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Distributed Energy Monitoring System for Smart Homes

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Abstract: ***In this technology savvy world, IoT and smart homes have been emerging technologies. There is no smart home without IoT. All electronic gadgets used in a home are made smarter by connecting them to the internet using IoT. All manufactures are designing their next generation devices with additional hardware which helps connecting the device to WIFI. These additional hardware's are either used to remotely control or monitor the device and implementing distributed monitoring system for a smart home. It monitors the power consumption of every electrical device at uniform interim of time. This data makes us conscious on the amount of electricity being consumed, which in turn leads to a ecofriendly life.***
Index Terms: IoT, AWS services

I. INTRODUCTION

Includes the control, consumption, and automation of home appliances utilize the Internet of Things. This project is to provide the consumer with a system that will provide the complete power consumption of the appliances used. This system will also include home automation applications. When-ever there is a growth in the consumption of power by any of the home appliances, the system will keep a track of it. The success of this project is, it will provide the user with a complete overview of his power consumption. The current idea of the project "Power Consumption Monitoring And Home Automation Using IoT" labels the issues encountered by both the consumers and the distribution companies. Home automation system is growing apace, within which they supply comfort, convenience, quality of life and security for residents. Nowadays, most of the house automation system that provides facilities for aged and disabled folks and that they scale back the human labor within the production of services and goods. This self-operating system may be designed and developed by employing a single controller that has the power to manage and monitor completely different interconnected appliances like power plugs, lights, temperature and humidity sensors, smoke, gas and hearth detectors yet as emergency and security systems. One of the Enormous benefits of the home automation system is that it can be controlled and operated easily from an array of devices such as smartphones, tablets, desktop, and laptop. The boom of wireless technologies influences us to use smartphones to remotely control and monitor home appliances around the world. Various home automation systems use smartphones to liaise with microcontrollers using different wireless communication techniques such as Bluetooth, GSM, ZigBee, Wi-Fi. Smartphone apps are used to get connected to the internet so that permitted users can modify the settings of a system on their own devices. Different types automation sys-tems provide a extensive range of functionalities and services, some of the familiar features are devices control, thermostat control,Light remote control, live video monitoring, monitor security camera, instantaneous text alerts.

Power saving and consumption using IOT are based on building automation for a home called smart home which

A. MongoDB Atlas

MongoDB Atlas is a fully-managed cloud database devel-oped by the same people that build MongoDB. Atlas handles all the complexity of deploying, managing, and healing your deployments on the cloud service provider of your choice (AWS, Azure, and GCP). Atlas is a battle-tested database-as-a-service platform (DBaaS) artfully designed and built by the same team that created and continues to nurture and grow MongoDB. It provides all of the features of its database counterpart, without the operation and heavy lifting normally required when building new applications, letting you focus on what you do best. One of the most convenient parts about MongoDB Atlas is that it is available on-demand through a pay-as-you-go model. Its features a minimalistic interface that makes it dead simple to get up and running. Atlas will provision the instance accordingly and provide you with the following: -

1) *Automated Security Features:* MongoDB Atlas makes sure you know who's got eyes on your data and helps you keep all others out.
2) *Built-In Replication:* Their platform provides you with multiple servers for always-on availability, to make sure you're up, even when your primary master is down.
3) *Backups and Point-In-Time Recovery:* MongoDB Atlas' system makes strong efforts to protect against data corruption, intentional or not.
4) *Fine-Grained Monitoring:* You'll have a ton of info, organized in many ways, to help you recognize when it's time to take things to the next level.

5) *Automated Patching and One-Click Upgrades:* You get to take advantage of the latest and greatest MongoDB features as they come out, with MongoDB Atlas' automated patching and one-click upgrades for new major versions of the database.
6) *Options for Complementary Tools:* You get to choose things like which regions and billing options you'd like to use, making your instance really feel like your own creation.

B. MongoDB Stitch

MongoDB Stitch is a serverless platform that enables de-velopers to quickly build applications without having to set up server infrastructure. Stitch is built on top of MongoDB Atlas, automatically integrating the connection to your database. You can connect to Stitch through the Stitch Client SDKs, which are available for many of the platforms that you develop for including JavaScript, iOS, and Android. Stitch lets you read and write the data you've stored in MongoDB Atlas from a serverless function or directly in your client application code. A secure, role-based rules engine ensures that your users can only read and change the data that you want them to.

II. PROBLEM STATEMENT AND PROPOSED SOLUTION

Centralized monitoring of the power supply system enables monitoring of the operation of all devices in the system, using the same user application. In addition to monitoring of individual devices operation, the operation of passive elements, which together with the power electronics devices constitute the power system, is also monitored.

A. Problem Statement

In any Home people are not concerned about how much electricity is being consumed by each of the devices. Getting to know this helps to analyze which device consumes more electricity, hence creates more awareness about how they can save electricity.

B. Objectives of project

We propose distributed monitoring system for a smart home. It monitors the power consumption of every electrical device at regular intervals. This data makes us conscious on the amount of electricity being consumed, which in turn leads to a eco-friendly life.

