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SMART HOME SYSTEM DOCUMENTATION

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Table of Contents

ACKNOWLEDGEMENT 4
1.0 INTRODUCTION 5
1.1 Smart Home 5
1.2 National Instrument LabVIEW 5
2.0 SYSTEM DESIGN 6
2.1 Flow Chart 6
a. Client Side 6
b. Server Side 7
2.2 UML Design 7
a. Use Case 7
2.3 User Login 10
2.4 User Registration 10
a. Register User 10
b. Users List 10
2.5 Floor Design 11
a. Ground Floor 11
b. First Floor 12
c. Ground Floor Remote Design: 13
d. First Floor Remote Design: 14
e. Ground Floor Block Design (Client Side): 15
f. Ground Floor Block Design (Server Side): 15
g. First Floor Block Design (Client Side): 16
g. First Floor Block Design (Server Side): 16
3.0 PROTOCOL DESIGN 17
3.1 TCP/IP Connection 17
a. TCP Open 17
b. *TCP Write* 17
c. *TCP Listen* 18
d. TCP Read 19
d. TCP Close 20
3.2 *Clear Errors* 20

3.3 *Sample of Protocol Design* 21
a. AC Temperature Control 21
1. *Client Side* 21
2. *Server Side* 22
b. Door Control 23
1. Client Side 23
2. Server Side 23
c. Curtain Control 24
1. Client Side 24
2. Server Side 24
d. Master Control 25
1. Client Side (Master Lights) 25
2. *Server Side (Master Lights)* 25
1. Client Side (Master Curtains) 26
2. *Server Side (Master Curtains)* 26
4.0 HARDWARE REQUIREMENT 28
4.1 *Slide Door Opener* 28
4.2 *Remote Light* 28
..... 29
4.2 *Remote Curtain* 29
..... 29
..... 30
5.0 USER MANUAL 31
5.1 *User Registration* 31
..... 31
5.2 *Delete User* 31
..... 32
5.3 *User Login* 32
5.4 *Ground Floor Controller* 33
5.5 *First Floor Controller* 34
5.6 *Master Control* 34
5.7 *Air Conditioner Control* 35
5.8 *Television* 35

5.9 *Alarm* 36
5.10 *MP3* 36
6.0 Extra Features Added 37
6.1 *Air Conditioner* 37
6.2 *Alarm* 37
6.3 *MP3* 37
6.4 *Master Control* 37
7.0 LIMITATION 38
7.1 *Authority* 38
7.2 *Limited TV Channel Functions* 38
8.0 CONCLUSION 38
REFERENCES 39

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Besides, I also like to thank my friend who helped me a lot to complete this assignment. Although he is not an expert in LabVIEW he helped me out a lot by discussing the problem and doing online research together at TPM Cafeteria. I pray for his future prosper life.

Lastly, I am very glad that I have successfully able to complete my assignment on time. I appreciate all the helpers for helping me out along the way of this development. I thank all of them cordially for their helpful attitude.

1.0 INTRODUCTION

1.1 Smart Home

This is the era of advanced computing technology. Almost all of the works we are doing by the help of automation system or computer controlled. Now peoples are moving towards smart system. As the technology is upgrading day by day peoples want more security in their daily life. We know maintaining the security level for home is very crucial. So, here we have discussed about the ***SMART HOME*** development.

This ***SMART HOME*** is fully controlled by the members of the family. This home is made by special structure wiring with the use of TCP/IP connection where the users (family members) can access using a simple client side control. This is a double stored house where all the members will be given a unique **ID** with **PASSWORD** to access the system. Here the control panel is usually placed at the master bedroom. By using this system members can switch on the lights, open the doors, control the temperature of Air Conditioner, control television, set alarm clock and play music system. This ***SMART HOME*** enhanced the better living for mankind.

1.2 National Instrument LabVIEW

This desktop software is known as ***Laboratory Virtual Instrument Engineering Workbench*****.** This software is provided by ***National Instrument*** for the system-design platform and for the development through visual programming language. Here users don't need to code whereas they should have the proper basic of logical term while developing the system. This software is widely used by the engineers and scientist around the world. Users can develop the system depending on client and server side using this software.

2.0 SYSTEM DESIGN

2.1 Flow Chart

It is use to known as a diagram of the sequence of movement or the action of peoples those are directly involved regarding using the system. It shows how the system works following a process from beginning till end or execution.

a. Client Side

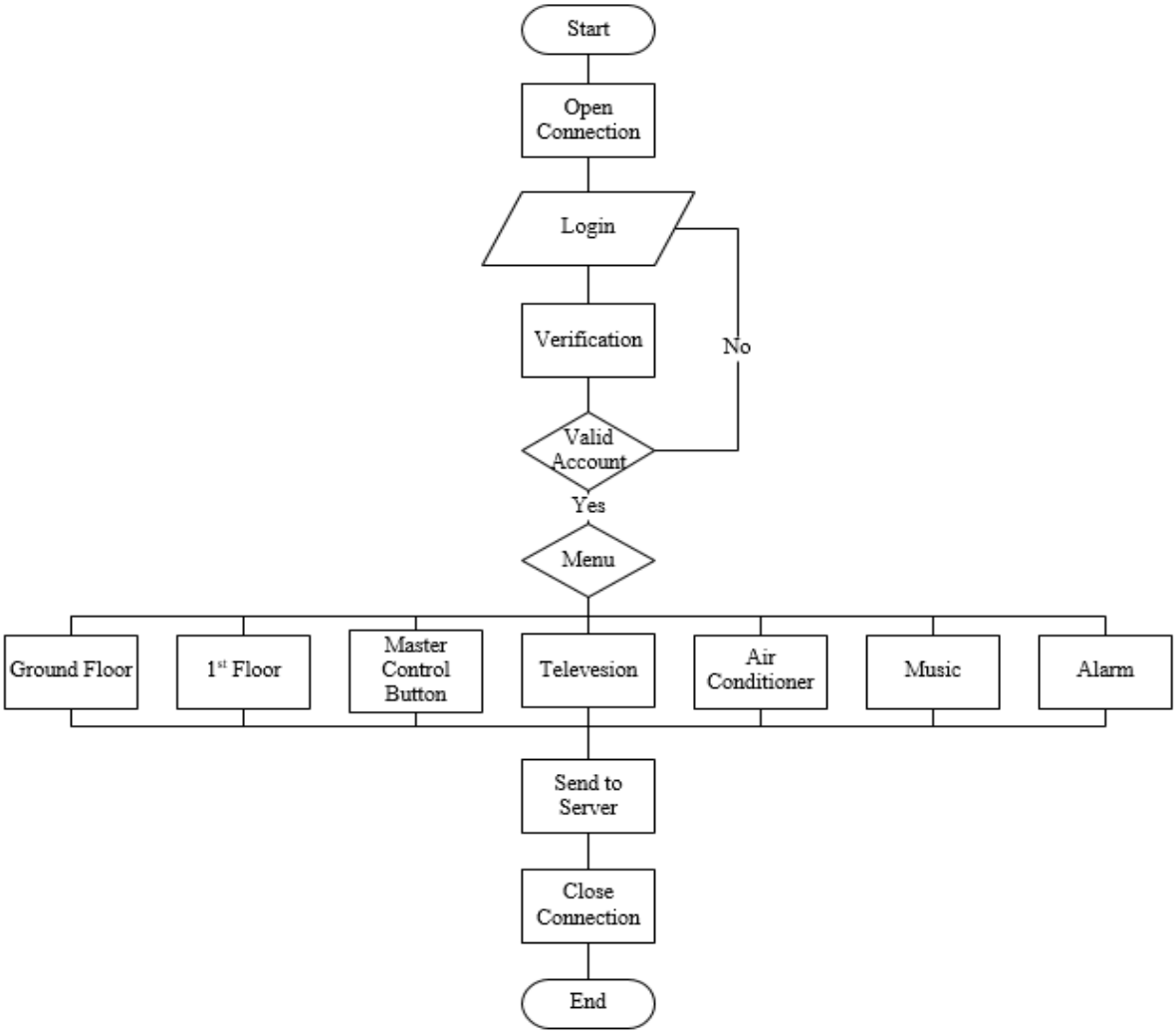


Figure 1 Client Side Flow Chart

b. Server Side

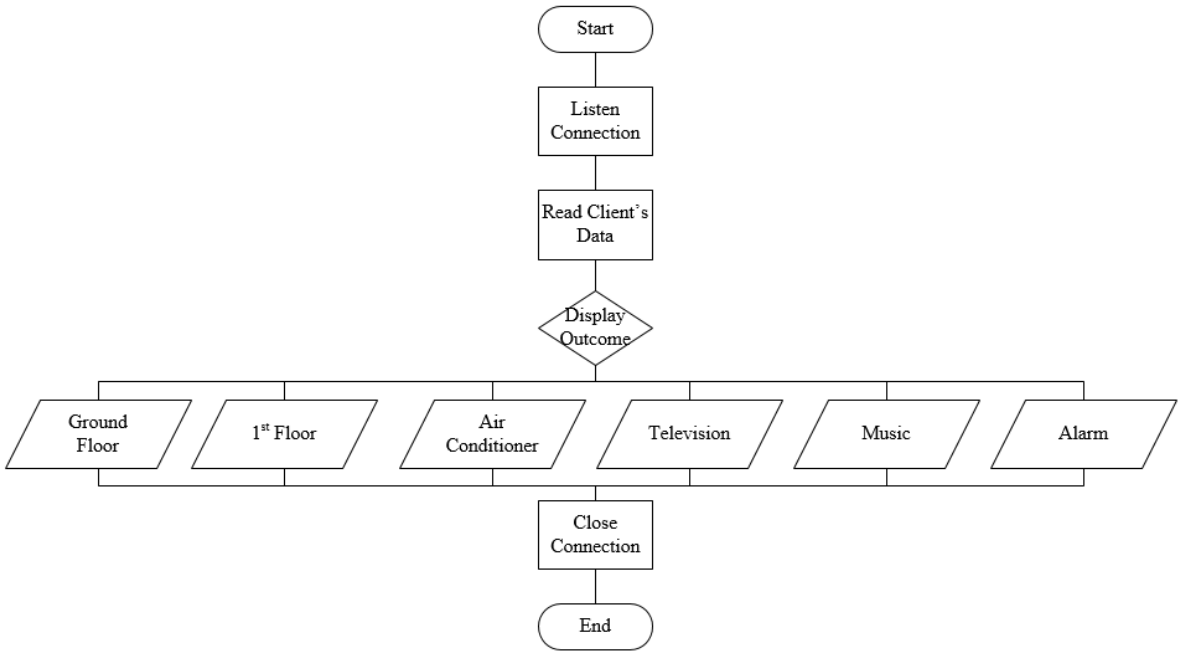


Figure 2 Server Side Flow Chart

2.2 UML Design

a. Use Case

It is a diagram which represents the user's interaction with the system. It shows the relationship between the users and the different use cases to which users are involved directly. It is also known as methodology which are usually used while analyzing the system to identify, clarify and also organize the system requirements. Below is our use case for the ***SMART HOME*** development.

