

GSM BASED SMART ENERGY METER

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Abstract— In this paper we are focusing on automatic billing and metering, The integration of the GSM(Global system for mobile communication) Short Message Service (SMS) and Arduino provide the meter reading system with some automatic functions that are predefined. The energy consumption and electricity bill will be provided through sms via GSM Module to the customer and to the concern electricity department. An alert message will be send to the customer and mahavitaran when the consumption unit reading reaches beyond the specific threshold. This paper gives details of hardware kit in which energy consumption details in terms of power units and power units are going to be displayed on the LCD(Liquid crystal display) and can be notified to the customer via SMS and customer will also be able to recharge with the help of GSM module as well as ATMEGA328 microcontroller.

KEYWORDS: Arduino, LCD display, GSM modem, Message receiver, Meter etc

I. INTRODUCTION

An Energy meter is a device that measures the entire amount of electrical energy mostly consumed by areas like commercial area, domestic. A smart energy meter (SEM) is electrical device having energy meter chip for electric energy consumed measurement and for digital 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 demand of electrical power, so electricity has become high priority for every 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 varied consumers and consumer could also be corporate or domestic. Technically due to some

faults in the system, losses may occur. These losses are often resolve or minimized using the advanced technologies, but some losses unpredictable. These are the losses caused by groups of people for their illegal access to the facility distribution, which we said the facility theft [2]. In Proposed system, method of GSM (Global system for mobile communication) based electronic energy meter is used. This paper which can automatically sense the used energy, and continuously records the reading, then sends it for the billing to billing section through the GSM module. Finally, after processing the collected data bill is generated with web based system software

2. RELATED WORK

Mr. Paraskevagos was first introducer of Automatic Meter Reading system, he used an advance technology developed like wired or wireless such as, power lines, cable networks, RF modules, GSM modules, LCD Display for just view purpose. Mr. Jain Abhinandan etal.[3] developed an entire Automated Energy Meter which has features like remote monitoring and energy meter controlling. The AMR(Automatic meter reading) continuously observe and monitors the energy meter then sends meter reading to the service provider via SMS(short message service). The bill was allowed to pay online and option for payment by credit card or debit card or even by net banking. Using a GSM(Global system for mobile communication) , automatic electric meter reading was built to demonstrate an automatic electric meter reading during this network. Meter reading may have many errors due to manual system. The government employee who took meter reading from the EB (Electronic board) he take approximately quite 150 meters photo every day . Then data of those photos will be get checked and put these data at server. Reading taking person has to revisit that place

one to 2 times, just in case if the house is closed. Some meters are also not reachable. Second option to take reading is by taking average of preceding bills, if home is closed for more than 2 months. Such problems are due to human involvement and to avoid this, billing process AMR (Automatic meter reading) is employed [4]. For future scope we will also update the tariff within the energy meter by writing a program. This process will be flexible for both user and therefore the company .

3. PROPOSED SYSTEM

The system consists of energy meter, an Arduino micro-controller and GSM modem AND relay circuit. After switching power on the Arduino and therefore the GSM modem, activate and connects the energy meter to load via relay. Then read the EEPROM (electrically erasable programmable read only memory) and display the present data. Arduino checks the impulse from energy meter i.e. If impulse occur increase the info and display current data. GSM modem checks the new SMS(short message service). If there's a replacement SMS and skim it. If the SMS is "DATA", send data to the precise number. If the When SMS is "LINE CUT", put off the relay, so load will disconnect. Again when the SMS is "LINE OK," then activate the relay so that load will be get connected. If there's any other SMS(Short message service). In any other formats, then delete the SMS(Short message service). If Arduino found any flaw or tampering into energy meter, then Arduino reply with buzzer or it close up the relay similarly it informs via SMS to service provider.

4. SYSTEM DEVELOPMENT

The system architecture of Arduino and (GSM Global system for mobile communication) based smart energy meter is shown within the Fig. 4.1. Using Arduino (Uno 3) and the energy meter IC, the energy consumption is calculated. In order to stop a tampering, detection program is present within the Arduino. Arduino and GSM (Global system for mobile communication) based smart energy meter can be divided into several parts as Energy Meter IC, LCD, Arduino, GSM (Global system for mobile communication) modem, Relay, Optocoupler, Control Unit, Display Unit and Power Supply Unit etc. The hardware description of various parts is separately introduced as follows:

4.1. Arduino

The Arduino Uno is a micro controller board which is based on the data sheet like ATmega328. This micro controller has up to 14 digital I/O pins from which 6 can be used as PWM(pulse width modulation) pin for outputs also six analog inputs. Arduino features a 16 MHz quartz oscillator with a USB (universal serial bus) connection and having an influence jack, an ICSP header, and one push button. It holds everything which required supporting the micro-controller, it just connect to a PC(personal computer) through a USB(universal serial bus) port. Actually Arduino is follow open-source platform which is employed for building project of electronics projects. The Arduino made from both a programmable circuit card (i.e. micro-controller) and some software, Integrated Development Environment that runs on our PC and upload computer code to the physical board. The Arduino [5] platform has become quite fashionable people just starting out with electronics, and permanently reason.

