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I confirm that I understand my coursework needs to be submitted online via MST platform under the relevant module page before the deadline in order for my assignment to be accepted and marked. I am fully aware that late submissions will be treated as non-submission and a mark of zero will be awarded.

Acknowledgement

We would like to show our gratitude towards our module leader Mr. Sugat Man Shakya and our tutor Mr. Suryansh Mathema, for giving us this wonderful opportunity to work in the IOT project of the topic, “Smart home system”. This gave us a chance to research about IOT and its domain which help to expand our knowledge in this domain.

We would like to express our gratitude, towards all our friends and family who generously assisted us in this project. Despite their schedules they offered insights and made the effort to assist us. We are truly touched by their support and would like to extend our thanks once again for their valuable contributions.

Abstract

The main aim of this IoT study project and to be able to control home appliances from anywhere using the mobile devices. This Internet of Things project uses a relay module and an ESP32 microcontroller to build a smart home automation system. Users may operate numerous household equipment, like motor and lights, remotely with any mobile devices. Device control is made possible by the communication between the relay module and the ESP32, which is connected via Wi-Fi. Furthermore, DHT sensor is used to monitor the temperature and humidity of the home as well. Through simplicity and remote appliance management, the project demonstrates how IoT may improve home automation.

Table of Contents

Table of Figures

Table of Tables

1. Introduction

Internet of things (IoT) is referred as a network of interconnected physical devices or objects such as appliances and vehicles, that are embedded with software, sensor and actuators that communicate with the computing system via wired or wireless connection allowing the physical world to be monitor and control (McKinsey & Company, 2022). We were assigned to utilize the concept and principal of the IoT in this project. The project “Smart home system” is based on ESP32 microcontroller board and relay module. The ESP32 development board is connected to the Wi-Fi which allows the IoT device to be control the electronic device connected through relay module and DHT module is also used to monitor the temperature and humidity of the home.

1.1. Current Scenario

One of the main issues with every home is the lack of a control system for electrical equipment. The amount of power used will rise when appliances are accidentally left on. As 80-90% of the electricity is wasted in heat and only 10-20% of the electricity is only used for electronic device function this device can save the electrical energy. Not only does this disorganized management lead to increased energy expenses, but it is also dangerous because of potentially harmful equipment that are left on. To reduce waste, increase convenience, and ensure a safer and more productive home environment, a solution that allows remote control of these devices is needed.

1.2. Problem Statement and Project as Solution

The absence of centralized control system for electrical equipment is a major issue in every household. This can lead to increased inconvenience, home insecurity when user is away, higher electrical usage, and potential electrical hazards particularly if there are differently-abled members present in the family.

The "Smart home system" can help reduce electrical usage, inconvenience, and potential electrical hazards by remotely controlling high electricity-consuming devices. Additionally, this system enables users to remotely simulate presence by turning lights on and off, providing an impression of someone being at home.

2. Aim and Objectives

2.1. Aim

The main goal of this IoT project is to create a system that can control the electronic device remotely by using mobile device.

2.2. Objectives

The objective of this project are as follows:

- To turn on and off the electronic devices through mobile device remotely using cloud.
- To manually switch on and off the devices.
- To monitor the temperature and humidity inside the home through mobile device.
- To be able to connect the IoT device with voice assistant to be able to control device through the voice assistant.

3. Background

3.1. Expected Outcome and Deliverables

As this group project aims to create the smart home system. This system uses ESP32, DHT module, LDR sensor and Rainmaker Cloud integration. By employing ESP32 as the central unit of the system, DHT-11 sensor module to monitor the temperature and humidity as well as LDR sensor to detect light detection; this setup can be connected to relay module allowing us to control the various electronic devices throughout the home. With the Rainmaker cloud service, the user can monitor the temperature humidity and the light level of the home remotely from anywhere in the world, automate the relay switches from the ESP Rainmaker application. Moreover, Rainmaker's platform integration with voice assistant such as Google Voice Assistant and Amazon Alexa provides an interface for the voice-controlled relay operation seamlessly.

