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IOT Smart Energy Meter

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Abstract: With the growing power demand & increasing use of energy, The transmission & distribution network are often improved to Advance Metering Infrastructure .Advanced metering Infrastructure is reliable, flexible to new changes considering control, monitoring & audit of energy .Energy Management is sort of traditional and need to be changed to AMI in area of residential services counting on new communication network using 5G module to determine network framework for IOT applications.

Keywords: USED-GSM, IOT, AMI, SCADA, mmTC, emBB.

I. INTRODUCTION

Wireless is the emerging technology & is becoming increasingly popular which is employed in various applications as home control, automation, and industrial process& energy management. Progress which results in enhancement of peoples standard of living by introduction of automation in energy management & intelligent building installation has been observed over recent years.
Consumption is increasing & tends to grow in next few years. There is growing demand of monitoring the consumption remotely. Centralized monitoring & control to manage multiple facilities from a single location is required.
Advanced metering infrastructure are systems that measure, collect & analyse energy usage & communicate with metering device such as smart energy meters.
AMI differs from traditional automatic meter reading it enables –two way communication with meter to extend reliability & transparency must be cost- effective, compact& consumer –interactive.
Traditional Metering System is Error prone, requires manpower to urge to houses & monitor usage of power producing spot billing. The procedures of sending bills to customer are very laborious & cumbersome, by using Wireless Eliminate manpower for billing at home or office's.
To achieve these goals usual electrical distribution must be complemented by an intelligent monitoring & information system
Automated meter reading system have been implemented using different technologies like GSM, ZIGBEE, WiMAX and Hybrid Technologies.

TABLE I VARIOUS TECHNOLOGIES

Technology Used	Cost	Feasibility	Reliability	Coverage	Communication Protocol
GSM	Low	Most Feasible	High	High	Stable
ZigBee	Medium	Small Scale	Low	Low	Least Stable
SCADA	High	Not Feasible	High	Low	Stable
PLC	Low	Least Feasible	Low	Very High	Very Stable
WiMAX	Medium	Small Scale	Medium	Low	Stable
Mixed	Varies	Feasible if GSM is a part of it	Varies	High If GSM is a part of it	Varies

ZigBee standard provides 250kbps data rate but with 5G higher data rate more control can be assured. Now, the goal is to build up an electrical energy metering with internet of things framework for public division with two-way communication technology for information monitor & control. 4G Network were not able to fulfil the connectivity requirements for IOT Applications.

II. PROPOSED SYSTEM

Smart meters is the need for smart technologies referring to control, monitoring& analysing the data. This Paper proposes use of Smart energy meter using 5G for IOT applications. Energy Meters can be integrated with 5G module or IOT component which can transmit data back to electricity board. The data can be stored in SQL database on the server with energy monitoring & management Centre. IOT (INTERNET OF THINGS) based application can be implied we can use

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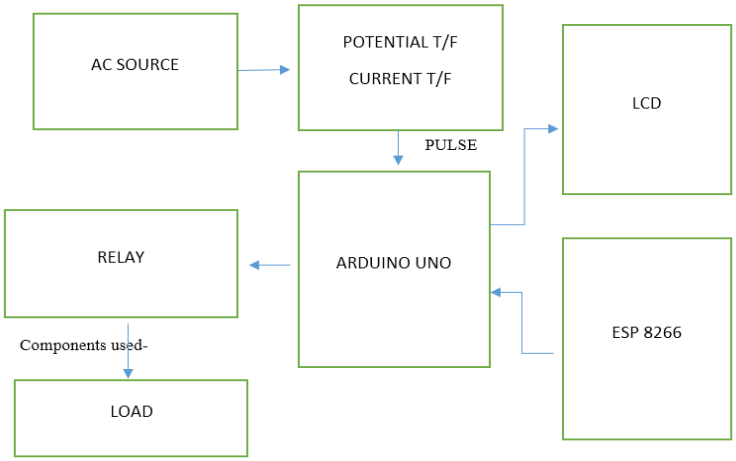
operator's network to communicate without spending on setting up of network & can rely on them with high security. 5G optimizes for connecting the millions of IOT devices to handle such kind of traffic remote monitoring (mmTC, emBB). We can set up interface between the user and the meter to monitor usage & control.

