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Smart Energy Meter Reading and Billing System using GSM Modem

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***Abstract:** In this paper we are focusing on automatic billing and metering, The GSM Short Message Service (SMS) and Arduino connection gives the metre reading system several predefined automatic capabilities.The energy consumption and electricity bill and loads will be providing through GSM module to the customer and to the concern electricity department. An alert message will be send to the customer and vigilance squad when the consumption unit reading reaches beyond the specific threshold. And loads on and off through gsm This paper contains energy consumption details in terms of power units and power units will be displayed on the LCD and will be notified to the customer via SMS and customer will also be able to recharge with the help of GSM module as well as microcontroller.*
Keywords: Arduino UNO, Energy Meter, GSM Modem, LCD display.

I. INTRODUCTION

An Energy meter is a electronic device that measures the total amount of electric energy mostly consumed by areas like commercial area, domestic.

A smart energy meter (SEM) is electric device having energy meter chip for electric energy consumed measurement and for data communication using wireless protocol and peripheral devices for security purpose, data showing, meter controlling etc [1]. It is clear that today's emerging developments in every sectors with growing demands of electric power , so electricity has become high priority for each individual and also for organizations like a daily needs.

The very basic procedure of power supply includes power generation, power transmission and power distribution to the various consumers and consumer may be corporate or domestic. Technically observed that naturally due to some technical faults, losses may occur.

These losses can be resolve or minimized using the advanced technologies, but some losses unpredictable. These are the losses caused by human beings for their illegal access to the power distribution, and that we said the power theft [4]. Proposed system, introduced method of post-paid electronic energy meter.

II. LITERATURE SURVEY

1) Mr. Paraskevakos was the first to establish the Automatic Meter Reading system, and he did it using Theodore George's advanced technology. [1]

2) For server connection, there are two options: wired or wireless, such as power lines, cable networks, RF modules, GSM modules, and a simple LCD display. Mr. Abhinandan Jain and others.[2]

3) The creation of a fully automated energy metre with features like remote monitoring and energy metre control. The AMR continuously monitors and observes the energy metre before sending the readings to the service provider through SMS. The bill could be paid online with the option of paying with a credit card, debit card, or even net banking. To show an automatic power metre reading on this network, an automatic power metre reading was built using a GSM. Because of the manual technique, metre readings may contain several mistakes. Every day, the government employee who took metre readings from the EB photographed around 150 metres. The data from these photos is then checked and stored on a server. If the home is closed, the person who is reading has to return to that location one or two times. A few metres are also inaccessible. If the house has been empty for more than two months, the second option for getting a reading is to average the previous bills. Such issues arise as a result of human interaction, and to avoid this, the AMR billing method is implemented.[3]

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III. PROPOSED SYSTEM

The roadblock Figure 1 depicts a diagram of the proposed Smart Energy Meter in use on the consumer side. The Energy Meter and the Arduino Micro-controller are included in this kit. The energy metre in this system is connected to the distribution unit via a GSM module that responds to server commands.

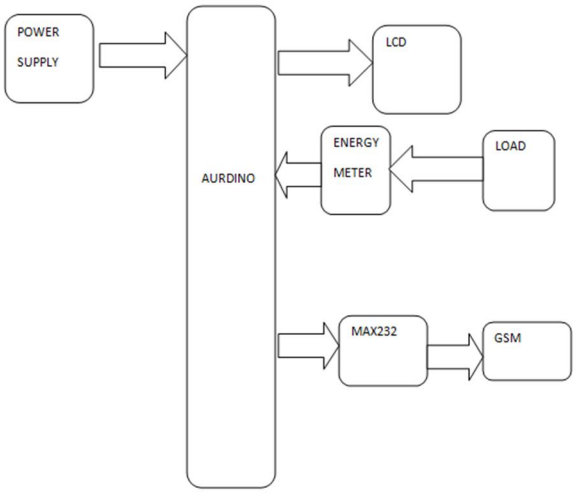

Fig 1.block diagram

IV. HARDWARE AND SOFTWAREDESCRIPTION

A. Hardware Components

The components that we require for designingthe system are of few sensors and controllers like:

