

AN-NAJAH NATIONAL UNIVERSITY



Faculty of Engineering

Computer Engineering Department

Graduation Project 2

Smart Home System

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Acknowledgment:

“

At first,“ Alhmdullah” that we were able to complete this project, then we would like to thank our supervisor Dr.Samer Arandi for his support and assistance in our project. We also want to thank all of our friends and doctors for all of their support and their helping to solve some of the problems that we faced. We shouldn't forget our beautiful families for their support and encouragement every day. In the end, we feel proud that we believed in ourselves and accomplished this project.

”

-Mujahed,Osama

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Abstract:

Nowadays, due to the great spread of technology, people are using it mainly in their lives to accomplish the tasks that they were doing manually, so what if people did not find this technology in the most important and most needed place for this technology where people spend most of their time (house).

Using a set of systems that help to achieve tasks and to control them remotely and monitor them makes it easy for the owner to deal with tasks and accomplish them in a better way.

The systems used are motion and light systems, a heating system to deal with fires and a controlling system to manage the gate of the house, an automatic irrigation system, an automated water filling system, and a camera monitoring system, and using an application to control and monitor them.

Chapter 1:

1 Introduction

1.1 Background

For many years, people have resorted to technology to facilitate their lives and solve their problems. The most important place they spend their time in is their homes. The idea of adding technology to homes will help them a lot and make their lives comfortable and easy. Therefore this is a very important field, and .research, projects, and industries must be conducted related to it

1.2 Problem Statement

We attempted in this project to give a project that tries to solve these problems :

- 1-Automatically controlling home lighting and air conditioning needs many things.
- 2-Securing your home and making it safer requires many things, and it is not easy.
- 3-Taking care of plants and watering them constantly may be a problem for any of us.
- 4-The tank of water in the house and knowing how much water it contains and whether it is empty and filled or filling it is not easy.

1.3 Objective and Scope

This model consists of multiple subsystems, The majority of these systems operate automatically through a mobile application, and each system in this project is very important and has its value in our lives as follows:

- 1- Lights, Water, Irrigation, and Air condition these systems can work automatically or the user can control them easily through the application .
- 2 -The fire system detects any smoke in the house and alerts the user with a loud alarm using a buzzer.
- 3 -monitoring camera, the user can open the application and monitor his home whenever he wants.
- 4 -The user controls the gate completely from the mobile application.

1.4 Overview of the report:

- Chapter 2 : Constraints and earlier work. In this chapter, we will talk about the causes of the problems we faced and took a long time to build the project and the earlier courses that we've taken in university which help us in the project .
- Chapter 3 : Literature Review. We will talk about our project and why it is important and previous projects similar to it.
- Chapter 4 : Methodology. This chapter will cover the tools, procedures and tasks our project provides.
- Chapter 5 : Results and Discussion. In this chapter we will discuss the results , the outcomes and the Challenges.
- Chapter 6 : Conclusion and Future. Work In this chapter, we will summarize our project completely, and we will talk about how to develop our project further and what are the possible additions.

Chapter 2

2 Constraints and earlier work

2.1 Constraints

- Knowledge constraints

Because we will use the ESP 32 piece for the first time and we did not learn how to use it before and we lacked information about how to use some sensors also this is the first time that we will use the Flutter language.

- Time Limit

We have a limited time to determine the components of our project and what contains sensors and parts inside and implement it on the hardware and software sides.

2.2 Earlier Work

We took some courses in our college that helped us build and develop this project and these are:

● Digital Circuit Lab:

During this lab, we learned a lot. We learned how to use basic electronic components, wire them with other things, and how build small projects.

● Microcontroller Lab:

In this lab, we learned how to use controllers like PIC and Arduino which basically help us to use ESP 32.

● Wireless Course:

In this course, we learned how to control electronic components from away using wifi.

- **Microcontrollers:**

In this course, we learned how to know the requirements of the sensors by reading the datasheet.

- **Critical thinking Course:**

In this course, we learned how to do research and how to write reports in the right way.

Chapter 3

3 Literature Review

The smart home is an important project, and it is not a big and difficult project, but it offers people a lot, and it is like other smart home projects that are part of the IoT World.

Here we will present an example of a similar previous project for a graduate student from An-Najah University, Asmaa Hamayel, whose project was called "House Management Service", which contains a set of sensors such as fire , gas , ... , also their project has a mobile application that users can monitor and control the "House Management Service", also their project has an air conditioning and lighting systems, meaning if the temperature reaches a certain level, the air conditioner is automatically turned on, as well as the lighting if the degree of light is less than a certain limit, the lighting will be turned on.

The main benefits of the project are that it contains air conditioning and lighting systems, as well as windows and door control from the mobile application and gas sensor that can be a good thing for the user's safety. On the other hand, the main Disadvantages of the project are that They do not have any environmental systems like an Irrigation system, No water tank level detection and auto filling system, and not a house monitoring system like security cameras and motion sensor.

