Advanced Home Electricity Monitoring and Controlling System Using IoT

A PROJECT REPORT

submitted by

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to

The APJ Abdul Kalam Technological University

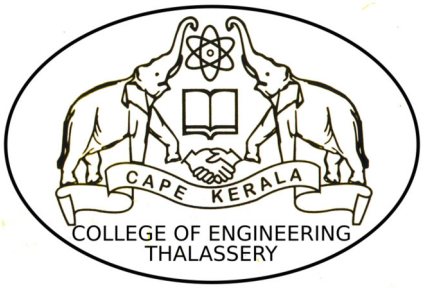
In partial fulfillment of the requirements for the award of the Degree

of

Bachelor of Technology

In

COMPUTER SCIENCE AND ENGINEERING



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DECLARATION

We undersigned hereby declare that the project report **"Advanced Home Electricity Monitoring and Controlling System Using IoT"** , submitted for partial fulfillment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of **Prof. RINIL K R** . This submission represents our ideas in our own words and where ideas or words of others have been included, We have adequately and accurately cited and referenced the original sources. We also declare that we have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in our submission. We understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

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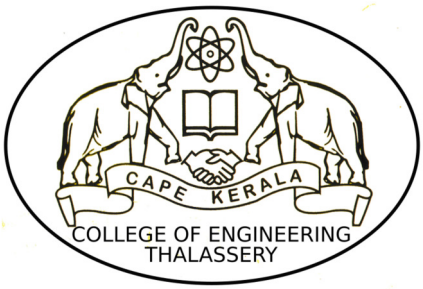

CERTIFICATE

This is to certify that the report entitled **ADVANCED HOME ELECTRICITY MONITERING AND CONTROLLING SYSTEM USING IoT** submitted by **NAZIM V K (TLY16CS034)**, **SAHALUDHEEN CK(TLY16CS045)**, **SAYOOJ SATHEESH (TLY16CS050)** and **MOHAMMED RAQEEB SHAFEEQUE(TLY16CS030)** to the APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Computer science and engineering is a bonafide record of the project work carried out by him/her under my/our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

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ABSTRACT

One of the biggest problem the society facing is energy crisis.Actually the problem is not energy crisis,the problem is our unorganised usage of energy.People are ignorant about the usage of electricity in their day to day life.So in this project we are making the users aware of their daily electricity usage.We are collecting the energy used by each electronic devices in a house and monitor it through an android application.We have two part in this project, a hardware part which include an arduino board and current sensors to collect the current used by devices and convert it into energy and a wi-fi module Node MCU to transfer that data to database.Also relays are used to control the device remotely.Second part is a software part which is used to monitor that data to the user.We are also including a controlling feature i.e the user can on/off the devices using this mobile application.

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ABBREVIATIONS

IoT	Internet of Things
SoC	System on Chip
SQL	Structured Query Language

CHAPTER 1

INTRODUCTION

Electricity is one of the basic needs.For each and everything we are depending on electricity.The use of electricity has increased exponentially which in turn resulted in high demand and cost.Due to this we are facing electricity crisis.Actually the problem is not electricity crisis,but it is our unorganised usage of electricity.We have no way to know which of the device is consuming more energy, or which device is consuming the least.This unawareness leads to wastage of electricity.

We are also facing other causes which lead to energy crisis like water scarcity which in turn effect the production of electricity.We should use electricity in a controlled manner.Wastage of electricity should be minimized so that everyone can benefit from the limited energy produced.

The only solution is a good monitoring system which provide accurate details of our electricity consumption.So our project is to develop an android application that will monitor the electricity consumption of each appliances at our home,office etc .Apart from this monitoring system we are also providing a remote controlling system through android application which will help us to control equipment in this project.

1.1 MOTIVATION

Lack of awareness in our electricity consumption is the main cause of electricity crisis.We don't have any efficient monitoring system so that we can know how much energy we are using unnecessarily and could minimize the wastage. The method of production of electricity is different in different places there are hydro electric power system ,nuclear power plants wind energy ,even though the production of electricity is different the con-

sumption is about the same. if we look globally there is huge wastage of electricity.This lead us to develop a mobile application which provide user to get the details of the energy consumption of each appliances in our home,office,institution etc.

1.2 ORGANIZATION OF THE THESIS

The thesis is organized into 6 chapters.Chapter 2 describes the background study of related techniques.The proposed methodology is explained in Chapter 3.chapter 4 widely describes how this system operates and the resources required etc.it also describes the implementation of our system.Chapter 5 describes Result and analysis of our proposed system and chapter 6 describes conclusion and future work of our proposed system.

CHAPTER 2

LITERATURE REVIEW

Our project is an IoT based Electricity monitoring and controlling system,for that we have read many IEEE published journals and conference paper. From those papers we have attained many new ideas for our project. Along with those ideas we have included our own contributions by using technologies other than those mentioned in the journals and papers.Following are the papers we have referred related to our project :

First paper we referred was **PMA: Power Monitoring Application for Android** proposed by Kant Suwansit, B.Konsombut, P.Hankongkaew and T.Tantidham in 2014.They have stated that with the impact of global warming and climate change energy conservation policies have become a major concern in every country. PMA is developed for android smart phone devices for monitoring energy usage of each electronic device.In this method they are using CT sensors ,ardiuno,web server and android application. Current Transformer(CT) sensors are used to detect the current through the load.CT sensors are connected to the devices and arduino board. The measured value is analog value which is converted to digital value by using micro controller arduino. The power consumption data is then send to the server .When the server receives the data,it will manipulate the data into daily, monthly, yearly and statistics form.The user can view this data using an android device.

In the MySql database there are separate table for:-

Location -which contains roomid and name, Arduino -Each arduino has an id ,mac address ,ip address,room id and name,Device -Containing arduino id to which these device connected, device name,type, Data min-consumption data in minutes, Data hour- consumption data in hour, Data month-consumption data in month, Data year-consumption

data in year.

