International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 06 | June -2017 www.irjet.net p-ISSN: 2395-0072

A REAL-TIME IOT IMPLEMENTATION FOR EFFICIENT ENERGY CONSUMPTION

[1]J.Surya predeepa , [2]Dr.R.Perumalraja,

PG student[1] , Professor & Head [2]
[1,2]Department of Information and Technology,
Velammal College of Engineering & Technology, Madurai

Abstract-*In this modern era, electricity is very important to support our daily life. But today most of the people suffer due to increasing electricity bill. The existing utility system only provides feedback at the end of the month in the form of bill. So we can't identify which device consumes more energy. In this paper we have proposed an effective implementation of internet of things (IoT) used for efficient power consumption which in turn reduces the electricity bill gradually. All electronic appliances in home/office continuously report their usage patterns and energy consumed to the server via microcontrollers. A mobile app is designed to trigger an alarm whenever the user consumes more power through any electronic device and the user is able to continuously monitor the power consumption and charge of every device connected. Fuzzy concept is used to design a predictive model for every device that controls the device being over used. User is always kept alerted of power consumption through every device. This leads to a efficient power consumption and reduced current bills.*

Keywords: Internet of Things, energy efficiency, usage pattern, mobile application, fuzzy concept.

1. INTRODUCTION

Electricity consumption by households is largely affected by household income and appliances owned. Electricity bill is a recurrent monthly expenditure for households and the demand for electricity to residential consumers is generally inelastic. However, the percentage of household income spent on energy is one of the indicators of energy poverty. [5]. Energy consumption varies for commercial building due to several factors such as electrical appliance usage, electrical appliance type, management, etc. Due to the advancement in technology, there are new emergence appliances that are of high efficiency and have less energy consumption. Energy saving is of great important instead of its wastage, as utilizing the energy efficiently reduces the cost of energy [6]. Several electronic appliances in home/office, they consume lots of energy. So it increases the electricity bill. One way of reducing these costs is to monitor, in real time, how much power is being consumed and from these data make informed decisions about how to manage the electrical devices being powered. A system that can give users an estimate of how much energy is being, has been, and might be consumed will allow them to adjust their habits and lower the costs.

The systematic electronic monitoring of energy consumption of every electronic appliance in home can be achieved with the help of Internet of things (IoT). Its major contribution is its proposed solution that is based on Arduino MEGA microcontroller. Arduino MEGA microcontroller will capture the information such as time stamp, the energy value consumed(in watts), hours used, number of times the device is switched on in a particular month (that finds how frequently the device is used) and give the values to server through RF transceiver. The measured energy use of individual appliances can be displayed through a mobile app. The mobile app is designed to retrieve the information from the server and also designed in such a way that it should alert the user through an alert message when his tariff plan is about to change due to over energy consumption.

2. METHODOLOGY

Our approach allows user to inexpensively Monitoring energy use and through this system user can easily understand their usage patterns and adopt their behavior to reduce their energy consumption and costs.

- Several electronic appliances are used every day that consumes lot of energy. To enable internet access to all electronic device in home we should attach to them a microcontroller which features Ethernet/WiFi interface and it should be compatible with Arduino MEGA.
- Whenever a new energy event is detected (an electronic device is switched on) the microcontroller in arduino board captures the information such as time stamp, the energy value consumed(in watts), hours used, number of times the device is switched on in a particular month (that finds how frequently the device is used)

- Microcontroller converts the collected information as a JSON (Java Script Object Notation since it is ease for data exchange in any format) and transmits it to the server. Server is responsible to carry out the process of storing the JSON object as a document inside a SQL database. (Note : CouchDB is much better since it itself acts as a HTTP server that supports CRUD operations in JSON objects)

Sample JSON Object for Air Conditioner

"device_id" : "Room 1" "device_type" : "Air Conditioner" "date_time" : "2016-11-04T10:40:54" "consumotuon_time_in_secs" : 4500 "energy_consumption_inWh" : xxx

Units = power consumed in watts * time in secs / 3600000
Units = power consumed in watts * time in hours / 1000
For eg : AC works for 14 hours. During 14 hours compressor works for just 4 hours and fan works for 10 hours
Energy Consumption part 1 (Assume Compressor consumes 1500w) = 1500 * 4/1000 = 6 units
Energy Consumption part 1 (Assume fan consumes 80w) = 80 * 4/1000 = 0.8 units Total units consumed = 6.8 units

1. Mobile app has to be designed in such a way that it should retrieve the information from the server and compute all the above calculations. It should send those information to the user via text message for every single event (every time when a connected device is used)

