Home appliances data on cloud

A Project Report submitted
in partial fulfilment of the requirements for the degree of

Bachelor of Technology

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Department of Information Technology

May 9, 2022

Declaration of Authorship

I, Avnish Raj [LCS2019076] along with Shaikh Abbas Ali [LCS2019075] , Kushagra Patel [LCS2019071] , Anuj Kumar [LCS2019073] declare that this project titled, "Home appliances data on cloud" and the work presented in it are our own. We confirm that:

- This work was done wholly or mainly while in candidature for a B.Tech at this Institute.
- Where any part of this project has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where we have consulted the published work of others, this is always clearly attributed.
- Where we have quoted from the work of others, the source is always given. With the exception of such quotations, this Project is entirely our own work.
- We have acknowledged all main sources of help.
- Where the project is based on work done by ourselves jointly with others, We have made clear exactly what was done by others and what we have contributed.

Signature: _____

Date: May 9, 2022
Place: Lucknow, India

Abstract

A smart home is a home setup where internet-enabled appliances and devices can be automatically controlled remotely using a networked device. But such appliances are expensive comparatively and most of us have the older device in good condition. So many of us don't see the need of changing, but with simple micro-controllers and relays and sensors the smart home idea can be achieved with the older appliances only by collecting their data and cloud and by applying some advanced algorithms those data can be used to make our lives much easier

Acknowledgements

We would like to express our gratitude towards Dr. Brijesh Kumar Chaurasia for his valuable suggestions and encouragement in completion of our project. We would also extend our thanks to Dr. Deepshika Agarwal and Dr. Mainak Adhikari and our honourable Dean, Dr. Dhananjoy Dey for their support in the accomplishment of our project. We would also be thankful to our director Dr. Arun Sherry for providing all the required facilities in completion of this project. We would like to extend our deep appreciation to all my group members, without their support and coordination we would not have been able to complete this project.

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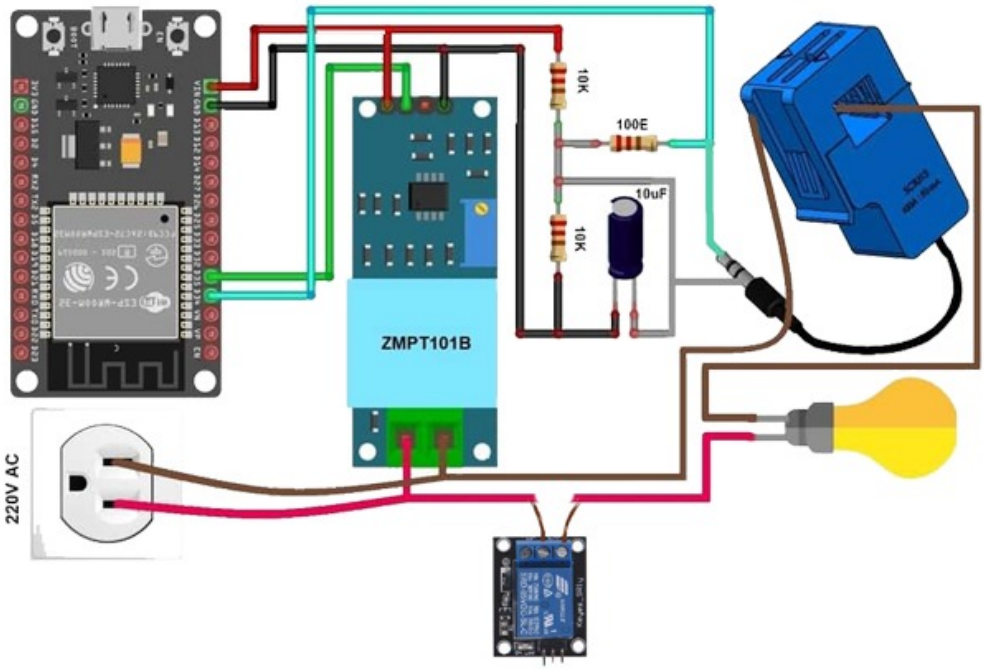
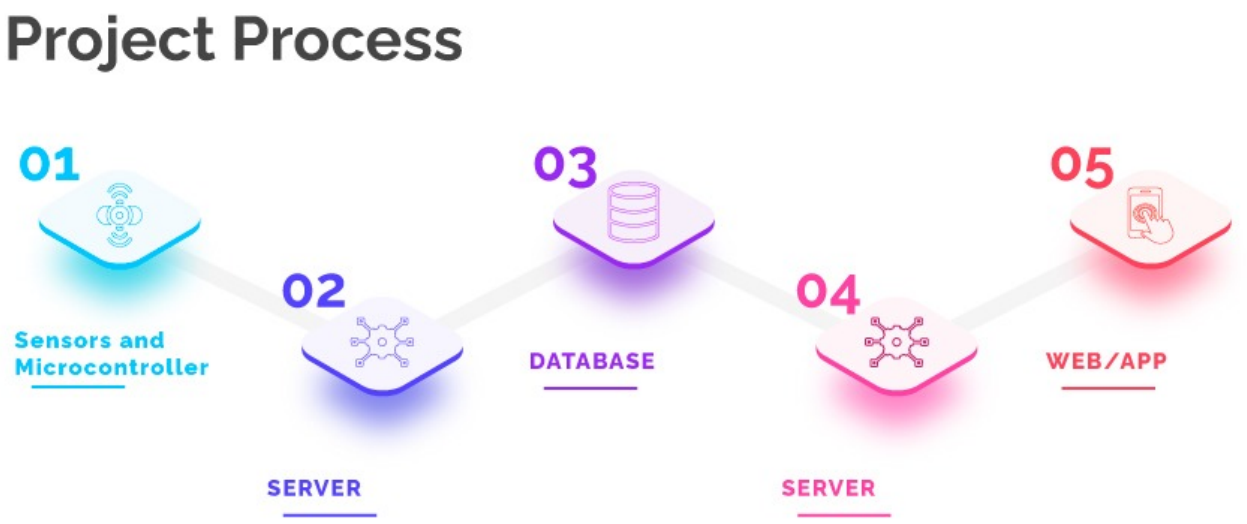


fig 1.1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For/Dedicated to/To my...

Chapter 1

Introduction

1.1 Background

Nowadays there are many smart home appliances available in the market to make your home smart and your life easier,

But do you know what type of data is being collected from your smart devices? And who is collecting them? And also we all know how expensive it is to install smart home devices. So we thought to come up with an idea to make our home smart which will not only give us the smart home privilege but also our data will be collected on our Indian servers and the cost can be minimum. The other thing was the facility to control different devices from a single app and dashboard which we will also try to solve

1.2 Motivation

Our data is our own property and right, so why let other country people to collect it from us. The goal of our project is to propose a solution to make every home in India a smart home by converting home appliances into smart ones using sensors and devices and collecting those data on our own servers to use it to benefit the people of India.