The second paper among them was **Design and implementation of home energy and power management and control system** by Vanessa Barnes,Thomas K. Collins and Godfrey A. Mills in 2017 .In this paper it says that efficient use of electricity is the way to increase energy efficiency and decreasing cost of power and supply.The system can monitor ,regulate and manage demand response by scheduling and controlling. These all can be achieved through mobile app.These method uses embedded and micro controller for monitoring ,scheduling ,controlling and managing electronic equipment.In this paper they are using current and voltage sensors to collect and calculate the energy used by devices.This calculated energy is then transferred to a Raspberry Pi server using bluetooth.The data in the Raspberry pi is transmitted using Wi-fi communication.The instructions from the user is passed to the Raspberry Pi from where it is decoded and appropriate message(i.e device on/off)is passed to the arduino.The corresponding device will be turned on/off according to the instruction recieved from user.

In 2018 YongMei Jiang, QiuXuan Wu, Yang Yang and XiaoNi Chi proposed the paper **Design of a Home Energy Management System Based on Cloud Service**.In this paper they proposes the energy management in house.The system can monitor ,regulate demand responds by scheduling.Using home micro grid HEMS is achieved..The electricity consumption data is stored using cloud computing .The unit named SCADA collects the data from home micro grid,controls the equipments in the grid and uploads the data to the server via internet.The data processed by SCADA is transferred to the server using an intelligent gateway.Raspberry Pi is used as the intelligent gateway in this paper.They used WeChat server for storing data.So the user can get the data from anywhere using a WeChat account.A smart socket with wifi communication is developed by them to read the voltage,current,active power etc. used by devices and gives it to the SCADA unit.

The fourth one we referred was **A sensors-based monitoring system of electrical consumptions and home parameters remotely managed by mobile app for elderly**

habits' control proposed by P. Visconti, P. Costantini, R. de Fazio, A. Lay-Ekuakille and L. Patrono in 2019.In this paper they have used some sensors for detecting the interaction of the elderly, diseased or disabled people with the electronic devices to understand thier behaivour.In this paper they used ESP-07 ESP8266 Serial Wifi Module with Arduino board to collect ,process and transfer the data recieved from sensors to a remote server.The data stored in the remote server can be retrived using an android application.The app will send multiple HTTP posts towards the server for sending data and the server and corresponding PHP web services are developed to serve the client request. The power consumption is calculated using a smart plug which calculate the amount of current enering and leaving the plug and is passed to the wifi gateway to store it in the remote server.

In the paper **Smart Power Monitoring System Using Iot** published in 2019 proposed by A.Y. Devadhanishini, R.K. Malasri, N. Nandinipriya, V. Subashini and P.G. Padma Gowri they used an extra module called GSM module for communication between the system and the user.The data is collected from the devices using a power meter and send to the arduino.Arduino will pre-process the data and send the data to the server through wifi module named ESP8266x Wi-fi module.The data in the server can be retrieved using an android application.Also the user instructions like device turn on/off can be send to the arduino through cloud server.The GSM module is used to inform or give an alert about the over usage of electricity.The GSM module will connect the system to the registered mobile number so that the alert will be send to that mobile number.

CHAPTER 3

PROPOSED SYSTEM

Our proposed system has a current sensor named ACS712 which detect the amount of current flow and this sensor gives an analog signal as output.This analogue output is passed to Arduino which converts the analog signal to digital value.This digital value is then processed to find the energy in units.This data is transfered to cloud storage through a wi-fi module called nodeMCU(ESP8266).Both Arduino and nodeMCU can be coded using open source software Arduino IDE.The data obtained is stored in the database in cloud so that we can access data from anywhere at anytime.A mobile application is the front end of our system.This application shows the usage of electricity in real time.We get a clear picture of our usage of electricity in our day to day life.This application also provide interface to control the appliances remotely by way of relay switches.A button is provided for relay connected devices so that when we click on the button it will sent signal to the relay via nodeMCU.If the signal is false the device is turned off.If the signal is true the device is turned on.

CHAPTER 4

METHODOLOGY/THEORY/MODELLING

The hardware consists of a current sensor, Arduino Uno, relay and node MCU . The sensors measure the current consumed by the load. These sensors collect the device status and report it to the Arduino periodically. The microcontroller is a high end single SoC on the edge that collects the information from the sensors.The output from current sensor is an analogue signal which is converted to digital value so that we get actual current value flowing through the wire. Arduino uno is programmed to get the energy usage.Then calculated value is forwards it to the cloud using a wifi module. Since the microcontroller cannot provide enough power to the load, an external power source is supplied to provide a power driving circuit for the appliances. end.

4.0.1 ARDUINO

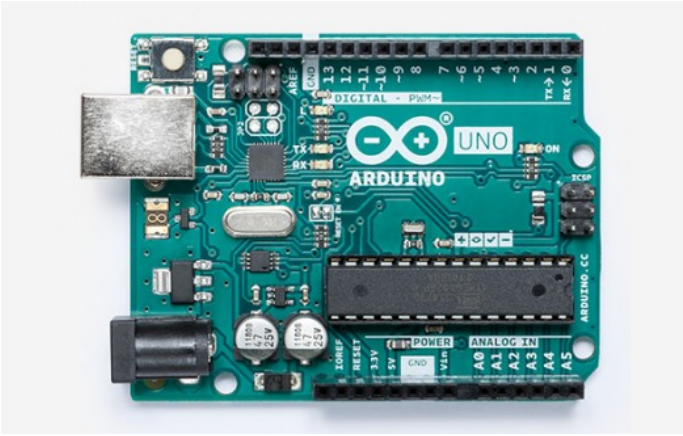

Figure 4.1: Arduino

The Arduino UNO is an open-source microcontroller board developed by Arduino. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital

pins, 6 Analog pins, and programmable with the Arduino Integrated Development Environment via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery. Special pin functions of Arduino UNO are that each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The UNO has 6 analog inputs, labeled A0 to A5, each of which provide 10 bits of resolution.

