VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANASANGAMA, BELAGAVI-590018

INTERNSHIP REPORT

On

"IOT Based Home Automation System"

Submitted in Partial fulfilment of the Requirements for the VIII Semester of the Degree of

BACHELOR OF ENGINEERING

in

Information Science and Engineering

Submitted by

PRANJALI S, (1CR19IS107)

Under the Guidance of

Internal Guide
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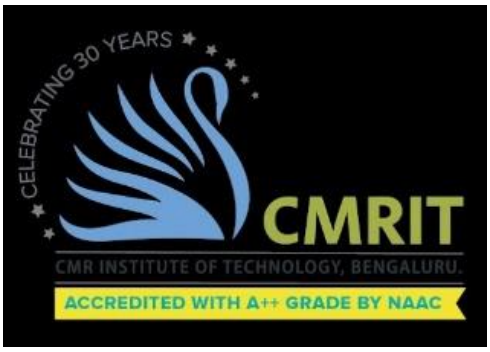
DEPARTMENT OF INFORMATION SCIENCE& ENGINEERING

CMR INSTITUTE OF TECHNOLOGY

#132, AECS LAYOUT, IT PARK ROAD, KUNDALAHALLI, BANGALORE-560037

2022-2023



DEPT. OF INFORMATION SCIENCE & ENGINEERING

Certificate

This is to certify that **Pranjali S (1CR19IS107),** student of CMR Institute of Technology have undergone Internship in partial fulfilment for the award of **Bachelor of Engineering** in **Information Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year **2022-2023**. It is certified that all corrections/suggestions indicated for Initial Reviews have been incorporated in the Report. This **Internship** has been approved as it satisfies the academic requirements in respect of project work prescribed for the said degree.

Sign. of Internal Guide
Dr. Srividya R
Associate Professor
Department of ISE
CMRIT, Bengaluru

Sign. of HOD
Dr. M. Farida Begam
Professor & HOD
Department of ISE
CMRIT, Bengaluru

Viva

Name of the examiners **Signature with date**

1.

2.

EMERTXE

Internship Offer Letter

Date	17th November 2022
Name	**Pranjali S**
College Name	CMR Institute of Technology
Department	Others
Internship Cohort	II22_006

Dear **Pranjali S,**

Hearty Congratulations!

We are pleased to offer you an Online internship in IoT for a duration of 4 weeks at Emertxe Information Technologies, Bangalore. This internship is an initiative from Emertxe to skill yourself in the core IoT Programming.

Kindly note, you will go through our internship evaluation process mentioned below. Upon successfully clearing, you will be provided a completion certificate.

This certificate is issued for your college administration purpose.

We look forward to your active participation in the internship program and building your foundations for your future career in the core Embedded / Electronics / IoT domains.

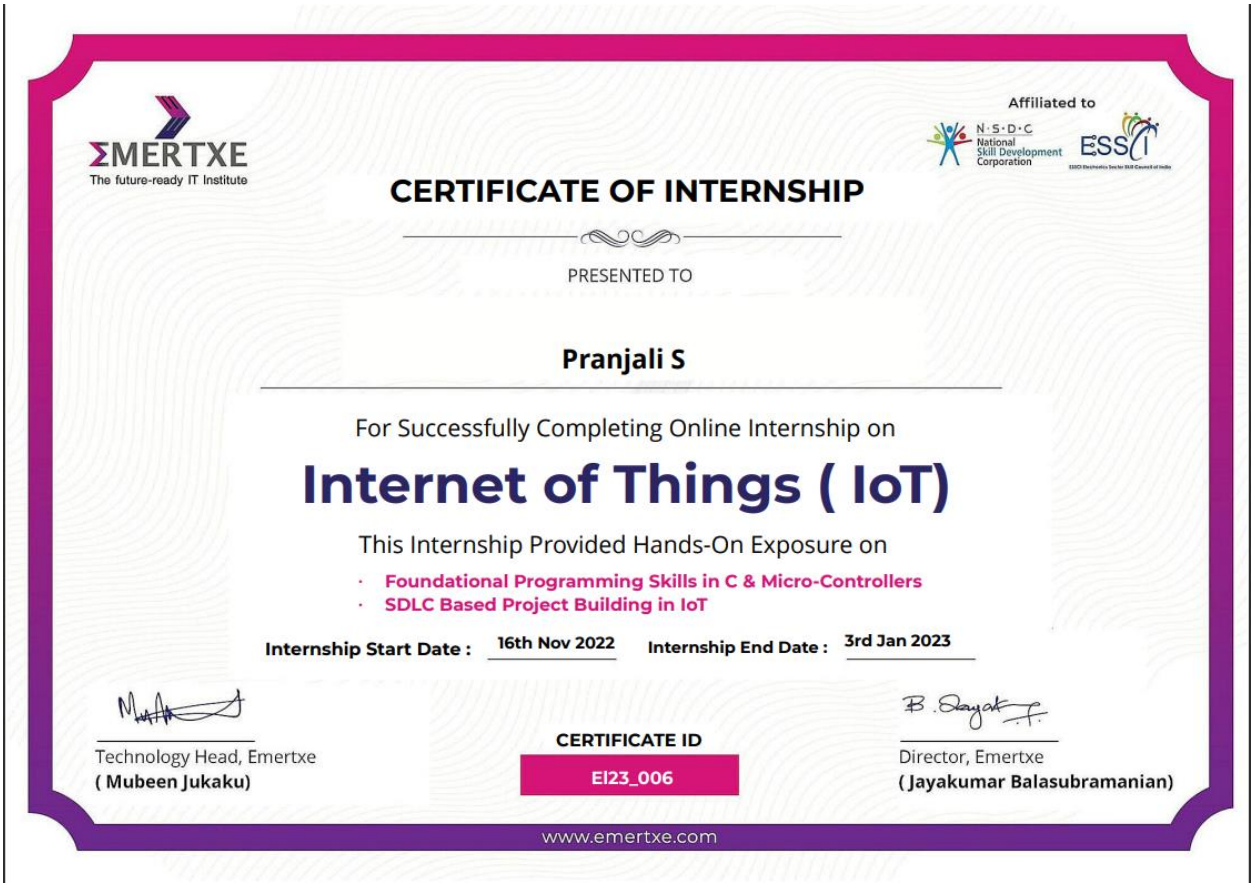
Mubeen Jukaku,

Technology Head, Emertxe

Jayakmar Balasubramanian,

Director, Emertxe

**Internship Evaluation will be done based on regular attendance, attending quizzes and on-time project report submission*


EMERTXE
The future-ready IT Institute
Affiliated to
N·S·D·C National Skill Development Corporation
ESSCI
CERTIFICATE OF INTERNSHIP
PRESENTED TO
Pranjali S
For Successfully Completing Online Internship on
Internet of Things (IoT)
This Internship Provided Hands-On Exposure on
· Foundational Programming Skills in C & Micro-Controllers
· SDLC Based Project Building in IoT
Internship Start Date : 16th Nov 2022
Internship End Date : 3rd Jan 2023
Technology Head, Emertxe
(Mubeen Jukaku)
CERTIFICATE ID
EI23_006
Director, Emertxe
(Jayakumar Balasubramanian)
www.emertxe.com

ACKNOWLEDGEMENT

Any work of significance requires a great deal of effort and time put into it. But a factor of even greater importance is efficient guidance and encouragement. In spite of all my dedicated work, this internship would not have been possible without continuous help and guidance provided by people who gave their unending support right from when this idea was conceived.

I would like to thank to **Dr. Sanjay Jain,** Principal, CMRIT, Bangalore, for his constant co-operation and support throughout this Technical Seminar tenure.

I would like to thank **Dr. M Farida Begam, Professor & Head ,** Department of Information Science and Engineering, CMRIT for her constant guidance and support during this Technical Seminar period.

I would like to thank my guide, **Dr. Srividya R, Associate Professor,** Department of Information Science and Engineering, CMRIT for her constant guidance that helped me in completing the Technical Seminar work successfully.

Last but definitely not the least I would like to thank **my family** and **friends** who have always supported me in every path of the internship.

PRANJALI S
(1CR19IS107)

DECLARATION

I, **Pranjali S**, bearing **1CR19IS107,** student of eight semester B.E in Information Science and Engineering from CMR Institute of Technology, Bangalore, hereby declare that this **Internship** titled "**IOT Based Home Automation System"** was carried out by me.

I have done the work assigned to me during the period and all the contents about work assigned are prepared and presented by me. The eight semester **Internship** has been done by me under the supervision of **Dr. Srividya R**, Department of ISE, Internal Guide, CMR Institute of Technology, Bangalore.

This work is submitted to Visvesvaraya Technological University in partial fulfilment of the requirement for the award of degree of Bachelor of Engineering of Technology in Information Science and Engineering during the academic year 2022-2023.

Place: Bangalore

PRANJALI S
(1CR19IS107)

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Chapter 1

INTRODUCTION

1.1 Company profile and introduction

Emertxe Information Technologies is one of the top-notch finishing schools focused on Embedded Systems & IoT.

We have been in the EdTech industry for the past 18+ years by offering hands-on practical training programs to make engineering students land in core jobs in the Electronics / Semiconductors Industry.

As a part of our long term skill building initiative we are reaching out to Engineering colleges. This internship already had a roaring success with 5000+ students ever since we launched it three months back.

Our Vision :-

Globally make life easier by innovation, technology and education in multidisciplinary fields by maintaining high standards of quality.

Our Mission :-

Drive technology by creating a platform to constantly drive technology education to make life easier, leading to technology aware country.

Our Approaches :-

- Inspire by coaching
- Outcome focused
- Learning by doing

We serve :-

- Fresh Engineers
- Working Professionals
- Organizations

Emertxe is India's pioneer institute for Embedded Systems Courses, Linux and IoT training, located in Bangalore, Since 2003.

Our Embedded training vertical has generated huge pool of Industry ready embedded engineers.

For freshers we offer placement oriented embedded courses and IoT courses with attractive scholarships.

For working professionals weekend options are available with embedded systems trainings and advanced workshops.

Practical approach, applied learning, result oriented approach makes us the preferred choice for Embedded systems training in Bangalore.

Emertxe's Embedded institute's flagship training centre in Bangalore, offers one of the most exhaustive suites of courses in Embedded systems and IoT technology courses available in India.

Along with embedded systems and IoT, Emertxe offers training in specialized courses in Qt QML application programming, Qt for Embedded, Embedded android system development, Yocto for custom embedded Linux development, Advanced Linux device drivers courses,

Software engineering courses as individual verticals.

