Wireless Energy Metering for IOT Application

**S. Usha, C. Subramani, C. Vimala, M. Venkatesan,
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Abstract: ***In recent times, with the development of technology, and the ever increasing demands of the population in terms of electrical power in order to run the many home used appliance has increased, hence the need to effectively reach the masses in terms of informati0on of consumption and billing is also of great importance. The advent of IOT (internet of things) has led to minimization of many process related functions. This paper proposes wireless energy metering using RF Transceiver. It is a simple system which is used for measuring electrical bills through wireless communication and sends the information regarding consumed power & also sends the dead line for paying of electrical bill. The primary advantage of this system is its efficiency, cost redundancy and portability, this system also gives a leading edge over online payment and approachability. An overview of this technology is provided in detail in this paper, along with the simulation and feasibility.***

Keywords: AMR, RF Transmitter, RF Receiver, Energy Meter, Automatic Energy Meter Devices.

I. INTRODUCTION

The ever increasing population has indirectly led to the increase of supply of electric power to the masses of households and industrial applications Running in abundance all across the world, due to such an increase in demand and supply of electric power, it is necessary to keep stringent check on the usage and billing of such systems. However currently in most under developed as well as developing nations, the process of metering and billing is analog and manual. These outdated systems are inefficient and can provide faulty results [1].

With the advent of the internet and wireless technology, and the development of much faster and compatible processing systems, many of the processes which initially seemed difficult to proceed with in a digital environment seems possible now[2]. Wireless energy metering is one such application. Initially most metering systems made use of merz-price type and similar digital and analog metering systems, but many of these systems are prone to human and system anomalies, which can affect both the billing company as well as the customer. Further these devices can be tampered and the reading within it can be corrupted, also there is high probability that systems might fail once in a while and it will go unnoticed. In order to avoid such faults this paper discusses the modulation of a new wireless metering system using RF Transceiver [3].

In the modern age since the advent of GSM and internet communication, long range supervision, control and accessibility has evolved and is no longer a hindrance, using this to our advantage we focus on developing an advanced wireless metering monitoring system, which primarily revolves around the use of a RF transmitter. This technology simplifies the metering system at the same time it provides greater freedom of control to both the consumer and the supplier, the systems on providing detailed information of power consumption to the consumer, hence solving all cases of discrepancies between the consumer and the supplier. In the work presented here, a technique has been developed to read electric power meter readings from a remote server automatically using the RF transceiver integrated along with the meter. The group of meters of a certain consumer, residential or industrial environment sends the meter readings to the central server. The central server then stores the information in database for analysis and sends the bill to the customer display unit. The RF based data collection can be done very quickly and efficiently. Data can be collected after any desired time interval such as hourly, daily, weekly, or monthly basis. Further an arrangement can be made to detect fault and failures, also a no tamper module can be integrated along with this system, this will ensure there is no human intervention and it will eliminate the possibility of corruption as well[4].

The development cost of the RF based remote meter will be higher than conventional meter but the electric supplier revenue will increase in the successive months because it will eliminate the possibility of system failures and provide accurate data.[5] Remote meter can be used in residential apartments and most industries and plants, where power is consumed in bulk.

II. DESIGN OF PROPOSED METHOD

The methodology of this project design is divided into two sections:

Hardware Architecture: The hardware implementation consists of the development of the main controller, sensor nodes and the communication protocol.

Software Architecture: The software implementation focuses on the programming of the microcontroller using AVR compiler.

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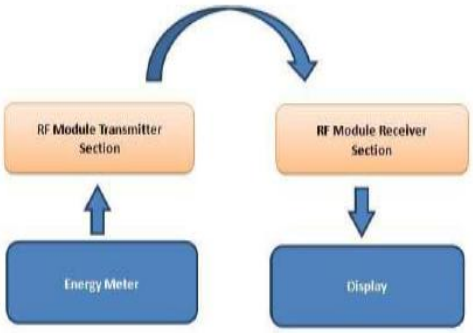


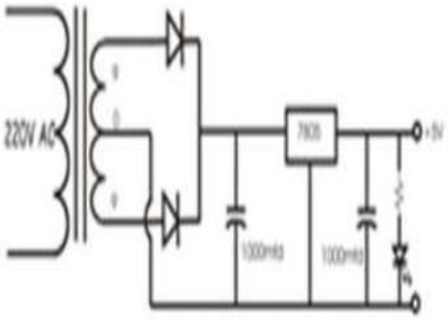
2.1 Hardware architecture

The hardware part of the Wireless energy meter consist of the following modules:

- Micro-controller unit,
- Liquid Crystal Display (LCD)
- Electrically Erasable Programmable Read Only Memory (EEPROM),
- Real Time Clock (RTC)
- Energy Measuring Module (EMM),
- Tamper detection unit
- Relay and ZigBee protocol.

