Design and Implementation of a Smart Irrigation System

by

Oliur Rahman
ID: CSE1803015011

Md. Naymul Islam
ID: CSE1803015035

Md. Ziaul Haque
ID: CSE1803015007

Johirul Islam
ID: CSE1803015009

Supervised by
Md. Ashfakur Rahman

Submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SONARGAON UNIVERSITY (SU)
September 2022

Design and Implementation of a Smart Irrigation System

by

Oliur Rahman
ID: CSE1803015011

Md. Naymul Islam
ID: CSE1803015035

Md. Ziaul Haque
ID: CSE1803015007

Johirul Islam
ID: CSE1803015009

Supervised by
Md. Ashfakur Rahman

Submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SONARGAON UNIVERSITY (SU)

September 2022

APPROVAL

The project titled **"Design and Implementation of a Smart Irrigation System**" submitted by Oliur Rahman (CSE1803015011),Md. Naymul Islam(CSE1803015035), Md. Ziaul Haque (CSE1803015007) and Johirul Islam (CSE1803015009) to the Department of Computer Science and Engineering, Sonargaon University (SU), has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering and approved as to its style and contents.

Board of Examiners

Md. Ashfakur Rahman
Lecturer,
Department of Computer Science and Engineering
Sonargaon University (SU)

Supervisor

(Examiner Name & Signature)
Department of Computer Science and Engineering
Sonargaon University (SU)

Examiner 1

(Examiner Name & Signature)
Department of Computer Science and Engineering
Sonargaon University (SU)

Examiner 2

(Examiner Name & Signature)
Department of Computer Science and Engineering
Sonargaon University (SU)

Examiner 3

DECLARATION

We, hereby, declare that the work presented in this report is the outcome of the investigation performed by us under the supervision of **Md. Ashfakur Rahman, Lecturer,** Department of Computer Science and Engineering, Sonargaon University, Dhaka, Bangladesh. We reaffirm that no part of this **project** has been or is being submitted elsewhere for the award of any degree or diploma.

Countersigned

(Md. Ashfakur Rahman)
Supervisor

Signature

Oliur Rahman
ID: CSE1803015011

Md. Naymul Islam
ID: CSE1803015035

Md. Ziaul Haque
ID: CSE1803015007

Johirul Islam
ID: CSE1502005045

ABSTRACT

The modern world almost wholly depends on advanced technology. Consequently, our life is fully influenced by modern technology-based devices. This project aims at developing smart irrigation system that is capable of dry field auto irrigation. Irrigation is a part and parcel of a farmer's daily routine for their field. But it is a monotonous, unpleasant task that consumes a lot of time and labor. It is not only hard for sick, old, disabled people but also turning unaffordable for modern or busy farmer life. The project presents the use of correct soil moisture sensors which helps to ease out the pain to monitor and keep records about the changes in soil moisture. The Easier Pro will collect and process the data received from the Sensors. When a threshold moisture level of the soil is reached, the water will supply accordingly. This is essential because water must be provided to the plant at a particular time for a good yield. This project is highly using for farmers, Nursery professionals by eradicating traditional or manual method of irrigation system. Now days, robotics is rather a matter of programming which was a pure mechanical application before. At first the project examines the challenges in Smart Irrigation System: structural requirements, control and positioning, obstacle detection and operation adjustment. This project has ability to be detecting fire and make alarm in motor room.

ACKNOWLEDGMENT

At the very beginning, we would like to express my deepest gratitude to the Almighty Allah for giving us the ability and the strength to finish the task successfully within the schedule time.

We are auspicious that we had the kind association as well as supervision of **Md. Ashfakur Rahman**, Lecturer, Department of Computer Science and Engineering, Sonargaon University whose hearted and valuable support with best concern and direction acted as necessary recourse to carry out our project.

We would like to convey our special gratitude to **Arifur Rahaman**, Assistant Professor and Coordinator and **Bulbul Ahamed,** Associate Professor and Head, Department of Computer Science and Engineering, for their kind concern and precious suggestions.

We are also thankful to all our teachers during our whole education, for exposing us to the beauty of learning.

Finally, our deepest gratitude and love to my parents for their support, encouragement, and endless love.

LIST OF ABBREVIATIONS

IOT	Internet of Things
IT	Information Technology
I/O	Digital IO stands for Digital Input and Output
DC	Direct current
PC	Personal Computer

CHAPTER 1

INTRODUCTION TO SMART IRRIGATION SYSTEM

1.1 Introduction

For ages, farmers across the world have had to be resourceful when rain fails to come. To take matters into their own hands, they've used technologies like irrigation systems to overcome water deficits and maximize crop fields. Irrigation systems, however, are inefficient. About half of all irrigation water is wasted due to runoff, wind, and evaporation. That's because most irrigation systems rely on simple timers and controllers for scheduling. A much more efficient approach is to use water only when needed and apply exactly the right amount. Agriculture is the backbone of all developed countries. It uses 85% of available fresh water 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. Easier Pro based plant communicator helps the farmer by checking the moisture of the soil and if the moisture is below the level then automatic water is irrigated. Over irrigation occurs because of poor distribution or management of waste water, chemical which lead to water pollution. Under irrigation leads to increase soil salinity with consequent buildup of toxic salts on the soil surface in areas with high evaporation [7].