4.0.2 ACS712 CURRENT SENSORS

Sensing and controlling current flow is a fundamental requirement in a wide variety of applications including, over-current protection circuits, battery chargers, switching mode power supplies, digital watt meters, programmable current sources, etc. This ACS712 can accurately detect AC or DC current. The maximum AC or DC that can be detected can reach 30A, and the present current signal can be read via analog input/output port of Arduino.

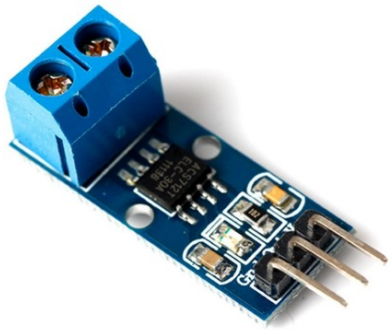

Figure 4.2: ACS712 Current sensor

Here we use the Current Sensor ACS712 30A to measure current used by the load which is connected to phase wire. Series connection with the load and input power supplies to detect current. Current Sensor gives the analog signal, but we want digital signal for transmitting. For that, analog signal is send to Arduino for converting it to

digital.

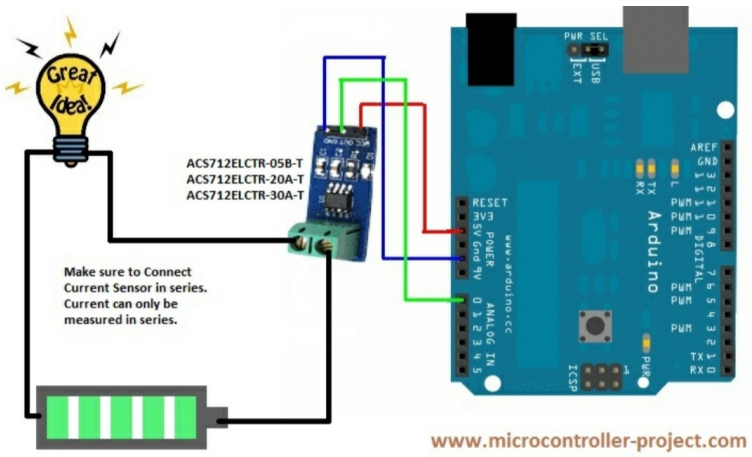

Figure 4.3: ACS712 interfacing with arduino

4.0.3 NODEMCU WIFI MODULE

Figure 4.4: NodeMCU wifi module

The ESP-01 ESP8266 Serial WIFI Wireless Transceiver Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is cost-effective.

This module has a powerful enough onboard processing and storage capability that al-

lows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existing interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions and requires no external RF parts.

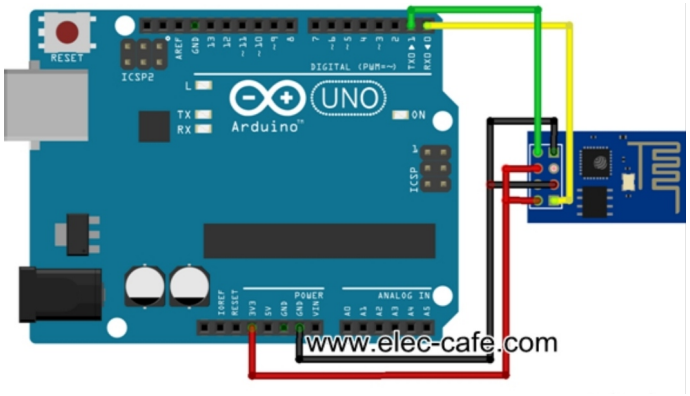

Figure 4.5: ESP8266 programming mode

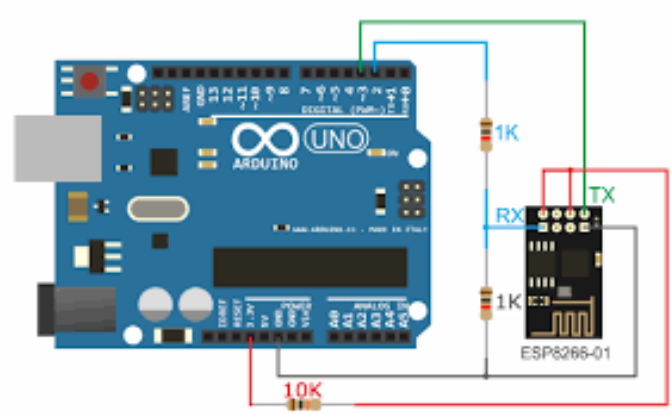

Figure 4.6: ESP8266 in running mode

4.0.4 RELAY MODULE

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. The Arduino relay module can be used in two states which are Normally open state (NO) and Normally closed state (NC).

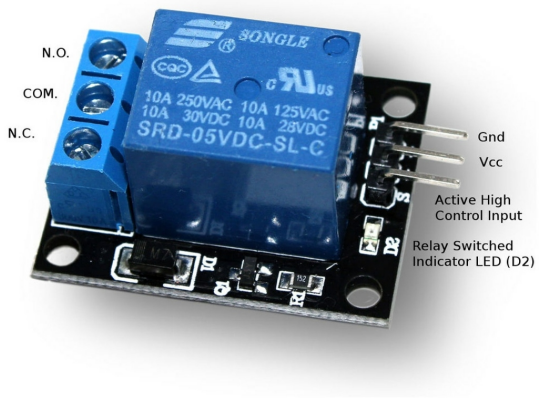

Figure 4.7: Single channel relay module

In the normally open state, the initial output of the relay will be low when it will be powered. In this state, the common and the normally open pins are used. In the normally closed state, the initial output of the relay will be high when it will be powered. In this state, the common and the normally close pins are used.