Here the Microcontroller performs the most crucial role of the system, its functions includes processing and detailing the metering information, to control the RF Transmitter and the data sent through it, it also acts as the processing module, to provide an interface between the user and the system.

In this system the microcontroller sends display values to the GUI (graphic user interface) LCD screen and provide the user with the ability to control the system. The EEPROM will be calibrated to store the parameters under which the meter functions. Power supplied through a relay which is controlled by the microcontroller. The system working time is provided by the RTC and the corresponding values are noted. The controller and the LCD works at 5V. The entire meter is calibrated trough an external calibration Routine by a PC Through an external SPI interface.



2.2 Software Implementation

The software integration in this module focuses on providing a suitable GUI interface and processing the right metering values. Further the software is also responsible for recording the time, monitor the billing cycle and the format in which the data is processed and sent. The EEPROM is hard programmed and will have the same calibration settings, until the user wishes to deliberately alter the boot cycle, as well the billing parameters. The communication system is illustrated in figure 1.

For the providing an accurate idea of the functioning of this system, a ATMEGA16 microcontroller using AVR compiler is used. The receiver and transmitter block diagram are demonstrated in figure 2 and 3 respectively. The integrated software module include USART and LCD character module programming, and ADC programming. All of this programming is done using C language.

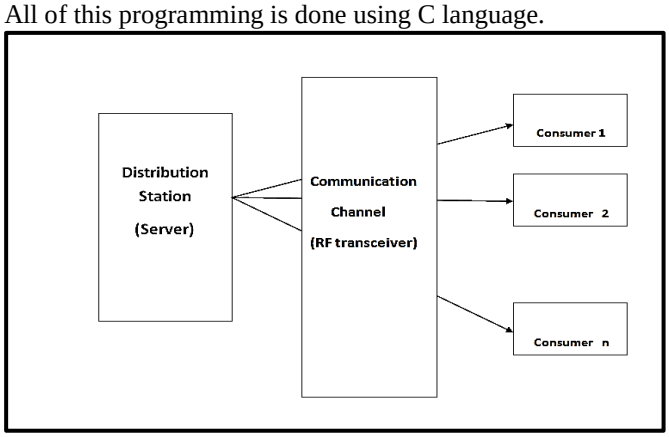


Figure 1: Communication system

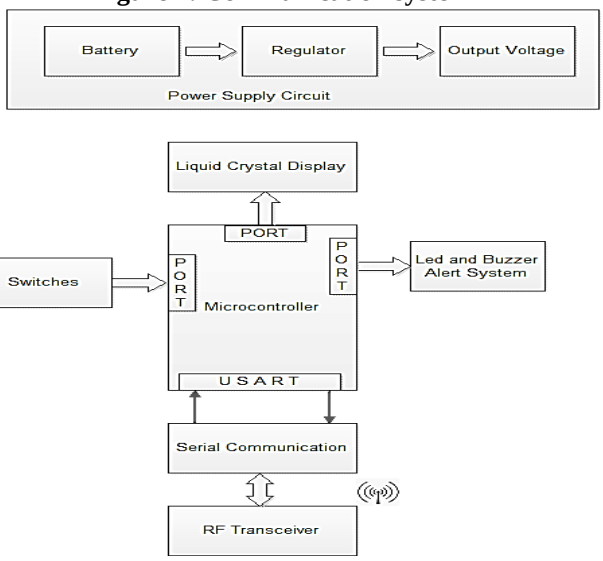


Figure 2: Block diagram of receiver

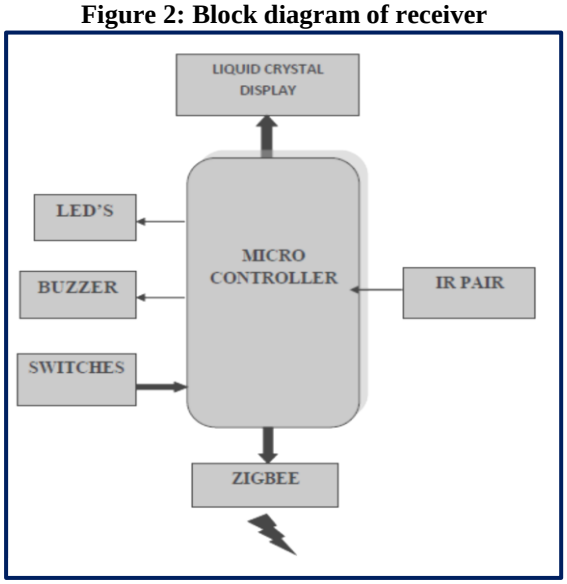


Figure 3: Transmitter block diagram

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III. SIMULATION RESULTS OF WIRELESS ENERGY METER

In the conventional system the billing is made by manually to the consumer's home and construct the bill. If the customer is not readily present, the billing system will be not completed. After taking the meter reading,

