www.ijiarec.com

ISSN:2348-2079

Volume-7 Issue-2

International Journal of Intellectual Advancements and Research in Engineering Computations

IOT based energy meter

Ramraj.B[1], Parthiban.V[2], Peppatto.A[2], Satheesh.R[2]

[1]Assistant Professor, Department of Electrical and Electronical Engineering, Nandha Engineering College (Autonomous), Erode-52.

[2]UG Students, Department of Electrical and Electronical Engineering, Nandha Engineering College (Autonomous), Erode-52.

ABSTRACT

Internet of Things-based applications is becoming more effective solutions for many real time problems. In this paper, real-time monitoring system for residential energy meter is proposed. This system provides continuous access to energy consumption to the consumer by exploiting the advancement of IOT technology. The proposed system is effective cost as it requires a simple upgrade on the existing meters than complete replacement. Further, it is light weight, compact with the usage of SOC for control and communication. Through this analysis, it is found that from the collected data, it is possible to obtain the pattern of consumption as well as faultiness present in the existing system. The proposed work can also be extended to large scale from which load distributed in the area can be estimated.

INTRODUCTION

In present-days, due to advancement in Internet technology computerized electricity billing and online bill payment has become possible. However, the assessment of meter reading is still carried out manually. It requires huge Manpower. Further, the incorrectness in assessment leads to high revenue loss. AMR technology that combines automatic assessment of consumption, analysis on the assessed data for billing and payment. To achieve AMR, assignment of IP address to each energy meter is essential. This technology of bringing any device online and connecting it to the internet is termed as IOT.Based on the communication medium used for data delivery, the existing AMR systems can be classified into two categories namely wired systems and wireless systems. In a wired system, the data transfer is performed either through PLC or HFC. In the case of wireless, it is executed using GPRS, Wi-Fi. Energy metering through the wire is expensive as it requires infrastructural changes. When compared to other wireless modules, Wi-Fi is more suitable for this kind of application as it has become one of the common facilities at every residence. The objective of this work is to develop an IOT-based energy metering system for the residential sector. The proposed system integrates the advancements of SOC, cloud services along with open source messaging applications.

Author for correspondence:
Department of Electrical and Electronical Engineering, Nandha Engineering College (Autonomous), Erode-52.

EXISTING SYSTEM

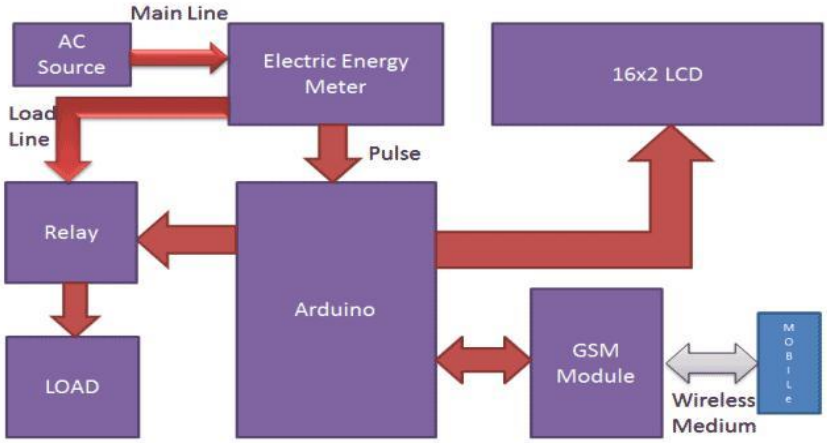

Fig.1.Block Diagram of Existing System

We have interfaced electricity energy meter with Arduino using the pulse LED of electricity Energy meter. We only need to connect this CAL LED to Arduino through an Opt coupler IC. When we power up the system then it reads previous values of rupees stored in EEPROM and restores them into the variables then checks the available balance with the predefined value and take action according to them, like if available balance is greater than 15 rupees then Arduino turns on the electricity of home or office by using relay. And if balance is less than 15 rupees then Arduino sends a SMS to user phone regarding low balance alert and requesting to recharge soon. And if balance is less than 5 rupees then Arduino turns off the electricity connection of home and sends a SMS to user's phone for 'Light Cut' alert and requesting to recharge soon. GSM module has been used to send and receive messages, you can check about GSM module and AT commands here [1-5].

