Dissertation on

"Automated smart curtains using IOT"

Submitted in partial fulfilment of the requirements for the award of degree of

Bachelor of Technology in Computer Science & Engineering

UE17CS490B – Capstone Project Phase - 2

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January - May 2021

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CERTIFICATE

This is to certify that the dissertation entitled

'AUTOMATED SMART CURTAINS USING IOT'

is a bonafide work carried out by

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in partial fulfilment for the completion of seventh semester Capstone Project Phase - 2 (UE17CS490B) in the Program of Study - Bachelor of Technology in Computer Science and Engineering under rules and regulations of PES University, Bengaluru during the period Jan. 2021 – May. 2021. It is certified that all corrections / suggestions indicated for internal assessment have been incorporated in the report. The dissertation has been approved as it satisfies the 8th semester academic requirements in respect of project work.

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DECLARATION

We hereby declare that the Capstone Project Phase - 2 entitled “Automated smart curtains using IOT” has been carried out by us under the guidance of Prof. Sunitha R assistant professor and submitted in partial fulfilment of the course requirements for the award of degree of Bachelor of Technology in Computer Science and Engineering of PES University, Bengaluru during the academic semester January – May 2021. The matter embodied in this report has not been submitted to any other university or institution for the award of any degree.

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ACKNOWLEDGEMENT

We would like to express my gratitude to Prof. Sunitha.R and Prof. Prasad HB Department of Computer Science and Engineering, PES University, for their continuous guidance, assistance, and encouragement throughout the development of this UE17CS490B - Capstone Project Phase – 2.

We are grateful to the project coordinators, Prof. Silviya Nancy J and Prof. Sunitha R, for organizing, managing, and helping with the entire process**.** We take this opportunity to thank Dr. Shylaja S S, Chairperson, Department of Computer Science and Engineering, PES University, for all the knowledge and support we have received from the department. We would like to thank Dr. B.K. Keshavan, Dean of Faculty, PES University for his help.

We are deeply grateful to Dr. M. R. Doreswamy, Chancellor, PES University, Prof. Jawahar Doreswamy, Pro Chancellor – PES University, Dr. Suryaprasad J, Vice-Chancellor, PES University for providing to me various opportunities and enlightenment every step of the way. Finally, this project could not have been completed without the continual support and encouragement we have received from my family and friends.

ABSTRACT

Automatic Electronic Curtain Control System is a simple and powerful concept, which uses TB6600 stepper motor driver, to Open and close the Electronic Curtain automatically. By using this system manual works are removed. It is operated using a mobile application that allows multiple users to control the curtain system whether to open it or close it or partially open or close. This curtain system is connected to the main server that helps multiple users to operate the system. It can also be operated based on a particular point of time in a day by adding time domain into the code. In sunny and rainy days, ON time and OFF time differ significantly which is one of the major disadvantages of using timer circuits or manual operation.

This system is operated based on the environment the user has since ours is an indoor scenario we operate the curtain system using a cell phone application that allows the user to open the curtain system as per his or her requirements as the stepper motor has a huge capacity to pull the curtain system it depends on the size and weight of the curtain system and power is always necessary in case of power failure, we need to weight for the power backup to start the curtains once again.

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CHAPTER-1

INTRODUCTION

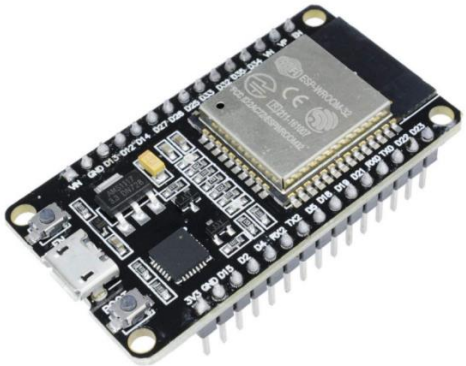
An embedded system is a computer system designed to perform one or a few dedicated functions, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. In contrast, a general-purpose computer, such as a personal computer, is designed to be flexible and to meet a wide range of an end-user needs. Embedded systems control many of the common devices in use today. Embedded systems are controlled by a main processing core that is typically either a microcontroller or a digital signal processor (DSP).

Since the embedded system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale. Physically, embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

In general, embedded system is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems such as the operating systems and microprocessors which power them but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected. Here in this world that has a wide area of applications in IOT its our responsibility to contribute to the same so we plan to design a smart curtain which makes the usual human work easier and helps him or her to save the time.

When we talk about smart homes the main perspective of people is that they are expensive and overrated but at the same time because of this attitude the country lags behind in the wild spread fire of technologies. It's very hard to move this mentality out and make it available to each and every citizen of the country keeping in mind the economic efficiency and here we have an idea of doing the same reducing the expenses by the use of proper devices so that the system can be put to work at the right time rather than wasting power.

Also, we plan to make it more faster in processing so that it responds to the user's needs immediately by reducing unwanted calculations and figuring out the constant terms and calculating the out comes with high speeds. So here we have a the application that takes user inputs and passes it to the system where the micro controller directs the curtains to open in a proper amount. And also, a mobile application that can listen to the user commands and operate based on his requirements. Making the human life simpler and more advanced is the main goal of this project at the same time cutting out the extra expenses and installing them in the IOT labs is our main goal. This system is a combination of small devices with effective planning and plotting that helps the users to make their environment more automatic and helps them to carry out all their wishes at one point using a small mobile application



ESP32 TB6600

Figure 1: ESP32 and an TB6600 stepper motor driver module the two most important components.

CHAPTER 2

PROBLEM STATEMENT

In the world of advancing technologies that makes human life more automated the concept of smart homes is a wild spread fire so we are planning are to work on the concept of smart curtains. This system will make the smart homes more automated and reliable so that the human activities can be reduced instead of walking up to the window and turning the curtains open this work can be cut out by using the system.