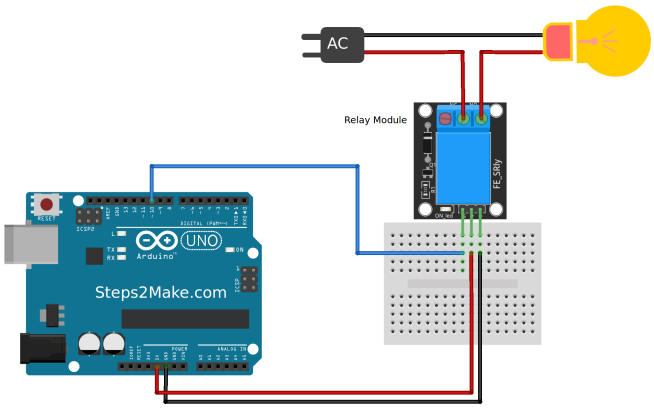

Figure 4.8: Relay interfacing with arduino

4.1 SOFTWARE

In this project we use an android application for monitoring and controlling the device.Each user has a user id and a password to login to the application.When the user login into the app there are two options to choose;one for monitoring and other for controlling.In monitoring section we can categorise devices to which area the appliance be-

long to, example a fan in a room1 can be viewed in the roomid 1.So when we choose room1 we can see all appliances belong to that room.We can see the amount of electricity consumed by each device in units.We use database to store and retriev data and it is stored in a cloud storage.

The second part that is controlling part,here a switch is provided corresponding to each appliance which send signal to nodemcu to turn on/off the appliance corresponding to the relay id of that appliance.

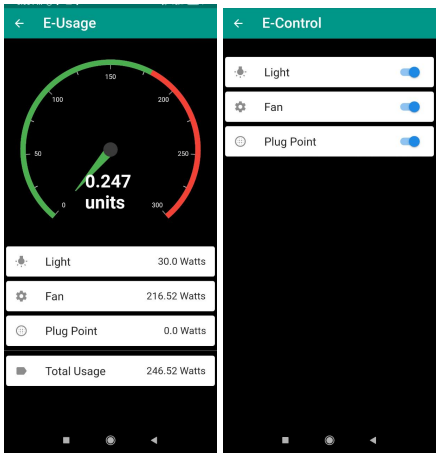

Figure 4.9: Application UI

E-Flow is a Home Electricity monitoring and controlling application which provide the accurate amount of current flowing through the devices. The app is developed using Flutter ,a framework developed by Google. This framework provides powerful and beautiful widgets which makes the task easy to developer. The backend we are using here is Firebase which is also under Google so it is easy to sync between them. The language used by flutter is Dart an object oriented language. The main functionalities in the app are:

1.Authentication

2.View usage

3.Control usage

4.1.1 AUTHENTICATION:

The user must have a valid email and password to retrieve the data stored in the Firebase. In order to achieve this the app provides a Sign Up screen and a login screen. Also if the user forgot the password the app provides an option to reset the password.

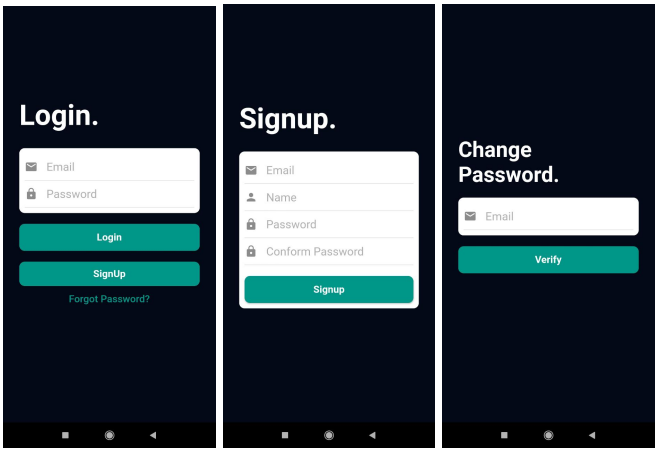

Figure 4.10: Application Authentication pages

Initially when we open the app we show the app name as splash screen. During this time the app check whether an authorized user is present or not. It is done by using a method called “currentUser()” using a dot operator.

```
@override
initState() {
  FirebaseAuth.instance
      .currentUser()
      .then((currentUser) => {
            if (currentUser == null)
              {Navigator.pushReplacementNamed(context, "/login")}
            else
              {
                Navigator.pushReplacement(context,MaterialPageRoute(builder: (context) => Home()))
                    .catchError((err) => print(err))
              }
          })
      .catchError((err) => print(err));
  super.initState();
}
```

Figure 4.11: Code for checking current user

The method will be called whenever we open our application. It return the unique id generated for the authorized user stored in Firebase. If no user is currently logged in ,then it returns a null value. So if the value is null then the app will move to login screen.

If there is a valid user then the app will enter the home screen of the user

4.1.1.1 SIGN UP SCREEN

If the user has a valid email id and password registered previously then user can enter those email and password to get into his home screen. Otherwise the user need to register it by using Sign up function. So to create new user with email id and password "createUserWithEmailAndPassword(email,password)"is called which in turn create a user in firebase with corresponding email and password passed as arguments. We are using Form which help us to validate the information entered into the form. So after filling the form with valid information, by clicking the sign up button it first check whether the data entered are valid or not if valid then it matches the password and confirm password then if both are same then it calls "createUserWithEmailAndPassword(email,password)" with entered email and password as arguments. The corresponding user will be created in the firebase.

