IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IOT BASED SMART ENERGY METER MONITORING WITH IDENTIFICATION OF ELECTRICITY THEFT

Suraj Rajendra Bhole , Vishvajeet Tukaram Dabhole ,
Rihan Kashim Mulani , Kuldeep Sanjay Salunke
(Student's)
Project Guide
Prof. S.M.Tamboli
Department of Electrical Engineering,
Faculty of engineering & faculty of management, Talsande, Tal. Hatkanangale, Dist. Kolhapur Maharashtra 416112, India.

Abstract: One of the major problem that the world faces this moment is Energy Extremity. It can be reduced to a certain extent by duly covering our energy consumption and avoiding energy destruction. Currently people face numerous problems like power theft. This system will find energy theft fluently.

This IOT electricity meter is conforming of Atmega 328 microcontroller with a WIFI module for IOT connection and GSM module for mobile connection, on which client will admit information via SMS. This smart electricity meter also consists of a current detector that sends the current reading to the microcontroller.

We've to connect cell phones with the system via SMS which will help to configure with the system. In case of an exigency, the information will be shared on the configured number. We've to set costs for the unit and for which we've four buttons.

With the help of buttons, we can set costs for the unit. As we start the system, it shows reading on the IOT screen. Reading will be changed with respect to time. In the case of energy theft, the theft will be caught and displayed on the IOT screen. Indeed the information will be entered through SMS on the configured number. After entering the alert, the driver can switch off the system using IOT to avoid theft..

Index Terms **- Iot, Wi-Fi module, Energy meter, GSM module, Atmega 328P.**

I. INTRODUCTION

The smart energy meter that based on IoT and Atmega 328P microcontroller. In this system we reduce human participation in electrical energy conservation. The theft of the electricity increases the costs paid by client. Commonly this system is used for the discovery of theft. The Atmega 328P microcontroller checks the main meter reading. If there is difference between current of meter coil and load current (by passing in meter) then massage of theft will be display on the LCD display and also display on the iotgecko. Client can be access the iotgecko from anyplace. By using the consumer number it can be access on the mobile at the anytime

II. BLOCK DIAGRAM

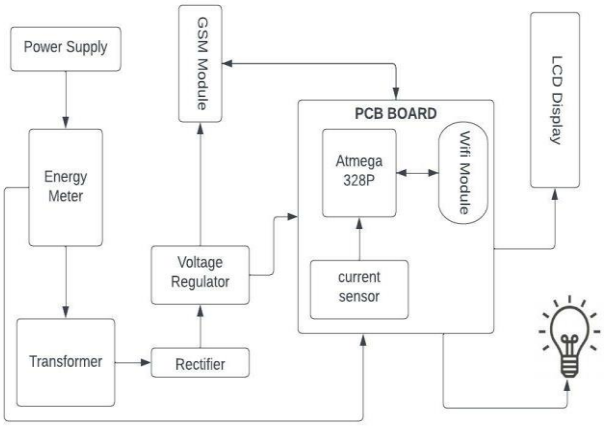

Fig.2 Block Diagram

III. COMPONENTS

3.1 ENERGY METER:

.

Fig.3.1- Energy Meter

Electronic meters measure energy using highly integrated components or other customized integrated circuits These devices digitize the instantaneous voltage and current via a high-resolution sigma-delta ADC. Computing the meter which is used for measuring the energy utilized by the electric cargo is known as the energy meter. It's used in domestic and industrial AC circuits for measuring power consumption.

Electronic meters measure energy using highly integrated components or other customized integrated circuits. These devices digitize the instantaneous voltage and current via a high-resolution sigma-delta ADC. Computing the product of the voltage and current gives the instantaneous power in watts. Integration over time gives energy used, which is usually measured in kilowatt-hours (kWh). Here, two basic sensors are employed. These are voltage and current sensors. The voltage sensor built around a step-down element and potential divider network senses both the phase voltage and load voltage. The second sensor is a current sensor; this senses the current drawn by the load at any point in time.