1.2 Objectives

1. Create a plant communication device based on Easier Pro, Moisture and fire sensor
2. Use Easier Pro IDE for coding in Easier Pro device and various dependencies
3. Proper research for Easier Pro device and its circuit
4. Proper circuit design for the project
5. Proper testing and debugging of the device configuration
6. Create proper prototype of Plant Communicator
7. Conducting a survey regarding the project

1.3 Proposed Solution

The main aim of this project is to create plant communicator device based on Easier Pro Which help us to monitor moisture, temperature, fire and irrigate if the moisture level is below.

CHAPTER 2

INTRODUCTION TO ROBOTICS AND IT'S ADVANTAGES

2.1 Microcontroller: Robotics made easy

Microcontroller is simply a single general purpose integrated circuit that can be programmed for versatile areas of application. Although modern microcontrollers possess all the qualities of a computer, they are mostly used to provide autonomy to electronic appliances. Yes, microcontroller is the thing that makes electronic appliances 'intelligent'. With the introduction of microcontroller, automation and robotics has become a job of programming and then connecting other electronic components that can control virtually any kind of machine. Microcontroller is the reason that makes robotics being dominated by CSE and IT professionals which was traditionally a topic of mechanical Engineering. Today, microcontroller has become so cheap and widely available that they can be used to control the simplest projects. But the success of microcontroller would not be so enormous if a supporting technological environment was created. Different communities have supported different types/brands by sharing their experiences, solving problems, creating IDEs and producing common technical platforms. This is why using microcontrollers and programming them have become so easy to learn and implement. For example, Easier Pro, which is one of the most dominating platforms in robotics world, earned popularity because it is supported by a vast 3 number of technical experts. This project has adopted Easier Pro IDE, so the positive aspects of this platform will be discussed later. Without simplicity and availability of shared knowledge microcontrollers would remain a monopoly of high-end technical experts rather than being an attraction to novice programmers. Solution of problems is widely available and its IDE supports almost all other third-party microcontrollers [1].

2.2 Internet of Things: A new horizon in technology

When the first idea of electronic computing machine arrived around eighty years ago, people hardly anticipated to what extent this technology would impact everyday life in future. At first it was a tool of high-end scientific research, then it became available for personal use and now, it can fit in our pocket. With advancement in computational and electronic technologies, drastic development of internet infrastructure and rapid increase in demand for household appliances, making everything automated has become a reality in the first two decades of this century. Internet of Things (IOT) is the concept that all object we use will communicate with each other so that their functionalities are synchronized to serve human beings smartly and effectively. For example: when a person leaves his home, the security system will activate. His rooms, clothes, utensils get washed, food is prepared just before he returns and served when he sits for dining, all are done by machines who adopt themselves with each other via internet. Yes, that is no more a fairytale in the 21st century. Its impact on overall future human life and the society is a matter of intensive thought and research but it is sure that IOT is a reality and it is going to bring a drastic change in our lifestyle. Our project will be mostly dominated by implementation of microcontroller and creating the structure of a robot but IOT will be used to remotely control it in future [5].

2.3 Rationale of the Project

In last several decades, we got much electromechanical equipment in our agriculture system that has made farmers daily life easy, smooth and relaxing. Although most of them are dedicated for field preparation, planting the seeds machine are some examples which indicate that there are many other places in farmers field where new electronic appliances will soon find their place. Smart Irrigation system is such a major activity which has seen every 4 little research for automation. No high advantage automated smart irrigation systems commercially available yet. If successful and then commercially produced, it will quickly attract public attention, save times in everyday life and create business opportunities.

2.4 Basic Structure of the Robot

We tried with different structural and electronic configurations of the robot. Here, the components of an auto mate-controlled robot powered by Easier Pro are presented [5].

i. Easier Pro boards featuring.

ii. One water motor.

iii. Water Sensors.

iv. Battery for power supply.

CHAPTER 3

Theory of the project

3.1 Introduction

Smart irrigation systems are a combination of an advanced technology of sprinklers with nozzles that improve coverage and irrigation controllers that are watering and water conservation systems that monitor moisture-related conditions on your property and automatically adjust watering to optimal levels.

3.2 Requirement Analysis

Require analysis also called requirements engineering, is process of determine user expectation for a new or modified product. These features, called requirements, must be quantifiable relevant and detailed. In software engineering such requirements are often called functional specifications. Requirement analysis is an important aspect of project management [6].

