# Embedded Based Digital Energy Measurement for Improved Metering and Billing System

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**Abstract:**In this research paper,the proposed concept is to replace the traditional manual meter reading. Now a days the traditional manual Meter Reading was not suitable for longer operating purposes as it spends much human and material resource. It brings additional problems in calculation of readings and billing manually. The number of Electricity consumers is increasing in great extent. It became a hard task in handling and maintaining the power as per the growing requirements. Presently maintenance of the power is also an important task as the human operator goes to the consumer's house and produces the bill as per the meter reading. If the consumer is not available, the billing process will be pending and human operator again needs to revisit. Going to each and every consumer's house and generating the bill is a laborious task and requires lot of time. It becomes very difficult especially in rainy season. If any consumer did not pay the bill, the operator needs to go to their houses to disconnect the power supply. These processes are time consuming and difficult to handle. Moreover, the manual operator cannot find the Un-authorized connections or malpractices carried out by the consumer to reduce or stop the meter reading/power supply. The human error can open an opportunity for corruption done by the human meter reader. So the problem which arises in the billing system can become inaccurate and inefficient.But, in this proposal greatly reduces the manpower, save time and operates efficiently without any human interference. And the person who is checking the amount electricity consumed by the user automatically using the microcontroller chip. Our proposed model and project work aims that a new approach for data security and transmission of data using ZIGBEE technology.

**Keywords**: PIC microcontroller, Digital energy meter, Voltage Sensor, Current Sensor and Zigbee.

## I. INTRODUCTION

Traditional metering method is not convenient for energy measuringand billing, also more difficult (i.e.) measurement of energy consumed by the particular user done manually and data sent to electricity board where the amount is calculated based on the usage of electrical unit.The most common type of electricity meter is the electromechanical induction watt-hour meter. The electromechanical induction meter operates by counting the revolutions of a non-magnetic, but electrically conductive, metal disc which 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. The current coil similarly consumes a small amount of power in proportion to the square of the current flowing through it, typically up to a couple of watts at full load, which is registered on the meter[4].The disc is acted upon by two coils. One coil is connected in such a way that it produces a magnetic flux in proportion to the voltage and the other produces a magnetic flux in proportion to the current. The field of the voltage coil is delayed by 90 degrees, due to the coil's inductive nature, and calibrated using a lag coil This produces eddy currents in the disc and the effect is such that a force is exerted on the disc in proportion to the product of the instantaneous current, voltage and phase angle (power factor) between them. A permanent magnet exerts an opposing force proportional to the speed of rotation of the disc. The equilibrium between these two opposing forces results in the disc rotating at a speed proportional to the power or rate of energy usage. The disc drives a register mechanism which counts revolutions, much like the odometer in a car, in order to render a measurement of the total energy used.The type of meter described above is used on a single-phase AC supply. Different phase configurations use additional voltage and current coils.

Figure.1 Traditional energy meter


Fig.2. Electronic digital meter

Three-phase electromechanical induction meter, metering 100 A 240/415 V supplies. Horizontal aluminium rotor disc is visible in centre of meter the disc is supported by a spindle which has a worm gear which drives the register. The register is a series of dials which record the amount of energy used. The dials may be of the *cyclometer* type, an odometer-like display that is easy to read where for each dial a single digit is shown through a window in the face of the meter, or of the pointer type where a pointer indicates each digit. With the dial pointer type, adjacent pointers generally rotate in opposite directions due to the gearing mechanism.

The amount of energy represented by one revolution of the disc is denoted by the symbol Kh which is given in hours per revolution. The value 7.2 is commonly seen. Using the value of Kh one can determine their power consumption at any given time by timing the disc with a stopwatch [4].

$$P = 3600 . Kh \backslash t$$
Where:
        t = time in seconds taken by the disc to complete one revolution,
        P = power in watts.

Electronic meters display the energy used on an LCD or LED display, and some can also transmit readings to remote places. In addition to measuring energy used, electronic meters can also record other parameters of the load and supply such as instantaneous and maximum rate of usage demands, voltages, power factor and reactive power used etc. They can also support time-of-day billing, for example, recording the amount of energy used during on-peak and off-peak hours [4].

## II. LITERATURE SURVEY

A. Vijayaraj*et al* [1] the paper titled as Automated EB Billing System Using GSM and Ad-Hoc Wireless Routing" In our system the central EB office has immediate access to all consumer homes in a locality with the help of an RF system. The EB meter present in each house is connected by wireless network with the EB office which periodically gets updates from the meter. The EB office using a backend database calculates the amount to be paid according to the number of units consumed and sends it back to the meter for display and also to the user's mobile phone.

Irf *Quazi et al* [2] the paper titled as" Pre-paid Energy Meter based on AVR Microcontroller" In this paper, the idea of pre-paid energy meter using AVR controller have been introduced. In this method 8051 has been replaced by AVR controller because, it is energy efficient i.e. it consume less power, it is fastest among all the microcontroller families, it has inbuilt ADC and have advanced RISC architecture. In this paper, energy meters have not been replaced which is already installed at our houses, but a small modification on the already installed meters can change the existing meters into prepaid meters, so this meters are very cheaper. The use of GSM module provides a feature of pre-paid through SMS.