III. ARCHITECTURE

Architecture Design of Electrical energy Monitoring System with Wi-Fi module



ARDUINO (UNO):

Arduino UNO is the main part of the system. It is an open-source microcontroller based on Atmega328p developed by Arduino cc. It consists of sets of digital & analog pins that can be interfaced to various components. Having 14 digital pins, 6 analog pins can be programmed through Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, thought accepts voltages between 7 and 20 volts

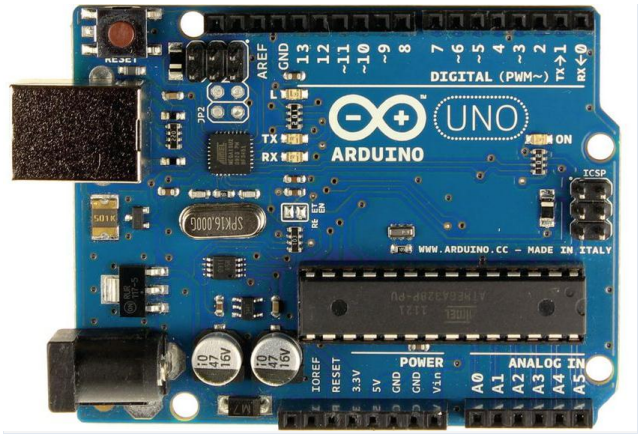


Fig 1 Arduino Microcontroller

RELAY:

Relay is an electromagnetic switch, which is controlled by small current, and used to switch ON and OFF relatively much larger current. Means by applying small current we can switch ON the relay which allows much larger current to flow. A relay is a good example of controlling the AC (alternate current) devices, using a much smaller DC current. Commonly used Relay is Single Pole Double Throw (SPDT) Relay, it has five terminals as below:

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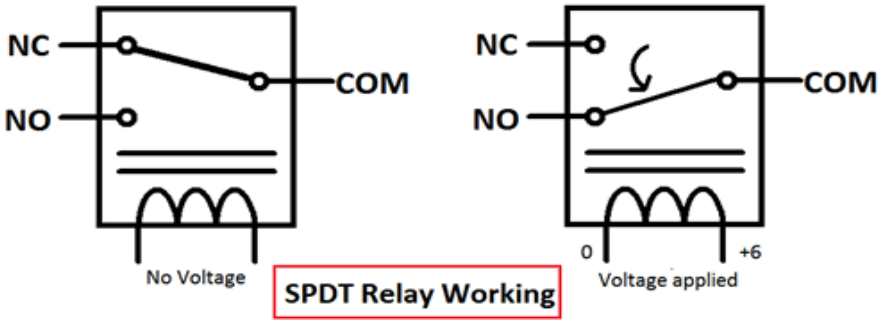

Fig 2 SPDT Relay

LCD:

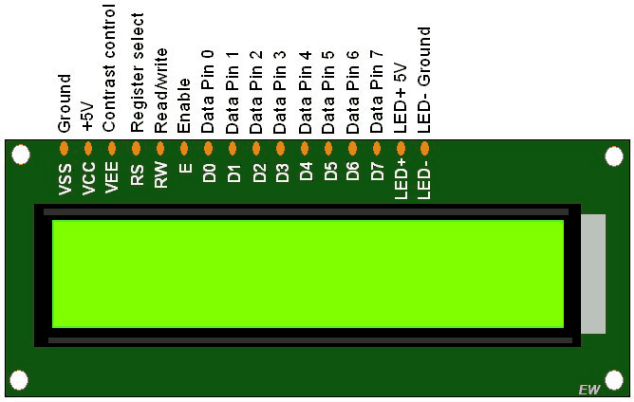

Fig 3 LCD Display

LCD stands for Liquid Crystal Display used in displaying various parameters. There are various types of LCD's used in Embedded Systems. 16*2 LCD display is usually preferred having 2 rows that accommodates 16 characters having 8 data lines & 3 control lines that can be used for control purpose can be operated in two mode 4 bit mode & 8 bit mode.