The recorded consumption has to be compared with the earlier recorded consumptions. If the meter is not working it has to be recorded accordingly and intimated to the section officer. Nil consumption shall never be recorded. The availability or otherwise of meter terminal cover seal, meter cover seals and the meter box seal if box is provided is to be noted

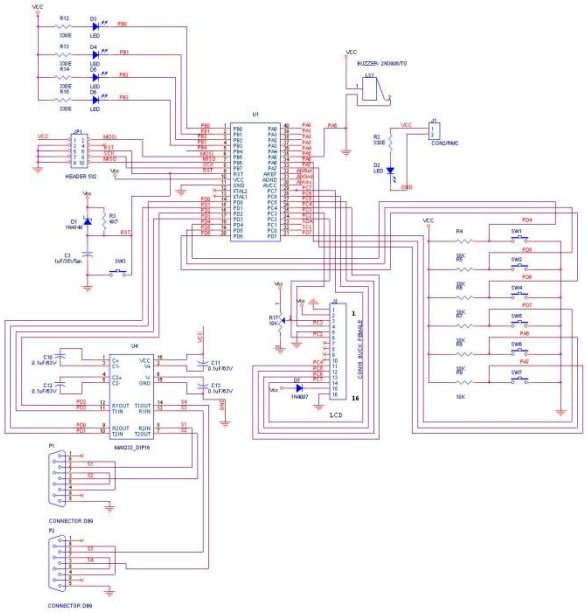

Figure 4: Circuit diagram of wireless energy meter

The purpose for which the supply was released and being used has to be noted. If the consumer has connected any additional loads other than the contracted load it has to be noted & brought to the notice of the section officer. Meter to be checked for performance with consumer's load. Meter readings are to be recorded properly without any parallax error. At the time of taking meter readings the reader has to check whether the service is a live service or under disconnection service. The circuit diagram and simulation of wireless energy meter are illustrated in figure 4 and 5 respectively.

Meter readings are to be noted strictly in accordance with the dates assigned and in case of any burnt or stuck up meters the cases are to be reported to the section officer and average consumptions to be worked out by the section officer only. No burnt meter is to be changed or directed without proper authorization. In case if the consumer does not pay the burnt meter charges, the meter cost may be got included in the energy consumption bill, The stuck up meters and burnt meters services are to be carefully

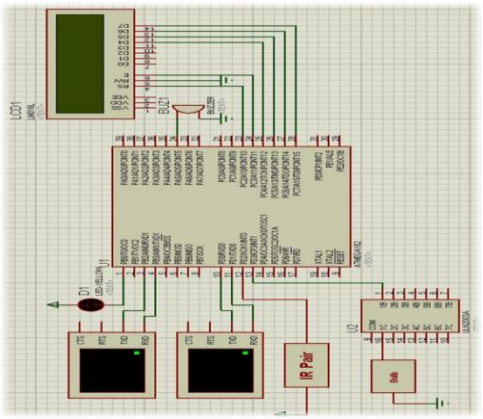

Figure 5: Simulation of wireless energy meter

Watched and pursued for immediate replacement. The meter readings are to be noted both in the register and on the reading formats on the specified dates for enabling timely preparation of the bills. While taking readings, the consumer has to be intimated the consumptions recorded and make an entry in the consumer's card with authentication. It is advisable to rotate the meter readers and areas periodically so that anomalies or discrepancies will not find a place. If the theft of energy or malpractice is suspected at any service premises the fact may be brought to the notice of the higher authorities.

IV. CONCLUSION

The proposed billing system is not only efficient but also feasible and possible to be integrated at a large scale. The concept of this paper involves the usage of an integrated IOT environment making it fairly easy to construct and implement, as it can be inferred from the above results. The simulation and the tests regarding this system prove to be positive. The primary advantage of this system is that it can be implemented over a large area, and the consumer usage and billing data can be fairly checked, further the payment process which is processed through the user end and the due date penalty wireless surveillance can also be achieved through this type of system.

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