface must be simple and easy to use.

6. Robustness and reliability:

The system must be designed in such a way that it can sustain non-ideal conditions such as humidity, temperature, rainfall for a long period of time for it to be of practical use. The components must not get damaged easily due to environmental conditions.

Chapter No. 4

Proposed Solution (Methodology, Implementation)

The initial step of the smart irrigation system's development is its planning and construction. The project's requirements are analyzed, critical components are determined, and a comprehensive schematic architecture of the system is created during this phase. The design should incorporate an Arduino microcontroller, a soil moisture sensor, a rain sensor, a DHT22 sensor, an RC servo, and a GSM900a.

Once the design has been completed, the appropriate system components must be chosen. This calls for selecting goods of exceptional quality that satisfy the project's requirements. Track humidity, rain, and other weather-related events using reliable soil moisture sensors, rain drop sensors, and DHT22 sensors, for instance.

The circuit design process may begin once all of the system's components have been selected. A buck converter, which reduces voltage from 12V to 5V, should be used to power the microcontroller and other components.

The system's functioning prototype has been built and put through a lot of testing. This is accomplished by mounting the components to a breadboard and programming an Arduino microcontroller to use sensor data to operate an RC servo that opens and shuts the irrigation valve in response to the soil moisture level. The system also has to be tested to make sure it can transfer data to the Thingspeak cloud platform and connect with the GSM900a module.

The system must be designed and integrated once it has undergone functional testing. The components of a printed circuit board (PCB) are linked and encapsulated using this method. The system must be easy to set up and maintain.

The system must then be installed and kept up with. The system has to be installed and tested. To ensure that the system continues to work, it must be made simple to maintain. It should frequently be serviced.

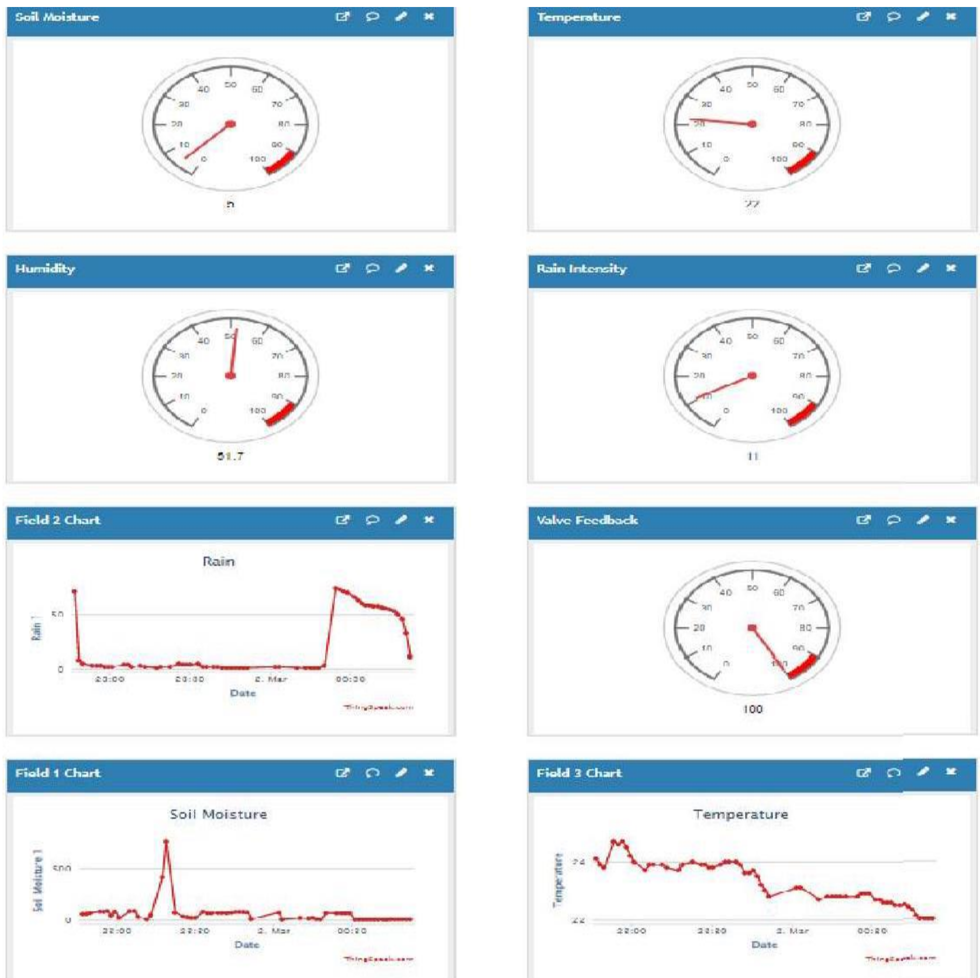
Conclusion:

A farmer may create a smart irrigation system that automates irrigation, maintains soil fertility, and consumes less fertilizer using an Arduino microcontroller, a soil moisture sensor, a rain drop sensor, a DHT22, and a GSM900a. The project process includes planning and design, component selection, circuit design, prototyping and testing, assembly and integration, deployment, and maintenance. This strategy makes it possible to plan, develop, and deploy the system in the most effective and efficient way possible.

Chapter No. 5

Results and Discussion

Results:



Screenshot from Thingspeak Fig 5.1

The displaying of real time data collected from the sensors and the corresponding valve feedback plays a crucial part in this project. It enables the user to remotely monitor the irrigation process and ensure that it is functioning properly. The data displayed visually through graphs and gauges makes it easier for the user to assess the data obtained by the system and draw informed irrigation-related conclusions.

The purpose of valve feedback gauge is to demonstrate how change in environmental factors such as temperature, humidity and soil moisture content corresponds to the proportional opening and closing of the valve. It can also identify any unusual activity related to the valve or any defects.

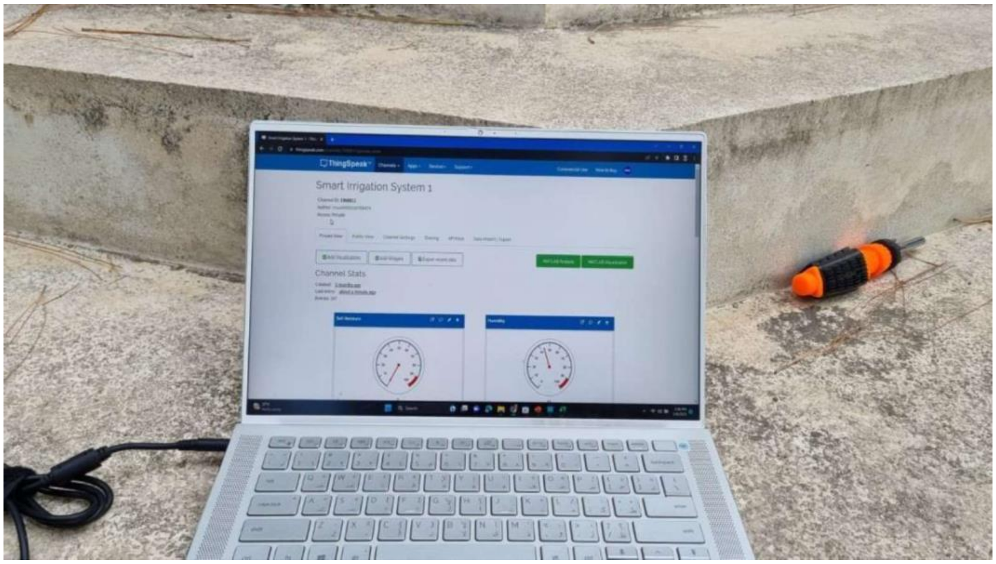
The gauges for the soil moisture, rain, and humidity sensors display changes in real-time data as the various environmental conditions vary from time to time. The gauges can also be used to change the threshold values for the sensors so that the irrigation system is optimal for the current situation. The gauges help to provide a clear and concise visual representation of data collected by the sensors placed on the field making it easier to comprehend and make sense of the data for the user.