C. Proposed Solution

In this technology savvy world, IoT and smart homes have been emerging technologies. There is no smart home without IoT. All electronic gadgets used in a home are made smarter by connecting them to the internet using IoT. All manufactures are designing their next generation devices with additional hardware which helps connecting the device to WIFI. These additional hardware's are either used to remotely control or monitor the device. We propose distributed monitoring system for a smart home. It monitors the power consumption of every electrical device at regular intervals. This data makes us conscious on the amount of electricity being consumed, which in turn leads to a eco-friendly life. The components used in this system are as follows:

1) *Arduino UNO:* Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and micro-controller kits for building digital devices. So the received value from the RF Receiver is being calculated with the help of Arduino and then computed value is being sent to the MongoDB database.
2) *HC-05 Bluetooth Module:* The HC-05 is a very cool module which can add two-way (full-duplex) wireless func-tionality to your projects. You can use this module to com-municate between two microcontrollers like Arduino or com-municate with any device with Bluetooth functionality like a Phone or Laptop. There are many android applications that are already available which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rates hence it is easy to interface with any microcontroller that supports USART. We can also configure the default values of the module by using the command mode. So, if you looking for a Wireless module that could transfer data from your computer or mobile phone to microcontroller or vice versa.
3) *Channel Relay Breakout:* The 4 Channel Relay Break-out is an easy way to use your Arduino, Raspberry Pi, or other microcontroller to switch high voltages and high current loads. The board is both 3.3V and 5V logic compatible and uses 4 digital outputs to control 4 individual relays. Each relay has the common, normally open, and normally closed pin broken out to a convenient 5.0mm pitch screw terminal.
4) *MongoDB Atlas:* MongoDB Atlas is a fully-managed cloud database developed by the same people that build MongoDB. Atlas handles all the complexity of deploying, managing, and healing your deployments on the cloud service provider of your choice (AWS, Azure, and GCP).

D. System Requirements

1) Software Tools

Android Studio
Amazon Web Service Arduino Software

2) Hardware Tools

Arduino UNO
HC-05 Bluetooth Module 4 Channel Relay
Jumper wires
LED/FAN/BULB

III. LITERATURE SURVEY

In this literature, many different related approaches to our paper exits.

A. Power Consumption Pattern and PLC Based Monitoring

Describing the usage of all devices which are used in smart home can be used as a method for determining an person activities of daily living. A power consumption pattern for individual devices which plays a important role in non-intrusive load monitoring systems.This is a different behaviour of individual devices while it is functioning.This paper suggest a characteristics model, using the real power and reactive power as property to narrate the power consumption pattern of independent devices.The outcome of this propsed system is to achieve 100% classification accuracy by using Mahalanobis distance.[1]

A PLC based renewable energy gateway which helps in monitoring the energy generation.The server which gathers energy that is being consumed by all devices and analyze them to reduce the cost. The server which aggregates all the energy data from numerous system and compares then generates a statistical information.The HEMS architecture is expected to reduce the home energy use and result in saving of home energy cost.[2]

B. Power Consumption Based on Zigbee Technology

Taking into mind the disadvantage of smart home on wiring, maintainability and mobility, a scheme for remote monitoring of smart home is being implemented based on ARM and ZigBee technology. Developing a home network based on ZigBee Technology, and then gateway is developed with S3C6410 which Linux operating system is embedded, using TD-LTE wireless terminal system as external network, so that the user could see the scene of the environment. The real-time monitoring data is more accurate by using Ultra-low power consumption and Arm11 processor. The system is widely used to monitor the environmental data of hospitals, factories and other places. It has good development prospects.[3]

Consumption of power be likely to grow in the large number of electric home appliances. An embedded system without any new additional wiring has been develop mainly for home power management. By using PLC technology, electronic devices can be managed and watched over a domestic power lines. We relate a PPCOM (PLC Power-Controlled Outlet Module) which combines many AC power sockets, the power measuring module, the PLC module and a micro controller into a power vent to toggle the power of the sockets to on/off and to calculate the power consumption of plugged-in electric devices. We have also defined an embedded home server which brace the Web user interaction by allowing the user to control easily and watch the electric devices by means of the network. In addition, the field experiments reported have exhibit that our model can be practically implemented and provides sufficient results.[6]

C. Home Electric Energy Saving Based on SVM(Support Vector Machine) Method

This paper deals with, a smart home power saving system is implemented by combining some of the devices such as smart meter, smart plug, smart mobile devices, and database server. The smart meter which contains a power metering unit, a data storage unit, a meter interface unit and a ZigBee module. The smart plug is collection of a core control unit and a remote monitoring. Users can use smart phone to check and control the operation of appliance, the power consumption information can be monitored anywhere by connecting smart plug to the Ethernet along Wi-Fi media. Apart from this, the main charac-teristics in the database server can be used to identify appliance operation mode by Support Vector Machines (SVM) method, which makes an successful message for home electric energy saving application. Finally, a first version of this module was built up and tested, the test results validate the feasibility of the proposed smart home electricity saving system.[5]

The most important challenging now a days is Energy saving. The combination of these components such as the Arduino, WIFI and GSM Short Message Service (SMS) helps the system as Smart Power Monitoring system. Smart power meter helps the data for optimization and lower the power con-sumption. This system helps in communicating with embedded controller and GSM modem for transmitting of data.This system which includes a motion sensor such that if there is no human in the place or house it will automatically trip the power supply so this helps in lesser power consumption.[4]

