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Power Theft Detection by Using GSM Technology

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ABSTRACT: Power theft is normally done by two methods that is bypassing or hooking. So to detect it, a system (current measuring and comparing) is proposed in which the household distribution of current is done indirectly from the electric pole to an intermediate distributor box and then to the individual houses. The current is measured periodically in the distributor box and is posted to the server database for each house using GSM module. Similarly, for each house electric meter is designed which can measure the value of the current and post the same to the server database periodically using GSM module.

I. INTRODUCTION

Electricity theft is a very common problem in country, where population is very high and the uses of electricity are ultimately tremendous. In India, every year there is very increasing number of electricity thefts across domestic electricity connection as well as industrial electricity supply, which results in loss of electrical energy and because of which we are facing the frequent problems of load shedding in urban as well as rural areas so as to overcome the need of electricity for whole state. Theft of electricity is the criminal practice of stealing electrical power. According to a study the world loses US\$89.3 billion annually to electricity theft. The highest losses were in India (\$16.2 billion), followed by Brazil (\$10.5 billion) and Russia (\$5.1 billion). Nationally, total transmission and distribution losses approach 23% and some states' losses exceed 50%. Also the ways using which theft can be done are innumerable so we can never keep track of how a theft has occurred, and this issue is needed to be solved as early as possible. In this, we propose an electricity theft detection system to detect the theft which is a made by the most common way of doing the theft and that is bypassing the meter using the a piece of wire, people simply bypasses electricity meter which is counting the current unit by placing a wire before and after the meter reading unit. The proposed system will be hidden in such meter and as soon as a theft occurs. This project will automatically collect the reading from houses or industries and compares with the overhead line values and vice versa. If any theft occurs it turns on the relay circuit and trips the main circuit. It also sends a message to the Electricity Board (EB) to inform about the theft and the area of its occurrence.

II. LITERATURE SURVEY

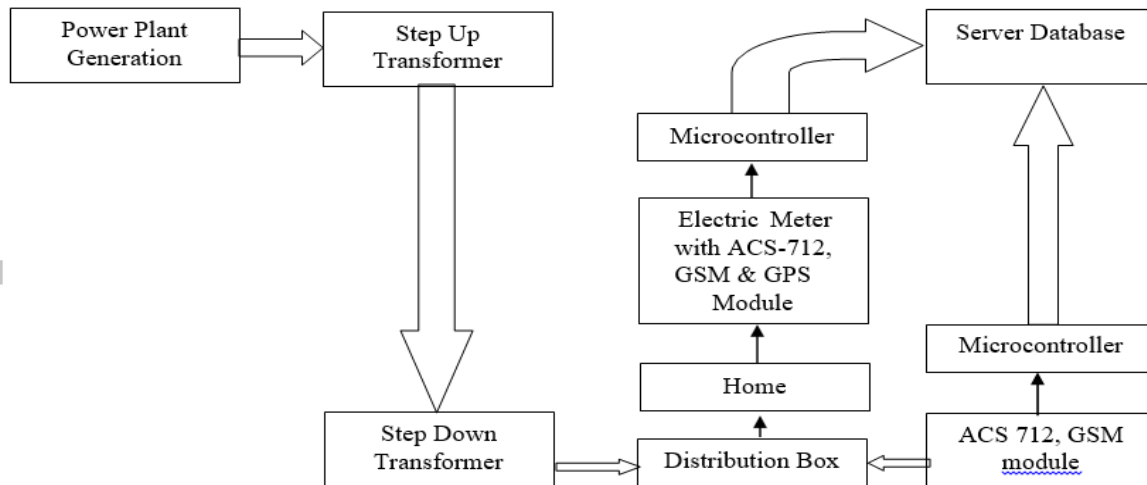
In this paper, the method reduces the heavy power and revenue losses that occur due to power theft by customers. By this design it can be concluded that power theft can be effectively curbed by detecting where the power theft occurs and informing the authorities. The proposed system will be hidden in electric meters in such a way that as soon as the difference between current crosses the threshold value, an automatic message and email will be sent to the concerned authority along with its location and image of that particular area.

The paper uses the approach based on power line communication principle which is use for detecting the theft in electricity. A high frequency signal is introduced in the distribution network which changes its amplitude and frequency as the load in the lines increases or decreases. The changes will be detected through the gain detectors if any illegal connection is made between the poles then there will be modification in the values of gain and through which the illegal connection in the electricity will be discovered and proper action will be taken by the authorities to neutralize such connection but this approach is not tried for the theft detection for the customers illegal use and it is infrastructure based.

From this paper, there are all civilians are affected by power pilferage where, the detection and reporting illegitimate activities might surely provide a hand to reduce the price paid which would be full-filled successfully by the proposed system involving 'automated message alert' and 'load-cutoff' whenever tampering attempts are made to energy-meters.