1) ARDUINO UNO-ATMega328P

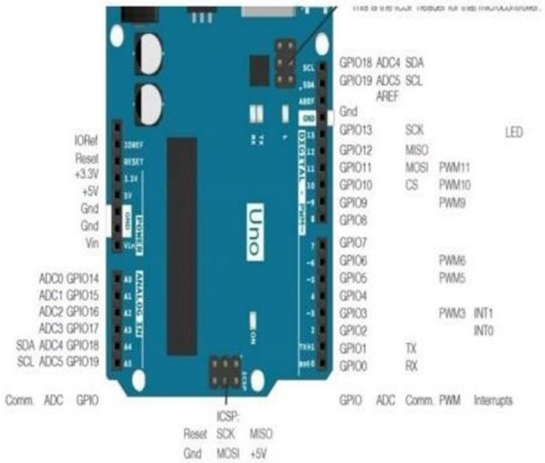

Fig.2.Arduino Uno

The Arduino Uno is a microcontroller development board based on the Atmega-328P microcontroller.The arduino performs a variety of roles, including microcontrollers, computer circuit units, and mostly small computers that run simple software package programmes. The arduino is sufficiently low-powered and can be powered by various batteries for years, yet it is capable of measuring data far faster than a person's brain can process/suppose. The Board is an Italian group that designs and sells circuit sheets that make microcontrollers simple to use; they call these circuit sheets Arduino, and there are many different types of Arduino, they can be used in a variety of ways and have a variety of uses. For example, we had simple Arduino sheets that looked like Arduino-uno and were conservative/very beneficial for each work.

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2) Energy Meter

Fig.3.Watt-Hour Meter

An energy metre, also known as a Watt-Hour Meter, is a device that measures the quantity of electrical energy consumed by consumers. Utilities are one of the electrical departments that instal these devices in various locations such as houses, industries, organisations, and commercial buildings to charge for the power consumed by loads such as lights, fans, refrigerators, and other household equipment**.** Watts are the most fundamental unit of power, and they are measured with a watt metre. One kilowatt is equal to 1,000 watts. One unit of energy is consumed when one kilowatt is used for one hour. As a result, energy metres calculate the product of quick voltage and currents and provide instantaneous power. This power is added up over a period of time, yielding the total amount of energy used during that time.

3) GSM Modem: GSM (Global System for Mobile Communication) digital cellular technology is used to transmit mobile data and voice services. In 1970, Bell Laboratories used a mobile radio system to accomplish this concept. It is the name of the standards group that was formed in 1982 in order to develop a general European mobile telephone standard.

Fig.4.GSM modem

In a GSM system, there are macro, micro, pico, and umbrella cells, among others. Each cell is different depending on the implementation domain. In a GSM network, there are five different cell sizes: macro, micro, pico, and umbrella cells. Depending on the implementation environment, each cell's coverage area varies. A GSM modem is connected to the MC through the level shifter IC Max232 in the configuration below. When a SIM card-mounted GSM modem receives a digit command via SMS from any mobile phone, it sends the information to the MC via serial communication. During the execution of the software, the GSM modem gets the command ‘STOP,' which causes the MC to generate an output, the contact points of which are utilised to disable the ignition switch. The user's instruction is based on an intimation received through the GSM modem "ALERT," a programmed message, which is only transmitted if the input is driven low. The entire action is exhibited on a 162 LCD screen.

4) 16x2LCDMODULE: LCD modules are commonly used in most deep- seated activities due to their low cost, accessibility, and developer friendliness. In our daily lives, most individuals would have brushed up against these screens, whether at PCOs or mini-computers. On top of that, the aesthetics and pin outs have been well depicted, allowing us to become piece technical.In spite of the fact that it has sixteen columns and two rows, the 16x2 alphanumeric display is recognised as such. There are several combinations available, such as 8x1, 8x2, 10x2, 16x1, and so on, but the 16x2 alphanumeric display is the most widely used.This means it will have a total of (16x2=32) thirty- two characters, each of which will be made up of 5x8 element Dots. We now believe that each character has (5x8=40) forty pixels, and that thirty-two characters will have (32x40) 1280 pixels. Furthermore, the Position of the Pixels must be communicated to the alphanumeric display. As a result,agitating everything with an MCU will be a difficult task, thus an interface IC such as the HD44780 is used, which is located on the back of the alphanumeric display Module itself. This IC's functionality is to interact with the MCU's commands and knowledgeto highlight critical information on ouralphanumeric display screen.

Fig.5.LCD display

Specifications
Operating Voltage is four.7V to 5.3V
LCD display module, which means will showalphabets and numbers.
Consists of 2 rows and every row will print sixteencharacters.

5) Power Supply: The circuit receives its power from a controlled power supply. The transformer steps down the a.c. input from the mains supply to 12V and feeds it to a rectifier. The rectifier produces a pulsing d.c voltage as an output. To obtain a pure d.c voltage, the rectifier's output voltage is routed via a filter, which removes any a.c components present even after rectification. This voltage is now fed through a voltage regulator, which converts it to a pure constant dc voltage.

