IOT BASED STUDIO AUTOMATION

Project Report in

Computer Applications

Submitted to

Goa University

By

Mr. Aaron Savio Cardozo

Mr. Alrich Monterio

Mr. Astle Fernandes

Mr. Benson Coutinho

Mrs. Jagruti Nadge

THIRD YEAR BACHELOR OF COMPUTER APPLICATIONS

2023-2024

Under the Guidance of

Asst. Prof. Johann Rodrigues

Rosary College of Commerce and Arts

Navelim, Salcete-Goa

DECLARATION

We declare that this project report entitled **"*IOT based Studio Automation*"** has been prepared by us and to the best of our knowledge. It has not previously formed the basis for the award of any diploma or degree by this or any other University.

Name of the Students	**Roll No**	**Signature**
Mr. Aaron Savio Cardozo	R/BCA-21-102	
Mr. Alrich Monteiro	R/BCA-21-107	
Mr. Astle Fernandes	R/BCA-21-111	
Mr. Benson Coutinho	R/BCA-21-115	
Mrs. Jagruti Nadge	R/BCA-21-133	

DATE: 10 February 2024

PLACE: Navelim

CERTIFICATE

Certified that this project report entitled **"*IOT based Studio Automation*"** is a record of work done by the candidates themselves under my guidance during the period of study and that to the best of my knowledge, it has not previously formed the basis of the award of any diploma or degree by this or any other university.

Asst. Prof. Johann Rodrigues

Project Guide

Certified that the project entitled **"*IOT based Studio Automation*"** has been undertaken by the students during the academic year 2023-2024 in the laboratory of this college.

Asst. Prof. Tracy Almeida

Project Coordinator

Prof. Helic. M. Barretto

Principal

Examined the project entitled **"*IOT based Studio Automation*"** during the academic year 2023-2024.

Examiner

ACKNOWLEDGEMENT

With immense pleasure we present before Goa University our project entitled **"*IOT based Studio Automation*"**. We would like to thank and express our gratitude to all those who help in making this project a success.

We are deeply thankful to our project guide Asst. Prof. Johann Rodrigues for all the guidance and assistance rendered the successful completion of this project.

We express our sincere gratitude to our project coordinator Asst. Prof. Tracy Almeida for helping us to successfully complete our project.

We are grateful to our Principal Prof. Helic M. Barretto and Administrator Rev. Fr. Gabriel Coutinho for providing us with the best facilities to complete our project work.

We express our gratitude to the other Professors, Librarian, and System Administrators of our college for all the help rendered in their capacities.

In a special way we are thankful to our parents for financing our project and our friends for all their valuable suggestions.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

List of Screenshots

Chapter 1
SYSTEM ANALYSIS

System analysis is the process of analysing a condition in order to make improvements through improved practices and protocols. This project is developed by examining and analysing the current system discovering the scope of the study. The study was conducted about the current system and working environment.

We also tested the feasibility constraints such as time, technological and cost/economic feasibility and have eventually decided to move forward with the project.

The time provided by the college was 7 months ranging from July- February. Thus, the project will be developed keeping in mind the time and resource provided by the college. A team of 5 members will be dynamically working on the project to obtain the desired output.

The execution of the project will require the technical skills and knowledge of Arduino programming. The financial requirements of this system do not demand funds that are not convenient. The funds required for the study are conveniently economic for our institution and our group members.

Through the analysis of "***IOT based Studio Automation*** ", we studied the existing systems that are available in the market and found that they are very expensive, so we planned to build a low cost effective IOT based Studio Automation which is affordable and will provide better functionality.

1.1 INTRODUCTION

We are used to having remote controls for our TVs and other technology in today's society, which makes life easier.

We have come up with the ***"IOT based Studio Automation"*** which is designed to automate and control various devices in a room. Our main goal is to use an Arduino board to build a system that lets people use a smartphone to control many devices using Bluetooth. Users can easily control lights, curtains, and automated doors with this studio automation system.

This system is budget-friendly and allows users to control lights and curtains using their smartphones.

By introducing this studio automation system, which enables users to operate lights, curtains, via Bluetooth from their smartphones, our system seeks to save customer's valuable time.

1.2 Limitation of Existing System

1. Door:

-Previously, doors were operated manually by pushing or pulling them

2. Curtains:

-In the past, curtains were opened and closed using our hands.

3. Lights:

-Lights were controlled by switches, requiring manual operation to turn them on or off.

1.3 Features of Proposed System

1. Door:

- The system enables users to open or close doors using sensors, eliminating the need for physical contact.

- Automatic doors detect approaching individuals and open accordingly without requiring touch.

2. Curtains:

- The system introduces an advanced feature for automating the opening and closing of curtains.

- With a simple button press, smart curtains will automatically open or close based on user instructions.

3. Lights:

- Users can fully control lights through the application, enhancing energy efficiency.

- In addition to toggling lights on/off, users can directly manage them using their smartphones.

Chapter 2
SYSTEM DESIGN

System Design involves planning out how a system will work by deciding on its structure, parts, how they'll interact, and the information they will use. It's like designing a blueprint for a system to make sure it meets the needs it's supposed to.It may take a bottom-up or top-down approach, but either way the process is systematic where in it takes in account to all related variables of the system that needs to be created from the architecture, to the required software, right down to the data and how it travels and transforms throughoutits travel through the system.

After the analysis of the *"**IOT based Studio Automation**",* we established certain facts that have to be handled to improve our system. First and foremost, we identified the processes that are reliable and do not require extensive change. We turn our focus to processes that need to be modified and redesigned to improve overall system performance.

We have used use case diagram to show how user interact with the system and app and show the relationship between the user, sensors and the different use cases. We have also used activity diagram which shows the flow between the actions in an activity. We used the circuit diagram and block diagram to show the connection between Arduino Uno, motor driver, Dc motor, battery, Led, HC-05 Bluetooth model, servo motor and PIR sensor.

