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EMBEDDED SYSTEMS

SMART ROOM

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Abstract

The project demonstrates the design and implementation of a Smart Room System which increases home automation and energetic efficiency with the aid of the PIC16F877A microcontroller. This system employs environmental sensors and a manual push-button interface to automate the control of lighting, fan speed, and door/window shutter operation within the room. The smart room increases comfort by controlling temperature and light levels while at the same time, energy is optimized with the system's response to real-time changes. The paper highlights system architecture, important parts, their goals as well as restricting factors in the implementation and their possible answers.

Table of Contents

INTRODUCTION

Embedded systems are integrated computing systems consisting of hardware and software that can perform a specific task efficiently. They are used in automation, healthcare, and IoT, enhancing functionality and addressing challenges in the world. The PIC16F877A microcontroller works perfectly in these applications because it is cost-friendly and versatile, containing features such as analog to digital converters, timers, and serial communication interfaces. The PIC16F877A will be used in this project to develop a smart room system that automates common tasks, improves user comfort, and helps conserve energy. The system will utilize temperature, light, and ultrasonic sensors, as well as servo and DC motors enabling the automatic control of shutters, fans, and lights, so that they adapt to the environment. This project seeks to implement an embedded system for modern automation and to create an efficient living space that conserves energy.

OBJECTIVES

The primary objectives of this project were to:

1. Develop a smart room system using the PIC16F877A microcontroller to automate essential room functions.
2. By offering responsive room automation and remote control options, you may increase user accessibility and convenience.
3. Integrate environmental sensors

The key goal of this project energy efficiency, and user convenience through embedded system technology, the main objective of this project is to design and implement a smart room system that makes use of the PIC16F877A microcontroller to automate and remotely control various room functions, such as lighting, fan speed, door, and shutter operation, based on environmental conditions and user inputs.

COMPONENTS AND ILLUSTRATIONS

The table below provides a comprehensive list of all hardware components used in the SMART ROOM , along with their respective figures for visual reference.

Switch ON OFF	
3X Battery 3.7V	
DS18B20 TO-92 temperature sensor	
Wires	
LDR module	
DC motor with gearbox	

Push Button	
PIC16F877A	
Ultrasonic Sensor	
10K	
Crystal 8MHz	
Dual H-Birdge	
Servo Motor	
BreadBoard	

Table1: Hardware components

SENSORS (WHY WE USE THEM IN THE PROJECT)

Ultrasonic Sensor: detects the presence of a person at the door in order to open it.
Servo motor: to open and close the door.
DC motor with gearbox: for the fan, and to open and close the shutter.
LDR sensor: to know the mode of the day (night or day).
Temperature sensor: to know the temperature inside the room to turn the fan on or off.
Push buttons: to turn on and off the things.

