"GSM Based Electricity Theft Detection in Distribution Systems"

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Abstract : Electrical power theft detection system is used to detect an unauthorized tapping on distribution lines. Implementation area of this system is a distribution network of electrical power supply system. Existing system is not able to identify the exact location of tapping. This system actually finds out on which electrical line there is a tapping. This is a real time system. Wireless data transmission and receiving technique is used. This will provide an additional facility of wireless meter reading with the same technique and in same cost. This will protect distribution network from power theft done by tapping, meter tampering etc.

Keywords- RISC, AVR, GSM, Power Supply Design.

1. INTRODUCTION

Power theft is the biggest and major problem in recent times which leads to huge loss to electricity boards. It is very important to take this issue in to consideration and hence to resolve and to overcome these losses prices are increased. So if this theft get prevented then lots of power can be saved, to which will in turn be very beneficial. The normal practice for power theft is to short input and output terminals or to place magnet on the wheel. These practices meter are followed in old meters. So by sensing current flow through the line and energy feedback or using circuit breaker. In this novel system a micro controller is interfaced with an energy metering circuit & current sensing circuit, GSM and a contactor to make or break power line. In normal condition micro controller reads energy pulses and current signals. If current is drawing and energy pulses are not getting then it indicates power theft. So microcontroller trip the output using relay. This information is sent to substation using wireless communication.

2. SURVEY

Earlier several cases related to electricity theft generally used to take place in villages because they need more power requirement for their field to drive water pump and its motors. All the other farm related work which requires more electricity. Hence various modes of power theft are studied which are as follows :-
Bogus seal and tampering of seals, Meter tampering, meter tilting, meter interface and meter bypassing, Changing connection, Direct tapping from line, By using remote sensing device,Improper of illegal use of power meters.

Two Major Ways of Power Theft

Power Tapping: Often power theft is done during transmission by illegal tapping of the power lines to divert the power to the required destinations. It is also done by illegal connections to the power grid stations, which are cut at the time of billing.

Meter fraud: In many areas where manual reading of the meter is done, the person is often bribed to give false readings and thus the amount paid is for lesser amount of power compared to the power actually consumed. Also meters are tampered by obstructing the motion of the disk (usually electro mechanical consists of slowly spinning disks to record the power consumed.

Following is the brief description of work done on theft detection models by various researchers:-

In the paper [1],The paper uses the approach based on power line communication principle which is use for detecting theft in electricity. A high frequency signal is introduced in the 0distribution 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. Uses the concept of customer's historic usage pattern of electricity to create the user load profiling information which is used to detect the unusual flow of electricity and thus provides the class of customers which could be further synthesized to detect possible fraud customers. The paper uses many concepts like Extreme Learning Machine, Support Vector Machine. There are various process carried out in these process of detection. Firstly the usage data of customers is pre-processed. The processing is done in three steps Data Selection, Data Separation and Data Normalization. Then there is the process of feature selection which automatically takes the important features of the data. Then the data is categorized by the abnormal usage patterns by using ELM. Then the categorized data is further classified by SVM to detect the possible fraud in electricity. But as we are using SVM. The accuracy of detection decreases as SVM is not accurate in classifying data to the extent so there is possibility of getting failure in detection of fraud.

In the paper [2], a comparison has been done between K Means and N-K Means clustering on the basis of time and speed factors. K-means: It is a very efficient technique used to split out uniform and no uniform data into groups based on Centroids or means of clusters. N-K means: It is proposed on the basis of normalization. This algorithm applies normalization which is useful for clustering on the basis of available data and weight it also evaluates initial centroids. K-means produce efficient results after the changes are made in the databases. We apply converted algorithm on the basis of weighted average core of dataset with calculation of initial centroids. Before applying N-K means algorithm we normalize and pre-process the dataset. Mainly it depend on proposed method in three stages. In first stage, convert raw data into understandable format for that data pre-processing techniques are used. In second stage, into a specific range normalization is perform to get the data objects in typical form. In third stage we apply the N-K means algorithm to obtain the clusters. Paper presents efficient algorithm where we have first pre-processed our dataset on the basis of normalization technique and then generated effective clusters. This is done by assigning weights to each attribute value to find the standardization. This algorithm has proved to be better than traditional K-means algorithm on the basis of execution time and speed and Experimental results prove the proposed N-K means algorithm has better time complexity and overall performance comparing to K means clustering.