This generation always tries to find ways to minimize human efforts and make the best use of the artificial intelligence and resources that are available in a large quantity. Today IOT is an area that undergoes major changes day by day where new technologies emerge within no time and it is a very fast-growing part of IT industries so here, we have a challenge of designing smart curtains for the daily use of this society where they can be reliable, fast performing and energy conserving at the same time.

In the smart home environment smart curtains play an every important role they should work in such a fashion that they must know when to open and how much to open based on the user's needs and also light and the outside weather conditions so we plan to use the mobile application that allows the user to control the system whether to open it completely or partially based on his or her needs in this was the entire system can be operated by multiple users depending on their desire.

These users need to get connected to the main server that lets them the access to the curtain system that will also be connected to the same server. This system can be also be advanced by adding a time frame to the curtain code that allows the curtains to automatically close after a particular point of time in a day that makes it more of a self-learning AI system.

This system is built for providing some personal space for the user when they need it is designed in a such a way that it can be controlled by a mobile application that helps the user to adjust the system Based on their needs. It uses a protocol that helps to transfer light weight messages from users end to the main server which then transfers it to the ESP32 microcontroller that then transfers this to the TB6600 stepper motor driver which then runs the stepper motor to carry out the curtain opening or closing as per the user's commands.

So here the ideology is to run the system by using the application and also in-case of power failure it can be operated manually. So, we build a system that can work automatically as well as on human commands this will make it more user friendly and the curtains can be a perfect fit for their name that is the smart curtains. We also have to make sure that all the risks and constraints of this device are minimized and it can be utilized for the best of human intentions.

This system adds a beauty to the smart environment that helps the users to make their atmosphere more futuristic along with saving the power consumption and also integrating the entire system into one powerful working system. This highlights the efficient way of using the smart technologies for human purpose using simple tools to handle large amount of work.

CHAPTER 3

LITERATURE SURVEY

This chapter briefs about the research and findings made in this area of work related to the smart curtains

3.1 An IOT automated curtain system for smart homes by Souza et.al, 2018

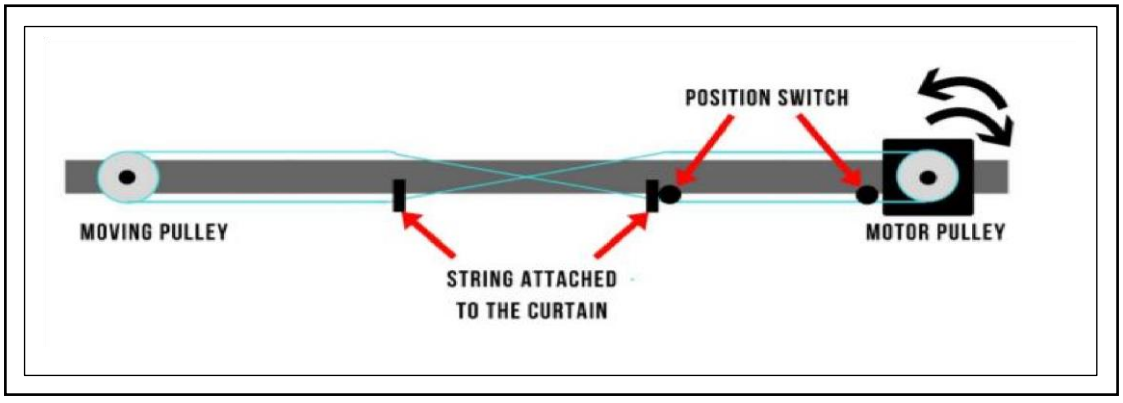
This section gives information about the use of position switches in the smart curtain scenario and various operation modes involved

3.1.1 Position switch

It has all the other system as mentioned earlier but here we have a reed switch that is used to calibrate the last position of the curtains and then adjust them automatically from their last position so there will be a track of the moments of the curtain using the magnets that are attached to the curtains and the switches that are stationary. So this paper is mainly based on calibration of the curtains position.

3.1.2

Figure 2: Schematic diagram of the mechanical structure



3.1.3 PIR sensor

For detecting whether people are in the room or not they have proposed the concept of PIR sensors that is the passive infrared sensor which is used to detect the motion in the room using the infrared light but here we have to face a drawback if someone is already sleeping in the room then the motion won't be detected and it might cause problems in the proper working of the system

3.1.4 Conclusions

In this design they have concentrated on the low power consumption and also the calibration but it does not give more accurate picture on how to detect the presence of humans and also it talks about the LDR that we are using here to capture the intensity of light.

3.2 The Applied Research of the Electric Curtain

This paper talks about the use of fuzzy and PID the combination of two algorithms that gives more accurate and required results since the electric smart curtain system faces multiple disturbances so here, they plan to combine the classic fuzzy logic and the Incremental PID control algorithm to achieve the required results.

3.2.1 Fuzzy algorithm

The fuzzy control algorithm basically has real number values between zero and one both included and these values speaks about the partial truth which is useful for our design where we get options to open curtains partially if needed it processes all the input data and gives us the best result required to operate the curtains.

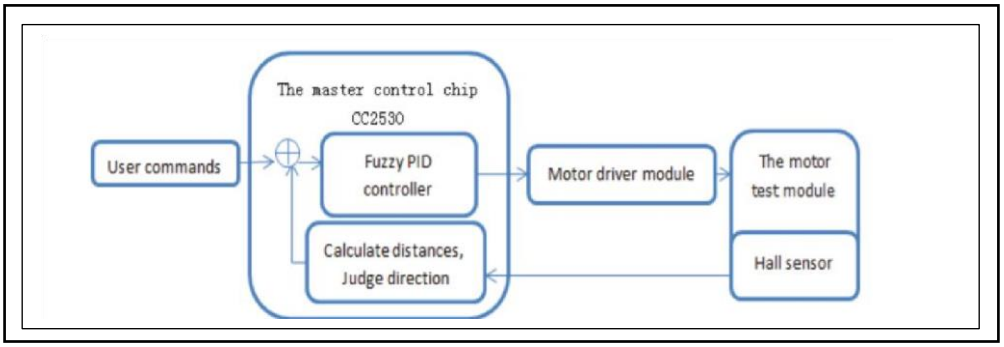
3.2.2 PID control algorithm

Proportional integral derivative control algorithm takes a feedback value and sends it to process the calculation and produce the desired results it has wide range of applications in the industrial areas. Here the last location of the curtain is obtained and the curtain is adjusted to the desired position by taking the last location of the system.

