

# IOT BASED SMART ENERGY METER BY USING PLCC

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**Abstract--Electricity is one of the fundamental necessities of human beings, which is commonly used for domestic, Industrial and agricultural purposes. Power theft is the Biggest problem in recent days which causes lot of loss to Electricity boards. In countries like India, these situations are more often. If the theft is prevented, then lots of power can be saved. This is done using Smart Energy Meter (SEM), which is an electric device having energy meter chip for measuring the electric energy consumed and o X10 Protocol is used for serial communication. This paper presents a smart energy meter for an automatic metering and billing system. In this meter energy utilized and the Corresponding amount will be displayed on the LCD Continuously and communicated to the controlling EB Station. Communication between user/household and substation is done using PLCC. This meter can work In Pre-paid using RFID. This proposed system replaces traditional meter reading methods and enables remote access of existing energy meter by the energy provider. Also they can monitor the meter readings regularly without the person visiting each house.**

**Keywords—Smart Energy Meter, PLCC, RFID;**

## I. INTRODUCTION

Power Line Carrier Communication, is an approach to utilize the existing power lines for the transmission of information. In today's world every house and building has properly installed electricity lines. This technology has been in wide use since 1950 and was mainly used by the grid stations to transmit information at high speed. Now a days this technology is finding wide use in building/home automation as it avoids the need of extra wiring. The data collected from different sensors is transmitted on these power lines thereby also reducing the maintenance cost of the additional wiring. In some countries this technology is also used to provide Internet connection. Power-line communication (PLC) has been recently envisaged for transportation systems. In the aeronautic sector, one of the important tendencies is the "more electric" aircraft, with the replacement of hydraulic energy sources by electrical ones. However, each electric system needs a power supply and a communication network. Reducing the cabling harnesses is currently a key issue that could be solved by introducing PLC technology. In, few measurements of the transfer function of a link between the left wing and the right wing and between a wing and the cockpit of a military aircraft were presented, constraints on the

processing time being emphasized. In, the transfer function of a power line in a transport aircraft was modeled to optimize the communication parameters.

To the website which can be viewed by the user at any time. It have two sections 1.EB Section 2.Home Section and in this both section using the WIFI technology. In this home section, first recharge our user card then we should keep our user card in the RFID reader and this will automatically read our card amount and use the IR sensor for count the one complete rotation and use the voltage sensor and current sensor for measuring the both current and voltage continually and this continuous reading will directly updated to the EB office and here by using the WIFI technology can directly update.

## MOTIVATION

Now a days internet are fast moving in to the future, need to update day-to-day gadgets and we are so busy updating are used to gadgets forgetting about the basic essential device like EB Meter. In recent days, the biggest problem is power theft which causes lot of loss to electricity boards and also Power consumption. The main objectives of this system are

- Detect the current theft by using current sensor.
- Reduces the man power.
- The bill payment section will be take place in home itself.
- Cost very low.

## II. LITERATURE REVIEW

An electricity meter, electric meter, electrical meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device.

Electric utilities use electric meters installed at customers' premises to measure electric energy delivered to their customers for billing purposes. They are typically calibrated in billing units, the most common one being the kilowatt hour [kWh]. They are usually read once each billing period

[1] Guilin Zheng, Zhifu Zhang, "Intelligent wireless electric power management and control system based on Zigbee technology", International Conference on

Transportation, Mechanical, and Electrical Engineering (TMEE) Changchun, China, pp. 1120-1124, December 16-18, 2011 wireless electric power management and control (IWEMC) system based on ZigBee technology is presented in this paper. It evolves from the traditional automatic meter reading (AMR) system. The IWEMC system includes intelligent electric meter, data collector, concentrator and specialized analysis software

[2] Ashna.k and Sudhish N George, "GSM Based Automatic Energy Meter Reading System with Instant Billing" This project was supported and financed by National Institute of Technology, Calicut, IEEE 2013

Wireless GSM energy meter and its associated web interface, for automating billing and managing the collected data globally. A GSM based wireless communication module is integrated with electronic energy meter of each entity to have remote access over the usage of electricity

[3] G. L. Prashanthi and K. V. Prasad, "Wireless power meter monitoring with power theft detection and intimation system using GSM and Zigbee networks" Journal of Electronics and Communication Engineering Volume 9, Issue 6, Ver. I (Nov - Dec. 2014).