1.3 Objective

The objectives of our project are as follows: Converting old appliance into smart: In order to do that we will use a micro controller Esp32 with various sensors as needed by the appliance. The micro controller is able to connect to a local wi-fi network and send data to our servers.

Storing data on Cloud/Database: For this project we are using the free services such as Heroku domains and servers and MongoDB Atlas free cloud databases where we'll collect the data sent by the Esp32. Which can be retrieved by the users anytime from the web page or Application

Data visualization: After Data is being collected we need web page or app interfaces where the users will be able to see the collected data and can also change the state of the device through internet from anywhere in the world

1.4 Contributions

Smart home is still a dream for many and companies providing such technologies are solely dependent on some countries or companies which are not good for our privacy. In the coming era we know every home will fully become a smart one but still the wait for the common people is long because of the high prices of the devices and no unified platform for such smart devices. Our project will help all the people to fully automate their home or make their homes smart by using our solution and all their devices will share a simple easy to use platform (web/app). And also our people's privacy will not be endangered

Chapter 2

Literature Review

1) Novel architectures in terms of software technologies with focus on domestic environmentsand habitat monitoring are proposed in (Monacchi et al., 2013) .In (Monacchi et al., 2013) the authors promote design guidelines for collecting and integrating household data, thus enabling data interoperability.

2) In (Lee and Lee, 2015), they suggest a four-layer architecture made up of: sensing, networking, service and interface. The role of the cloud is missing; therefore, it is not clear how services would be enabled.

3) In literature (Da Xu et al., 2014) we can see the model is augmented with the cloud in the middle, This multi-level stratified holistic framework supported internet of Things is employed as a wrapper or generalization of all the key features of IoT solutions for smart homes known in the literature.

4) Authors of (Kamilaris et al., 2011) propose a solution for a Web-based energy-aware smart home framework that enables smart appliances to the Web. They have developed a graphical user interface to ease the interaction. The evaluation of their solution is done using a WSN organized in a star topology

5) VillaSmart (Caracaş et al., 2013) is associated with the ECOGRID EU (EcoGridEU, 2015) project. The authors have installed a modular and extensible WSN in a test and reference household called VILLASMART.

Chapter 3

Problem Formulation

For collecting Home appliance data on cloud we'll be facing many problems. Lack of information and awareness regarding data collection, higher cost, privacy endangerment and expensive old devices which can be used for years are some of the basic problems that we observed in out current homes. Our homes can be made smart without replacing all our appliances using our project idea, the new expensive smart home devices are not necessary for making our homes smart.

It's already 2022 but still our homes have the same mechanical switches and inability to control devices from mobile phones and we don't even know daily power usage of devices for using electricity efficiently. All these features are available at the higher industrial levels but for common people like you and me will have to wait for long until our homes will be like that but with the use of our projects the same old appliances can be made smart by collecting their electricity usage data and controlling them through our mobile phones from anywhere.

Chapter 4

Proposed Methodology

The simple method we are proposing in-order to make our devices smart by collecting their data through sensors then sending them to our data bases using internet and then displaying it on our web pages or applications

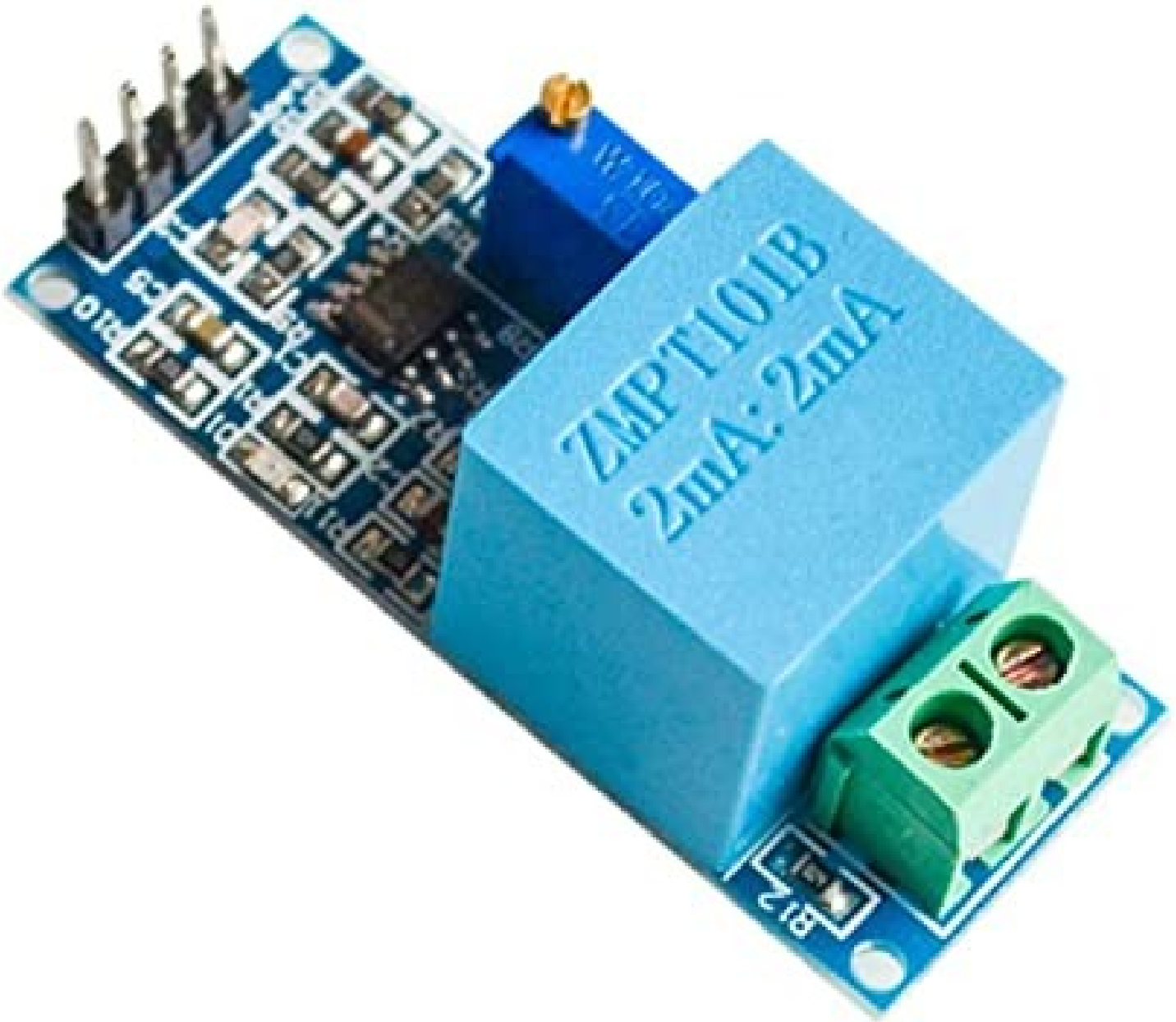
Step 1) Collecting data: We are using the current (SCT-013) and voltage (ZMPT101B) sensors to see how much electriicity our device is withdrawing.

