

IoT Based Monitoring and Controlling of Smart Speaking Energy Meter and Current Theft Detection using Raspberry pi 3

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Abstract - The Electromagnetic Energy meter reading systems universally has more problems, such as difficulty in construction, not dual way communications quickly and also they do not provide information to the consumers instantly. To solve this problems, this paper is described to measure unit consumption of the load used by the user by continuously monitoring the power usage in a single day. The main objective of this paper is to eliminate the human involvement in electricity maintenance. The unit consumption is measured using wireless sensors and calculations are performed automatically using Raspberry pi and bill is updated on the cloud through IOT circuits and it can be checked by the consumer anywhere globally. The units consumed and the estimated bill is sent to the registered mobile number of the consumer through GSM module. The consumer is made to pay for the load used. In case of any tampering or power theft in energy meter during consumption the alert message is given to the web server as well as to the consumer and the fine amount will be added along with their load usage bill. WIFI performs the IOT operation where and through which the information is sent to the Cloud. With the help of Raspberry pi unit and cost is converted into speech to help the ill-literates and visually impaired people to know about their unit consumption and cost.

Keywords: Raspberry pi, GSM module, wireless sensor networks, LCD display.

1. INTRODUCTION

The Internet of Things can be used to monitor and detect various devices or objects from a remote Location. IOT is a growing phenomena which are used in every field nowadays. Here we are going to monitoring of Power using IOT.

Internet of Things is the network of physical devices embedded with the electronics, Software, Sensors, Activators and network connectivity with the objective of exchange data or collects the data. The IOT uses a cross platform frame work. It uses simple communication devices like Bluetooth, WIFI for the remote accessing of various devices. It uses direct integration method.

The electricity plays an serious role in our day to day life. Nowadays as the demands are increasing rapidly it became

very hard to maintain the electricity in the permissible limit. As the demand of electricity is going day by day. It is required to monitor the power consumption in accurate manner. Hence the usage of IOT is introduced.

Without Electricity we cannot plan our day to day life. Electricity has become a major role in our society. Energy crisis is one of the major problems that the world faces today. The best usage of Electricity in an economical way is the best remedy to overcome the Electricity crunch.

Since the demand for electricity is increasing the people are unaware of their usage of electricity by proper implementation of monitoring techniques and controlling techniques using IOT we can efficiently use the energy we can avoid the wastage of energy in an unwanted way.

In India, the consumers are made to pay their electricity bill once in a month or once during two month. Hence the consumer doesn't have any knowledge in the usage of energy. This kind of knowledge can be improved by the accurate monitoring of energy or power.

An energy meter is a device that measures the amount of electric energy usage by various electrical appliances. The main drawback of previously used energy meters is that they do not provide information to the consumers instantly, which is resolved by our proposed systems. The proposed technology is purely digitalized, consumer can able to monitor the energy usage and the respective cost through internet and also energy usage data, cost, current theft will also be notified instantly to the consumer's registered mobile number through GSM module. This IOT technology gives as the freedom to monitor the energy consumption without any drawbacks. The power theft and the tampering of energy can be greatly reduced by this method since the usage of energy since the consumption of energy is increasing rapidly in day to day life, this method helps us to use the energy in a profitable manner. If the consumer uses excess amount than the predefined amount the supply will be turned off and fine amount will be added along with their bill.

2. EXISTING SYSTEM

Normally the energy consumption or measured by electro Mechanical induction meter or Electronic meter. Both this

method use physical or manual efforts of humans to calculate energy usage. Electro mechanical induction meter use aluminium disc which is directly proportional to the energy consumption. Electronic meter uses a display system to show the output on the LCD or LED. So both provide inaccuracy in recording. In this method not only monitoring of energy or power is done it also provides as the value of certain electronic parameter such as instantaneous and maximum rate of demand usage voltages, power factor and reactive power. Normally energy are measured on monthly basis hence the inaccuracy in the value of the energy used can cause serious crisis. This problem can be overcome by usage of remote accessing devices.

3. PROPOSED SYSTEM

This smart speaking energy meter we monitor the energy or power usage by a remote technology using IOT. Since it doesn't have any physical contact with the equipment. The degree of accuracy in the way of measuring the energy is very high.

The proposed system consists of current transformer and potential transformer, a raspberry pi (microcontroller), IOT and Solid state relay. The data from energy meter by the help of current and potential transformer will be transmitted to cloud by Raspberry pi. The stored data can recognize by authorized persons of electricity board and customer can be monitor.

It is smart, if the number of units usage is 9 units per day at home, as per the UK government research. If the usage goes above 9 units then the supply cut off. Like that, in the house the circuit is designed such the power goes off automatically after the usage of certain limit, so that the power steal can be detected and the respective fine amount will be added along with their bill. In the event of not paying the bill there will be an alert message on the web page. When the EB person presses On- Off button then it mean that he is giving the command to raspberry pi, so that the raspberry pi works on its program related to the given command.