Monitoring can provide information about power flow and demand and help to identify the cause of power system disturbances. The proposal in this paper is to monitor the power consumed by a model organization such as a household consumers from a centrally located point. Monitoring the power means calculating the power consumed exactly by the user at a given time. The power consumed by the user is measured and communicated to the controlling substation whenever needed by the person at the substation.

[4] O.Homa Kesav and B. Abdul Rahim, "Automated Wireless Meter Reading System for Monitoring and Controlling Power Consumption" International Journal of Recent Technology and Engineering Volume-1, Issue- 2, June 2012

Implementation of wireless automatic electric meter (AMR) network, implementing based on Zigbee technology for reduced power consumption. Wireless Electric meter is used for the collection of unit count and it is evolved from traditional meter reading scheme and power theft from the transmission line. This wireless automatic reading technology saves human resources and improves the accuracy.

[5] Design and implementation of smart energy meter V. Preethi; G. Harish 2016 International Conference on Inventive Computation Technologies (ICICT) Year: 2016 Communication between user/household and substation is done using Zigbee. GSM network is used for sending SMS to the local authorities regarding the theft cases. Also they can monitor the meter readings regularly without the person visiting each house

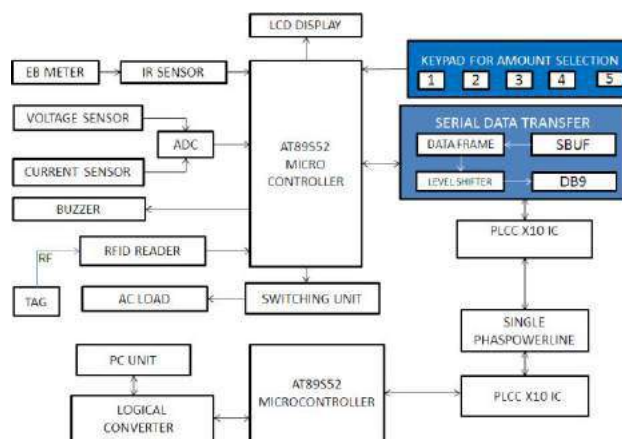
The above paper represents that Energy utilization and transmission via wireless technology like Zigbee. This makes an Radiation hazards and affects an human and living organisms. By using PLCC energy utilization transmits through the EB station

### III. PROPOSED SYSTEM

In this proposed system it stops the corruption in the electricity and to reduce the hard task in handling and maintaining the power as per the growing requirements. In this proposed system PLCC technology was used for transmitting and receiving the data. This paper also presents an overview of prepaid energy meter which can control the usage of electricity on consumer side to avoid wastage of power and to minimize the electricity theft. The proposed system is mainly used for reduce the man power.

#### Block diagram

The proposed system has two sections one is home section and another one is electrical base station (EB). Communication between these two sections can be done through PLCC. Power metering system will monitor consumed power in particular home and transmitted via a PLCC. In this system, Meter reading transfer through serial data communication. For a transmission and receiving X10 protocol are used. RFID reader will detect the smart card and amount selection will done through via keypad. Energy utilized and the corresponding amount will displayed on LCD continuously and communicated to the controlling base station. The user can identify the power theft by using current sensor. Monthly bill along with the due date is send to the consumer by IOT.



#### IV. HARDWARE DESCRIPTION

The Block diagram is shown in Figure 1. The Block diagram of smart energy meter mainly consist of

- AT89s52 Microcontroller
- IR Sensor
- UART
- MAX232
- PLCC
- RFID Reader

##### A. Microcontroller

The AT89S52 is a low-power, high performance CMOS 8-bit microcontroller with 8k bytes programmable Flash memory technology and is compatible with the Indus standard 80C51 instruction set and pin out.

##### Features

- Compatible with MCS-51 Products.
- 8K Bites of In-System Programmable (ISP) Flash Memory Endurance: 1000 Write/Erase Cycle.
- 4.0V to 5.5V Operating Range.
- Fully Static Operation: 0 Hz to 33 MHz
- Three –level Program Memory Lock.
- 256 x 8-bit Internal
- 32 Programmable I/O Lines.
- Three 16-bit Timer/Counters.
- Eight Interrupt Sources.
- Full Duplex UART serial Channel.
- Low-power Idle and Power-down Modes.
- Interrupt Recovery from Power-down Modes.
- Watchdog Timer.
- Dual Data Pointer.

##### B. IR SENSOR

This sensor can be used for most indoor applications where no important ambient light is present. For simplicity, this sensor doesn't provide ambient light immunity, but a more complicated, ambient light ignoring sensor should be discussed in a coming article. However, this sensor can be used to measure the speed of object moving at a very sensor, which rely on sending 40 KHz pulsed signals cannot be used because there are time gaps between the pulses where the sensor is 'blind'.