It's erected around a current motor and other active bias(similar to voltage comparator) which convert the tasted current to voltage for processing.

3.2 Current sensor:

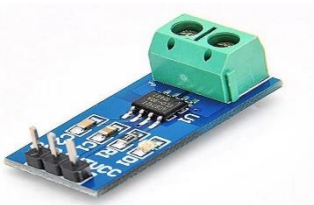

Fig.3.2 – Current Sensor

The current senser helps to detect the flow of current in the circuit . Technical terms aside, it's simply put forth as a current sensor that uses its conductor to calculate and measure the amount of current applied.. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switched-mode power supplies, and overcurrent fault protection. The device consists of a accurate, low-offset, linear Hall sensor circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which is sensed by the integrated Hall IC and converted into a proportional voltage. Device accuracy is optimized through the close immediacy of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided

by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging. The output of the device has a positive slope (>VIOUT(Q)) when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4)

3.3 GSM Module:

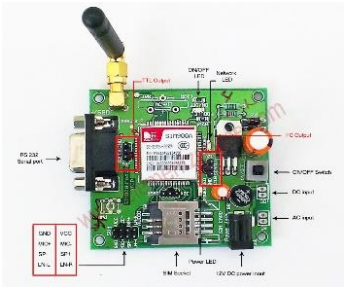

Fig. 3.3 – GSM module

GSM (Global System for Mobile Communications, originally Group Spécial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to define the protocols for second-generation (2G) digital cellular networks used by mobile phones, first deployed in Finland in July 1991.

GSM is a TDMA based wireless network technology developed GSM phones make use of a SIM card to identify the user's account. The practice of the SIM card allows GSM network users to quickly move their phone number from one GSM phone to another by simply moving the SIM card. Now GSM networks operate on the 850MHz, 900MHz, 1800MHz, and 1900MHz frequency bands. Devices that sustenance all four bands are called quad-band, with those that support 3 or 2 bands called tri-band and dual-band, respectively. In the United States, Cingular operates on the 850 and 1900MHz bands, while T-Mobile operates only on the 1900MHz band.

3.4 Atmega 328P Microcontroller:

ATmega328 is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328 has 32KB internal flash memory. ATmega328 has 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM). This property shows if the electric supply supplied to the micro-controller is removed, even then it can store the data and can provide results after providing it with the electric supply. Moreover, ATmega-328 has 2KB Static Random Access Memory (SRAM). Other characteristics will be explained later. ATmega 328 has several different features which make it the most popular device in today's market. These features consist of advanced RISC architecture, good performance, low power consumption, real timer counter having separate oscillator, 6 PWM pins, programmable Serial USART, programming lock for software security, throughput up to 20 MIPS .

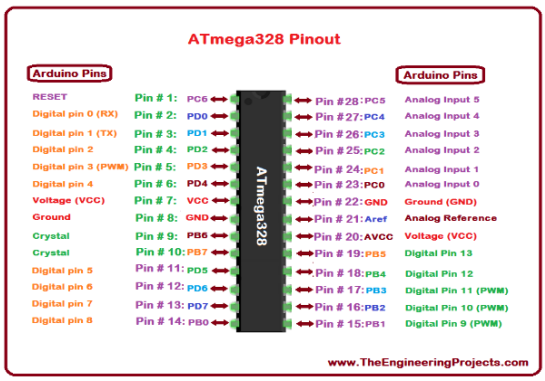

Fig 3.4- Atmega 328P

Atmega328 is the microcontroller, used in basic Arduino boards i.e Arduino UNO, Arduino Pro Mini and Arduino Nano. It has an EEPROM memory of 1KB and its SRAM memory is 2KB. It has 8 Pins for ADC operations, which all combine to form Port A (PA0 – PA7).