FLOWCHART

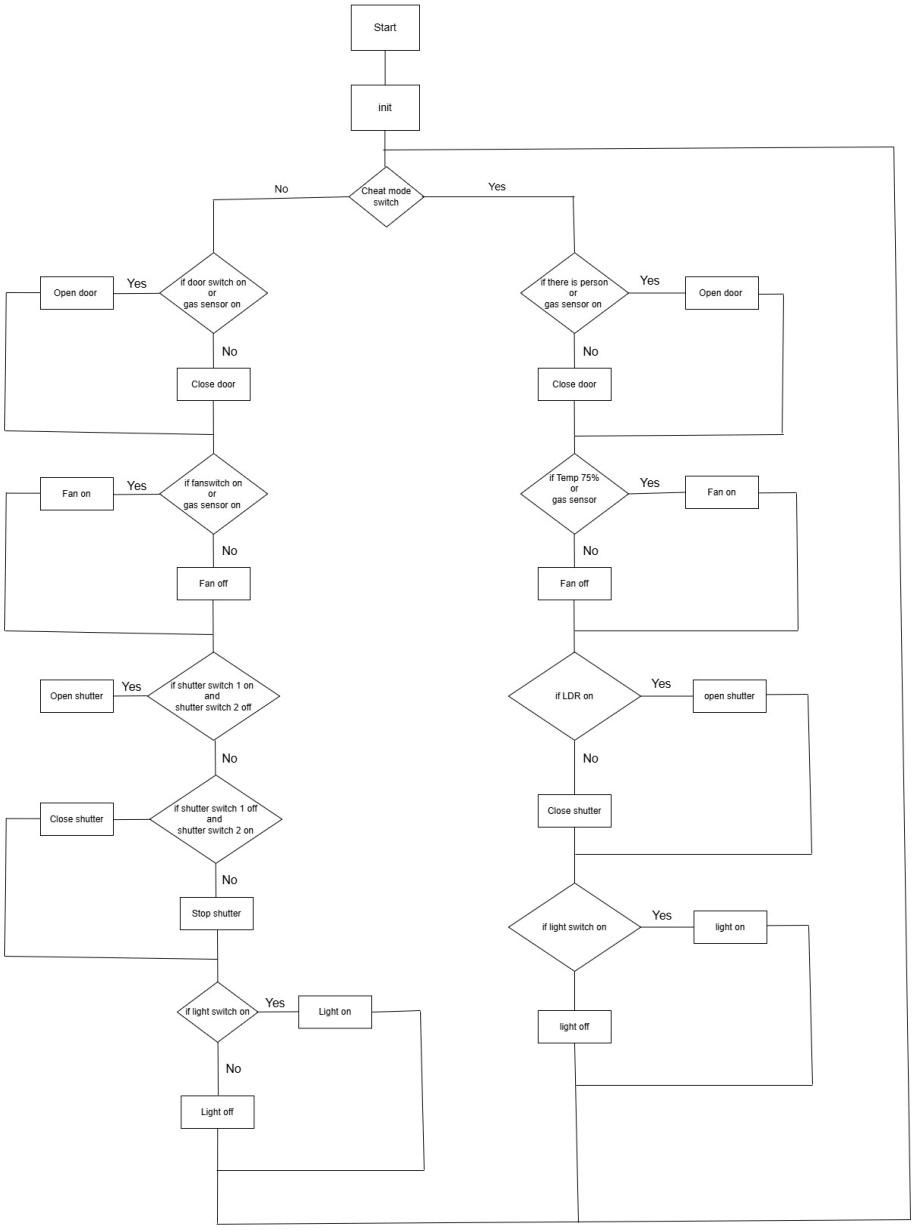