The IR Sensor-Single is a general purpose proximity sensor. Here it is used for collision detection. The module

consists of an IR emitter and IR receiver pair. The high precision IR receiver always detects IR signals. The module consists of 358 comparator IC. The output of Sensor is high whenever it IR frequency and low otherwise. The on-board LED indicator helps user to check status of the sensor without using any additional hardware.

##### Most Important Features

- High accuracy
- High sensitivity (110 V/W)
- Low resistance (50 kohm).
- Very good signal-to-noise-ratio
- Good response time (40 ms)
- Low cost thin film technology
- Easy and accurate measuring of the sensor temperature by means of a built-in temperature sensor (SMTIR9902).

##### Typical Applications

- Contactless measurement of surface temperatures or Infrared radiation.
- Temperature measurement on moving objects.
- Continuous temperature control of industrial sites.
- Thermal alarm systems.
- Climate control.
- Medical instruments.

##### C. UART

A universal asynchronous receiver/transmitter is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with other communication standards such as EIA RS-232.

The Universal Asynchronous Receiver/Transmitter (UART) controller is the key component of the serial communications subsystem of a computer. The UART takes bytes of data and transmits the individual bits in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes. Serial transmission of digital information (bits) through a single wire or other medium is much more cost effective than parallel transmission through multiple wires. A UART is used to convert the transmitted information between its sequential and parallel form at each end of the link. Each UART contains a shift register which is the fundamental method of conversion between serial and parallel forms.

#### D. MAX232

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

The drivers provide RS-232 voltage level outputs (approx.  $\pm 7.5$  V) from a single +5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to +5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case.

The receivers reduce RS-232 inputs (which may be as high as  $\pm 25$  V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.

The later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors – 0.1  $\mu$ F in place of the 1.0  $\mu$ F capacitors used with the original device.

#### D.PLCC

PLCC is an approach to utilize the existing power lines for the transmission of information. In today's world every house and building has properly installed electricity lines. By using the existing AC power lines as a medium to transfer the information, it becomes easy to connect the houses with a high speed network access point without installing new wirings.

This technology has been in wide use since 1950 and was mainly used by the grid stations to transmit information at high speed. Now a days this technology is finding wide use in building/home automation as it avoids the need of extra wiring. The data collected from different sensors is transmitted on these power lines thereby also reducing the maintenance cost of the additional wiring. In some countries this technology is also used to provide Internet connection.

#### E. RFID

Radio-frequency identification (rfid) is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. Some tags require no battery and are powered and read at short ranges via magnetic fields (electromagnetic induction). Others use a local power source and emit radio waves (electromagnetic radiation at radio frequencies). The tag contains electronically stored information which may be read from up to several meters away. Unlike a bar code, the tag does not need to be within line of sight of the reader and may be embedded in the tracked object.

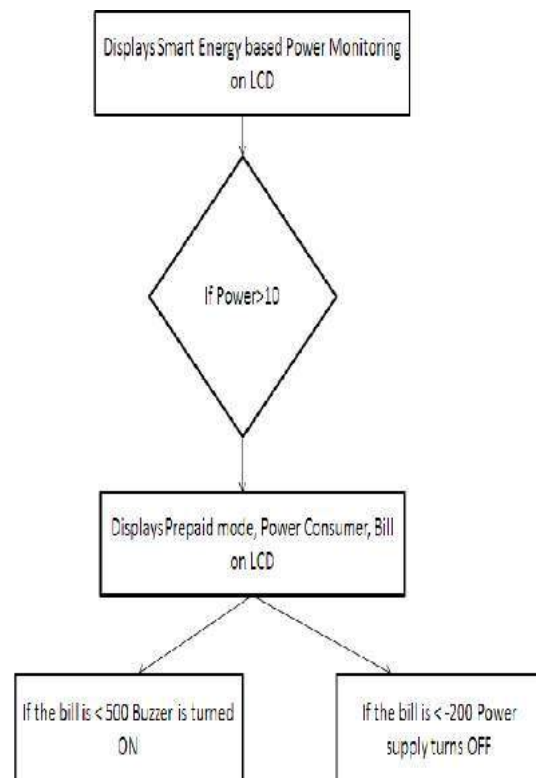
RFID tags are used in many industries. An rfid tag attached to an automobile during production can be used to track its progress through the assembly line.