3.3 Hardware Requirements

1. Easier Pro.

2. Water Sensor.

3. Fire Sensor.

4. Required wires.

5. Water motor.

6. Power source.

3.4 Easier Pro Board

1. It’s an automation project development board.

2. More than 300 Robotics and Automation projects are easy to develop using this board.

3. Plug and Play system.

4. Low cost.

5. Solder less project development.

6. Safe from electric shock.

7. Project development in short time.

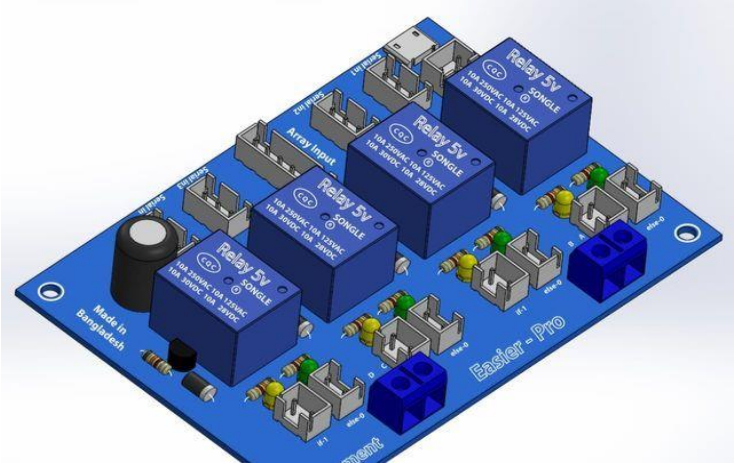


Fig: 3.1: Easier Pro Board

8. Free from amp and voltage variation.

9. Performance is satisfactory.

10. Unlimited project recombination can be done.

11. One of the best devices for home automation.

12. Security systems can be developed.

13. Various types of wireless communication can be developed.

14. The protection system is possible in easy way.

15. The device can be controlled according to the time schedule [3].

3.5 Water Sensor

Water sensor brick is designed for water detection, which can be widely used in sensing rainfall, water level, and even liquid leakage.

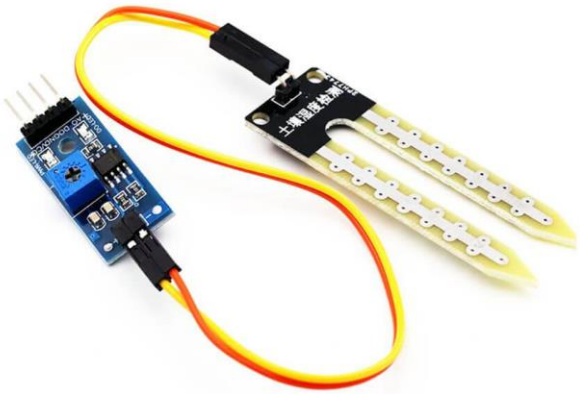


Fig: 3.2: Water Sensor

Connecting a water sensor to an Easier Pro is a great way to detect a leak, spill, flood, rain, etc. It can be used to detect the presence, the level, the volume and/or the absence of water. While this could be used to remind you to water your plants, there is a better Grove sensor for that. The sensor has an array of exposed traces, which read LOW when water is detected [7].

3.6 Fire Sensor

1. Indicator light: a green one for the switch, a red one for power.
2. Built in a potentiometer for sensitivity control.
3. Onboard signal output indication, output effective signal is high, at the same time the indicator Light up, the output signal can directly connect to microcontroller IO.

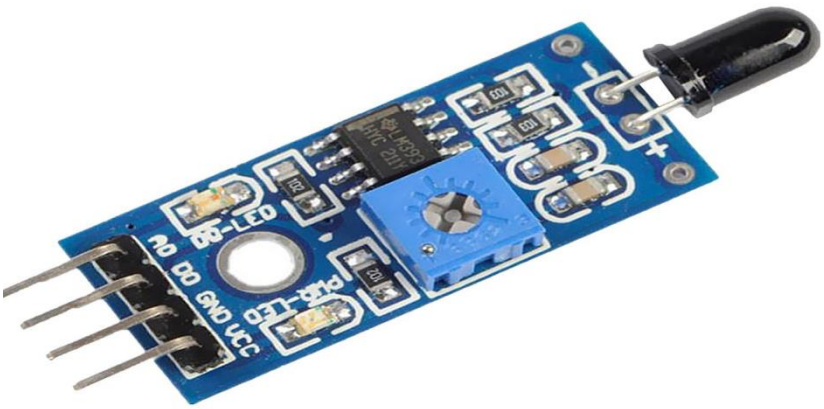


Fig: 3.3: Fire Sensor

4. Can detect fire or wavelength in 760 ~ 1100 nm nano within the scope of the light source.
5. Detection angle about 60 degrees, the flame spectrum especially sensitive.
6. The flame of the most sensitive sensors Flame, the regular light is also a response, generally used for fire alarm purposes.