3.2.3 Combination of fuzzy self-adjusting PID control system

As we all know there are many external factors that effect the working of this system as the system is highly non-linear and has a lot of uncertainties, we need to handle them all as we know the motors uniform rotation will be affected by unstable voltage and current. The sensitivity of the sensors may be affected by the external factors like dust and other tiny things. So the traditional PID control system will not perform well in this case because of the non linearity in the curtain system this algorithm becomes unstable so here we have the fuzzy self-tuning PID control algorithm is applied to the actual curtain control of smart home system, It is useful in solving the bigger system error and less than ideal dynamic characteristics of the past curtain controller system, and it contributes greatly to raising the reliability and precision of the control system. This will help us generate the values we actually need for the system. The results show the correctness and feasibility of the algorithm design, and it greatly improves the dynamic and static performance of the system and automation.

3.2.4 Control system diagram



3.3 Curtain control systems development on Mesh wireless network

This section concentrates on low power usage of the curtain system and a mobile application that can control the system with a swipe.

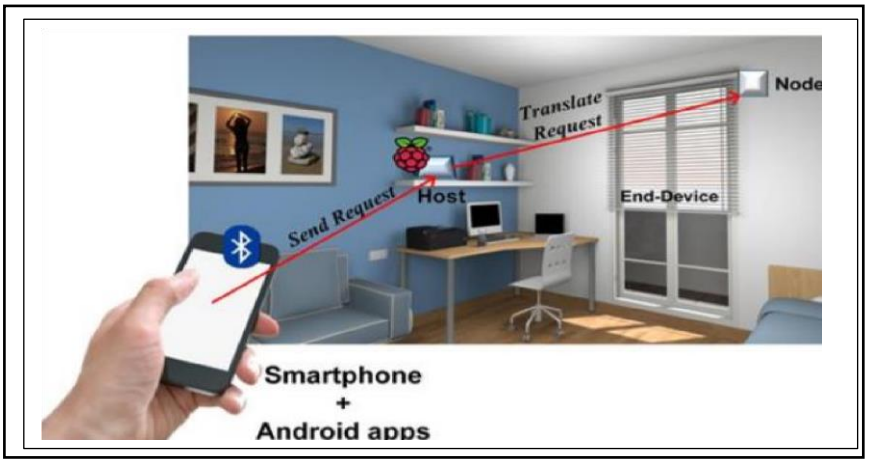
3.3.1 Power conservation

One of the most important challenge is the power conservation so this section basically speaks about the power conservation of the system where we use an STM32L100RCT6 microcontroller chip is used as the device processor due to its low power consumption and cost. So here the system is affordable by many people as it is easy to set up and makes the human work load lesser.

3.3.2 Protocol Design of this system

It is also made to work when the user is not at home with the help of a cloud system and when the user is inside the room it runs on Bluetooth system where the user connects directly to the micro controller and gives commands these commands then transferred in the form of packets we are also using the required protocol in this process. We use the universal synchronous and Asynchronous receiver transmitter as the primary peripherals of communication in this network system.

3.3.3 Architecture of Smart curtain system



3.3.4 WSN Design

As previously stated, the curtain controller is part of a WSN designed for a smart home system. The WSN is designed using Digi Mesh scheme from ZigBee technology. This scheme differs from the standard ZigBee nodes scheme that requires role initialization in each node. Each end device has been programmed to send data to the host address. In this work, Raspberry Pi 2 is utilized as the host of the WSN. The host serves as WSN gateway where all information and data communication between user and the WSN. Zigbee mainly achieves low cost low powered goals and works on unlicensed RF range. Raspberry Pi 2 has four USB sockets and USART GPIO, which are used for connecting the Wi-Fi and Bluetooth modules as well as Zigbee module. While ideally the host is used for managerial purposes within smart home system platform layer, in this work the host function is limited as one of the bridges between the WSN and the user. The user communicates with the host through Bluetooth and/or Wi-Fi, while the host will process the command and relay the result to the WSN via ZigBee.

3.4 Design of intelligent control system of curtains based on Arduino

This system takes into consideration of various factors like the sun light illumination, the temperature and humidity detection and time detection. And getting all these inputs and calculating them using the fuzzy system.

3.4.1 Sunlight Illumination Detection

The bridge photoelectric detector made by photosensitive resistance can reduce the influence of temperature on the sensitivity of sunlight illumination detection. Covering a layer of filter on photosensitive resistance makes the photoresistor accept more ultraviolet ray in sunshine, so as to achieve the improvement of the detection accuracy. By this we are able to generate accurate data based on the sunlight illumination. The bridge photoelectric detector uses two

same type of photosensitive resistance as the bridge arm, which is used as temperature compensation to shield one of the photosensitive resistances.

