

Automatic Electricity Bill Generating System

N. Rajathi, N. Suganthi, Shilpa R.

Abstract: *The traditional way of reading energy meter is an expensive work where the reader of the meter has to go in person to each meter and take the meter reading manually. This manual reading goes into the billing software to generate the bill to automate the payment process. This method of reading has short comings, such as reading error and involves more labors. To overcome this issue, an automatic power meter reading and billing system is proposed. Automation of energy meter reading and billing data entry process would reduce the laborious task and financial wastage. The proposed work measures the energy consumption in each house and generates the bill automatically with Arduino and Wi-Fi. The main goal of this work is to reduce the energy consumption in houses by notifying the owner continuously about the amount of units that are consumed. The goal of this work is to automate the billing process by checking the electricity unit's consumption in a house and hence subsequently reduces the manual labor. The calculations are carried out automatically and the bill is updated on the Internet by the help of Wi-Fi. The bill amount can be checked by the owner anywhere and at any time by visiting the website or the online portal.*

Keywords: *Arduino, Electric meter, Wi-Fi module, Billing*

I. INTRODUCTION

Before the awareness of electricity existed, people knew about the shock that was present inside electric fish. There is a rapid progress in the early 19th century in electrical science. Then again, the greatest advances in electrical engineering were made in the late 19th century. The presence of charge gives rise to an electrostatic force: charges exert a force on each other, an effect that was known but not understood, in antiquity. According to the science, motion is an electric charge, and it is measured in amperes. There is a concept called electron, which is nothing but two charge particles produce current. Electric current can flow through some things called as electrical conductors, but the opposite is called an insulator which will not flow. Electricity generators are the one's which supply electricity, but electricity can also be supplied from chemical sources such as electric batteries or by other means from a wide variety of sources of energy. Electricity is a very convenient way to transfer energy, and growing, number of uses. Incandescent light bulb was discovered in the 1870s. This led to the lighting becoming one of the first publicly available applications of electrical power. Electricity was not part of the everyday life of many people, even in the industrialized Western world during the early 20th century.

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Electricity became very popular during the Second Industrial Revolution. with electricity ceasing to be a novelty and becoming a necessity of everyday life in the latter half of the 20th century, it required particular attention by popular culture only when it stops flowing, an event that usually signals disaster. Electricity has an important role in our day today lives. It has come to a significance that without electricity it is impossible to survive. The electricity consumed by the commons are measured with the electric meter which is fixed at every individual's home. This is then periodically noted by the supplier most probably the government employee to calculate the energy consumed. Traditional meter reading for electricity consumption and reading is done by human operator. He has to go door to door and gave the bill slips of the utilization to the respective consumer [1-3].

They go to each and every house to check for the number of units that has been consumed. The manual reading has defects such as errors in reading, inaccuracy, external conditions that influence the measured values, leads to a delay of the work. In addition, the traditional technique also requires large manpower. In order to resolve all these issues, an automatic energy meter reading is proposed. By automating the meter reading process the labor employed could be reduced and they can be used for other works. Furthermore, the users are known about the electricity utilization when an LCD panel is attached to the unit. This will help to minimize over utilization

II. RELATED WORK

Internet of Things(IoT) plays a vital role in many daily applications [12,13] and energy management is one of them. The smart meters are digital meters and are of same size as traditional meters [4]. The smart energy meter measures more detailed readings than Kwhr so that utility helps to plan the expansion of network and power quality [5,6]. In [7], the authors proposed methodology for reading electricity meter measurements remotely using Short Message Service (SMS). The SMS have been received using the Global System for Mobile communications (GSM) networks. Handoko Primicanta et al. [8] proposed hybrid Automated Metering Reading System(AMR). This system combines both ZigBee and GSM technology. The data collector unit will be connected to the central computer by using GSM and the ZigBee module is attached to the electric meter. In [9], Arun et al. proposed the design and implementation of a secured low cost Automatic Meter Reading System. The proposed system measures and transmits the total electrical energy consumption to main server using GPRS (General Packet Radio Service) technology.



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The three main parts of the proposed system are accurate digital meter, a transmission facility and the billing server. A low cost off the step materials are used to make inexpensive AMR system. Sapna Ganurkar et al. The authors in[10] discussed the idea of using an AT89S52 micro controller for a prepaid energy meter. It is based on the idea of “Pay first and then use it”. The amount of energy consumed is counted by using a LDR (light Dependent Resistor) circuit and displays the remaining amount of energy on the LCD. In[11], the authors discussed about the various communication protocols for automatic reading applications. There are so many technologies proposed to automate the EB meter reading system. Power lines are also used to transmit the reading data as well. However, to transmit data in power lines is not as cheap as implementing other technologies.