3. Novel System

In this Novel system GSM technology used to transmit the meter reading to the customer and service provider with the required cost. In this system ATMEGA328 is use to detect theft by observing the unit difference between two meters. When theft is detect then by the help of GSM module SMS is generate for service provider. Which cut the power supply automatically.Circuit diagram for novel system shown in figure 3.1.
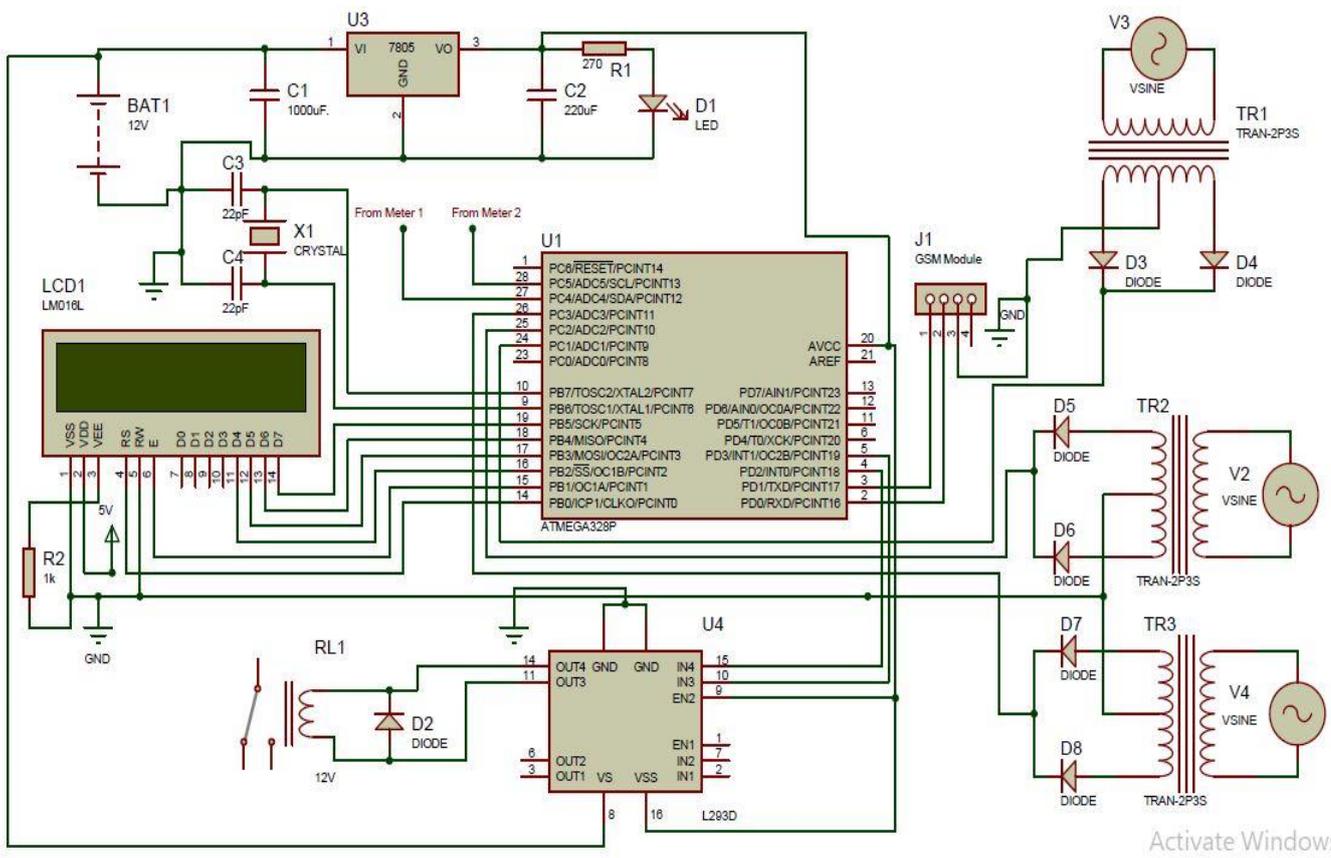
3.1 Circuit Diagram

