

# Radio Frequency Based Automatic Meter Reading System

Prachi Agrawal

**Abstract-**This paper specifies a practical model of Pulse Detection and Electric Metering System based on the Radio Frequency (RF). The supporting device transmitter works on 98.5 MHz operating frequency and 200.5 MHz carrier frequency and receiver works on same.. This project works within the range of 50 meters. This Radio Frequency (RF) based Pulse Detection and Electric Metering System is used for clear and accurate billing based on actual consumption rather than on an estimate based on previous consumption.

**Keywords-**Automatic Meter Reading, Digital Power Meter, Radio Frequency, Short Messaging System.

## I. INTRODUCTION

Although there are variety of industry definitions, Radio Frequency based Pulse Detection and Electric Metering System is generally regarded as the reading of a utility meter by a means that does not require physical access and visual inspection of the meter. Traditional meter reading for electricity consumption and billing is done by human operator from houses to houses and building to building. This requires huge number of labor operators and long working hour to achieve complete area data reading and billing. Human operator billing are prone to reading error as sometime the houses electric power meter is placed in a location where it is not easily accessible. Labor billing job is sometime also restricted and slowed down by bad weather condition. The increase development of residential housing and commercial building in the developing country such as for example Malaysia require more human operators and longer working hours to complete the meter reading task. This increases the energy provider operation costs for meter reading. In order to achieve efficient meter reading, reduce billing error and operation costs. This system play an important role to addressed the above mentioned problems. Radio Frequency (RF) based Pulse Detection and Electric Metering is the system of automatically collecting data from energy meter and transferring that data to central database for billing and analysing. With the advent of digital technology analogue electro-mechanical meter is continuously replaced by digital electronic meter. Digital electronic meter offer greater convenience to implement and establish automatic meter reading system electronically. Efficiency and reliability of retrieving meter reading in this system was a major challenge. Various AMR technologies and methods using power line carrier (PLC) communications, Supervisory Control and Data Acquisition (SCADA), telephone modem, Internet, Ethernet,

microcontroller, Wi-Fi,bluetooth and ZigBee were established and developed to provide and demonstrate the solution of efficiency, reliability and effectiveness of AMR. The above mention methods are either too expensive to implement and operate, require complex setup of infrastructure ,short operating distance and still require field intervention of human operators o prone to error and reliability issue due to noise in the transmission line weather condition. Radio Frequency based Pulse Detection and Electric Metering System in this paper takes advantages of accurate billing troubleshooting and analysing. The main advantage of this project is for security purpose because continuous monitoring is possible by this system and hence this system is able to detect power theft.

## II. SYSTEM OVERVIEW

In this system the transmitter is connected to the meter and it counts the pulses from it. The pulse which is being consumed by the subscriber's meter is being transmitted by the transmitter. The receiver which is connected to the main server receives the pulses. The receivers are connected to the computer and display the units. Sitting at that computer place a particular subscriber's number is fed by the worker of the electricity board to the computer which is installed in the meter. By receiving the meter reading signal by subscribers to the substration for billing it is being received by a 100 channel modem and it is then feeded to PC then it is calculated for billing by electricity. With this process the annual calculation can be done by the computer itself, which makes more easier for the electricity board to calculate the billing.

## III. HARDWARE ARCHITECTURE

The hardware architecture and appearance of this system can be divided into two parts. First one is transmitter and second is receiver. Block diagram of transmitter is shown in fig.1.1 As per the block diagram the transmitter consists of carrier wave generator, frequency generator, adder and antenna.

**Manuscript Received on May 2014.**

Prachi Agrawal, E&TC (VLSI & Embedded System Design), Disha Institute of Management and Technology, CSVU University, Raipur, (C.G.)

