

# Advance autonomous billing system in the EB meter with GSM technology

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**Abstract** - Our project is a working model which incorporates sensors to measure parameters like Voltage and current. An Arduino microcontroller board is used for analyzing the inputs from the LED bulb. This project provides a device which will continuously monitor the vital parameters to be monitored for a Energy Metering. This is very useful for future analysis and review of energy metering condition. For more applications, this project can be improvised, by incorporating node mcu sensors and IoT technology systems, thereby making it useful in electrical industry as a very efficient and dedicated energy metering system. IoT is becoming a major platform for many services & applications, also using Node MCU not just as a sensor node but also a controller here. Paper proposes a Smart energy metering system as a step forward to the progress made in this department till now.

**Key Words:** Arduino UNO, GSM, Node MCU, IOT, Smart energy.

## 1. INTRODUCTION

With the developing populace of India and its growing electric powered strength needs, the strength gadget has grown swiftly over beyond 50 years. At present, on the quit of each month someone from power board is going to each residence and take the meter readings manually that are used for power invoice calculations, that is a gradual and hard process. In this traditional billing gadget humans attempt to control the meter analyzing with the aid of using adopting diverse corrupt practices together with bypassing supply, magnetic interference etc. Thus the traditional billing technique is inaccurate, costlier, time eating and has loss of transparency, for this reason that is inflicting a stark quantity of sales loss to the distribution companies. Therefore, numerous tries had been made to triumph over a lot of these drawbacks of traditional billing gadget. Even alevn though the meters are made digital, the method of billing is same. Therefore the scope of this paper is to layout and broaden a clever strength meter that gives each the providers and customers with consumer pleasant services.

## 1.1 Aim and Objective:

### Aim:

The aim of the project is to transfer the EB bill automatically through mobile phone by using GSM technology and IOT concept without any employees and has a additional feature of storing data and monitoring them over the cloud.

### Objective:

- To make energy consumption prepaid.
- To centralize the control of all energy meters.
- To prevent power thefts at consumer premises.
- To reduce cost of man power for billing

## 2. Literature Review

For Communication, to the server, many alternatives are there as wi-fi or stressed inclusive of cable networks, and the special GSM modules, which can be recognized via way of means of researchers. Different Countries Trying to put into force this idea. From the special papers, we've got special studies paintings concerning our new concept. In paper [1] (2014) Pradip Kulkarni and Manisha Shinde have posted a paper on the automation of the strength billing technique in that new structure that the strength board has a guide technique and to cast off that technique they added a module wherein information is amassed from the energy, water and switch to the centralized station from the billing purpose. The information has accrued the usage of an unmarried digital digicam, this means that the digital digicam is located in the front of the meter of everyone's residence and the digital digicam will seize a photo of the meter and the server will immediately fetch that information from every residence in order that human interplay is definitely avoided. ARM7-LPC 2138 is used because of the interface among the devices. After that, the photo will attain the server and undergoes the special processing thru Matlab, in order that each month's analysis is saved withinside the database of the strength board. So the era used on this paper turned into photo segmentation and the AMR, Zigbee, so the blessings of this

era had been this era is used properly, and the downside for this structure turned into that it's far costly. In paper[2](2015) R.G.Yadawad has posted on sensible strength billing and the renovation gadget wherein new manner of billing technique there had been many mistakes withinside the special fashions which had been added in advance so on this paper the version used turned into thru cell agents. This paper tells us the how the brand new structure is greater viable for the usage of cell agents

### 3. Scope of the Project

- Better management of total energy usage and get details about the amount and timing of your energy use, so we can adjust accordingly and save money.
- Advanced meter data can be used to compare costs between competing utilities and to arrange for bulk-rate purchasing.
- Identify and implement operational strategies to control load factor, peak load requirements and reduce energy waste and understand the consumption patterns.

### 4. Microcontroller

A micro-controller is a small pc on a single integrated circuit containing a processor core, memory, and programmable input/ output peripherals The vital component for us is that amicro-controller incorporates the processor (which all computer systems have) and memory, and a few input/output pins that you may control. (regularly known as GPIO - General Purpose Input Output Pins).



