IoT Based Energy Consumption Recording & Live Monitoring Application

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Abstract **- The emerging of IoT concept recently in our lives, has offered the chance to establish energy efficient smart devices, systems and cities. Due to the urging need for conserving energy, this paper proposes an IoT based energy efficient wireless smart metering system design. Electricity has become the most essential and unavoidable thing which every human is dependent on. The need to implement smart phones from the point of view of optimal energy consumption and reducing the cost of consuming electricity by subscribers is an important issue. In this paper we present idea to send instantaneous power consumption data to the customers.**

Keywords - Smart energy meter, MQTT Protocol, Automatic billing system.

I. INTRODUCTION

The need to implement smart homes from the point of view of optimal energy consumption and reducing the cost of consuming electricity by subscribers is an important issue. To develop and implement smart power grid applications in a wide range of countries, the need to design smart energy metering infrastructure is required. On the other hand, due to the extensive Internet of Things (IoT) technology and the development of various network connectivity sensors, it is possible to send instantaneous power consumption data to the customers. This can be achieved by designing and building smart hardware systems. Later, home network system will be designed and implemented. This project is a smart electricity billing system which is developed for the effective conservation of electricity and avoid the unnecessary wastage of electricity power as well as the over payment of bills. IoT can be used to furnish intelligent management of energy distribution and consumption in heterogeneous circumstances. In the recent years, by the growth of IoT and digital technologies, smart grid has been become smarter than before. The future power grid needs to be implemented in a distributed topology that can dynamically absorb different energy sources.

II. EXISTING SYSTEM

In the existing system, the electric meter reading is done manually by a electricity board employee. During this process we encounter scenarios such as the meter reading may not be accurate, extra cost on bills will be generated even though we are even out of station. Sometimes electricity board employees may not be able to take proper meter readings due to locked gate, dogs in the house etc. In this system the connection and disconnection of electricity is done manually, at such situations people in the house will take the electricity connection theftly which is loss to the electricity board. In this system, there is no proper information on usage and percentage of electricity used. This is very time consuming, manual and ineffective process.

III. PROPOSED SYSTEM

In this project, we develop smart electricity billing system. This will allow the end user to know on which appliance how much amount of electricity is being consumed daily. Maintenance, refinement and processing of data is done in the network server that maintains the user information in the required data storage. Advanced Metering Infrastructure (AMI) utilizes the smart grid communication infrastructure to transfer metering data as well as customer consumption- related information. Machine learning used here is supervised learning technique, which is implemented using C# language. The data are fetched from those sockets working on IOT and stored in MySQL server. The data stored in server are used as inputs for other sockets and the prediction process is carried out. This process predicts the high electricity consuming appliance and alerts the user.

IV. METHODOLOGY

The proposed IoT based metering system is designed to contribute in establishing energy efficient smart cities. Its main aim is to minimize the rapid increase in average electricity consumption issue & electricity theft. Additionally, it provides a more convenient solution to problems faced from using the existing meters, such as the manual readings' , travel expenses , waste of papers [which leads to cut trees] errors from the analog electromechanical meter. The conventional electromechanically metering system interacts with the cloud to update energy consumption and units consumed automatically Consumer can be updated about consumption from the client portal provided and accessed via browser. It won't make any sense for the consumer to know energy used until the end of the month. However, it guarantees that customers will always have electricity usage and consumption updates. On the other hand, IOT meters offer many advantages both to the utility provider and the consumers. To the utility provider, this reduces many issues tremendously arising from meter readers such as delays, wrong and infrequent meter reading resulting in bulk amount of billing that consumers would need to pay and further consequent in not paying, disputes and so forth.

Additionally, IOT metering system encourages users to control their energy consumption, in order to avoid cut off, due to zero credit. Thus, the proposed metering system uses the IOT metering as an attempt for building energy efficient new cities. shows the complete proposed system design with the components and building components for each unit block, which will be further discussed. The sensing unit comprises of the voltage transformer and the current sensor that are connected to the main supply. The voltage transformer used was a 240V to 6V step down transformer. Whereas, the current sensor was a SCT-013-000 non-intrusive sensor, clipped over a single wire either live or neutral, to sense the passing current this sensors output is voltage, so, to get current reading, a burden resistor is connected to the two terminals of the sensor,. The readings of both components are transferred to the next unit for processing. Once we get the reading our model will send data to the cloud via esp8266 using MQTT or HTTP post, which in turn update the consumption for the consumer at server side once in a while, which we can customize based on the setting avail in theapplication.