To load new code the Arduino doesn't require a separate hardware. It can simply connect through USB port.The Arduino IDE can also uses C++ platform for more effectiveness. The new popular board is introduced i.e. Uno best for beginning.

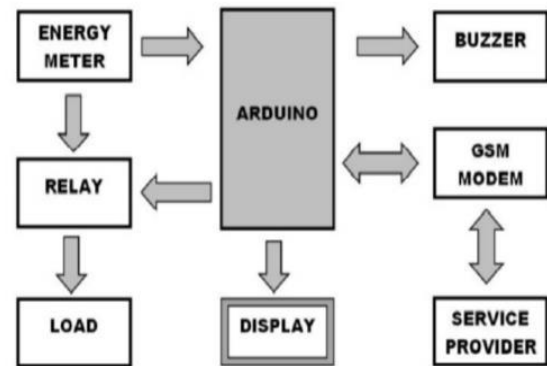


FIG 4.1. BLOCK DIAGRAM

4.2 GSM Shield (SIM 900)

The GPRS (general packet radio service) Shield is trusted module SIM900 from SIMCOM also it's compatible with Arduino. The special Modem of 3V3/5V TTL (transistor-transistor logic) interfacing circuitry is supposed , which allows to directly interfacing to the microcontrollers of 5V

and 3V3 Microcontrollers i.e. ARM(Acorn risc machine), ARM Cortex XX. At very first stage Modem is in Autobaud mode. This GSM/GPRS(global system for mobile communication)/ (general packet radio service) TTL (transistor-transistor logic) Modem has internal TCP/IP stack to enable you to connect with internet via GPRS (general packet radio service) . it's suitable for SMS(short message service), also as DATA transfer application in M2M interface. The GPRS (general packet radio service) Shield provides you ways to talk using the GSM telephone network. The shield allows to understand SMS(short message service), MMS(multimedia messaging service), also as GPRS (general packet radio service) and Audio via UART (universal asynchronous receiver transmitter) by sending AT commands .The shield also has the 12 GPIOs, 2 PWMs (pulse width modulator) and an ADC(analog to digital converter) of the SIM900 module (They are all 2V8 logic) present onboard. This Shield connects Arduino to the wireless internet using the GPRS (general packet radio service) wireless network. Plugging this module to the Arduino circuit board , which is connect a SIM card from an operator which also provides GPRS (general packet radio service) coverage and follow some simple instructions to start out controlling via the web .

4.3 Optocoupler

An optocoupler works as breaker in power system . it's a tool commonly used to electrically separate microcontroller electronics from any potentially dangerous current or voltage in its surroundings. An Optocathode, is a high power device .It is 4N35optocoupler with 6 pin, pin 1and 2 connected to meter. 1 connected to anode 2 NC, pin 4Emitter, 5collector, 6Base. Each optocoupler made from material gallium arsenide infrared LED and a silicon NPN phototransistor. Its features are Isolation test voltage 5000 VRMS Usually have one, two or four light sources (LED diodes) on their input while on their output, opposite to diodes, there's an equivalent number of elements sensitive to light (phototransistors, photo -thyristors or phototriacs).

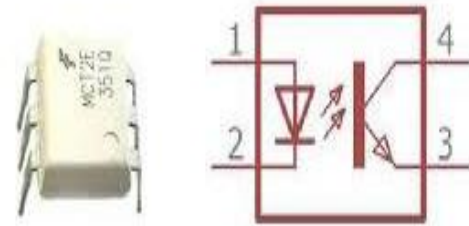


Fig4.3.Phototransistor

4.4. Relay

A relay is an electrically operated switch. Most relay circuits use an electromagnet to mechanical switch, some other principles can be also used, like solid-state relays. This relay circuit is operated over electrically switch which allows switching on or off a circuit using voltage or current which is higher than a microcontroller handling capacity. The function of the relay is to protect each circuit from each other. There are three connections for each channel in the module and these are NO COM and NC.

4.5 Power Supply Unit

A power supply is an electronic device that supplies electric energy to an electrical load. As all know any invention of the latest technology cannot be activated without the source of power. All the electronic components starting from diode to Intel IC only work with a DC supply usually ranging from $\pm 5V$ to $\pm 12V$. We are utilizing for the same, the cheapest and commonly available energy source of 230V-50Hz and stepping down, rectifying, filtering and regulating the voltage to convert it into suitable DC voltage. In our project, the required voltage is +5V & +6V to run Energy meter IC, Micro-controller, and the display unit.

5. CONCLUSION

In the proposed system wireless energy meter is designed to continuously observe or monitor the reading of meter and turn OFF the power supply remotely whenever the consumer could not pay the bill. Proposed system will avoid human interference and it will help to provide precise meter reading. It shows the corresponding information on the display screen (i.e. LCD) for users. 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 going anywhere, using the card reader embedded energy meter from his household's perimeter. Thus in short this paper proposed technique to reduce current problems faced by both consumer and supply company.

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