Smart Irrigation System deployed on Field Fig 5.2

Valve and the system Fig 5.3

Another important component of the system is the raindrop sensor. When rain is detected, the gadget may suspend irrigation to avoid overwatering the crops during wet conditions.

It is essential to display valve feedback and sensor data as it is an essential component of the smart irrigation system. Using this the user can monitor the system from any location on the globe and make informed decisions about the watering schedules. The graphs and virtual gauges provide visual information about the system behavior and that can be used to make a clear analysis for improving crop yield.



Cloud Data Acquisition Fig 5.4

Discussion:

The smart irrigation system is a crucial and innovative application of technology in the agricultural sector. Automation of irrigation is the major objective of the technique, which will reduce water use and boost agricultural output. In order to maintain soil fertility, it also tries to avoid the use of excessive fertilizers that might harm the crop. The major component of the system is the Arduino microcontroller, which collects data from a number of sensors including the soil moisture sensor, rain drop sensor, and DHT22.

After that, a GSM900a module transfers the data from the microcontroller to the cloud based Thingspeak platform. The platform's data storage and analysis allow farmers to remotely monitor the health of their crops and make informed decisions about fertilization and irrigation.

One of the most important sensors in this system is the soil moisture sensor. The ability of the gadget to monitor the moisture content of the soil enables the microcontroller to open and close irrigation valves in accordance with the needed soil moisture levels. This practice ensures that the crops get the optimum amount of water required for growth, increases crop yield, and enables more efficient utilization of water resources and prevents water wastage.

The temperature and humidity levels which are measured by DHT22 sensor have a significant impact on the amount of water required for irrigation. Farmers may use the sensor data to make informed decisions about when and how often to apply fertilizer to the soil as well as whether or not to irrigate their crops depending on the given sensor data as displayed by gauges and graphs. Optimizing these factors, farmers may optimize crop growth and output, which will boost income and enhance food security and also help to preserve soil fertility and water resources by preventing water wastage.

Another important component of the system is the raindrop sensor. When rain is detected, the gadget may suspend irrigation to avoid overwatering the crops during wet conditions. This feature helps to conserve water and prevent waterlogging, which can damage crops and reduce output. The system's capacity to respond to shifting weather patterns also helps farmers conserve water resources and keep the optimal moisture level in the soil.

A key component of the system is the buck converter, which converts 12 volts to 5 volts. This feature ensures energy efficiency and protects the system's electronic components from damage. By maximizing its use of energy, the system may function sustainably and lessen the environmental impact of agriculture.

Chapter No. 6

Conclusion and Future Work

Conclusion:

This project was created to help the farming community with automatic irrigation solutions. It focuses on preserving soil fertility and reducing the use of artificial fertilizers that may harm the crops. DHT22, rain drop sensor and a soil moisture sensor are used by the Smart Irrigation System to collect data in the Arduino microcontroller which is further used to control water flow using a proportional valve made using RC servo and a ball valve.

The GSM900A module is used to make it simple for the farmers to monitor their crops by looking at the visualized data on Things Speak IoT cloud platform. Farmers can get access to real time data and monitor the moisture content and other crucial data through this platform.

A buck converter is used to reduce the voltage from 12V to 5V to boost the system's energy efficiency. This reduces energy usage while improving system performance.

This project will help reduce fertilizer usage, produce more crops and practice environmentally friendly farming methods.

Future work:

In this section we will explore how this project can be further expanded by other engineers by adding new modules that will make it more useful and add a whole new range of functionality to it. This is discussed briefly below as follows:

1. Expansion of sensor network for disease and pest control:

The hardware of this project can be expanded to incorporate ultrasonic sensor, passive infrared sensor (PIR) interfaced with Arduino microcontroller that can emit and receive IR radiation from nearby objects including pests, insects that can harm the crops. Once a pest is detected by the PIR sensor, a buzzer can be activated that will produce ultrasound waves in the frequency range of 1-5 kHz to 100 kHz to repel the pests. Other techniques such as RGB imaging, thermography, chlorophyll fluorescence can be used for disease detection.

2. Development of a mobile application:

A mobile app can be developed for this project to enhance the ease of accessibility and flexibility that will show real time data of the crops and soil moisture content allowing farmers to remotely access the data at any time from any place using just a mobile device.