FIG. 3.1 Circuit diagram of novel system

3.2 GSM

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication as shown in figure 3.2. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. Hence the MODEM is the soul of such modules as shown below.
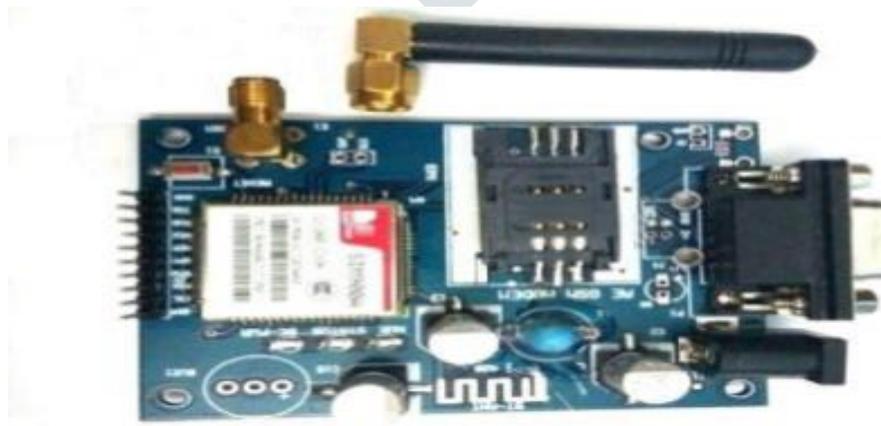

Fig.3.2 GSM system used for novel architecture

3.3 ATMEGA 328

The Atmel 8-bit AVR RISC-based microcontroller is used for novel system combines 32 kb ISP flash memory with read-while-write capabilities, 1 kb EEPROM, 2 kb SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz as shown in fig 3.3.
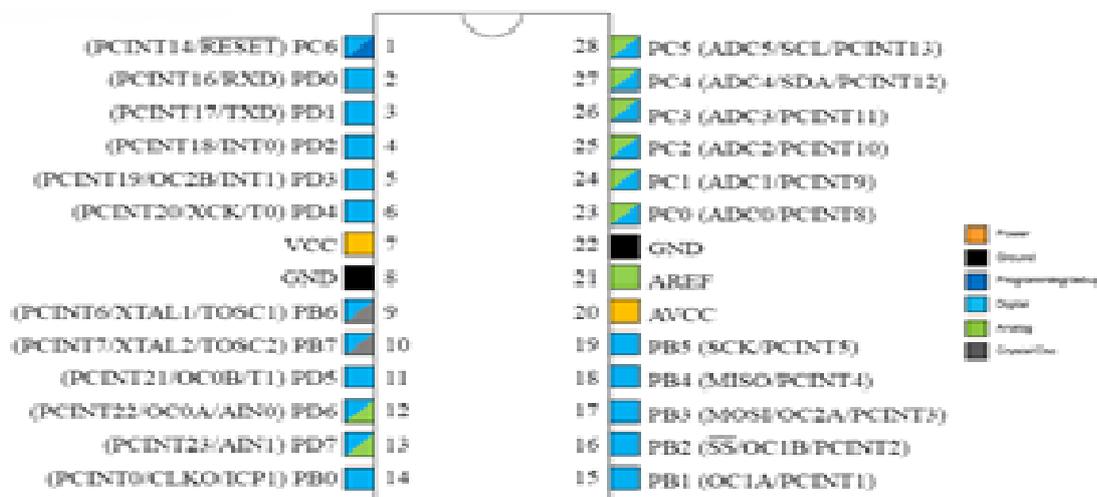
Fig. 3.3 Pin Diagram Of Atmega328