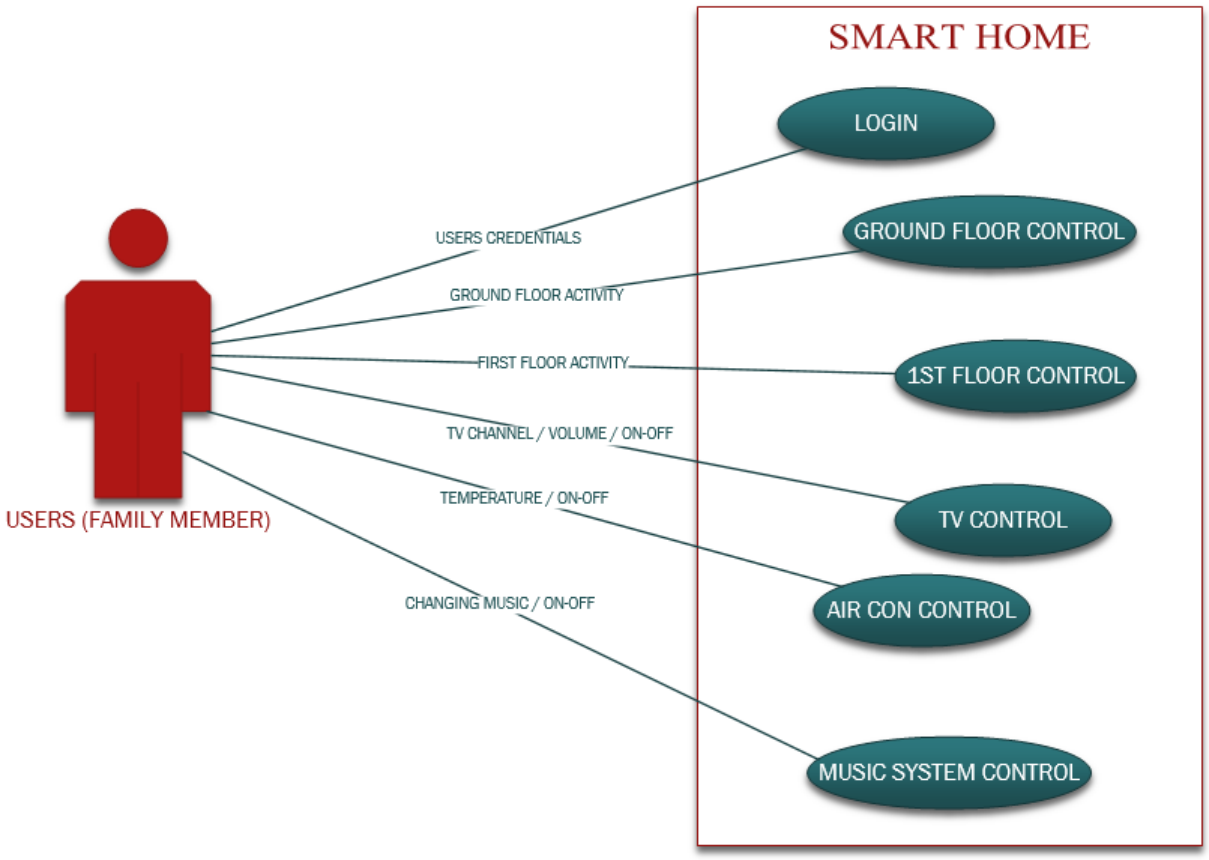


Figure 3 UML USE CASE

Name :	**Login**
Actor :	**Family Members**
Description :	**Describe the process used to login to the system**
Successful Completion :	**Members can access into the system**
Alternative :	**None**
Precondition :	**Members must have unique ID and PASSWORD**
Post condition :	**System is accessible to the member**
Assumption :	**None**

Name :	Ground Floor Control
Actor :	Family Members
Description :	Describe the process used to access ground floor
Successful Completion :	Members can access into ground floor UI
Alternative :	None
Precondition :	Members must have unique ID and PASSWORD
Post condition :	Ground floor activity is accessible to users
Assumption :	None

Name :	First Floor Control
Actor :	Family Members
Description :	Describe the process used to access first floor
Successful Completion :	Members can access into first floor UI
Alternative :	None
Precondition :	Members must have unique ID and PASSWORD
Post condition :	first floor activity is accessible to users
Assumption :	None

Name :	TV Control
Actor :	Family Members
Description :	Describe the process used to access TV control
Successful Completion :	Members can access the TV remote
Alternative :	None
Precondition :	Members must have unique ID and PASSWORD
Post condition :	TV control UI is accessible to users
Assumption :	None

Name :	Air Conditioner Control
Actor :	Family Members
Description :	Describe the process used to access Air Con control
Successful Completion :	Members can access the Air conditioner control
Alternative :	None
Precondition :	Members must have unique ID and PASSWORD
Post condition :	Air Con control UI is accessible to users
Assumption :	None

Name :	Music System Control
Actor :	Family Members
Description :	Describe the process used to access music system

Successful Completion :	**Members can access the music system**
Alternative :	**None**
Precondition :	**Members must have unique ID and PASSWORD**
Post condition :	**Music system UI is accessible to users**
Assumption :	**None**

2.3 User Login

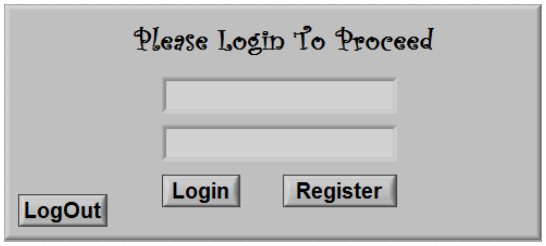


Figure 4 Login Panel

2.4 User Registration

a. Register User

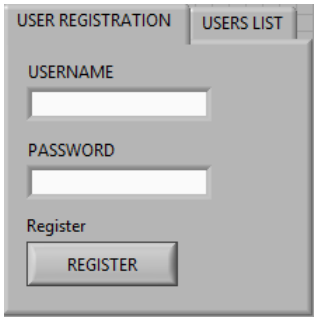


Figure 5 User Register

b. Users List

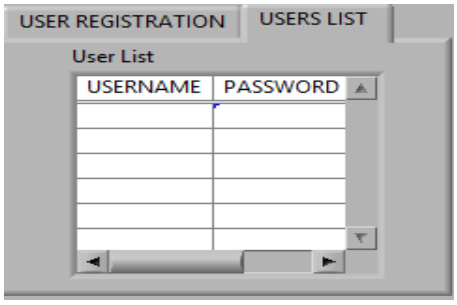


Figure 6 Users List

2.5 Floor Design

a. Ground Floor

Figure 7 Ground Floor Design

Above is our ground floor design. Here users can control garage, living room, kitchen, study room, store room, rumpus, hall, laundry room, meal, alfresco, porch and entry.

b. First Floor

Figure 8 First Floor Design

Above is our first floor design. It consists of one master bedroom, 2 common bedrooms, 2 washrooms, 1 family room, 1 balcony which is attached with master bedroom, 1 toy room for kids and 1 hall space.

c. Ground Floor Remote Design:

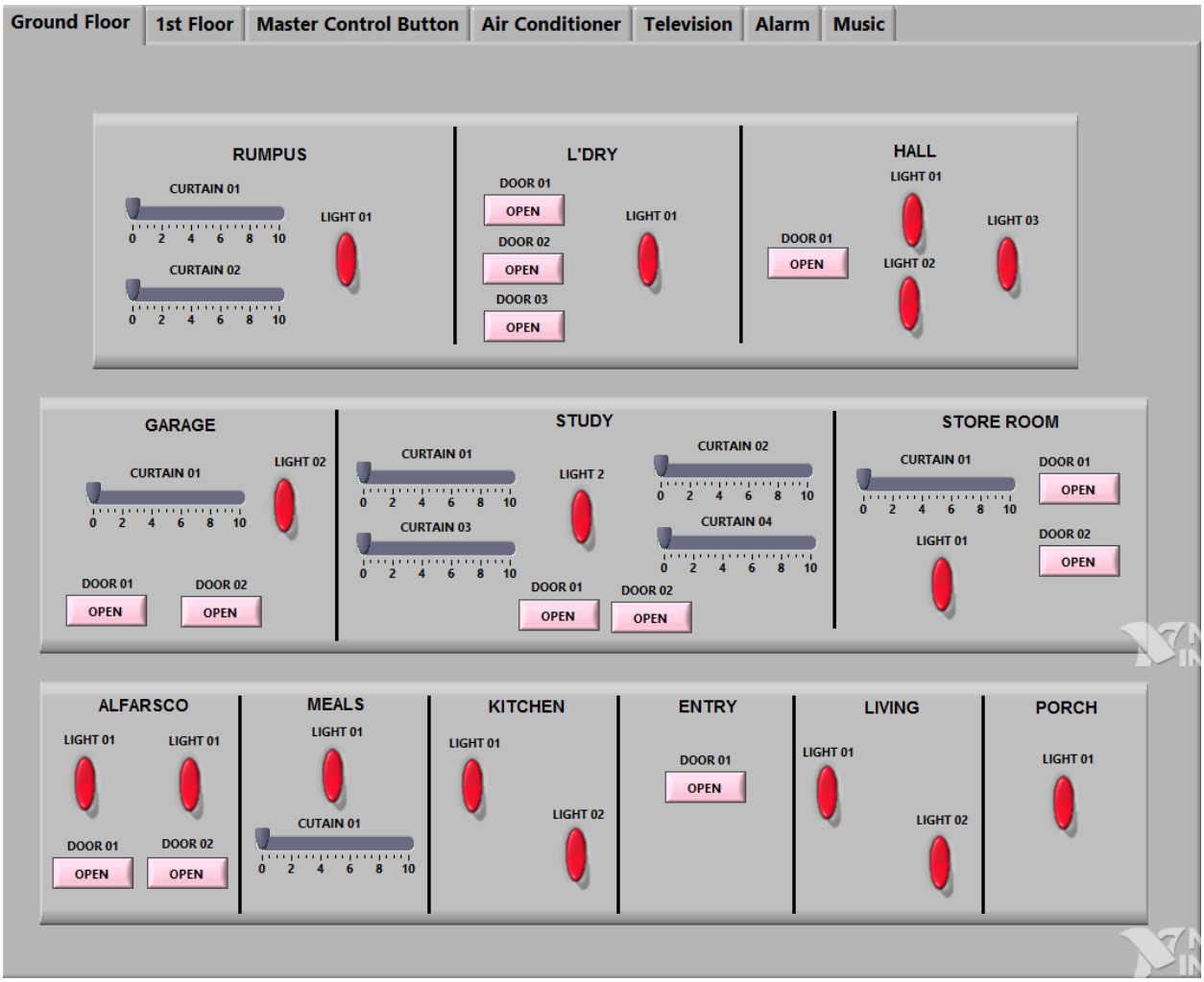


Figure 9 Ground Floor Remote Design

d. First Floor Remote Design:

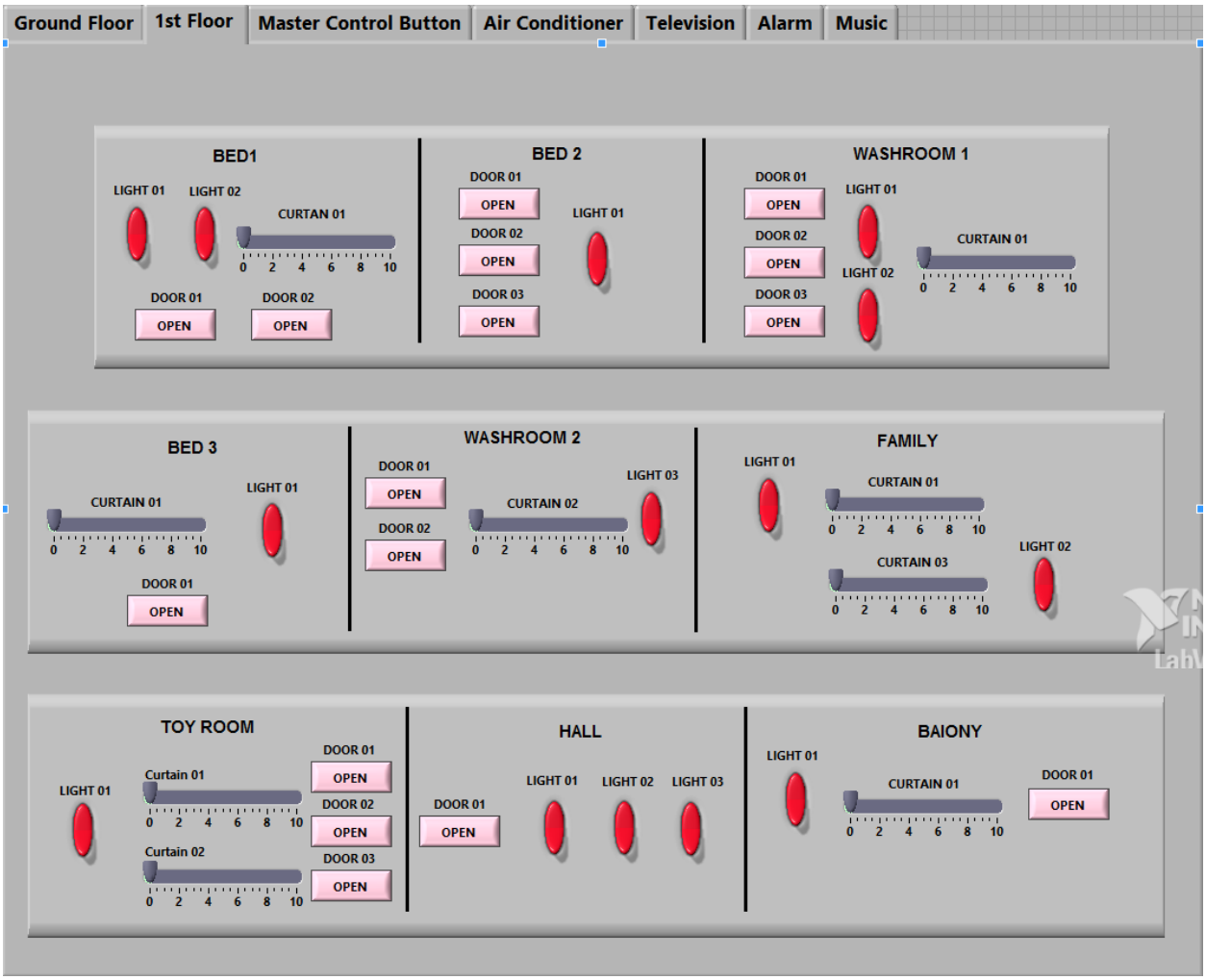


Figure 10 First Floor Remote Design

e. Ground Floor Block Design (Client Side):

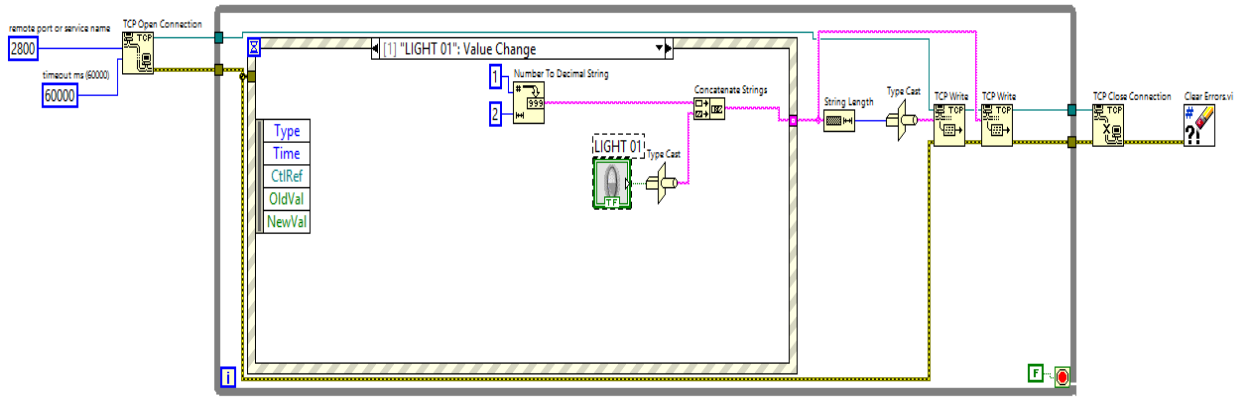


Figure 11 Ground Floor Client Side Block Design

f. Ground Floor Block Design (Server Side):

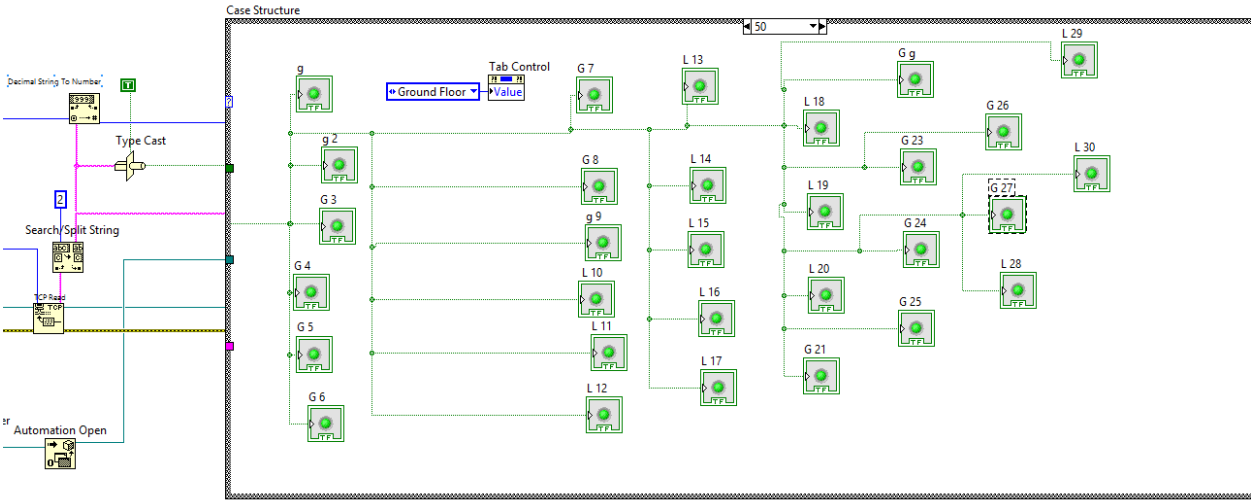


Figure 12 Ground Floor Server Side Block Design

g. First Floor Block Design (Client Side):

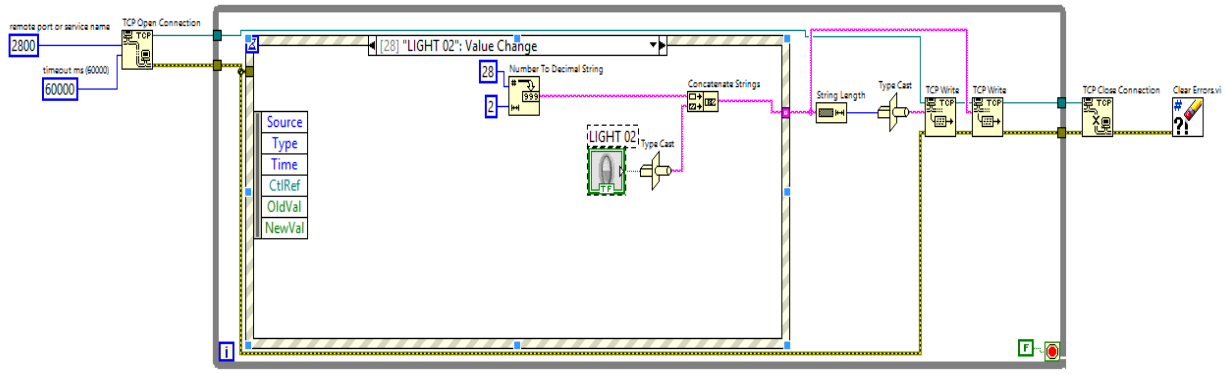


Figure 13 First Floor Client Side Block Design

g. First Floor Block Design (Server Side):

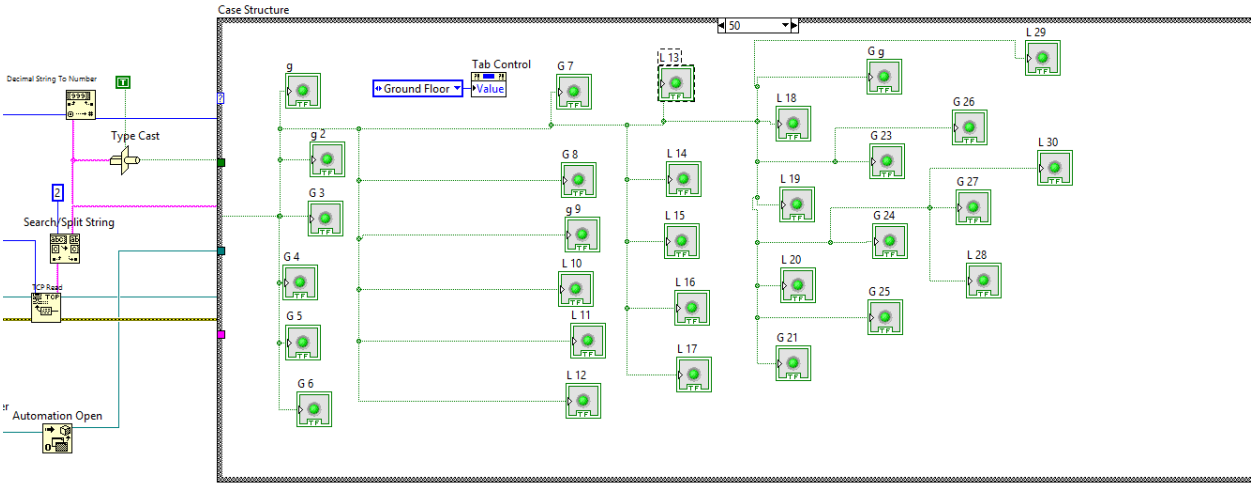


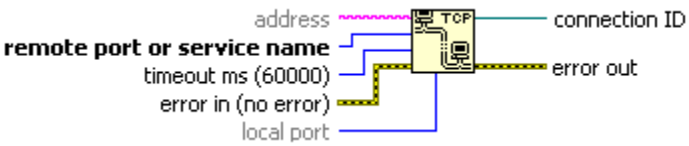
Figure 14 First Floor Server Side Block Design