3.7 Required Wires

Wires are simply wire that has connector pins at each end, allowing them to be used to connect two points to each other without soldering. Wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Though jumper wires come in a variety of colors, the colors don't actually mean anything. This means that a red wire is technically the same as a black one. But the colors can be used to your advantage in order to differentiate between types of connections, such as ground or power [7].

Fig: 3.4: Connection Wires

3.8 Water Pump

Using the water pump 5V voltage that powers the Easier-Pro will simplify dramatically the electric design of our automatic smart irrigation system. So, if the sizing of our project allows it, use low voltage water pumps [4].

Fig: 3.5: Water Pump

3.9 Power Source

Easier-Pro can operate satisfactorily on power that is available from the USB port. It provides 5V DC voltage and can be sourced from the port from a PC, wall socket adapter or portable power bank.

CHAPTER 4

System Design

4.1 Introduction

In this chapter, there is a fully discussion about the project design. A general block diagram has been developed and implements according diagram. Here we describe overall project description implementation procedure and working principle. Total project flow chart is also available in this chapter.

4.2 System Block Diagram

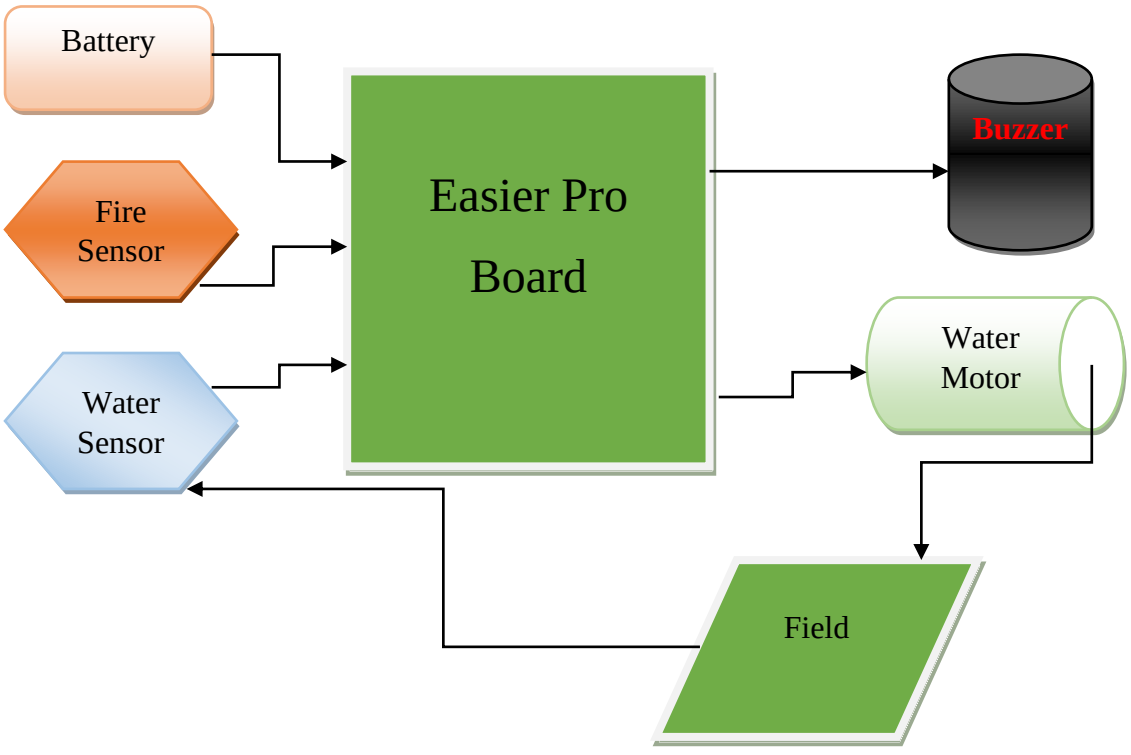


Fig: 4.1: System Block Diagram

4.3 Circuit Diagram

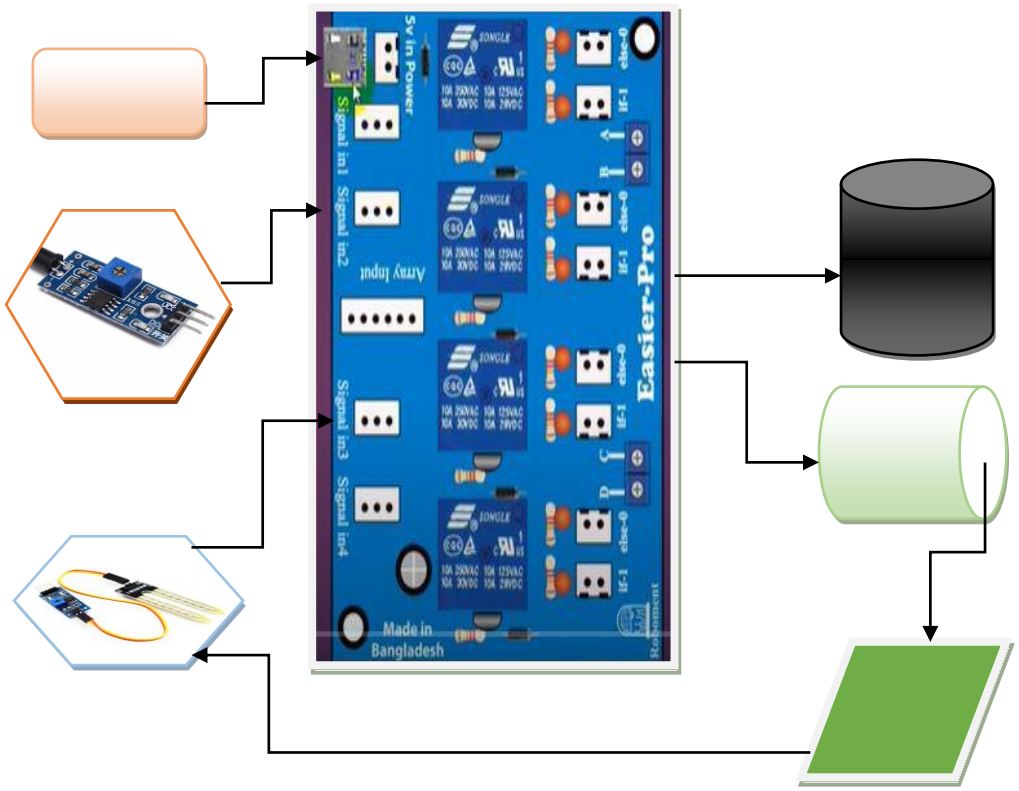


Fig: 4.2: Circuit Diagram

4.4 Working Principal

The system detects dry soil from a field and auto motor start to irrigate. We connect the battery to power supply. If we get input from water sensor 1/moist then output signal is 1. If we get input from water sensor 0/dry then output signal is 0. We connect water pump in signal 0 and water motor auto start.

If we get input from fire sensor 0/no fire then output signal is 0. If we get input from fire sensor 1/fire then output signals is 1. We connect Buzzer in signal 1 and Buzzer Alarm auto start.