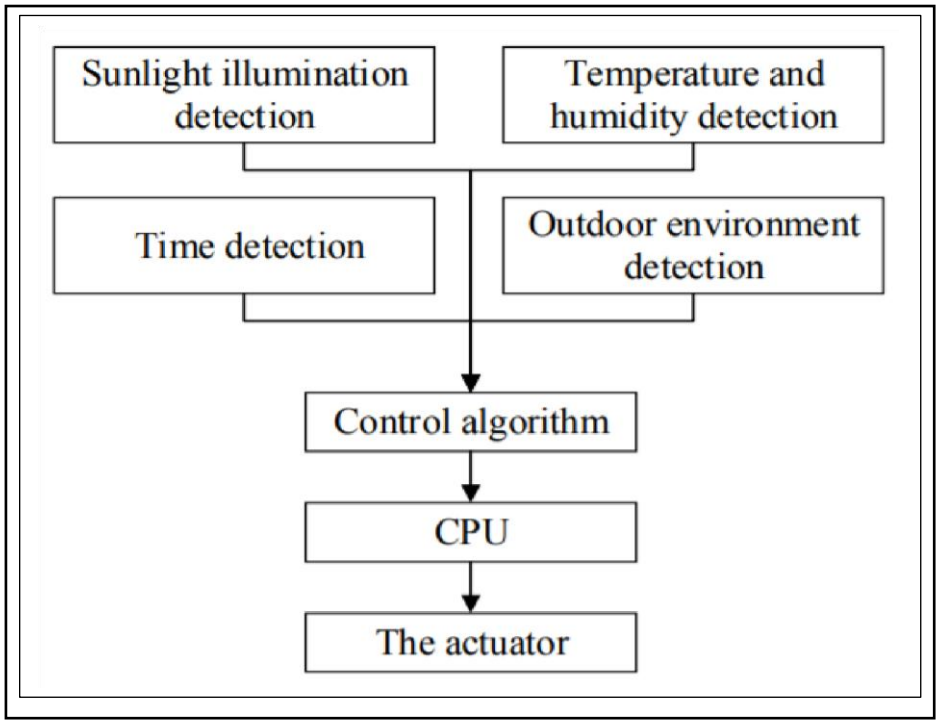
3.4.2 Time control

This feature helps the user to open the curtain at a particular time of the day for example 8 AM and also there is one more clock that gives the delay in the sense open the curtain after several hours. This will also help us to save power by reducing the system activities. These time control activities can be reset by the mobile application if the user wishes to do so.

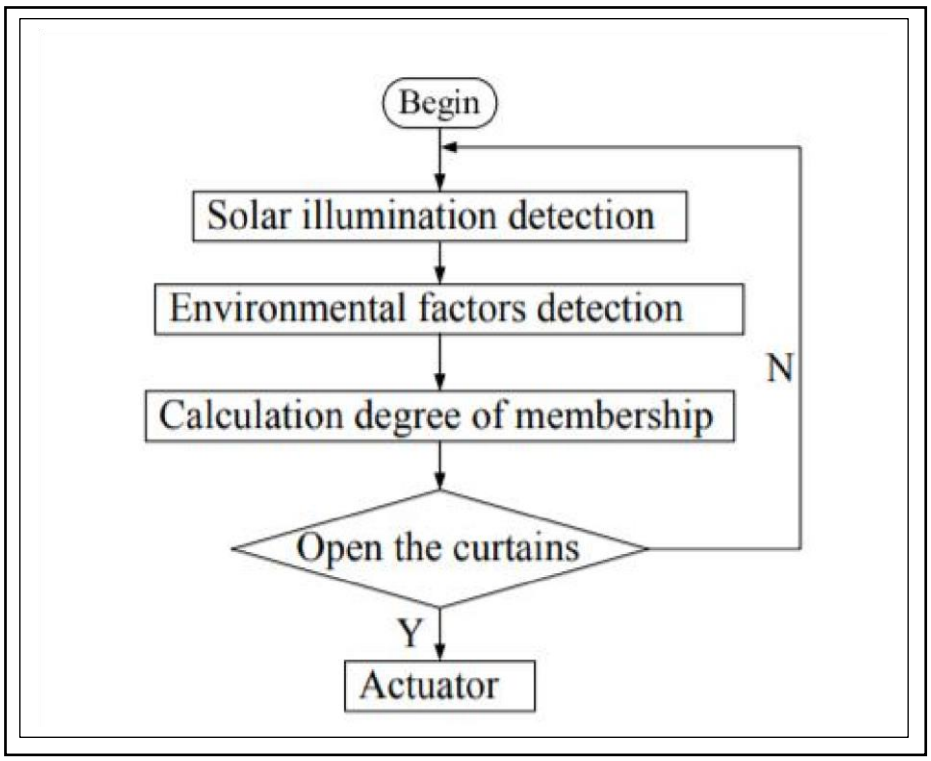
3.4.3 Mobile Application that is remote control

In the development of smart home, real-time monitoring and remote controlling must be worth heeding in the industry. Arduino network was used to build a simple Web server whose function is sending the curtain of real-time information to the mobile phone application or other terminal and receiving the control signal from the mobile phone. So by this the user can pass commands sitting at one point.

3.4.4 Figure 5: Block diagram



3.4.5 Figure 6: Flowchart of writing control algorithm



CHAPTER 4

PROJECT REQUIREMENT SPECIFICATION

4.1 Introduction

In this study we aim to build a smart curtain for home automation that allows users to close or open the curtains automatically by taking input from the mobile application. This next generation of technology opens up possibilities for sleek style, easy living and home comfort. In the current system they haven't focused on power consumption So, here we are trying to focus on power consumption. The basic requirements are met in this part of the project.

4.2 Project Scope

Currently people are using normal curtains which need human intervention for opening and closing. Smart curtains can be programmed to change position based on temperature, time of the day and other factors. In case of an indoor scenario, it can be controlled using a mobile application. So, we can reduce human interaction and create more of AI systems so that it fits into the smart home environment.

4.3 Project perspective

Briefing based on the characteristics of the project

4.3.1 Product perspective

This feature comes under the broad umbrella of Home Automation. Product focuses on automating curtain positions based on certain parameters also keeping performance in mind.

4.3.2 Product features

The product is basically made to follow human commands that are passed to it through a mobile application that is the user interface. This message is received at the main server end that is then directed to the working end that is the microcontroller this then commands the stepper motor to drive the curtain system based on user's desires.

4.3.3 User classes and characteristics

User with privileges that authenticates the user before granting the access to these rooms and also privileges to users based on login credentials.

4.3.4 Operating environment

A room where a smart curtain is installed with all other hardware equipment and the user has to be equipped with an application to provide inputs.