SCT-013 Current Sensor:

The SCT-013 is a Non-invasive AC Current Sensor Split Core Type Clamp Meter Sensor that can be used to measure AC current up to 100 amperes. Current transformers (CTs) are sensors are for measuring alternating current. They are particularly useful for measuring whole building electricity consumption. The SCT-013 current sensors can be clipped straight either to the live or neutral wire without having to do any high voltage electrical work.

Specifications 1. Input Current: 0-30A AC 2. Output Signal: DC 0-1 V 3. Non-linearity: 2-3 4. Build-in sampling resistance (RL): 62 5. Turn Ratio: 1800:1 6. Resistance Grade: Grade B 7. Work Temperature: -25 °C +70 °C 8. Dielectric Strength (between shell and output): 1000 V AC / 1 min 5 mA

ZMPT101B AC Single Phase Voltage Sensor:

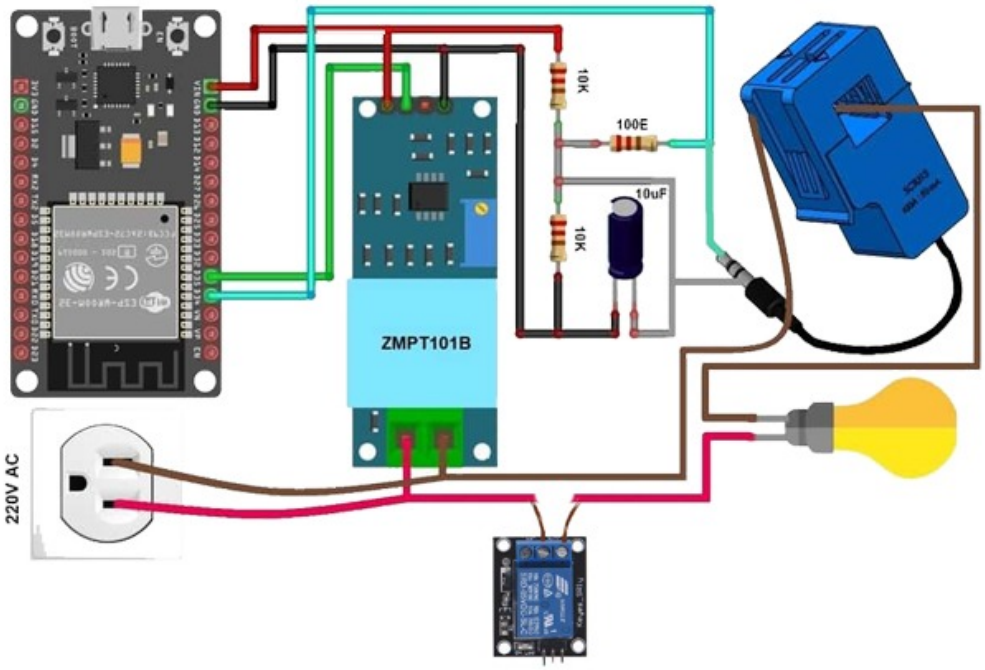


The ZMPT101B AC Single Phase voltage sensor module is based on a high precision ZMPT101B voltage Transformer used to measure the accurate AC voltage with a voltage transformer. This is an ideal choice to measure the AC voltage using Arduino or ESP32.

Specifications 1. Voltage up to 250 volts can be measured 2. Lightweight with on-board micro-precision voltage transformer 3. High precision on-board op-amp circuit 4. Operating temperature : 40ºC + 70ºC 5. Supply voltage 5 volts to 30 volts

The values of these two sensors will be collected in the microcontroller Esp32 which is wifi enabled so it can send the data directly to our servers

Circuit Diagram Hardware Setup:



The connection diagram is simple. Both the Sensor, i.e. SCT-013 Current Sensor ZMPT101B Voltage Sensor VCC is connected to Vin of ESP32 which is a 5V Supply. The GND pin of both the modules is connected to the GND of ESP32. The output analog pin of the ZMPT101B Voltage Sensor is connected to GPIO35 of ESP32. Similarly, the output analog pin of SCT-013 Current Sensor is connected to GPIO34 of ESP32. You need a two resistor of 10K a single resistor of 100 ohms connected along with a 10uF Capacitor. The relay shown in the diagram works as a switch for changing the state(ON/OFF) of the appliance.

Step 2) Storing data on Cloud: After the is collected by the micro-controller it is sent to the data base using HTTPS secure protocol which will be stored in an encrypted format in our MongoDB cloud database.

Step 3) In the final step we will make a simple beautiful interactive interface (website/Application) which users will use to see their power consumption of all devices and also the users can control the status of the device (ON/OFF) from anywhere in the world.