4.5 Flow Chart

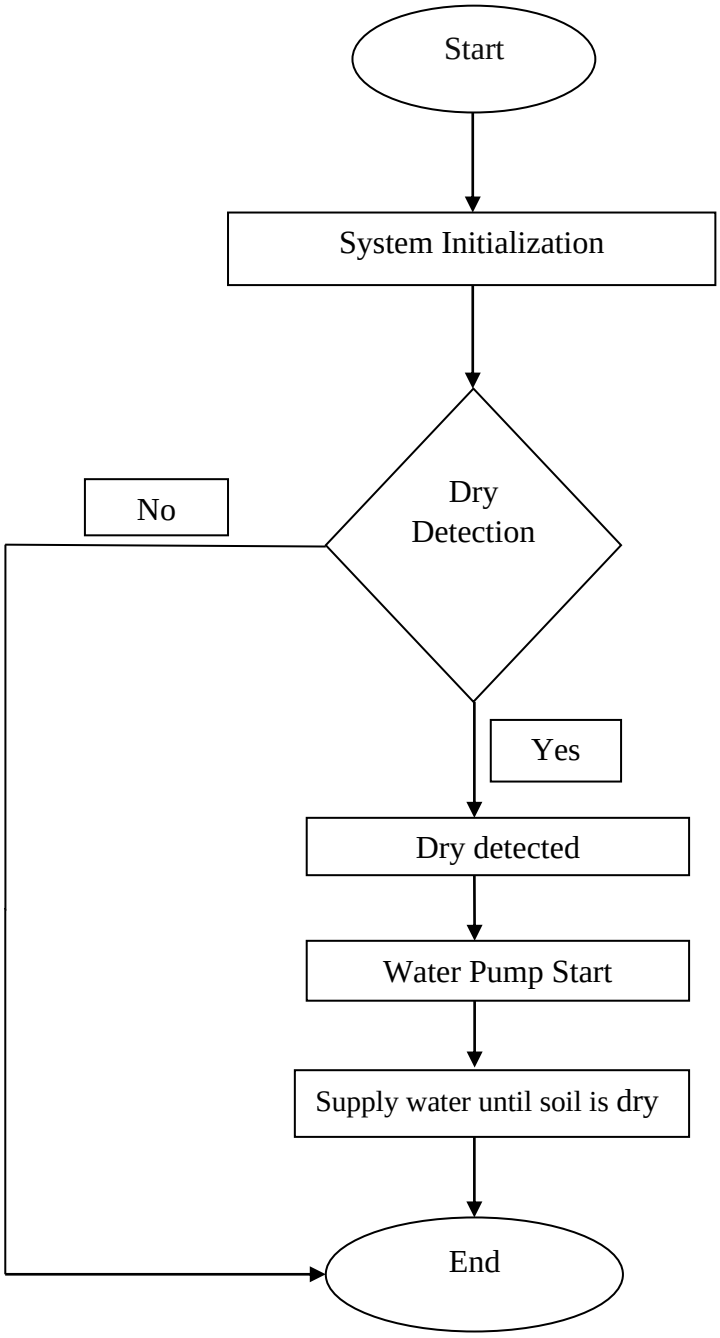


Fig: 4.3: Flow Chart

4.6 Algorithm

Step 1: Start

Step 2: Dry detection

Step 3: If the value is moist perform step 7 else perform step 5

Step 4: Output “Field is dry”

Step 5: Auto start water pump

Step 6: Supply water until field is dry

Then go to step 8

Step 7: Output “field is moist”

Step 8: Stop

CHAPTER 5

RESULT AND DISCUSSION

5.1 Introduction

This chapter contains the results obtained and discussion about the full project. We have also