Chapter 4

4 Methodology

In this chapter, we will talk about the hardware and software tools that we needed to implement the project.

4.1 Components

4.1.1 Hardware Component

Name	Quantity
ESP32	3
breadboard	3
Smoke Sensor	1
Servo motor	1
Piezo Buzzer	1
Water level sensor	1
DHT11(Temperature Sensor)	1
LDR	2
12v Water pump	2
Soil moisture sensor	1
Motion sensor	1
ESP32 Cam	1
12v Fan	1
Two channel relay	2
12v Lamp	1
LCD	1
I2C Driver	1
FTDI	1
LEDs	4
Resistors	5
Wires	N

4.1.2 Pin Mapping

Pin	Device
23	DHT11(Temperature Sensor)
21	fan
33	Smoke sensor
25	Piezo Buzzer
27	Led 1
14	Led 2
13	Led 3
12	Led 4
32	Inner IDR
34	outer IDR
17	Water pump
25	Soil pump
36	Water signal
34	Soil moisture sensor
26	Servo motor

4.1.3 software and Libraries

In this project we used many libraries during its building process in both sides hardware and software side (mobile app).

Hardware side :

1. C++ programming language has been used to program the controller ESP32 .
2. WiFi : which is a library used to check the connection status between the controller(ESP32) and the access point and get some information like the controller IP.

3. DHT: an Arduino library that provides us really effective service to deal with the temperature sensor.
4. Stepper (servo): It is a library that gives us the ability to deal with the stepper motor.
5. FirebaseESP32: A library that makes the communication between the controller (ESP32) and the real-time server (Firebase) .
6. ESP Camera: The library used to program the esp32cam.

Software Side (mobile app) :

1. Dart : Is a client optimized language for fast apps on any platform.
2. Flutter : an open source framework from Google used to build beautiful cross platform designs .
3. Firebase : Which is a real time server in our project it acts as a database .

4.2 Smart Home subsystems

4.2.1 Air condition system

This system consists of a temperature sensor, a two-channel relay, and a 12v fan.



This system mainly depends on the temperature sensor so that if the temperature is greater than the value of the threshold the controller sends a signal to the relay to close the circuit and then turn on the fan, and the user has the ability to control the threshold value through the application so that he enters the value he wants easily and it will send that value to the Firebase server which the controller keeps reading that value and runs the system using it.