- Atmega328P is more popular than the other controller . Atmega 328P is highly performance And the low power controller From the microchip. Atmega is 8bit microcontroller. This microcontroller based on AVR RISC Architecture. This controller used in the Arduino Boards.
- This microcontroller are used like other controllers. This microcontroller are required separately program like other controllers. When you not give any program then this controller are not performed.
- This microcontroller required program and we are write the fitted program and this program file in the microcontroller flash memory. After fitted this program in flash memory then this microcontroller works like fitted program. It has 8 Pins for ADC operations, which all combine to form PortA (PA0 – PA7).

- It also has 3 built-in Timers, two of them are 8 Bit timers while the third one is 16-Bit Timer.

- You must have heard of Arduino UNO, UNO is based on atmega328 Microcontroller. It's UNO's heart.
- It operates ranging from 3.3V to 5.5V but normally we use 5V as a standard.

- Its excellent features include cost-efficiency, low power dissipation, programming lock for security purposes, real timer counter with separate oscillator.
- It's normally used in Embedded Systems applications. You should have a look at these Real Life Examples of Embedded Systems, we can design all of them using this Microcontroller.

3.5 WIFI Module:-

ESP8266 Wi-Fi module is WIFI periodical transceiver module, grounded on ESP8266. Small size and low cost makes it suitable for detector bumps. It works on3.3 V and consumes current up to 250mA. Current consumption is relatively big so it's generally not powered
on battery. Before we start using ESP8266 Wi-Fi module we need to update ESP8266 firmware.

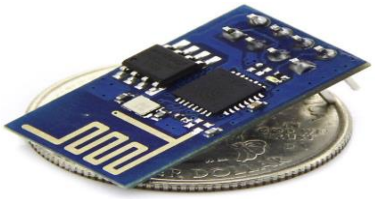

Fig.3.5- Wi-Fi Module

For Arduino board we will use Arduino pro minimized 3.3V 8Mhz and software serial port. HW serial port will be available for program uploading and debugging. Later you can switch module to HW serial port. Before we start using ESP8266 Wi-Fi module we need to update ESP8266 firmware. We use V0.9.2.2 version of firmware. New firmware default baud rate is 9600 which makes possible to use software serial on Arduino board. ESP8266 current consumption is too big to use Arduino internal regulator. We will use dedicated power regulator AMS1117. Make sure to use big enough additional capacitors to prevent voltage drops when transmitting.

ESP8266 Features

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units
- +19.5dBm output power in 802.11b mode
- Integrated temperature sensor
- Supports antenna diversity
- Power down leakage current of < 10uA
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4μs guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

3.6 LCD Display:-

LCD (Liquid Crystal Display) screen is an electronic display module and finds a wide range of operations. A 16x2 TV display is veritably an introductory module and is veritably generally used in colorful bias and circuits. These modules are preferred over seven parts and other multi-member LEDs. The reasons being LCDs are provident; fluently programmable; have no limitation of displaying special & indeed custom-made characters robustness, and so on.

A 16*2 LCD means it can display 16 types per line and there are 2 similar lines. In this display, each character is displayed in a 5x7 pixel matrix This LCD has two registers, namely, Command and Data.The command register stores the command commands given to the LCD.

For adjusting the difference of the display VEE pin is used by carrying voltage at this pin. This is done by connecting one end of a POT to the Vcc (5V), the other end to the ground, and connecting the center terminal (wiper) of the POT to the VEE pin. See the circuit diagram for a better understanding.

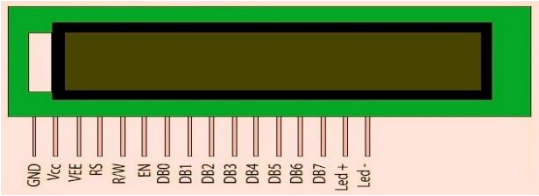

Fig. 3.6- LCD Display

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

VEE pin is meant for adjusting the contrast of the LCD display and the contrast can be adjusted by varying the voltage at this pin. This is done by connecting one end of a POT to the Vcc (5V), other end to the Ground and connecting the center terminal (wiper) of of the POT to the VEE pin. See the diagram for better understanding.