2.1 Block Diagram

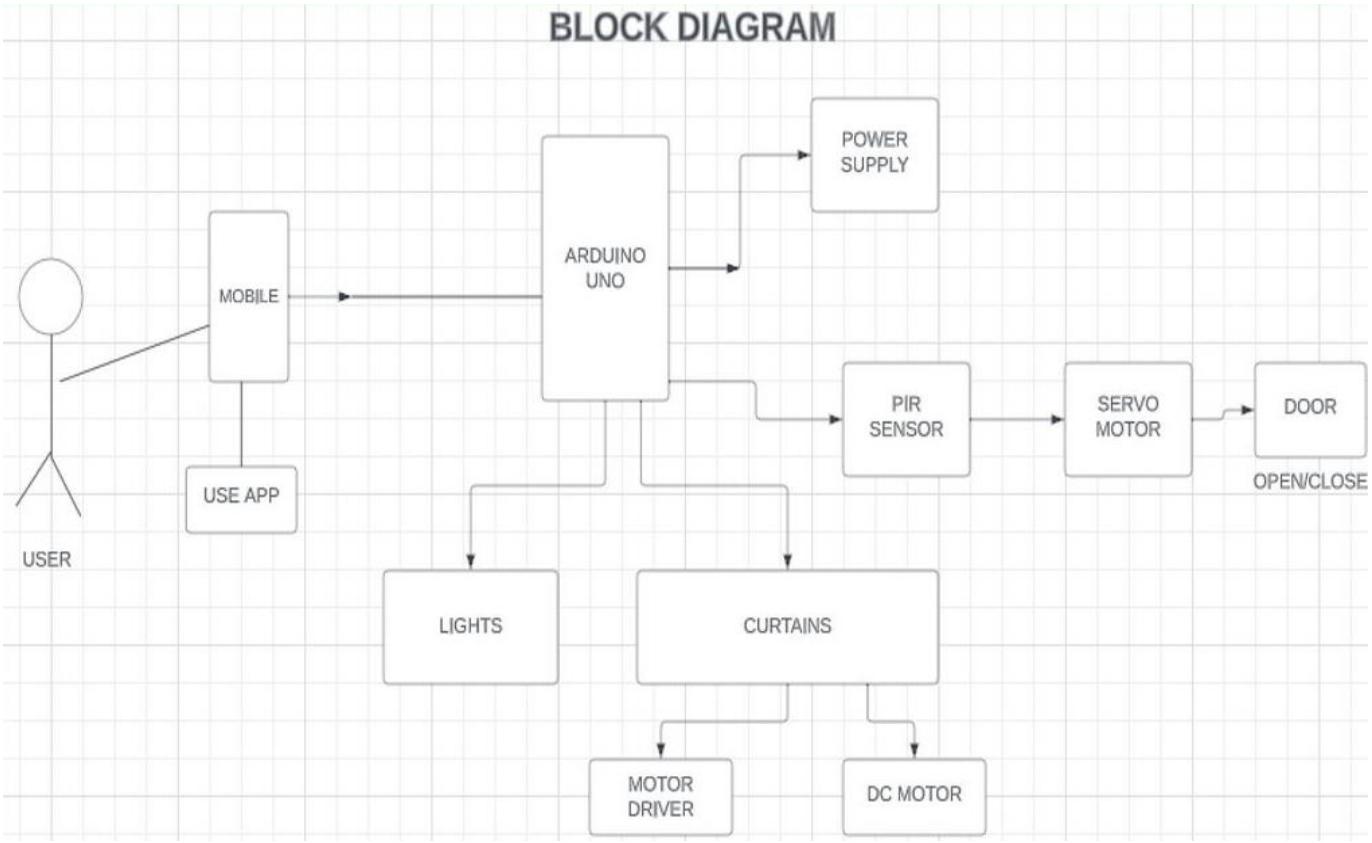


Figure2.1: *Block diagram for* ***"IOT based Studio Automation"***