3. Integration with precision farming techniques:

Precision irrigation means providing a crop with water and nutrients at the right time in small, measured doses to facilitate optimal growth and better utilization of natural resources. This improves crop yield and efficiency. This module can be incorporated to expand this project further.

4. Testing and optimization in different environments:

This system can be tested on various different environments to check how the system performs in different weather conditions. Farmers can determine how well the system works for different crop types and environmental conditions and identify any areas for improvement.

References

1. Adafruit Industries. (n.d.). DHT22 temperature-humidity sensor + extras. Retrieved from https://www.adafruit.com/product/385

2. Rain sensor module tutorial. (2017, March 13). Retrieved from https://lastminuteengineers.com/rain-sensor-arduino-tutorial/

3. Soil Moisture Sensor. (n.d.). Retrieved from https://www.dfrobot.com/product-1385.html

4. GSM SIM900A mini module. (n.d.). Retrieved from https://www.electronicscomp.com/gsm-sim900a-mini-module

5. Agricultural Sensors Market by Sensor Type (Temperature, Humidity, Light, Soil Moisture, CO2, PH), Application (Precision Farming, Livestock, Aquaculture), and Geography - Global Forecast to 2022. (2017, May). Retrieved from https://www.marketsandmarkets.com/Market-Reports/agricultural-sensors-market-174327554.html

6. Arduino. (n.d.). Arduino - Home. Retrieved from https://www.arduino.cc/

7. DHT22. (n.d.). DHT22 Temperature and Humidity Sensor. Retrieved from https://www.sparkfun.com/datasheets/Sensors/Temperature/DHT22.pdf

8. GSM900a Module. (n.d.). Datasheet. Retrieved from https://www.elecrow.com/download/GSM900A%20Datasheet.pdf

9. ThingSpeak. (n.d.). ThingSpeak - IoT Platform for Data Collection and Analytics. Retrieved from https://thingspeak.com/

10. Raindrop Sensor. (n.d.). Datasheet. Retrieved from https://components101.com/sites/default/files/component_datasheet/Rain%20Drop%20Sensor%20Module.pdf

11. Soil Moisture Sensor. (n.d.). Datasheet. Retrieved from https://cdn.sparkfun.com/datasheets/Sensors/SoilMoistureSensor.pdf

12. Buck Converter. (n.d.). Datasheet. Retrieved from https://cdn-shop.adafruit.com/datasheets/TPS63031.pdf

13. Grove. (n.d.). Grove - Seeed Studio. Retrieved from https://www.seeedstudio.com/Grove-c-1003.html

14. DFRobot. (n.d.). DFRobot - Quality Arduino Robot IOT DIY Electronic Kit. Retrieved from https://www.dfrobot.com/

15. Thingspeak. (n.d.). ThingSpeak - IoT Platform with MATLAB Analytics. Retrieved from https://thingspeak.com/

16. SIMCom. (n.d.). SIMCom - Wireless Modules for M2M IoT. Retrieved from https://simcom.ee/

17. PighiXXX. (n.d.). Servo library. Retrieved from https://www.arduino.cc/en/reference/servo

18. STMicroelectronics. (n.d.). L7805 - Positive voltage regulators. Retrieved from https://www.st.com/en/power-management/l7805.html

19. Bourns, Inc. (n.d.). Multifuse Resettable Fuses - MF-R Series. Retrieved from https://www.bourns.com/products/circuit-protection/resettable-fuses-multifuse-polymer/mf-r-series

20. Abid, M., Alzahrani, A. A., & Abido, M. A. (2020). IoT-Based Smart Irrigation System for Precision Agriculture. IEEE Access, 8, 201109-201121.

21. Das, S., Kundu, A., & Sarkar, S. (2018). A smart irrigation system using Raspberry Pi and Arduino with Wi-Fi module. 2018 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India.