Model also consists REES52 5V RELAY one channel 5V Relay Module for Low Level Triggering to turn on / off current based on relay status, which in turn connected to Arduino. Once the data uploaded to the cloud, server application will read and update units consumed for the client and generate bill, which will be shared to client via email and short sms for notification. If the user didn't pay within due date, server will publish MQTT command code to instruct arduino MQTT subscriber command to read the command and control relay based on ON/ OFF . Consumer will be provided with asp.net browser based application to view usage and pay bills to avoid human intervention for connection and disconnection of service due to non-payment.

V. ARCHITECTURE

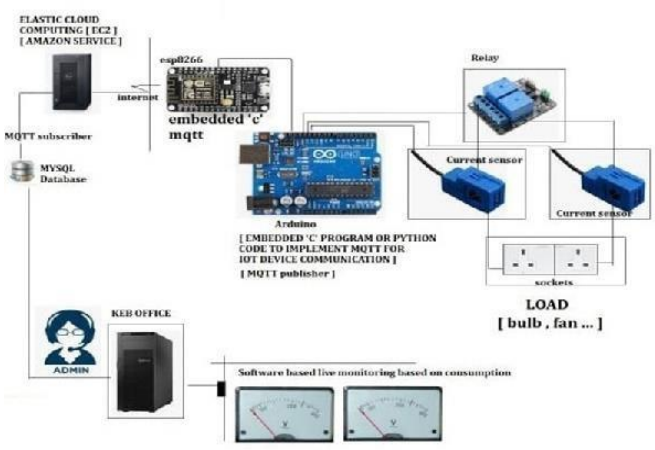

Fig.1: Architecture Depicting Entire Workflow

a) Arduino: Arduino python / C programming to control entiremodel.

b) Electronically controlled relay: To turn on/off load based on commandreceiver.

c) Current Sensor: To identify current usage by the load and same driven toArduino.

d) Esp8266: Uses MQTT protocol to publish load info to cloud

e) Load: Like Bulb, Fan, Laptop, Charger & soon.

f) Amazon Web Services (AWS): It is a subsidiary of Amazon.com that provides on demand cloud computing platforms to individuals, companies and governments, on a paid subscriptionbasis.

g) My SQL & Asp.net: One is database and the other used to serve webapplication.

VI. FUNCTIONALITY

The components used have various functionality and their own purpose of use.

Communication module from Current sensor and Load: This module used to read load consumption by the load connected via relay, so that consumption can be calculated and same will be used for the billing purpose.

Communication module from ESP8266 to relay: This module used to send the commands from Wi- fi module to the relay device. The input is given in the form of MQTT commands in order to function the relay. The Arduino code is uploaded to the ESP8266 module. The ESP module can be controlled by the devices which are connected to the same server using MQTT. The messages are given as an input to the device which can ultimately turn ON/OFF the relay module which is connected to ES. Relay works as an electrical switch. This will send the current supply to the current sensor and the load.

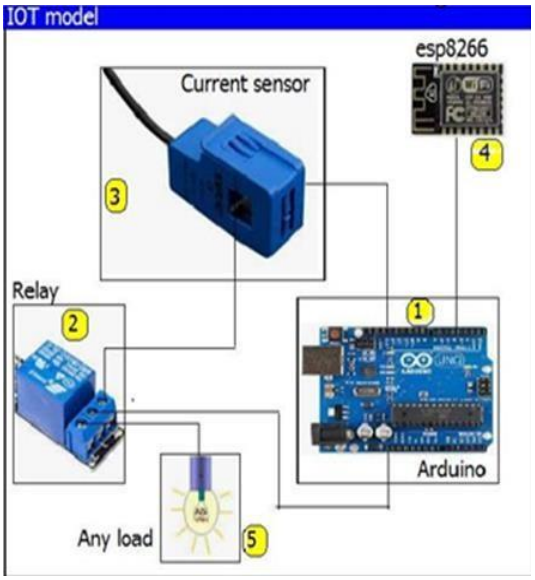

Fig.2: Component Interaction

Communication module from Relay to Current Sensor: This module used to measure the value of current by the sensor. The relay is switched ON by the command passed through MQTT protocol. The current from relay switch

passes through the current sensor. The current sensor uses some HallEffect Sensors with a lot of gain applied, followed by a peak detector, to sense the magnetic field generated by the current in a wire. The sensor output is just an analogue voltage which is proportional to the current sensed.

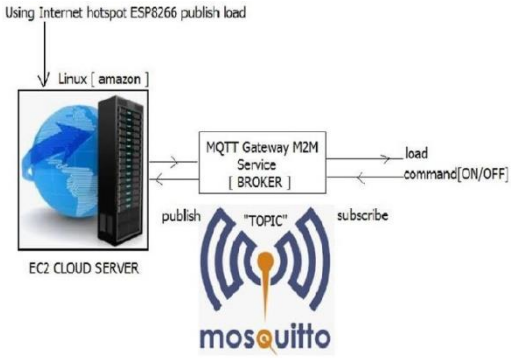

Fig.3: MQTT Communicating through AWS

Services provided through web based application: Customer can pay bills and admin can monitor it using asp.net browser. It's very easy to use and run this application. Customer can edit, update and view profile here.