2.2 Use Case Diagram

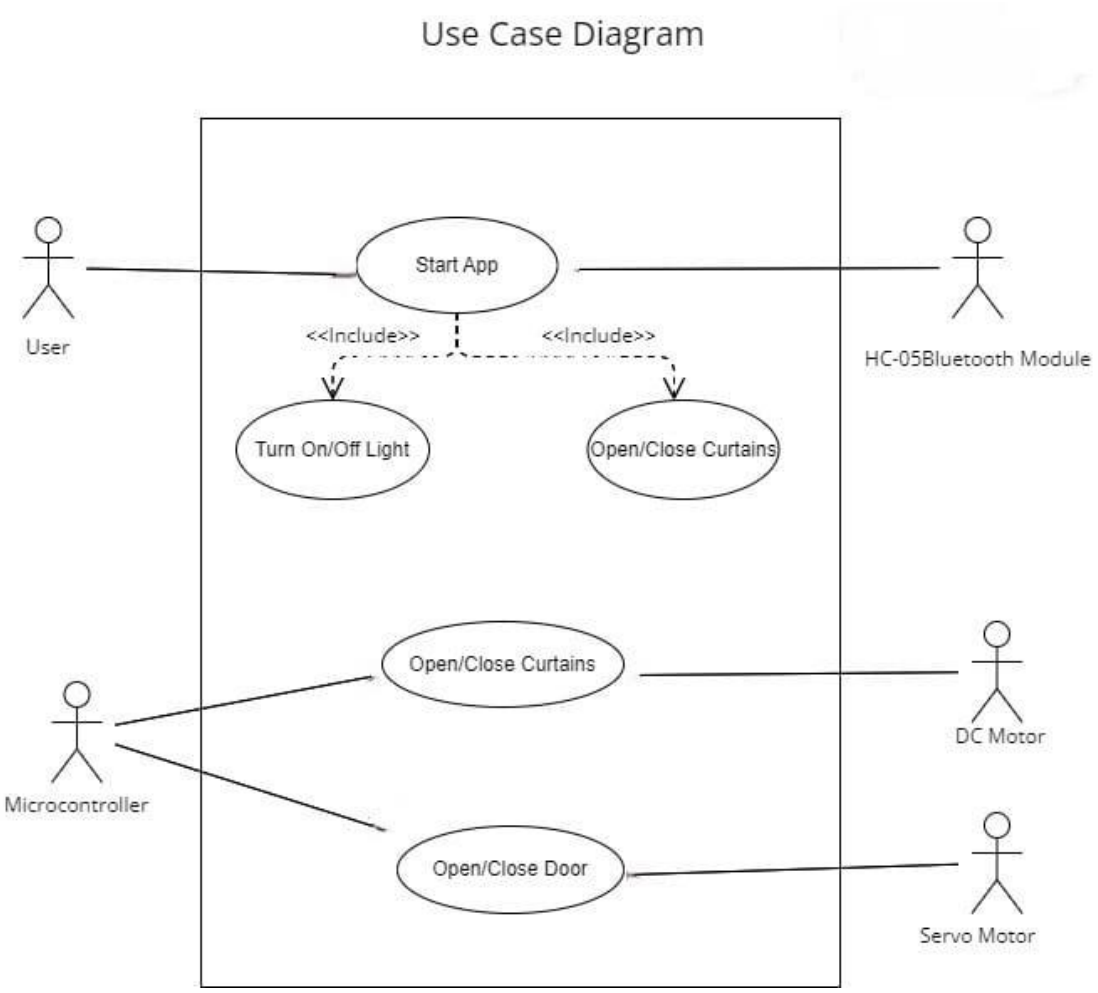
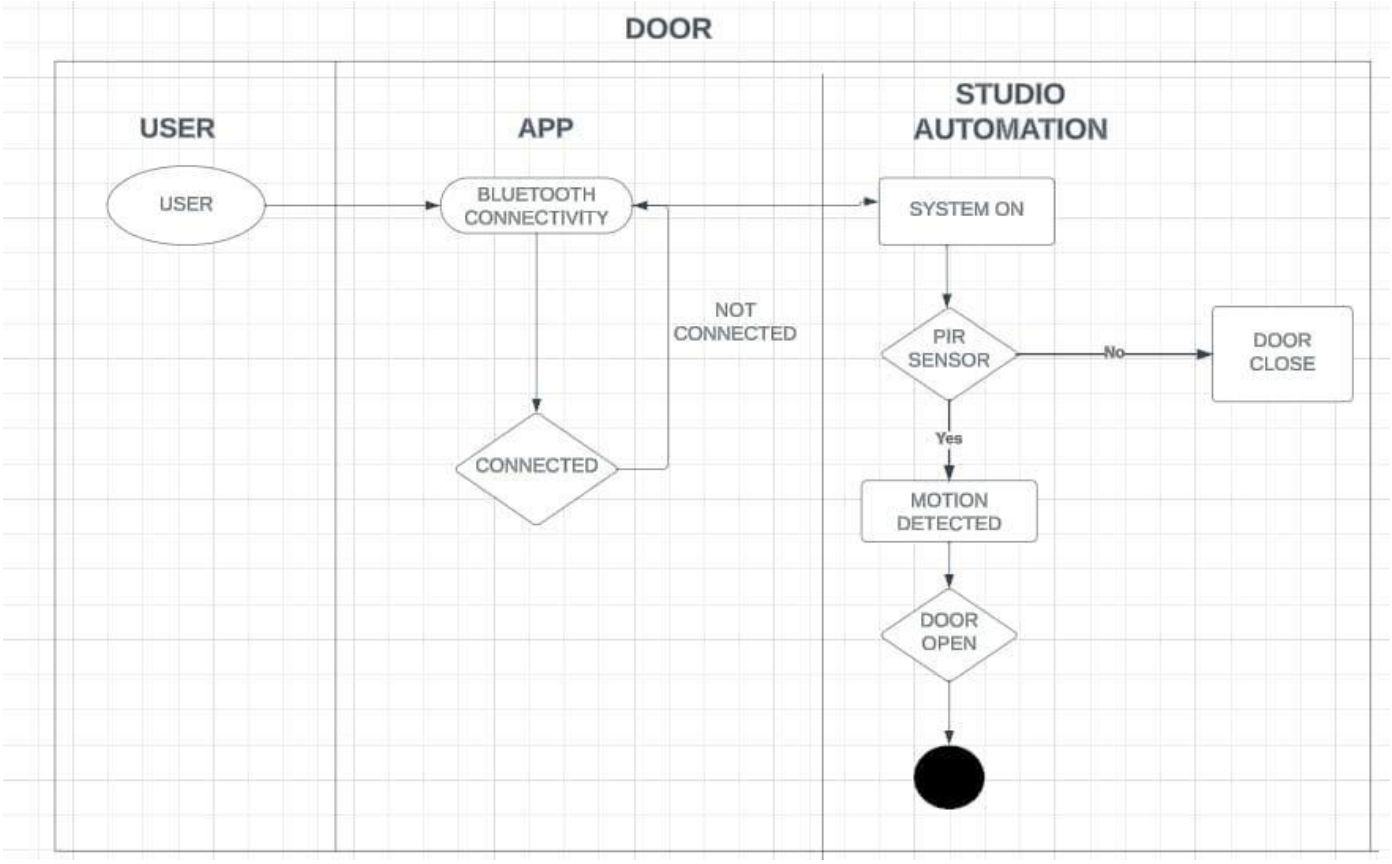