22. Khan, M. A. (2020). IoT-based Smart Irrigation System using Raspberry Pi and Sensors. International Journal of Advanced Research in Computer Science and Software Engineering, 10(1), 145-149

23. Patil, P. B., Masal, M. R., & Bhuruk, P. R. (2021). Smart irrigation system based on IoT. International Journal of Electrical and Computer Engineering (IJECE), 11(3), 2642-2648.

24. Rana, S., Singla, A., Chauhan, A., & Bhattacharya, A. (2019). Smart Irrigation System using IoT. 2019 International Conference on Electrical, Computer and Communication Technologies (ICECCT), Coimbatore, India.

25. Wang, S., Yang, B., Xu, Y., Zhang, Z., & Jin, X. (2020). A Smart Irrigation System Based on IoT and Data Mining. IEEE Access, 8, 91215-91222.

26. Altieri, M. A. (1999). The ecological role of biodiversity in agroecosystems. Agriculture, ecosystems & environment, 74(1-3), 19-31. doi: 10.1016/S0167-8809(99)00028-6

27. Garg, R. K., & Jain, M. K. (2013). Irrigation engineering and hydraulic structures. Khanna Publishers.

28. Lamm, F. R., Stone, L. R., Rogers, D. H., O'Brien, D. M., & Kranz,W. L. (2006). Subsurface drip irrigation: Past, present, and future. Irrigation Science, 24(3), 63-77. doi: 10.1007/s00271-005-0014-2

29. Qu, H., & Li, X. (2019). Smart irrigation system for precision agriculture based on Internet of Things technology. Journal of Ambient Intelligence and Humanized Computing, 10(7), 2723-2733. doi: 10.1007/s12652-018-1012-4

30. Shock, C. C., & Feibert, E. B. (2017). The potential for smart irrigation technology to increase agricultural productivity in the United States. Journal of Soil and Water Conservation, 72(3), 31A-34A. doi: 10.2489/jswc.72.3.31A

31. Singh, R. K., Kumar, R., & Gupta, S. K. (2013). Smart irrigation system using wireless sensor network. International Journal of Computer Science and Information Technologies, 4(6), 962-965.

32. Yang, S., & Ma, X. (2018). Design of smart irrigation system based on Internet of Things. In 2018 IEEE 3rd Advanced Information Technology,

Electronic and Automation Control Conference (IAEAC) (pp. 1214-1217). doi: 10.1109/IAEAC.2018.8521824

Appendix-A

Certificate of Approval

It is certified that the work presented in this report was performed by **Mohammed Saad Khan 2019250, Husnain Ali 2019178, Malik Muneeb 2019225** under the supervision of **Dr. Farhan Khan.** The work is adequate and lies within the scope of the BS degree in Computer Science/Computer Engineering at Ghulam Ishaq Khan Institute of Engineering Sciences and Technology.

---------------------	---------------------
Dr. Farhan Khan	**Dr. Dur e Zehra**
(Advisor)	(Co-Advisor)

Dr. Ahmar Rashid

(Dean)