4.3.5 General constraints, assumptions and dependencies

These can include the following:

- Regulatory policies: none as of now in case other than the authentication rules and regulations

- Hardware limitations - when the power supply is switched off due to various reasons, Smart curtain might not operate. For this reason, will make sure that this curtain system can be operated manually.
- Safety and security consideration - sign up and sign in features enables only valid users to operate on smart curtains.
- Usage limitations: none

4.3.6 Risks

Security risks - should be taken care by implementing proper authentication mechanism
Availability risks - should make sure constant power supply to all the hardware equipment for smooth operation.
Network connectivity and response time are also need to be looked at.

External factors like any disturbance in the power supply or any external damage to the system might cause failure

4.4 Functional Requirements

This may include,

- The user controls the entire system using a mobile application that lets him to open, close or partially open the entire curtain system. It can also be operated by using the time factor that is whether to open or close the curtain at a particular point.
- The system has various parts that come together to perform a smart task that does not need human effort. It uses a NEMA stepper motor that rotates the entire curtain system using the curtain string that helps to rotate the entire curtain to the required position.

- In case of power failure, we need to wait for the power to come back and then the entire system can be operated. It will be connected to house voltage that helps us to power the entire system we also have a power adapter that helps us to control the current flow to the system.
- It makes use of the MQTT protocol to transfer messages across the system that helps to transfer the user commands to the micro controller.
- In case of a power failure, we need to wait until the back up system is turned on in such situations, we can operate the curtain system manually that is by removing the connection between the curtains and the stepper motor.

4.5 Non-Functional requirements

4.5.1 Security Requirements

The system can be operated by a client who has access to the main server that is one must know the login credentials to the main server and should have the MQTT IOT application to control the system these credentials are confidential as they contain their own test keys so security breach is a least possible scenario here.

4.5.2 Power requirement

The system runs on house voltage so all the time to run this system the power supply plays an important role as we all know if there is a failure then we need to wait for the backup supply or else we need to remove the system and handle the curtains manually then old school way.

4.5.3 Performance requirement

That is how fast will it responds to the commands and a smooth working throughout the day. Minimum processing and maximum output can be gained my making calculations keeping the constants in mind.

CHAPTER 5

SYSTEM REQUIREMENT SPECIFICATION

5.1 External interface requirement

We plan on having a simple Mobile application which will enable signup and sign in options. Once login is authenticated users will be provided with options whether to open or close the curtain. You need the MQTT application and the key to control the curtain system it should be connected to the main server as the micro controller.

5.1.1 Hardware requirements

It has a stepper motor that has a capacity to pull a load of fifteen kilograms that is connected to stepper motor driver that is TB6600 which helps us to control the amount of current flow inside the motor and also that helps us to decide the step angle. Along with this we also have facilities to change the direction of rotation

This driver is connected to the power supply adapter and also the micro controller that is out ESP32 that guides all the operations of the stepper motor and also helps us to design the working of the same using the Arduino IDE. This micro controller will be connected to the main server that in turn receives commands for a mobile application that is connected to the same system using the Wi-Fi protocol.

5.1.2 Software requirements

We have the Arduino IDE to code the ESP32 that we are using in the current project and no external software are required for the system.

5.1.3 Communication interface

That is with the help of mobile application the user can communicate with the system.

CHAPTER 6

HIGH LEVEL AND LOW- LEVEL DESIGN MODULE

6.1 Design Consideration

In this study we aim to build a smart curtain for home automation that allows users to close or open the curtains automatically by a mobile application. This next generation of technology opens up possibilities for sleek style, easy living and home comfort. Currently people are using normal curtains which need human intervention for opening and closing. Smart curtains can be programmed to change position based on user commands that are given through the application or the time factor.

6.1.1 Design goals

- The newly proposed device is a user-friendly device which gives the user the luxurious feel and also serves the purpose of different user classes. We plan on developing a device that would make the users life simpler and healthier.
- The device is designed such that the curtains can open or close automatically by taking the commands from the user or based on the time factor.
- That is the user can operate it on various modes based on the environment they are installed in either the user can open them completely or he can open it partially based on the curtain dimensions or he can also close the same.
- The device can also be operated using an application and in case of any unexpected power failures the device can also be operated manually.
- When someone enters the room, they have to connect their cellular device to the main server which detects the presence of a user then that person can access the curtain system using the MQTT application that helps them to operate and control the system.

- In this fashion as explained earlier multiple users can control the curtain system that helps it to be user friendly and also, they can shut it down in their absence to save power and here multiple users act as nodes to this system and the main server is the central monitoring system.

6.1.2 Architecture choices

The entire system is built, on a step-by-step procedure initially we had a model prepared for the same and later using various combination of motors and different trials were taken and the best fit for the situation was chosen. Based on the size and material of the curtain system choosing the essential components becomes more important. At the same time the design should be handy and not a bunch of wires and devices that would be difficult and won't give a neat look to it.

6.1.3 Restrictions and dependents

- Interoperability requirements

  Since the commands are passed by the user, we need to make sure that no two users pass command to the same system at a time and there must be a proper way to receive them from multiple users and execute each command one after the other without loosing any packets.

- Interface/protocol requirements

  We have an interface for the user that is the application interface which allows the curtains to be operated on the smart phones. Here the user has our MQTT application that allows them to operate the curtain system using a key that lets only the authenticated users to use it.

- Data repository and distribution requirements

  For the device to work perfectly, it should be provided with the right inputs when the curtain should close and when it should open and when there are inputs from users how to handle those and process accordingly also aim on tracking all the inputs so that the device can work more efficiently according to the user's needs.

- Discuss the performance related issues as relevant

  The security of the device is very important; therefore, authenticity plays a major role as the device will be connected to main wi-fi in college for networking there are chances of other people getting the access and tampering it. So, we have to make sure we provide authenticity to the device.