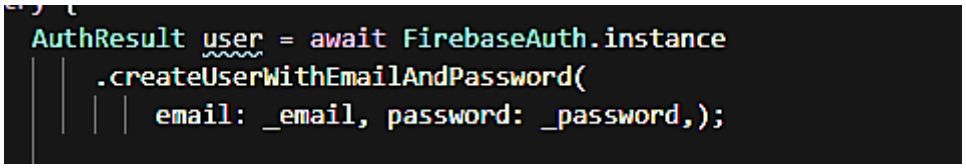

Figure 4.12: Code for creating new user

4.1.1.2 LOGIN SCREEN

Once we have a valid email and password we can enter them in login screen and click the login button, firstly it validate the data and if valid then it call a method "signInWithEmailAndPassword(email,password)" which will check the Firebase server whether this user is already registered and if registered it return the user and the user can enter home screen. If not registered previously , the app returns an error message.

```
AuthResult user = await FirebaseAuth.instance
    .signInWithEmailAndPassword(email: _email, password: _password);
    print(user);
```

Figure 4.13: Code for signin using email and password

4.1.1.3 FORGOT PASSWORD

Sometime we may forget our password or we need to change our password for security ,in order to provide this feature a "sendPasswordResetEmail(email) " is called. It first validate the email and check whether this email is registered previously. If the email is already registered then the provided email will receive a mail to change the password and there after the new password can be used for login.

A conformation mail will be provided for the user to reset their password. the user just need to click the link provided and type in their new password. and the new password will be set.

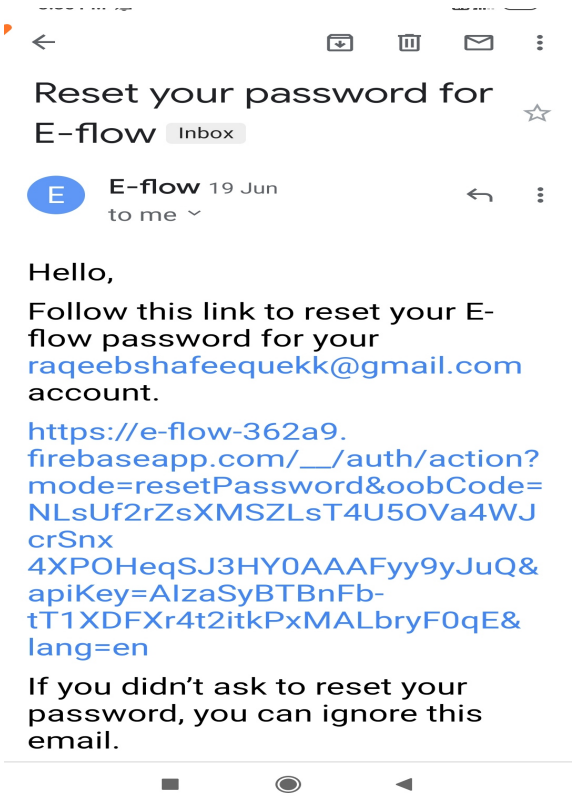

Figure 4.14: Password reset mail

```
await _firebaseAuth.sendPasswordResetEmail(email: email);
```

Figure 4.15: Code for password reset

4.1.2 VIEW USAGE

Once the user enters the home screen there are two options to choose; View Usage and Control Usage. View usage is where we can see the amount of current used by each device . In this screen there is a meter similar to speedometer which shows the amount of units used by the user. Below it the reading of each individual devices are shown. Then below all of the device the total energy used is also shown.

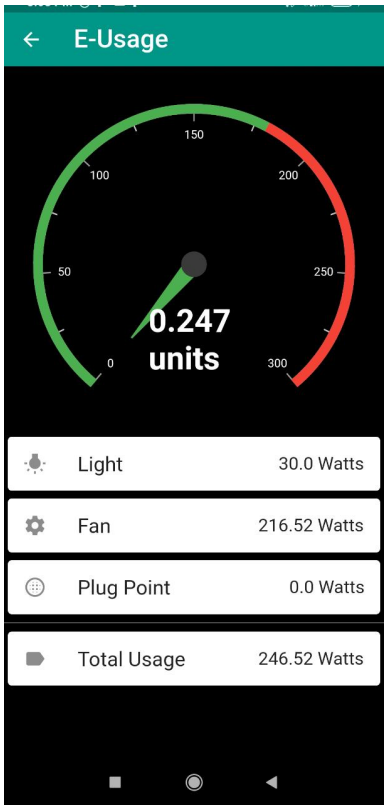

Figure 4.16: View usage page

The data in the firebase can be read in real time. Whenever a new data is uploaded into the firebase, the new data will be added to corresponding device and also to the total usage. This can be achieved by the “Stream” widget. StreamBuilder is used to get

the real time latest data. A Data snapshot of the data in firebase will be obtained using ".snapshot". So the updates will reflect simultaneously in the app in real time.

```
DataSnapshot snapshot=snap.data.snapshot;
fdata = snapshot.value['fan'];
pdata = snapshot.value['plug'];
bulb = snapshot.value['bulb'];
```

Figure 4.17: Code for view usage

The data is stored in the database as an array and is accessed from application as a list of data and the total usage of each device is calculated using sum of list. This sum is found for each device . The total sum is fund by adding the usage of each device. Each time a new power reading is added into the database ,the sum is again updated from the app

4.1.3 CONTROL USAGE

This section of app is to control our devices remotely from our phone. For each device there is a relay connected to it. So to control this we create a data in the firebase. This data is accessed from both application and hardware. This data is a Boolean data i.e only two values True/False. So when the switch is on in the app the corresponding value in the database will be True and when we turn off the device the data will be updated to False. This can be achieved by using" update(key:newValue)",the value of the existing key is changed with newValue.

```
void update(String device,bool newValue) async {
  await FirebaseDatabase.instance.reference().update({device:newValue});
}
```

Figure 4.18: Code for relay

So whenever the switch changes its state the current value (True/False) is updated.