3.0 PROTOCOL DESIGN

3.1 TCP/IP Connection

It is known as Transmission Control Protocol which is used for the communication protocol to connect through internet. This is built into UNIX Operating system. The de facto standard is used for transmitting the data over networks.

a. TCP Open



It opens a TCP network connection with address and a remote port or service name. Below are the parts it included:

A. ***Address***

B. ***Remote Port or Service Name***

C. ***Timeout MS***

D. ***Error In***

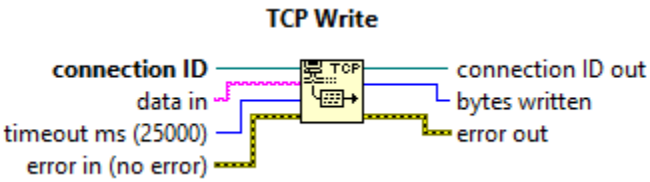
E. ***Local Port***

F. ***Connection ID***

G. ***Error Out***

Using this client and server side are connected. If there is no address given for TCP Open connection, LabVIEW will establish a connection using local server.

b. *TCP Write*



It writes data to a TCP network. Below are the parts included:

A. ***Connection ID***

B. ***Data In***

C. ***Timeout MS***

D. ***Error In***

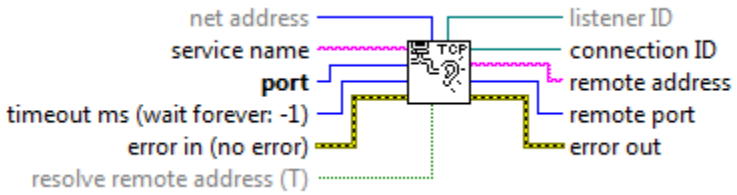
E. ***Connection ID Out***

F. ***Bytes Written***

G. ***Error Out***

After we added a TCP Connection we need something that can pass data and this can be done with TCP Write. Generally it allows string value to pass but others (Boolean, Numeric) are needed to be converted using TYPECAST converter.

c. *TCP Listen*



It creates a listener and waits for an accepted TCP network connection at the specified port. Below are the parts included:

A. ***Net Address***

B. ***Service Name***

C. ***Port***

D. ***Time Out MS***

E. ***Error In***

F. ***Resolve Remote Address***

G. ***Listener ID***

H. ***Connection ID***

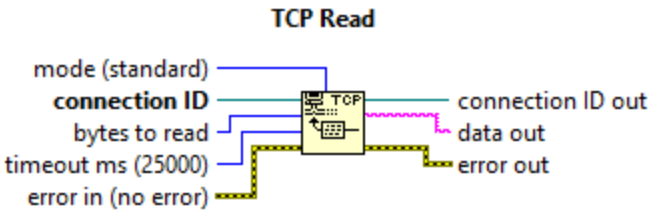
I. ***Remote Address***

J. ***Remote Port***

K. ***Error Out***

This allow users to receive data from TCP write using a same port number that was added with TCP Open. Users need to make sure they received data from the same IP address otherwise the data will not be transmitted over a network connection.

d. TCP Read



It reads a number of bytes from TCP network connection and return the result in data out. Below are the parts included:

A. ***Mode***

B. ***Connection ID***

C. ***Bytes To Read***

D. ***Time Out MS***

E. ***Error In***

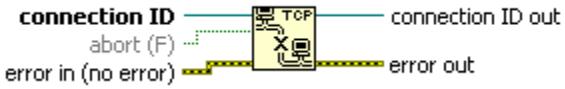
F. ***Connection ID Out***

G. ***Data Out***

H. ***Error Out***

It received from the TCP Listener and used to read it in a bytes. It usually work two times. At first Read is to get the number of bytes from TCP Listener then secondly it will generate the data into string format.

d. TCP Close



It use to close the TCP network connection. Below are the parts included:

A. ***Connection ID***

B. ***Abort***

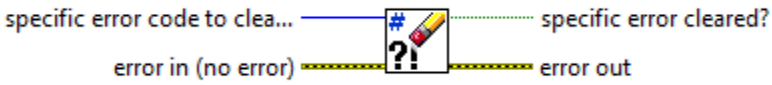
C. ***Error In***

D. ***Connection ID Out***

E. ***Error Out***

It is required to terminate the network connection between the client and the server side after data being transmitted.

3.2 *Clear Errors*



It is use to reset the error status to no error, code to 0, and source to an empty string. Below are the parts included:

A. ***Specific Error Code To Clear***

B. ***Error In***

C. ***Specific Error Cleared***

D. ***Error Out***

It also describes the error condition before the ERROR IN nodes run.

3.3 *Sample of Protocol Design*

a. AC Temperature Control

1. *Client Side*

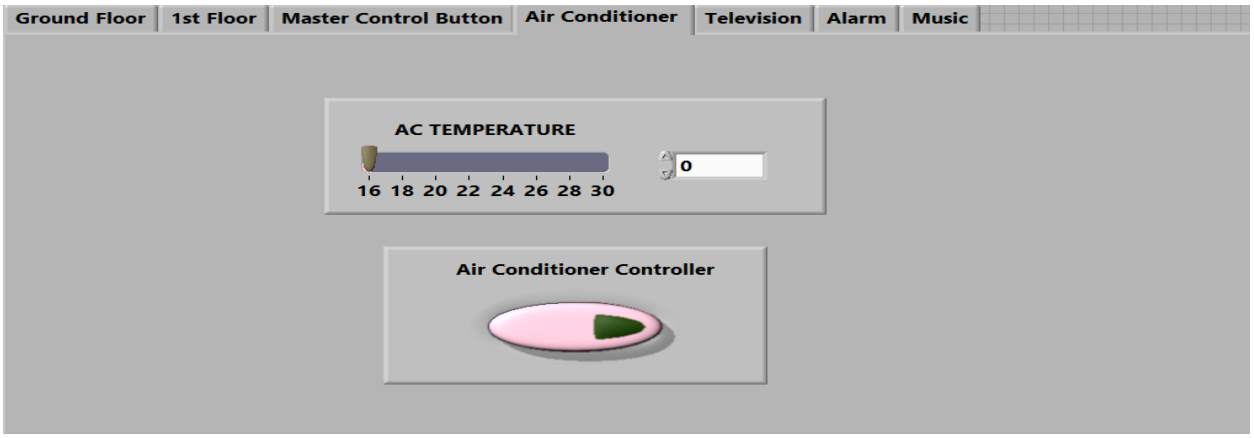


Figure 15 Client Side AC Controller

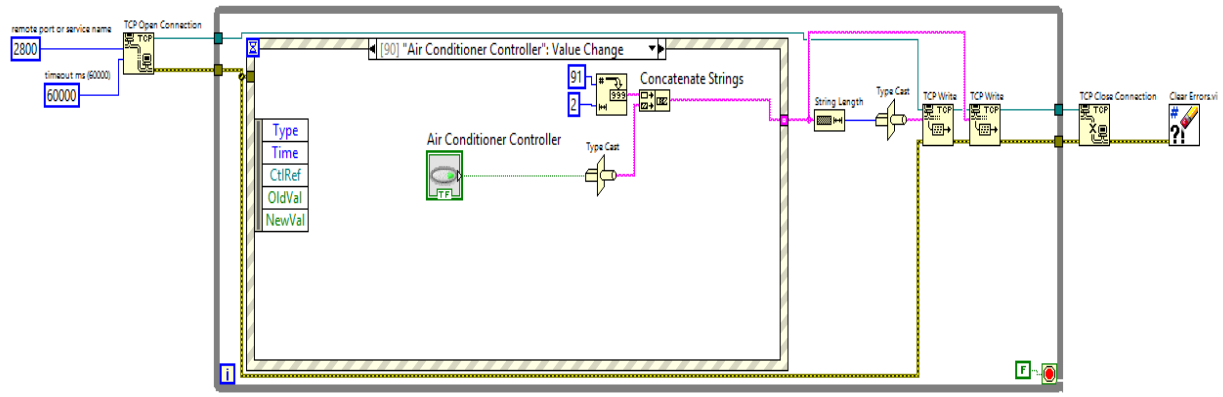


Figure 16 AC Controller (on/off) Protocol Design

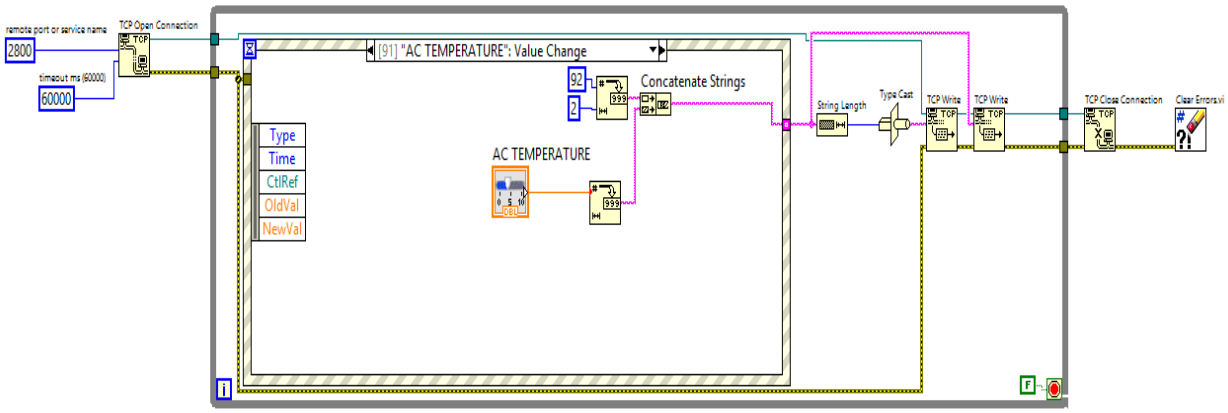


Figure 17 AC Controller (changing temperature) Protocol Design

From above figure 8 is our client side controller for Air Conditioner. From here users can switch on/off Air Con and also can change the temperature. Here figure 9 showing the protocol design of AC Controller (on/off). We used event structure to handle the event occurring using TCP / IP from client side. We used type cast to convert the Boolean function from button which concatenate strings and pass it to string length. To convert this string length again we added type cast so that TCP / IP write function can write the data getting from the users and pass it to server. Again, from figure 10 it is the same mechanism we are using "Changing Volume" and adding with "Number to Decimal String" function and concatenate it.