- End User Environment

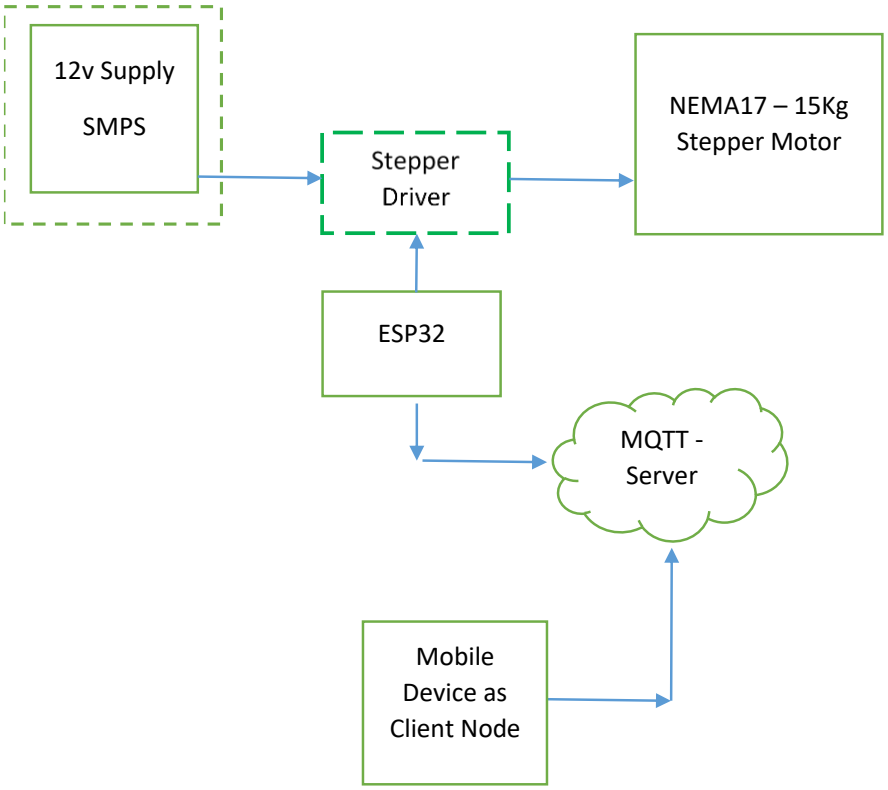
  From the perspective of a user, the requirements are a device that would support the application to control the device and that connects to the internet so that it can connect to the device and give commands.

- Hardware or software environment

  The device can be accessed through an application so the user needs stable internet connection, it is expected to be the only software limitation and the hardware limitations could be the device to work automatically it needs constant supply of electricity so it can be one of the limitations.

- Discuss issues related to deployment in target environment, maintainability, scalability, availability, etc.

6.2 Design details with the block diagram



The entire system is controlled by the ESP32 that provides the user with the Wi-Fi communication capabilities. Thus, this micro controller will be connected to the main server. There is a mobile application that is the MQTT app that helps the user to pass the commands over the Wi-Fi which also is connected to the main server.

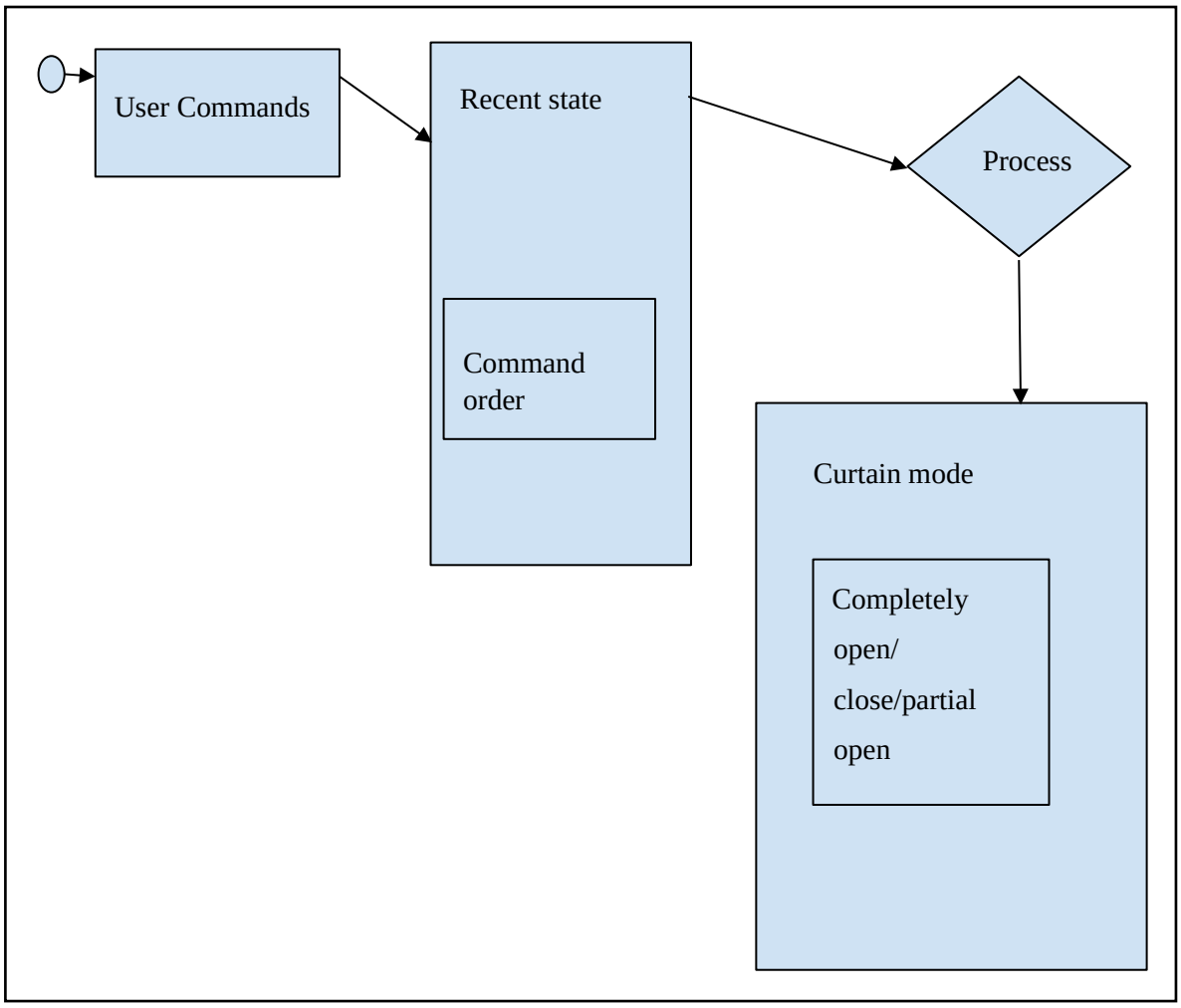
Multiple mobile devices with the key code can act as nodes to the MQTT server. It has the Mosquito that is the broker application that is run on the local server to establish a medium of communication.