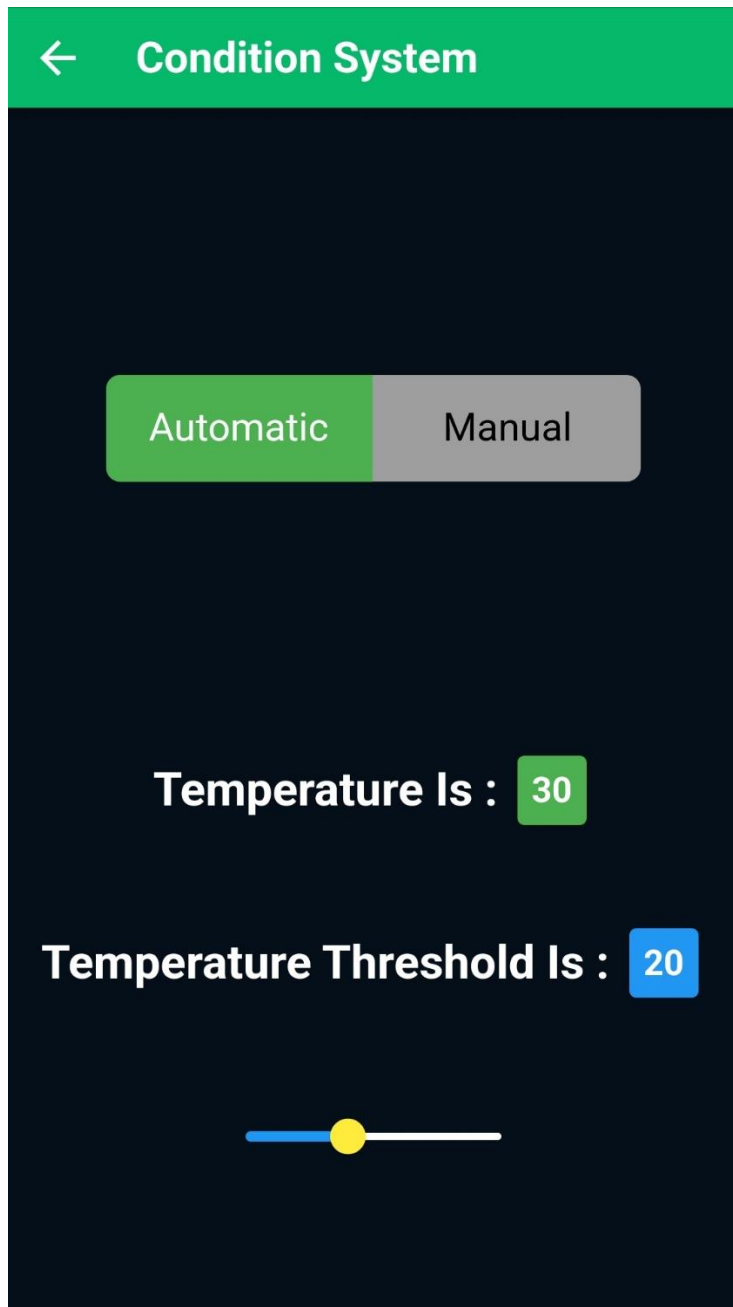


Figure1 .Air Condition System

4.2.2 Outdoor lighting system

The system consists of a 12v lamp , motion sensor , LDR and two-channel relay.



This system relies on two types of sensors, light sensors, and motion sensors as follows: When a motion is detected by the motion sensor, The light sensor reads the value of the intensity of light, and if it is less than a certain value (10) The controller sends a signal to the relay to close the circuit and the lamp turns on, and the lamp will stay on until the motion stopped and the lamp timer value ends that is determined by the mobile application then the controller will send a signal to the relay to open the circuit and turn off the lamp.

In manual mode, it is done manually by the user , If the user wants to turn on the lamp, he only has to press the “On” option throw the application regardless of the motion or the LDR sensor reading, and if he wants to turn it off, he presses on the “Off” option then the system will depend on the motion sensor read value again.

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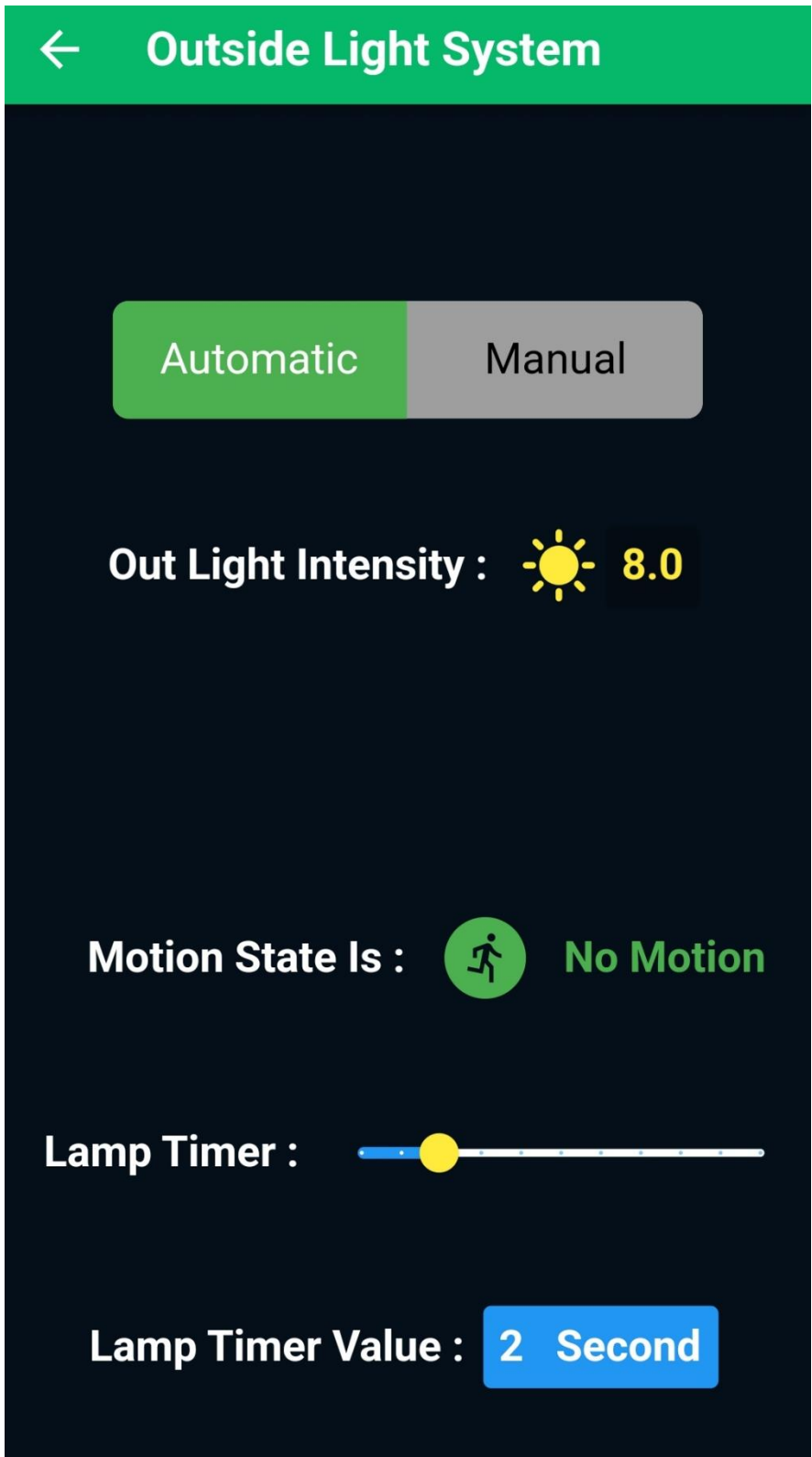


Figure2 Outdoor Light System:

4.2.6 Fire detection and alarm system:

The system consists of a smoke sensor and piezo buzzer:



A system to secure the house from fires and gases, when gas or smoke spreads in the room and its value is higher than a threshold (50) the controller will turn on the piezo buzzer which represents the smoke alarm.