III. SYSTEM DESIGN



IV. MATERIAL DESCRIPTIONS

Current division rule has been used to detect the power theft. According to this rule, a parallel circuit acts as a current divider as the current divides in all the branches in a parallel circuit, and the voltage remains the same across them. The current division rule determines the current across the circuit impedance. We connect a current sensing module ACS712 in both the distribution box and the meter installed in the house. The current from ACS712 is fed into a microcontroller (ArduinoUno). The data of either side is then sent to the authorized database after the arduino is interfaced with the GSM-GPS module.

Hence the data are compared, if the difference is more than the provided threshold, POWER THEFT is detected. The hardware and software required for our solution is:

1. ArduinoUno
2. Current Sensing Module (ACS712)
3. GSM (SIM800)
4. GPSModule
5. Relay
6. Database

Ardino UNO

Arduino is an open-source electronics prototyping platform based on flexible, easy-to use hardware and software. As Arduino is open source, the CAD and PCB design are freely available. There are several different arduino boards are available on the market (both original and cloned) such as Arduino UNO, Arduino Nano, Arduino Mini and Arduino Mega.

For our work specifically we used this board (Fig. 5.1) due to the below specifications.

1. 6 analog inputports
2. Power Inputconnector.
3. 14 digital I/O ports (of which 6PWM)
4. Standard USB for data and power andprogramming.
5. 1 hardware serial port(UART)

Current sensing Module (ACS712)

The ACS712 Current Sensor as shown in Fig. 5.2 offered on the internet are designed to be easily used with microcontroller devices for Integrated Circuit, controllers like the Arduino. These sensors are based on the Allegro



ACS712ELC chip. These current sensors are offered with full scale values of 5A, 20A and 30A.

GSM Module

SIM800 is a quad-band GSM/GPRS module that works on frequencies GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900MHz, DCS1800MHz and PCS 1900MHz. SIM800 features GPRS multi-slot class12/class 10(optional) and supports the GPRS coding schemes CS-1,CS-2, CS-3 and CS-4; With a tiny configuration of 24*24*3mm, sim800 can meet almost all the space requirements in users' applications, such as M2M,smartphone, PDA and other devices.

Relay

SPST stands for single pole single throw and DPDT stands for double pole double throw. An SPST switch is a simple on/off type switch and can be used for coil splitting and as a kill switch for the guitar. These terms have given rise to abbreviations for the types of switch which are used in the electronics industry such as "single-pole, single throw" (SPST) (the simplest type, "on or off") or "single-pole, double-throw"(SPDT), connecting either of two terminals to the common terminal.

GPS Module

To get the information of the device's geographical position, a GPS navigation device is needed that is capable of receiving information from satellites. Using suitable software, the device may display the position on a map, and it may offer directions. SIM800 has 68 SMT pads, and provides all hardware interfaces between the module and customers' boards.

So to detect this we have to make the following arrangements: Firstly we will use a GPS module to store the latitude and longitude of every pole and house on the 1st day of installation of the meter.

Connection and arrangements at the distributor box

1. The live wires from the POLES should be fed into a distributor box blockwise.
2. The distributor box has the capability of distributing the power among the houses of particular locality. Accordingly, subsequent distributor box will be set up for a cluster of houses.
3. Hence the AC current is measured in the distributor box separately for each house using the ACS712 module and the magnitude of this current is fed into the microcontroller.
4. A server side database is maintained and the measured value of current is transmitted with the help of GSM/GPRS module and is updated into the data base table containing the user-id at a regular desired period (referring timestamps).

Connection and arrangement at the electric meter installed in each house

1. The main objective of this connection is to measure the total current actually entering the electric meter. So a fixed connection is made at the inlet terminal of the electric meter in such a manner that tampering of this connection is made void with the help of laser sensors and microcontroller.
2. The respective connection too consists the ACS712 module to measure the AC current and fed into the microcontroller.
3. Hence now the same measured current is transmitted with the help of GSM/GPRS module and is updated in the same database table for same user-id that was maintained for the distributor box at regular desired period (referring timestamps).

Google map API/ Google street view

1. At this stage the theft table of database has the exact location of the theft.
2. Hence the location from the database is transmitted to the satellite through satellite communication

Mobile Application

1. Mobile Application has been made for authorized people to get access to the area of theft and take suitable actions.
2. This application has a direct access to the database of the theft table.
3. The location is directly sent to this application with the electric meter's unique id.
4. The user of the mobile application gets pinged when the theft is detected.



VI. ADVANTAGES

1. The government saves money by the control of theft in energy meter and also more beneficial for customer side and the governmentside.
2. The metering IC ensures the accurate and reliable measurement of powerconsumed.
3. Cost is low when compared to other energy meters without automatic meter reading and theft control.
4. This method will reduce the energy wastage and save a lot of energy for futureuse.
5. Optimized use ofenergy.