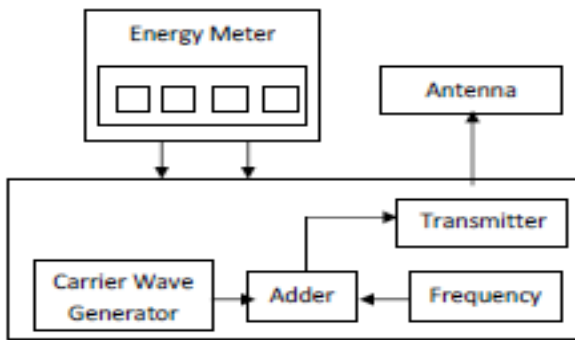


Fig. 1.1 Block Diagram of Transmitter section

#### IV. PULSE DETECTION AND ELECTRIC METERING SYSTEM

This system basically involves the installation of an intelligent meter at residential customers and the regular reading. It also sends the pulses according to the load of the power consumption of the customer and after that manipulate or calculate total power consumption. With the development of country's economy and the improvement of national power, the power requirement is still ever increasing due to use of improper power management systems and the conventional energy metering system. Over the past years, metering devices have gone through much improvement, and are expected to become even more sophisticated, offering more and more services. Meters in the past, and today in a few countries were electromechanical devices with poor accuracy and lack of configurability. Theft detection was also a challenge. Such meters are limited to providing the amount of energy consumption on site. The Automatic Power Meter Reading System is consists of GSM Digital Power Meters installed in every consumer unit and an electricity e-billing system at the energy provider side. The GSM Digital Power Meter (GPM) is a single phase IEC61036 standard compliance digital kWh power meter with embedded GSM modem which utilizes the GSM network to send its power usage reading using short messaging system (SMS) back to the energy provider wirelessly. At the power provider side an e-billing system is used to manage all received SMS meter reading, Compute the billing cost, update the database, and to publish billing notification to its respective consumer through SMS, email, web portal and printed postage mailing. A working prototype of the GAPMR system was build to demonstrate the effectiveness and efficiency of automatic meter reading, billing and notification through the use of GSM network. Design and Implementation of Wireless Automatic Meter Reading system presents an implementation methodology for a wireless automatic meter reading system (WAMRS) incorporating the widely used GSM network. In this paper they suggested a method where we utilize telecommunication systems for automated transmission of data to facilitate bill generation at the server end and also send to the customer via SMS and email. At recent developments in this direction seem to provide opportunities in implementing energy efficient metering technologies that are more precise and accurate, error free, etc. The implementation of Radio Frequency Based Pulse Detection and Electric Metering provides with many vital

features as compared with the analog utility meter reading with man power. This system has the following capabilities: This technique of meter reading system solves the purpose of security. It provides us the facility of accurate billing instead of the estimate billing. Only the one time investment costed for installation of this process. No network disturbance being occurred while transmission because the whole transmission is done by negative modulation in MHz. By reviewing the communication process we used the Radio frequency (RF) communication which covers on MHz in AM and FM modulation because the communication has to travel more or less between 15 km. The range between transmission and receiving is being calculated up to 15 km range. The transmission and receiving is being specified by a particular process that is the synchronizing method between transmitter and receiver. In this system the technique of frequency modulation (FM) has been used. Actually frequency modulation is a technique used for modulating a radio signal to carry sound or other information. Frequency modulation is used for short distance transmission. For only demo process we are using frequency modulation technique. In actual process we use amplitude modulation technique, because this technique is used for long distance transmission. The energy consumption is being calculated using a standard energy meter. Smart meter reading system can be divided into two parts. First one is transmitter and second is receiver. The transmitter is being installed in energy meter. In this transmitter a tank circuit is used which consists of one variable inductor and a fixed capacitor is wired with the help of a transistor its number is BF495 which works as a mixture in this transmitter circuit. This combination produces the carrier wave of 210 to 230.5 MHz frequency which works as the carrier wave and the reason of using the tank circuit in order to adjust the bandwidth that is differs the range of the transmission because this circuit works on total synchronizing process. The capacitor connected to the two input terminals which work as the high pass filter and low pass filter for the transmitter. The main frequency working the transmitter which is known as operating frequency is being produced by capacitor and is connected between base and emitter of the transmitter. Instead of this transmitter that is BF495 we can use 2N3702, BF498, AC128 or BU205. These types of transistor are known as RF based transistor. The combination of frequency as well as carrier wave is being done by the same transistor which is being connected and it amplifies the negative voltage with that of the frequency and emit through the collector. The voltage is depending upon the variation of the tank circuit of the oscillator coil which is being connected in the tank circuit. The output of the amplifier can be variate according to the adjustment of the bandwidth. Finally this is being feed at to a transmitter transistor whose number is 2N702 which amplifies negatively with the help of 75 ohms antenna.

