

An Advanced Smart Anti-theft Energy Metering System For Developing Countries

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Abstract— Now-a-days technology has developed to a large extend. At the same time the need for systems with automation and high security are preferred. In many developing countries, especially in India, governments are failing to satisfying ever increasing demand of electricity because of revenue loss. It is happening due to lack of proper maintenance of Power by the electricity department. So many reasons are there. i.e. sometimes consumer cant paid unexpected bills in time, sometimes service man can't take proper reading at meter while billing and one more major problem is electricity theft. All occurred at meter like by passing meter, cutting meter and un authorized utilization of power all these should not known to electricity department. To get rid of all these problems installation of antitheft energy meter system in every consumer house is a solution. In this system a server is maintained at the service provider side. By using this paper I can avoid such problems. In this paper I are building electricity meter that will be able to identify thefting of energy through wireless technology in order to avoid theft from home. Buzzer sounds when theft occurs .

Keywords- *Electricity theft; GSM networks; SMS; smart energy meter; buzzer*

I. INTRODUCTION

This paper is designed to control electricity theft. After energy meter this paper is connected if something wrong things happens with meter and reading of meter does not match with actual reading circuit will break the supply of home. Microcontroller is used to measure power consumption and displayed on LCD. In a situation where there is high level of theft, there is need for better security system[1].

The proposed paper work aims on the design and development of electrical energy theft prevention aspect. This paper envisages the development of electrical theft identification. The main purpose of this paper is that to detect the theft of energy that is carried out individually from homes.

This paper can make a revolution in the field of energy distribution system. The response of this paper is quit fast as Ill as sharp. The switching and the intimation property of this circuit make this paper very effective and efficient in the field of smart world. Energy theft that is carried out through the distribution line is easy but for individual used this theft monitoring is very difficult.

But by using this circuit the task of finding the theft becomes easy. In the area of fast communication this paper makes its own impact as I are using GSM module for the communication beaten the meter and MSEB. The password security makes the controlling more secure and reliable.

II. ELECTRICITY THEFT

Few methods of stealing electricity are ,

- Directly connection from distribution lines.
- Grounding the neutral cable.
- Putting a magnet on electromechanical meter
- Insert disc to stop rotating of the coil.
- Hitting the meter to damage the rotating coil .
- Interchanging input connection with output connections.

In some refined ways electricity is been stolen by tampering secondary side of current transformer (CT) to which energy meter is connected. When CT's are tempered, current measurement will not be exactly the same as of normal operating CT's current flowing from energy meter to consumer. It will show reduction in current measurement readings[3].

The coil used in electromechanical energy meters is not calibrated correctly, therefore its internal calibration is not accurate. In three phase meters, electromechanical energy meter will not detect energy flow change of using one phase out of three, keeping the neutral open. It will consider as no energy flows from meter to user load. Smart meters detect such thefts by glowing —ELI Earth leakage whenever it sense any miss match beaten phase and neutral current[4].

- —ELI glow in smart meter indicates either neutral of your residence is connected to the neutral of your neighbors or vice versa.

Unmetered supply:

Unmetered supply to agricultural pumps and single point connections to small domestic consumers of maker sections of the society is one of the major reasons for commercial losses.

In most states, the agricultural tariff is based on the unit horsepower (H.P.) of the motors. Such power loads get sanctioned at the low load declarations. Once the connections are released, the consumers get into the habit of increasing their connected loads, without obtaining necessary sanction, for increased loading, from the utility. Further estimation of the energy consumed in unmetered supply has a great bearing on the estimation of T&D losses on account of inherent errors in estimation. Most of the utilities deliberately overestimate the unmetered agricultural consumption to get higher subsidy from the State Govt. and also project reduction in losses. In other words higher the estimates of the unmetered consumption, lesser the T&D loss figure and vice versa.

Moreover the correct estimation of unmetered consumption by the agricultural sector greatly depends upon the cropping pattern, ground water level, seasonal variation, hours of operation etc. To increase the food output, almost all the State Governments show benevolence to farmers and arrange supply of electric power for irrigation to the farmers at a nominal rate, and in some States, without charges at all. In view of this, most Electricity Boards supply power to agriculture sector and claim subsidy from the State Govt. based on energy consumption. Since the energy supplied to the agriculture sector is a generous gesture by the State Govt., all the electricity boards have eliminated energy meters for agriculture sector services. The absence of energy meters provides ample opportunities to SEBs to estimate average consumption in agriculture sector at a much higher value than the actual. In the absence of energy meters, most of the SEBs resort to fudging consumption figures to include not only the under estimated T&D Losses but also energy theft from their system. The extent of fudging is more in the States where agricultural activity is high. The benefit derived by these boards is not only the extent of subsidy from the respective States but also self-praise, by showing much less T&D losses. Further the boards are ignoring the inefficiency in operating the distribution system by blaming the agricultural supply for all ills and raising the tariff of other consumers.

Most of the methods being employed by SEBs for estimating the unmetered energy consumption are as follows: -

- Load factor based estimation.
- Estimation based on feeder wise theoretical calculation of losses.
- Estimation based on readings of meters installed at all the Distribution Transformers located on a feeder.
- Phase of your residence is connected to the

III. HARDWARE REQUIREMENT

A. Microcontroller (PIC 16f690):

This is a 20 pin IC out of which 18 pins can be used as a input output pins and rest of two are used for Vcc and GROUND

a) Features of PIC:

- 4-ch PWM 10-bit
- 256 bytes of EEPROM data memory
- Extended WDT

- MPLAB® ICD 2 programming support or debugging support with optional header adapter
- Precision internal oscillator-software selectable 8 MHz - 32 KHz



Fig 3.1: PIC 16f690 microcontroller

B. BUZZER:-

A **buzzer** or **beeper** is a signaling device, The word "buzzer" comes from the rasping noise that buzzers made when they are electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles. Other sounds commonly used to indicate that a button has been pressed are a ring or a beep. This novel buzzer circuit uses a relay in series with a small audio transformer and speaker. When the switch is pressed, the relay will operate via the transformer primary and closed relay contact. As soon as the relay operates the normally closed contact will open, removing power from the relay, the contacts close and the sequence repeats, all very quickly...so fast that the pulse of current causes fluctuations in the transformer primary, and hence secondary. The speaker's tone is thus proportional to relay operating frequency. The capacitor C can be used to "tune" the note. The nominal value is 0.001uF, increasing capacitance lowers the buzzers tone.