Figure2.2: Use Case Diagram for ***"IOT based Studio Automation"***

2.3 Activity Diagram



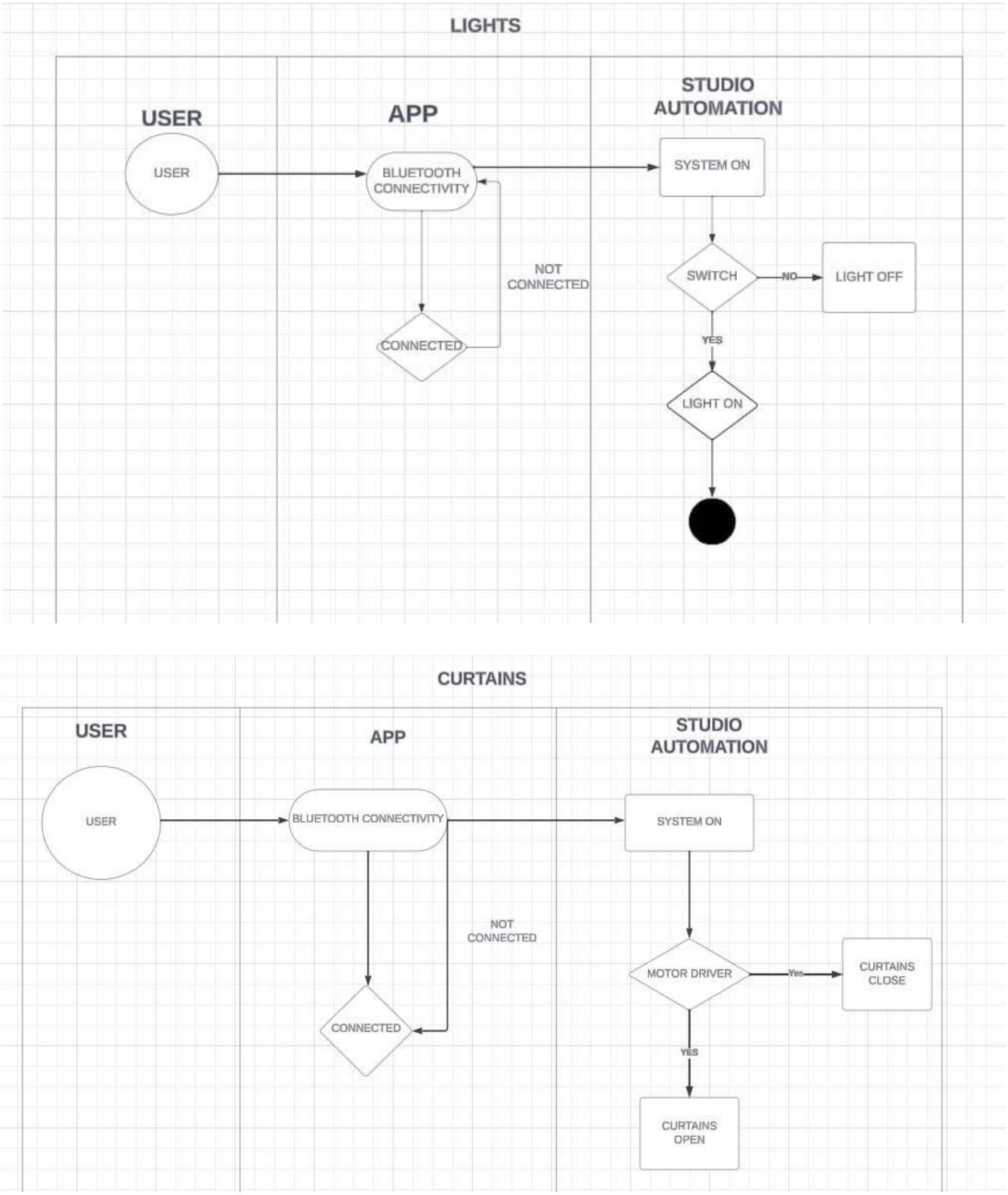


Figure2.3: *Activity Diagram for* ***"IOT based Studio Automation"***

2.4 Circuit Diagram

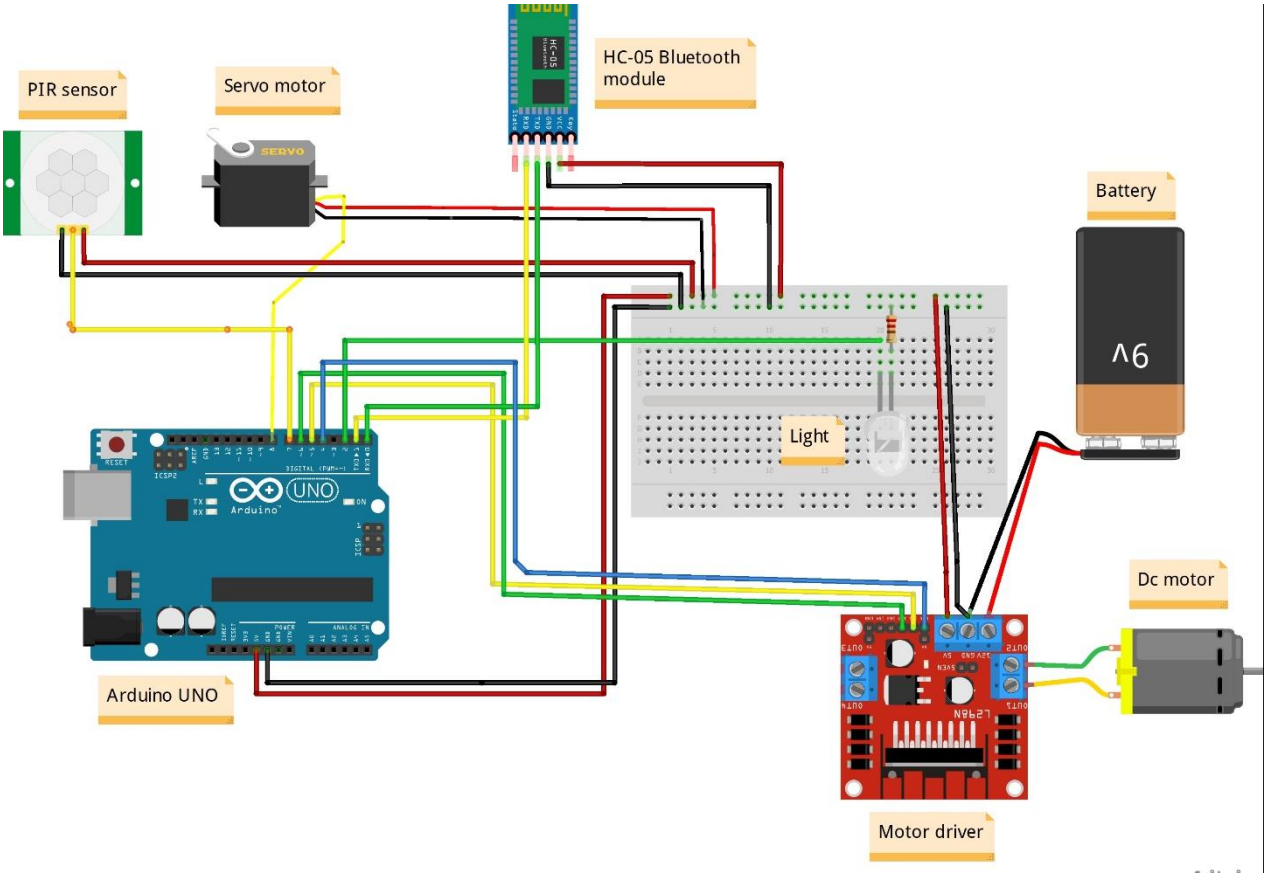


Figure2.4**: Circuit Diagram for **"IOT based Studio Automation"

Chapter3

SYSTEM IMPLEMENTATION

The ***"IOT based Studio Automation"*** is a combination of both hardware and software components and is implemented using all the components mentioned below. The main aim of this model is to create and develop a studio automation system using an Arduino board which can be controlled through Bluetooth via a smart phone. The door is automated with the help of Pir sensor and Servo motor. The Pir sensor will sense the motion and will trigger the Servo motor to open and close the door. For the light a led is been used which can be controlled by a smartphone. And for the curtain a Dc motor is used which is connected to Motor Driver.