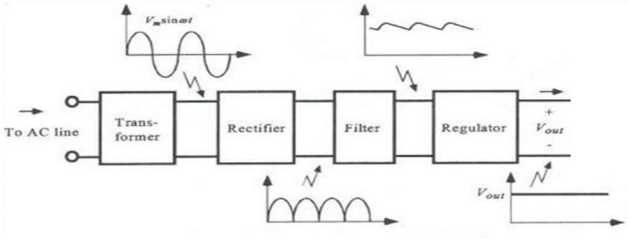

Fig.6.power supply

B. Software Requirements
1) Arduino IDE

Fig.7.ArduinoIDE

It is an ASCII text file that will be used to programme the Arduino board. The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, and Linux) created by Arduino. It's used to write and transfer data to Arduino viable sheets, as well as other vender improvement sheets with the support of outsider centres.

V. WORKING

The readings are continuously recorded by the Microcontroller (ATmega328)-based system, and the live metre reading can be supplied to the user after the card is verified. Each energy metre must have a GSM modem with a SIM card in order to deliver the metre reading to a user through SMS. The SMS has expanded its service to include content providers, allowing it to give a wider range of services to mobile users. Users of mobile phones The cost savings could be due to better staff utilisation and the absence of data tampering. Both customers and energy providers will save time as a result of this.

When the load is turned on, the current sensor and voltage divider circuit on Arduino are ready to sense the current and voltage values (DC regulate 5 V). The power computation is then checked by Arduino. It then sends a signal to the LCD to turn it on.After validating the load, display the AC voltage, AC current, and energy usage. The GSM network and calibration work The SMS will be sent once the GSM network is ready. The consumer's mobile phone in terms of unit usage and bill amount The clock is ticking every second. The microcontroller detects and stores the power calculation. The product is designed to meet the needs of the customers.

VI. RESULTS&DISCUSSION

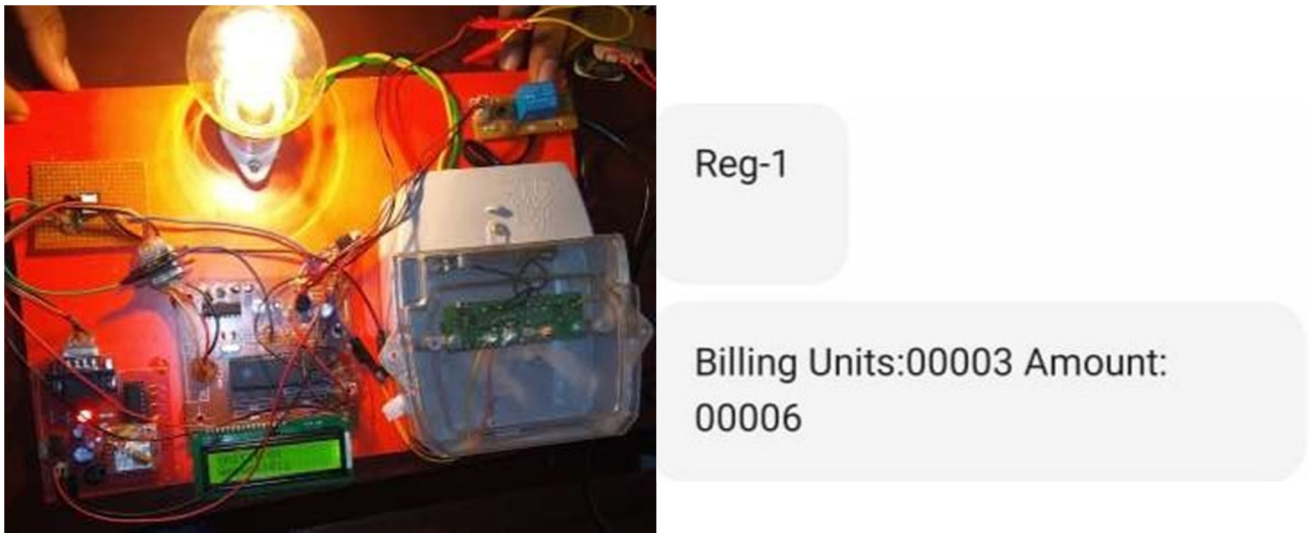

Fig.8.output

A LED bulb is employed as a load in the hardware kit. Figure 6 illustrate the hardware setup and results. Furthermore, the SMS will be sent to the customer as billing units and a bill amount for the load utilisation.

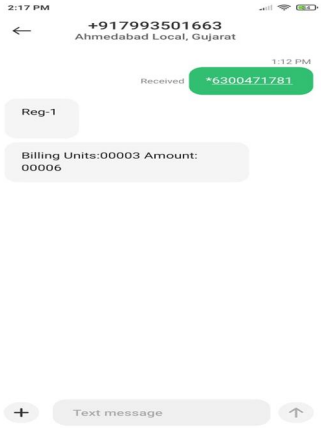

Fig.9.GSM output

Consumers will receive messages indicating unit usage and bill amount via GSM mode after this project is completed, based on the time settings as shown in figure 7 above. and this is final output.