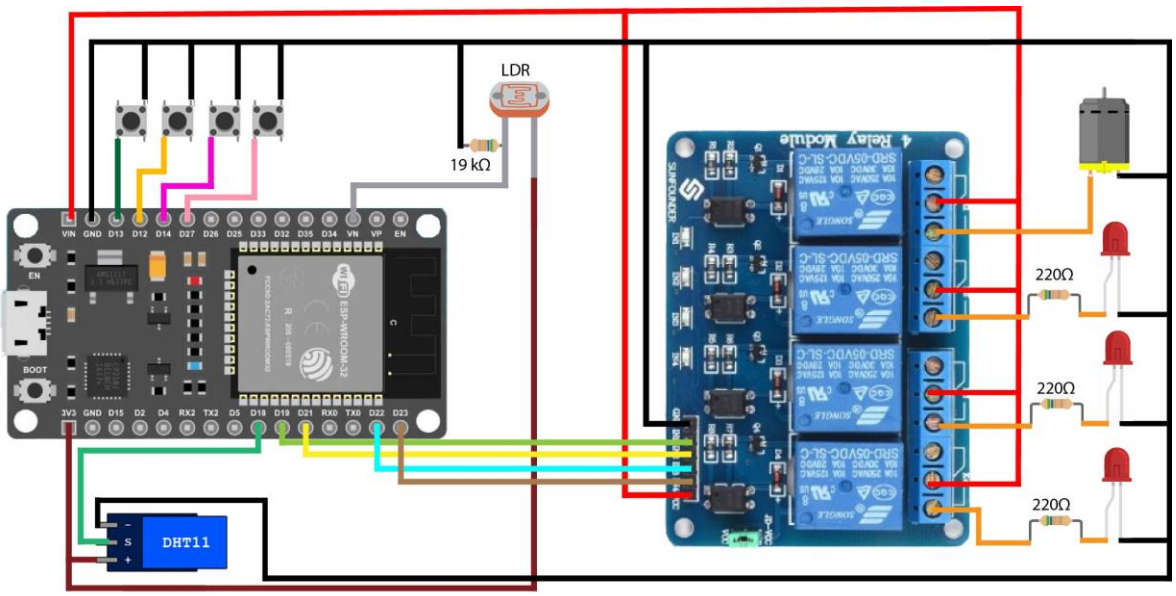

Figure 3.1: Circuit Diagram of The System

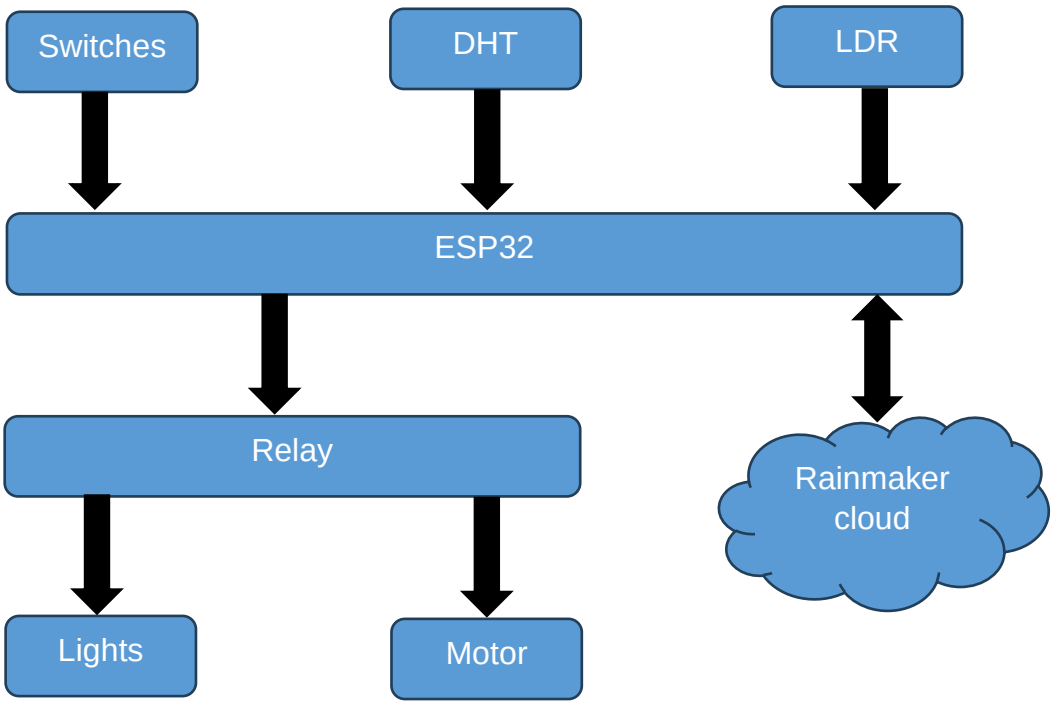

Figure 3.2: Block Diagram of the System

3.2. Requirement Analysis

3.2.1. Hardware Requirement

a. ESP32 Development Board

ESP32 is a versatile and powerful microcontroller unit that has integrated Wi-Fi and Bluetooth capabilities, extensive GPIO support, and low-power features (CircuitSchools, 2022).

Figure 3.3: ESP32 Board

b. Relay Module

Relay Module is circuit board that is used as switch. It consists of electromagnet that mechanically switches an electrical circuit on or off. (GEP Power Products, 2023).