## V. RESULT

The smart Automatic Meter Reading System presented in this paper absorbed many advantages. The result of frequency transmission by transmitter using FM modulation technique in CRO is shown in fig.

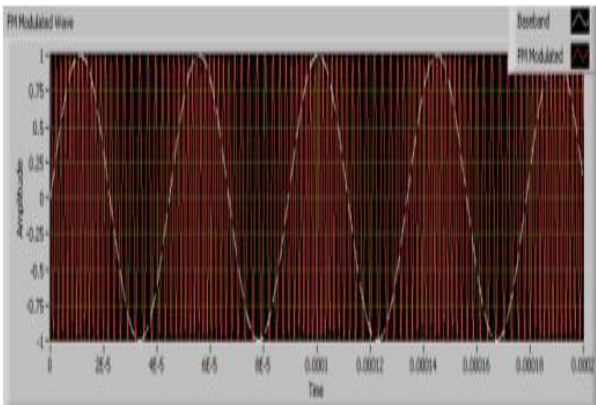


Fig.6.1 Frequency Transmission

## VI .CONCLUSION

A complete working prototype of this system was built to demonstrate an automatic meter reading system using frequency modulation system. The distribution Company is facing many problems in terms of losses like power theft. Also the consumers facing many problems like sometimes they get an estimate bill based on previous consumption rather than accurate bill based on actual consumption. The remedy for all these problem is to keep track of the consumers load on a timely basis, which will help assure accurate billing, smart automated process instead of manual work and detect online theft. The smart meter reading system proven to provides effective, reliable and efficient wireless automatic meter reading, billing and security through the use of this system. Thus reduce human operator meter reading operation costs.

## REFERENCES

1. H. G. Rodney Tan, C.H. Lee, "Automatic Power Meter Reading System using GSM network", 978-981-05-9423-7 c\_2007 GPRS.
2. Irfan Quazi, Sachin Kumar Gupta and Rajendra Prasad, "Pre Paid Energy Meter based on AVR Microcontroller", IJERA, Vol-1, pp. 1879-1884.
3. Shoeb S.Sheikh "Design and Implementation of "Wireless Automatic Meter Reading System" IJEST, Vol-3 pp. 2329-2334.
4. Rob van Gerwen, Saskia Jaarsma and Rob Wilhite, KEMA, "Smart Metering" July 2006.
5. T.H.Lee, "Design of CMOS Radio Frequency Integrated Circuits", second edition, CUP, 2004.
6. Li Yujin, "Remote Automatic Meter Reading System based on GPRS Technology" IEEE 2010.
7. Litting Cao, Wei Jiang, Zhaoli Zhang, "Automatic Meter Reading System based on wireless Mesh Networks and SOPC Technology" IEEE Nov. 3, 2009.
8. Liting Cao, Jingwen Tian and Dahang Zhang, "Networked Remote Meter-Reading System Based on Wireless Communication Technology" in International Conference on Information Acquisition, 2006 IEEE.
9. Richa Shrivastava and Nipun Kumar Mishra, "An Embedded System for Wireless Prepaid Billing of Digital Energy eter," International Journal of Advances in Electronics Engineering, pp. 322-324.
10. Amit Jain, Mohnish Bagree "A prepaid meter using mobile communication" International Journal of Engineering, Science and Technology, Vol. 3, No. 3, 2011, pp. 160-166.

11. Md. Mejbaul Haque<sup>1</sup>, Md. Kamal Hossain, Md. Mortuza Ali, Md. Rafiqul Islam Sheikh "Microcontroller Based Single Phase Digital Prepaid Energy Meter for Improved Metering and Billing System" International Journal of Power Electronics and Drive System (IJPEDS) Vol.1, No.2, December 2011, pp. 139-147 ISSN: 2088-8694.
12. <http://www.seminarprojects.com/Thread-automatic-meter-reading-amr#ixzzle7T3VMcj>.
13. International Standards for all electrical, electronic and related technologies available at- <http://www.iec.ch>.