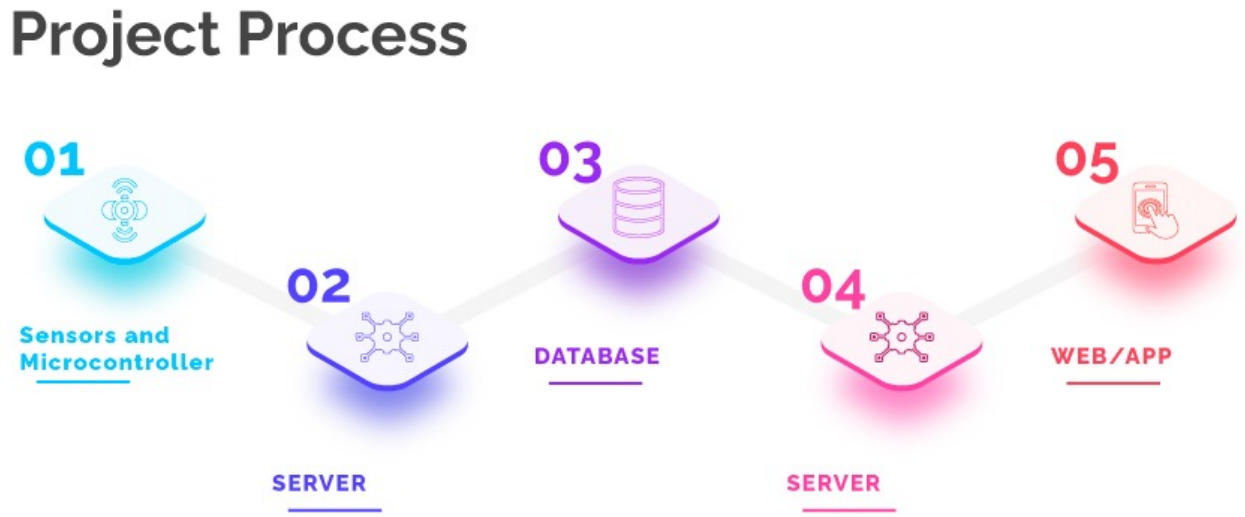
Chapter 5

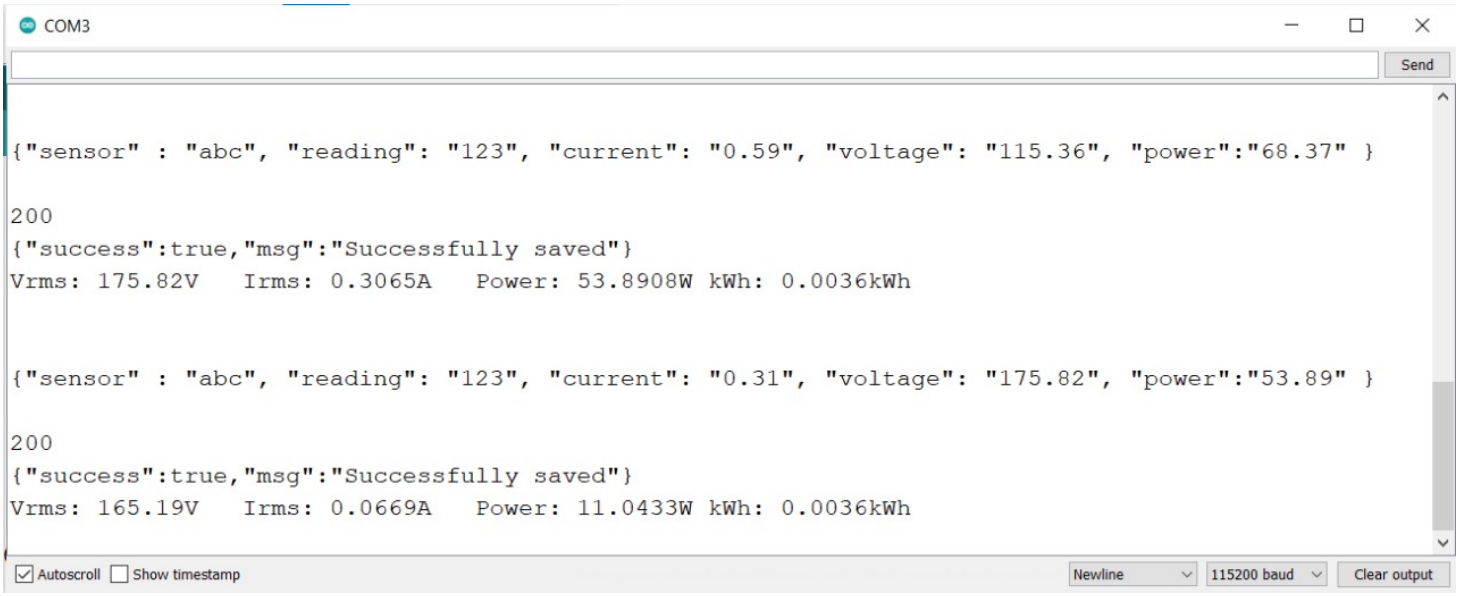
Novelty/Additions to the Existing Framework

As we know by now that the technologies used by the existing companies for providing the futuristic smart home experiences are mostly made by other countries like Chine where we wouldn't want our private data to go, so we are enabling data privacy protection from such companies and also the idea of unified platform for all the smart home appliances is not new can't be seen implementing by others. So with our project we would love to give data security and single simple platform to the consumers to make their dream of smart home come true easily and cost efficiently.