2. *Server Side*

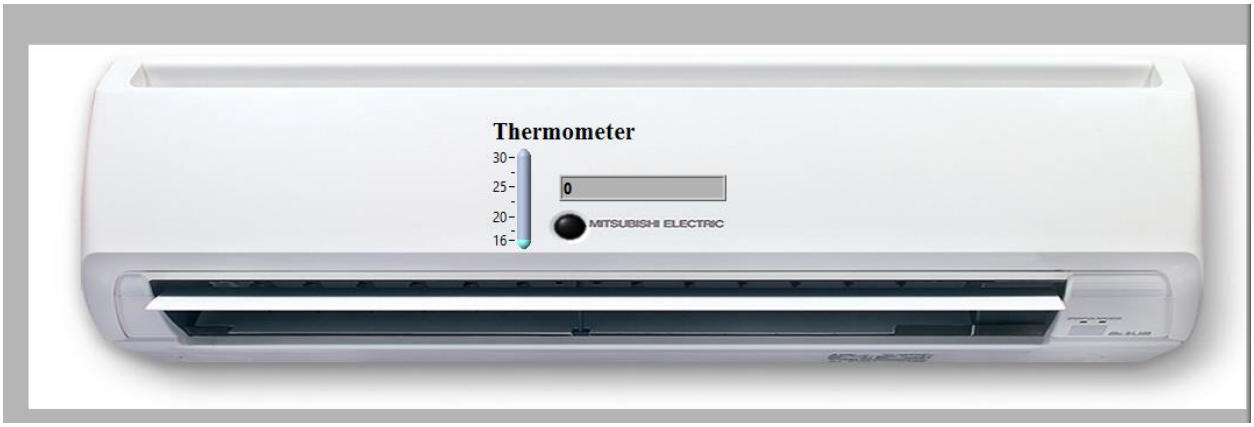


Figure 17 Server Side AC Design

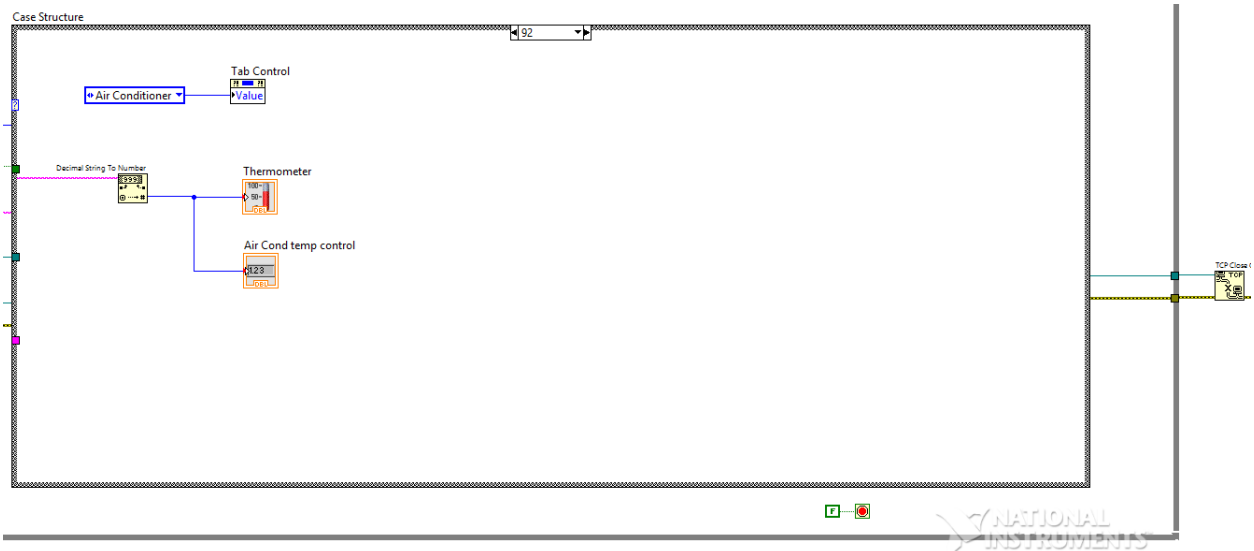


Figure 18 AC Protocol Function

Above figure 11 is our server side AC design. After receiving the command from client side trough TCP / IP users will see the AC function and can see the temperature which was already set from

client side. From figure 12 we can see how the case structure is handling the case using case ID. When the client pass the command from client side, the command will receive by server side using TCP/IP Listen and will do according to it. After completing all the command it will terminate the function by TCP / IP Close.

b. Door Control

1. Client Side

Figure 19 Client Side Door Switch

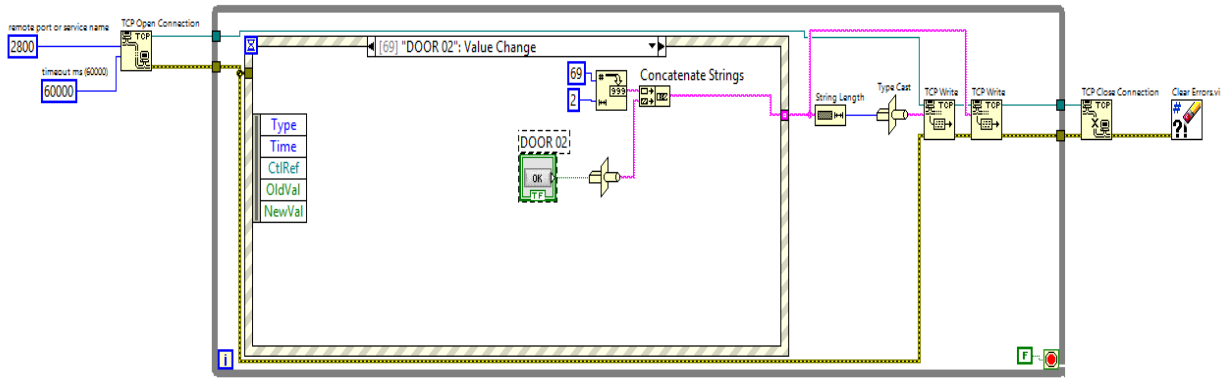


Figure 20 Client Side Door Design

Above is our SMART HOME door controller. From the client side using TCP/ IP Open Connection users can send the command to open and close the door to the server side. Here we concatenate the strings and pass the data using string length function through type cast converter. After the successful transmission the system will close the connection using TCP / IP Close Connection protocol.

2. Server Side

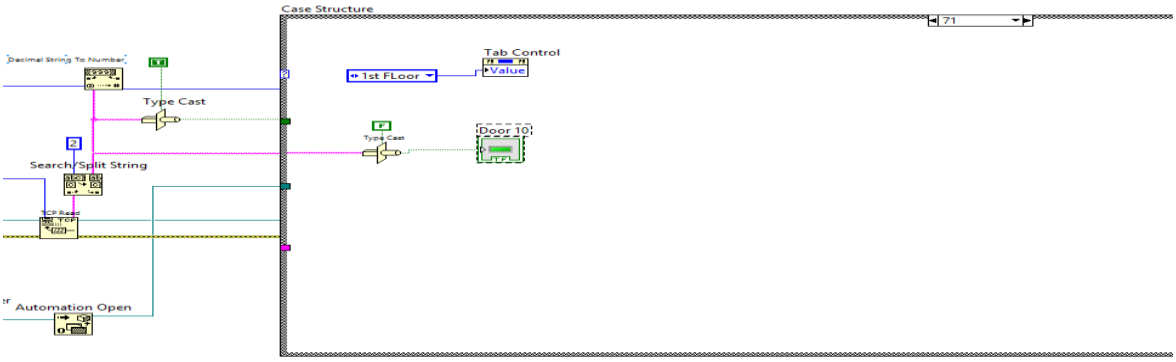


Figure 21 Server Side Door Design

This is our SMART HOME server side door design pattern. After transmitting the data from client side the server side will receive the data using TCP / IP Listen and read the data using TCP / IP Read. Then it will convert the data to Boolean as the door function (LED LIGHT) can only receive Boolean value.

c. Curtain Control

1. Client Side

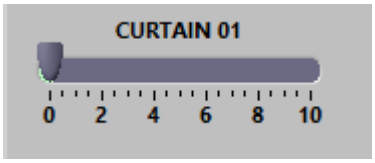


Figure 22 Client Side Curtain Switch

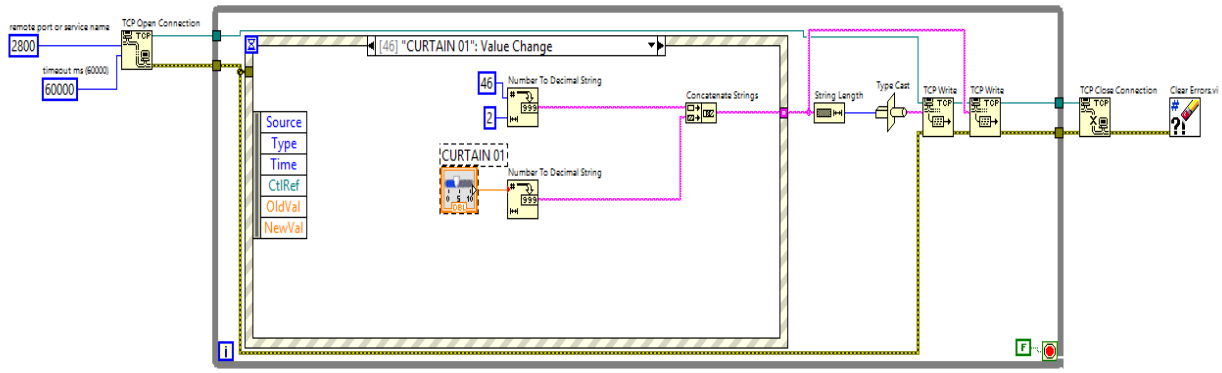


Figure 23 Client Side Curtain Design

Above is our SMART HOME curtain controller. From the client side using TCP/ IP Open Connection users can send the command to open and close the curtain to the server side. Here we concatenate the strings and pass the data using string length function through type cast converter. After the successful transmission the system will close the connection using TCP / IP Close Connection protocol.