D. HEMS for Power line Communication

This paper tells us about Home Energy Management System (HEMS) which deals with power line communication. We are implementing a HEMS which can provide a easy available information on home energy consumption in real time system, intelligent planning for controlling appliances, and fine tuning of power consumption at home. This consists of 3 modules: an advance power control planning engine, a device control function, and a power resource management server. Our model system reduces the cost of power consumption by about 10%.[7]

This paper deals about an energy saving device like Surveil-lance and Control system which is based on IOT.A large amount of energy is being consumed by lighting devices, so making upgraded efficiency and quick fault detection is a important challenge.In this work, two different model methods is followed based on the nature of application.The first model is for small areas or certain premises, IEEE 802.11 wireless technology is used where all the devices are connected to a single Wi-Fi network.In the second model like street lamp pole where number of devices moves only in single direction, wired configuration is used to avoid range issue.[8]

E. Iot Based Home Power Management

The project which deals with a cloud platform of smart home power management using the Internet of Things (IoTs) sensor technology. Taking edge of the IoTs technology and the benefits of mobile phone, this platform can facilitate users to manage household related electric devices and home ser-vices and provide a better suggestion for power consumption management based on the users' behaviors and habits.[9]

A home server is an combined system for communication, broadcast, game, media center. The home server should be turned on for 24hr a day because it plays a vital role of network hub, multimedia contents server, and home automation con-troller. It is necessary to reduce the power consumption of the home server in order to lower the functional cost. This paper which deals with the service oriented power management where the services are divided into blocks for classifying its resources.[10]

F. Using Home Server as a Platform for Power Consumption

This paper deals with a new scheme of the home server platform for offering home digital services by connecting home network and the Internet.

The proposed system is an combined form of a home multimedia server, a home control server, and a home information server. The proposed system has an associate between access networks and home networks. We have developed the proposed home server architecture, and prove that the system can be a main device of the home digital service environments.[11]

With the recent growth in the use of internet and cheaper components, large number of Home automation system with IOT capacity are in high demand.

Home automation system design comprises of a gateway with UI capabilities, this exper-iment demonstrates that the proposed gateway work efficiently by transferring instructions from different protocols, a Graph-ical User Interface (GUI) which allows user to communicate with the context environment settings.[12]

G. Dynamic distributed Power Management System

They had developed an adaptive classification scheme(ACS) to differentiate power source type and automation sensor in smart homes, and had a propose of Dynamic distributed power management system.This can try reducing the power consump-tion and extends operation life of home sensor networks.[13]

This paper deals with a new architecture for home network systems. The system architecture makes it possible to provide absolute integration management and cooperative control for all types of network devices (e.g. AV, CE, residential facilities). Therefore, home network systems based on this new archi-tecture will allow users to improve their living environment thus by saving the power which is being consumed by each devices.[14]

IV. ARCHITECTURE AND DESIGN

A. System Overview

The schematic overview of our Smart Home system as shown in the Figure 4.1 comprises of four major units, electrical devices, Bluetooth module, server and user appli-cation. Here the user operates all the devices with the help of Bluetooth module such as On/Off and monitors the power consumed by each device. The consumed data is stored in the backend database.

In the above distributed architecture we can choose the devices which everyone wants to control and monitor its power consumption. Thus it makes controller aware of power consumed by each devices which are connected to IoT. This system sends and collect power consumption data through IoT and stores it in the MongoDB Atlas database.The household power is controlled through this system, users can accurately track their power which is being consumed,so by that they can reduce unnecessary power wastes.Further they receive reminders that in-turn helps us in reducing power consumption by checking out which device is consuming high voltage current and that device can be turned off.