PROPOSED SYSTEM

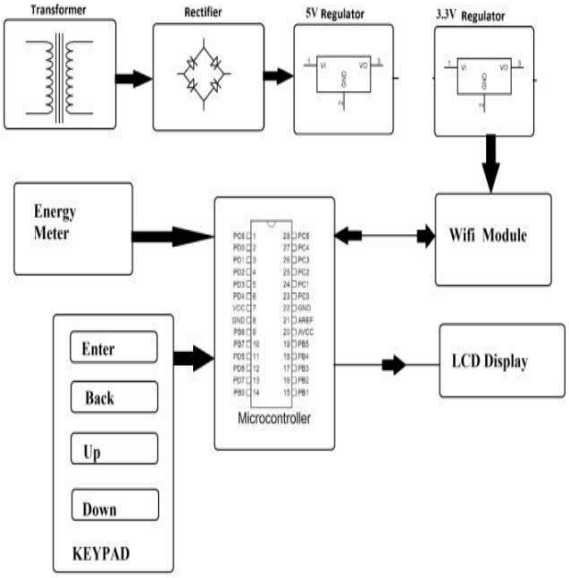

Fig.2.Block Diagram of Proposed System

The Proposed IOT based electricity energy meter consists of power line communication modem, theft detection and Wi-Fi unit. In power supply unit we have step-down transformer is used to covert 230V to 12V from main supply. Here we have used a bridge rectifier to convert Alternating current to direct current. The capacitor is used to reduce the ripple and to get a smooth DC voltage [6-10].

ATMEGA 328 Micro Controller

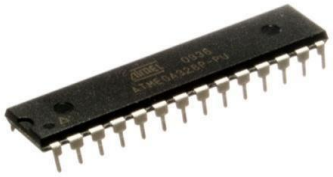

Fig.3.ATMega 328 Microcontroller

AT mega 328 has 1KB Electrically Erasable Programmable Read Only Memory (EEPROM). This property shows if the electric supply supplied to the micro-controller is removed, even then it can store the data and can provide results after providing it with the electric supply. Moreover, ATmega-328 has 2KB Static Random Access Memory. AT mega 328 have several different features which make it the most popular device in today's market. These features consist of advanced RISC architecture, good performance, low power consumption, real timer counter having separate oscillator, 6 PWM pins, programmable Serial USART, programming lock for software security, throughput up to 20 MIPS etc.ATmega328 is an 8-bit and 28 Pins AVR Microcontroller, manufactured by Microchip, follows RISC Architecture and has a flash type program memory of 32KB. It has 8 Pin for ADC operations, which all combines to form Port A (PA0 – PA7). It also has 3 built-in Timers; two of them are 8 Bit timers while the third one is 16-Bit Timer .You must have heard of Arduino UNO, UNO is based on atmega328 Microcontroller. It operates ranging from 3.3V to 5.5V but normally we use 5V as a standard. Its excellent features include the cost efficiency, low power dissipation, programming lock for security purposes, real timer counter with separate oscillator. It's normally used in Embedded Systems applications. You should have a look at these Real Life Examples of Embedded Systems; we can design all of them using this Microcontroller [11-13].

WI-FI Modem

Fig.4. Wi-Fi Modem

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by manufacturer ESPRESSIF System. The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it

could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.

Transformer

A transformer is an electro-magnetic static device, which transfers electrical energy from one circuit to another, either at the same voltage or at different voltage but at the same frequency

Rectifier

The function of the rectifier is to convert AC to DC current or voltage. Usually in the rectifier circuit full wave bridge rectifier is used.

