

Smart Energy Meter Using GSM & Arduino

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Abstract— The main aim is to propose a different method for measuring and billing of the energy consumed rather the conventional method. Here a new procedure is followed based on ATmega 328P microcontroller for controlling and detecting energy consumed. The energy meters used now-a-days are modified version of the older system, the digital meters doesn't have a prepaid system, where the power to be consumed is estimated prior to its usage and recharged, similar to that of a prepaid talk time for mobile. It is possible to recharge the electricity balance through this system just by sending SMS. It also continuously reads the energy meter reading and automatically sends some updates like low-balance alert, zero-balance alert, recharge alert when necessary to the registered number through GSM modem, illegal usage of power is detected and alert message sent to the authorities immediately.

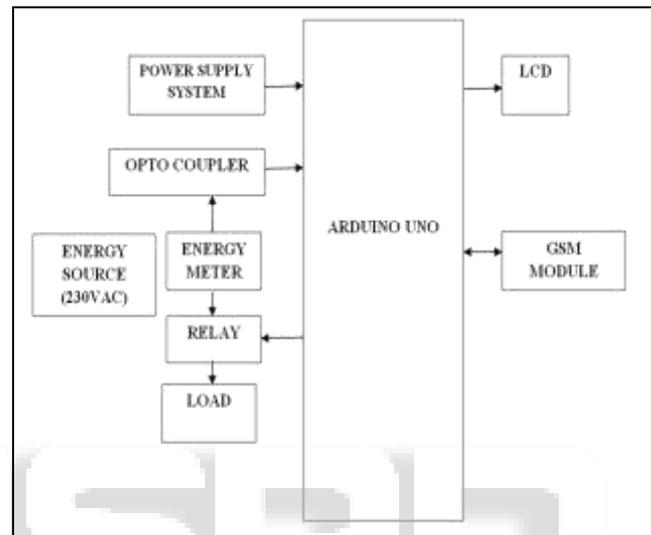
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I. INTRODUCTION

Microchip has positioned itself to target the motor control market, where our advanced designs, progressive process technology and industry leading product performance enables us to deliver decidedly superior performance over our competitors, which includes the best of the industry. These products are positioned to provide a complete product solution for embedded control applications found throughout the consumer, automotive and industrial control markets. Microchip products are meeting the unique design requirements of the motion control embedded applications. The Electrical metering instrument technology has come a long way from what it was more than 100 years ago. From the original bulky meters with heavy magnets and coils, there have been many innovations that have resulted in size & weight reduction in addition to improvement in features and specifications. Resolution and accuracy of the meter have seen substantial improvements over the years. Introduction of the digital meter in the later part of last century has completely changed the way Electrical parameters are measured. Starting with Voltmeters & Ammeters, the digital meter has conquered the entire spectrum of measuring instruments due to their advantages like ease of reading, better resolution and rugged construction. Of particular significance is the introduction of the Electronic Energy Meter in the mid-eighties. Now a days, the energy consumption and energy distribution has become a big subject for discussion because of huge difference in energy production and consumption. In this regard, energy consumers are facing so many problems due to the frequent power failures; another important reason for power cuts is due to the un-limited energy consumption of rich people. In this aspect, to minimize the power cuts and to distribute the energy equally to all areas, some restriction should have over the power consumption of each and every energy consumer, and according to that the Government

should implement a policy, by introducing Autonomous Energy Meters everywhere in domestic sector. Hence, the need has come to think on this line and a solution has to be emerged out.

II. BLOCK DIAGRAM



1) Block Diagram Explanation:

This Project mainly consists of Power Supply section, ARDUINO UNO Microcontroller section, LCD display section, Current Sensor, OPTO coupler, relays, energy meter, WIFI IOT.

2) Power Supply:

This section is meant for supplying Power to all the sections mentioned above. It basically consists of a Transformer to step down the 230V ac to 9V ac followed by diodes. Here diodes are used to rectify the ac to dc. After rectification the obtained rippled dc is filtered using a capacitor Filter. A positive voltage regulator is used to regulate the obtained dc voltage.

3) Opto Coupler:

An Optocoupler is an electronic component that interconnects two separate electrical circuits by means of a light sensitive optical interface.

4) Energy Meter:

An electricity meter, electric meter, electrical meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device.

Electric utilities use electric meters installed at customers' premises for billing purposes. They are typically calibrated in billing units, the most common one being the kilowatt hour (kWh). They are usually read once each billing period.

When energy savings during certain periods are desired, some meters may measure demand, the maximum use of power in some interval. "Time of day" metering

allows electric rates to be changed during a day, to record usage during peak high-cost periods and off-peak, lower-cost, periods. Also, in some areas meters have relays for demand response load shedding during peak load periods.

5) Relay:

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

6) LCD Display:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight.

7) Arduino Uno Microcontroller:

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the 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, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website.

8) GSM:

GSM (Global System for Mobile communications) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets. It was first deployed in Finland in December 1991. As of 2014, it has become the global standard for mobile communications – with over 90% market share, operating in over 193 countries and territories

III. WORKING

The block diagram shows the construction of the “Smart Energy Meter using GSM & Arduino” it mainly consists of Arduino board, GSM module, Energy meter, LCD & Load. The 230V AC power supply is given to operate the loads. A 20V adapter is used to provide 5V to the Arduino board and from here it is interfaced with relay, GSM and LCD. The transmitter and receiver pins of GSM are connected to the receiver (Rx 0) and transmitter (Tx 1) pins of Arduino board. The optocoupler is given to the 8 pin of Arduino Uno and the other end is given to the energy meter. The relay is connected to the 12 pin of the Arduino board and to the energy meter as well as the load. The load in turn is connected to the energy meter. The LCD 6 pins i.e. RS, Rw, E, D0-D2 are given to the 2, 3, 4, 5, 6, 7 pins and the switch is connected to the 13 pin of the Arduino board. Here we are representing the switch outside of the energy meter just to represent the power theft in real life.



IV. CONCLUSION

Putting a full stop at the wastage of electricity, the problem of load shedding can be dealt with ease. It is being said that half of India still don't get electricity which no longer will be true. Man power will be limited as there won't be any need of personally visiting each and every electricity meter as it was in the earlier days. The monopolistic power distribution market in Asia is gradually transforming into a competitive marketplace. Differentiation in service is going to be the key competitive factor to the improve market share in the deregulated power markets prepaid meters with their advantages over conventional ones are likely to help power

distributors to differentiate and offer value –added services to consumers. Encourage consumers to opt for prepaid meters on a voluntary basis and offering tariff or non-tariff incentives to those consumers who prepaid their power changes would help the utilities to implement this system

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