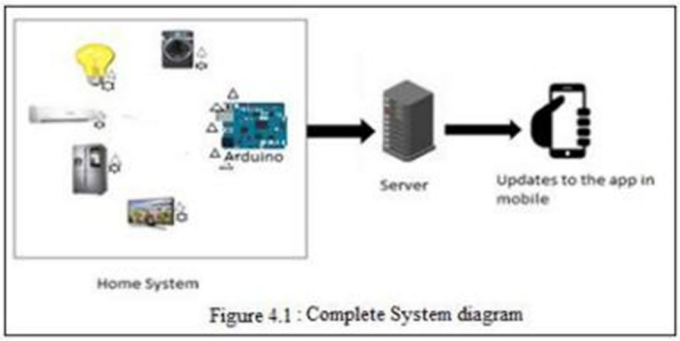


Figure 4.1 : Complete System diagram

B. Software Architecture

Block Diagram

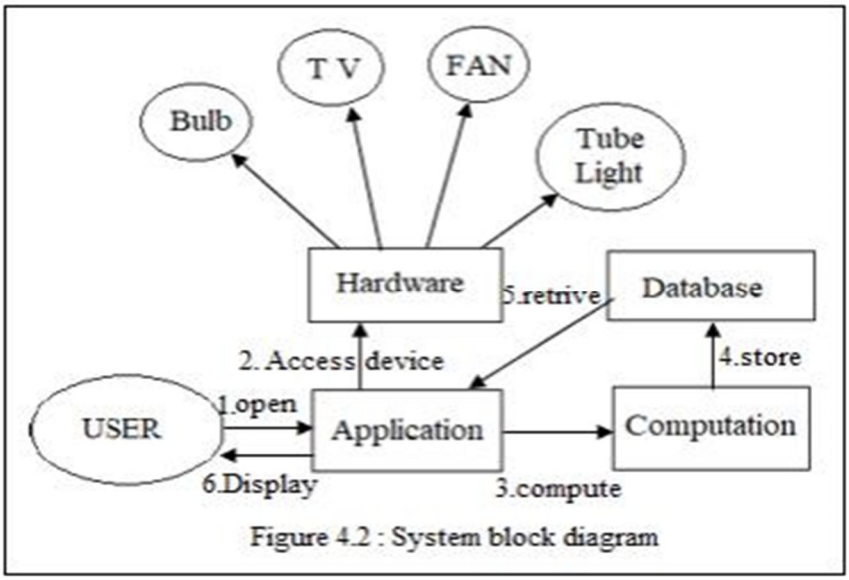


Figure 4.2 : System block diagram

The overall block diagram of the proposed system is shown in the Fig 4.2.

1) User opens the Mobile Application.
2) Communicates to electronic devices through hardware components.
3) The received value is computed.
4) The final result is stored in Database.
5) The value is retrieved from database and displayed in User mobile application.

C. Circuit Diagram

The complete hardware setup has been showing the Figure 4.3. So, this setup will help to control the electrical devices via a Bluetooth. If the user to connecting to the for the first time, it will ask the user to enter the password. Enter (0000 or 1234).

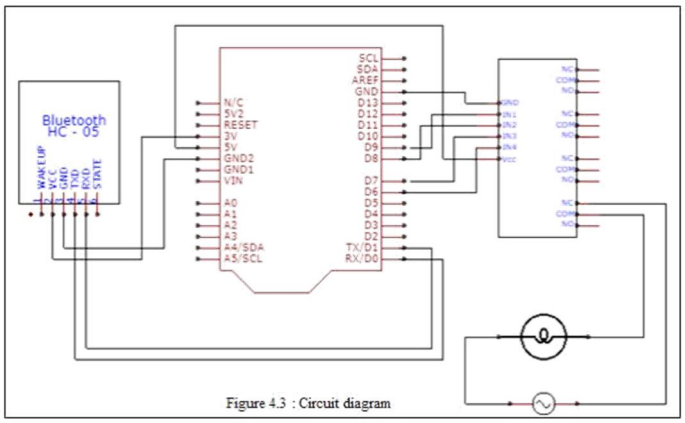


Figure 4.3 : Circuit diagram

Data Flow Diagram

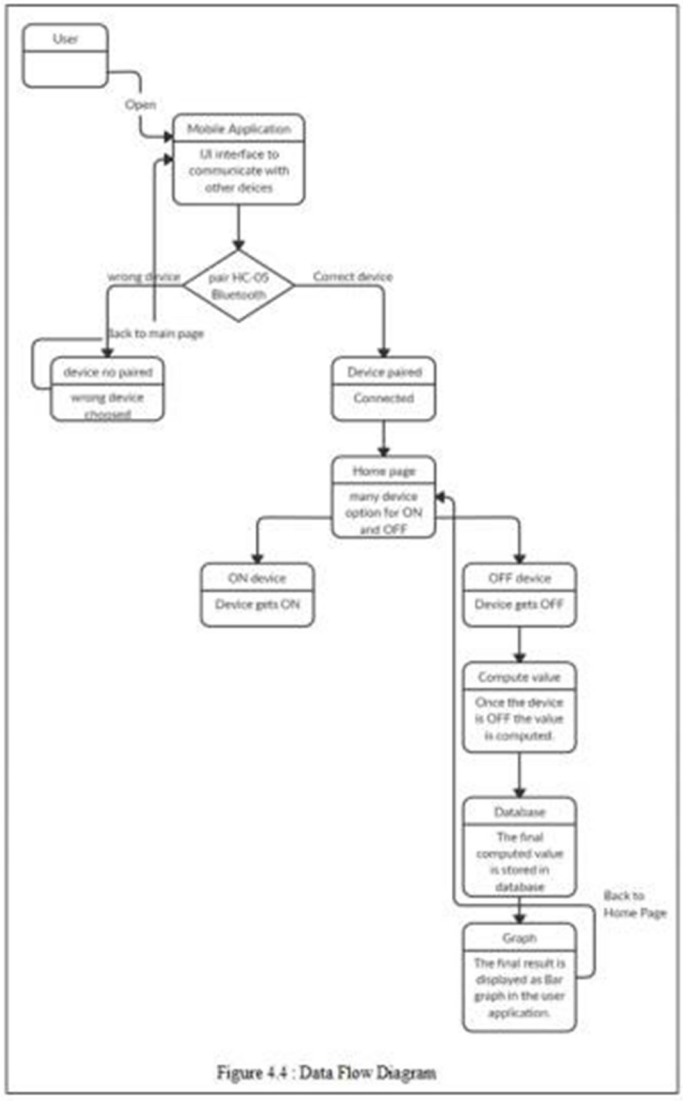


Figure 4.4 : Data Flow Diagram

A data flow diagram (DFD) is a graphical representation of the flow of data through an information system. A DFD gives the preliminary overview of the system without going into great detail. Fig.4.4 represents the DFD of our proposed system. The flow of the system is as follows:

1) User access to the mobile application.
2) Pair with HC-05 Bluetooth device.
3) Once the device is paired, it goes to the Home page.
4) The user now can communicate with electrical device such as ON/OFF.
5) Retrieved time value is computed to find power consump-tion.
6) The final result is stored in MongoDB atlas database.
7) Value is retrieved and plotted displayed as graph to the user mobile application.