Voltage regulator

Voltage regulator constitutes an indispensable part of the power supply section of any electronic systems. The main advantage of the regulator ICs is that it regulates or maintains the output constant, in spite of the variation in the input supply.

RESULTS AND DISCUSSION

The proposed system is currently installed in the customer premises to observe the real-time energy consumption. The record of one-week data is considered for analysis. The unit consumption is executed every minute and ported to the cloud periodically for every 10 minutes. In the case of power failure the controller re-initializes and obtains the previous value stored in the cloud on request–response basis. Then it continues with the process as mentioned earlier.

In the initial stage, the pulses are sensed for every 1 min and the corresponding units are accumulated. Every 5 minutes the last computed value is sent to the cloud for storage. The meter readings received at the cloud are stored in a tabular format including the timestamp and the unit values. As new values are appended to the table, history of the meter reading can be maintained. The client/customer sends a text message to the Bot. The sent text is captured by the Bot and analyzed. If the captured text is a defined command then the Bot replies with the appropriate response. If the Bot does not recognize the text it will respond by listing the available commands. The output at the client side generated using the messaging.

CONCLUSION

The developed system exploits the emerging technology IOT for real time residential energy metering. It provides ubiquitous and continuous monitoring of energy consumption. The significance of this work is to reduce manpower requirements in assessing the energy readings and also reduce errors caused by them. A low cost single module system is developed to sense, compute and transfer real-time data. It also provides a user-friendly platform to offer interactive experience to the customers. Further, the developed work can be extended to a large scale in order to determine the load distributed in the area. This, in turn, can devise a mechanism to strengthen the existing system.

REFERENCES

[1]. Open energy meter [paper] available: https://openenergymonitor.org/emon/buildingblocks/int reduction-to pulse-counting, 2016.
[2]. ESP8266 SoC [paper] available: https://github.com/esp8266/Arduino, 2016.
[3]. Node MCU development board [Online] available: http://www.nodemcu.com/index_en.html, 2016.
[4]. Ubidots NodeMCU API [paper] available: https://ubidots.com/docs/devices/nodeMCU.html, 2016.
[5]. Ubidots Python API, available: https: //github.com/Ubidots/Ubidots-python.,2016.
[6]. Telegram Messenger Bot available:https://core.telegram.org/bots,https://github.com/nickoala/telepot, 2016.
[7]. Telegram Messenger Application [Online] available: https://core.telegram.org/api, 2016
[8]. Damminda Alahakoon, Xinghuo Yu,"Smart Electricity Meter Data Intelligence for Future Energy Systems: A Survey" in IEEE Transactions on Industrial Informatics, 12(1), 2016, 425- 436.

[9]. Ravi Ramakrishnan, Loveleen Gaur,"Smart Electricity Distribution in Residential Areas, Internet of Things based Advanced Metering Infrastructure and Cloud analytics" in International conference on Internet of Things and Applications (IOTA), 2016.

[10]. Qazi Mamoon Ashraf, Mohd.Izhan, Mohd.Yusoff, Amir Alif Azman, Norbaizura, Mohd.Nor, Nor Aliya Ahmad Fuzi, Mohd.Shahril Saharedan, Nurul Afzan Omar, "Energy Monitoring Prototype For Internet of Things: Preliminary Results" in IEEE 2nd World Forum on Internet of Things (WF-IoT), 2015.

[11]. Chunchi Gu, Hao Zhang , Qijun Chen ,"Design and Implementation of energy data collection system using wireless fidelity (Wi-Fi) module and current transformer" in IEEE International Conference on System Science and Engineering (ICSSE), 2014.

[12]. A.Ali, N.A.Razali, N.H.Saad, N.Vitee, "Implementation of Automatic Meter Reading (AMR) Using Radio Frequency (RF) Module in IEEE International Conference on Power and Energy (PECon), 2012.

[13]. Li, Xiaoguang Hu, Weicun Zhang,"Design of an ARM-based Power Meter Having Wi-Fi Wireless Communication Module" in 4th IEEE conference on Industrial Electronics and Applications (ICIEA), 2009.