III. THE PROPOSED SYSTEM

The proposed system measures the energy consumed at each house automatically and the readings are being displayed to them at their EB box. This also helps the commons to be aware of their usage and reduce if they are over using the resource available to them. The readings and bill are transferred to the EB database via Wi-Fi module. Thus reducing human labor. The working of the system proposed includes two major parts

- i. Hardware Module
- ii. Website Module

The flow diagrams of both the modules are presented in Fig.1 and Fig.2.

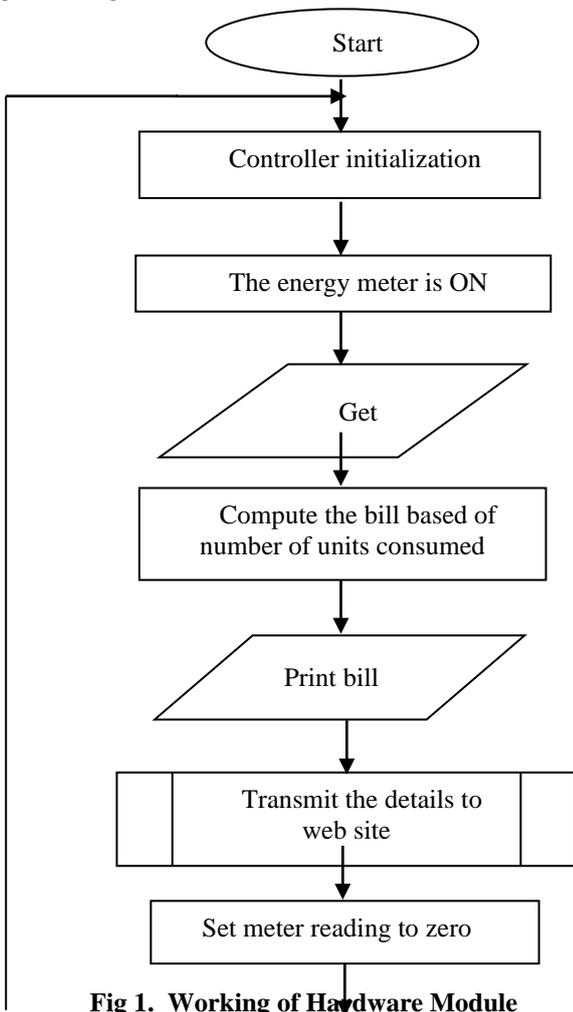


Fig 1. Working of Hardware Module

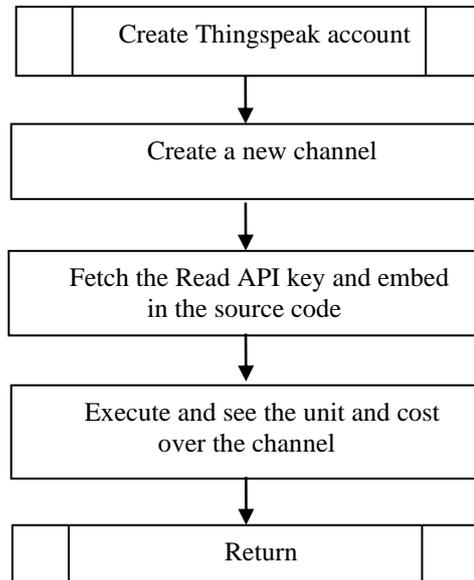


Fig 2. Working of Website Module

A. Hardware Components

The list of hardware components used and their purpose of usage is listed in Table 1.

Table1.Hardware Components used

Hardware	Purpose
Arduino	This micro controller board featuring analog and digital pins with other components that allow the easy integration of the board with other circuits.
Energy meter	On a single-phase AC supply, the electro mechanical induction meter operates through electromagnetic induction .It does so by counting the revolutions of a non-magnetic, but electrically conductive, metal disc. This is made to rotate at a speed proportional to the power passing through the meter. The number of revolutions is thus proportional to the energy usage. The voltage coil consumes a small and relatively constant amount of power, typically around 2 watts which is not registered on the meter.
LCD	A liquid crystal display, commonly known as LCD is a special thin flat panel. Light can go through it, or can block it. The panel is made up of several blocks, and each block can be in any shape. Each block is filled with liquid crystals that can be made clear or solid, by changing the electric current to that block.
Capacitor	A capacitor can store electric energy when it is connected to its charging circuit. On disconnecting, it can dissipate that stored energy. Capacitors are commonly used in electronic devices to maintain power supply while batteries are being changed. Capacitors can be used in a variety of different ways in electronics circuits.
Step down transformer	A Step down Transformer is a type of transformer, which converts a high voltage at the primary side to a low voltage at the secondary side. If we speak in terms of the coil windings, the primary winding of a Step down Transformer has more turns than the secondary winding.
Regulator	A voltage regulator is used as a simple feed-forward design or as a negative feedback.It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.
Switch	Switches are devices which are either completely on (“closed”) or completely off (“open”). The simplest type of switch is one where two electrical conductors are brought in contact with each other by the motion of an actuating mechanism.
WIFI	The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any micro controller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