V. IMPLEMENTATION

A. Implementation Platform

1) Hardware
a) Processor: Intel i5 core
b) RAM: 8 GB
c) GPU: NVIDIA GTX 1050
2) Software
a) Operating System: Windows 8 or above(64-bits)
b) Programming Language: JAVA and C program
c) IDE: Android Studio and Arduino. Database: MongoDB Atlas

The above requirements were satisfied by the use of Android Studio IDE where the training could be done on an instance that matches the necessary requirements as mentioned above.

B. Implementation Steps

User has to follow the circuit diagram as mentioned in the Figure 4.3 for establishing communication between external devices and user application.
Develop an C program to communicate with External electrical devices using Arduino IDE.
Develop an application that can interact with Arduino using android studio.
Connect to backend MongoDB Atlas database for storing of each information.

C. Steps to Connect App to MongoDB Atlas

1) Create an Atlas Account.
a) Click Sign up with Google
b) Enter one of the following identifiers for your Google account:
i) your Gmail or Google Apps email address
ii) the phone number associated with your Google account.
c) Click Next.
d) Enter the password for your Google account.
e) Click Next.
f) Review and select the checkbox to accept the Terms of Service and the Privacy Policy.
g) Click Submit.

2) Log into Atlas.
a) Click on Build a Cluster.
b) Select starter cluster and click Create a Cluster.
c) Select your preferred Cloud Provider and Region.
d) Select M0 sandbox for cluster tier.
e) Enter a name for your cluster in the Cluster name field.
f) Click create cluster to deploy the cluster.

3) Whitelist Your Connection IP Address.

a) Open the connect dialog.
b) Configure your whitelist entry.
c) Click Add IP Address.

4) Add Database user to your cluster.

a) Open the connect Dialog.
b) In the create a MongoDB User step of the dialog, enter Username and a Password for your database user.
c) Click Create MongoDB User.

5) Connect to your Cluster.

Add a Stitch App.

a) In Atlas, click Stitch Apps in the left-hand navigation.
b) Click the Create New Application.
c) In the Create a new application dialog, enter an Appli-cation Name for your Stitch app.
d) Select a cluster in your project in your project from the Link to Cluster dropdown. Stitch will automatically create a MongoDB service that is linked to this cluster.
e) Enter a name for the service that Stitch will create in the Stitch Service Name field.
f) Select a deployment model and deployment region for your application.
g) Click Create.

VI. EXPERIMENT AND RESULTS

A. Complete Hardware Setup

User has to follow the instructions as provided in the Figure 4.3 and setup the connections. Once the connections are being done, test for the system for any loose wire connections.

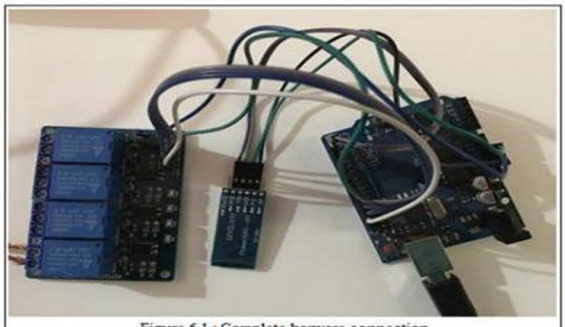


Figure 6.1 : Complete harware connection

B. Complete Work Setup

User mobile application and working hardware setup is shown in the Figure 6.2. So, now the user can operate the electrical devices remotely with help of application and monitor the power consumed by each devices.

Figure 6.2 : Smart Home device Setup

C. Application requesting to Enable Bluetooth and pair de-vices.

To connect Bluetooth device, first user has to allow the Bluetooth permissions as shown in the Figure 6.3. once the Bluetooth is turned on, the user can see the list of Bluetooth devices that are available and can choose the preferred one (HC - 05) as displayed in the Figure 6.4.

Figure 6.3 : Bluetooth setup

Figure 6.4 : Pair device

D. Application Home Page

Once the Bluetooth device is paired, the application then navigates to the Home page where the user can view the devices that are available as shown in the Figure 6.5. Now the user can operate those devices remotely like On/Off based on their needs. Whenever user need to disconnect the device, then he can click on the “Disconnect Pairing”.

If the user is trying to connect for wrong Bluetooth device then it shows an error message as mentioned in the Figure 6.16.