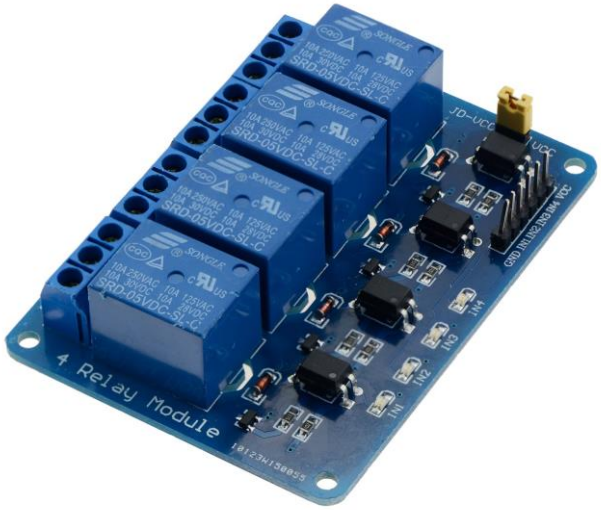

Figure 3.4: Relay Module

c. DHT Module

Digital Humidity and Temperature (DHT) module is mainly used for measuring temperature and humidity of the surrounding air with the help of humidity sensor (MicroPython, 2023).

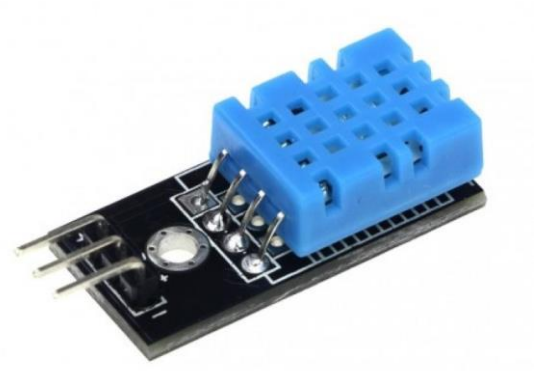

Figure 3.5: DHT-11 Module

d. Momentary Switch

Momentary switches are switches which remain in on state if the switch is being actuated or pressed when released it will return to the off state (Langir Electric, 2023).

Figure 3.6:Momentary Switches

e. Breadboard

Breadboard is a board that is mainly used for building or prototyping circuits without soldering (CircuitBread, 2019).

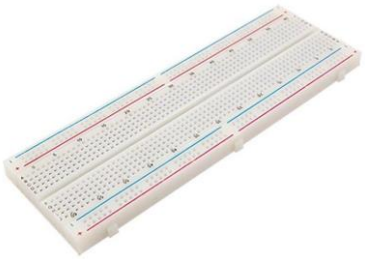

Figure 3.7: Breadboard

f. Jumper Wires

Jumper wires are the metal connector that is used to close or open the circuit in the breadboard.

Figure 3.8: Jumper Wires

g. LDR Sensor

LDR sensor also known as Light Dependent Resistor is a passive electronic sensor that is used to detect the light levels (Karvinen & Karvinen, 2014).

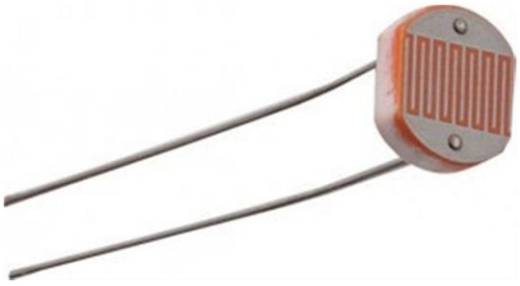

Figure 3.9: LDR Sensor

h. Resistor

It is an electronic device that is used for regulating the flow of electric current in the circuit. It allows us to control the flow of current in the circuit (Karvinen & Karvinen, 2014).

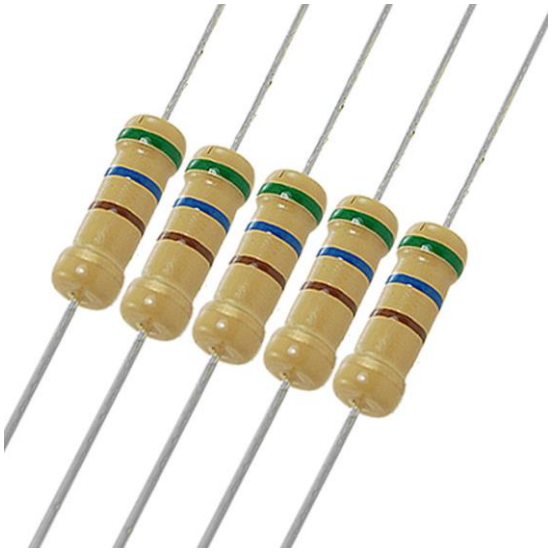

Figure 3.10: Resistor

3.2.2. Software Requirement

a. Arduino IDE

Arduino IDE is an open-source development environment for Arduino and Arduino compatible microcontroller boards (Culkin & Hagan, 2017). It is used for writing codes and uploading to the ESP32 board.

b. MS Word

MS Word is used for the documentation of this project.

c. Espressif RainMaker Cloud

Espressif RainMaker is an IoT cloud software that lets users to create wireless control and remote monitoring devices based on any kind of a IoT solution using ESP32 with just one click of deployment (IoTDesign pro, 2023).

d. Krita

It is used for creating the system architecture and the circuit diagram of the Smart home system.