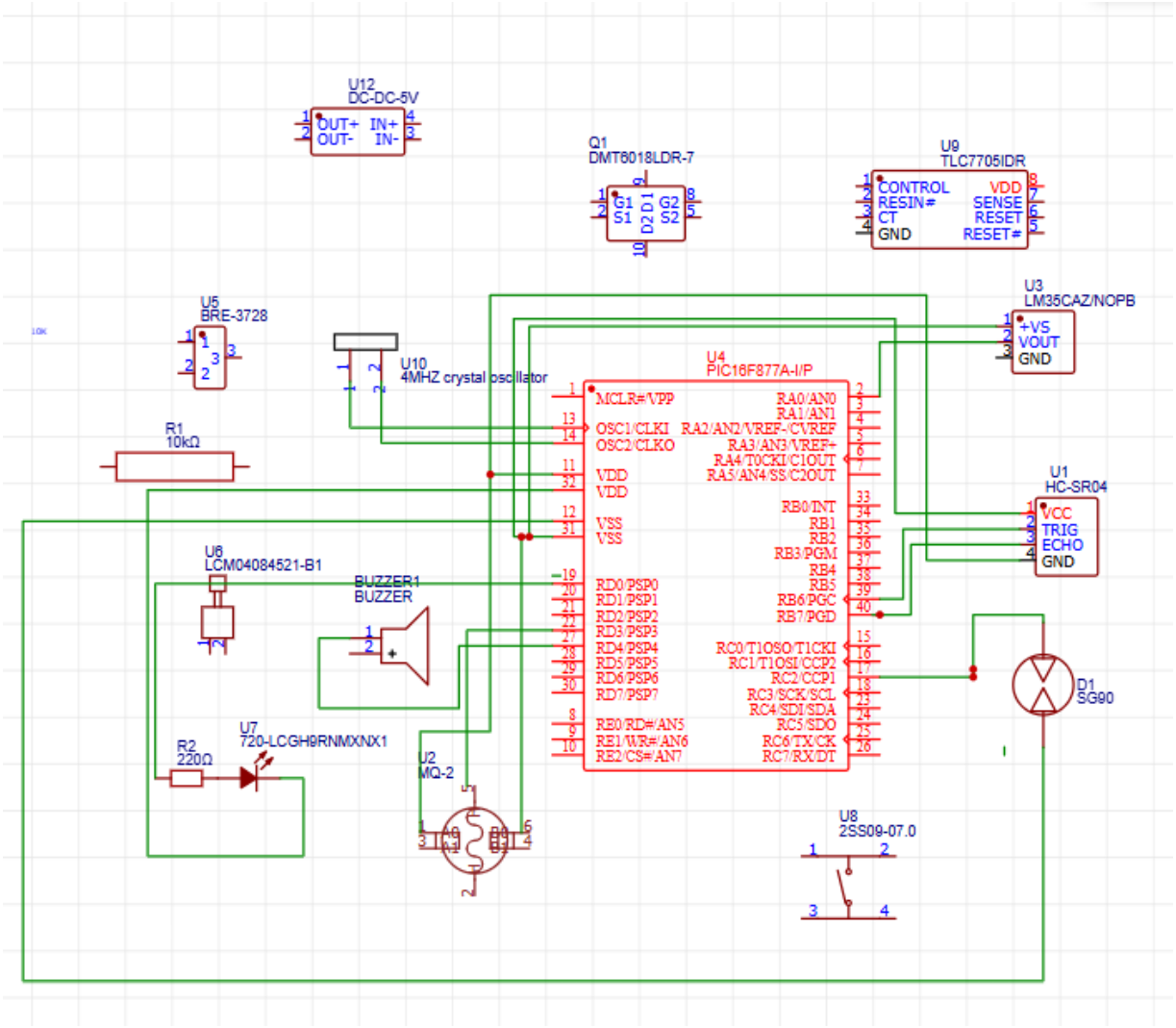
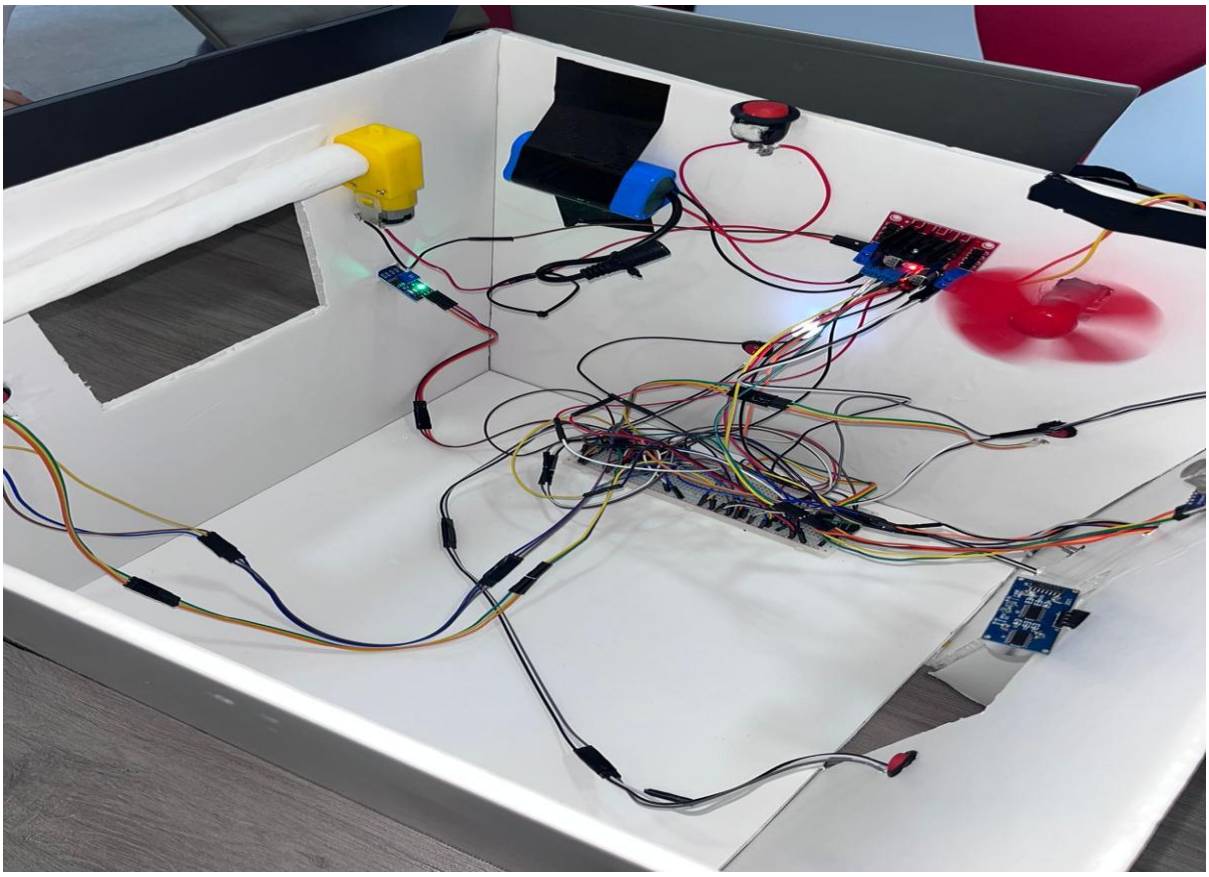