2. Server Side

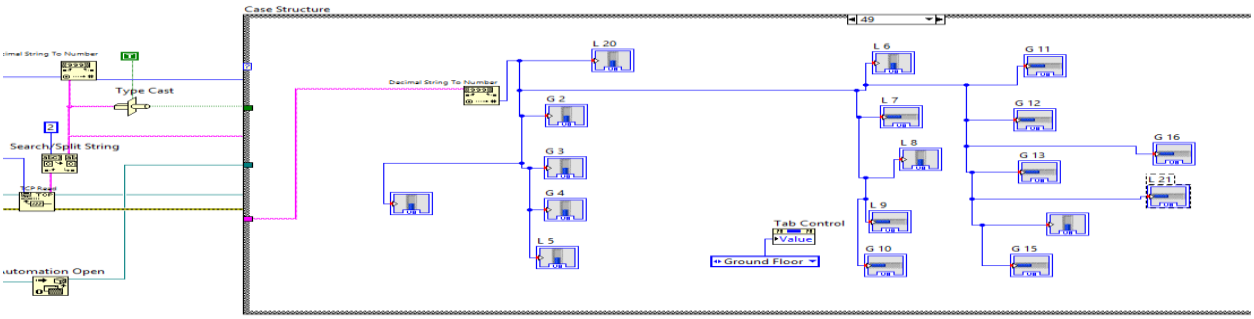


Figure 24 Server Side Curtain Design

This is our SMART HOME server side curtain design pattern. After transmitting the data from client side the server side will receive the data using TCP / IP Listen and read the data using TCP / IP Read. Then it will convert the data to Boolean as the curtain function (Fill Slides) can only receive Boolean value.

d. Master Control

1. Client Side (Master Lights)

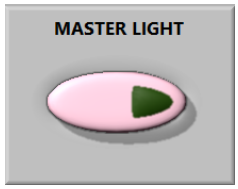


Figure 25 Client Side Master Light Switch

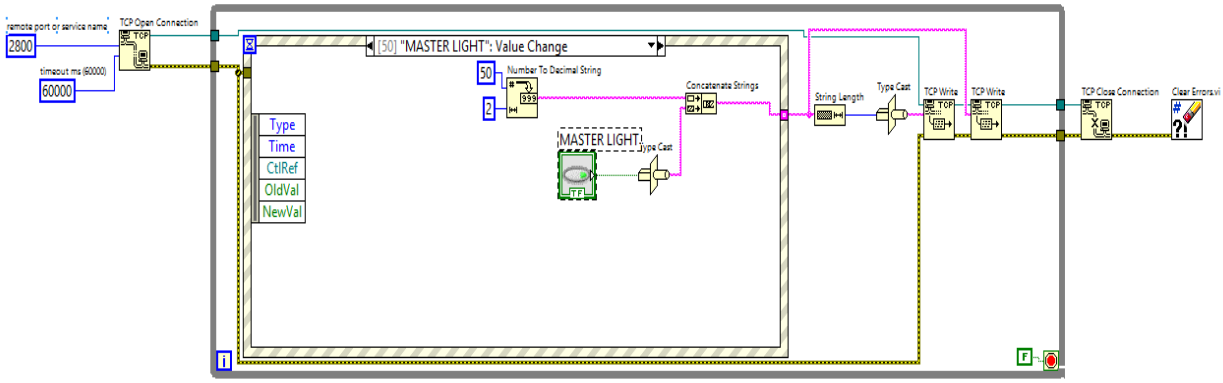


Figure 26 Client Side Master Light Design

Above is our SMART HOME master controller for lights. From the client side using TCP/ IP Open Connection users can send the command to switch off and on the lights to the server side. Here we concatenate the strings and pass the data using string length function through type cast converter. After the successful transmission the system will close the connection using TCP / IP Close Connection protocol.

2. Server Side (Master Lights)

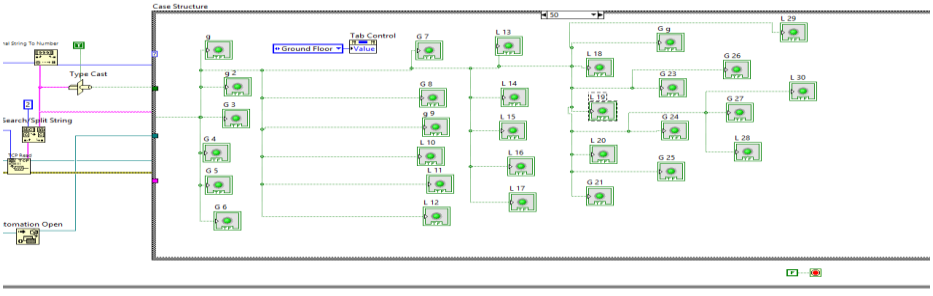


Figure 27 Server Side Master Light Design

This is our SMART HOME server side master light controller design pattern. After transmitting the data from client side the server side will receive the data using TCP / IP Listen and read the data using TCP / IP Read. Then it will convert the data to Boolean as the light function (LED) can only receive Boolean value.

1. Client Side (Master Curtains)

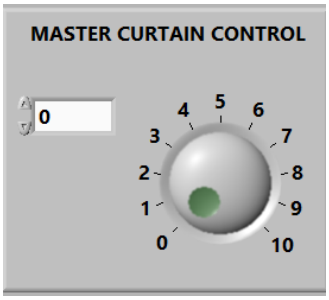


Figure 28 Client Side Master Curtain Switch

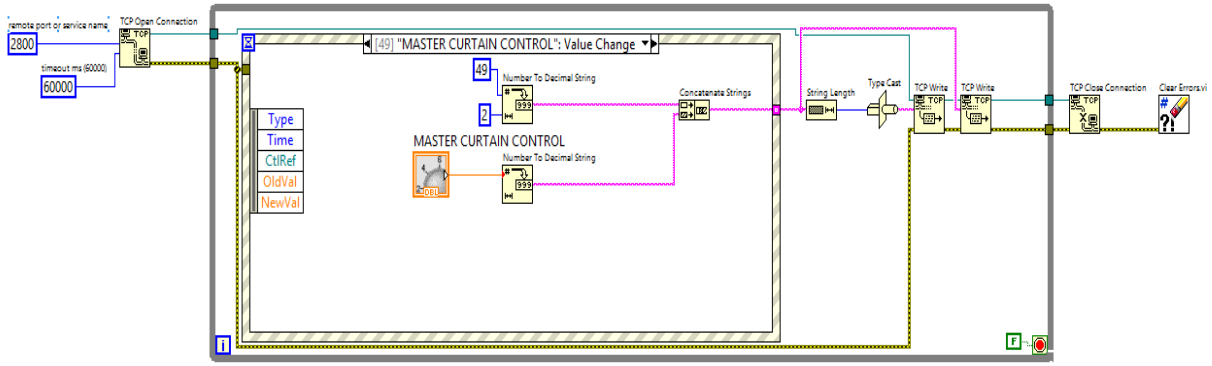


Figure 29 Client Side Master Curtain Design

Above is our SMART HOME master controller for curtains. From the client side using TCP/ IP Open Connection users can send the command to open and close curtains to the server side. Here we concatenate the strings and pass the data using string length function through type cast converter. After the successful transmission the system will close the connection using TCP / IP Close Connection protocol.

2. Server Side (Master Curtains)

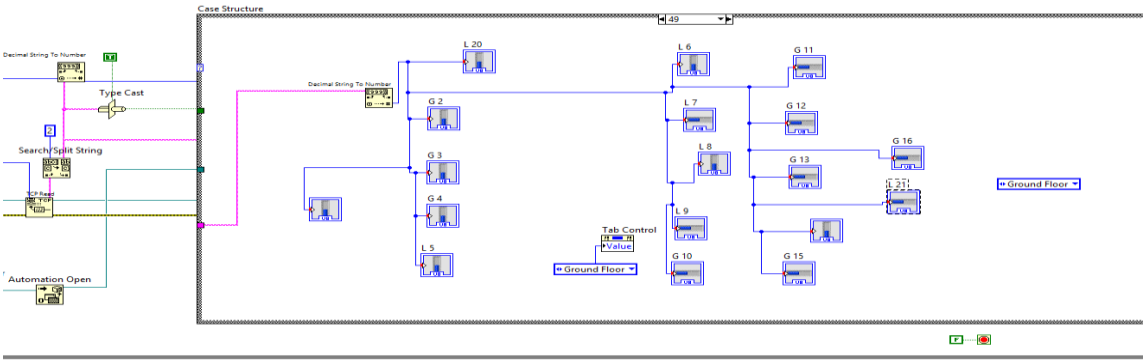


Figure 30 Server Side Master Curtain Design

This is our SMART HOME server side master curtains controller design pattern. After transmitting the data from client side the server side will receive the data using TCP / IP Listen and read the data using TCP / IP Read. Then it will convert the data to Boolean as the curtain function (Fill Slides) can only receive Boolean value.

4.0 HARDWARE REQUIREMENT

As this system has been developed as a software, we can also implement it in our real world. For the implementations we need the following hardware:

4.1 *Slide Door Opener*

The users can control the door to open and close from a distance using the slide door opener. This door moves only one way by sliding from right to left. The electromagnetic sensor will prevent users to open or close the door without the remote system. Here electromagnet are attached to the edge of the doorframe and the plate are attach on the left corner. The sensor are used to be connected with the electronic drive train so that it will be able to open and close smoothly. This opening and closing mechanism are usually attached to a panel of the door through a cog wheel. Here this cog wheels are connected by rubber wheels to control the closing and opening the door. Besides, it has duel functions. This door functions manually too. In case of power failure it can be operated manually by simply opening the lock and slides. For further reference below are the picture added which shows the components for sliding door:

Figure 31 Sliding Component 1

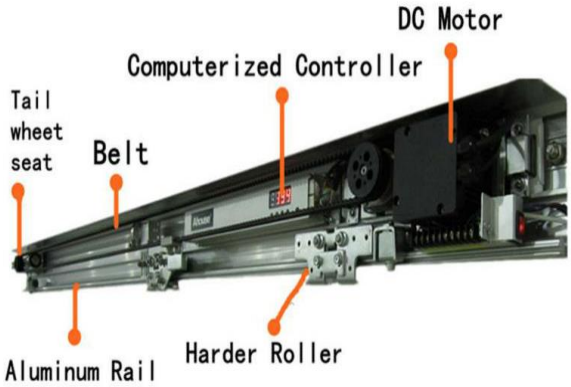


Figure 32 Sliding Door Component 2

4.2 *Remote Light*

The main two things of this remote light controller are: transmitter and receiver. This is important in case of turning a standard light fixture, load, into a wireless manifestation. Here the transmitter send the signal to the fixture to turn on and off the lights. When the user press the light switch it will, this will shoot a signal to the receiver using radio frequency. Then the receiver will interpret that signal and turn the load on and off depending on the opposite state of the fixture. Besides the transmitter which is in a wireless light switch needs to receive the power from third party source. As a third party battery can be used but the problem will face is when the battery run out users won't be able to know when it is getting close to that

time. In case of flexibility issues there are two possibilities for the power supply and that is solar power and kinetic energy. Moreover, the receiver need to be wired. It can be placed anywhere between the breaker and load. Sometimes it used to be recommended to place it on a junction box. Receiver follows the RF signal and tells the light when to switch on and off.