Through the mobile application, the user can turn off the alarm and monitor the state of the smoke sensor if it detects any smoke in the room.

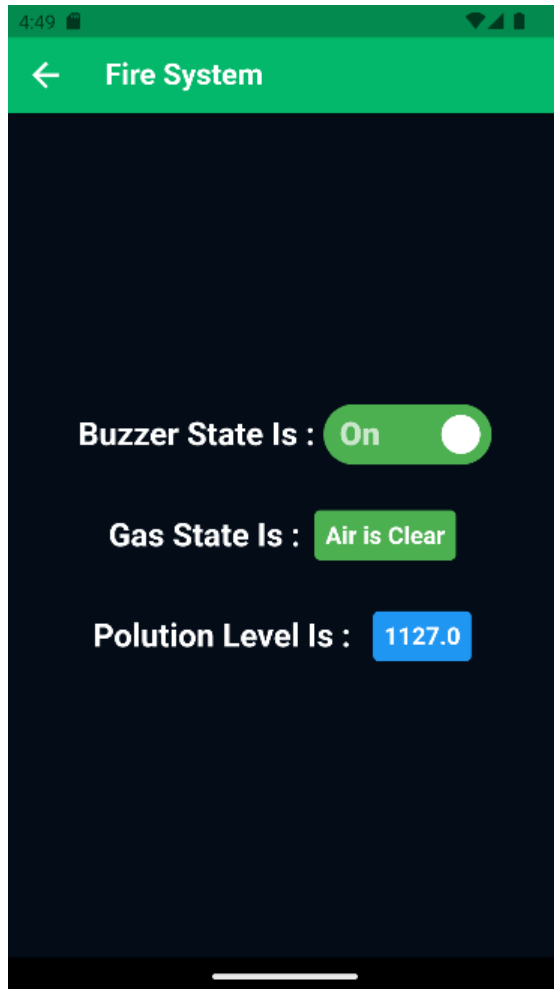


Figure3 Fire Alarm System

4.2.5 Indoor lighting system:

The system consists of a LDR , Resistors and LEDs:



This system mainly depends on the LDR sensor, which reads the amount of light intensity, the system contains four LEDs, and the number of lighted LEDs is controlled by the ESP32 which depends on the read value from the LDR

In automatic mode, The LDR read value is divided into many levels, when the value is read is between 0 to 20 all LEDs will be on, if it is between 20 to 40 three LEDs will be on, 40 to 60 two LEDs will be on, 60 to 80 one LED will be on, higher of that all LEDs will be off

In manual mode, the user can control in lights from the mobile application. regardless of the value of LDR when the value of the slider on the mobile application is 0 then all LEDs will be off, if it is 1 to 20 one LED will be on, and two LEDs will be on when it is 20 to 50, and 50 to 80 three LEDs will be on, and if it is higher of 80 all LEDs will be on