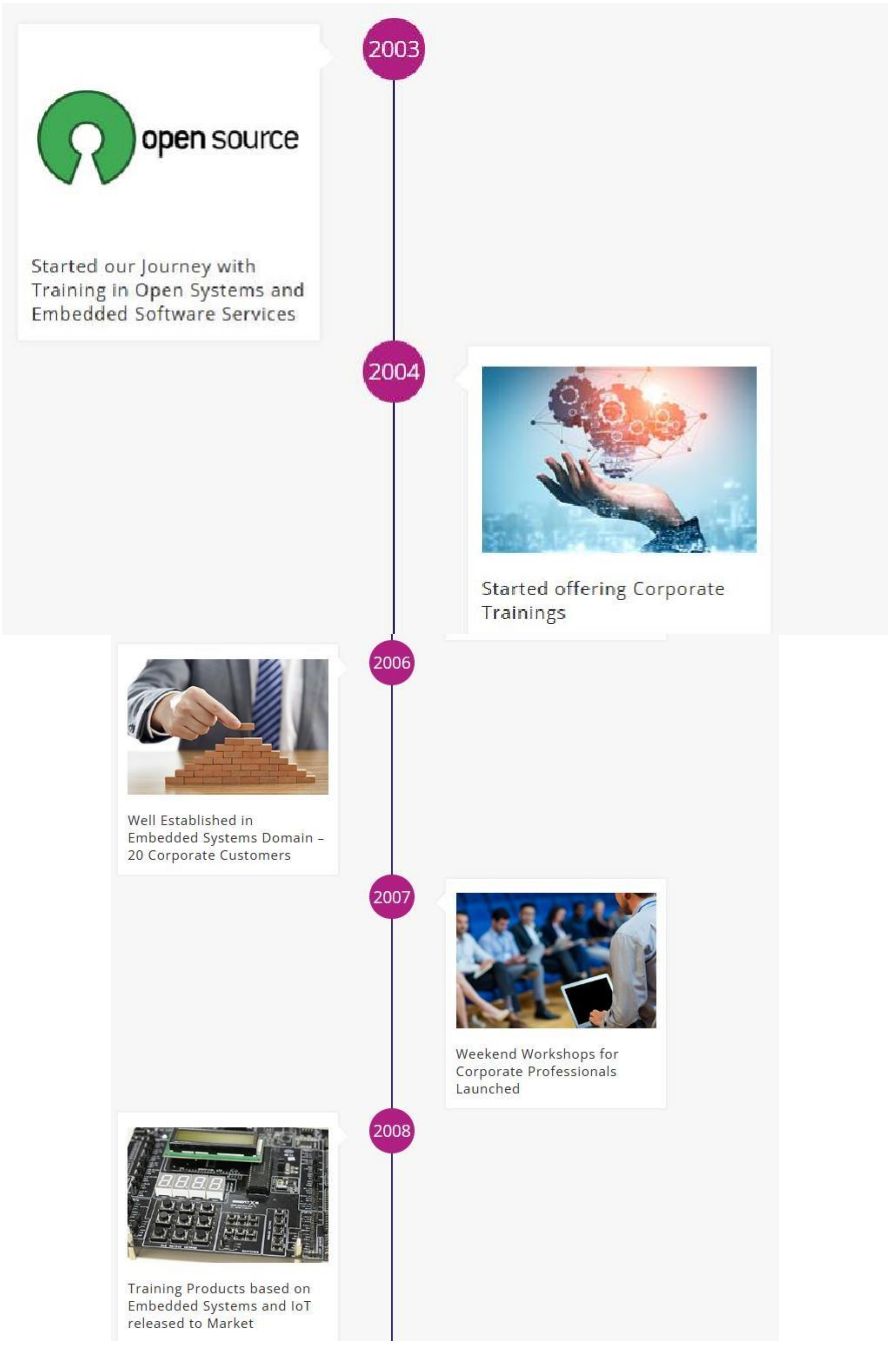
We offer short term and long term trainings in each technology areas, catering to various segments.

Our story:-

Started by a set of technocrats and business savvy individuals we have more than 15 years of strong footprint in the area of technology education.

Ours is the only institute with Experienced Embedded Trainers in India with highest number of trainers.

Have a look into how our story evolved from initial days.


2003
open source
Started our Journey with Training in Open Systems and Embedded Software Services
2004
Started offering Corporate Trainings
2006
Well Established in Embedded Systems Domain – 20 Corporate Customers
2007
Weekend Workshops for Corporate Professionals Launched
2008
Training Products based on Embedded Systems and IoT released to Market

2009

SUNGKONGHOE UNIVERSITY

Strategic Partnerships with Foreign Universities

2011

Launched IoT products in market for Industrial & Agriculture segment

2013

Java ORACLE

Training portfolio expanded to Java based applications & Android

2014

Training business positioned as IT finishing school separately from product development

2015

Consolidation of Embedded Systems training and growth

2016

Piloting of e-learning initiatives

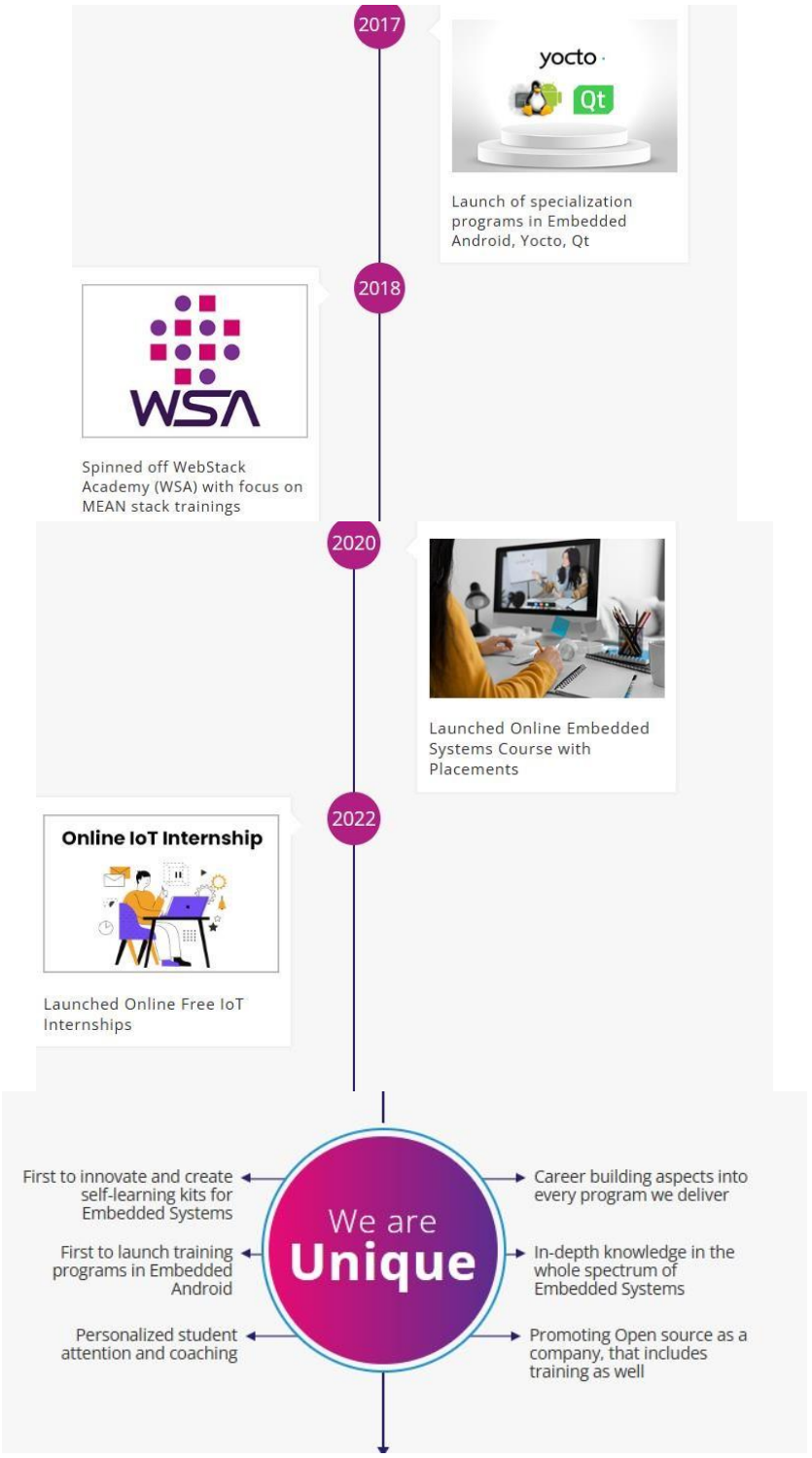


Fig. 1. Our story

1.2 About the software

Arduino IDE

The arduino software (IDE) is an open source software, which is used to program the Arduino boards, and is an integrated development environment, developed by arduino.cc.

Allow to write and upload code to arduino boards.

And it consists of many libraries and a set of examples of mini projects.

Arduino software (IDE) is compatible with different operating systems (Windows, Linux, Mac OS X), and supports the programming languages (C/C++)

The Arduino software is easy to use for beginners, or advanced users. It uses to get started with electronics programming and robotics, and build interactive prototypes.

Arduino software is a tool to develope new things. and create new electronic projects, by Anyone (children, hobbyists, engineers, programmers, … etc).