Figure 6.5 : Home page

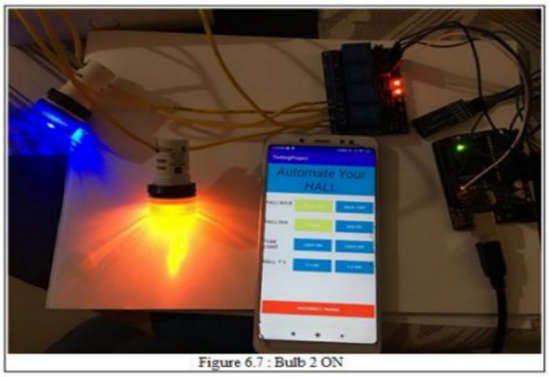


Figure 6.7 : Bulb 2 ON

Here we are controlling electrical devices (On/Off) with the help of Bluetooth HC-05.

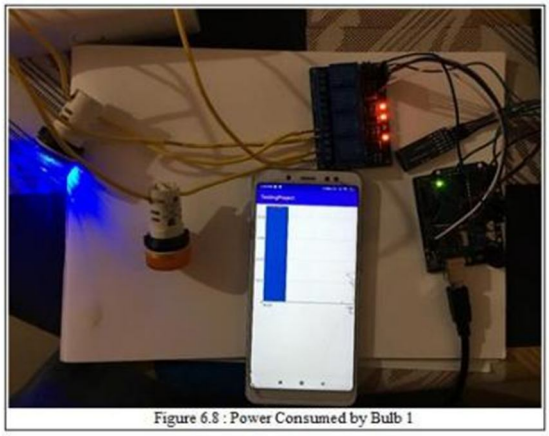


Figure 6.8 : Power Consumed by Bulb 1

E. Project Work Flow.

With the help of mobile application, we are able to operate external devices such as Bulb, fan etc. as shown in the Figure 6.6. When the 'ON' button is clicked the device gets on and vice versa.

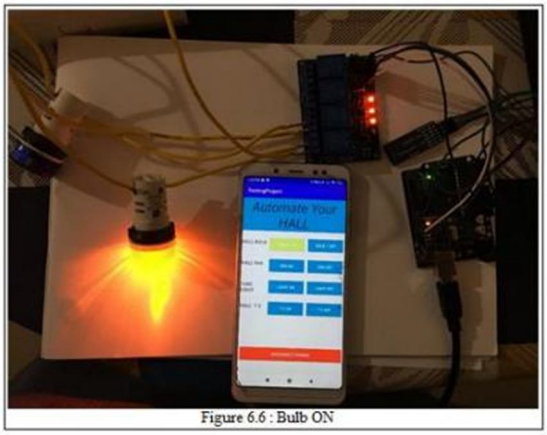


Figure 6.6 : Bulb ON

We can now monitor the power consumed by each device that is shown in the Figure 6.8 and 6.9. The sum of each result is being calculated and represented in form of Bar chart. So, now the user can reduce the wastage of power consumed by each device by monitoring regularly.

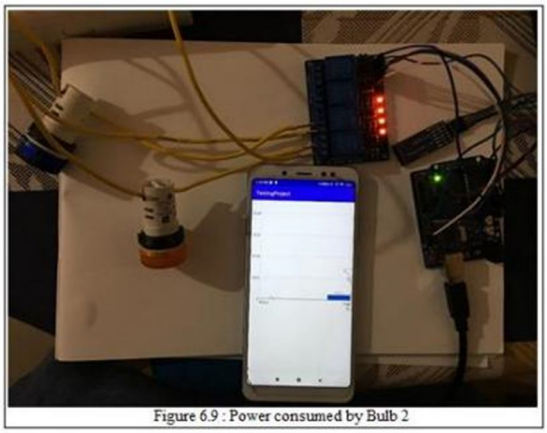


Figure 6.9 : Power consumed by Bulb 2

The Graph is displayed once the devices are being Off. The power consumed by each device is calculated based on: (1 joule per sec * watts * Minutes * 60) / 24hrs.


Figure 6.10 : MongoDb Atlas Database

Once the Energy is calculated in Kilowatt-hour (kW h), the value is stored in MongoDB Atlas Database as shown in Figure 6.10.
Follows the steps mentioned above in section 5.3 for connecting MongoDB to your mobile application
The value is retrieved from MongoDB database and displayed as bar chart onto the user mobile application as shown in Figure 6.11.

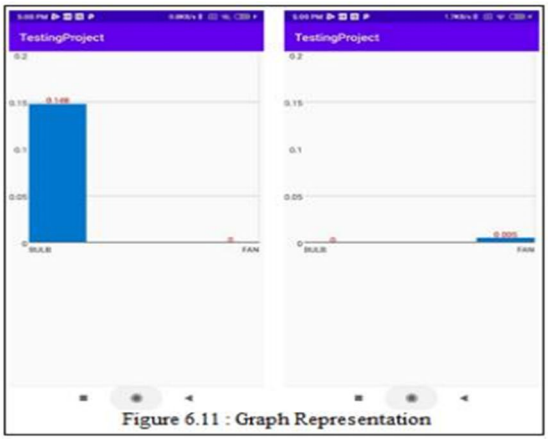


Figure 6.11 : Graph Representation

VII. TEST CASE

1) *Test Case 1:* As per below figure bulbs of 30W placed on the bulb board. As power supply of the system turns on then current starts flowing. When bulb is switch on for 3 min then value is,

a) Predefined value = 30 watt.
b) Time bulb is ON:6 min.
c) Final computed value: 0.003 kW h.