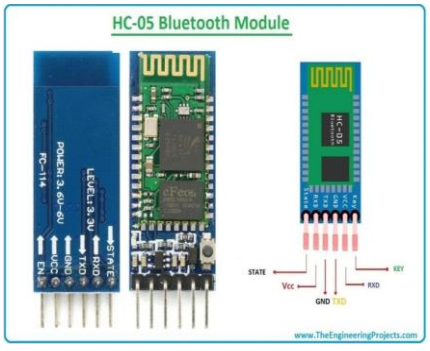
To control this function, we have developed an app. The software we have used to create this app is "MIT App Inventor".

3.1 Hardware Implementation Tools

3.1.1 Arduino Uno

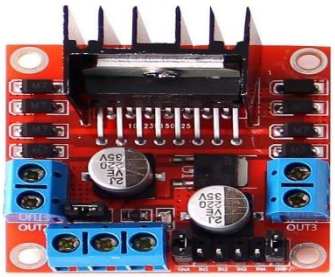
The **Arduino Uno** is a popular microcontroller board widely used in electronics projects and prototyping. It features digital and analog input/output pins, allowing it to interact with various sensors, actuators, and other electronic components. The Uno R3 board includes a USB interface for programming and power supply, making it easy to connect to a computer for code uploading and debugging. It also has onboard LEDs for visual feedback and a reset button for restarting the microcontroller. The Arduino Uno R3 is beginner-friendly, versatile, and supported by a large community of users, making it an excellent choice for both beginners and experienced makers alike.

3.1.2 HC-05 Bluetooth Module



A **Bluetooth module** is a basic circuit set of chips which integrates Bluetooth functions and which can be used in a wireless network transmission. The Bluetooth module is divided into 2 types that are (i) data transmission module (ii) remote control module. The Bluetooth module utilizes radio waves to establish connections and enable communications between devices such as Smart phones, computers, IOT devices and more.

3.1.3 (L298N) Motor driver

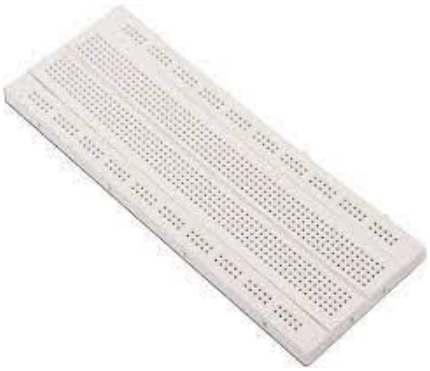


The **L298N** is a motor driver module commonly used to control the motion of motors. It acts like a power booster for motors, allowing them to move forwards or backwards based on input signals. This module can handle different types of motors and can also control the speed of the. Two motors can be connected simultaneously.

3.1.4 Dc Motor

A **DC motor** is a type of electrical motor that rotates and transforms electrical energy from direct current (DC) into mechanical energy. The most popular kinds rely on the forces created by the coil's induced magnetic field as a result of current flowing through it. The internal mechanism of almost all Dc motor types, whether electronical or electronic, allows it to periodically change the direction of current in a portion of the motor. Precise control of speed and torque is possible with DC motors through the use of pulse width modulation (PWM), voltage, or current variations.

3.1.5 Bread Board

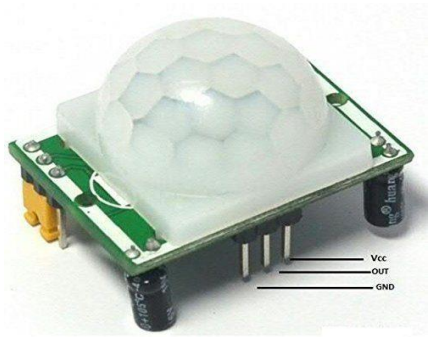


A **breadboard** is a fundamental tool in electronics prototyping, allowing engineers to quickly build and test circuits without soldering. It consists of a grid of interconnected metal clips housed within a plastic base. Components such as resistors, capacitors, and integrated circuits can be inserted into the holes on the breadboard and connected by inserting wires into the clips. There are several sizes and configurations for breadboards. They are essential for learning electronics, testing circuit designs, and creating prototypes before moving to permanent soldered constructions.

3.1.6 9v battery

The **9v battery** is an extremely common battery that was first used in a transistor radio. It is in a rectangular shaped prism that utilizes a pair of snap connectors which are located at the top of the battery. The typical life of a alkaline 9v battery is about 10 years.

3.1.7 PIR Sensor



An electronic gadget called a **PIR sensor** picks up infrared light that neighbouring objects emit. Motion detectors frequently use it to identify when something moves inside their detection range. The terms "PIR" (passive infrared sensor) and occasionally "PID" (passive infrared detector) are used to refer to them. Instead of sending out signals on its own, this kind of sensor detects infrared radiation that is either naturally generated or reflected from objects.

3.1.8 Servo Motor

A **servomotor**, also known as a servo motor, is a linear or rotary actuator that enables accurate control over acceleration, velocity, and position. They move to and retain that position precisely by receiving a control signal that specifies the desired location and velocity. Servo motors can be used in locations with limited dimensions due to their high torque-to-size ratios.

3.1.9 Led

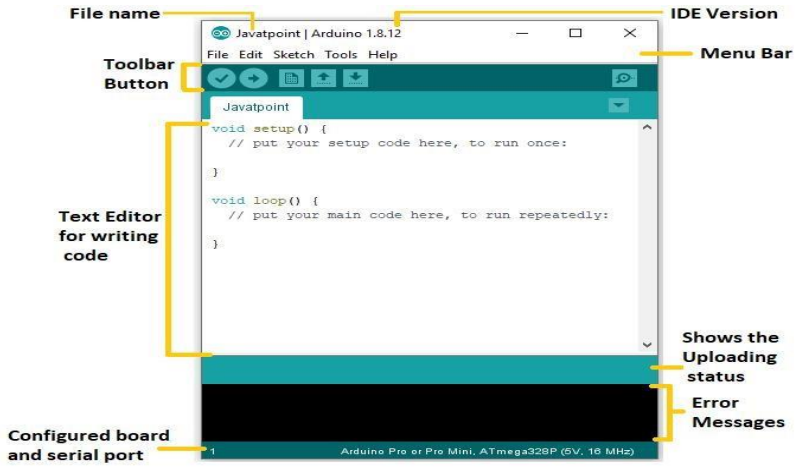
LED (Light Emitting Diode) technology is revolutionizing lighting with its energy efficiency, long lifespan, and versatility. Unlike traditional incandescent bulbs, LEDs emit light when electrons move through a semiconductor material. This process produces minimal heat, making LEDs more efficient and durable. Because they don't contain mercury or other dangerous compounds and have a low energy consumption, LEDs are also environmentally beneficial. All things considered, LED lighting offers a viable option for economical and environmentally friendly.