covered discussion about advantage, limitations and application of the current version of the vehicle accident detection.

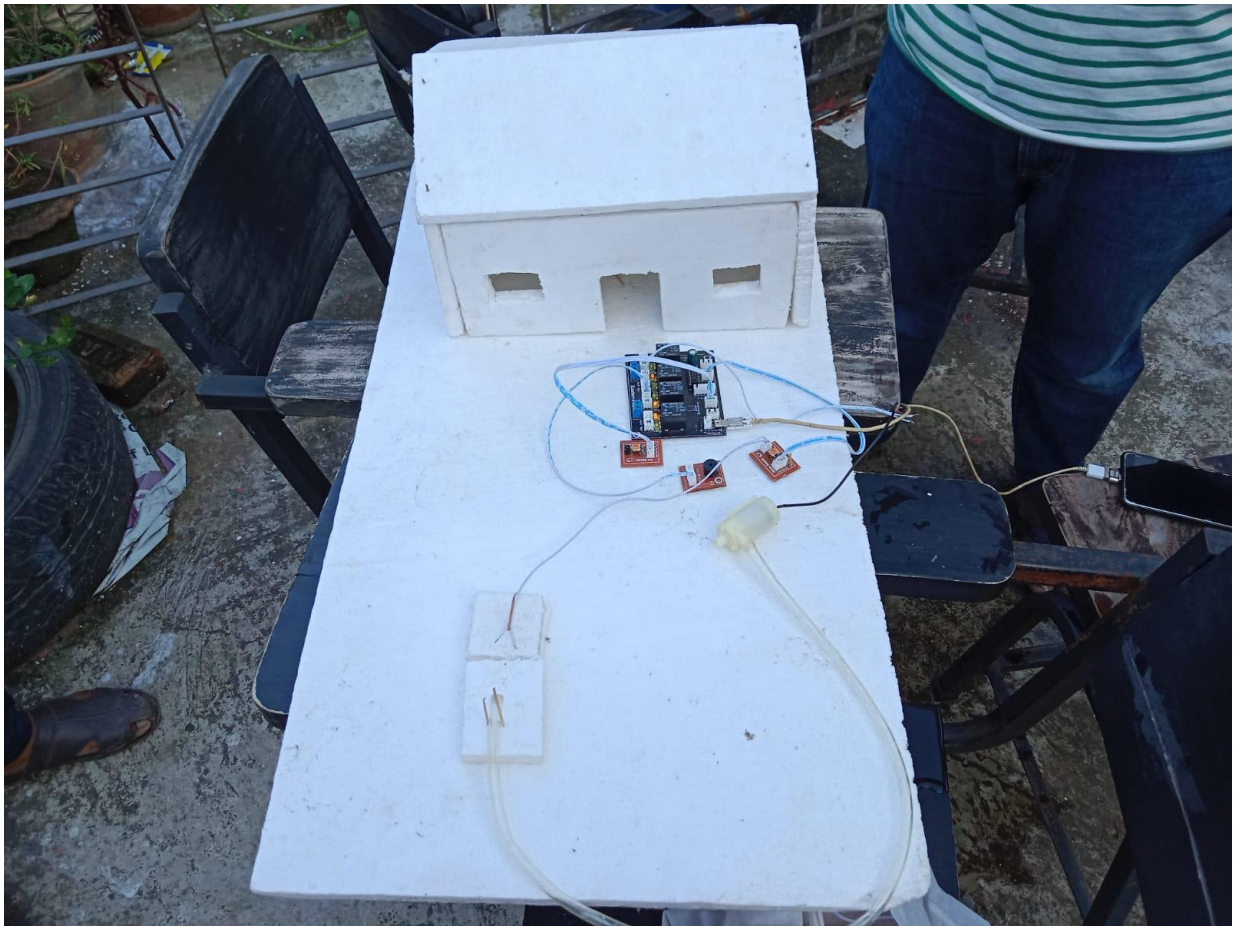
5.2 Results

The result includes the successful operation of an automatic irrigation system and fire alarm systems. This system detects dry soil from a field and auto motor start to irrigate. This system detects fire from a motor room and auto buzzer start to alarm. The results include the successful operation of an automatic smart irrigation system.

