
Automated Electric Meter Reading And Monitoring System.

Harshvardhan Sakhare, Shaishav Oza, Suyash Gaonkar, Vishal Gorule,

Prof. Sumita Chandak.

(Information Technology, Atharva College of Engineering, India)

Abstract: *In recent years, automated meter reading systems (AMR) are being utilized in most developed countries. The advantages these electric metering system offers make it a more accurate measuring device than the conventional electromechanical meter reading system. AMRs capacity to automatically transmit data real-time increases the reliability of this metering system, unlike electromechanical meters which occasionally make use of previous readings as a basis of the consumer's current billing. It also puts consumers at a disadvantage as the accuracy of power consumption readings is being compromised.*

Keywords– Automation Electric Meters, ZigBee, Arduino, Android, Internet of Things.

I Introduction

The present electromechanical meter reading systems comprises billing based on monthly basis and estimation basis or on predicted consumptions. The advantage of proposed system is that billing is based on near-real time than on estimation based on past predicted consumptions. The timely information coupled with analysis can help both utility providers and customers can better control the use and production of electric energy.

Present AMR technology can be very well exploited by criminals by just picking up the wireless signals that are broadcast by utility meters. Hence our technology could provide better security at transmission and at server. In case of traditional electro mechanical meters this technology would also save utility providers the expense of periodic tips to each physical location to read a meter.

II Existing Systems

As far as a utility provider is concerned the development of a reliable automated meter reading system is concerned, the main focus is to develop a system which can read the meter readings at a minimum possible low cost. There are many communication methods to link remote nodes with the master units such as GPRS, Ethernet, and RF (Radio frequency) etcetera [1]. The electricity demand is increasing with the growth of population and with the use of different appliances in the households. So, there is a need for consumers to track their daily usage and understand the consumption patterns to save and control these resources [2]. A GPRS and GSM based Energy meter with instant billing facility is introduced is efficient, but still the problem of missing SMS will degrade the accuracy and performance. A more reliable and user friendly system by creating web portal for multiple access using the advanced Android frame work which will manage the data efficiently even if there is loss of SMS. It makes the design different from the previous proposals and also increases the throughput [6]. The use of AMR systems could benefit both the country and its citizens. This same feature of AMR abets the saving of electricity, since it helps consumers understand how electrical power is used and consumed in their homes [7].

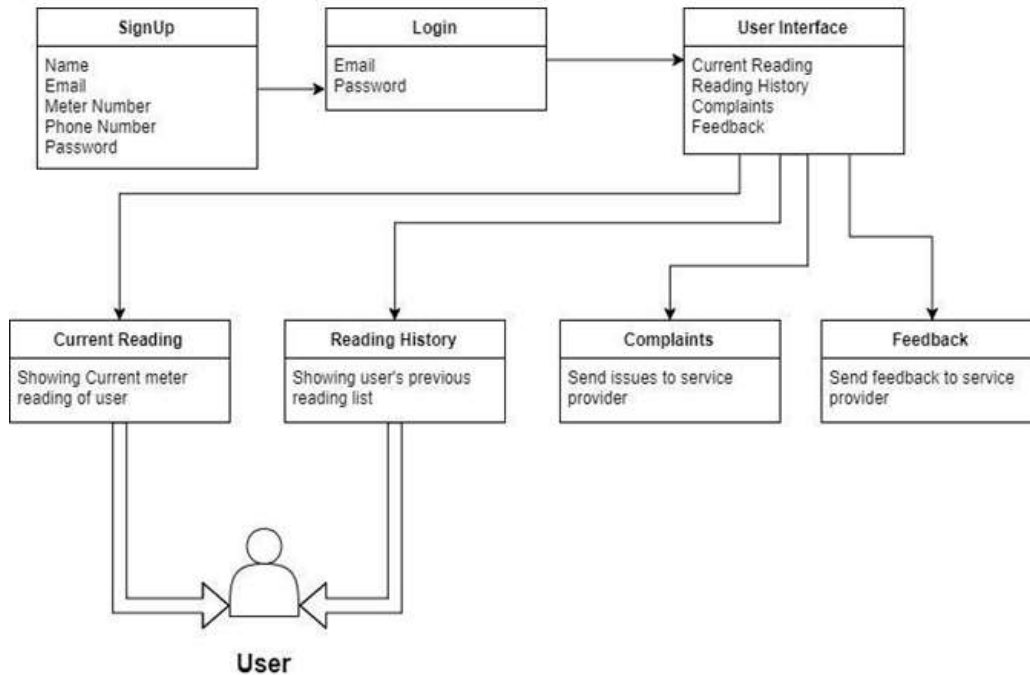
The present Automated Meter Reading System in developed countries makes use of RF (Radio Frequency) or PLC (Power Line Communication) for transmission of the meter readings. The RF works on frequency range of 3 KHz to 300 GHz.