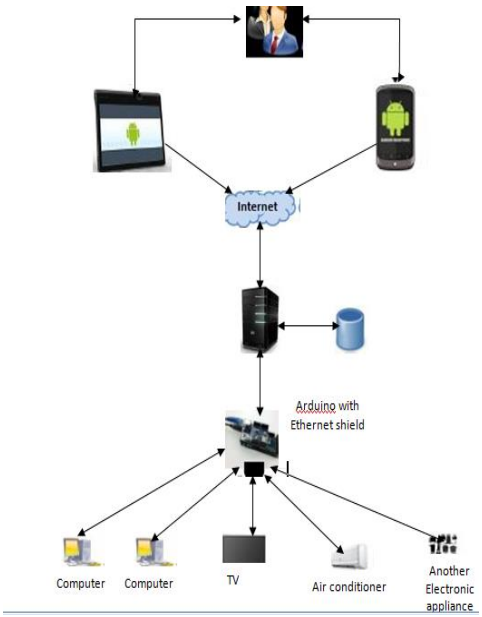

Figure 1 *Design architecture*

2. Now the user is able to view the energy consumed by individual devices. Mobile app should be designed in such a way that it should alert the user through a alert message when his tariff plan is about to change due to over energy consumption.

For eg : If a person is consuming 90 units an alert message is thrown stating that his tariff plan is about to change after 100 units. (after 100 units rupees/unit increases to 6.05 from 5.45 form the very first unit. Similarly for 200 units it goes to 6.75)
So for every tariff change the user is alerted with a message.

3. Fuzzy logic is introduced here to design a predictive model. Based on previous database each device is set to a maximum energy consumption (MEC) value. User is allowed to fix his range of units to be consumed overall.

For eg: if a user is fixing his electricity bill should not exceed more than 5000 then the value of MEC is fixed accordingly. If the device crosses the MEC value, then the user is triggered with an alarm every time when the device is switched on.
This Model allows the customer to manage his power consumption and electricity bills more efficiently.

3. IMPLEMENTATION

The followings are the steps of the implementation of our work.

1. First, we acquire the Arduino board and CT sensor. We program C code to retrieve the energy usage from the appliance device in minute interval. Initially, we tested our system by connected the Arduino board with a PC as an appliance workload to make sure that the C code is performed properly.
2. Second, we programmed Android application to connect to the server that can retrieve data of power consumption from the server and display it on Android system. Also alert the user through an alert message when his tariff plan is about to change due to over energy consumption.
3. Third, the user interfaces on the Android screen are designed and created for the user's needs.
4. Fourth, couch database is designed and created for keeping the historical records of the energy usage for each appliance device.

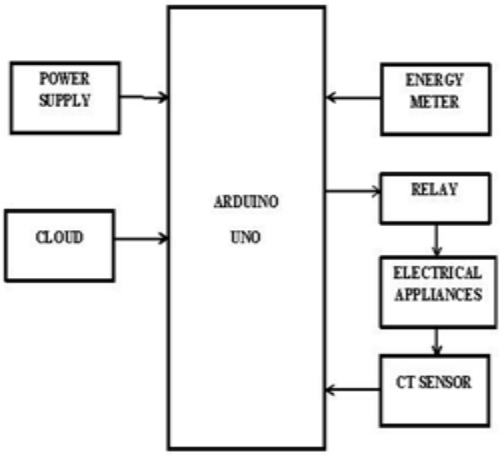

Figure 2 Block diagram of power consumption Monitoring

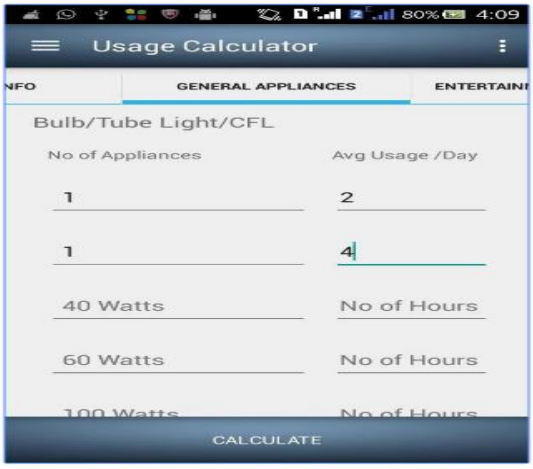

Figure 4 Snapshot of mobile app

Structure of android application

Power consumption monitoring (PCM) application is developed using android studio. The PCM android application consists of each electronic appliance electricity usage details that is how much power consumed and charges calculated for consumed unit of power.

It also consists of alert system whenever the tariff plan changed, it will send the message to the user based on units of electricity usage. Using this application we can retrieve the data stored in server.