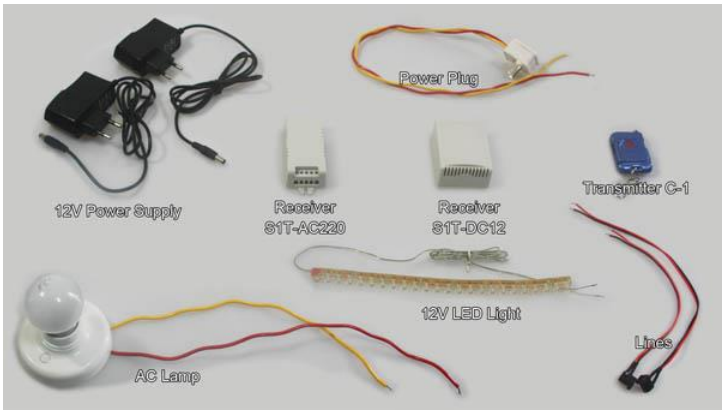


Figure 33 Remote Light Components

4.2 *Remote Curtain*

Here one remote operate 8 sets of curtain system. To implement in the real world one carrier of the curtain should move to the end of the track and other carrier is on other end of the track and should be fasten properly. After that move the copper ring to the first career and tight it properly by using the clamp to press ring. The overall system can be installed either on the wall or on ceiling. For that different materials is essential. Moreover, transmission box also needed to be installed properly. It should be inserted into the carrier box. Besides, infrared is also included as one of the important component. It works as a receiver of the port. Here, adapter need to be connected to supply the electricity and the transmission box both. The receiver is designed specifically for this system. User need two batteries tom operate the receiver. It should be charged for long time to use.

Figure 34 Carrier & Track With Base

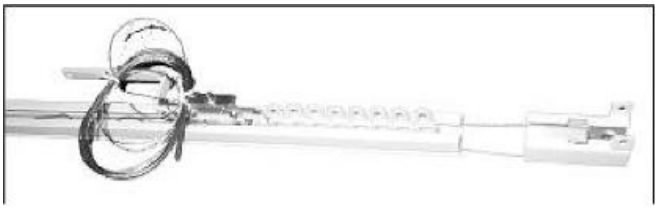


Figure 35 End Base

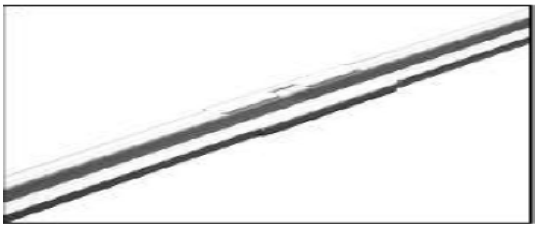


Figure 36 Track Connector With Base

5.0 USER MANUAL

Here we have explained how the users can interact with the system. This will help users to troubleshoot some of the important things like login, new user registration, master control etc. Below is our user manual:

5.1 *User Registration*

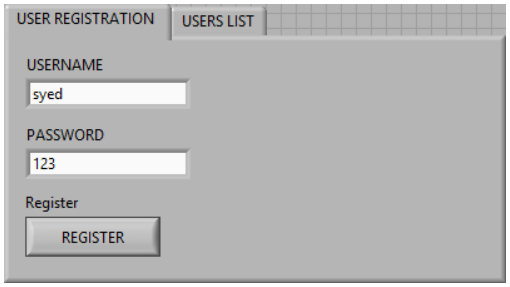


Figure 37 User Registration Panel

For the first time users need to register themselves to access the system. They need to enter their username and password. After that they need to click the button “REGISTER”. The system will save their credential and show it to the “USERS LIST”.

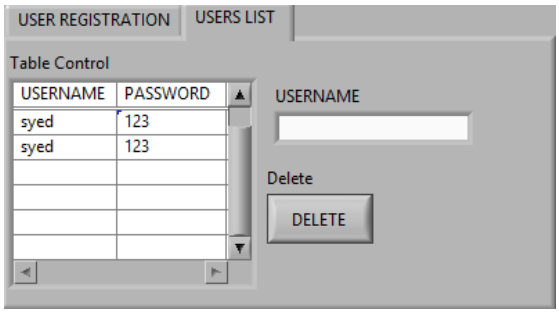


Figure 38 Users List Table

5.2 *Delete User*

For deleting specific user enter the username in the textbox and click the button “DELETE”. The system will delete the user from text file.

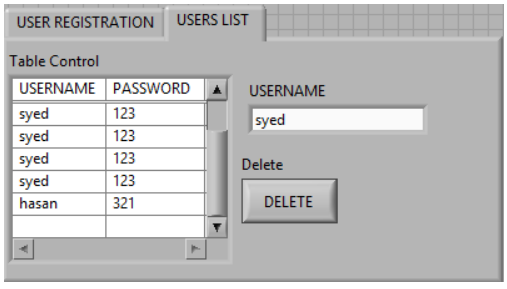


Figure 39 Delete Users

As shown in above figure users need to enter the username and click on the button “DELETE” and this will delete the user from the table.

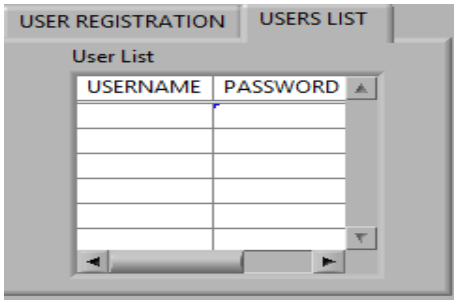


Figure 40 Users List Table After Deleting

5.3 *User Login*

After registering the credentials user need to login to access the system. Below shows how the login panel designed:

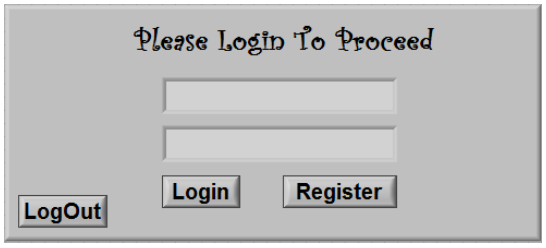


Figure 41 Client Side Login Panel

After that the system will show below dialogue box where users need to key in their credentials (ID and Password) to login.

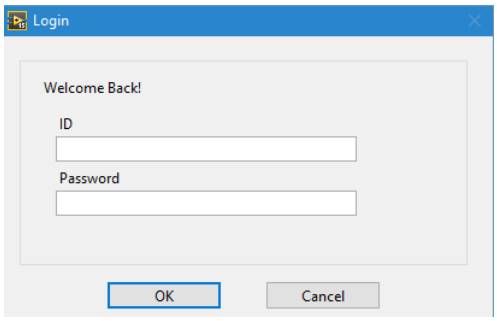
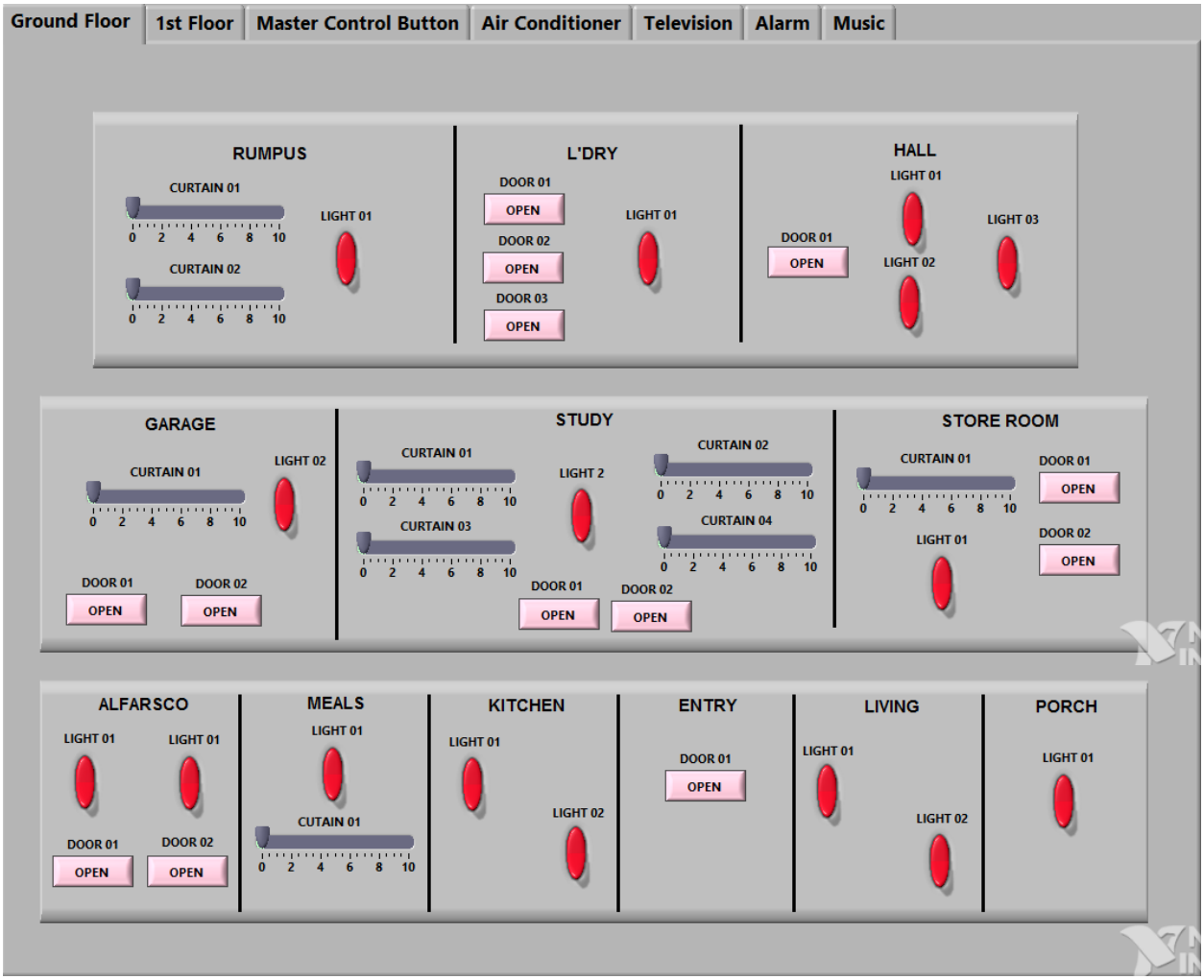


Figure 42 Login Dialog Property

After the successful login the system will redirect the users to ground floor controller. From here users can access all the functionalities we added in ground floor design.