3.1.10 Jumper Wires

An electrical wire, or a set of them in a cable, with a connector or pin at each end is called a **jumper wire** (also called a jumper, jumper wire, or DuPont wire). It is used to connect the components without soldering.

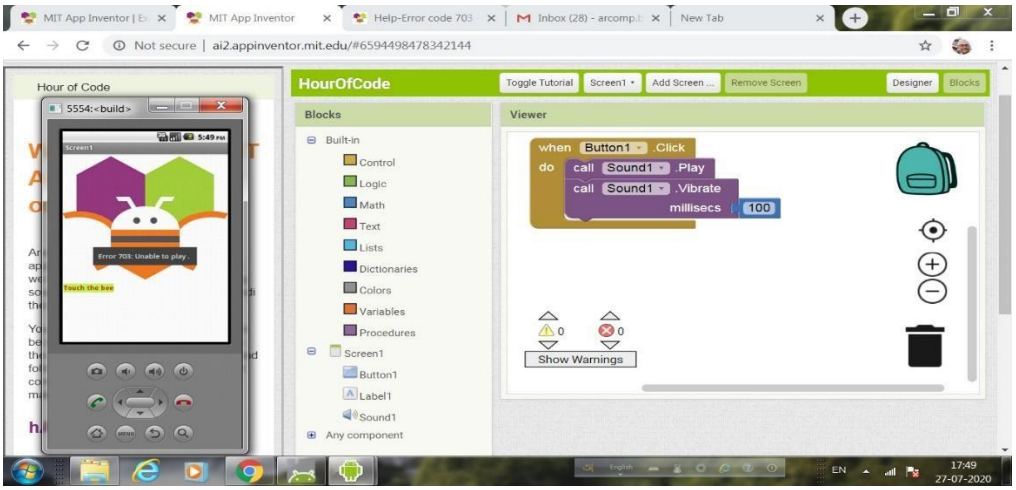
3.1 Software Implementation Tools

3.1.1 Arduino Software (IDE)



A message box, a text console, a tool bar with buttons for frequently used activities, many menus, and a text editor for writing code are all features of the **Arduino Software (IDE),** also called the Arduino Integrated Development Environment. It connects to the Arduino hardware in order to upload and communicate with programs.

3.1.2 MIT App Inventor



MIT App Inventor is a programming learning tool that is aimed at to beginners but also novices wishing to advance further. It came about as a collaboration between Google and MIT. It uses coding to create real-world usable apps for Android and IOS devices, which students can play.

Chapter 4
SYSTEM TESTING

System testing is a type of testing used to verify a software product's integration and completeness. Checking the end-to-end system specifications is the aim of a system test. System testing is a type of black box testing used to assess how well the entire system complies with set standards. To objectively assess the system's quality, a team separate from the development team typically conducts system testing. Functional and non-functional testing are both included.

One kind of testing to examine lOT devices is IOT testing. The need for quicker and better service delivery is growing in the modern day. The need to create, access, consume, and exchange data across several devices is enormous. The goal is to give users more insight and control over a variety of networked IOT devices. IOT testing framework is crucial as a result.

Reliability Testing:

An essential component of an IOT device's successful deployment is reliability testing. It's critical to confirm that the devices will continue to operate consistently throughout time, in addition to their proper operation during the first testing.

Scalability Testing:

Scalability testing is an important part of the development process for IOT devices, especially those such as the smart drive motor, relay. This type of testing checks to see how the device performs when a large number of other devices are connected to the network. It also allows for the detection of any errors or issues that may arise when multiple devices are interacting with each other. This helps to ensure that the device is able to handle a large number of connections and can properly communicate with other devices.

Performance Testing:

To establish a strategic method for creating and carrying out an IOT testing plan, performance testing is crucial. We send studio system for testing to check the system is performing all the functions correctly.

4.1 Validation Report& Testing

Report: I

Module: Hardware Devices

Functional Specifications: To check all the devices and sensors connected to Arduino UNO

Test Objective: To check all components are working and connected successful

TEST CASE NO	TEST CASE	TEST DATA	EXPECTED RESULT	ACTUAL RESULT	STATUS (PASS/ FAIL)
1	Check whether the Arduino UNO Is turning on	Arduino uno,12v power supply	Arduino UNO indicator light should turn on	Arduino UNO indicator light turn on	PASS
2	Check whether the Bluetooth module works	Arduino uno, Controller mobile app, Bluetooth module, mobile phone	The indicator light of Bluetooth module should turn on when connected to Arduino Uno board and Bluetooth connectivity should be visible on the mobile App	The indicator light of Bluetooth module turns on when connected to Arduino Uno board and also the Bluetooth connectivity is visible on the mobile App	PASS
3	Check whether the Motor driver shield works	Arduino uno, Controller mobile app, Bluetooth module, Motor driver shield, Battery	The indicator light of motor driver shield should turn on when connected with Battery	The indicator light of motor driver shield turns on when connected with Battery	PASS

4	Check whether the DC Motors are working	Arduino uno, Controller mobile app, Bluetooth module, Motor driver shield, Battery	The DC motors when connected with motor driver shield should start rotation of the motors	The DC motors when connected with motor driver shield starts rotating	PASS
5	Check whether the Servo Motor works	Arduino uno	The servo motor when connected to Arduino uno it should rotate in different angles	The servo motor when connected to Arduino uno it rotates in different angles	PASS
6	Check whether PIR Sensors works	Arduino uno	The PIR sensor when connected to Arduino uno, it should sense the motion	The PIR sensor when connected to Arduino uno, it senses the motion	PASS
7	Check whether Led is turning on	Arduino uno, controller mobile app, Bluetooth module, led	The Led light when connected to Arduino uno, it should turn on the light.	The Led light when connected to Arduino uno, it turns on the light.	PASS