At the customer side there will be a controller of raspberry pi which connected with supply system and IOT module help to send data to cloud. If any command from the authorized EB person will be received by IOT module and to raspberry pi. Raspberry pi will control the whole switching also the control for used indication.

To indicate the user like power theft, over power usage, instantaneous power, and total energy usage will be given by raspberry pi controller by speech and display indication will be done by raspberry pi, this method really helps the ill-literates and visually challenged people to know about their energy usage and the cost. In case wifi or internet connection is not available at the time, There is also a GSM

module has attached to the system in customer side, data from the controller will be send to the GSM module, it will be send to consumers registered mobile number everyday.

4. BLOCK DIAGRAM OF PROPOSED SYSTEM

4.1 RASPBERRY PI 3

Raspberry Pi is a low cost and portable size of Computer board it has a high performance powerful processor. Its main core language is Raspbian OS can also develop script or program using C language. Raspberry Pi 3 has Broadcom BCM2837 ARM cortex – A53 1.2GHz memory, 1GB LPDDR2 (900MHz) RAM, micro SD, 802.11n Wifi module, Bluetooth is 4.1 Classic low energy, 40 pin GPIO, Camera Serial Interface (CSI), Display Serial Interface (DSI).



4.2 CURRENT TRANSFORMER AND POTENTIAL TRANSFORMER

A current transformer is a type of transformer that is used to measure alternating current. It produce a current in secondary which is proportional to the current in its primary. In this project, a current Transformer and potential transformers used to measure the current flow, or total power being consumed. This information's are analog type. With the help of signal conditioning circuit, it is converted into digital format and sends it to the raspberry pi.

4.3 GSM Module

GSM /GPRS Modem-RS232 has dual band GSM/GPRS Engine. It can works on 900/1800 MHz. It has RS232 interface with the help of it we can connect it with Pc as well as with Microcontroller it is suitable for transferring data, sms, voice by using M2M interface. It has internal TCP/IP stack so that we can also connect it with internet via GPRS. In this project, it used to send the message to the consumer about their power usage and cost.



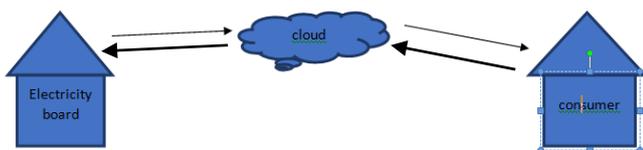
4.1 HARDWARE REQUIRED

- 1) Raspberry pi
- 2) Current transformer
- 3) Potential transformer
- 4) speaker
- 5) Required load(resistive load)
- 6) Relay

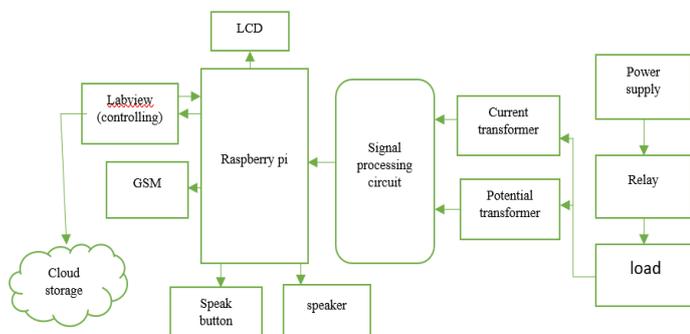
4.2 SOFTWARE REQUIRED

- 1) Thingspeak cloud
- 2) Labview software

5. BLOCK DIAGRAM



5.1 BLOCK DIAGRAM RELATED WITH CUSTOMER SIDE AND EB

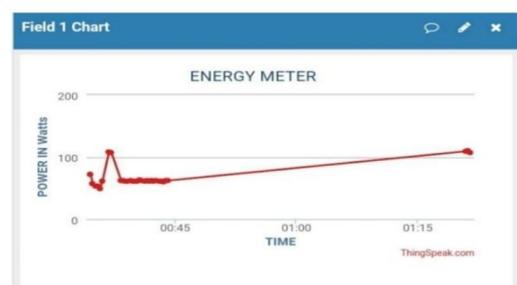


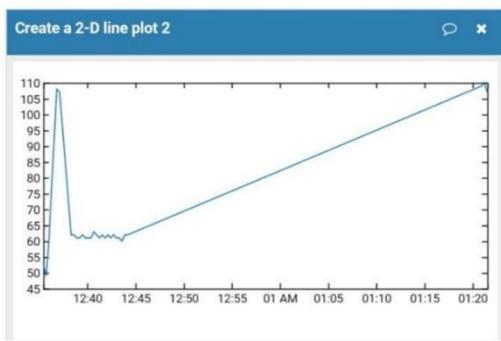
The raspberry pi is programmed in python. Raspberry pi is programmed such that when we press buttons on website