The problem with RF based AMR is that they are vulnerable to obstruction limits. Thick walls often impede wireless communications between different floors. PLC based AMR works in frequency range of 315 MHz to 24 GHz to transmit power less than or equal to 50 MWatts. Power lines are constructed with primary objective of delivering electricity. But, electricity's complex distribution network and noisy environment may cause various forms of interference to PLC. Factors for interference are huge load impedance variations, attenuation on selective PLC carrier frequencies, and strong noise interference.

The Demerit of using traditional metering system that during natural calamities, if the company personnel responsible for taking monthly readings is not able to reach to user's location to take readings, the bill is generated according on estimation basis. The statement generated by estimation, may be a loss or profit for either parties.

III Proposed System

It is a troublesome task for a common user to fetch readings out of a traditional electric meters and keep a track of usage tracking, as they have to coordinate with the utility provider for this matter. In India most of the electric meter reading is done manually and thus there is a potential of human error in the same. Making a self-energy audit on unit consumption is a tedious job because of lack of understanding of the mechanisms. This factors also make these audits a time consuming.



Initially the analogue readings generated by the meter would be fed into Arduino. But, as the analogue readings are in waveform, they first needed to be converted. The Arduino board consists of Analogue to Digital converter, which helps in converting analogue readings to digital readings, which is understandable by humans. The data after conversion is then fed to ZigBee module, which first encrypts the data obtained from the Arduino and then transmits the encrypted data to server-side ZigBee. The AES 128 standard encryption algorithm is used to encrypt the data. The data received on the server-side ZigBee is first decrypted using the same encryption algorithm, and then uploaded into the service provider's database. After the data is being uploaded into database, the consumer can access his/her meter readings through the Android application/Web portal available, in real-time. The user credentials entered in the user portal would be authenticated from the database, once authenticated, the daily consumption in terms of KW/hour would be displayed on the mobile devices. For any grievances regarding the services provided by the utility provider, a grievance cell is provided to register complaints, and an addition to it is feedback fragment in which user is free to speak about the services.

IV. Design Details

A. Arduino Module: Arduino is open-source hardware. Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor–transistor logic (TTL) level signals.

B. ZigBee Module: ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs. Its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics. ZigBee devices can transmit data over long distances by passing data through