So the nodemcu will also read the value when it is changed thus the device gets turned on/off according to the value in the database

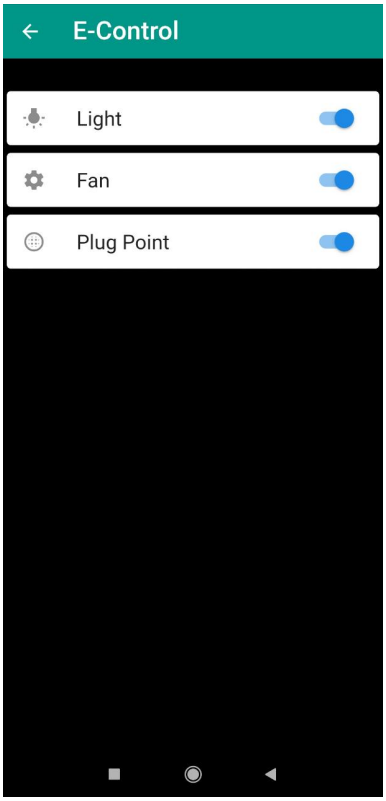

Figure 4.19: Control usage

4.2 DATABASE

4.2.1 FIREBASE

we are using firebase as our databse .Firebase is a mobile and web application development platform developed by Firebase, Inc. in 2011, then acquired by Google in 2014.It has many features such as

1.Firebase Cloud Messaging

2.Firebase Authentication

3.Firebase Realtime Database

4.Cloud Firestore

5.Firebase Storage

6.Firebase Hosting

from this features we are using firebase real time database,firebase authentication ,firebase storage

4.2.2 FIREBASE REAL TIME DATABASE

We are using firebase as our back end database.The firabase real-time database is a cloud hosted database.Data is stored as JSON and synchronized in real-time to every connected client.All clients connected to the real-time database will receive the updates in no time.thus being said once the electronics equipment consume 1 unit of data the user could receive that data simultaneously. there will not be any time dilation between the data transferring

4.2.3 OFFLINE

The usage of electricity is not null or zero it keeps on constant or increasing.but the availability of the internet connection could varied.It is not necessary that one could always have internet facility or connection.thus e overcome this problem n=bu storing data in database.The firebase apps we use will store the data with in them-self if the user is offline The firebase apps remain responsive even when the user is offline .The SDK installed will continue to store data updates in the local database and once the connection is reestablished the changes will be updated in the database .The client device will receive any changes it have missed when offline along with that synchronise with the current server state will also take place.

the figure 4.20 shows that the data is being stored in firebase when the user is offline. The data is stored in a local database in array format the array keeps on increasing till it

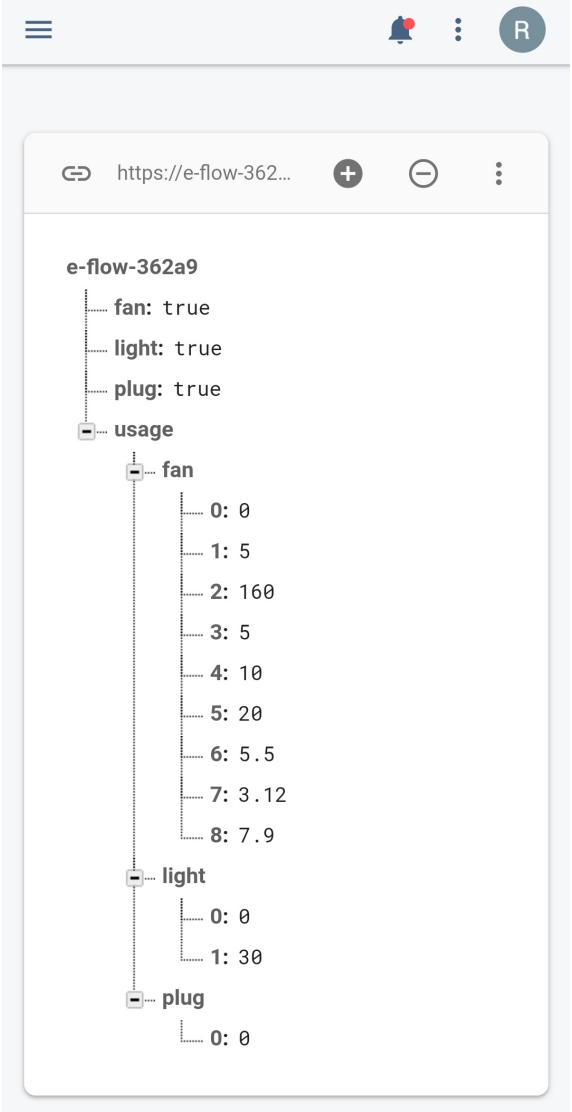

Figure 4.20: Firebase data storing

receives new data

4.2.4 AUTHENTICATION AND ACCESSIBILITY FOR CLIENT DEVICES

privacy is an important factor nowadays. One don't want their data to be public or one don't want their privacy to be interfered by other.thus arises a problem of authenticity .one could always have doubt of authenticity of our system.since Firebase is linked with google we can use google authenticity that is In firebase an user can authenticate himself by using email,google,facebook,twitter and github.Here the developer can integrate his

own proprietary authentication system with firbase authentication to grant users access to data without forcing the user to create an account outside the existing system.The email/password authentication system that we have used has functions to register new users,sign in existing users and sign out a signed in users.