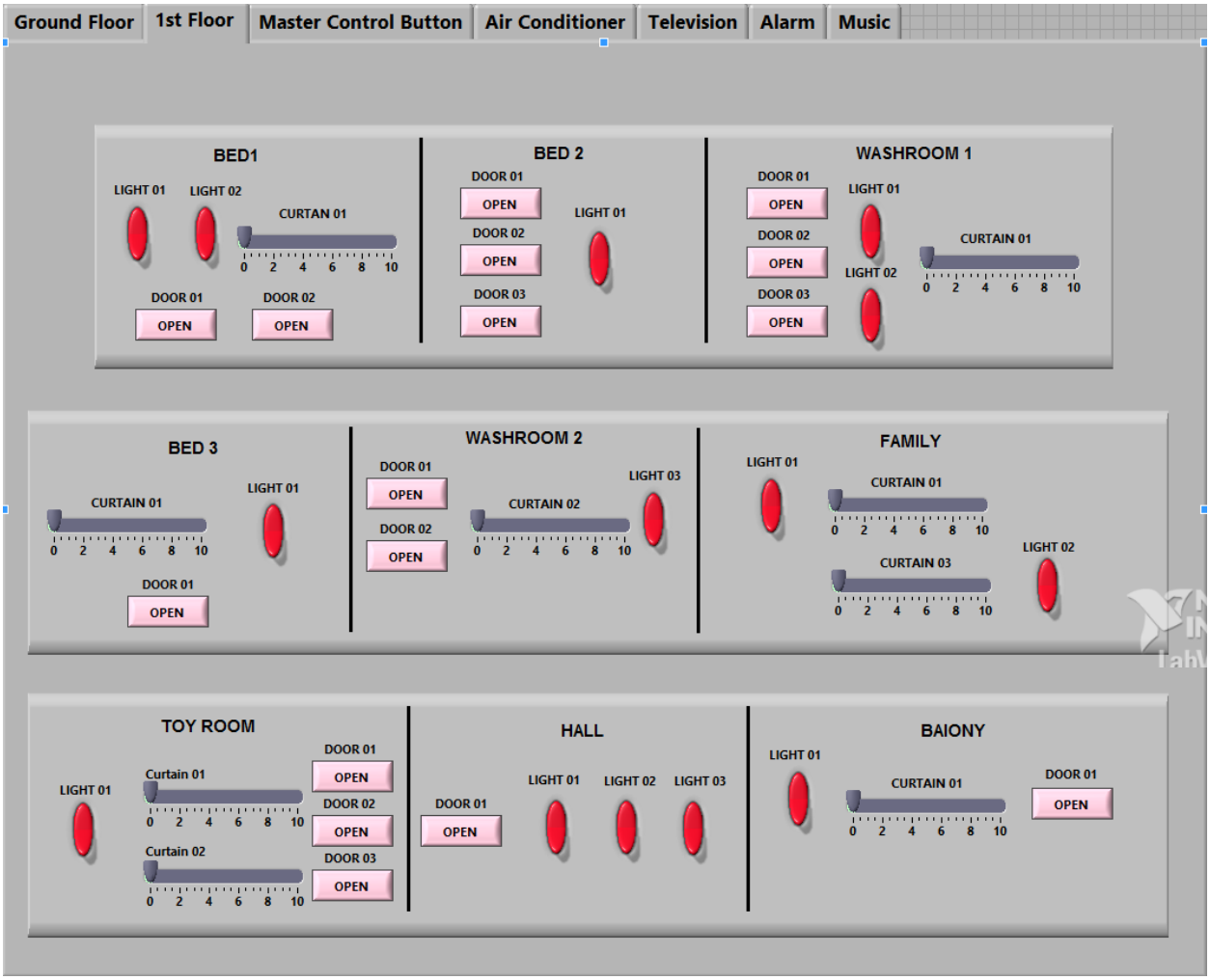
5.4 *Ground Floor Controller*

Below is our ground floor controller. Here we have added control for doors, curtains and lights.



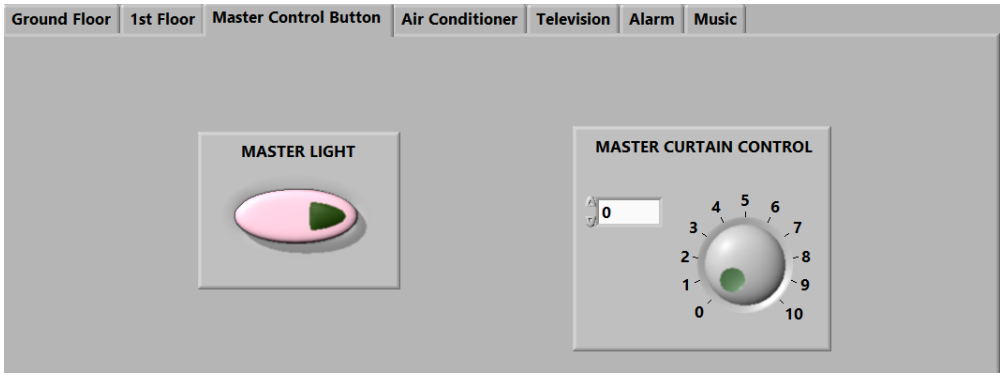
From this controller users can switch off / on the lights, curtains and can also open close the curtains of ground floor. This controller is programmed for “RUMPUS”, “LAUNDRY”, “HALL”, “GARAGE”, “STUDY ROOM”, “STORE ROOM”, “ALFARSCO”, “MEALS”, “KITCHEN”, “ENTRY”, “LIVING” & “PORCH”.

5.5 *First Floor Controller*



From this controller users can switch off / on the lights, curtains and can also open close the curtains of ground floor. This controller is programmed for “BED 1”, “BED 2”, “BED 3”, “BALCONY”, “HALL ROOM”, “TOY ROOM”, “WASHROOM 2”, “WASGROOM 1” & “FAMILY ROOM”.

5.6 *Master Control*



Above is our master control panel for both lights and curtains. From this panel users can control the lights and curtains of SMART HOME SYSTEM. The master curtain control is for opening and closing the curtain from client side. This is added as a way of security purposes. As for example if any of the lights or curtains do not work then users can control those by master control button.

5.7 *Air Conditioner Control*

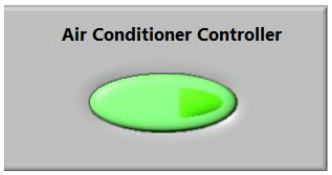


Figure 43 Air Con Switch

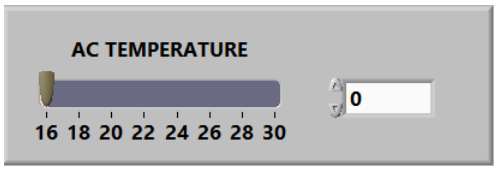


Figure 44 Air Con Temperature Slider

Above is the temperature control for Air Con. Users can control the temperature from client side by using the slider and the server side will show the Air Con temperature. The temperature box beside the slider will show the temperature selected by the user.

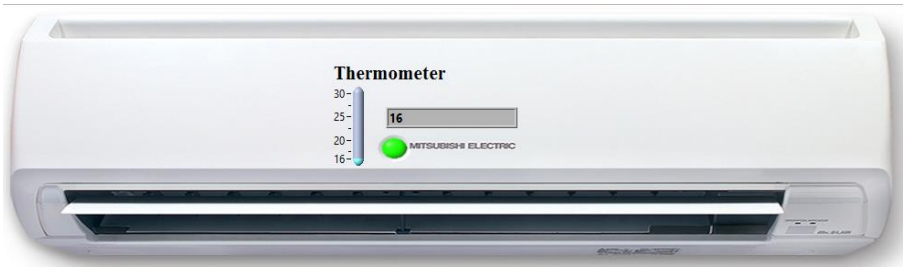


Figure 45 Server Side Air Conditioner

5.8 *Television*

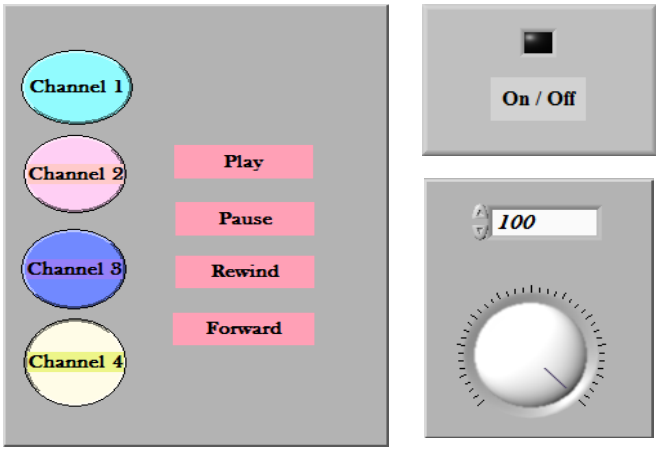


Figure 46 Client Side TV Controller

Above is the TV controller from client side. Users need to switch on the TV first then can change the channel according to their choice by pressing the button CHANNEL 1, CHANNEL 2, CHANNEL 3 & CHANNEL 4. We also added buttons for play, pause, rewind and forward. Besides the volume level can also control from client side.

5.9 *Alarm*

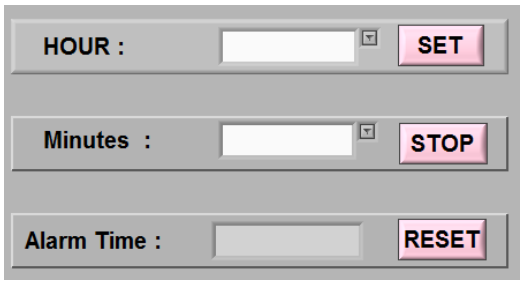


Figure 47 Client Side Alarm Clock

Above is our clock system for SMART HOME. Users can set hour, minutes and alarm time by pressing the button SET. Here STOP button will stop the alarm and RESET button will change the alarm time to default one.

5.10 *MP3*

Figure 48 Client Side MP3

This is our music system we added with SMART HOME. Users can change the song by using the slider we added stated decoration. Here green button is for ON and Red button is to switch off the system.

6.0 Extra Features Added

6.1 *Air Conditioner*

In our “Smart Home System” we added Air Conditioner. For using this function users must log in to the system using their credentials like username and password. Besides, master user can also connect using their portable device like smart phone or tablet whichever the convenient for them.

6.2 *Alarm*

We added alarm system for the users. Users can set the alarm according to their time. The only constraint of this system is without logging in users cannot be able to access this alarm system.

6.3 *MP3*

For entertainment purpose we also added music system for users. It can be controlled from client side. Before users need to access this panel they must enter their username and password in login panel.

6.4 *Master Control*

This is the most important features we added in SMART HOME SYSTEM. From the client side users can control all the lights of rooms using one master key. Again, the only constraint is users need to login into the system for the access.

7.0 LIMITATION

7.1 *Authority*

This is one of the limitations this SMART HOME SYSTEM having. Here users having the credentials can access the system. There is no authority issues regarding the system using TCP / IP connection. There is no access for the master user so that he or she can access extra functions of the system.

7.2 *Limited TV Channel Functions*

Although we have the functions for changing the channels but it is limited. So users cannot see more than 4 channels at a time.

8.0 CONCLUSION

Although this SMART HOME system have some limitations while using, it will help users to enjoy some technology advancement. This will keep their home safe as without the registered users it won't be able to access. We tried our best to develop this system in more user friendly environment. In future we will add more functions (depending on user's requirements) and will customize it for mobile version so that it will become more portable for the users. Although it has more advantages but there are some prerequisite while using. Users must have undisrupted power supply to control the SMART HOME system else the whole system will fail to communicate with users.

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