All LCD Have:

- Eight(8) Data pins
- VCC (Apply 5v here)
- GND (Ground this pin)
- RS (Register select)
- RW (read - write)
- EN (Enable)

IV. CIRCUIT DIAGRAM

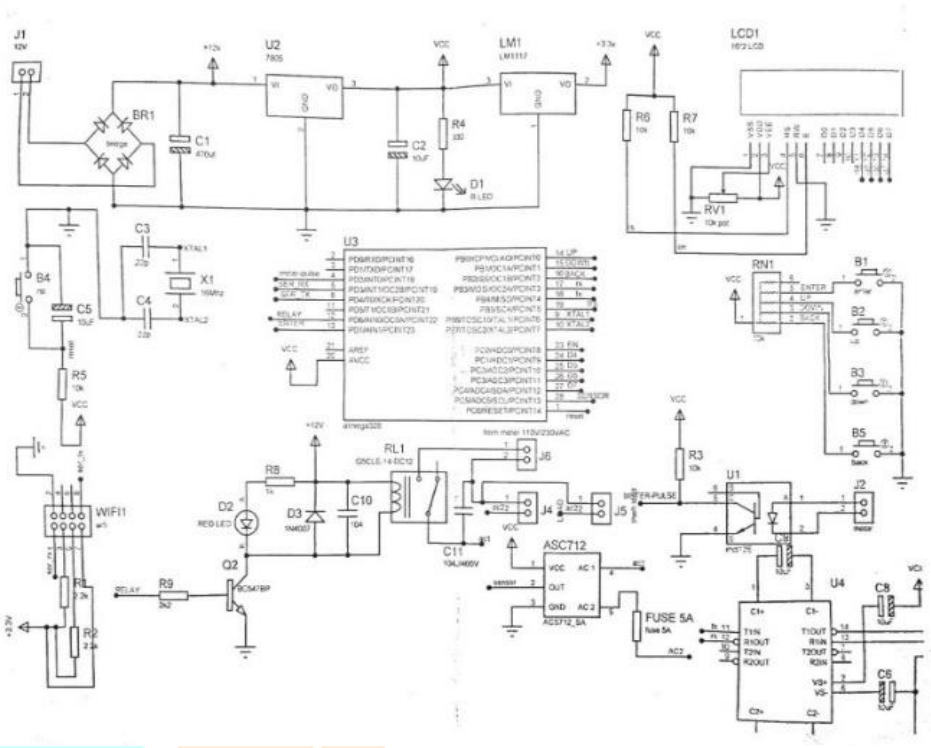

Fig.4 Circuit Diagram

V. WORKING OF PROTOTYPE MODEL

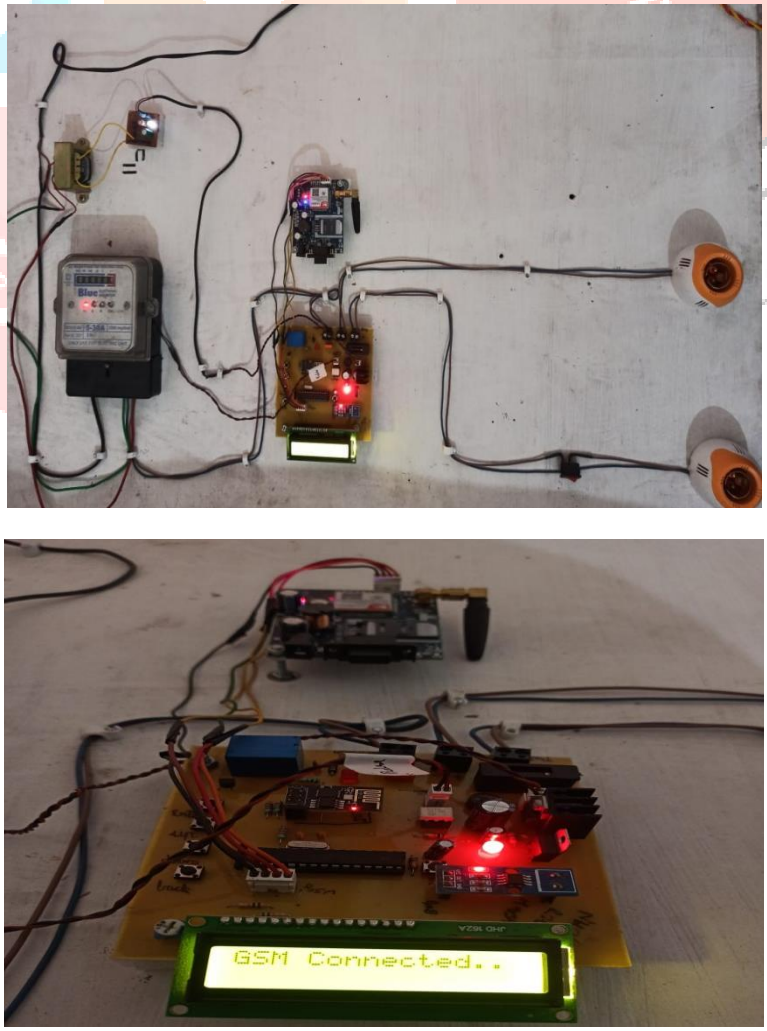

Fig. 5 Working Prototype Model

5.1 Working:

This Project is used to detect the theft of electricity and monitor electricity consumption. Initially, we supply the input voltage of 230 V to the energy meter this input voltage gets transferred into two sub-parts first is the transformer. In this step-down transformer is used in which it converts 230V AC to 12V AC and received by the Rectifier which is used to convert 12V alternating current to 12V direct current. This voltage is used by the regulator to supply the required energy to the components used on PCB Mount Board to maintain the proper operation of the circuit. And, another part is used to supply the 230V to the load which is consumed by the user.

To activate the load supply consumer need to place an activation call to the number connected to the GSM model which is automatically declined by the GSM module and the system gets ready to work and also activates the monitoring software connect to the Io/T device which is monitor by the Regional Electricity Board. The reading of the electricity consumed is shown on the LCD Display for the consumer and on the Web page Software for the operator. Here, whenever there is an observable change in Current Reading the Io/T sends the alter SMS to the Consumer as well as the Operator. So, that Operator can take appropriate action on Theft/problem...