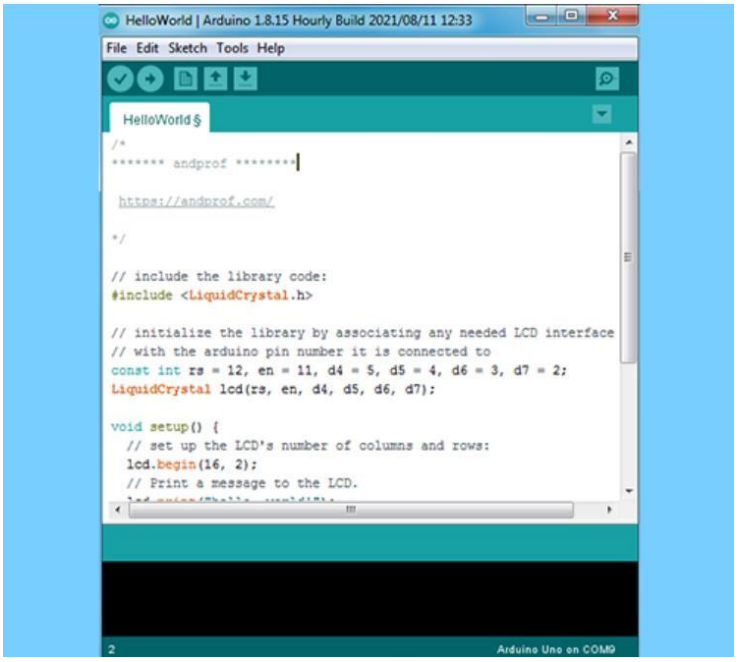


Fig. 2. Arduino Software Interface

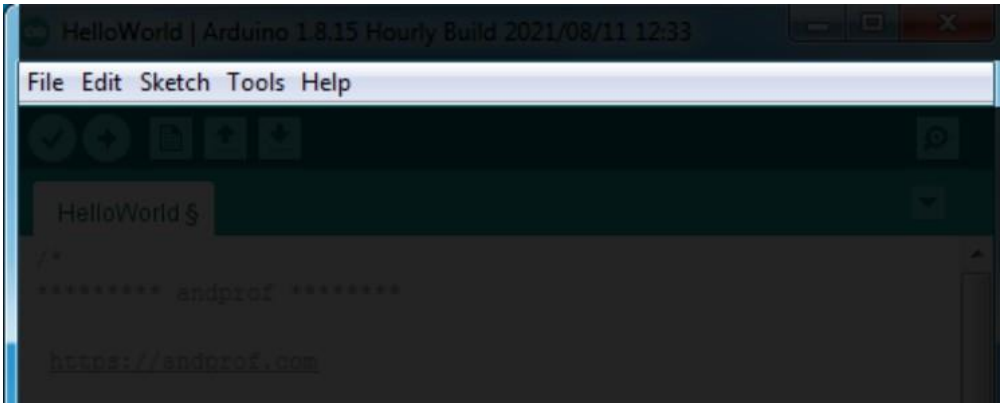


Fig. 3. Menus

Menus are the main menus of the program, and they are 5 menus (File, Edit, Sketch, Tools, Help), and they are being used to add or modify the code that you are writing.

The toolbar is the most important section in the Arduino software, because it contains the tools that you will use continuously while programming the Arduino board.

These tools are:

1. Verify: this button use to review the code, or make sure that is free from mistakes.

2. Upload: this button is use to upload the code on the arduino board.

3. New: this button use to create new project, or sketch (sketch is the file of the code).

4. Open: is use when you want to open the sketch from sketchbook.

5. Save: save the current sketch in the sketchbook.

6. Serial monitor: showing the data which have been sent from arduino.

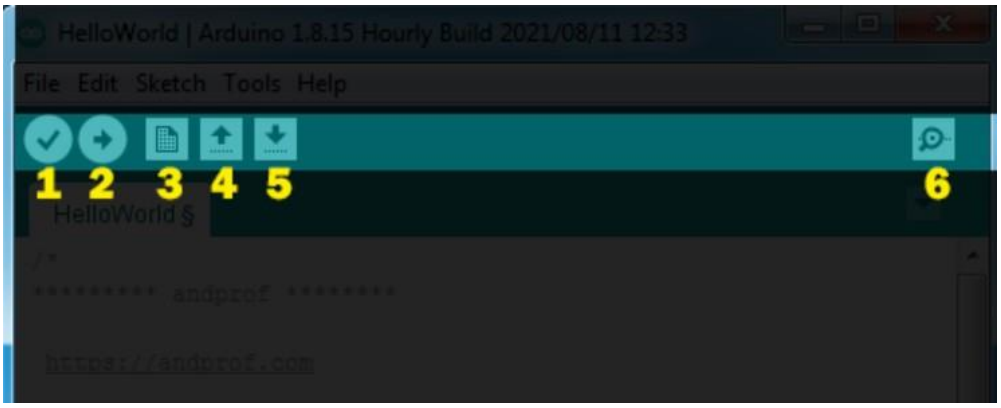


Fig. 4. Toolbar

Status bar is a space can be found down the code editor, through it showing the status of operation's completion (compiling, uploading, … etc)

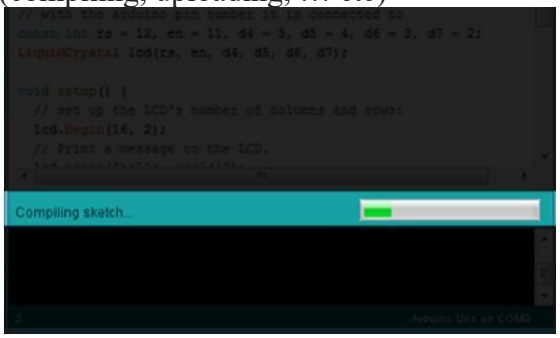


Fig. 5. Status bar

Code editor is liberator of codes, is the white space in the program, in which codes are been writing, and modifying on it.

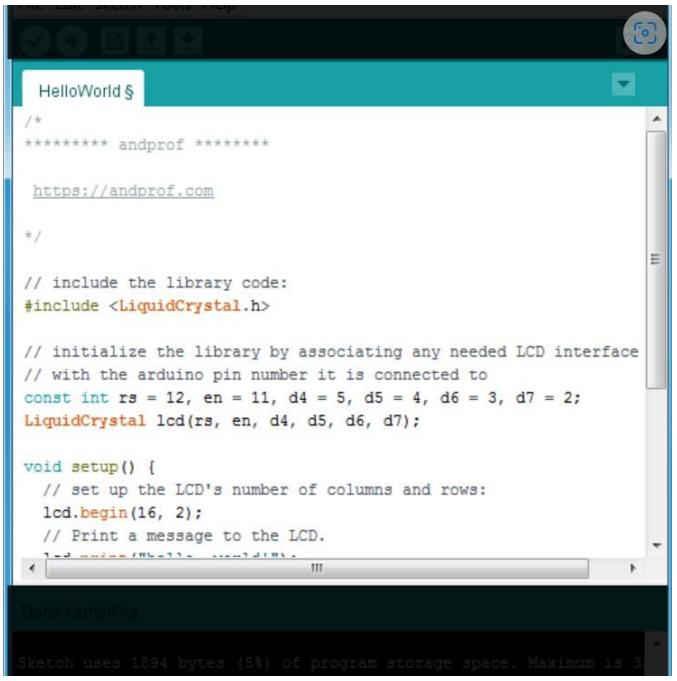


Fig. 6. Code editor

Program notifications this program showing you the mistakes of codes, and some problems that can be face you during the programing process.

And clarifies to you the type of the mistake or the problem which happened and it reason.

And it presents some instruction through it, which you have to apply to process the mistake or the problem.

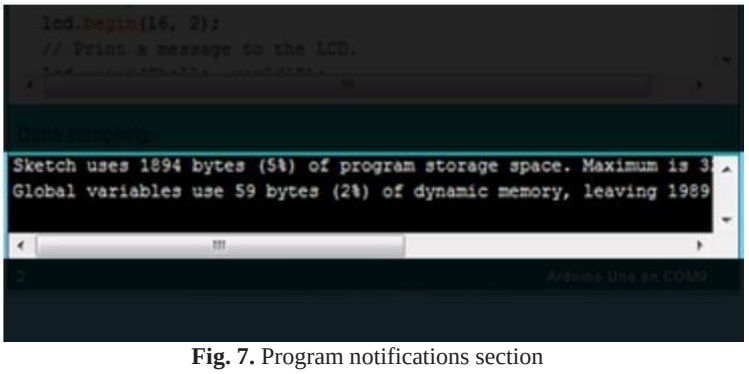


Fig. 7. Program notifications section

Serial ports selections is a space in which the program showing you the type of the port which is used to connect the arduino by computer.

Board selections is a space in which the program showing you the type of the arduino board.

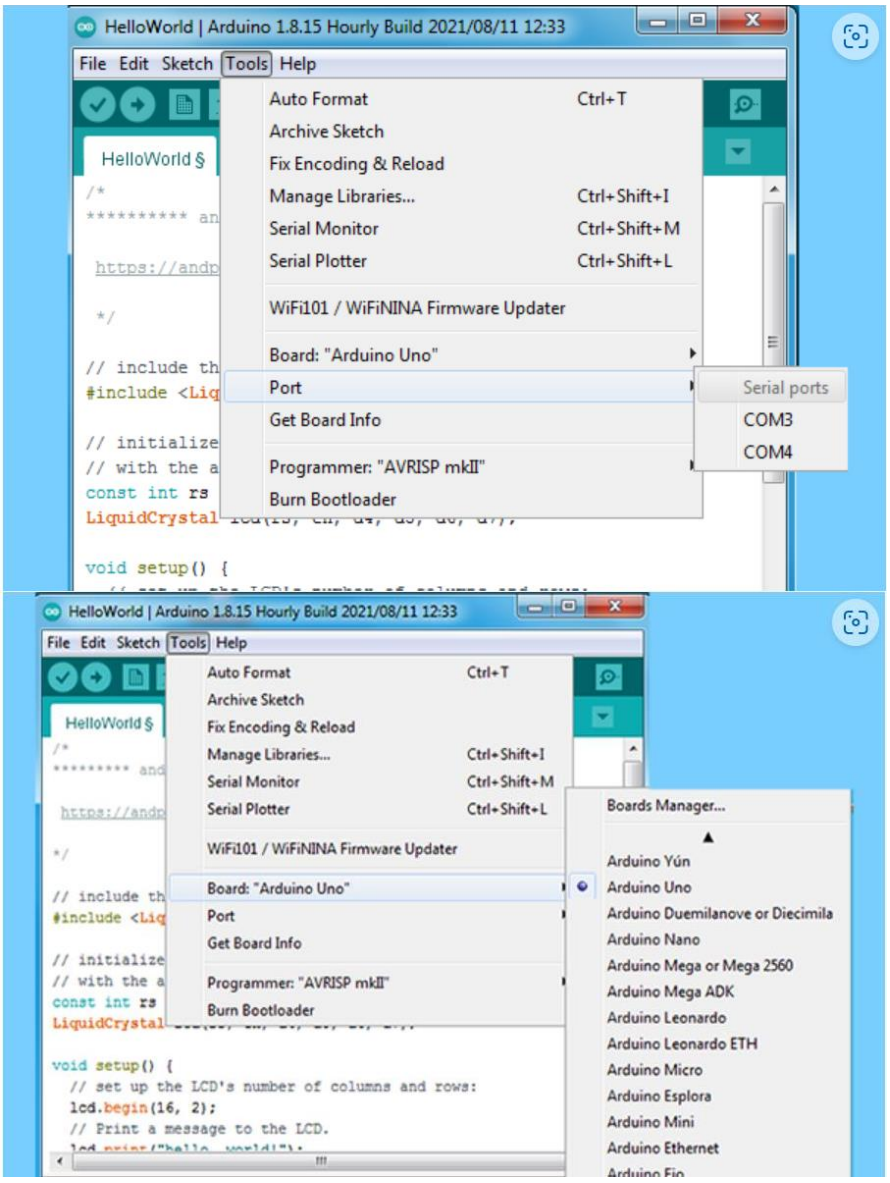


Fig. 8. Serial ports and Board selection

PICSimLab

PICSimLab is a realtime emulator of development boards with integrated MPLABX/avr-gdb debugger. PICSimLab supports picsim microcontrollers (PIC16F84, PIC16F628, PIC16F648, PIC16F777, PIC16F877A, PIC18F452, PIC18F4520, PIC18F4550 and PIC18F4620) and simavr microcontrollers (ATMEGA328). PICSimLab have integration with MPLABX/Arduino IDE for programming the boards microcontrollers.