5.3 Output

5.3.1 Before Power

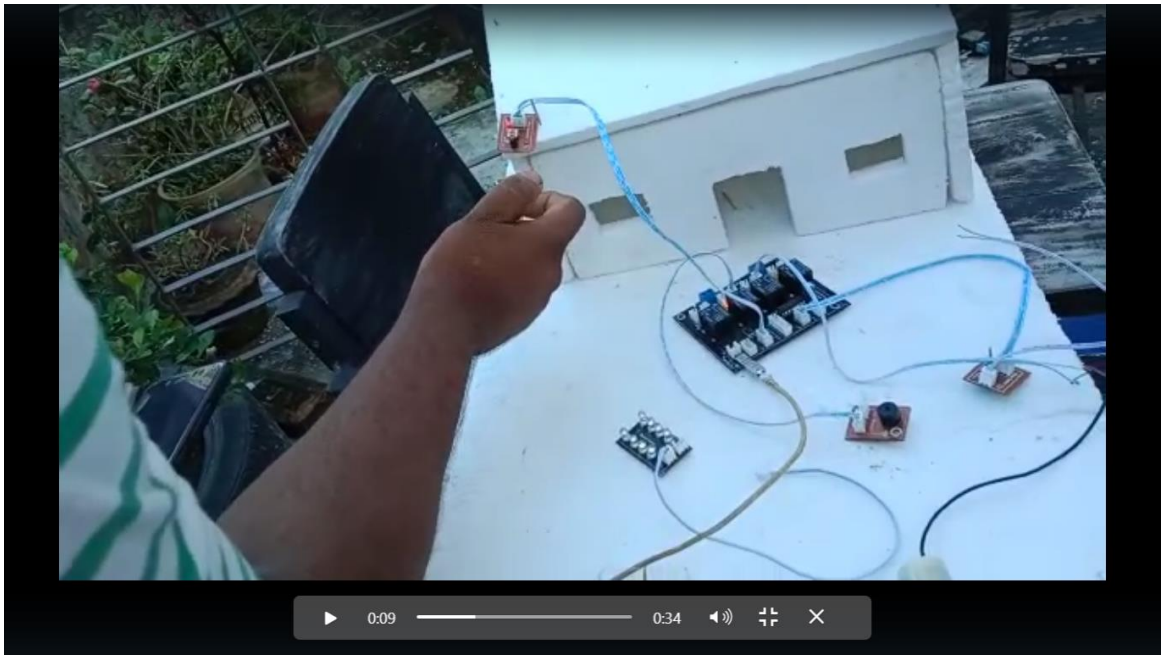
5.3.2 After Power



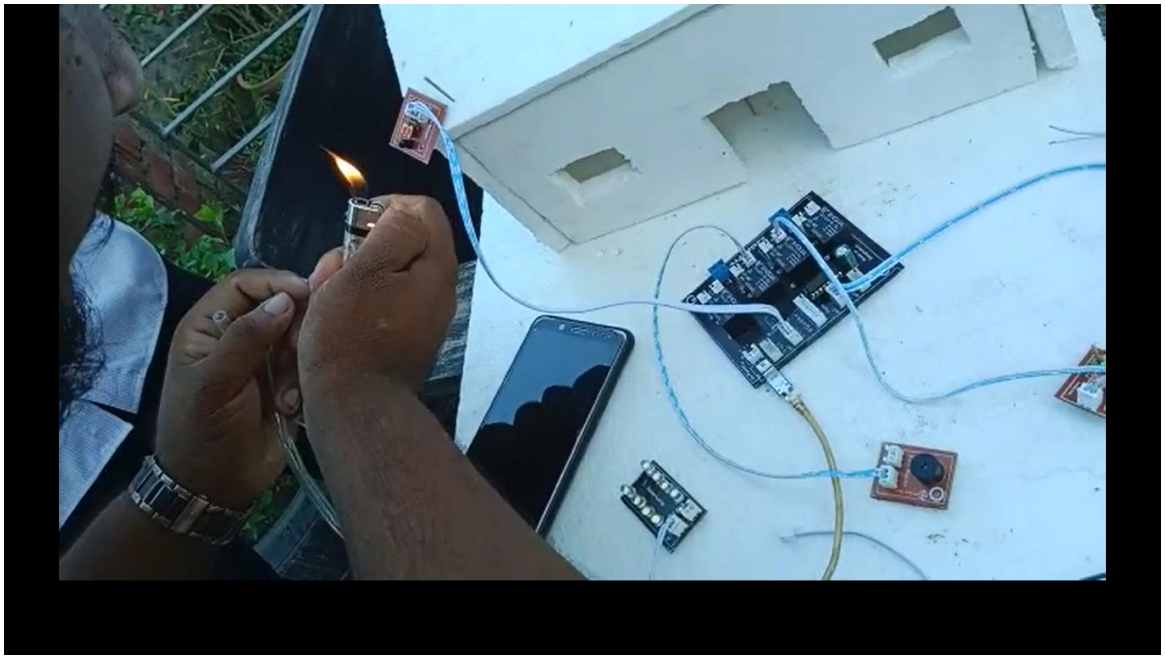
5.3.3 Dry Soil

5.3.4 Moisture Soil

5.3.5 Before Fire



5.3.6 After Fire



5.4 Application of the System

- It can be used in all types of fields for automatic smart irrigation and fire alarm.

5.5 Limitations of the Work

1. IOT is not implemented yet.
2. If any sensor doesn’t work properly, system doesn’t work properly.

CHAPTER 6

CONCLUSION AND FUTURE WORKS

6.1 Conclusion

With the theatrical inclination of our syllabus, it becomes very essential to take the advantages of any opportunity of gaining practical experience that comes along. The building blocks of this major project "Smart Irrigation System" was one of these opportunities. It gave us the required practical knowledge to supplement the already taught theoretical concepts thus making more competent as a learner. This is to make sure that the process of evaluating students will be effective, systematic and digital meeting more of user requirements. The functional services provided in the current version are ancient and paper-based. This project has given me an ample opportunity to learn and implement things from a prolific guidance. The project from personal point of view also helped us in understanding the following aspects of project development.

1. The planning that goes into implementing a project.

2. The importance of proper planning and an organized methodology.

3. The key element of team spirit and co-ordination in a successful project.

The project also provided us the opportunity with interacting with our teachers and to gain from their best experience.

6.2 Future Work

1. Further this system can be using light sensor.

2. We can develop this system to detect dark or light using light sensor for auto night light [2].

3. We will implement IOT in this project.

REFERENCES

[1] M. S. Munir, I. S. Bajwa, M. A. Naeem, and B. Ramzan, "Design and implementation of an IoT system for smart energy consumption and smart irrigation in tunnel farming," Energies, vol. 11, no. 12, p. 3427, 2018.