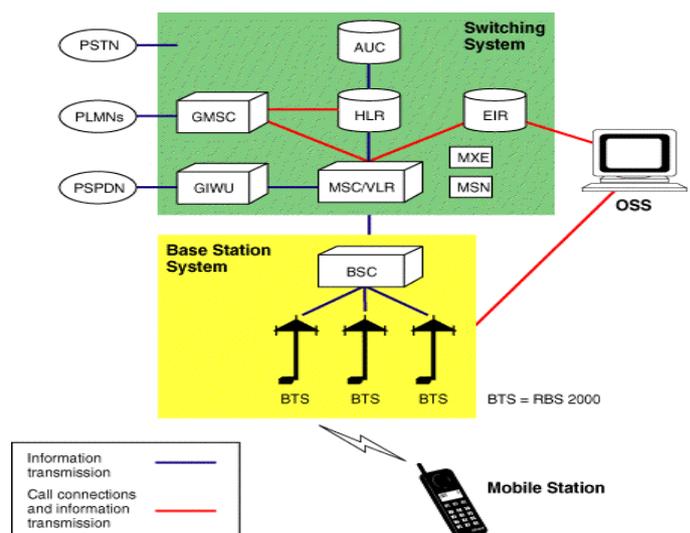
ATmega328P

We will be using the Arduino Uno board. This combines a micro-controller along with all of the extras to make it easy for you to build and debug your projects. The Uno is a microcontroller board based on the ATmega328P.

### 5. GSM Modem

Global device for molecular communication (GSM) is a globally set up style for virtual cell communication. GSM is the selection of a standardization corporation mounted in 1982 to create a common vicinity of European molecular cell smartphone present day that could formulate specs for a pan-European molecular cellular radio device working at 900 MHz.

GSM gives recommendations, no longer necessities. The GSM specs outline the competencies and interface necessities in elements however now do now no longer deal with the hardware. The motive for that is to restrict the designers as low as viable however although to make it viable for the operators to shop for devices from precise suppliers. The GSM community is broken up into 3 crucial systems: the switching device (SS), the bottom station device (BSS), and the operation and aid device (OSS). The primary GSM community factors are proven in the below figure.



GSM Network Element

### 5. Arduino IDE

The Arduino IDE (Integrated Development Environment) is Software to increase the coding withinside the environment. The Coding is advanced after which execute the process The all of the modules strolling in Embedded C software program coding.

```

Energy_Measuring_Code - Notepad
File Edit Format View Help
C:\Users\user\Desktop\Energy_Measuring_Code\Energy_Measuring_Code.ino
// Arduino IDE
// Energy_Measuring_Code.ino
// Created by user on 15/05/2022.
// This program calculates the power consumed by a smart energy meter.
// It uses an Arduino Uno R3 board connected to a smart energy meter.
// The meter outputs voltage, current, and total unit consumption.
// The program calculates the power (Voltage * Current) and the total amount (Total Unit * Amount per unit).
// The results are displayed on the serial monitor.

// Constants
const int VOLTAGE_PIN = A0; // Voltage pin
const int CURRENT_PIN = A1; // Current pin
const int UNIT_PIN = A2; // Total unit pin

// Variables
float voltage;
float current;
float total_unit;
float power;
float total_amount;

// Setup
void setup() {
  Serial.begin(9600);
}

// Loop
void loop() {
  // Read voltage
  voltage = analogRead(VOLTAGE_PIN);
  voltage = voltage * 5.0 / 1023;

  // Read current
  current = analogRead(CURRENT_PIN);
  current = current * 5.0 / 1023;

  // Read total unit
  total_unit = analogRead(UNIT_PIN);
  total_unit = total_unit * 5.0 / 1023;

  // Calculate power
  power = voltage * current;

  // Calculate total amount
  total_amount = total_unit * 5;

  // Print results
  Serial.println("Voltage: " + String(voltage));
  Serial.println("Current: " + String(current));
  Serial.println("Total Unit: " + String(total_unit));
  Serial.println("Total Amount: " + String(total_amount));
  Serial.println("Power: " + String(power));
  Serial.println("-----");
  delay(1000);
}
    
```