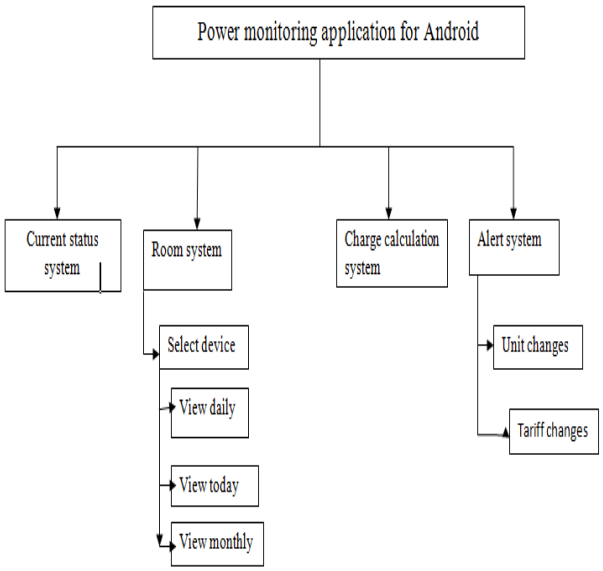

Figure 3 Structure of PCM application

4. CONCLUSION

This paper presents about the development of a system called real time energy consumption monitoring based on IOT. This system consists of two parts. The first part is database store power consumption data recorded by the Arduino MEGA iBoard pro. The second part is an android application used to view and monitor the power consumption of individual electronic appliance at home and their respective cost. It also used for alert the user when the maximum usage of electricity is reached.

ACKNOWLEDGMENT

I would like to pay special thanks, warmth and appreciation to my guide Dr.R.Perumalraja, who made my research successful an assisted me at every point to appreciate my goal.

REFERENCES

[1] Mohammed Abo-Zahhad, Sabah M. Ahmed, Mohammed Farrag, Mohammed F. A.Ahmed and Abdelhay Ali "Design and Implementation of Building Energy Monitoring and Management System based on Wireless Sensor Networks" 978-1 4673-9971-5/15/$31.00 ©2015 IEEE.

[2] Edwin Chobot, Daniel Newby, Renee Chandler, Nusaybah Abu-Mulaweh, "Design and Implementation of A Wireless Sensor and Actuator Network For Energy Measurement and Control At Home" International Journal of Embedded

Systems and Applications (IJESA) Vol.3, No.1, March 2013.

[3] Abdul Basit, Guftaar Ahmad Sardar Sidhu, Anzar Mahmood, *Member, IEEE*, And Feifei Gao, *Senior Member, IEEE* "Efficient and Autonomous Energy Management Techniques for the Future Smart Homes" IEEE Transactions On Smart Grid.

[4] Alessandro Ghelli, Hani Hagras, *Fellow, IEEE*, and Ghadah Aldabbagh, *Member, IEEE* "A Fuzzy Logic-Based Retrofit System for Enabling Smart Energy-Efficient Electric Cookers" IEEE Transactions on Fuzzy Systems, Vol. 23, No. 6, December 2015.

[5] Chen Li, T. Logenthiran, W. L. Woo, " Development of Mobile Application for Smart Home Energy Management: iSHome" 978-1-5090-0128-6/16/$31.00 ©2016 IEEE.

[6] Abubakar Kabir Aliyu1*, Abba Lawan Bukar2, Jamilu Garba Ringim3, Abubakar Musa "An Approach to Energy Saving and Cost of Energy Reduction Using an Improved Efficient Technology" Open Journal of Energy Efficiency, 2015, 4, 61-68 Published Online December 2015 in SciRes. http://www.scirp.org/journal/ojee http://dx.doi.org/10.4236/ojee.2015.44007.

[7] M. Victoria Moreno_ and Antonio F. Skarmeta "Exploiting IoT-based Sensed Data in Smart Buildings to Model its Energy Consumption" IEEE ICC 2015 SAC - Internet of Things.

[8] O. M. Longe, K. Ouahada, S. Rimer, H. Zhu, H. C. Ferreira "Effective Energy Consumption Scheduling in Smart Homes" 978-1-4799-7498-6/15/$31.00 ©2015 IEEE.

[9] Dariush Shahgoshtasbi, Student Member, *IEEE*, and Mo M. Jamshidi, *Fellow, IEEE* "A New Intelligent Neuro–Fuzzy Paradigm for Energy-Efficient Homes" IEEE Systems Journal, Vol. 8, No. 2, June 2014.

[10] Darshan Iyer N, Dr.K.A.Radhakrishna Rao "IoT Based Electricity Energy Meter Reading, Theft Detection and Disconnection using PLC modem and an optimization" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol.4, Issues 7, July 2015.