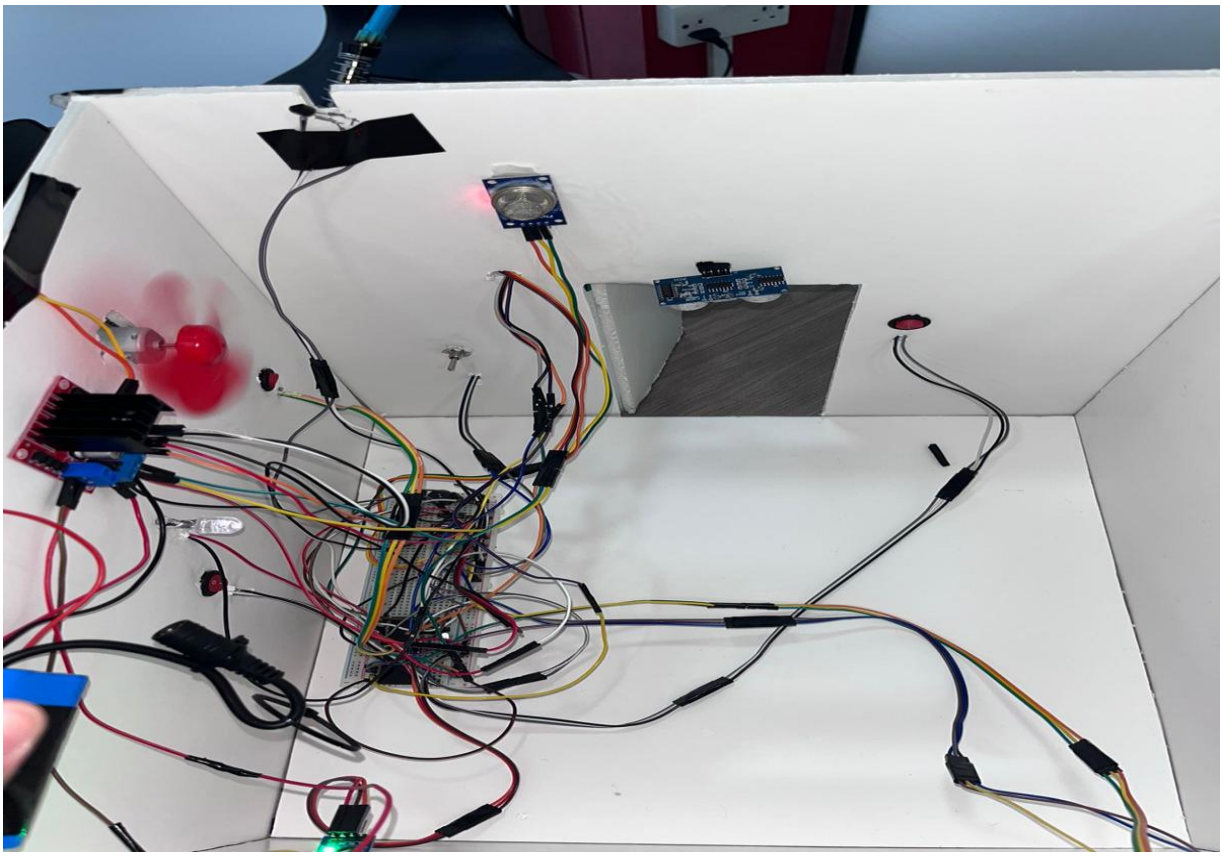
Figure 1: Flowchart of operation

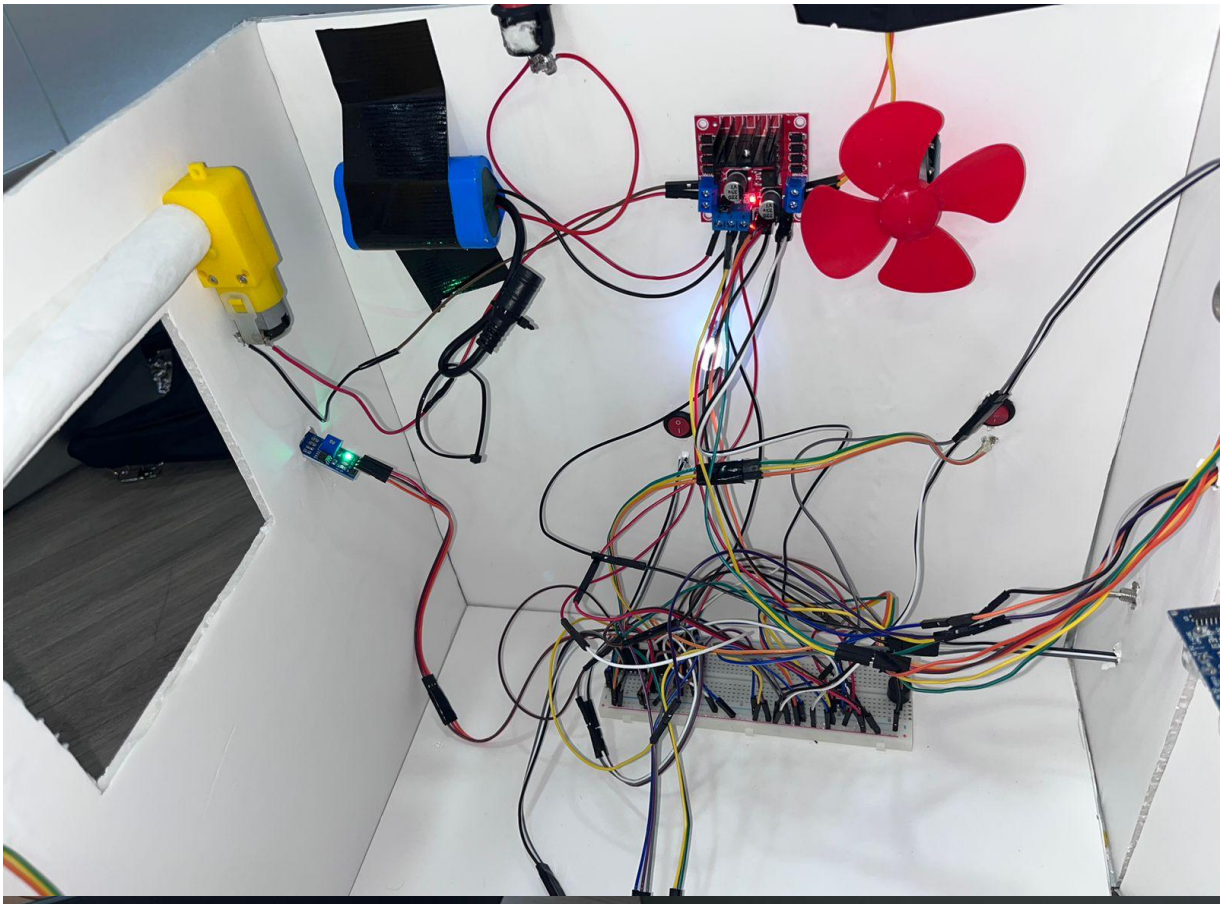
CIRCUIT DESIGN

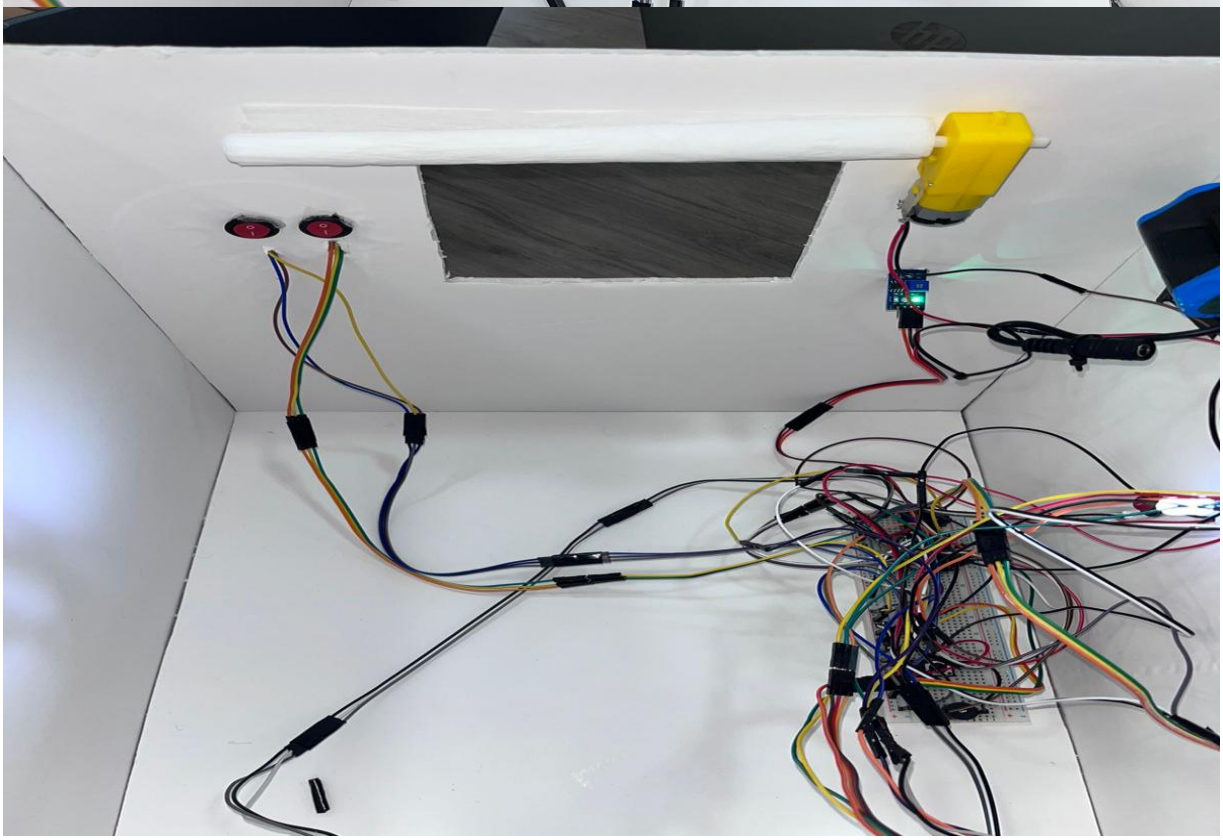


PICTURES









PROBLEMS AND RECOMMENDATION

1. Problem➢ Environmental noise or calibration issues can cause LDR, temperature, and ultrasonic sensors to give inconsistent readings.

Recommendation: For best results, calibrate sensors on a regular basis.

2. Problem➢ Using an H-bridge to control several motors (servo, DC) could cause overheating or unpredictable behavior.

Recommendation: Reduce power waste and achieve exact speed control with PWM signals.

3.Component Damage Problem ➢ Cause Difficulty: miswiring or incorrect component handling.

Recommendation: is to verify connections twice and handle parts with caution.

CONCLUSION

The Smart Room project has successfully shown how to automate a house by combining efficiency with convenience and energy conservation using the PIC16F877A microcontroller. The advanced robotic system with environmental sensing, automation logic, and autopilot/manual toggling control caters to modern homes by making them more comfortable, secure, and energy efficient. The project does, however, experience some technical and mechanical problems, which with polished software engineering, smart part choices, and better design interfaces can be resolved. It demonstrates how embedded systems can enhance the intelligence and responsiveness of living spaces while laying the groundwork for more advanced smart homes.