Features :-

- Real time emulation
- arduino support

Programming language :-

- Assembly, C

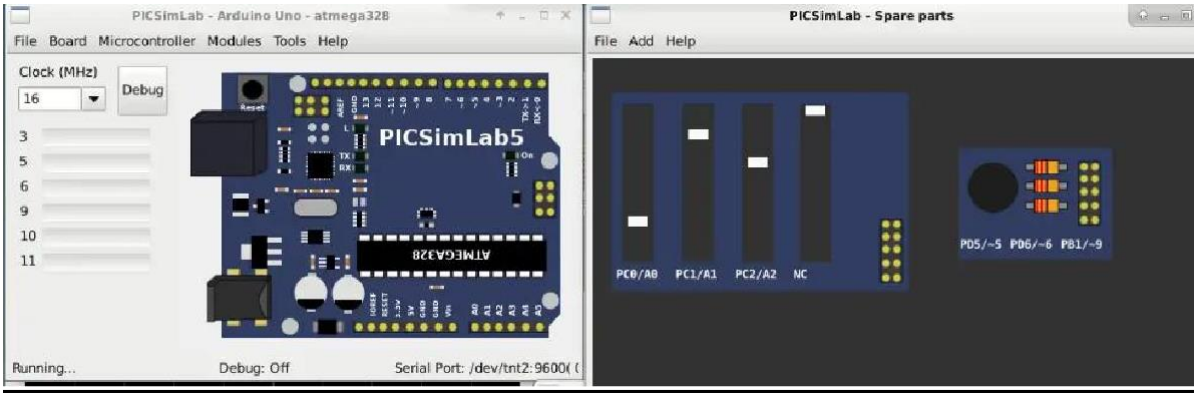


Fig. 9. PICSimLab

Serial Remote Tank

The serial remote tank is a tank simulator controlled by a serial communication protocol.

The tank has several sensors and actuators that can be read and controlled using the communication protocol. The parameters of the serial communication port must be 19200 8N1.

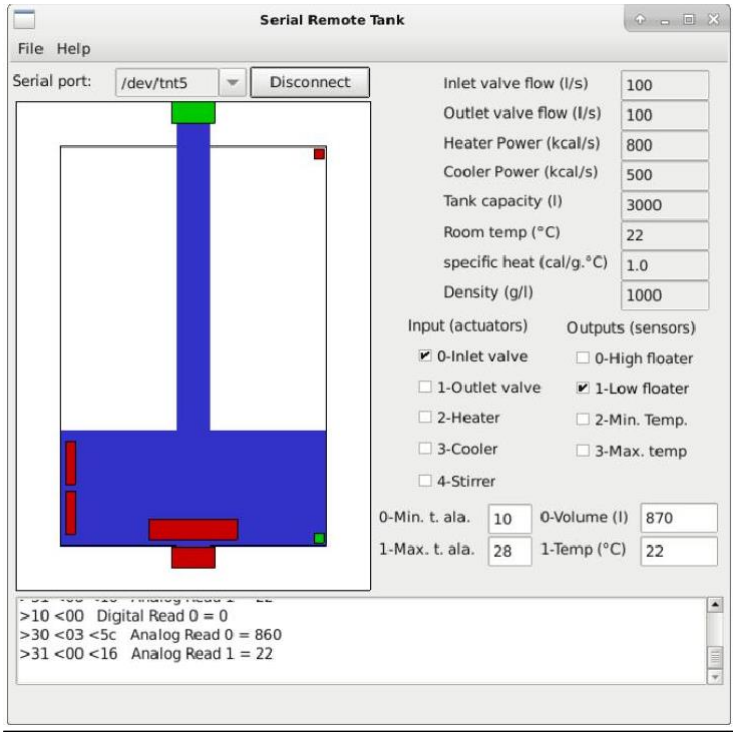


Fig. 10. Serial Remote Tank

Blynk IOT Mobile Application

Blynk is a highly accessible smartphone-based application available for both Android and iOS operating systems.

It provides an interactive dashboard where the user can build their own IoT projects by placing components.

This will as a result create a mobile app through which the user will be able to control microcontrollers connected through WIFI.

You can control LEDs, relays, electric motors and many more. No internal programming is required to build your project in Blynk.

You only need to drag and place your electronic components and it is as easy as that.

Thus, building your IoT projects through Blynk is extremely easy and requires very little effort.

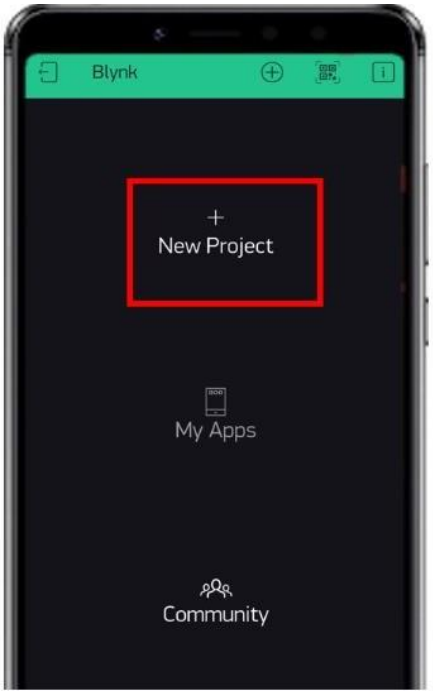


Fig. 11. Blynk IOT Mobile Application

Chapter 2

About the team where internship was done

Leadership Team

Emertxe leadership team consists of veterans who have a long term vision of making a positive impact in the way education is delivered in the country.

Our leadership team brings solid cross functional and deep domain expertise that makes us unique in the education industry.

Maaz Jukaku
Managing Director

Jayakumar balasubramanian
Director

Mubeen J
Technical Head

Our Advisors

Emertxe advisory team is the 'think-tank' of the organization.
They bringing real-time experience in state of the art technologies, industry best practices and innovative learning methods.
Our industry renowned advisors collaborate with us to make our vision a reality.

Vaidyanathan Ramalingam
Founder & CEO Skills2Talent

Chapter 3

OVERVIEW AND SCOPE

3.1 Overview

Home Automation industry is growing rapidly, this is fulfilled by the need to provide supporting systems for the elderly and the disabled, especially those who live alone. Coupled with this, the world population is confirmed to be getting older.

Home automation systems must comply with the household standards and convenience of usage.

Home automation is one of the major growing industries that can change the way people live. Some of these home automation systems target those seeking luxury and sophisticated home automation platforms; others target those with special needs like the elderly and the disabled.

Typical wireless home automation system allows one to control household appliances from a centralized control unit which is wireless. These appliances usually have to be specially designed to be compatible with each other and with the control unit for most commercially available home automation systems.

The developed system can be integrated as a single portable unit and allows one to wirelessly control lights, fans, air conditioners, television sets, security cameras, electronic doors, computer systems, audio/visual equipment's etc. and turn ON or OFF any appliance that is plugged into a wall outlet, get the status of different sensors and take decision accordingly.

The system is portable and constructed in a way that is easy to install, configure, run, and maintain. The perfect user interface still does not exist at present and to build a good interface requires knowledge of both sociology and technology fields.

The problem lies with the situation of the elderly or disabled people, who cannot usually help themselves to move around, and might require external assistance.

People who live alone might also need a helping hand at home.

Therefore An android app controlled home automation system is designed, so that the users can perform certain tasks by just the use of their phones. Having a phone as a remote will make the system more user-friendly and portable.

3.2 Scope

With the help of new technology, people demand more comfort in their lives. In this new era of automated things such as automatic cars, automatic dishwashers, automatic bots and so on, comes the need of automated homes where people have the luxury of doing things with least possible effort.

The Internet of Things commonly known as IOT (Internet of Things), refers to any device that can be connected to Internet and further controlled using it.

Home Automation Systems(HAS) involves the control and automation of lighting, ventilation, security. Home Automation is a modern technology that transforms our home in a way that a different set of tasks are performed automatically.
The main purpose of Home Automation Systems(HAS) is to save electricity and reduce human effort.Also, this system is also built to help the disabled people with walking disabilities or elderly people who struggle to walk and switch off/on the home appliances. The basic motivation for building this product is to make the lives of people more comfortable and easy. It will give people the comfort of staying in place and controlling systems through voice commands.

This internship presents controlling the home automation appliances using either voice commands or an android application.

Arduino Uno is a microcontroller board developed by Arduino CC. Arduin UNO is a microcontroller board having a number of input and output pins. It is not only a processing node in Wireless Sensor Networks(WSN) but also acts as a centralized controller in a Wireless Sensor Network(WSN).

Further integrating the Home Automation System(HAS) to the voice assistant makes it controlled using voice commands. The light in the system will be triggered based on the motion sensor which will indeed trigger the light sensor to check the ambient light and turn the light on if the sensor senses the reading below the threshold value. The fan circuit will be solely controlled either with a single tap on the android app or simple voice commands. Some other Home Automation systems make use of Bluetooth technology for communication. However, Bluetooth has connectivity issues along with the difficulty of wall penetration of the signals.

Apart from the connectivity and compatibility issues, most of the Home Automation Systems(HAS) proposed in the literature are too expensive to be afforded by a common man.

In this context, the proposed Home Automation System is a low cost, flexible solution, with ease of installation and integration with mobile devices.

The Home automation should be simulated on the picsimlab simulator, Blynk iot mobile applications used to control the devices . Should be able to control the lights, temperature of the home , inflow and outflow of water in the water tank.

Chapter 4

RELATED WORK AND IMPACT

The below table talks about the different methodologies already implemented this.