IV. IMPLEMENTATION

The implementation details about the proposed system are given below.

The system proposed measures the energy consumed at each house automatically and the readings are being displayed in the LED present at their EB box. This is very useful because it helps the commons to be aware of their usage and can reduce if they are over using the resource

available to them. The readings and bill are transferred to the EB database via Wi-Fi module. Thus reducing human labor.

A. Software Design

The working of the software module part in depicted in figure 3.

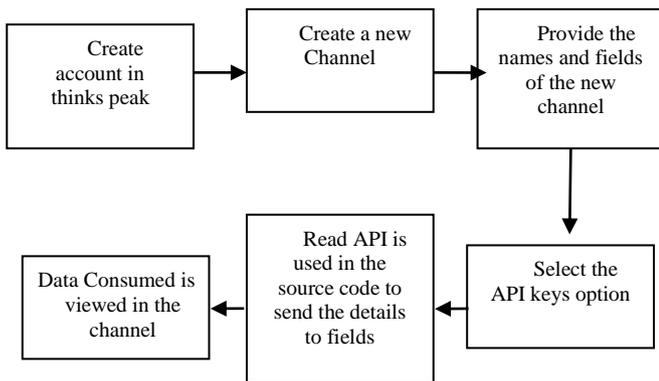


Fig 3. Working of Software Module

B. Extraction and Processing of data

The energy meter connected to the load starts to measure the energy consumed by the load once the switch is turned on. The energy meter has a LED bulb which blinks 3200 times per unit consumed. Now this is counted by the Arduino and the bill is generated. The bill generated and the unit consumed is displayed in the LCD panel and then transmitted to the cloud. The user can now log into their account to verify their unit consumed or just check the LCD panel connected to the meter. The workflow is pictorially represented in Figure.4.

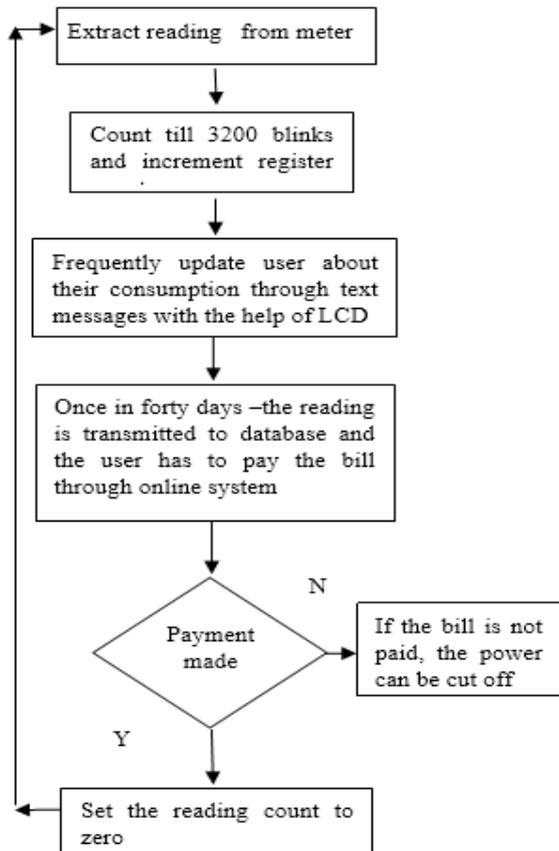


Fig 4. The Flow Chart for Date Extraction and Processing

The consumer readings are transmitted to the cloud with the help of the Wi-Fi module. The readings along with the cost will be displayed in the cloud platform. Every forty days the consumer can pay their bill at the local EB station and the data can be

reset. The final system developed is shown in Figure 5a and Figure 5b.