Since rfid tags can be attached to clothing, possessions, or even implanted within people, the possibility of reading personally-linked information without consent has raised privacy concerns.

Rfid can be used in a variety of applications,[16][17] such as:

- Access management
- Tracking of goods
- Tracking of persons and animals
- Toll collection and contactless payment
- Machine readable travel documents
- Smart dust (for massively distributed sensor networks)
- Tracking sports memorabilia to verify authenticity
- Airport baggage tracking logistics[18]

#### Flow Chart for RFID



## ALGORITHM

- A. Step 1: Start the program.
- B. Step 2: Read display value.(power monitor on LCD)
- C. Step 3: Get the value as "power".
- D. Step 4: If power value is great then 10 units, Then check display parameters (prepaid mode, power consumer, bill on a LCD).
- E. Step 5: Get the value of bill as "rs".
- F. Step 6: If the value of "rs" is less then 500 units then buzzer mode "ON".
- G. Step 6: If bill value is less then -200 units, then the relay tripper mode is "ON".
- H. Step 7: Stop the program.

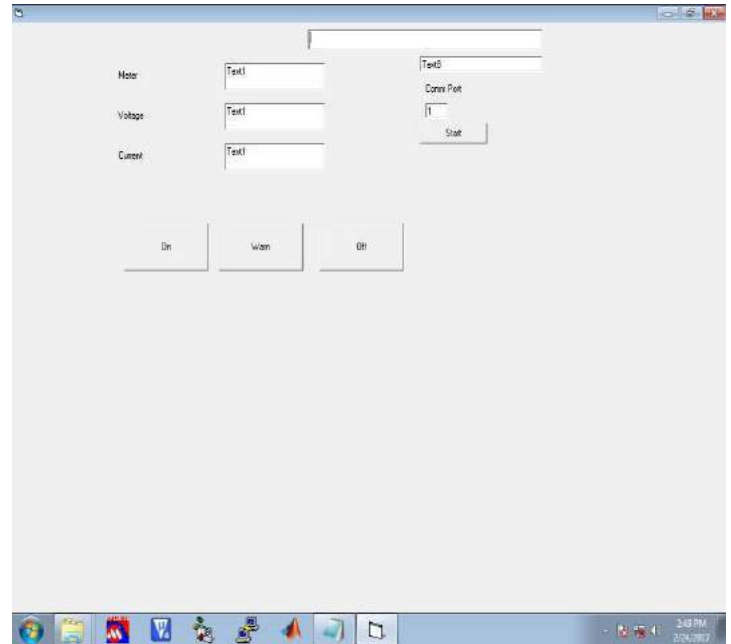
In prepaid mode ,customer shows the tag it enter the field and will vary antennas response will result in a perturbation of the magnetic field which can detected by the reader . By using keypad recharge can be done prepaid mode. Based on the power consume with respect to time the correspond amount is detected from the total amount and is displayed on the LCD . If recharge amount reduces to half a buzzer is activated and continuously alerts the consumer. The amount reach to zero, they provide some more time for consumer to recharge the amount, if they does not use this facility then man power is turned off using relay circuit.

It first checks whether the power is greater than 10 or not. In this mode initially I have recharge an amount of 1000. If it is less than 500 the buzzer alert the consumer, if it cross - 200 then the power is turned off automatically

### V. EXPERIMENTAL RESULT OF SMART ENERGY METER

The software tools used in my project are keil IDE, embedded c and flash magic for the working of SEM. The  $\mu$ Vision IDE from keil combines project management, make facilities, source code editing, program debugging, and complete simulation in one powerful environment. The  $\mu$ Vision editor and debugger are integrated in a single application that provides a seamless embedded project development environment. The  $\mu$ Vision IDE is the easiest way for most developers To create embedded applications using the keil development tools. Flash magic is a PC tool for programming flash based micro controllers, which allows us to easily access the features of microcontroller device. Then the result has been taken the voltage reading, current reading

and Meter reading .The output of an our project has been shown below.



### VI. Conclusion

The progress in technology about electrical distribution network is a non-stop process. In the present work by PLCC meter reading system is designed to continuously monitor the meter reading and to shut down the power supply remotely whenever the consumer fails to pay the bill. It avoids the human intervention, provides efficient meter reading, avoids the billing error and reduces the maintenance cost. It displays the corresponding information on LCD for user notification. The advantages of SEM are it requires less manpower, there is no need to chase payments, power theft detection is possible, bill is sent to the consumer with due date, the meter can act as prepaid meter, can minimize the power consumption in a house.

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