Table 1 Related work

Reference	Methodology	Advantages	Future Scope
[1]	In this we have used Raspberry Pi instead of Arduino and PIR sensors which are more effective than normal IR sensors for home security.	The biggest advantage of using Raspberry Pi instead of Arduino is the clock speed of Raspberry Pi. The PIR sensor is directly connected to the led array which will provide a better light environment for the camera to capture a clear photo.	Raspberry pi might be one day used as it has multiple GPIO pins which can be built by or programmed and used to interface various devices in the real world and controlled by python programming language.
[2]	The basic methodology is signal sent from Android Phone to Wi-Fi module. The android application consists of GUI buttons for each appliance. Eventually end users can access appliances over mobile devices.	This home automation works according to the user needs and demands and also the modes of function work as desired during the implementation. These smart switches can be used manually, on mobile phones and computers through the internet.	The project which is to be implemented is a home automation using easy IOT web server and wi-fi and has very good future development
[3]	The most basic implementation includes the use of an LDR sensor for light intensity and IR sensor to detect human presence .	This system, rather than making people physically go and turn appliances on or off, makes people control from sitting anywhere not only in its circumference but from anywhere in the world.	Project can be scaled by adding more control towards household components.
[4]	In this project the lights and fans are automatically controlled by the external light as well as Human presence and room temperature respectively.	Reduced power consumption. Cost efficient. User Friendly. Easy maintenance.	Use of upgraded sensors increases the precision of the sensor making the system more efficient.
[5]	The intensity of the external lamps(which are used outside the house) are controlled by means of an LDR sensor.	Rather than setting a specific time for the lamps to turn on, the photo-resistor helps control the intensity and thus saving electricity.	Can be implemented on a larger scale(street lights).
[6]	Using Raspberry Pi IR Camera to prevent unauthorized people from entering the house.	The Pi camera helps in streaming the live feed and also captures images at a higher resolution.	Using the biometric sensors present on the mobile of the user, the door can be locked or unlocked.

1. Raspberry provides security and various ways to control the devices in the house. Because of mobile phones the living is comfortable and at the same time it can be easily accessible through portable devices. It gives users all the rights to decide which makes it reliable as it always asks before taking any decision, it helps when there are any necessary decisions, it helps when there are any necessary decisions to be taken and they can be taken fast in case of an emergency.

2. The accuracy of Implementations meets the expectation. This home automation system works according to user needs and demands and also the modes of function work as desired during the implementation. Users need to give respective commands through his/her smartphone and the system works according to the assigned algorithm. This project is flexible and user friendly and easy to use. So it can be said that this system has higher accuracy with great efficiency.

3. Architecture for smart home control and monitoring systems using Arduino is proposed and implemented. It gives a basic idea of how to control different home appliances and provide security by using Arduino Uno controlled from a desktop application. In our project, we tried to implement an embedded system that meets the main functions of home automation for the management of lighting, habitat security, and temperature & humidity control. For these reasons, a desktop application was created to interact with an Arduino via the serial port.

4. The light sensor was properly configured to detect when the laser was broken, while not accidentally tripping due to different ambient light environments. In addition, the temperature and light control subsystem outputs are confirmed to be working. Specifically, the firmware has been tested and is confirmed to be outputting the appropriate signals to the subsystem BJT switches which control lighting and furnace operations. Overall, the project has been working to design specifications and has maintained a high quality standard which can be integrated into modern homes.

5. We found out that in this era of computers, smart home technology has become imminent. It's a smart technology that gives us a different level of living standard. We are fully dependent on a system where everything is fully automatic. We are using sun tracking technology so we can get maximum efficiency of solar power. It has two different user functions; one is controlled manually and other automatically. Security is password and/or biometrically protected and sensing ability gives this home strength to protect itself.

6. We observed that the raspberry pi based home security system has been successfully developed and verified. Not only has the raspberry pi been helped for live streaming but also for the camera as a movement recognition component. The capturing and causation notification would be done if there was any detection of movement. The inference of the tests performed on the system confirms that the security mechanism provides optimal observations.

Chapter 5

TASKS PERFORMED

5.1 Assumptions, Dependencies, Constraints

Assumptions :-

All the peripherals are simulated and no real time objects are interfaced .

Dependencies :-

Based on Blynk Mobile app.

Constraints :-

None

5.2 Requirements

5.2.1 Functional Requirements

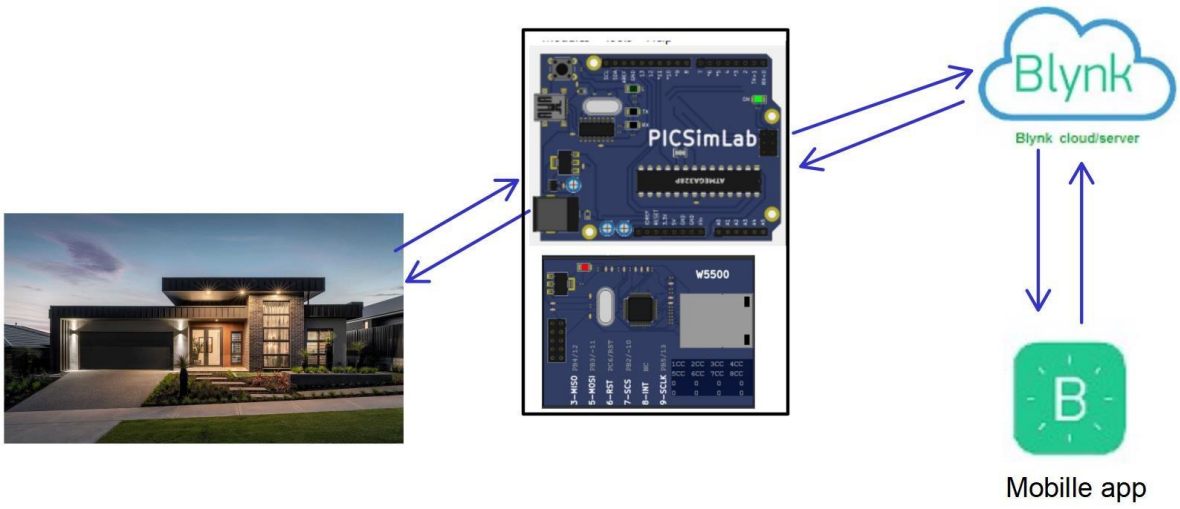


Fig. 12. Functional Requirements

The different requirements are :-

1. Garden Lights
2. PICSIMLab
3. Blynk cloud server
4. Blynk mobile app

5.2.1.1 Garden Lights

Description : -

Read the LDR sensor value, based on the reading from LDR, vary the brightness of the led, which resembles controlling garden lights based on the availability of sunlight.

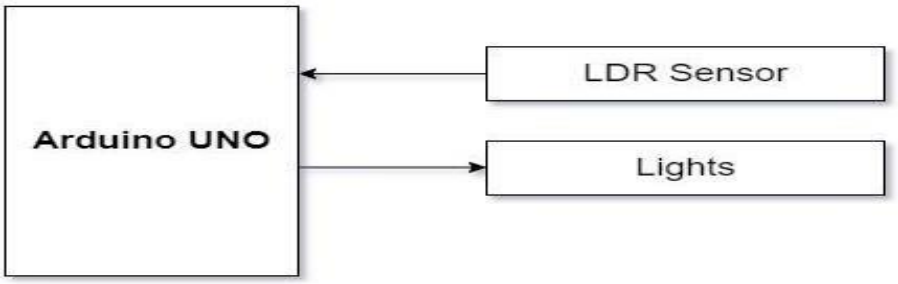


Fig. 13. Garden lights control

Requirement No	1 – Garden lights control
Description	Inputs - LDR Sensor
	Process - Read the LDR sensor value, based on the reading from LDR, vary the brightness of the led, which resembles controlling garden lights based on the availability of sunlight.
	Output - Garden Lights

Table 2 Garden lights control

5.2.1.2 Temperature Control

Description :-

The temperature control system consists of a heating resistor, an LM35 temperature sensor, and a cooler. Which resembles the temperature control system at home. Read the temperature from the temperature sensor LM35 and display it on the CLCD. Control the temperature of the system by turning ON/OFF the heater and cooler through the Blynk IOT mobile app .

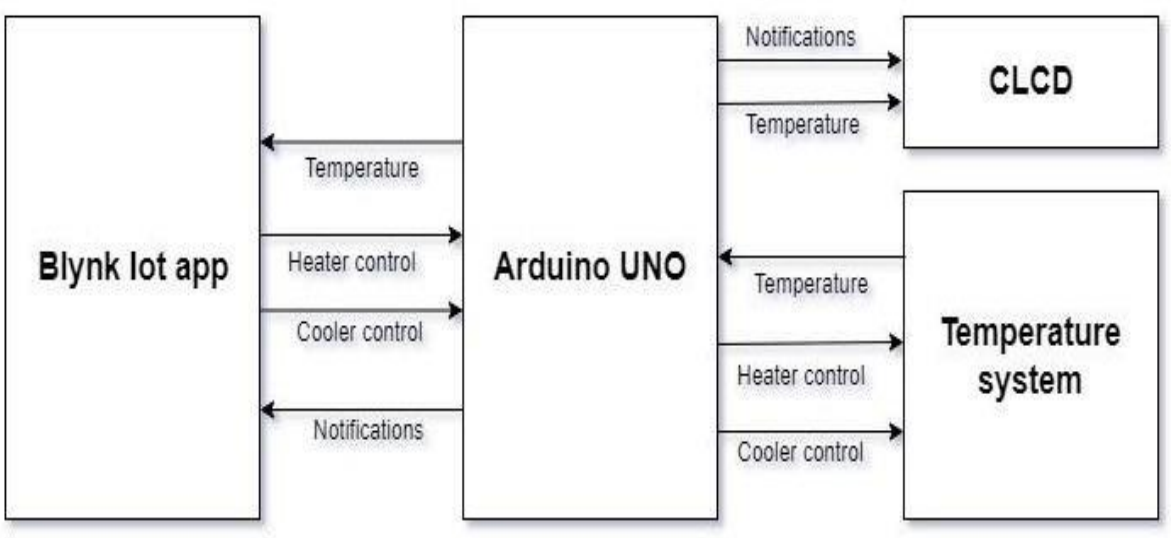


Fig. 14. Temperature control

Table 3 Temperature control system

Requirement No	2 – Temperature Control System
Description	Inputs - Temperature Sensor.
	Process - Read Temperature from temperature sensor LM35.
	Output - Display Temperature on Gauge Widget, Display Temperature on CLCD.

Table 4 Cooler control system

Requirement No	3 – Cooler Control System
Description	Inputs - Button Widget(Cooler button) on Blynk iot app .
	Process - Detect the change in the logic level
	Output - if the Button widget is at logic high, turn ON the cooler. if the Button widget is at logic low, turn OFF the cooler.

Table 5 Heater control system

Requirement No	4 – Heater Control System
Description	Inputs - Button Widget(Heater button) on Blynk iot app .