3.4. LCD Display

The commonly used 16x2 LCD display custom made characters, numbers, alphabets, and special characters is used. When there is no theft occur in energy meter then the LCD will display voltage current and power. If theft is occurs then it display THEFT IS DETECTED.
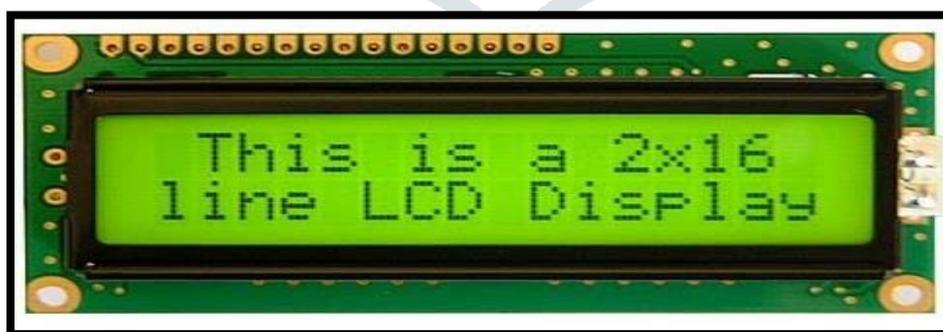
Fig.3.4 LCD Display

3.5 Relay

A relay switch can be divided into two parts: input and output. The input section has a coil which generates magnetic field when a small voltage from an electronic circuit is applied to it. This voltage is called the operating voltage. The output section consists of contactors which connect or disconnect mechanically. In a basic relay there are three contactors: normally open (NO), normally closed (NC) and

common (COM). At no input state, the COM is connected to NC. When the operating voltage is applied the relay coil gets energized and the COM changes contact to NO.

3.6 Voltage regulator(7805)

7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.
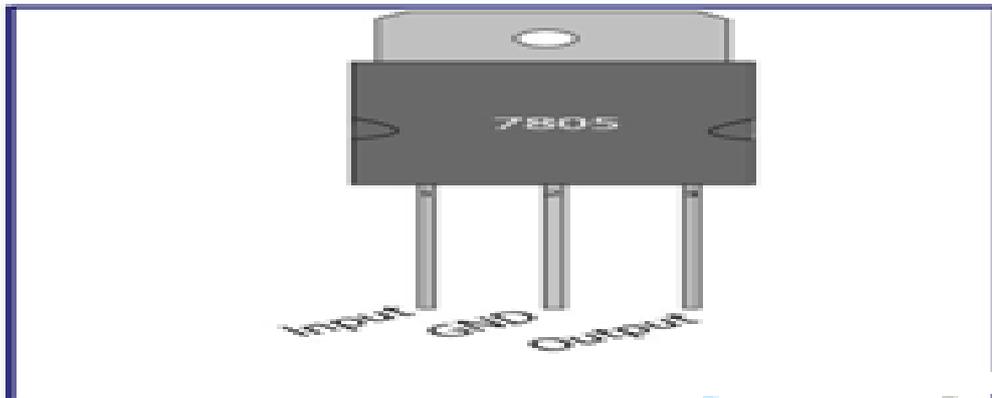