C. GSM module (SIM 900):

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.

a) General features:

- Quad-Band 850/ 900/ 1800/ 1900 MHz
- GPRS multi-slot class 10/8
- GPRS mobile station class B
- Compliant to GSM phase 2/2+ – Class 4 (2 W @850/ 900 MHz) – Class 1 (1 W @ 1800/1900MHz)
- Dimensions: 24* 24 * 3 mm



Fig3.2: GSM Module

D. RELAY:

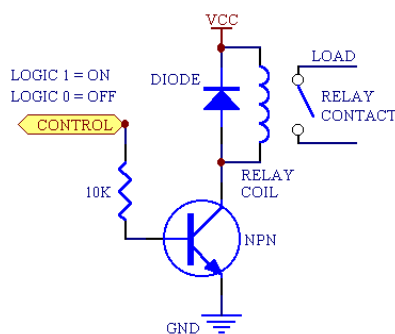


Fig3.3: Relay

It is an electromagnetic switch. Relay is used to control the electrical devices. Copper core magnetic flux plays main role here. The winding of the relay get energize to switch ON the relay and windings get de-energize to turn it OFF. An electronic switch is essentially just a switch that uses an electrical current, to turn on, usually turning off when the current is turned off. A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two in the relay pictured).

The armature is hinged to the yoke and mechanically linked to one or more sets of moving contact. It is held in place by a spring (automatic relay) so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open.

When coil is de-energized relay when no current is flowing in the electromagnet coil the armature is pulled up by the spring and its COM contact connects to the NC contact. When coil is get energized relay. When a voltage is applied to the electromagnet coil the current flowing in the coil produces magnetic energy in the iron core which pulls the armature down.

E. LCD (Liquid crystal display) :



Fig3.4: Liquid Crystal Display(LCD)

LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology.

F. Current measuring Device

Current measuring device is designed to convert the analog signal to the digital values which is given to the AT89S51 microcontroller unit. The microcontroller unit converts the binary data into digital and if it is less than alert and display the current status.

A small Controller Unit (MCU) usually includes associated data converter (ADC) and data converter (DAC) to supply intelligence. A wired or wireless communication interface permits the meter to move with the remainder of the grid, and in some cases, user's network each sensible Meter put in at the buyer end encompass a distinctive meter ID.

G. Electrical Meter

Electrical meter is the ordinary electrical meter; one extra module is inserted into the ordinary electrical meter. This module communicates to the utility company. The range of the network model is maximum than the wifi, zigbee and Bluetooth wireless data transmission module.

IV. WORKING:

In this paper I'm giving two reading of pulses to the microcontroller. First is directly from the energy meters pulsing mechanism and another is from the current transformer. The supply is given through the current transformer to the load. The microcontroller continuously monitors and compares both the signals.

If consumer tries to make any fault in the same energy meter the pulsing mechanism slows down the pulses. But current transformer shows the same current pulses. The microcontroller senses both the pulses. At this time, there is some difference occurs which can be seen after comparison.

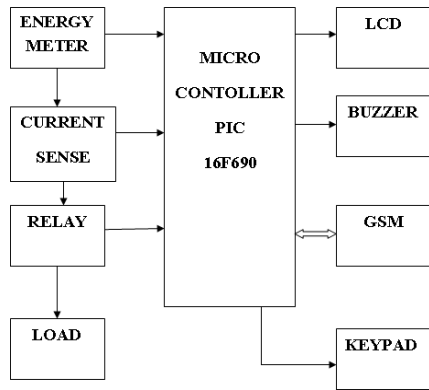


Fig4.1:Block Diagram

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As microcontroller senses the difference, it will immediately cut the supply with the help of relay. The supply will only be get switched ON after pressing the reset button. The buzzer sounds and the LCD display shows that “system is locked” status. The password will only be known to the MSEB engineer. As the system get locked one message will be sent to MSEB station by GSM module attached to the circuit. In this way the theft gets detected[4].

This system can be designed without any human efforts for making the circuit live. That means I can make the switching of the circuit with the help of GSM system remotely from anywhere in the world. The GSM SIM900 module is used for this type of communication.

The buzzer which indicates that the theft is carried out and intimate the user that the load is getting turn off. Here the relay plays a part of making the switching. The keypad used is 4x4 matrix keypad which is used for password entering purpose. A SIM card used in the GSM module should be of good range. The circuit is very simple as per the design is concern.

➤ **ADVANTAGES:-**

- Very easy to control monitor the parameters.
- Automatic control makes circuit smart.
- Very much cost effective.
- Easy to design.
- This paper has very low power requirements.
- No configuration needed and based on simple GSM communications.

➤ **APPLICATIONS:-**

- This paper is useful in industries.
- This paper can be applicable for domestic users

CONCLUSION:-

The smartness of this paper makes it different from any other paper related to this field of electricity. The GSM module enhances its features further with the sharp and reliable response to the theft. The instant action can be taken to the theft as the intimation and blocking process is so fast because of the microcontroller used and the switching is carried out with the help of electromagnetic relay.