Md. Mejbaul Haque1 *et al* [3] the paper titled as" Microcontroller Based Single Phase Digital Prepaid Energy Meter for Improved Metering and Billing System" In this project used two micro controllers and one energy meter IC. It's not like traditional one. They have used AT mega chip to calculate the energy consumption, it is have one smart card to recharge the amount and utilize it.

Abhinandan Jain *et al*[4] the paper titled "Design and Development of GSM based Energy Meter"Traditional metering method for retrieving the energy data isnot

convenient and the cost of the data logging systems is high. So this paper presents of design and development of Automatic meter reading (AMR) system. AMR system is a boom for remote monitoring and control domestic energy meter. AMR system give the information of meter reading, power cut, total load used, power disconnect and temper in gon request or regularly in particular interval through SMS. This information is being sent and received by concerned energy Provider Company with the help of Global system for mobile communication (GSM) network. Energy providerreceives the meter reading within a second without visiting person. AMR minimize the number of traditional visitsr equired by employs of energy Provider Company. This system not only reduces the labour cost but also increase meterreading accuracy and save hugs amount of time.

A.Vijayaraj*et al*[5] the paper titled as "GSM and ad-hoc wireless routing" In this proposed system through which electricity billing becomes fully automated and communication is made possible via wireless networks. The existing manual system in India has major drawbacks. This system is prone to errors and can also be easily manipulated. The prevailing manual system also requires lot of human workforce. The major disadvantage in this system is that the meter cannot be accessed by the meter reader if the customer is not present at home.In our system the central EB office has immediate access to all consumer homes in a locality with the help of an RF system. The EB meter present in each house is connected by wireless network with the EB office which periodically gets updates from the meter. The EB office using a backend database calculates the amount to be paid according to the number of units consumed and sends it back to the meter for display and also to the user's mobile phone. The advantages of the proposed system make the existing system incompetent. It is possible to connect to remote areas even when there is a power failure as it employs wireless technology. The new system is user friendly, easy to access and far more efficient than the existing system.

A. *Research problems in the traditional system*
In the current system we must go up to the EB office to pay these bills.The readings are taken from the analog meter in the consumer house and EB employee calculate those things.This system has some of advantages below[1].

1) Generating the bill - Here the EB Employee is going to and every house and takes the reading and generates the bills. It will take lot of time and laborious task
2) Disconnect the power supply- If the consumer did not pay the bill means again one of the EB Employee is go to disconnect the supply.
3) Corruption on meters- There is a interconnection between consumer and EB department so, the person is gives the wrong reading to the consumer and he gets some

money from the corresponding consumers. So, it gives the big loss.

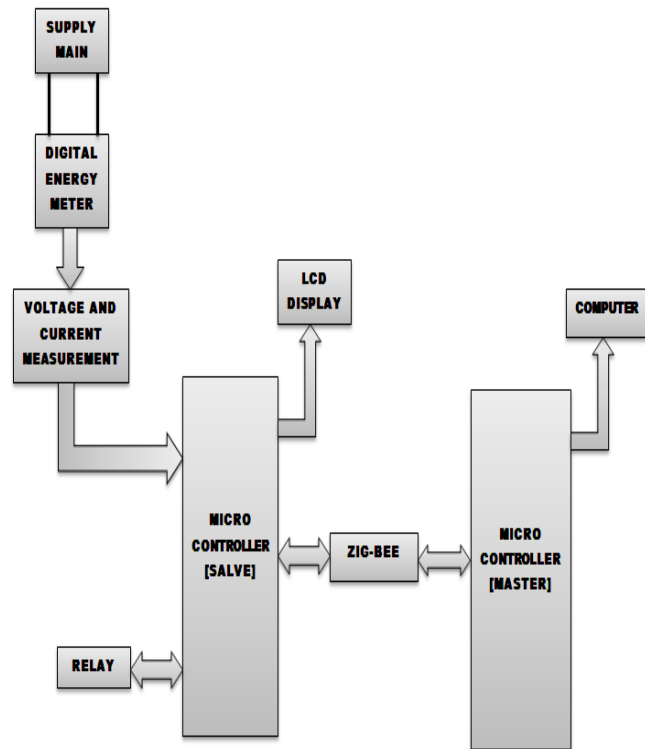## III.PROPOSED SYSTEM HARDWARE



Fig.3. Block Diagram of Proposed system

In Our In proposed system, we have used digital energy meter. It use current and voltage sensor itself measure the power ratings, and it is given to the slave microcontroller IC. It is already programmed for calculating values, such as amount of power utilized consumer, last date for paying bill, reset old readings, day by day update status, etc. The technology behind that, there is interconnection between the consumer and EB department. The thing is, if the consumer knows the amount bill means, it is possible to corruption on meter readings. So, the ZIG-BEE technology is used to transmit and receive the details about the corresponding consumer.so, it is not possible corruption both master and salve side i.e., (consumer and central office side). If the consumers not pay the bill means the connection will be disconnected through the relay logic.