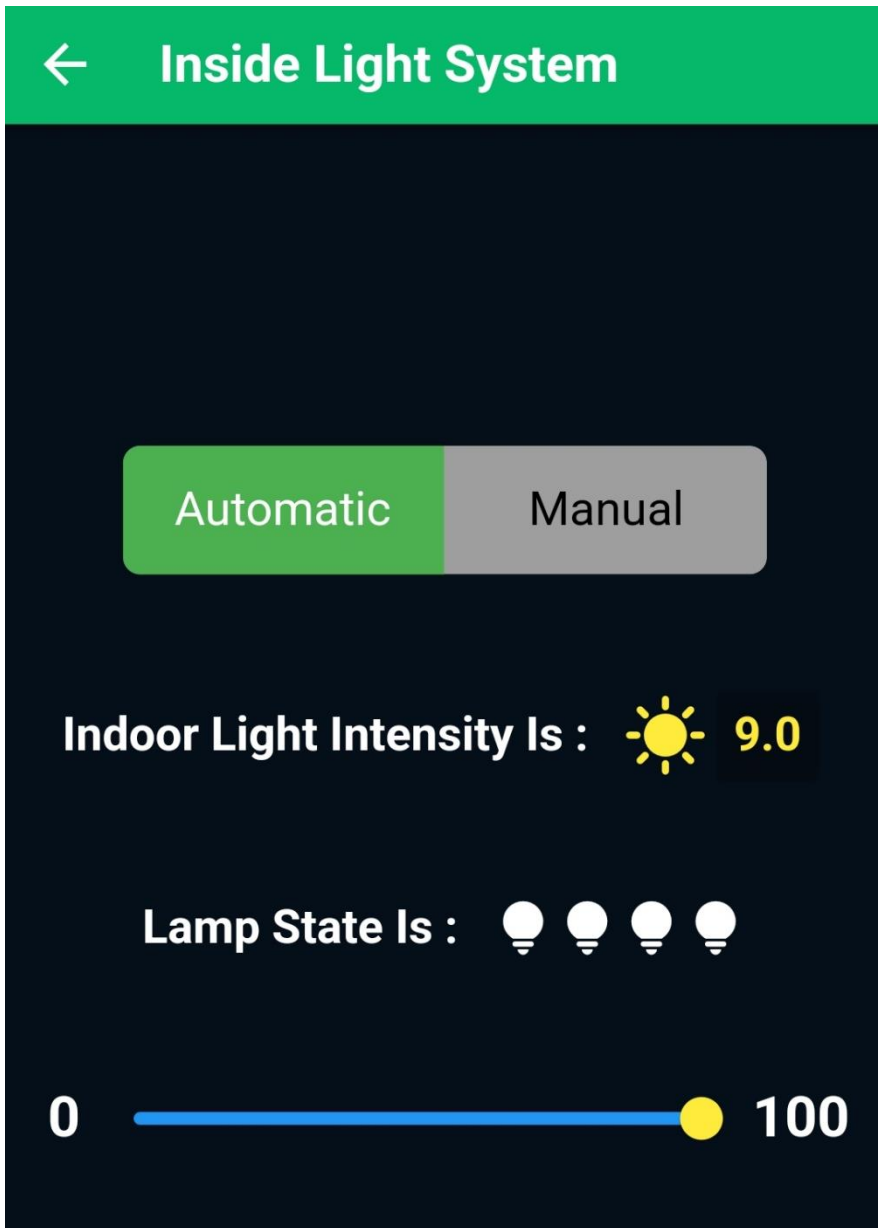


Figure4 Indoor Light system

4.2.5 Water tank filling system

The system consists of a water sensor, a 12v pump and two-channel relay.



The water level sensor measures the amount of water in the tank, in our system if the value read from the water sensor is less than 50, the controller sends a signal to the relay to close the circuit and start pumping water from the water source (the main tank) to the house water tank. The water pump will stay on until the water sensor level becomes above 50 then the controller sends a signal to its relay to open the circuit again and turn off the pump This is done in automatic mode.

In manual mode, it is done manually by the user. If the user wants to turn on the pump, he only has to press the “On” option, and if he wants to turn it off, he presses the “Off” option.