4. Individual Contribution Plan

The individual contribution of each member of the group to complete this project

Name	Responsibility	Task
Subigyan Paudel (Leader)	Software Development and maintenance, Task Division	• Develop firmware for microcontroller and assemble the hardware. • Requirement Analysis. • Research about expected output and deliverable. • Fix error in the code. • Document every step of development.
Kristina Shahi	Hardware Selection	• Select microcontrollers • Ensure connectivity. between hardware components. • Research about the project as solution. • Document every step.
Sujan Shahi	Testing and Quality assurance	• Test each individual component's unit. • Report the problems observed to leader. • Research about current scenario.
Parina Shrestha	Documentation	• Document the project details. • Write instructions or user manuals. • Aims and objectives

Table 4.1: Individual Contribution Plan

5. Conclusion

In conclusion, our journey of building a “Smart home system” has been extremely exciting. This project has demonstrated how IoT could completely change the way we interact with our living environment.

Our team’s aim is to present a working prototype that turns homes into responsive, intelligent spaces. With the help of smart technologies like the Internet of Things (IoT), our prototype shows how our homes are not just places to live but they are partners in improving our standard of life by automation.

Finally, it has been an amazing journey, and the knowledge we have gained will be useful to us in the future. We're excited about what lies ahead and prepared for the next big moves.

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7. Appendix

7.1. System Architecture

The architecture shows that board is connected to the Wi-Fi which allows the IoT device to be control the electronic device connected through relay module and DHT module is also used to monitor the temperature and humidity of the home. Since, the IoT device can be turned on and off remotely using mobile devices, it is comfortable and accessible from a distance and simplifies the control of various devices inside the home. And, the level of the lights can be also detected through LDR sensor which can be again used to automate using its parameters.

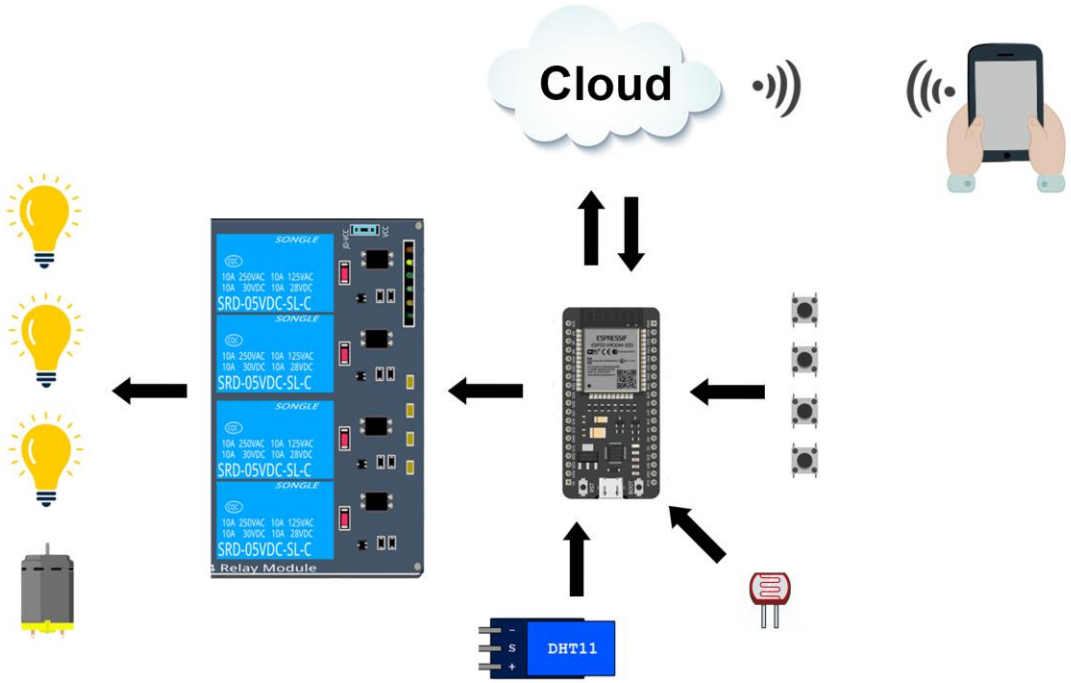

Figure 7.1: System Architecture of Smart Home System