VI. Advantages And Application

6.1 Advantages:

- Meter reading can be accessed from anywhere on the globe at anytime.
- Identify the theft status.

6.2 Applications:

- Residential and commercial building in a public energy supply system.
- State electricity board.

VII. Conclusion

Today, India is at the forefront of the world, but today and in the future, India faces many challenges. We have to find alternatives to overcome that crisis.

Today, India is facing a major crisis of power theft and through this project, alternatives have been found to reduce power theft. It is going to be used to reduce power theft today as well as in the future. Also, since online billing will be done, it will have accuracy. Since the company will provide all kinds of information to the customer from time to time, the number of complaints will be less. Environmental degradation will be reduced as the paper is not used for billing.

VIII. References

1. Lanedi C., Dipit. d.Inug.,delly inf. Secondaniv. di Npoli, Aversar Italy, Monrela, P.; lnilo G,, “ARM based energy controlling system using smart meter and network server,", IEEE Instrumentation and Measurement Technology conference Binjiang,, pp.1-6, May-2011.
2. Darshan N, Dr. K A Radhakrishnan Rao, “IoT Based Energy Meter Reading, Theft Detection and connection and Disconnection using PLC and Power optimization", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 5, Issue 8, 2015
3. ECI Telecom Ltd., Fighting Electricity Theft with Advanced Metering Infrastructure (March 2011) [Online] Available: http://www.ecitele.com
4. M. Golden, B. Min, “Theft and loss of electricity in an Indian Statetechnical report,” Int. Growth Centre 2012.