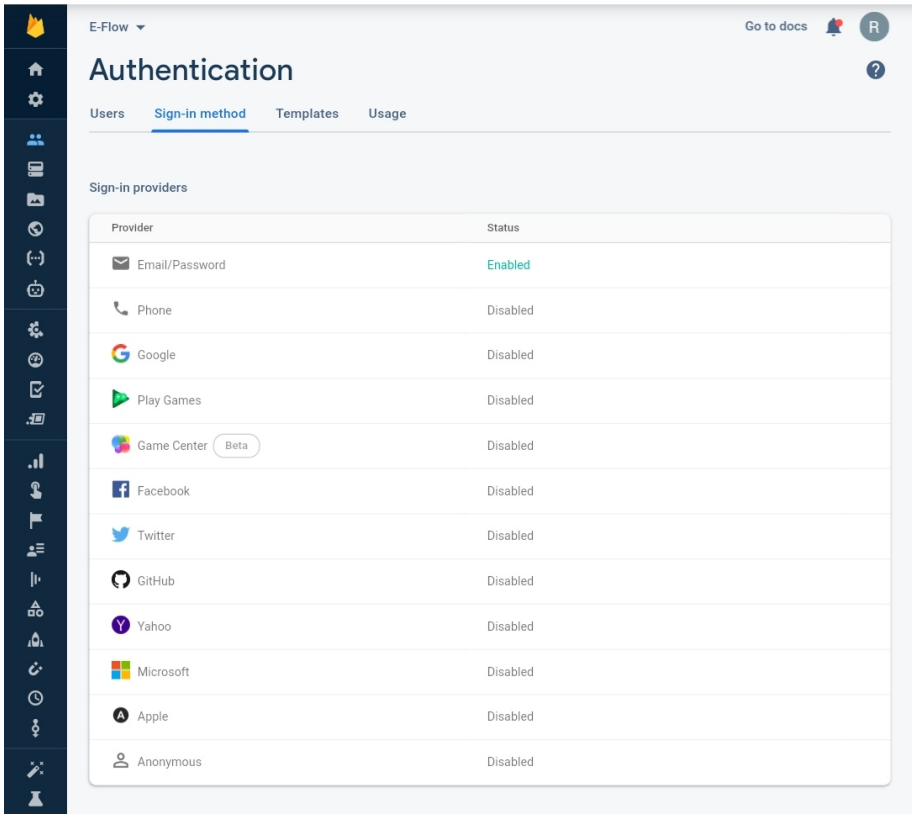

Figure 4.21: Authentication in FireBase

the above image shows the different sector to authentication. a user could authenticate them-self though any of these field they need not to create another account in the existing system

4.2.5 CONTROL DEVICE

The control of the devises is another feature of ours system.these control is occured by transmitting data from user to the electronic equipment . for this we are using FireBase as a mediator.the user will give command through their mobile application.the command is binary formatted that is either on or off. Initially the devise will be off or 0 When the

user makes any change in the current state of a device that change will be updated in the backend in real-time . Each electronic equipment have a corresponding value to their own. the user change these values according to their needs.

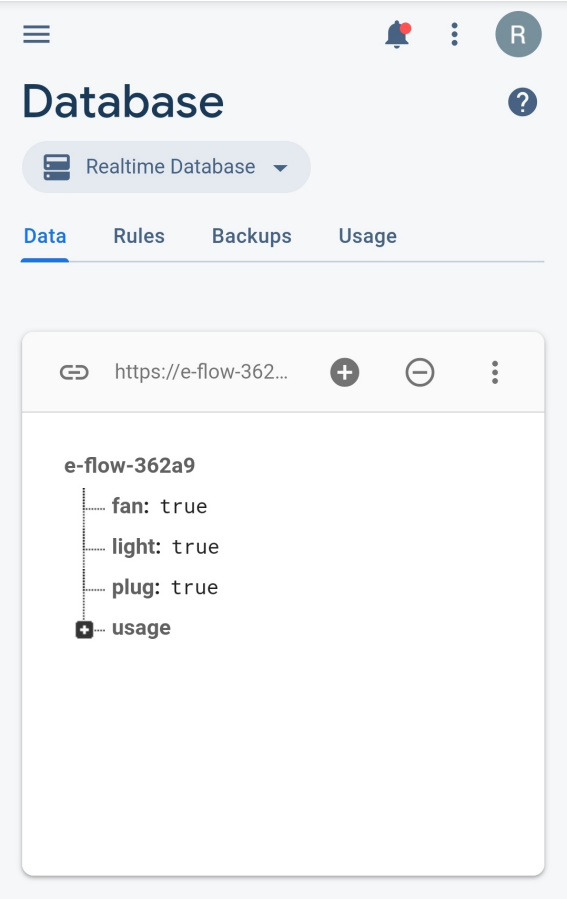

Figure 4.22: Controlling device

when the value is true then the device is on and if it is false the device is off.

4.2.6 USAGE DATA

The electricity consumed by the equipment are stored as an array.Each new data obtained from ardiouno is appended to corresponding devices array, it keeps on increasing or appending until the devise is turned on. then the total summery of each devise is displayed to the user through our application .Each data have an indexed value corresponding to a device.this indexed value indicates the current consumed in that time-span.

this image shows how the actual data are stored in the fire base.as you can see each