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VII. CONCLUSION

In the proposed system wireless energy meter reading is designed to continuously observed or monitor the reading of meter and turn OFF the power supply remotely whenever the consumer not to pay the bill and loads on and off through gsm . It avoids the human involvement also gives precise meter reading. It shows the corresponding information on display screen (i.e. LCD) for user.
The customer can easily know his bill in his mobile phone at the month's end via an SMS and can pay his bill using his debit card without having to go anywhere, using the card reader embedded energy meter from his household's perimeter.

VIII. ACKNOWLEDMENT

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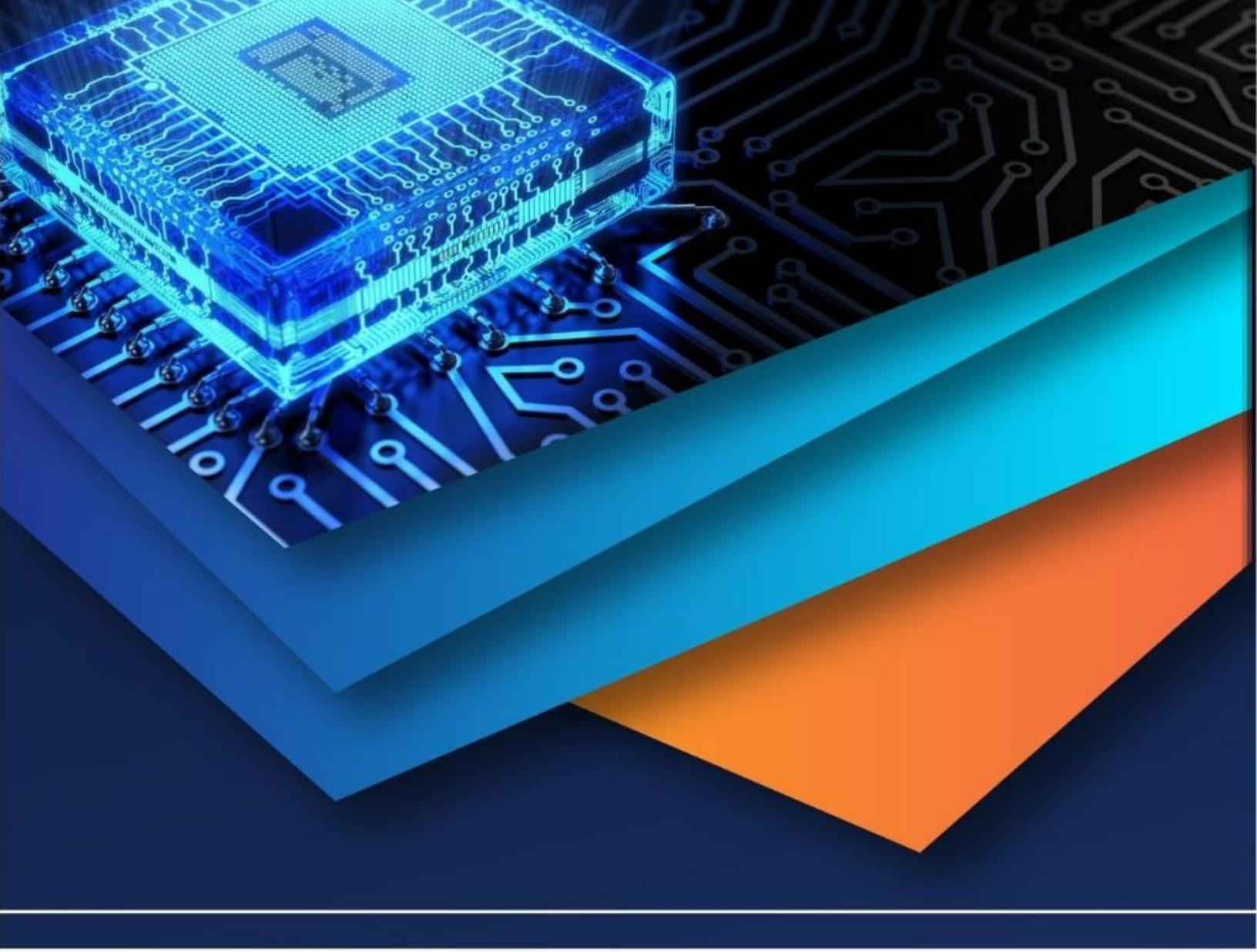

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