	Process - Detect the change in the logic level
	Output - if the Button widget is at logic high, turn ON the heater. if the Button widget is at logic low, turn OFF the heater.

Table 6 Threshold temperature control

Requirement No	5 – Threshold temperature control
Description	Inputs - Temperature sensor
	Process - Read and compare the temperature with 35 degrees
	Output - if the temperature is more than 35 turn OFF the heater and send notification to Blynk IOT app and display the same on the CLCD.

5.2.1.3 Water tank inlet and outlet valve control

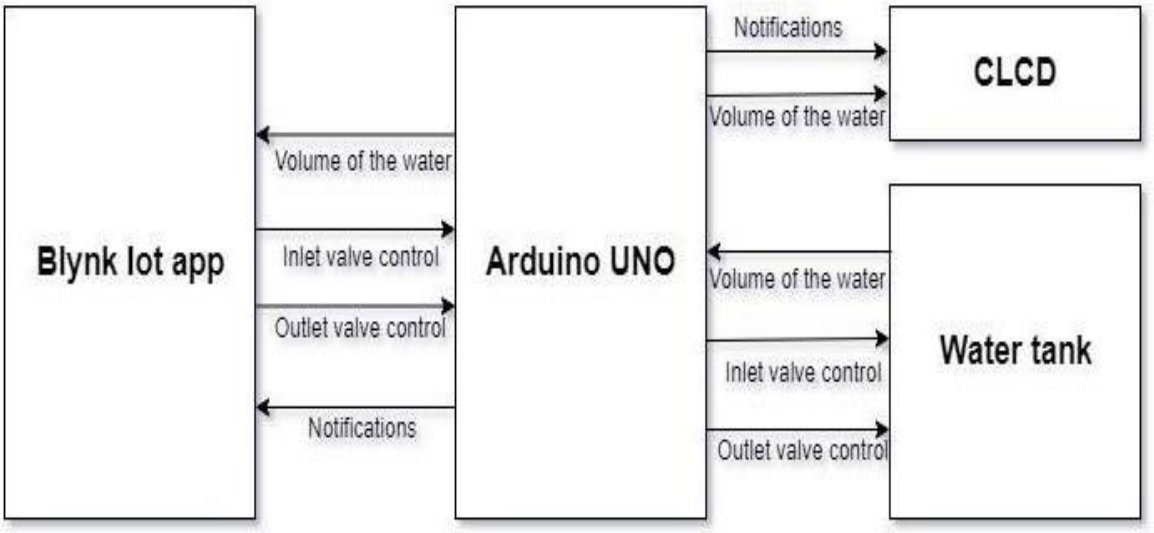


Fig. 15. Water tank inlet outlet control

Table 7 Display volume of water

Requirement No	6 – Display the volume of water in the tank
Description	Inputs - Serial tank.
	Process - Read the volume of the water in the tank by sending commands through serial communication.
	Output - Display the volume of the water on Gauge Widget Display the volume of water on CLCD.

Table 8 Inlet valve control

Requirement No	7 – Inlet valve control
Description	Inputs - Button Widget(Inlet valve button) on Blynk iot app .
	Process - Detect the change in the logic level
	Output - if the Button widget is at logic high, turn ON the inlet valve by sending commands through serial communication. if the Button widget is at logic low, turn OFF the inlet valve by sending commands through serial communication.

Table 9 Outlet valve control

Requirement No	8 – Outlet valve control
Description	Inputs - Button Widget(outlet valve button) on Blynk iot app .
	Process - Detect the change in the logic level
	Output - if the Button widget is at logic high, turn ON the outlet valve by sending commands through serial communication. if the Button widget is at logic low, turn OFF the outlet valve by sending commands through serial communication..

Table 10 Control volume of water in tank

Requirement No	9 – Control the volume of water in the tank

Description	Inputs - Serial tank.
	Process - Read the volume of the water in the tank by sending commands through serial communication.
	Output - if the volume of water in the tank is less than 2000 ltrs turn ON the inlet valve, and send notification to the blynk mobile app and display the same on the CLCD.

5.2.2 User Interfaces

BLYNK Application

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

Create widgets on Mobile blynk application :-
Button widgets to control heater, cooler, inlet valve , outlet value.

Gauge widgets to display temperature and volume of the water in the tank on the mobile application

Terminal widgets to display the notifications whenever threshold is crossed like "Temperature is more than 35 degrees", "" turning OFF the heater", "water level is full " "Water inflow disabled".

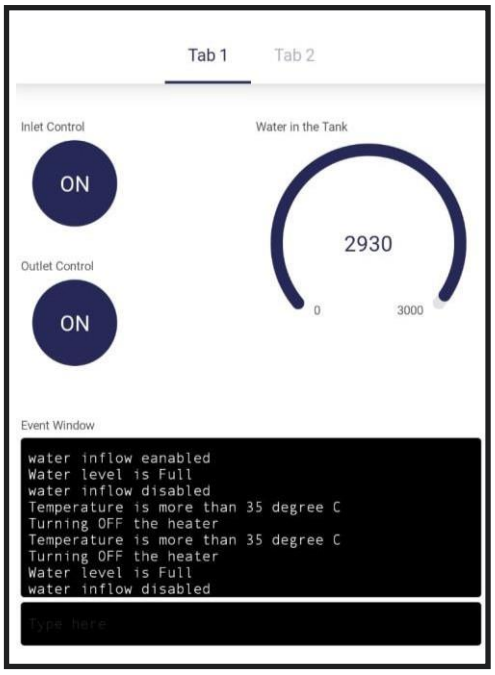


Fig. 16. (Tab1) Button widgets to control inlet valve, outlet valve, gauge to display volume of water in the tank and terminal to print the notifications.

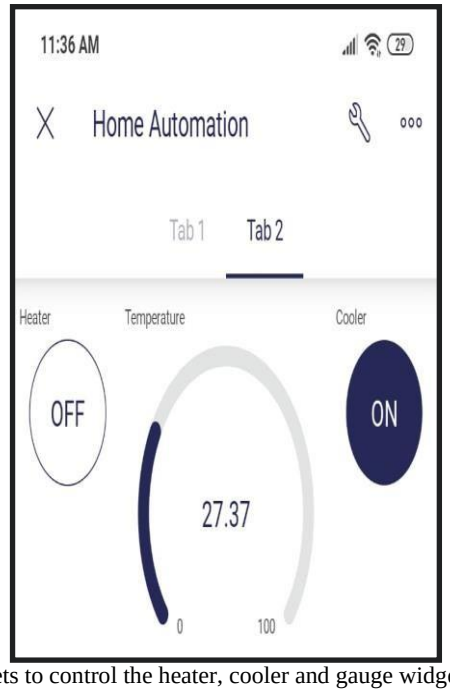


Fig. 17. (Tab2)Button widgets to control the heater, cooler and gauge widget to display the temperature.

THRESHOLD CONTROL

When the heater is ON if the temperature rises above 35 degree celsius then heater should turn OFF automatically and message “Temperature is more than 35 degree celsius Turning OFF the heater” should be displayed on the virtual terminal, “HT_R OFF” on CLCD.

When the water in the tank is full, turn off the inlet valve automatically and display “water level is full water inflow disabled” .

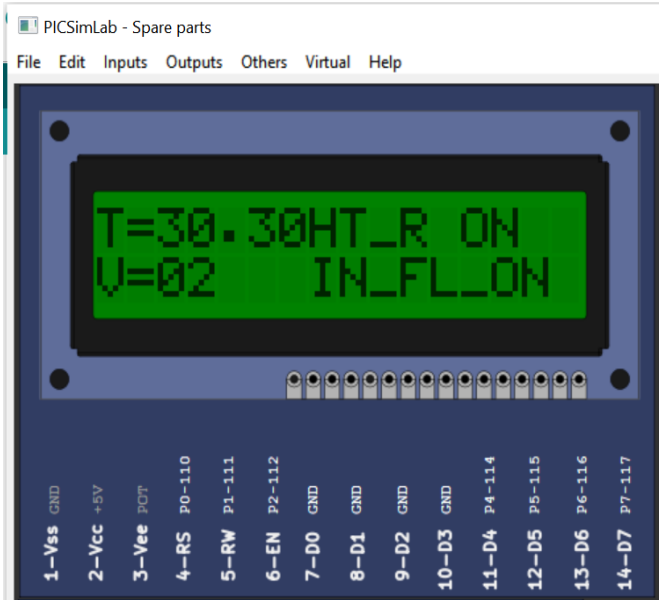


Fig. 18. Notifications on CLCD

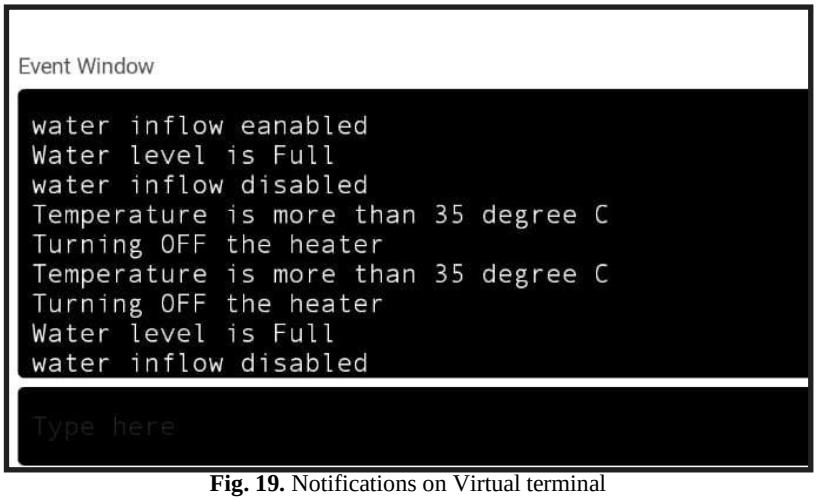


Fig. 19. Notifications on Virtual terminal

5.3 Tools Used

Software tools :-

- Arduino IDE :-

  The arduino software (IDE) is an open source software, which is used to program the Arduino boards, and is an integrated development environment, developed by arduino.cc.

- Picsim Lab :-

  PICSimLab is a real time emulator of development boards with integrated MPLABX/avr- gdb debugger.

- Remote serial tank :-

  The serial remote tank is a tank simulator controlled by a serial communication protocol.

- Blynk IOT mobile application :-

  Blynk is a highly accessible smartphone-based application available for both Android and iOS operating systems.