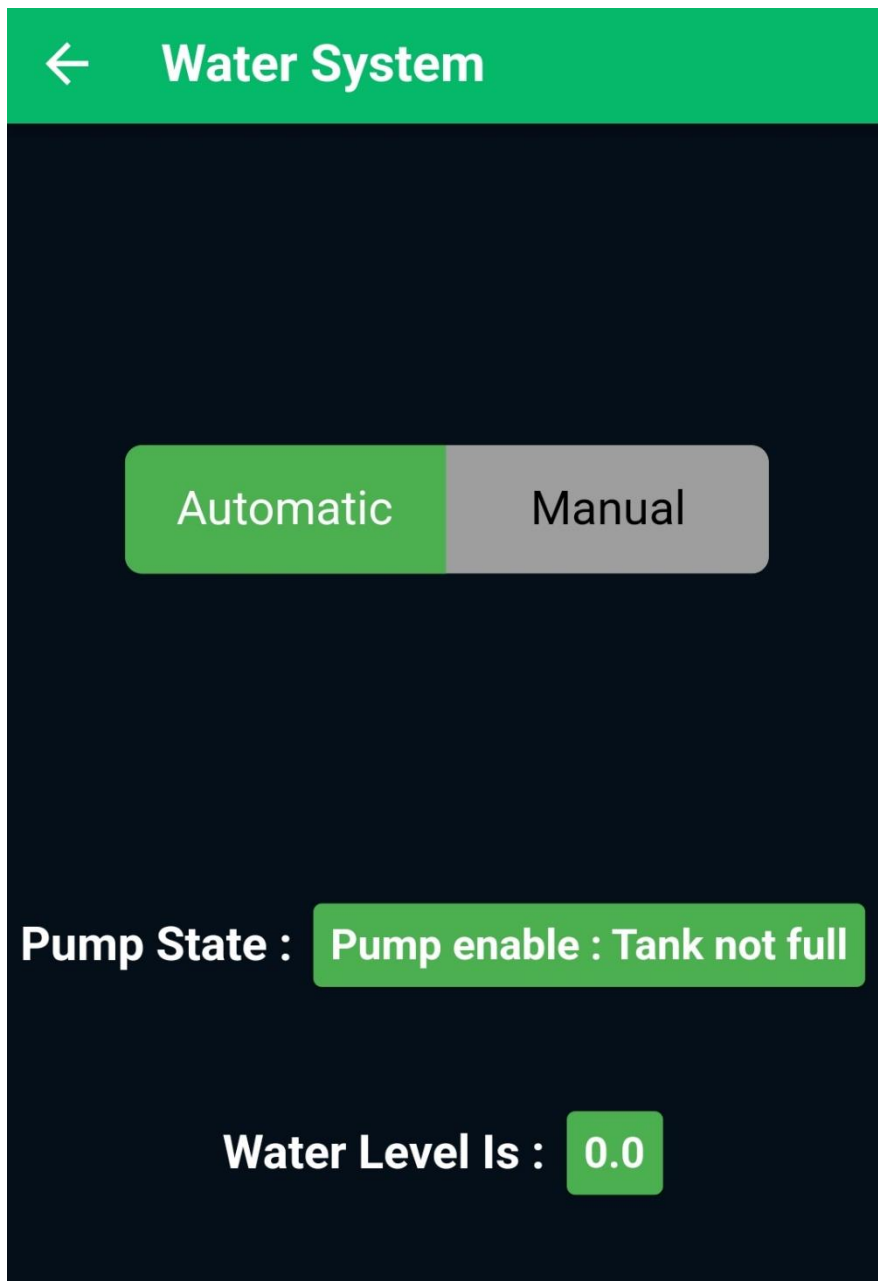


Figure 5 :Water Tank Filling System

4.2.1 Irrigation System:

The system consists of a soil moisture sensor, a 12v pump and two-channel relay



The soil sensor constantly reads the moisture level in the soil if it is less than a certain value (70) the controller ESP32 sends a signal to the relay to close the .circuit and turn on the pump

The process of pumping water from the pump to the soil continues until the soil moisture sensor value becomes higher than 90, then the sensor sends a signal to .the ESP32 to turn off the pump

Also, the user can control the pumping of water into the soil manually through .the manual mode in the mobile application