ESP8266:

The ESP8266 WI Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions another application processor. The ESP 8266 Wi-Fi module is a low cost component with which manufacturers are making wirelessly networkable microcontroller module. ESP 8266 Wi-Fi module is a system-on-a-chip with capabilities for 2.4GHz range. It employs a 32 bit RISC CPU running at 80 MHz It is based on the TCP/IP (Transfer control protocol). Module has 64 kb boot ROM, 64 kb instruction RAM, 96 kb data RAM. Wi-Fi unit performs IOT operation by sending energy meter data to webpage which can be accessed through address. The TX, RX pins are connected to the 7and 8 pins of the Arduino microcontroller.

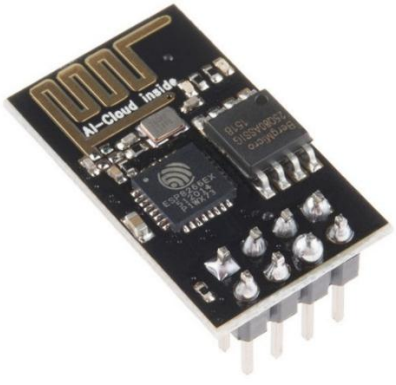

Fig 4 ESP8266

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VOLTAGE TRANSFORMER:

The voltage transformer is one in which the secondary voltage is substantially proportional to the primary voltage and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections. In an ideal transformer, the secondary voltage vector is exactly opposite and equal to the primary voltage vector, when multiplied by the turn's ratio. In a practical transformer, errors are introduced because some current is drawn for the magnetization of the core and because of drops in the primary and secondary windings due to leakage reactance and winding resistance.

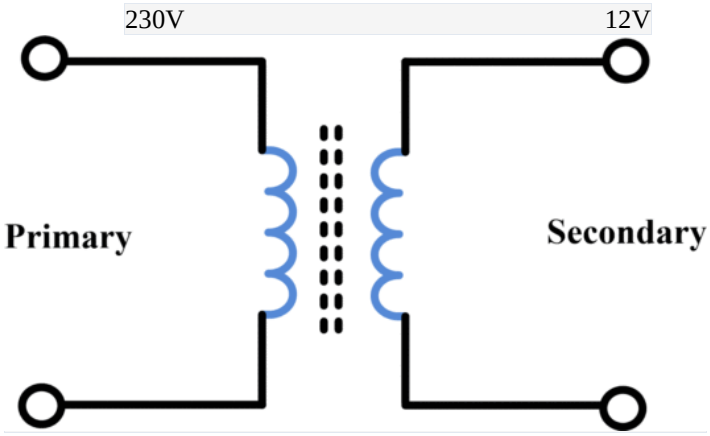

Fig 5 Voltage Transformer

CURRENT TRANSFORMER:

A current transformer is defined as an instrument transformer in which the secondary current is substantially proportional to the primary current and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections. This highlights the accuracy requirement of the current transformer but also important is the isolating function, which means no matter what the system voltage the secondary circuit need be insulated only for a low voltage. The current transformer works on the principle of variable flux. In the ideal current transformer, secondary current would be exactly equal and opposite of the primary current. But, as in the voltage transformer, some of the primary current or the primary ampere-turns are utilized for magnetizing the core, thus leaving less than the actual primary ampere turns to be transformed into the secondary ampere-turns. This naturally introduces an error in the transformation. The error is classified into two-the current or ratio error and the phase error. Thus by considering all these parameters are program into the microcontrollers to calculate the amount of power actually consumed.