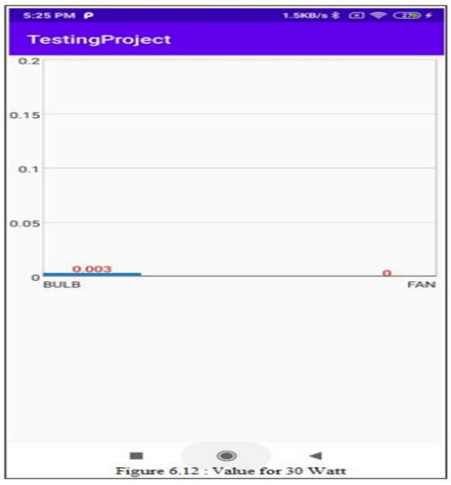


Figure 6.12 : Value for 30 Watt

2) *Test Case 2:* As per below figure bulbs of 30W placed on the bulb board. As power supply of the system turns on then current starts flowing. When bulb is switch on for 3 min then value is,

a) Predefined value = 300 watt.

b) Time bulb is ON:0 min.

c) Final computed value: 0.01 kW h.

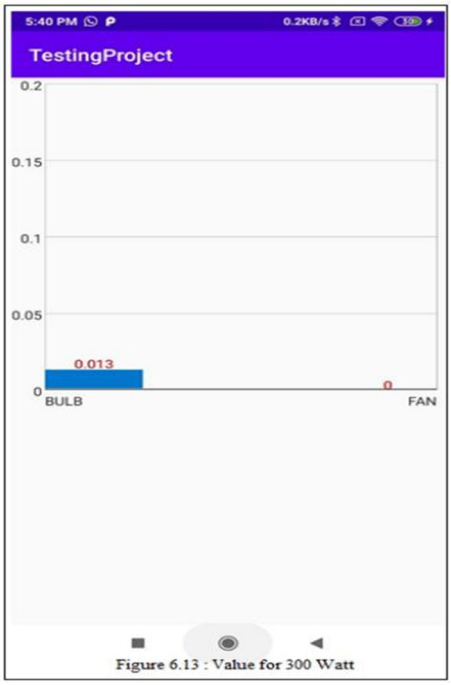


Figure 6.13 : Value for 300 Watt

3) *Test Case 3:* A person trying to communicate with electrical device far from 200 meters.

Figure 6.14 : Connectivity Fail

The Bluetooth Connectivity fails if the device is 10 meters far away. So, this is the main failure that occurs when the user is trying to connect from far distance as mentioned in above figure 6.14.

VIII. CONCLUSION

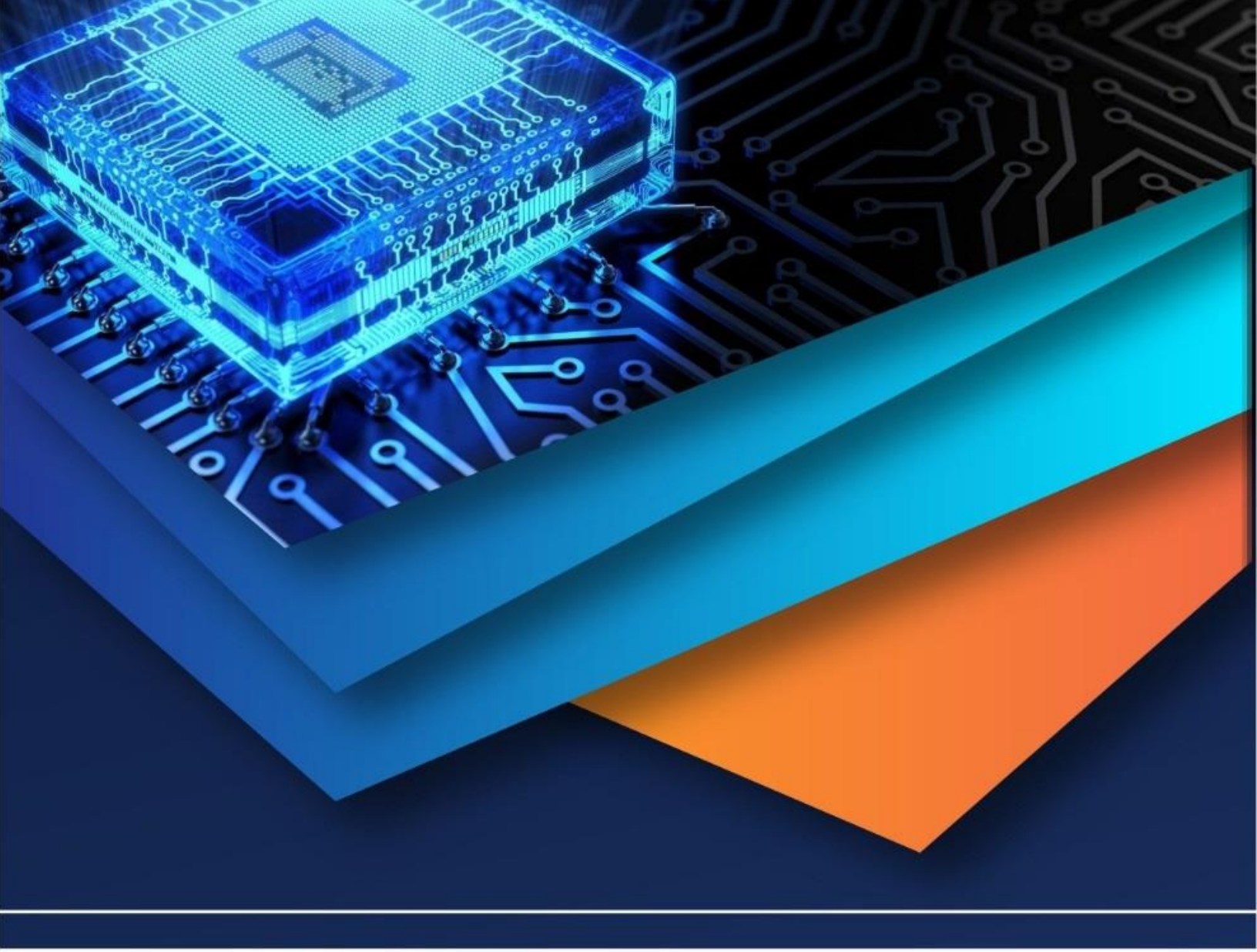
In the above distributed architecture, we can choose the devices which everyone wants to control and monitor its power consumption. Thus, it makes controller aware of power consumed by each device which are connected to IoT. This system sends and collect power consumption data through IoT and stores it in the AWS cloud. This cloud platform can analyse past power usage data and further provide power usage suggestions. The household power is controlled through this system, users can accurately track their power which is being consumed, so by that they can reduce unnecessary power wastes. Further they receive reminders that in-turn helps us in reducing power consumption by checking out which device is consuming high voltage current and that device can be turned off. In feature, performance of the distributed system and centralized system has to be evaluated.