Report: II

Module: Mobile APP

Functional Specifications: To check the Studio controller Application

Test Objective: To check all the controller buttons in the mobile Studio Controller App are working properly with the Studio Automation

TEST CASE NO	TEST CASE	TEST SUMMARY	INPUT DATA	EXPECTED OUTPUT	ACTUAL OUTPUT	STATUS
1	Testing the Bluetooth connectivity button	User clicks the connect Bluetooth button to connect with the Studio Automation system.	Serial	Connected	Connected	PASS
2	Testing the **ON** button	User clicks the **ON** button to turn on the light	When button is clicked it sends data=1	The LED light should turn on when **ON** button is clicked	The LED light turns on when **ON** button is clicked	PASS
3	Testing the **OFF** button	User clicks the **OFF** button to turn on the light	When button is clicked it sends data=0	The LED light should turn on when **OFF** button is clicked	The LED light turns on when **OFF** button is clicked	PASS
4	Testing the **OPEN** Button	User clicks the **OPEN** button to open the curtain	When button is clicked it sends data=O	The curtain should be opened when **OPEN** button is clicked	The curtain is opened when **OPEN** button is clicked	PASS
5	Testing the **CLOSE** button	User clicks the **CLOSE** button to open the curtain	When button is clicked it sends data=C	The curtain should be closed when **CLOSE** button is clicked	The curtain is closed when **CLOSE** button is clicked	PASS

Chapter 5

USER MANUAL

Product: IOT BASED STUDIO AUTOMATION

Version:1.0

Hardware Requirements:

Arduino UNO R3

PIR sensor

Servo motor

Battery

Bread board

Bluetooth module(HC-05)

Motor driver

Dc motor

Led

Jumper wire

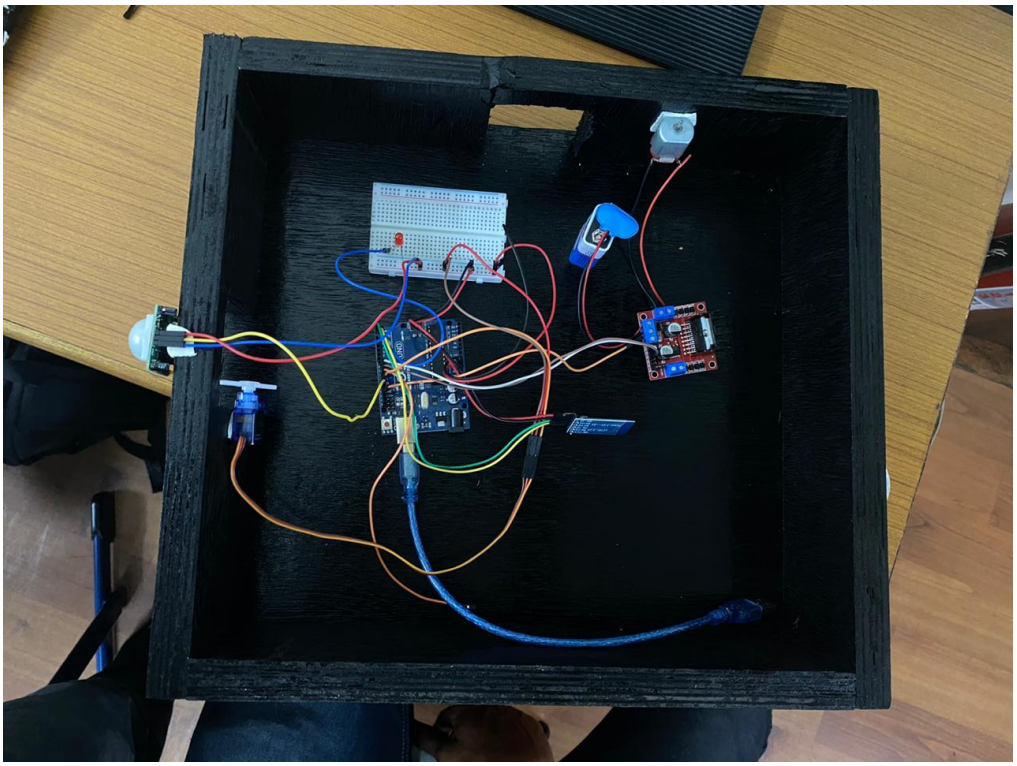
Software Requirements:

MIT APP Inventor

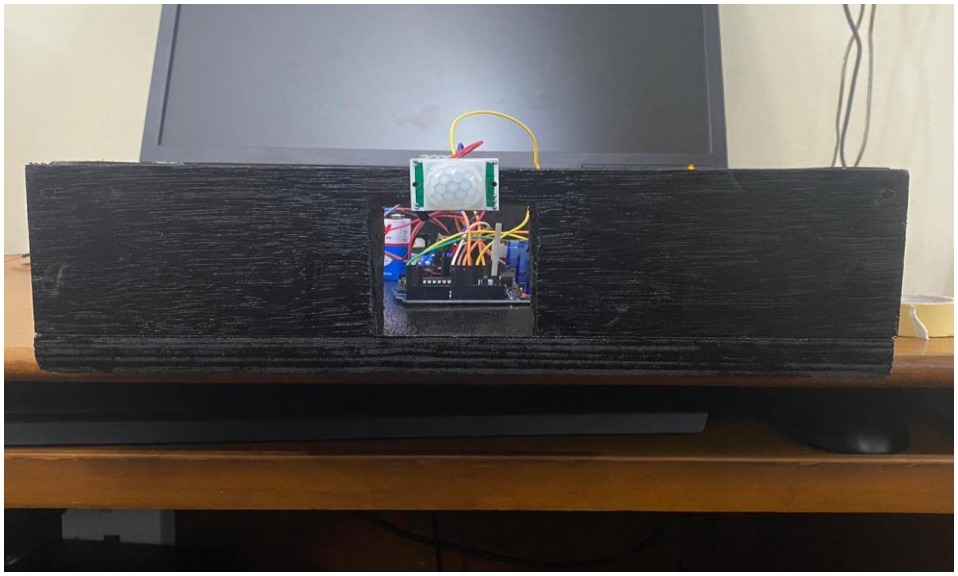
Programming language-Scratch

User Level Experience: Basic knowledge of using Android Apps.