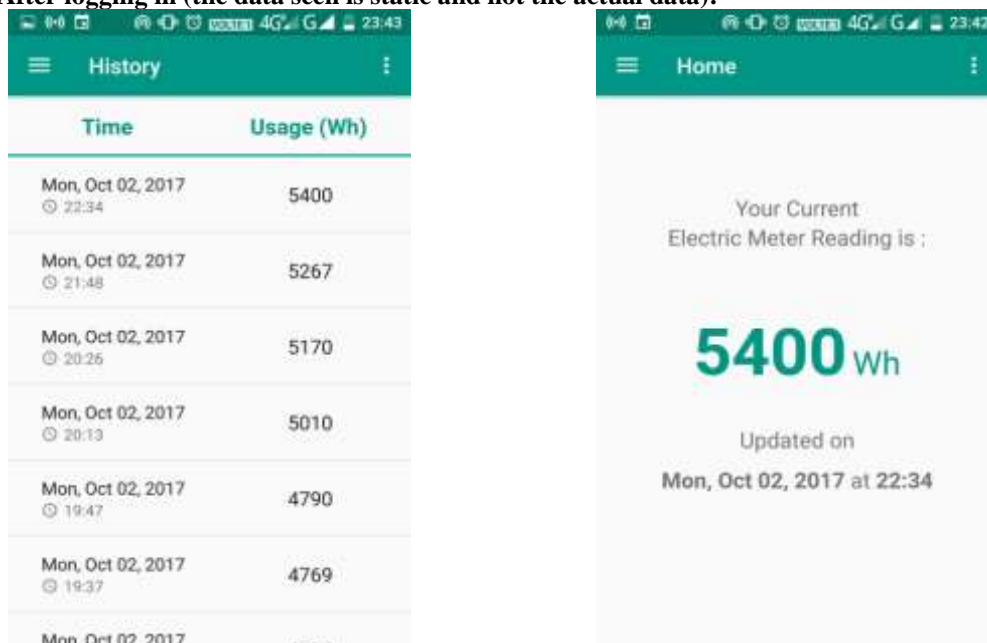
a mesh network of intermediate devices to reach more distant ones. ZigBee is typically used in low data rate applications that require long battery life and secure networking (ZigBee networks are secured by 128 bit symmetric encryption keys.)

C. Android Module: Android is a mobile operating system developed by Google, based on the Linux kernel and designed primarily for touchscreen mobile devices such as smartphones and tablets. Android's user interface is mainly based on direct manipulation, using touch gestures that loosely correspond to real-world actions, such as swiping, tapping and pinching, to manipulate on-screen objects, along with a virtual keyboard for text input. In addition to touchscreen devices, Google has further developed Android TV for televisions, Android Auto for cars, and Android Wear for wrist watches, each with a specialized user interface. Variants of Android are also used on game consoles, digital cameras, PCs and other electronics.

V. Expected Output

Initially the analogue readings generated by the meter would be converted into digital form which is done by Analogue to Digital converter present in Arduino board. The readings after conversion are then encrypted and transmitted with the help of ZigBee module. The data received by server-side ZigBee is first decrypted and then uploaded to the database. Below, the readings seen in the screenshots are the static data for visual representation how the data will appear after user logs into their respective accounts.

- **After logging in (the data seen is static and not the actual data):**



VI. Conclusion

In traditional electric meter reading system, a personnel is sent from service provider's office to take readings in monthly basis and the statement is generated and given to customer according to units consumed by him/her. The drawback of traditional system is that user is not able to keep record of its daily consumption and during natural calamities, the statement generated might be a loss or profit for either parties. The proposed system will help the customer to read his/her daily electric consumption seamlessly, and to keep track and take decisions easily. If there is any problem in the units consumed by the user he/she can easily lodge a grievance through the Android application provided, which is a hectic job in traditional meter reading.

References

Journal Papers:

- [1]. M.S. Dunuweera, G.D. Porawagamage, KTMU Hemapala and N.D. Silva. Design. "Implementation of an Optimized Communication Method for Remote Meter Reading using ZigBee", IEEE, 2017.
- [2]. S. Elakhumi and A. Ponraj. "A server based load analysis of smart meter systems", IEEE, 2017.
- [3]. N. Gupta and D. Shukla. "Design of Embedded Based Automated Meter Reading System for Real Time Processing", IEEE, 2016.
- [4]. K.T. Islam, A.M.J. Islam, S.R.H. Pidim, S. Moraslin and A.H.Md.T.H. Khan. "A Smart Meter System for Wireless Power Measurement with Mobile Application", IEEE, 2016.

- [5]. S.M. Soliman, B. Magdy and Mohamed A.A.E. Ghany. "Efficient Implementation of the AES Algorithm for Security Applications", IEEE, 2016.
- [6]. B.D. Sawarkar and S.S. Golait. "A Review Paper on Automatic Meter Reading and Instant Billing", IEEE, 2015.
- [7]. A.C.D. Bonganay, J.C. Magno, A.G. Marcellana, J.M.E. Morante and N.G. Perez. "Automated Electric Meter Reading and Monitoring System using ZigBee Integrated Raspberry Pi Single Board Computer via Modbus", IEEE, 2014.