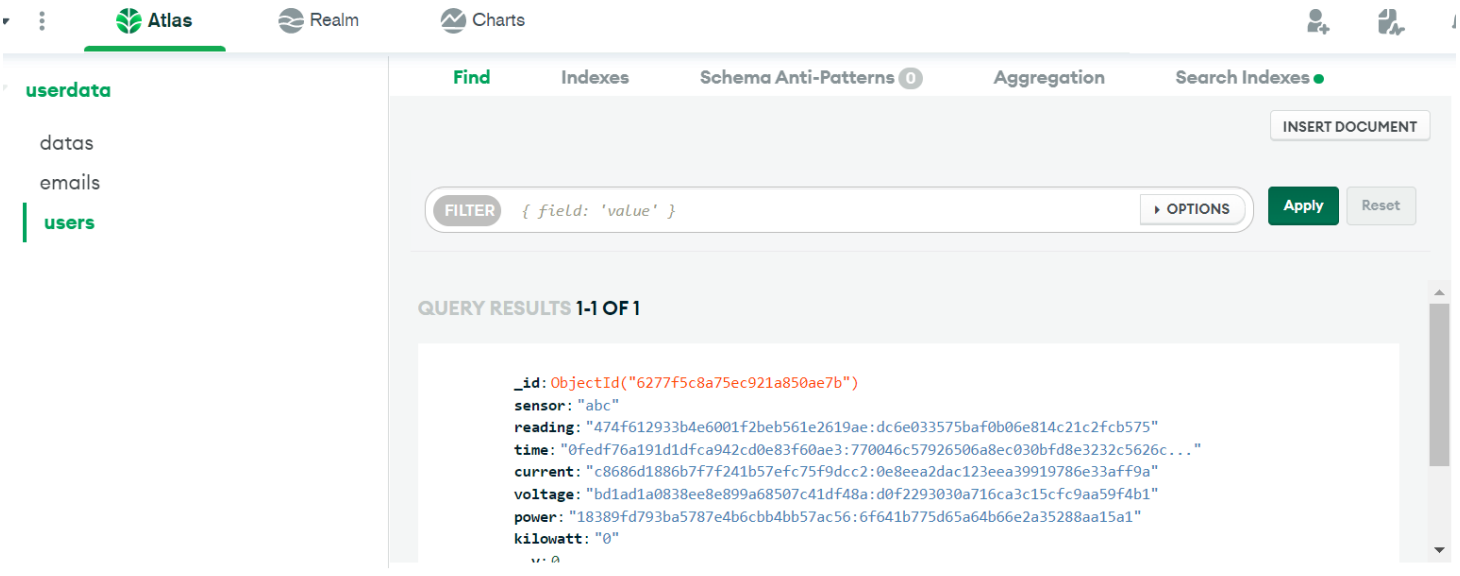
Chapter 6

Experiments and Results

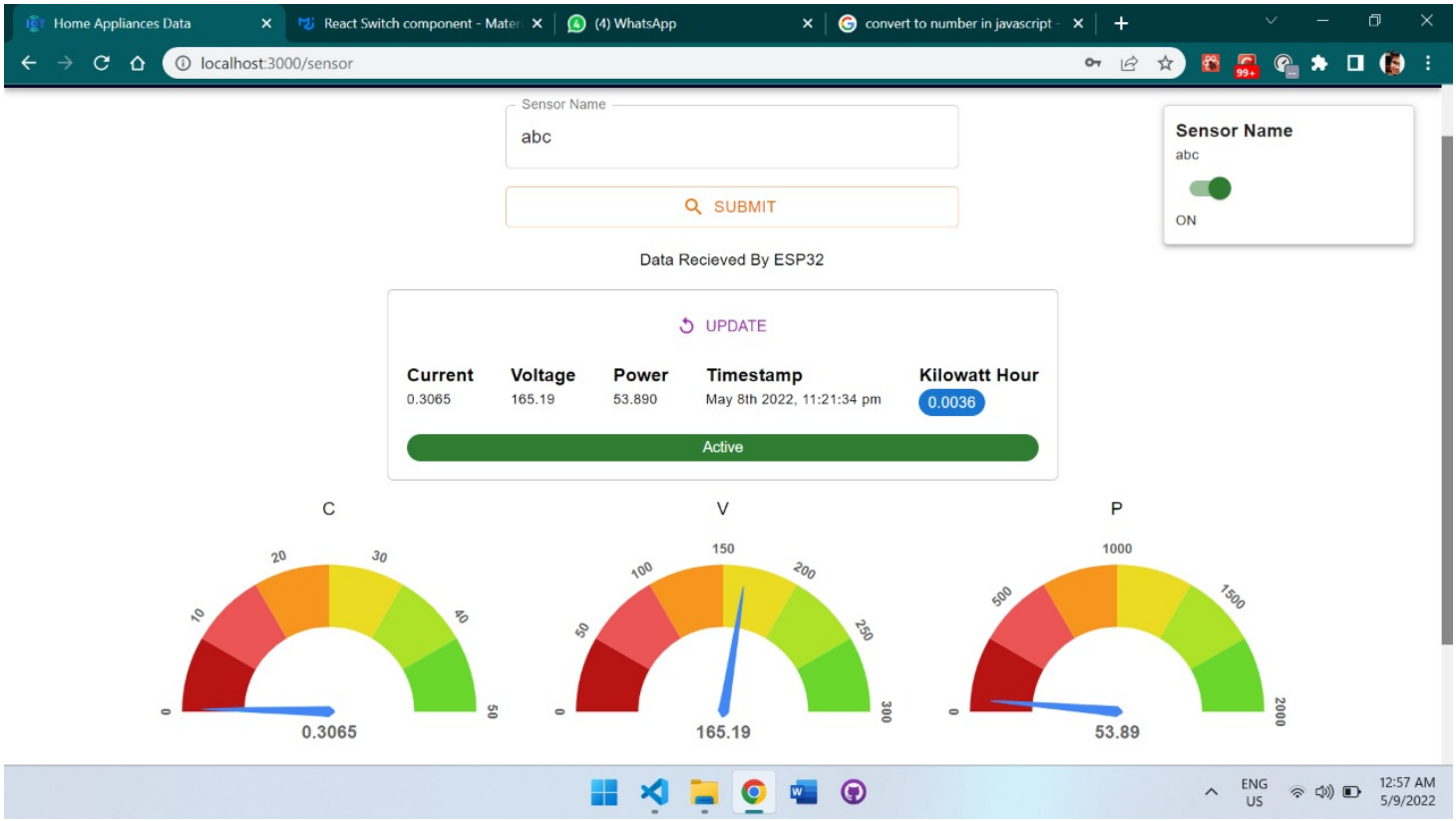




esp32 output



Database


Home Appliances Data
React Switch component - Mater
(4) WhatsApp
convert to number in javascript -
localhost:3000/sensor
Sensor Name
abc
SUBMIT
Data Recieved By ESP32
Sensor Name
abc
ON
UPDATE
Current
Voltage
Power
Timestamp
Kilowatt Hour
0.3065
165.19
53.890
May 8th 2022, 11:21:34 pm
0.0036
Active
C
V
P
0.3065
165.19
53.89
ENG
US
12:57 AM
5/9/2022

Website

Chapter 7

Conclusion and Future Work

In our project we tried to overcome the problems in making the home appliances smart and collected their electricity consumption data on our data base and then we displayed that data on out webpage/application from where we can also control the status of the device. We learned many things through this project like the use of microcontrollers and sensors which was a worthy experience and also we learnt the importance of team work and we helped each other in their contributions.

Future works: There are too many applications using this project but if we shall continue this project then these future works we'll try to apply.

1) Running different algorithms of machine learning on the collected data to detect patterns and automate many actions

2) We can make alert options on usage of more than a limit of a particular device to use electricity efficiently.

3) If all the home appliances are connected to our service we can also generate electricity bills also which users can compare to their actual bills,

4) We have used the electricity sensors there are so many sensors which can be used with many different appliances to make our lives easier.

Appendix A

Contribution of Group Members

A.1 Contribution of Shaikh Abbas Ali

- Studied the microcontroller Esp32 along with the sensors
- Build and connected circuit diagram
- Programmed the Esp32 to send data to the server by sending post request

A.2 Contribution of Avnish Raj

- Created back-end for our project
- Server for connection between esp32 and database.
- Server for connection between database and website/Android App.
- Database of our project
- Back-end testing

A.3 Contribution of Kushagra Patel

- Has worked on web application frontend structuring
- Implemented React Components, State Functioning , API fetching and Error Handling
- Front-end Testing

A.4 Contribution of Anuj kumar

- Created a mobile interface for controlling the device
- Simple and funtioning front-end using Flutter mobile app development