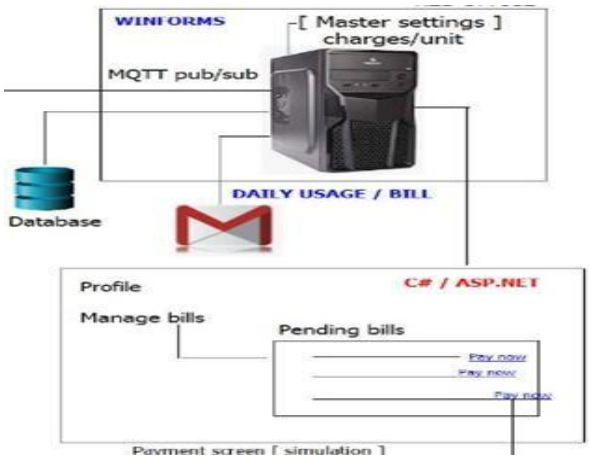

Fig.4: Web based application

VII. ADVANTAGES

The proposed IoT system has the following advantages:

A. There will be Continuous monitoring of power grid. Auto cloud service manager helps in fetching live data and display it via analogmeter.
B. Power consumption details will be generated which is useful for both customers and utilitycompanies.
C. Disconnection will be done in such a way that the household users cannot connect it back, thus preventing in the theft ofelectricity.
D. Current power consumption and cost of consumption details will be provided timely to thecustomers.
E. Bill will be generated which will have all the details of the power consumption on each home appliance connected. This helps the user to keep track on his bill and which appliance is consuming more electricity.
F. Necessary energy production and energy consumption in each specificarea.
G. The generated bill will be sent to the user either through a mail or asSMS.

VIII. RESULTS

Results showing the live monitoring scene of energy consumption. The Bill is generated to user accordingly.

Fig.5: Live Monitoring Scene

IX. CONCLUSION

The advancement on technology and the need of electricity in every aspect of life has made the electrical power irreplaceable. Taking advantage of IOT smart meters has developed and took various shapes and types. Consequently, the design of a low cost, low power and user friendly smart meter which helps in the conservation of energy can be of greatimportance.

REFERENCES

[1] Tobias Hochwallner Lukas Lang "Approaches for Monitoring and Reduction of Energy Consumption in the Home" June 30,2009.
[2] Mohammed ReyasudinBasir Khan and RazaliJidin. "USB Data Acquisition Device for Energy Monitoring," presented at Student Conference on Research and Development, Selangor, Malaysia,2011.
[3] Al-Naima, Jalil "Building a prototype Prepaid Electricity Metering System Based on RFID", International Journal of Electronics and Electrical Engineering, vol. 1, Issue 1, Iraq.12 March2012.
[4] Edwin Chobot, Daniel Newby, Renee Chandler, Nusaybah Abu-Mulaweh, Chao Chen, Carlos Pomalaza-Ráez "Design and Implementation of a Wireless Sensor and Actuator Network for Energy Measurement and Control at Home", March2013.
[5] Jacques Benoit. "The Internet of Things and the energy sector: myth or opportunity". Published in Power and Energy Automation Conference, Spokane, WA, March2016.
[6] ShikhaRastogi, Manisha Sharma and PratibhaVarshney. "Internet of Things based Smart Electricity Meters", International Journal of Computer Applications, vol. 133. Issue 8, January2016.
[7] D.Aswini1, N.Nisari2, Nivetha3, B.Vaishnavi4 "Power Consumption Alert System"March 2017.
[8] MahaAboelmaged*, Yasmeen Abdelghani*, Mohamed A. Abd El Ghany "Wireless IoT based Metering System for Energy Efficient Smart Cites",2017
[9] Au Thien Wan, Suresh Sankaranarayanan and SitiNurafifahBintiSait. "Smart Agent Based Prepaid Wireless

Energy Meter". International Conference on Cloud Computing and Internet of Things, pp. 77-81. December 2014. [10]Prajakta Pawaskar, Pradeep Chawande and SeemaJadhav. "Design and Implementation of Low Cost Three Phase Energy meter". IEEE International Conference on Recent Trends in Electronics Information Common ication Technology, India, May2016.

[10] V.Preethi, M.Tech and G. Harish. "Design and Implementation of Smart Energy Meter". International Conference on Inventive Computation Technologies (ICICT), Coimbatore, India. August 2016.

[11] F.Benzi, N. Anglani, E. Bassi, and L. Frosini,—Electricity Smart Meters Interfacing the Households, IEEE Transactions on Industrial Electronics, vol. 58, no. 10, Oct.2011.