then the required operation is carried out. Raspberry pi gets the units consumed by consumer by using current transformer and potential transformer. As per UK government, how smart the home it uses only 9 units per day. Like that if the number of unit consumed crosses certain limit then the power supply is switched off automatically as the theft is found. Here we have used 100W bulb to detect the steal. If the usage of electricity crosses particular limit then the consumer need to pay extra amount to the EB, then only supply will turned on. And also, If consumer not paid the bill on right time raspberry pi gets the command from Electricity board and switch off the power supply .Here using 100Wbulb instead of 60W increases the number units consumed, so depending on raspberry pi commands the relay connected to load turns off automatically. The Webpage consists of two buttons ON and OFF.OFF button is used to turn off the supply and ON button is used to turn on the supply. GSM module SIM 900a sends the data like units used and respective amount to the registered mobile number

6. RESULT:

Module 1: connections are built and power supply is given to the kit. Monitoring the energy meter reading and corresponding cost into the cloud. LCD display continuously displays the power usage.





Module 2: If the customer didn't pay the bill on time then power distribution can be off from the distant server by pressing button OFF on the webpage. The program written for button OFF in raspberry pi will off the relay connected to the supply.

Module 3: THEFT DETECTION

When the bulb of 100W is used in the project then it shows as theft identified and the circuit goes off automatically. The raspberry pi is programmed such that relay connected to the supply will be Turned Off when power stealing is found.

Module 4: SPEAKING PART

The speaking button is available in the proposed system to know the unit consumption as voice and it is heard through speakers. The raspberry pi is programmed such that it converts the text (unit consumption and cost) into speech to help ill-literates and blind people.

Module 5: With the help of GSM module the message received by the consumer mobile number to aware of per day unit consumption.

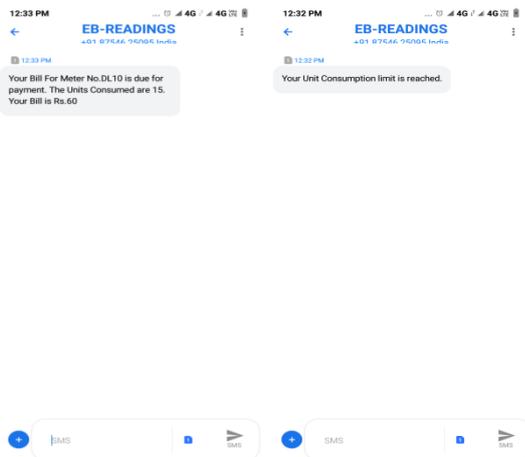


Fig-3Snapchat of unit computation and cost info to the mobile number

7. CONCLUSION

Here we have the combination of both hardware and software components for energy consumption monitoring. The hardware components here used are such as Raspberry pi, Solid state Relay, wifi module whereas the softwares used are Thinkspeak cloud and labview (for controlling process) technology. The required output is obtained either on LCD or on the Computer based on the program encoded on the computer. And also we can heard the energy usage and cost through speech.

8. REFERENCES

- [1] R.GiridharBalakrishna, Pyogannareddy, MLN vital "IOT based Power theft Detection" International journal of Innovation in Engineering and Technology.
- [2] E.F.Livgard, "Electricity customers' attitudes towards Smart Metering," in IEEE International Symposium on Industrial Electronics (ISIE), July. 2010, pp. 2519-2523.
- [3] H. Sundmaeker, P. Guillemain, P. Friess, S. Woelfflé, Vision and challenges for realising the Internet of Things, Cluster of European Research Projects on the Internet of Things - CERP IoT, 2010.
- [4] Srujanauddanti, Christina Joseph.Pckishore Raja "IOT based energy metering and Theft detection" International journal of pure and applied mathematics.
- [5] S.S Ali, M.Marroof, S.Hanif, "Smart energy meters for energy conservation & minimizing errors," PEDES, 2010, 2010 Joint International Conference on Power Electronics, Drives and Energy systems, pp.209-220
- [6] Ashna. K and Sudhish N George, "GSM based automatic energy meter reading system," IEEE Wireless communications, 2013.
- [7] SapnaGanurkar and PraveshGour, "Prepaid energy meter for billing system using microcontroller and recharge card," International Journal of Core Engineering & Management (IJCEM), vol. 1, issue 1, April 2014.
- [8] Paolo Barsocchi, Erina Ferro, Luigi Fortunati, Fabio Mavilia and Filippo Palumbo "Automatic power reading using GSM network" 2014 IEEE
- [9] SanketThakare, AkshayShriyan, VikasThale, PrakashYasarp, KeerthiUnni. "Implementation of an Energy Monitoring and Control Device based on IoT", 2016 IEEE
- [10] Ms Raksha R Sharma, Mrs kalyani P Wath, Mr Yogesh P bawangade "Design and talking energy meter based on microcontroller "International research journal of engineering and technology"