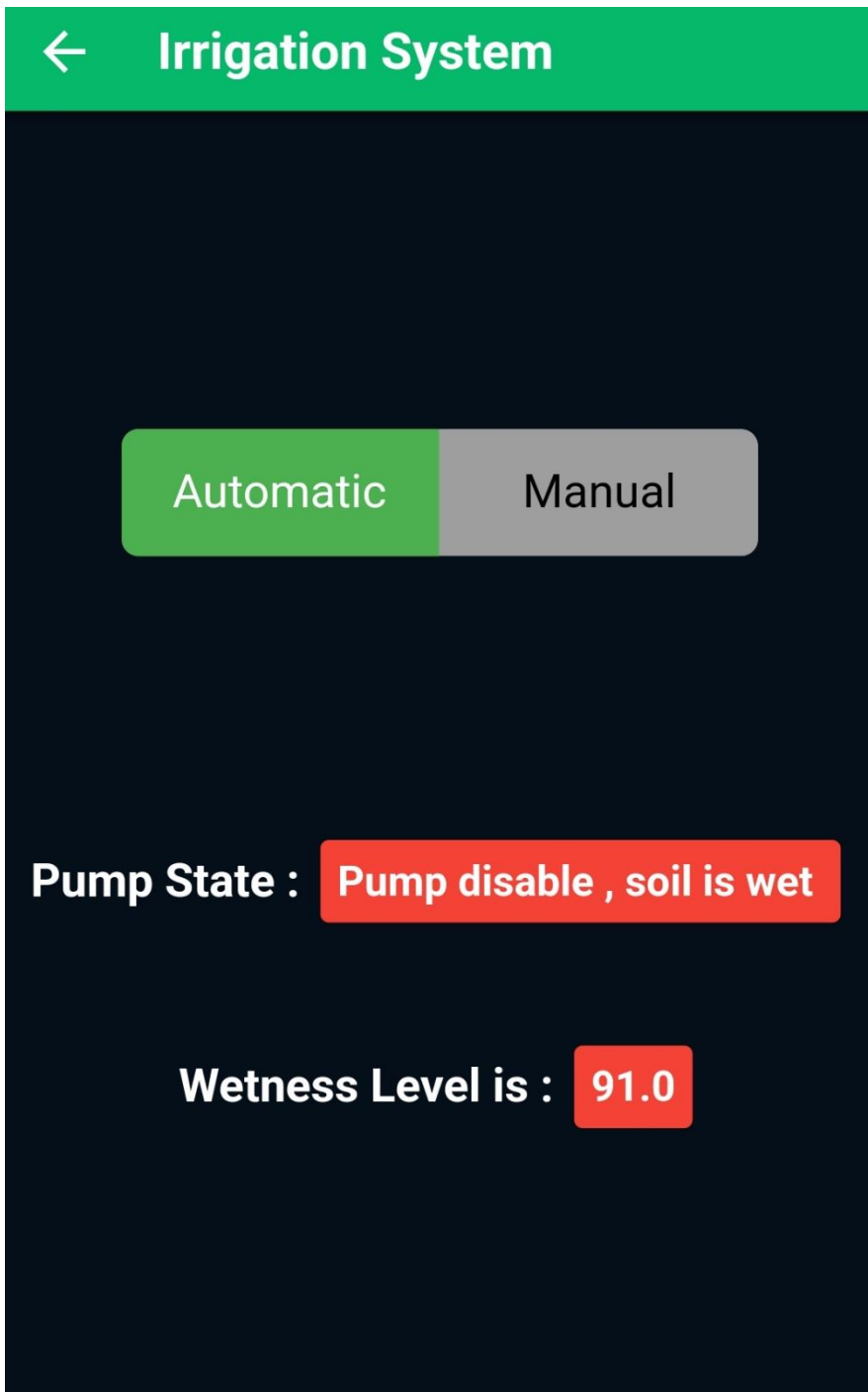


Figure 6 :IrrigationSystem

4.2.7 Monitoring system

This system consists of an ESP32Cam



This system gives the user the ability to monitor his home whenever he wants, as it contains an ESP32Cam connected directly with the Android app. The user can open the Android application and start monitoring his home easily.

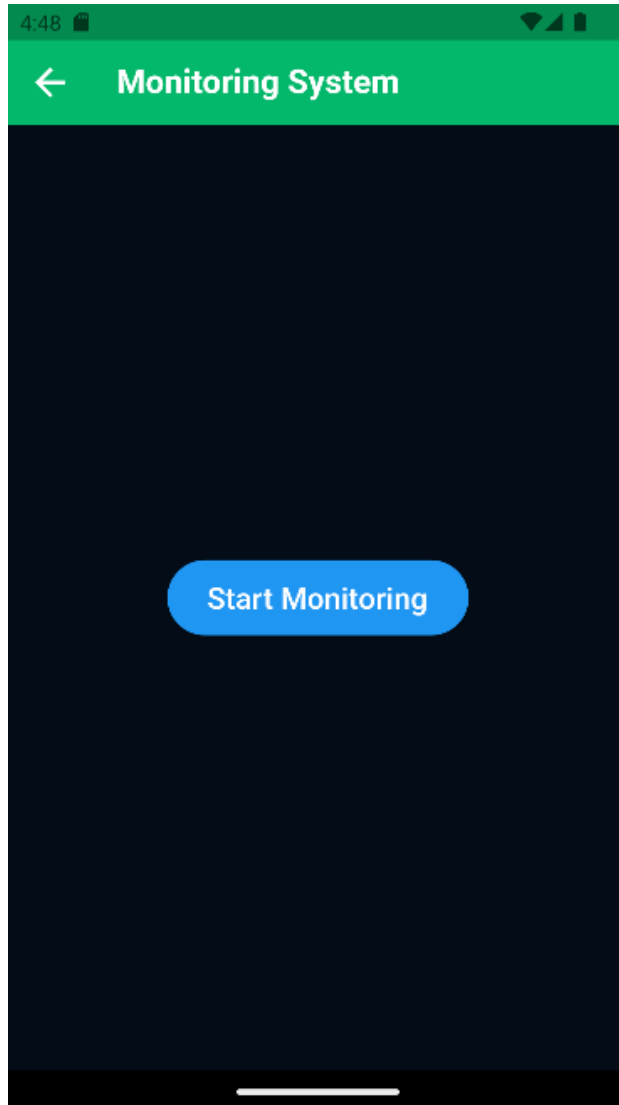


Figure 7 :Monitoring System

4.2.8 House gate system:

The system consists of a servo motor and an ice cream stick and a motion sensor.



The gate system work through an ice cream stick tied to the motor which stops as a barrier behind the door when it is in a closed position to prevent anyone from entering and if someone wants to enter, the stick will move away from the door.

in the automatic mode, if there is a motion from the motion sensor then the gate will open, and when the motion stops the gate will close.

in the manual mode, the user controls the gate through two buttons, “open” and “close” inside the app.