There is a direct power supply from the house voltage to the power adapter that runs the TB6600 stepper motor driver which in turn runs the stepper motor that does the physical work. The motor driver is connected to the ESP32 which passes the command to the driver based on the user's requirements.

Work flow of the system

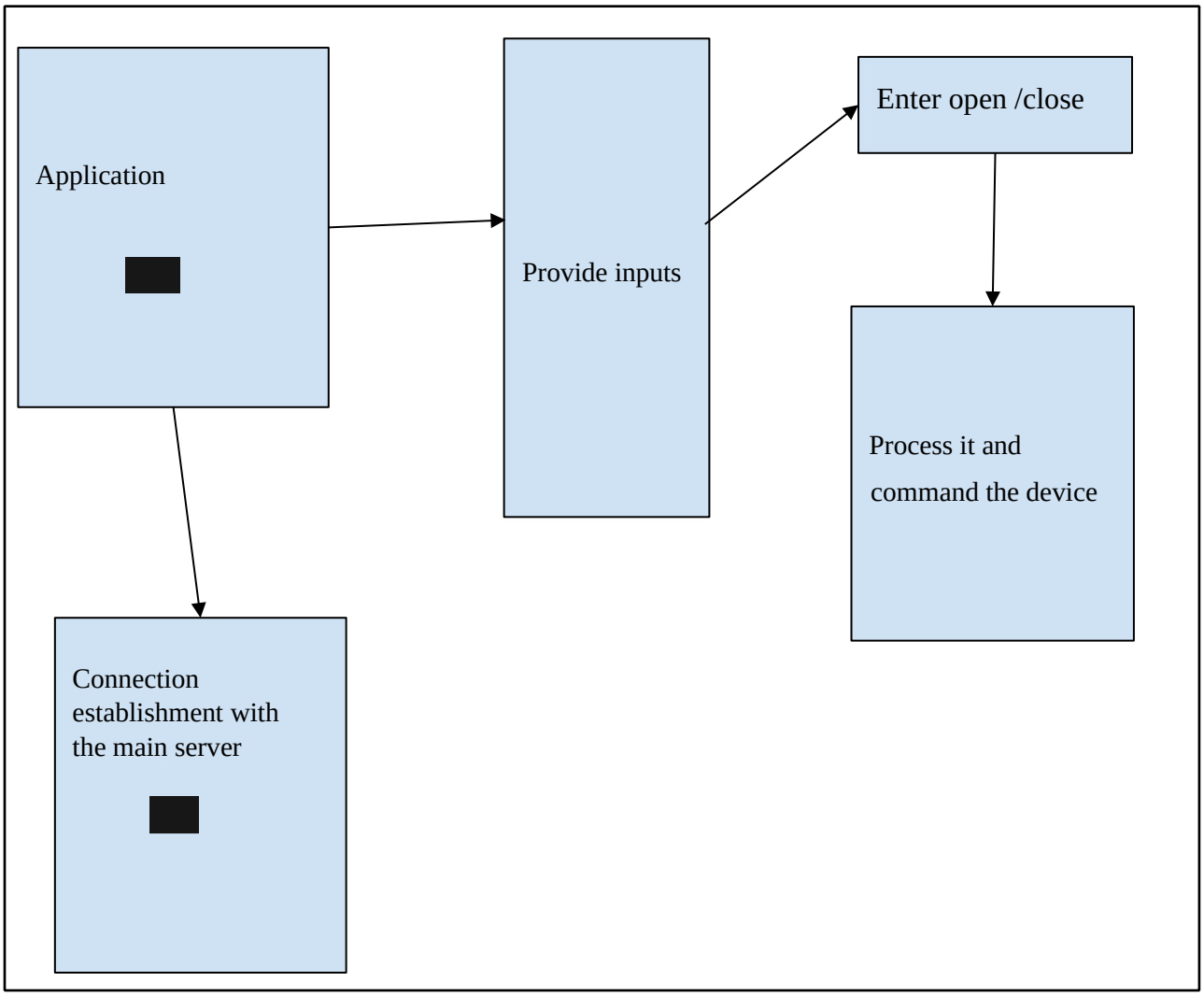
- The stepper motor selected is of 15kg NEMA 17 two phase motor. As per specification, it can take a current of 2A per phase when the maximum torque value reaches.
- In order to have a minimum current requirement from the supply, A 5A rated current SMPS is minimum required to carry out full load operation of a motor.
- In this project 12V 20A SMPS for seamless full load operation with higher marginal current supply value is selected.
- TB6600 stepper driver is used to drive a stepper motor. The main use case of driver is to send pulses for stepper motor in each phase of rotation (motor is 2phase). The driver can be configured for current limitation feature and the step angle of motor. Once these two configurations are pre-set then a gate pulse, direction and enable signal is triggered from controller. These signals will be generated from ESP32 microcontroller.
- An MQTT protocol is used to have seamless wireless communication published or subscribed over MQTT server. It's a light weight protocol which works top over TCP/IP protocol. In order to publish messages, Syntax: MQTT-pub broker_IP_address Topic Message. In order to subscribe messages, Syntax: MQTT-sub broker_IP_adrress Topic.
- To run MQT server/broker, create a local server by simply running a mosquito broker application file on windows OS.
- Note down the IP address in which the system is running the broker application. (IP config)
- Connect any mobile to Same Wi-Fi access point and give MQTT credential (IP address and port:1883)
- Now a successful full duplex communication is established for publish/subscribing messages over MQTT.