Program 1

```

ThingSpeak_Energy_Measuring - Notepad
File Edit Format View Help
C:\Users\user\Desktop\ThingSpeak_Energy_Measuring\ThingSpeak_Energy_Measuring.ino
// Arduino IDE
// ThingSpeak_Energy_Measuring.ino
// Created by user on 15/05/2022.
// This program calculates the power consumed by a smart energy meter and sends the data to ThingSpeak.
// It uses an Arduino Uno R3 board connected to a smart energy meter and a GSM module.
// The meter outputs voltage, current, and total unit consumption.
// The program calculates the power (Voltage * Current) and the total amount (Total Unit * Amount per unit).
// The results are sent to ThingSpeak via GSM.

// Constants
const int VOLTAGE_PIN = A0; // Voltage pin
const int CURRENT_PIN = A1; // Current pin
const int UNIT_PIN = A2; // Total unit pin
const int GSM_PIN = 2; // GSM module pin

// Variables
float voltage;
float current;
float total_unit;
float power;
float total_amount;

// Setup
void setup() {
  Serial.begin(9600);
}

// Loop
void loop() {
  // Read voltage
  voltage = analogRead(VOLTAGE_PIN);
  voltage = voltage * 5.0 / 1023;

  // Read current
  current = analogRead(CURRENT_PIN);
  current = current * 5.0 / 1023;

  // Read total unit
  total_unit = analogRead(UNIT_PIN);
  total_unit = total_unit * 5.0 / 1023;

  // Calculate power
  power = voltage * current;

  // Calculate total amount
  total_amount = total_unit * 5;

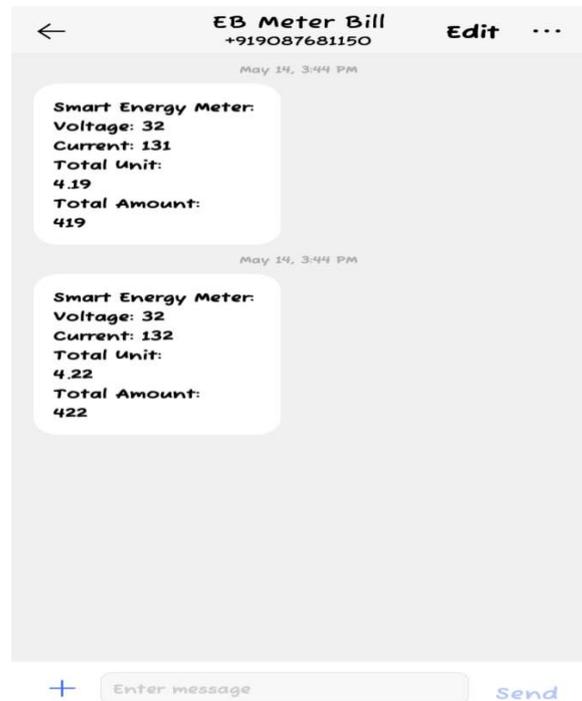
  // Print results
  Serial.println("Voltage: " + String(voltage));
  Serial.println("Current: " + String(current));
  Serial.println("Total Unit: " + String(total_unit));
  Serial.println("Total Amount: " + String(total_amount));
  Serial.println("Power: " + String(power));
  Serial.println("-----");
  delay(1000);
}
    
```

Program 2

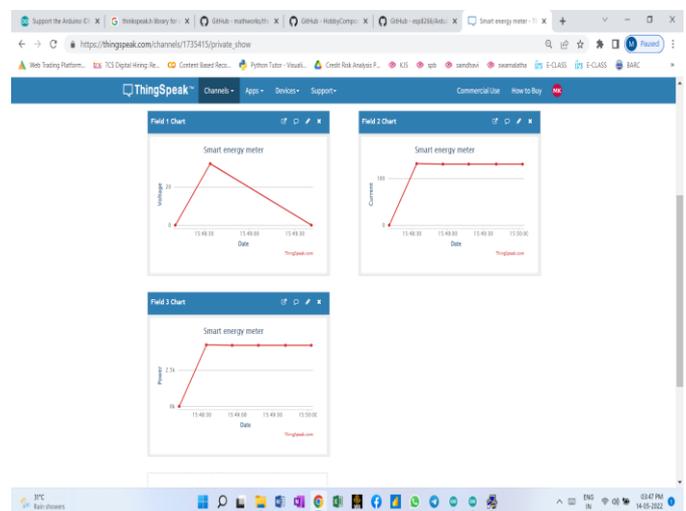
### 7. Working of autonomous billing system

The above two programs are used to calculate the power by using the formula  $power = voltage * current$ . The voltage and current received by the Arduino Uno from the current transformer and power transformer. The power is converted into units by using  $unit = power / 1000$ . Then calculate the total amount for power consumed. The amount per unit is 5Rs, so the total amount is  $total\ unit * amount\ per\ unit$ . Then this information is transferred to the GSM module, which transfers the EB bill through mobile as SMS and also stores the information in the cloud for consumer verification in the future.

### 8. Analysis of results & discussion



GSM transfer the bill to mobile



Data stored in cloud

The advantages of this Model are:

- Automation of all features including communication from the EB meter to the customer and EB office.
- Saves data using the node MCU in the cloud.
- It includes much less fee to communicate. This device will increase productivity.

## 9. Conclusion

By implementation of this project, the metering system is totally enhanced with modern technology. The whole process of operation can be centralized and can be extended to long distances by GSM modem. This project is quite time saving and provides user friendly services. This proposed Automated EB model includes an prototype module which has a Arduino Microcontroller. This module is used to make notice of the quantity of energy fed on via way of means of the consumer This EB workplace module calculates the facts and sends it to the consumer. The consumer additionally receives information of the invoice on his cell phone

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