Limitations

1. One major disadvantages of this system that it is not capable to detecting the exact location from where the power is being stolen giving only a approximation tothat place.
2. Cannotdeterminewhoisstealing,butevennootherexistingsystemiscapableofdoingthis.
3. If implemented on a large scale it may take a lot of time and manualinput.

Applications

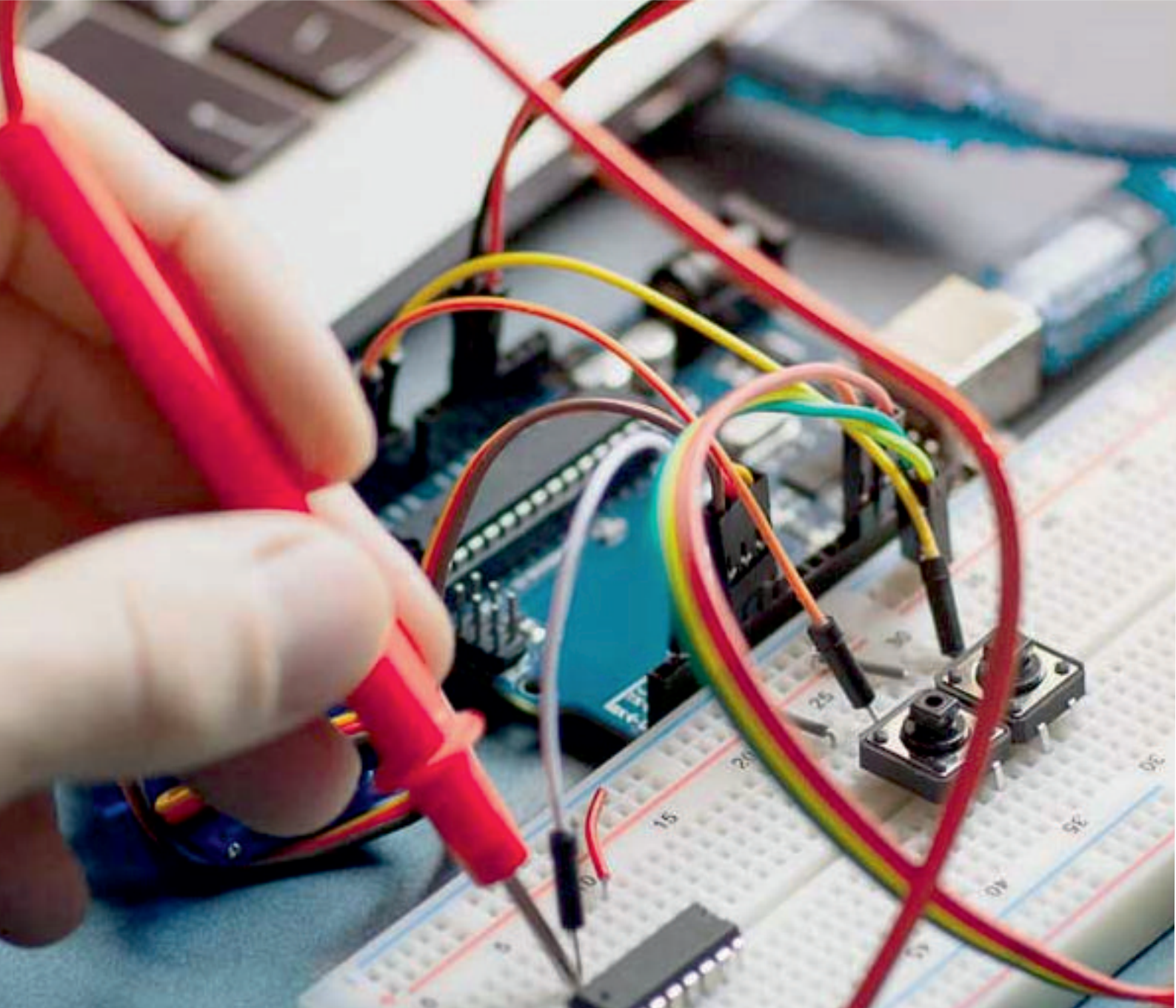
1. The Real-time Power monitoring athouses.
2. Sensing the power-pilferage, at theexact-location.
3. Transmitting the information, over wireless, tosubstations.
4. It can be used indomestic-households.
5. It can be implemented in malls, where huge amounts-of power arewasted.
6. It can also be implemented in, schools andcolleges.
7. The system can be incorporated for almost all-the-types ofusers.
8. The concept is well suited. especially for villages andinterior-areas

VII. CONCLUSION

This method reduces the heavy power and revenue losses that occur due to power theft by customers. By this design it can be concluded that power theft can be effectively curbed by detecting where the power theft occurs and informing the authorities. The proposed system will be hidden in electric meters in such a way that as soon as the difference between current crosses the threshold value, an automatic message and email will be sent to the concerned authority along with its location and image of that particulararea.

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