Appendix B

Appendix B

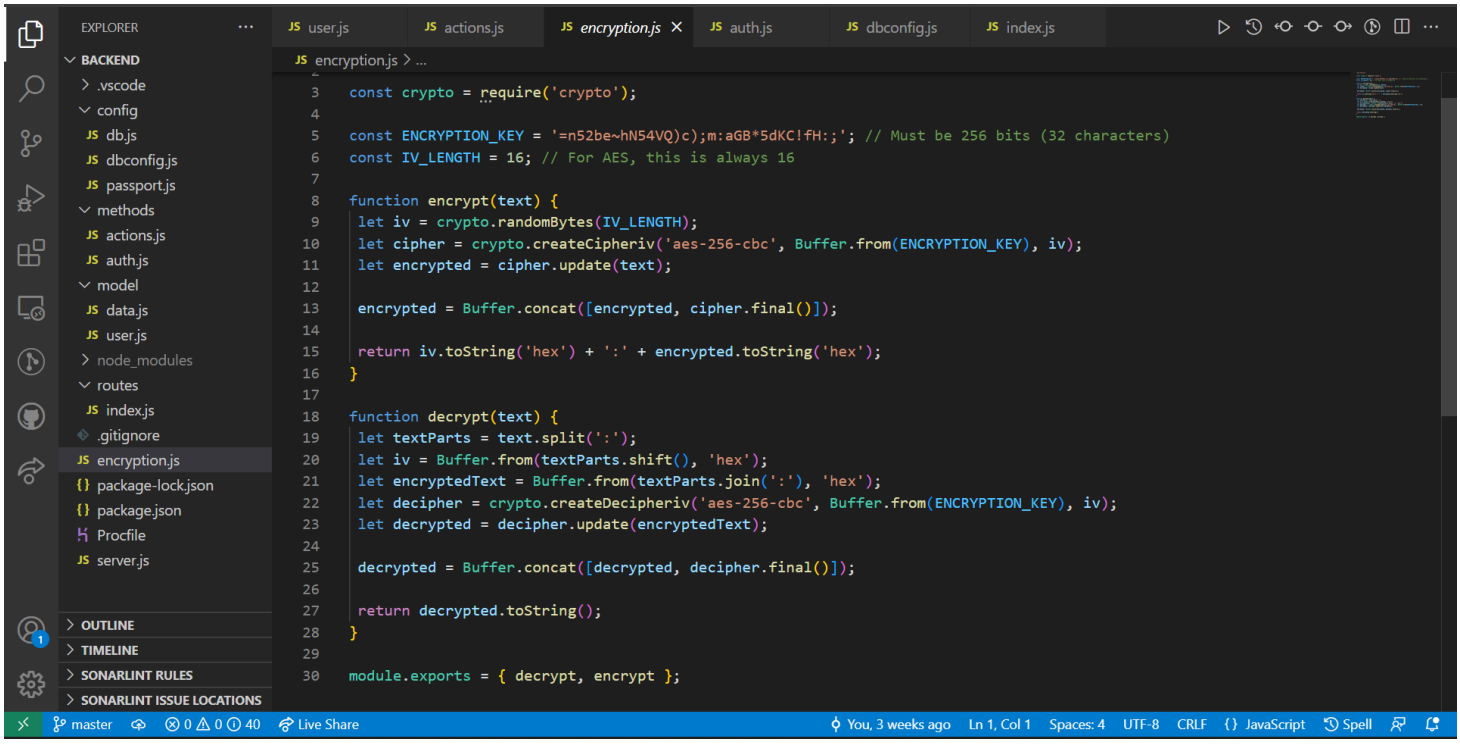
Code for ESP32

```
#include "EmonLib.h"
#include <WiFi.h>
#include <HTTPSClient.h>

EnergyMonitor emon;
#define vCalibration 106.8
#define currCalibration 0.52

const char* ssid = "309";
const char* password =  "avnish309";

float kWh = 0;
unsigned long lastmillis = millis();




void setup() {

  Serial.begin(115200);
  delay(4000);//Delay needed before calling the WiFi.begin
  emon.voltage(35, vCalibration, 1.7); // Voltage: input pin, calibration, phase_shift
  emon.current(34, currCalibration); // Current: input pin, calibration.

  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) { //Check for the connection
    delay(1000);
    Serial.println("Connecting to WiFi..");
  }

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

}

void loop() {
```

```
if(WiFi.status()== WL_CONNECTED){   //Check WiFi connection status

  HTTPSClient http;

  http.begin("https://iiitliot.herokuapp.com/modify");  //Specify destination for HTTP reque
  http.addHeader("Content-Type", "application/json");             //Specify content-type hea

  emon.calcVI(20, 2000);
   Serial.print("Vrms: ");
   Serial.print(emon.Vrms, 2);
   Serial.print("V");
   Serial.print("\tIrms: ");
   Serial.print(emon.Irms, 4);
   Serial.print("A");
   Serial.print("\tPower: ");
   Serial.print(emon.apparentPower, 4);
   Serial.print("W");
   Serial.print("\tkWh: ");
   kWh = kWh + emon.apparentPower*(millis()-lastmillis)/3600000000.0;
   Serial.print(kWh, 4);
   Serial.println("kWh");
   lastmillis = millis();

   String jsonotp = "{\"sensor\" : \"abc\", \"reading\": \"123\", \"current\": \""+String(em

  int httpsResponseCode = http.POST(jsonotp);   //Send the actual POST request
  Serial.print("\n\n"+jsonotp+"\n\n");

  if(httspResponseCode>0){

   String response = http.getString();                       //Get the response to the reque

   Serial.println(httpsResponseCode);   //Print return code
   Serial.println(response);           //Print request answer

  }else{

   Serial.print("Error on sending POST: ");
   Serial.println(httpsResponseCode);

  }

  http.end();  //Free resources

}else{

   Serial.println("Error in WiFi connection");
```

```
 }

  delay(10000);  //Send a request every 10 seconds

}
```