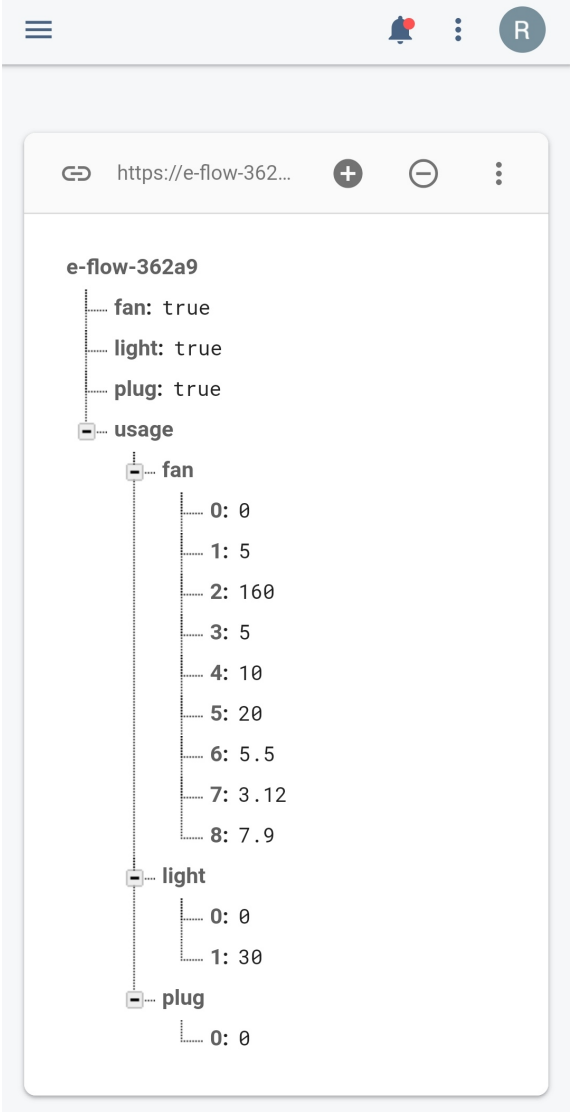

Figure 4.23: Data stored in database as array

equipment have their own array .each array has their on index.these data will be lost in a certain period set by the user .these last data can be stored in their respective devises.this happen due to the huge amount of data that are being retrieved from respected equipment.

As in the image you can see that the data are added together and the total power consumed by each equipment are shown.each new data which are appended to the equipment are added to the previous total amount. since we're using real time data the append data is added to previous data and shown to the user simultaneously.

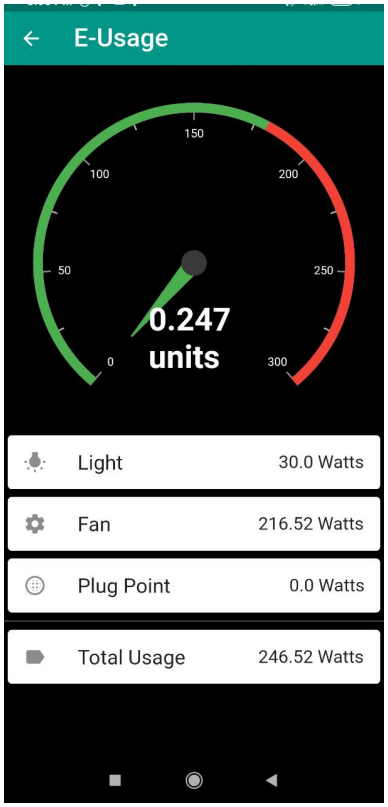

Figure 4.24: Data shown in mobile application

4.3 FIREBASE SECURITY RULES

Firebase Security Rules Use our flexible, extensible Rules to secure the data in Cloud Firestore, Firebase Realtime Database, and Cloud Storage.Firebase Security Rules is used to protect data from malicious users. we write simple and complex rules that protect the app's data .Firebase Security Rules are used to specify what data the users can access for Realtime Database, Cloud Firestore, and Cloud Storage. We have used the rule that allows access to all users registered in our app.

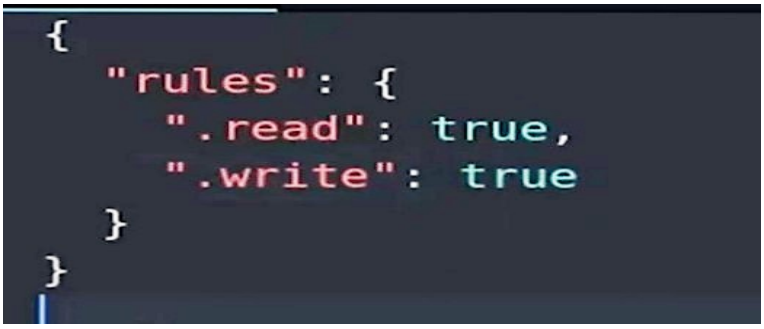

Figure 4.25: Firebase security rules

CHAPTER 5

RESULT AND ANALYSIS

5.1 RESULT

After implementing the system,we were able to obtain the output succesfully.Both controlling as well as monitoring was perfectly synced with the devices.The updation and the corresponding proper outputs are obtained in real time. The result can be divided into two parts based on the operation done by the system

5.1.1 MONITORING

The readings from all the electronics equipment which are connected to it were displayed in the mobile application accurately. The energy used by each equipment's are stored and displayed to the user. The user can manage their electricity consumption by analysing the usage.The system update data in real time and it will reflect simultaneously in the server and mobile app. The accurate data from the device is obtained and can be easily understood by the simple UI provided by the application.

5.1.2 CONTROLLING

The user was able to control each device connected to the system.It was able to turn on and off the device without fail multiple times. The application will be the master key to each device. If the master key is off they can't turn on the devise manually. The controlling from different locations were perfectly obtained.

5.2 ANALYSIS

Through this application the term electricity crisis is reduced to macroscopic level. The world we know would be in a much better organised in electricity field. Through this application one could control their electronic equipment electricity consumption and also they could reduce their unknown wastage of electricity to minimum.This application globally could reduce earths electricity wastage or electricity crisis up to 5 percent. Further more this system could be given to the state govt or central govt so that this facility could be obtained by the local natives.

CHAPTER 6

CONCLUSION

In this paper, we describe the design and development of a home power and energy management system with mobile interface for managing and controlling power in the home. This energy and power management system provides management solution for users to effectively monitor, control, and regulate the amount of power and energy usage in the home more easily and efficiently via mobile application software. Through the proposed system, users can know their energy consumption pattern, reduce their energy costs, lower the overall impact on demand, and enhanced energy management services. The system can offer a reliable solution for energy management system for users in a home. It is also recognized that having the ability to remotely monitor and control user energy and power consumption introduces issues of security and privacy.

The current system does not have adequate security measures to protect the user from unknown threats, and this will be explored in the extension work. The power consumption can be displayed in different time scales of each device and comparison among different devices like real-time, daily, monthly, yearly graph as well as statistical history upon user desires.

In the future, more details on the charges calculation and analysis for the user assessment should be considered. We should provide users to setup a threshold like the maximum power consumption for a desired electric device or each room and when the power consumption is over than the limit value, system will send notification to the users.

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