A. Future Work

The power monitoring system will be implemented with the help of WIFI module. So, the user can remotely control from any place and can view the amount of the energy that is consumed by each device can also be monitored. The backend will be changed with better serverless service provided by AWS for faster retrieval of data. Then GUI of mobile application will be enhanced.

REFERENCES

[1] Saba Rahimi, Student Member, IEEE, Adrian D. C. Chan, Senior Mem-ber, IEEE, and Rafik A. Goubran, Senior Member, IEEE(2011). Addison-Wesley, Reading, Massachusetts, 1993.Usage Monitoring of Electrical Devices in a Smart Home.
[2] Jinsoo Han, Chang-Sic Choi, Wan-Ki Park, Ilwoo Lee, and Sang-Ha Kim IEEE(2014). Smart Home Energy Management System Including Renewable Energy Based on ZigBee and PLC.
[3] Qi Wang Yunliang Wang.Design and implementation of smart home remote monitoring system based on ARM11.
[4] 2019 5th International Conference on Advanced Computing Communi-cation Systems (ICACCS 2019).Smart Power Monitoring System Using Iot.
[5] Design and Implementation of a Smart Home Energy Saving System with Active Loading Feature Identification and Power Management.C.M. Lin(EE dept),M.T. Chen(EE dept).
[6] Power Monitoring and Control for Electric Home Appliances Based on Power Line Communication. Chia-Hung Lien, Hsien-Chung Chen, Ying-Wen Bai, and Ming-Bo Lin
[7] Home Energy Management System based on Power Line Communica-tion.(2010) Young-Sung Son, Topi Pulkkinen, Kyeong-Deok Moon and Chaekyu Kim.
[8] IOT based Electrical Device Surveillance and Control System. Alok Kumar Gupta Rahul Johari swinger@ipu.ac.in.
[9] The Implementation of Smart Home Power Management: Integration of Internet of Things and Cloud Computing.(2019) Tsung-Chih Hsiao, Tzer-Long Chen, Tsan-Ching Kang, and Ting-Yuan Wu.
[10] Service-Oriented Power Management for an Integrated Multi-Function Home Server. Jinsoo Han, Intark Han, Kwang-Roh Park Home Network Group, ETRI, Daejeon, Korea.
[11] Home Server for Home Digital Service Environments. Changseok Bae, Jinho Yoo, Kyuchang Kang, Yoonsik Choe, and Jeunwoo Lee .
[12] Enabling IoT Services Using WIFI - ZIGBEE Gateway For a Home Automation System(2015).Vivek G.V, Sunil M.P.
[13] The New Architecture that realizes seamless connectivity and coopera-tive control for Home Network Systems. Teppei Shibata, Kazuya Ogawa, Hiroshi Takemura and Yoshinori Hatayama Digital Systems Development Center, Technology RD Headquarters SANYO Electric Co., Ltd.
[14] A Dynamic Distributed Energy Management Algorithm of Home sen-sor Network for Home automation system.(2016),Tui-Yi Yang,Chu-Sing Yang,Tien-Wen Sung.



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