Appendix-B

Code:

```
#include <SoftwareSerial.h>

#include <Servo.h>


Servo myservo;  // create servo object to control a servo

SoftwareSerial gprsSerial(2,3); //RX.TX




#include <String.h>

#include <DHT.h>

#include <LiquidCrystal.h>

LiquidCrystal lcd(12, 11, 10, 9, 8, 7);

#define DHTPIN A2




DHT dht(DHTPIN, DHT22);

const int rainsensor = A1;
```

```
float h;
float t;

int soilmoispin = A0;
int rain;
int soilmois;

int smoisreq=50;

void setup()
{
  gprsSerial.begin(9600); // the GPRS baud rate
  Serial.begin(9600);    // the GPRS baud rate

  dht.begin();
  myservo.attach(6);  // attaches the servo on pin 9 to the servo object
  delay(1000);
}
```

```
void loop()
{

  float humi = dht.readHumidity();
  float temp = dht.readTemperature();

  soilmois=analogRead(A0);
  map(soilmois,0,1023,100,0);

  rain=analogRead(A1);
  delay(100);
  int rainper=map(rain,0,1023,100,0);

  if(!isnan(humi)){
   h=humi;
  }

  if(!isnan(temp)){
   t=temp;
  }
```

```
Serial.print("Temperature = ");

Serial.print(t);

Serial.println(" °C");


Serial.print("Humidity = ");

Serial.print(h);

Serial.println(" %");


Serial.print("CurrentRain = ");

Serial.print(rainper);

Serial.println(" %");


Serial.print("Soil Moisture Content = ");

Serial.print(soilmois);

Serial.println(" %");
```

```
//Code to control proportional solenoid valve

  int servo_pos;

  if (soilmois < smoisreq/6) {
  servo_pos = 180;
  } else if (soilmois < smoisreq/3) {
  servo_pos = 50;
  } else if (soilmois < smoisreq/2) {
  servo_pos = 45;
  } else if (soilmois < smoisreq) {
  servo_pos = 30;
  } else {
  servo_pos = 0;
  }

myservo.write(servo_pos);
delay(1000);
```

```
lcd.begin(16, 2);
lcd.print("SM: ");

lcd.print(soilmois);
lcd.print("%");

lcd.print("H: ");
lcd.print(humi);

lcd.print("%");

lcd.setCursor(0,1);
lcd.print("T: ");
lcd.print(temp);
lcd.print("*C");

lcd.print("Rain");
lcd.print(rainper);
lcd.print("%");
delay(2000);
```

```
if (gprsSerial.available())
  Serial.write(gprsSerial.read());

gprsSerial.println("AT");
delay (1000);

gprsSerial.println("AT+CPIN?");
delay (1000);

gprsSerial.println("AT+CREG?");
delay (1000);

gprsSerial.println("AT+CGATT?");
delay (1000);

gprsSerial.println("AT+CIPMUX=0");
delay(2000);
```

```
  ShowSerialData();

  gprsSerial.println("AT+CSTT=\"ufone.pinternet\"");//start task and setting
the APN,
  delay (1000);

  ShowSerialData();

  gprsSerial.println("AT+CIICR");//bring up wireless connection
  delay(3000);

  ShowSerialData();

  gprsSerial.println("AT+CIPSPRT=0");
  delay(3000);

  ShowSerialData();

gprsSerial.println("AT+CIPSTART=\"TCP\",\"api.thingspeak.com\",\"85\"");
//start up the connection
```

```
  delay(6000);

  ShowSerialData();

  String str="GET
https://api.thingspeak.com/update?api_key=YK3863MYHQZ2HNLW&field
3=" + String(t) + "&field4="+String(h) + "&field3="+String(t) +
"&field1="+String(soilmois)+ "&field2="+String(rainper);

  Serial.println(str);
  gprsSerial.println(str);//begin send data to remote server.

  delay (4000);
  ShowSerialData();

  gprsSerial.println((char)22) ;//sending.
  gprsSerial.println();

  ShowSerialData();
}
```

Mohammed Saad

ORIGINALITY REPORT

13%	10%	4%	10%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Higher Education Commission Pakistan Student Paper	3%
2	louisdl.louislibraries.org Internet Source	2%
3	forum.arduino.cc Internet Source	1%
4	dspace.iiuc.ac.bd:8080 Internet Source	1%
5	mdpi-res.com Internet Source	1%
6	repository.smuc.edu.et Internet Source	1%
7	theiotprojects.com Internet Source	1%
8	Submitted to University of Wales College, Newport Student Paper	1%
9	Submitted to University of Sussex	

	Student Paper	<1 %
10	www.jetir.org Internet Source	<1 %
11	irigs.iiu.edu.pk:64447 Internet Source	<1 %
12	francisdoitwitharduino.blogspot.com Internet Source	<1 %
13	Submitted to Curtin University of Technology Student Paper	<1 %
14	Submitted to University of Northumbria at Newcastle Student Paper	<1 %
15	ceme.nust.edu.pk Internet Source	<1 %
16	es.scribd.com Internet Source	<1 %
17	Charles Bell. "Beginning IoT Projects", Springer Science and Business Media LLC, 2021 Publication	<1 %
18	www.coursehero.com Internet Source	<1 %
19	www.cyber-place.ru Internet Source	<1 %

20	Submitted to Kenyatta University Student Paper	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		