code for Encryption and Decryption



Encryption - Decryption code

Appendix C

Appendix C

C.1 References

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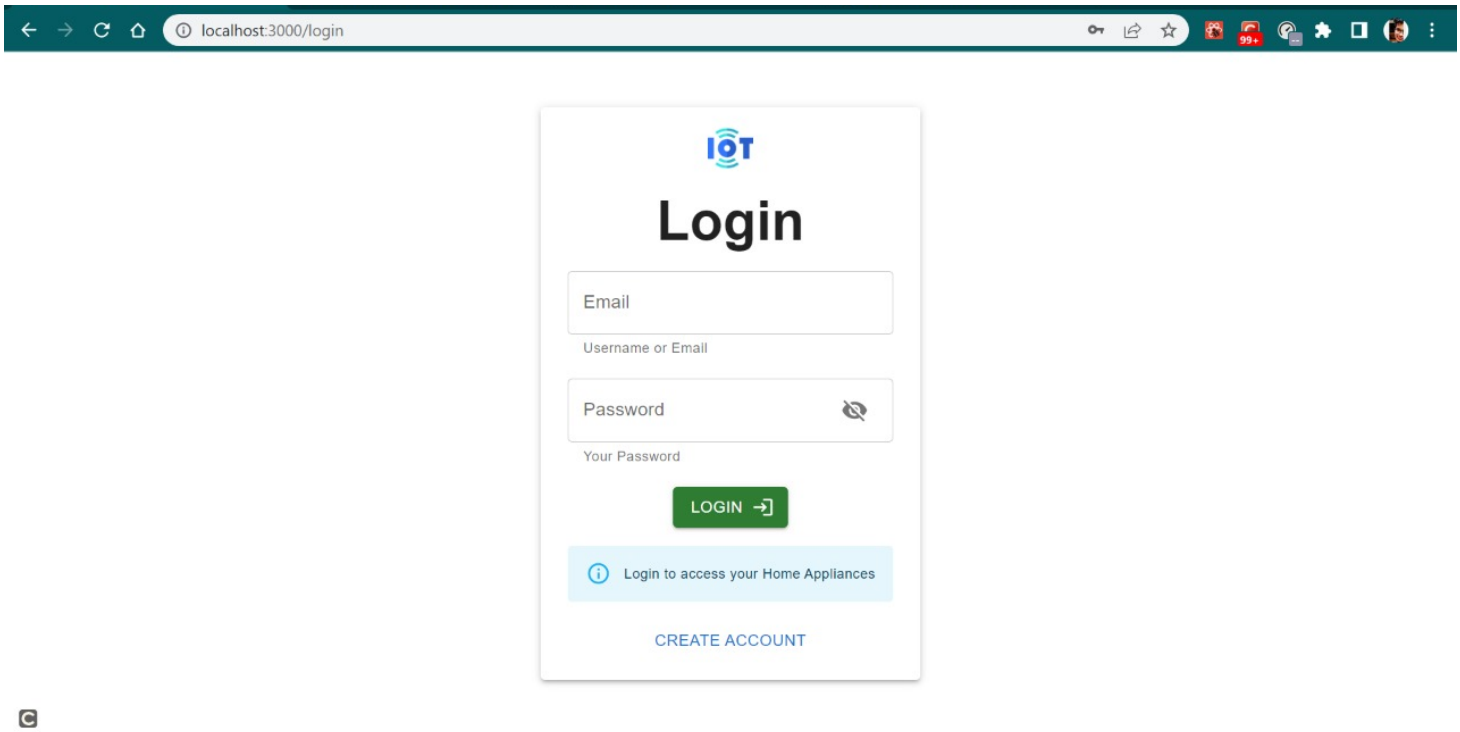
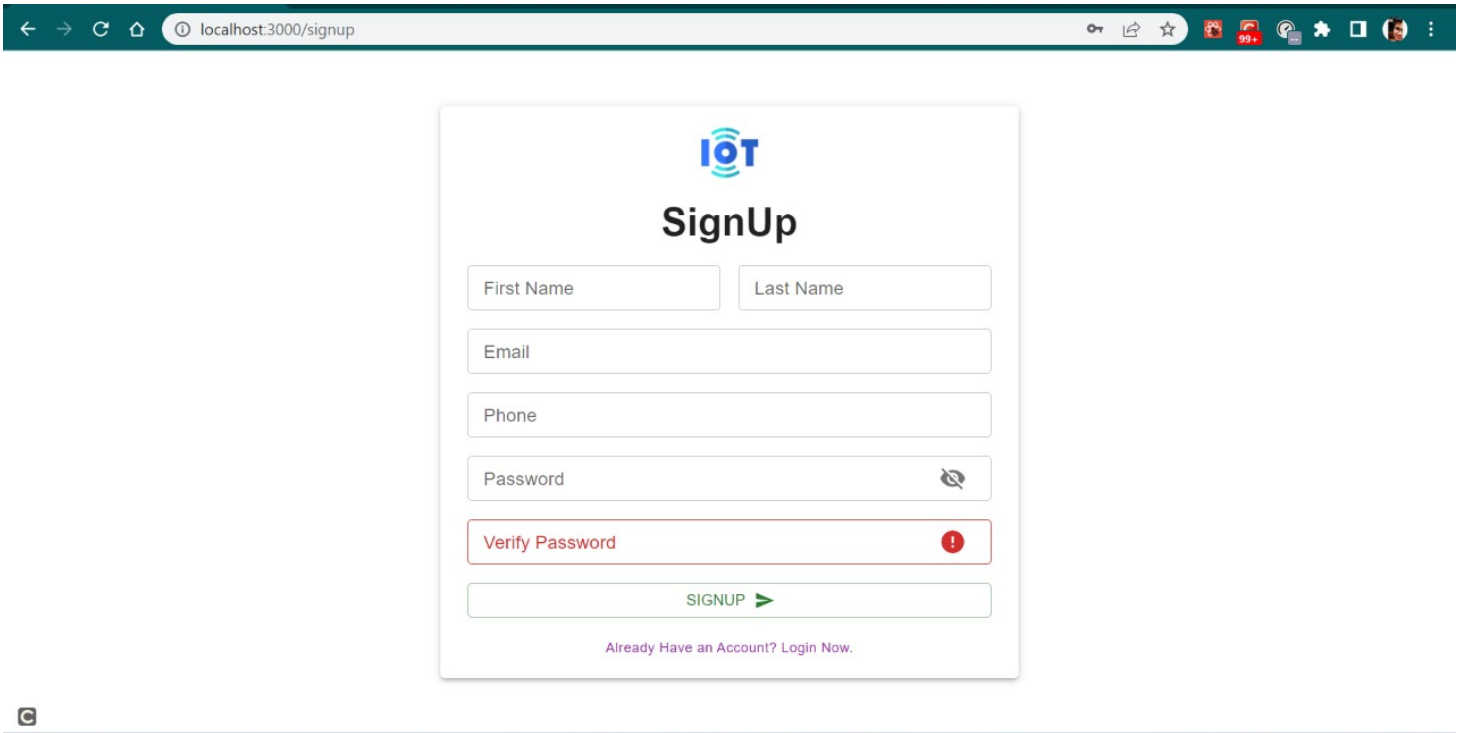
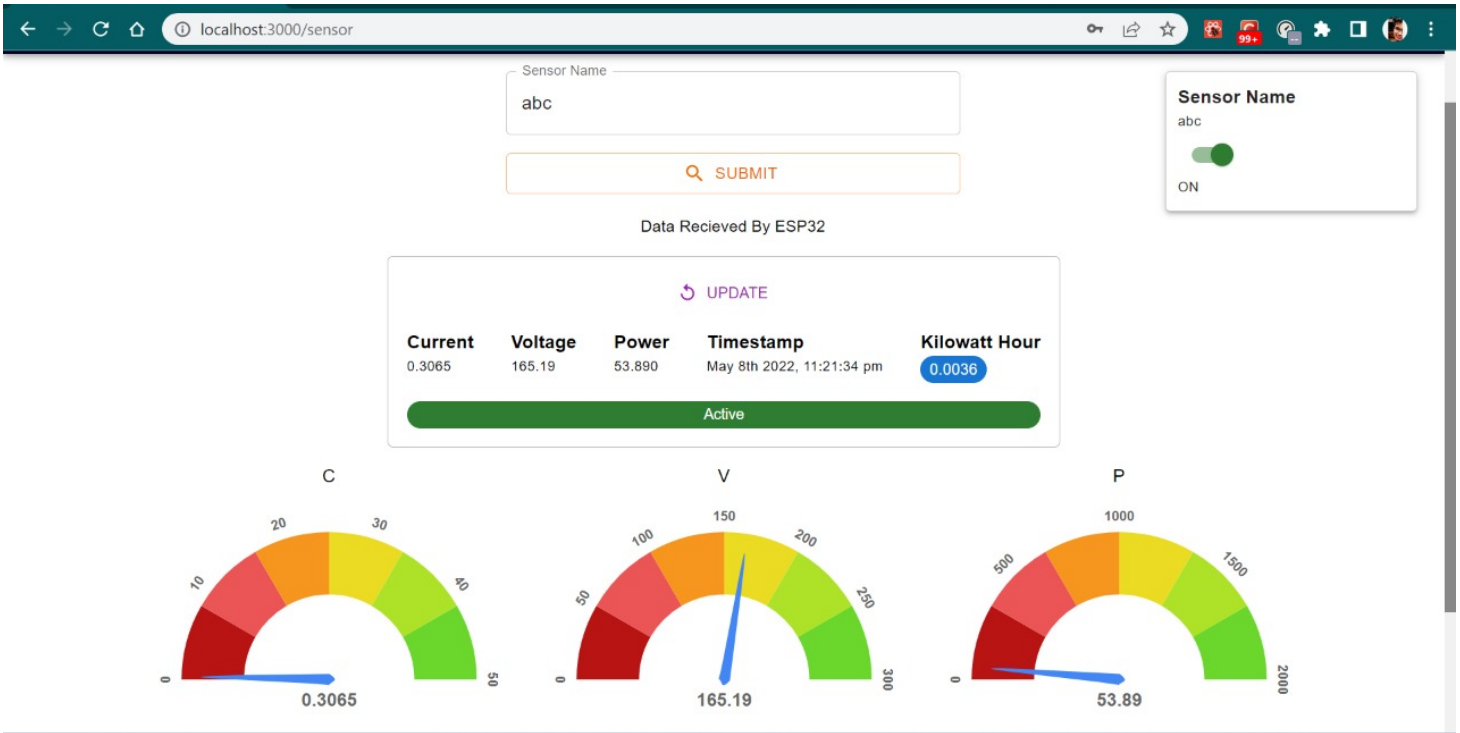
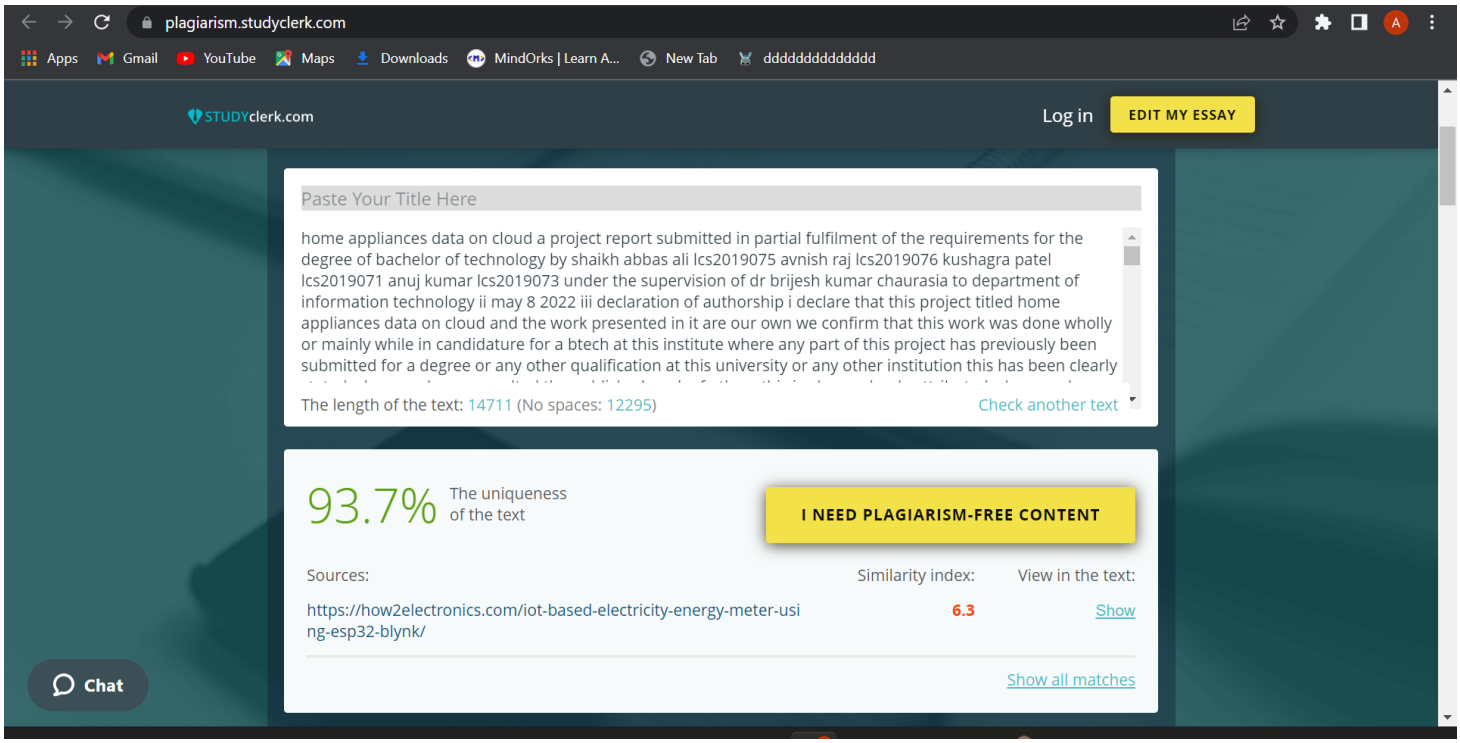
C.2 Outcome




localhost:3000/signup
SignUp
First Name
Last Name
Email
Phone
Password
Verify Password
SIGNUP
Already Have an Account? Login Now.


localhost:3000/sensor
Sensor Name
abc
SUBMIT
Data Recieved By ESP32
Sensor Name
abc
ON
UPDATE
Current
Voltage
Power
Timestamp
Kilowatt Hour
0.3065
165.19
53.890
May 8th 2022, 11:21:34 pm
0.0036
Active
C
V
P
0.3065
165.19
53.89

C.3 Plagiarism report



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