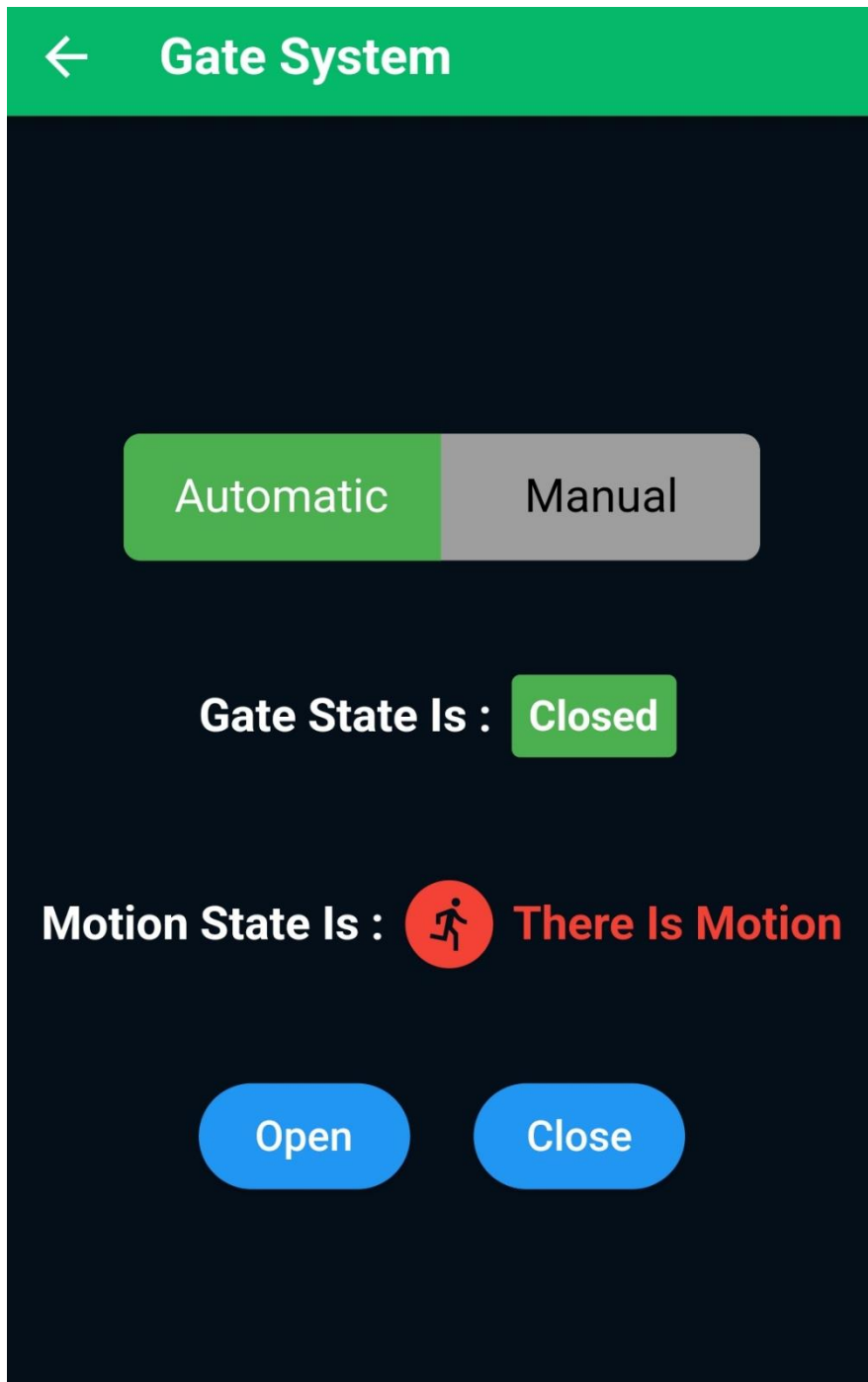


Figure 8 :House Gate System

Chapter 5

5 Result and Discussion

In this project, we have created a smart home model that can be remotely controlled through a mobile application and apply the principle of the Internet Of Things (IoT) which gives the user many functions and features that facilitate his life.

During our work on this project, we faced many difficult problems and challenges. We learned a lot while solving these problems. We gained experience in the field of hardware and in some languages that we did not know before and that's what we are going to talk about in this chapter.

5.1 Learning Curve

Because our knowledge in the field of hardware is little, and because we decided in this project to use new methods, which require a lot of studies and learning for the topics we want, and also we need to practice what we learn and take advantage of the errors and problems that will face us and one of the most important things that helped us was the great community interest in this field.

5.2 Challenges

We faced a lot of challenges while working on this project, and these are some of the challenges that we face :

1-The high prices of electronic parts and the difficulty of finding them in the market.

2-Learn and master flutter language.

3-Dealing with some parts of the project that need a special process.

Chapter 6 & 7

6 Conclusion and Future Work

6.1 Conclusion

We made a model of a smart home that uses the principle of the Internet of Things (IoT) that is controlled by a mobile application, and we have endeavored to put in it all possible useful features that make the user's life easy, and comfortable by modern technology.

6.2 Future work

And because the house is one of the most important places for us, the field of our project which is smart house is very wide, and many features and functions can be added to it for example :

1-Making the monitoring system more sophisticated and dependent on the movement and sound surrounding it and making it rotatable to cover more area.

2-Giving the user the ability to control the windows and doors of the interior rooms.

3-Increase the security of the house by setting a password to enter the house and operating an alarm if an attempt is made to open the main door by force.

7 References

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