6.3 ER Diagram



This diagram shows the working of the system in ER format where based the users desires and also the last state of the curtain system that helps us to analyse to which state the curtain needs to be taken.

6.4 User interface diagram



This UI diagram shows the way in which the user gets access to the system where he or she can operate the system. Here the user gets the mobile application where he needs to insert right credentials and later it asks what kind-off calibration he or she needs and then send this command to be executed by the motor system.

6.5 Design Code and its Features

The code is developed on the Arduino IDE platform that is then booted to the ESP32 which is the heart of the curtain controlling system.

```
#include <WiFi.h>
#include <PubSubClient.h>
#include <Stepper.h>
const char* ssid = "iphone";
const char* password =  "prakruthi";
const char* mqttServer = "172.20.10.2";
const int mqttPort = 1883;
const char* mqttUser = "hi";
const char* mqttPassword = "123";

const int stepsPerRevolution = 800;

WiFiClient espClient;
PubSubClient client(espClient);

Stepper myStepper(stepsPerRevolution, 25, 26, 27, 14);
 // (steps, pin1, pin2, pin3, pin4) // 1 & 2 for Coil-1 || 3 & 4 for Coil-2

void setup() {

  Serial.begin(115200);
  WiFi.begin(ssid, password);
  myStepper.setSpeed(20);
```

```
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.println("Connecting to WiFi..");
  }

  Serial.println("Connected to the WiFi network");

  client.setServer(mqttServer, mqttPort);
  client.setCallback(callback);

  while (!client.connected()) {
    Serial.println("Connecting to MQTT...");

    if (client.connect("ESP32Client", mqttUser, mqttPassword )) {

      Serial.println("connected");

    } else {

      Serial.print("failed with state ");
      Serial.print(client.state());
      delay(1990);

    }
  }

 //  client.publish("test", "Hello from ESP32");   //(topic, "message")
```

```
  client.subscribe("test");
 }

 void loop() {

  client.loop();
 }

 void callback(char* topic, byte* payload, unsigned int length) {

  Serial.print("Message arrived in topic: ");
  Serial.println(topic);

  Serial.print("Message:  ");
  String msg;

  for (int i = 0; i < length; i++) {
     msg = msg + (char)payload[i];
  }

  Serial.println(msg);

  if (msg == "9")
  {
    Serial.println("0 to 100 percent");
    myStepper.step(800);
  }
```

```
  else if (msg == "8")
  {
    Serial.println("100 to 0 percent");
    myStepper.step(-800);
  }
  else if (msg == "5")
  {
    Serial.println("0 to 50 percent");
    myStepper.step(400);
  }
  else if (msg == "4")
  {
    Serial.println("50 to 0 percent");
    myStepper.step(-400);
  }

  Serial.println();
  Serial.println("----------------------");

 }
```

This is a simple code that performs all these tasks that have been mentioned earlier its almost self-explanatory and has various simple and advanced libraries in it which helps us to publish and subscribe the messages for communication and it uses a duplex communication channel that helps the user to send and receive the messages at the same time.

CHAPTER 7

IMPLEMENTATION

7.1 Existing method

It has various microcontrollers that help the user to operate this system but the tubular ones can only be applied to small curtains but not the bigger ones most of them can be run either vertically or horizontally based on the environment we are working on and the curtain designs that have been used it can also be made more automatic using the sensors if it's an outdoor scenario and also it can be made more secure by using radio frequency identification All these techniques can be used to make the curtain system more advanced and efficient that have been already proposed in the market these systems should also concentrate on the power consumption factors as too many advancements can lead to situation where the power consumption may exceed way over the limits that can cause some serious issues when it comes to the case of efficiency so we bring a system that is detachable that can be used when required and that runs with minimum power.

7.2 Proposed method

In this we have a mobile interface that is the MQTT application that takes input from the user and it sends it to the main server which then transfers the messages to the ESP32 our micro controller that acts as the heart of the entire curtain system. We use MQTT domain for this purpose it is a protocol that is more advanced than the TCP/IP which helps us to transfer light weight messages in a faster manner so here it establishes a medium for communication between the interface and the micro controller that runs the stepper motor. In this scenario we have a TB6600 stepper motor driver that controls the current flow to the stepper motor that allows us to set the speed of rotation and also the direction. The best methodology is the tubular motor that is not currently available in the market and these motors are of smaller sizes that cannot be used to run the entire curtain of size two meters so we need to install multiple motors of the same kind to run the entire system.

CHAPTER 8

CONCLUSION CAPSTONE PROJECT PHASE – 2

There are multiple ways to make a curtain system automatic that is by using modern and advanced tools and controllers along with some sensors we can develop any kind of systems we desire. In this system we concentrate on the environment we are working on as it is an indoor environment, we cannot use the sensors and other stuff to detect the outdoor conditions and run the system. We also need to keep in mind the size of the windows and also the material of the curtain used for the same.

The users also get to make various choices like if they need a vertical driving system or a horizontal one but here, we develop a system that is portable and user handy. This system can be connected to the any curtain you desire using the curtain strings, they help the user to control curtains of any size not more than two meters long that makes the whole process automatic and it helps us to adjust the curtains the way we need either open it fully or partially based on various percentage or close it completely.

This system provides the user with an application that helps them to send messages in form of light weight packages that is received by the micro controller and it passes the commands to the motor system that adjusts the curtains accordingly it also provides multiple users to control the same curtain system with the help of an access key that has to be inserted in the mobile application.

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