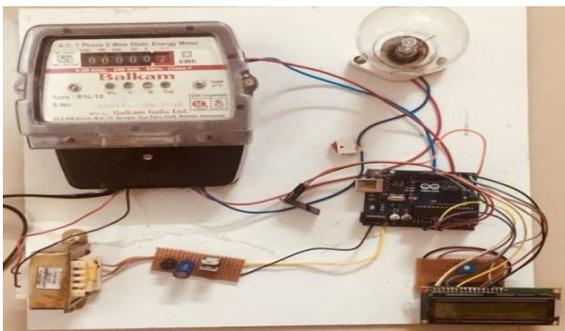
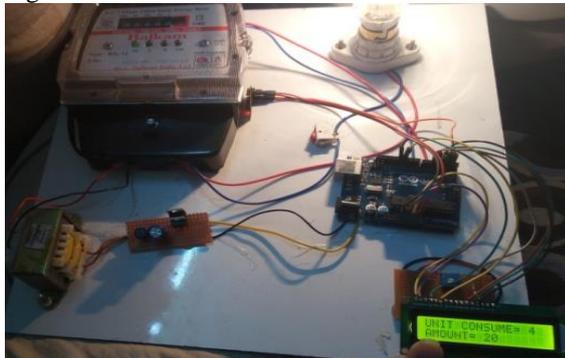


Fig.5.a and Fig.5.b Final Implementation of the Proposed System

V. CONCLUSION

The operating experience and practice indicated: the meter reading system has the benefits, such as, transmission speed is quick, the reliability is high, real time is strong and the operating cost is low. From the experimental results we have observed that the automatic electric billing system overshadows the traditional system of taking the readings by many factors. The proposed system work is to automatically detect the number of readings that has been consumed. These readings are then displayed to the user at their EB box. This helps the commons to be aware of the power and can reduce the energy if they feel that they are over using it. Since everything is automatic, human labor is reduced. An external condition which delays the readings to be taken are eliminated. Thus there are error free values. Hence accuracy is been preserved. The future work is to modify the propose system for the detection of illegal use of electricity.

REFERENCES

1. Ashna.k , Sudhish N George. "GSM Based Automatic Energy Meter Reading System with Instant Billing" 978-1-4673-5090-7©2013 IEEE
2. Liting Cao, Jingwen Tian and Dahang Zhang "Networked Remote Meter-Reading System Based on Wireless Communication Technology" IEEE International Conference on Information Acquisition, August 20 – 3, 2006, Weihai, Shandong, China.
3. Vinu V Das, "Wireless Communication System for Energy Meter Reading" International Conference on Advances in Recent Technologies in Communication and Computing 2009.
4. [4] T. Chandler, "The technology development of automatic metering and monitoring systems," in IEEE International Power Eng. Conf., Dec. 2005.
5. Smart meter Implementation Strategy Prospectus. July 2010. DECC, Of gem/Ofgem E-Serve.
6. M. Faisal and A. Mohamed, "A new technique for power quality based condition monitoring," in 17th Conf. Electrical Power Supply Industry, Oct. 2008.
7. Md. Wasi-ur-Rahman, Mohammad Tanvir Rahman, Tareq Hasan Khan and S.M. Lutful Kabira, "Design of an Intelligent SMS based Remote Metering System", Proceedings of the 2009 IEEE International Conference on Information and Automation June 22 - 25, 2009, Zhuhai/Macau, China.
8. Aryo Handoko Primicanta, Mohd Yunus Nayan, Mohammad Awan,"Hybrid System Automatic Meter Reading", Computer Technology and Development, 2009. ICCTD'09.
9. S.Arun,Dr. Sidappa Naidu , "Hybrid Automatic Meter Reading System",in July 2012 International Journal of Advanced Research in Computer Science and Software Engineering.
10. Sapna Ganurkar, Pravesh Gour."Prepaid Energy Meter for Billing System Using Microcontroller and Recharge Card", International Journal Of Core Engineering & Management (IJCEM) Volume 1, Issue 1, April 2014.
11. Tarek Khalifa, Kshirasagar Naik and Amiya Nayak "A Survey of Communication Protocols for Automatic Meter Reading Applications" in IEEE Communications Surveys & Tutorials, vol. 13, no. 2, second quarter 2011.
12. Suganthi N, Arun R, Saranya D and Vignesh N, "Smart Security Surveillance Rover",International Journal of Pure and Applied Mathematics, Vol. 116, No.12, 2017, 67-75.
13. Vanitha, V, Sumathi,VP,Cynthia,J and Illakia,B "Next Generation Vehicle Diagnostic Systems", International Journal of Pure and Applied Mathematics Volume 116 No. 11 2017, 251-259.