Hardware tools :-

- Laptop
- Stable internet connection

Chapter 6

IMPLEMENTATION

6.1 Code Snippets

home_automation_blynk_controlled.ino file

```
/*************************************************************
Title        :   Home automation using blynk
Description  :   To control light's brigntness with brightness,monitor temperature , monitor water level in the tank through blynk app
Pheripherals :   Arduino UNO , Temperature system, LED, LDR module, Serial Tank, Blynk cloud, Blynk App.
 *************************************************************/

// Template ID, Device Name and Auth Token are provided by the Blynk.Cloud
// See the Device Info tab, or Template settings

#define BLYNK_TEMPLATE_ID "TMPLA3Dl2bvh"
#define BLYNK_DEVICE_NAME "Home automation"
#define BLYNK_AUTH_TOKEN "bqBgUdX_UNz9gJPZyaHZlgHYFv-UjBTU"

// // Comment this out to disable prints
//#define BLYNK_PRINT Serial

#include <SPI.h>
#include <Ethernet.h>
#include <BlynkSimpleEthernet.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

#include "main.h"
#include "temperature_system.h"
#include "ldr.h"
#include "serial_tank.h"

char auth[] = BLYNK_AUTH_TOKEN;
bool heater_sw;
bool inlet_sw,outlet_sw;
unsigned int tank_volume;

BlynkTimer timer;

LiquidCrystal_I2C lcd(0x27, 16, 2); // set the LCD address to 0x27 for a 16 chars and 2 line display

// // This function is called every time the Virtual Pin 0 state changes
```

```
// /*To turn ON and OFF cooler based virtual PIN value*/
BLYNK_WRITE(COOLER_V_PIN)
{
  int value = param.asInt();
  if (value)
  {
    cooler_control(ON);
    lcd.setCursor(7,0);
    lcd.print("CO_R ON ");
  }
  else
  {
    cooler_control(OFF);
    lcd.setCursor(7,0);
    lcd.print("CO_R OFF ");
  }

}
/*To turn ON and OFF heater based virtual PIN value*/
BLYNK_WRITE(HEATER_V_PIN)
{
  heater_sw = param.asInt();
  if (heater_sw)
  {
    heater_control(ON);
    lcd.setCursor(7,0);
    lcd.print("HT_R ON   ");
  }
  else
  {
    heater_control(OFF);
    lcd.setCursor(7,0);
    lcd.print("HT_R OFF   ");
  }

}
// /*To turn ON and OFF inlet vale based virtual PIN value*/
BLYNK_WRITE(INLET_V_PIN)
{
  inlet_sw=param.asInt();
  if(inlet_sw)
  {
    enable_inlet();
    lcd.setCursor(7,1);
    lcd.print("IN_FL_ON");
  }
  else
  {
    disable_inlet();
    lcd.setCursor(7,1);
```

```
  lcd.print("IN_FL_OFF");
  }
}
/*To turn ON and OFF outlet value based virtual switch value*/
BLYNK_WRITE(OUTLET_V_PIN)
{
  outlet_sw=param.asInt();
  if(outlet_sw)
  {
    enable_outlet();
    lcd.setCursor(7,1);
    lcd.print("OUT_FL_ON");
  }
  else
  {
    disable_outlet();
    lcd.setCursor(7,1);
    lcd.print("OUT_FL_OFF");
  }
}
// /* To display temperature and water volume as gauge on the Blynk App*/
void update_temperature_reading()
{
  // You can send any value at any time.
  // Please don't send more that 10 values per second.
  Blynk.virtualWrite(TEMPERATURE_GAUGE,read_temperature());
  Blynk.virtualWrite(WATER_VOL_GAUGE,volume());
}

/*To turn off the heater if the temperature raises above 35 deg C*/
void handle_temp(void)
{

  if((read_temperature() > float(35)) && heater_sw==1)
  {
    heater_sw=0;
    heater_control(OFF);

    lcd.setCursor(7,0);
    lcd.print("HT_R OFF   ");

    Blynk.virtualWrite(HEATER_V_PIN,OFF);

    Blynk.virtualWrite(BLYNK_TERMINAL_V_PIN,"Temperature is above 35 degree celcius \n");
    Blynk.virtualWrite(BLYNK_TERMINAL_V_PIN,"Turning off the heater \n");



  }
```

```
}

// /*To control water volume above 2000ltrs*/
void handle_tank(void)
{

  if((tank_volume<2000)&& (inlet_sw==OFF))
  {
    enable_inlet();
    lcd.setCursor(7,1);
    lcd.print("IN_FL_ON");
    inlet_sw=ON;
    Blynk.virtualWrite(INLET_V_PIN,ON);
    Blynk.virtualWrite(BLYNK_TERMINAL_V_PIN,"Water level is less than 2000 \n");
    Blynk.virtualWrite(BLYNK_TERMINAL_V_PIN,"Turning on the inlet valve \n");

  }

  if((tank_volume==3000)&& (inlet_sw==ON))
  {
    disable_inlet();
    lcd.setCursor(7,1);
    lcd.print("IN_FL_OFF");
    inlet_sw=OFF;
    Blynk.virtualWrite(INLET_V_PIN,OFF);
    Blynk.virtualWrite(BLYNK_TERMINAL_V_PIN,"Water level is full \n");
    Blynk.virtualWrite(BLYNK_TERMINAL_V_PIN,"Turning off the inlet valve \n");

  }

}

void setup(void)
{
    //connecting aurdino to blynk server
    Blynk.begin(auth);
    /*initialize the lcd*/
    lcd.init();
    /*turn the backlight */
    lcd.backlight();
    /*clear the clcd*/
    lcd.clear();
    /*cursor to the home */
    lcd.home();
    //Initializing gargen lights as output pin
    init_ldr();
```

```
  init_temperature_system();

    lcd.setCursor(0,0);
    lcd.print("T=");

    lcd.setCursor(0,1);
    lcd.print("V=");

    init_serial_tank();

    timer.setInterval(500L,update_temperature_reading);
  }

  void loop(void)
  {
   Blynk.run();
    timer.run();
    //control brightness of garden lights using LDR Sensor
    brightness_control();
    lcd.setCursor(2,0);
    String temperature;
    temperature= String(read_temperature(),2) ;
    lcd.print(temperature);
    tank_volume=volume();
    lcd.setCursor(2,1);
    lcd.print(tank_volume);
    handle_temp();
    handle_tank();
    // Blynk.run();
    // timer.run();
  }
```

ldr.cpp file

```
#include "ldr.h"
#include "Arduino.h"
#include "main.h"

void init_ldr(void)
{
  pinMode(GARDEN_LIGHT, OUTPUT);

}

unsigned input_value=0;

void brightness_control(void)
{
 //read the values from LDR sensor
```

```
  input_value = analogRead(LDR_SENSOR);
    //scale it down from (0 to 1023)to (255 to 0)
     input_value =  (1024 - input_value)/4;
     analogWrite (GARDEN_LIGHT, input_value);

     delay (1000);
  }
```

ldr.h file

```
#ifndef LDR_H
#define LDR_H

#define LDR_SENSOR      A1
#define GARDEN_LIGHT    3

void init_ldr(void);
void brightness_control(void);

#endif
```

main.h file

```
#ifndef MAIN_H
#define MAIN_H

#define ON    1
#define OFF   0

#define TEMPERATURE_GAUGE       V1
#define COOLER_V_PIN            V2
#define HEATER_V_PIN            V5
#define WATER_VOL_GAUGE         V4
#define INLET_V_PIN             V6
#define OUTLET_V_PIN            V7
#define BLYNK_TERMINAL_V_PIN    V8

#endif
```

serial_tank.cpp file

```
#include "serial_tank.h"
#include "Arduino.h"
```

```
#include "main.h"

unsigned int volume_value;
unsigned char valueh, valuel;

void init_serial_tank(void)
{
   Serial.begin(19200);
   Serial.write(0xFF); //sincroniza comunicação
   Serial.write(0xFF);
   Serial.write(0xFF);
}

unsigned int volume(void)
{
  Serial.write(VOLUME);
  while(!Serial.available());
  valueh = Serial.read();
  while(!Serial.available());
  valuel = Serial.read();
  volume_value = (valueh << 8) | valuel ;

  return volume_value;
}
void enable_inlet(void)
{
   Serial.write(INLET_VALVE);
   Serial.write(ENABLE);
}
void disable_inlet(void)
{
   Serial.write(INLET_VALVE);
   Serial.write(DISABLE);
}
void enable_outlet(void)
{
   Serial.write(OUTLET_VALVE);
   Serial.write(ENABLE);
}
void disable_outlet(void)
{
   Serial.write(OUTLET_VALVE);
   Serial.write(DISABLE);
}
```

serial_tank.h file

```
#ifndef SERIAL_TANK_H
#define SERIAL_TANK_H
```

```
//input digital
#define INLET_VALVE  0x00
#define OUTLET_VALVE 0x01

//sensors digital
#define HIGH_FLOAT 0x10
#define LOW_FLOAT  0x11

//sensor analog
#define VOLUME 0x30

#define   ENABLE  0x01
#define   DISABLE 0x00

void init_serial_tank(void);
void enable_inlet(void);
void enable_outlet(void);
void disable_inlet(void);
void disable_outlet(void);
unsigned int volume(void);

#endif
```

temperature_system.cpp file

```
#include "temperature_system.h"
#include "Arduino.h"
#include "main.h"

void init_temperature_system(void)
{
   //setting heater and coller pins as output pins
   pinMode(HEATER,OUTPUT);
   pinMode(COOLER,OUTPUT);

   //initially turning off heater and cooler
   digitalWrite(HEATER,LOW);
   digitalWrite(COOLER,LOW);

}

float read_temperature(void)
{
   float temperature;
   temperature = (((analogRead(A1) *(float)5/ 1024)) /(float) 0.01);
   return temperature;
```

```
}

void cooler_control(bool control)
{
  digitalWrite(COOLER,control);
}
void heater_control(bool control)
{
 digitalWrite(HEATER,control);

}
```

temperature_system.h file

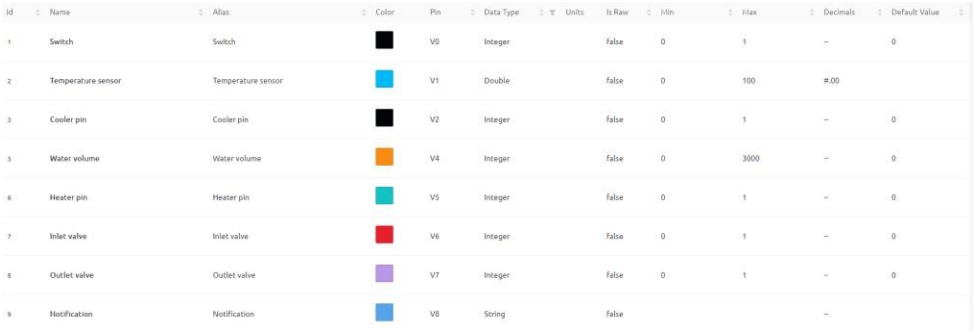
```
#ifndef TEMPERATURE_SYSTEM_H
#define TEMPERATURE_SYSTEM_H

#define HEATER            5
#define COOLER            4

#define TEMPERATURE_SENSOR    A1

float read_temperature(void);
void init_temperature_system(void);
void cooler_control(bool control);
void heater_control(bool control);
#endif
```

6.2 Snapshots



Id	Name	Alias	Color	Pin	Data Type	Units	Is Raw	Min	Max	Decimals	Default Value
1	Switch	Switch		V0	Integer		false	0	1	–	0
2	Temperature sensor	Temperature sensor		V1	Double		false	0	100	#.00	
3	Cooler pin	Cooler pin		V2	Integer		false	0	1	–	0
5	Water volume	Water volume		V4	Integer		false	0	3000	–	0
6	Heater pin	Heater pin		V5	Integer		false	0	1	–	0
7	Inlet valve	Inlet valve		V6	Integer		false	0	1	–	0
8	Outlet valve	Outlet valve		V7	Integer		false	0	1	–	0
9	Notification	Notification		V8	String		false			–	

Fig. 20. Virtual pins

Pins to control the inlet, outlet and volume of water in tank , the temperature , the on and off of the heater and cooler .