[2] A. Kumar, K. Kamal, M. O. Arshad, S. Mathavan, and T. Vadamala, "Smart irrigation using low-cost moisture sensors and XBee-based communication," in Proceedings of the Global Humanitarian Technology Conference (GHTC), San Jose, CA, USA, October 2014.

[3] B. Cardenas-Lailhacar, M. D. Dukes, and G. L. Miller, "Sensor-based automation of irrigation on Bermuda grass, during dry weather conditions," Journal of Irrigation and Drainage Engineering, vol. 134, pp. 184–193, 2008.

[4] J. Gutiérrez, J. F. Villa-Medina, A. Nieto-Garibay, and M. A. Porta-Gandara, "Automated irrigation system using a wireless sensor network and GPRS module," IEEE Transactions on Instrumentation and Measurement, vol. 63, no. 1, pp. 166–176, 2014.

[5] S. Rawal, "IOT based smart irrigation system," International Journal of Computer Applications, vol. 159, no. 8, pp. 7–11, 2017.

[6] M. S. Munir, I. S. Bajwa, and S. M. Cheema, "An intelligent and secure smart watering system using fuzzy logic and blockchain," Computers & Electrical Engineering, vol. 77, pp. 109–119, 2019.

[7] Ayush Pandey, "Smart_Irrigation_System," Bachelor of Information Technology and IT Security at Islington College, DOI:10.13140/RG.2.2.28499.53286,Jan 19,2020.

[8] Brush, R.E. 1982. *Wells* Construction: Hand Dug and Hand *Drilled.* Peace Corps Information Collection and Exchange Manual M-9. Washington, D.C.

[9] Anon (1996) Landscape Irrigation Auditor Training Manual (Australian Version), 2 nd Edition March 1996, The Irrigation Association, USA. [7] Ayush Pandey, "Smart_Irrigation_System," Bachelor of Information Technology and IT Security at Islington College, DOI:10.13140/RG.2.2.28499.53286,Jan 19,2020

[10] Doorenbos, J. and Pruitt, W. O (1977) Guidelines for predicting crop water requirements, FAO Irrigation and Drainage Paper No. 24, 2nd Edition, FAO, Rome, Italy.

[11] Handreck, K. A. and Black, N. D. (2001) Growing media for ornamental plants and turf, 3 rd Edition, New South Wales University Press, Kensington, Australia.