## IV.WORKING METHODOLOGY
The idea behind this proposed system is very simple that is, from this we have used ZIGBEE technology using data transmitting and receiving purpose. But in case of this technology is very costly.
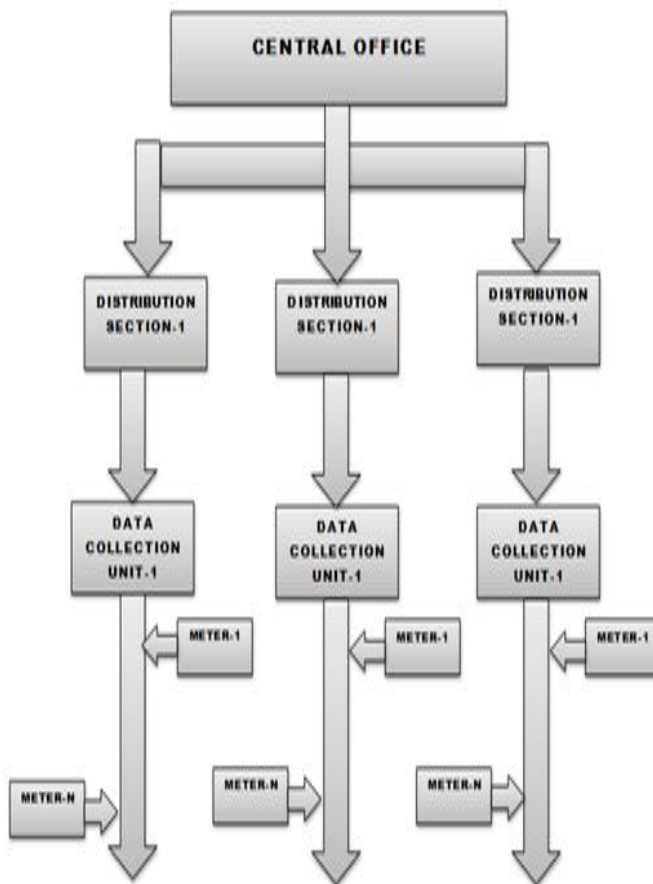
Fig 4.working methodology of proposed system

If it is used in every consumer means. So, we have planed to the transceiver is only a distribution section. From this maintainer and initial cost is reduced. After paying the electricity bill they have given the password that is used to connection will disconnect or connect.We have transmitter section on every distribution section, and the receiving section in electricity board. So, the entire control on electricity board. From this the security of data transmission and reduced the manpower on electricity board.

A.  *Benefits of the proposed system*

• Smart automated process instead of manual work.

• Accurate information from the network load to optimize maintenance and investments.

• Customized rates and billing dates

• Streamlined high bill investigations.

• Automatic outage information and faster recovery.

• Better and faster customer service

B. *Features of the Proposed system*

• Customized rates and billing dates

• Streamlined high bill investigations.

• Automatic outage information and faster recovery.

• Better and faster customer service.

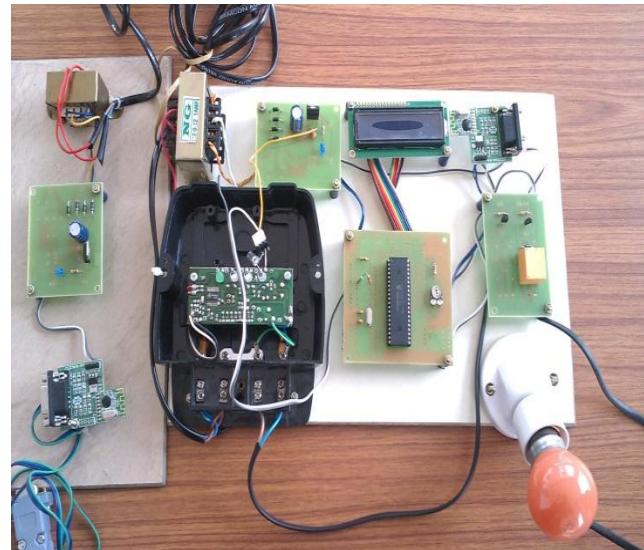## V. IMPLEMENTATION MODEL OF PROPOESD SYSTEM



Fig 5.  Model of proposed system

## VI. CONCLUSION

In this paper, from our above work, can conclude that this proposed model can provide a safe, secure and efficient way to energy measurement calculation and energy billing system. This method possible to solve the problem of manual process of energy measurement and billing system and our technology gives towards solution. From this, we hope this proposed  ideacan make a great change in assessment of electricity bill and can give the benefit to the government by reduce the manpower and time consumption to the cost reduced.

## ACKNOWLEDGMENT

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## BIOGRAPHY

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