Fig. 21. PICSimLab :- Heater ON Inlet ON

Heater and Inlet valve is turned ON

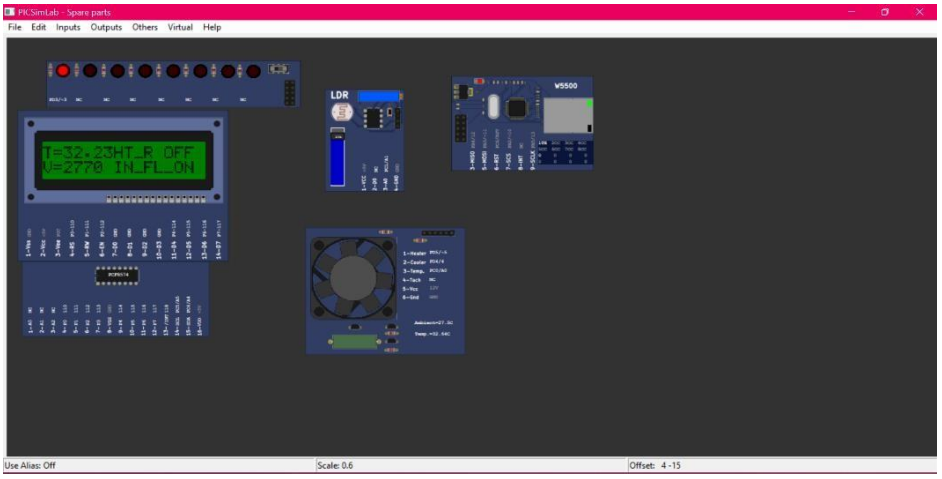
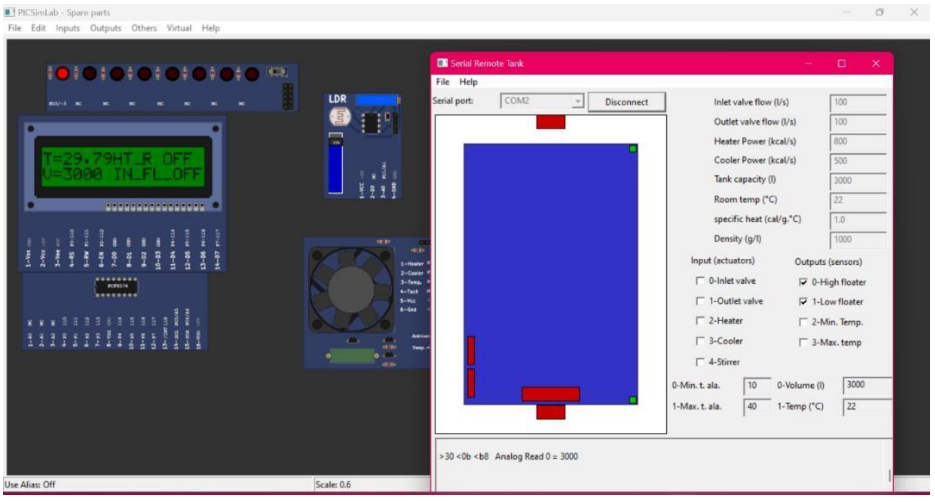


Fig. 22. PICSimLab :- Heater OFF Inlet ON

Heater is turned OFF and Inlet valve is turned ON



Fig, 23. PICSimLab :- Heater OFF Inlet OFF

Heater and Inlet valve is turned OFF

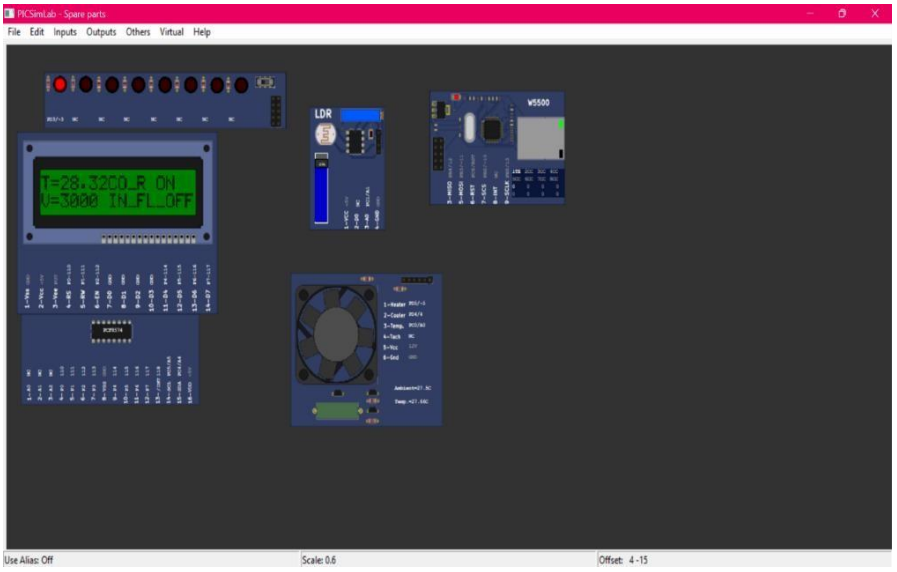


Fig. 24. PICSimLab :- Cooler ON Inlet OFF

Cooler is turned ON and Inlet valve is turned OFF

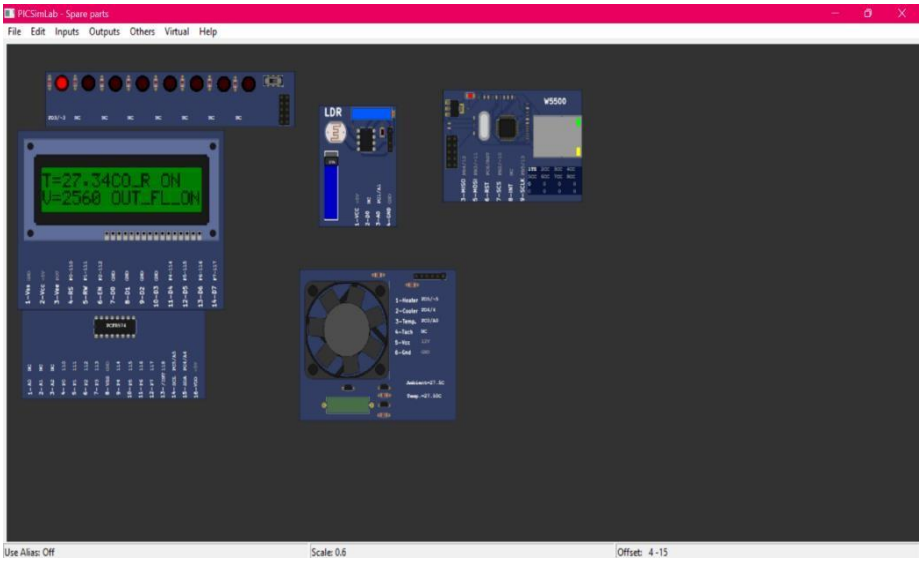


Fig. 25. PICSIMLab :- Cooler ON Outflow ON

Cooler and Outlet valve is turned ON

Fig. 26. Blynk IOT application :- Tab1

Button widgets to control inlet valve, outlet valve, gauge to display volume of water in the tank and terminal to print the notifications.

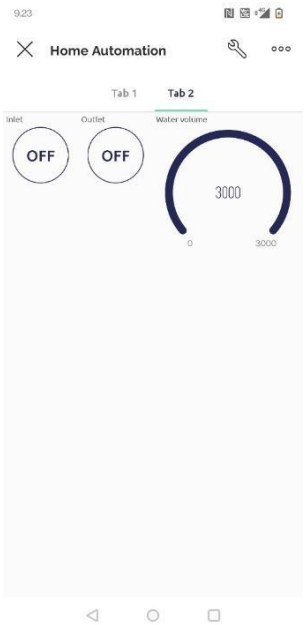


Fig. 27. Blynk IOT application :- Tab 2

Button widgets to control the heater, cooler and gauge widget to display the temperature.

Chapter 7

CONCLUSIONS

IOT based Home Automation is a very different concept than what is presently available in the market.

This would make automation more easy and intuitive. The people will be able to interact with the system anywhere across the world.

It also is an important aspect in the present world where people are so busy, this would help them in easing the basic functionality of their life.

The world around us is going digital in every aspect we can imagine and it is happening fast, we also need to move forward with it.

Our system is a great initiative step in automation, it would also provide security in the near future. As it is based on IOT we can assign access to our electronic devices being anywhere across the world.

The following are the features of our system:

A. Easy to use.

B. Saves unnecessary power consumption.

C. Low cost compared to other automation systems.

D. Easy to implement.

E. Has good processing power and can handle multiple functions at the same time.

F. Uses reliable wireless connection.

Using BLYNK Iot application and Picsimlab simulator, simulated home automation, where LED, temperature system, Serial tank resembles Light, Heater, Cooler and Water tank in real time.

CLCD acts like a dash board used for displaying the events, Widgets from Blynk Iot app like button widgets are used to control heater, cooler and inlet valve, outlet valve.
Gauge widgets to display the temperature and volume of the water.

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