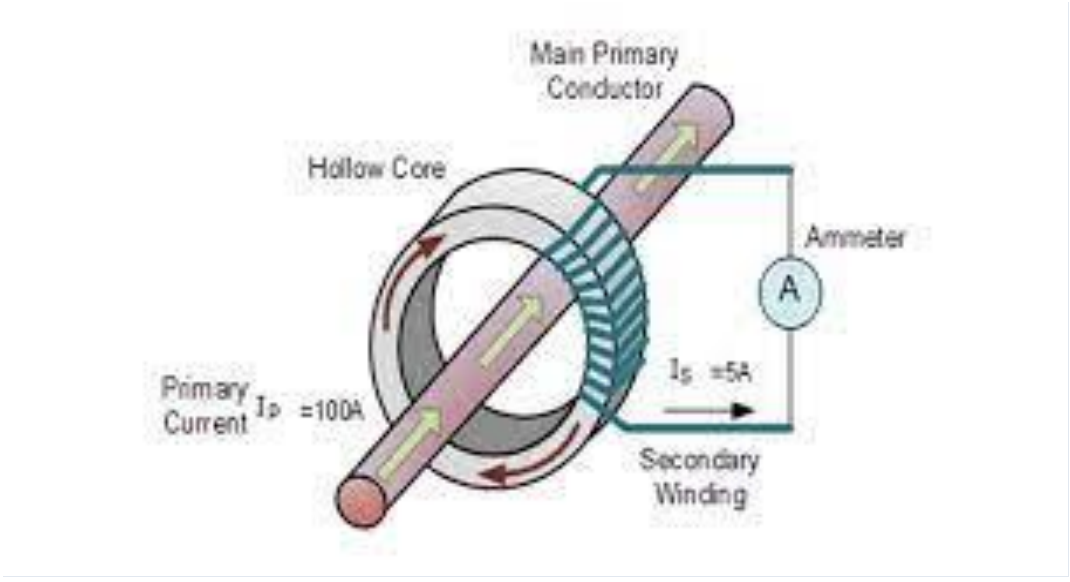

Fig 6 Current Transformer

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IV. SIMULATION

Proteus Simulation software is used to simulate IOT Smart Energy Meter By interfacing Arduino with NodeMCU (Wi-Fi Module) with LCD Display.

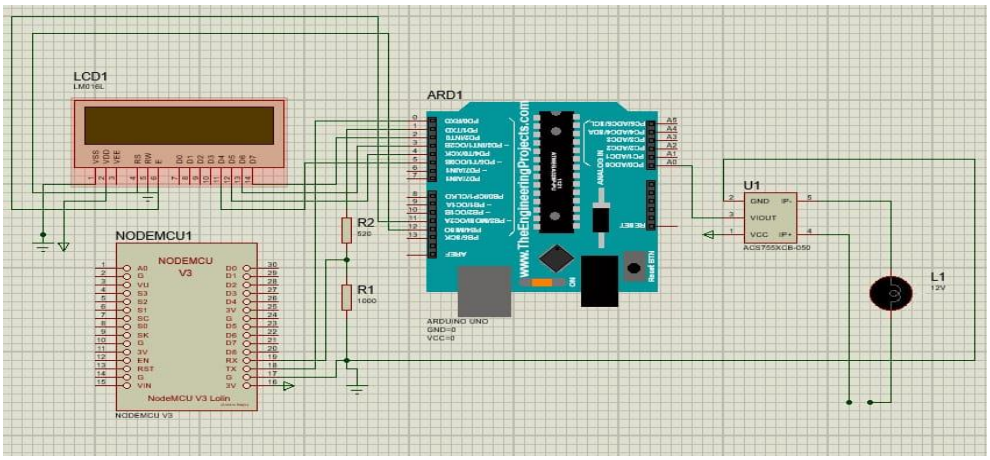

Fig 7 Simulation of Smart Energy Meter

V. CONCLUSION

In this project, the smart energy meter is simulated using proteus software has been proposed. This meter which records the energy usage by the consumers and transmits that information to the utilities for monitoring, controlling, audit and other purposes. The collected data's and parameters such as voltage, current, consumed power and billing amount are transmitted to the monitor section as well as the home section. Hence smart meter will eliminate the man power and provides accuracy. Smart meter also reduces the difficulty faced by the people when readings are taken manually and they can monitor it using IOT devices. The smart energy meter works with accuracy giving real time data feedback to consumer over IOT.

VI. FUTURE SCOPE

- Can be implemented In Smart Cities.
- Can reduce the commercial losses we face in the utility.
- Implements anti power theft monitoring.
- Complete avoidance of tempering of energy meter where there is scope of using power in illegal way.
- Load can be controlled remotely to avoid wasteful use of energy.

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