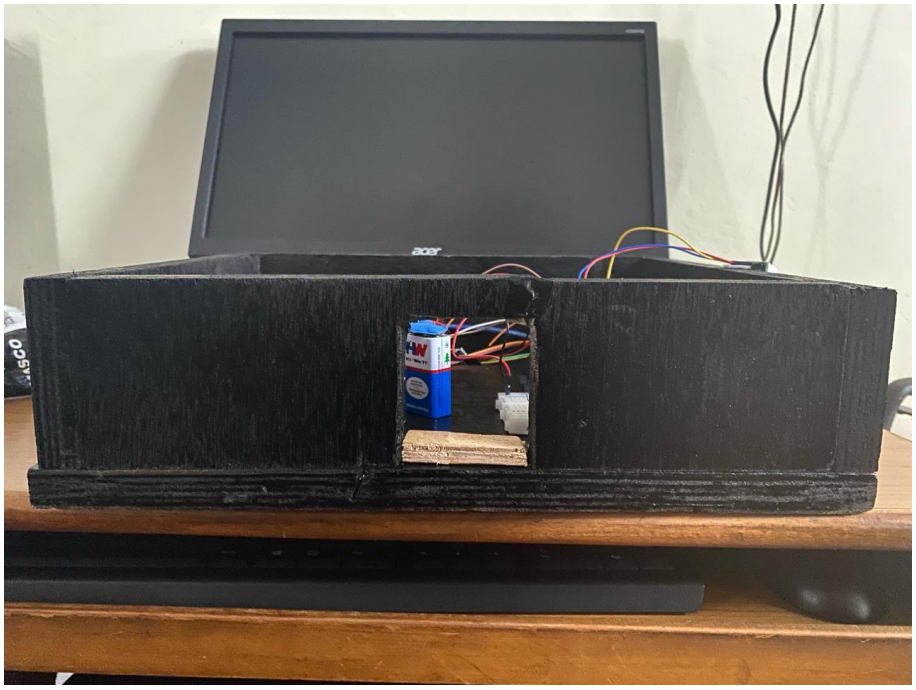
About: This product is ***"IOT based Studio Automation"*** which is developed to turn on/off the light and open curtains automatically through smart phone.



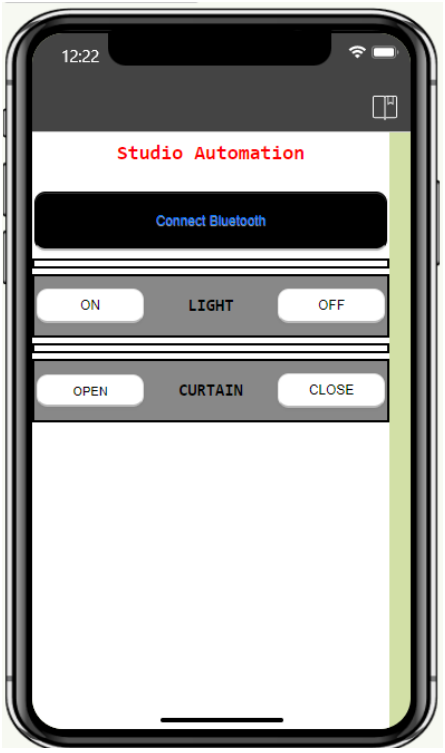
Screenshot5.1 Top view of "**Studio Automation System**"



Screenshot5.2 Front view (Door) of "**Studio Automation System**"



Screenshot5.3 Side view (Window) of the "**Studio Automation System**"



Screenshot5.4 User Interface of the "**Studio Automation App**"

Chapter 6
FUTURE ENHANCEMENT

1. Door:

Future Enhancement: Implement voice recognition technology to allow users to verbally command the doors to open or close, providing an even more convenient and hands-free experience. Additionally, integrate AI algorithms to anticipate user movements and adjust door opening speed and distance accordingly for smoother operation.

2. Curtains:

Future Enhancement: Integrate light and temperature sensors to enable the curtains to automatically adjust based on ambient conditions, providing optimal lighting and temperature control throughout the day. Furthermore, incorporate machine learning algorithms to learn user preferences over time and adjust curtain movements accordingly for personalized comfort.

3. Lights:

Future Enhancement: Introduce motion detection capabilities to the light control system, enabling lights to automatically turn on or off based on detected movement within a room. Additionally, integrate compatibility with smart home assistants such as Amazon Alexa or Google Home for seamless voice-controlled operation of the lights, further enhancing user convenience and accessibility.

Chapter 7
CONCLUSION

After conducting an experiment on the Studio Automation system, the results prove that the work rate of the system is satisfactory. We connected sample appliances to which the appliances were successfully controlled with the help of a smart phone via Bluetooth.

This project was a great experience as it helped us learn different skills like connecting wires, building circuits, etc. This project has given us a great opportunity to work as a team and present it.

We demonstrated the Bluetooth-based device's by pairing it with various android mobile phones from various manufacturers. Thus, a low-cost studio automation system was effectively created, put into practice, and tested.

Chapter 8

REFFERENCES

- Arduino UNO R3
  https://docs.arduino.cc/hardware/uno-rev3/
- Home automation project
  https://www.youtube.com/watch?v=zRcRMdh7F-c
- Arduino with PIR sensor
  https://randomnerdtutorials.com/arduino-with-pir-motion-sensor/
- Controlling servo motor with Arduino and PIR sensor
  https://forum.arduino.cc/t/controlling-servo-motor-with-arduino-and-pir-sensor/911736
- Smart door using PIR sensor
  https://youtu.be/ZWh6nWciMSE?si=TASGwbpOF0GArdqx
- Arduino UNO with Bluetooth to control an Led
  https://projecthub.arduino.cc/mukeshkp2005/arduino-with-bluetooth-to-control-an-led-a7ad0a
- L298N Motor driver with Dc motor using Arduino
  https://projecthub.arduino.cc/lakshyajhalani56/l298n-motor-driver-arduino-motors-motor-driver-l298n-7e1b3b
- Automatic smart curtain
  https://youtu.be/hLJmEt0Qu9w?si=uwJkNmTNwhZU3CJ5
- Bluetooth App using MIT app inventor
  https://youtu.be/evVRCL9-TWs?si=mCcwfdr0La7M_OPe

Chapter 9

Annexure

Tasks	Start Date	End Date	Duration(Days)
Analysis	03-07-2023	21-09-2023	80
Design	22-09-2023	31-10-2023	39
Implementation	1-11-2023	21-01-2024	81
Testing	06-11-2023	08-02-2024	94