Figure 3.7 Pin diagram of 7805 IC
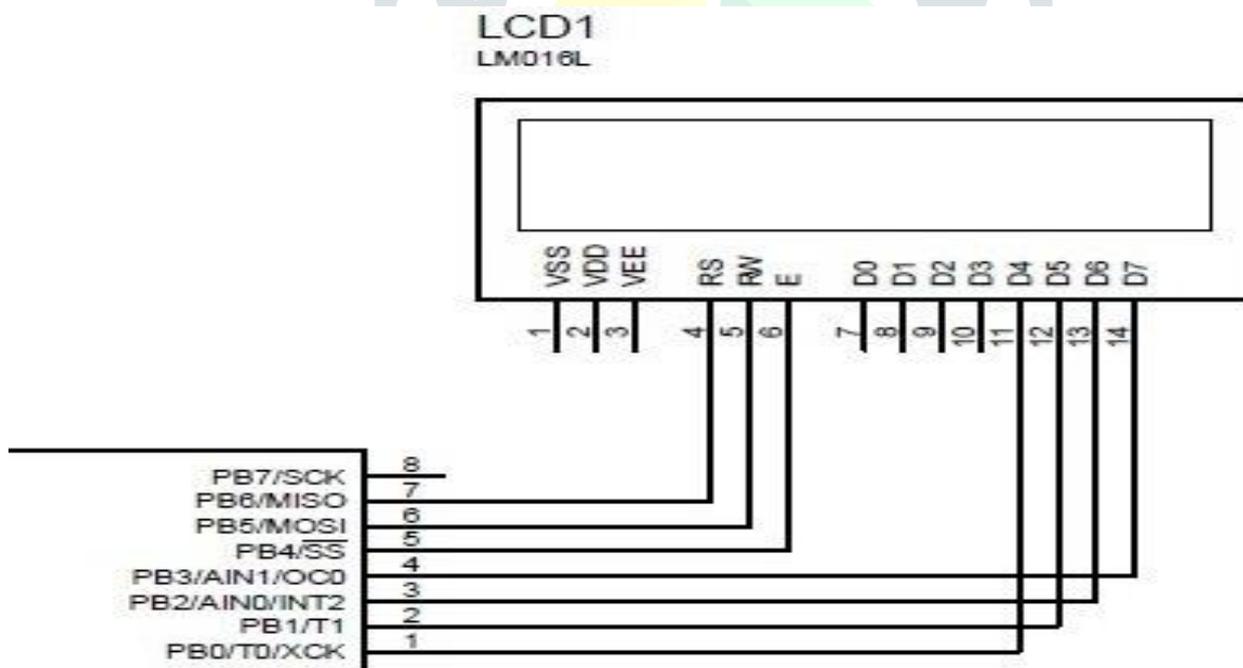
3.7 Interfacing of LCD with Atmega328.

Fig 3.7 Interfacing of LCD with ATMEGA328

3.8 SMS Alert.

The hardware of the automatic meter reading and theft control system by using GSM module our project at designing such a system which will automatically collect the reading and also detect the theft. Current transformer is used to measure the total power consumption for house or industrial purpose. This recorded reading is transmitted to the electricity board as per his demand for transmitting the reading of energy meter GSM module is used. The energy theft is control by IR sensor, IR is placed in the screw portion of energy meter seal. If the screw is removed from the meter message is send to the electricity board. The measuring of energy meter and monitoring of IR sensor is done with a PIC microcontroller. Then bypass of meter is detected by using to CT. One is in energy meter another is placed on electricity pole.

Fig.3.8 Output Of SMS Alert System

4. Applications and Advantages

- Dynamic Update of Meter reading on mobile.
- Reduce Man power & paper work for Sending Energy Bill Manually.
- Complete Automation of Sending Meter Reading.

Advantages

- Pay before use

- Lower Overheads

- No bill production

- No bill distribution

- No need to cash payments

- No further actions such as disconnections

5. Conclusion And Result

The project model reduces the manual manipulation work and theft. Use of GSM in our system provide the numerous advantages of wireless network systems. The metering IC ensure the accurate and reliable

measurement of power consumed. Hence we are trying to manipulate cost wise low when compared to other energy meter without automatic meter reading and theft control.
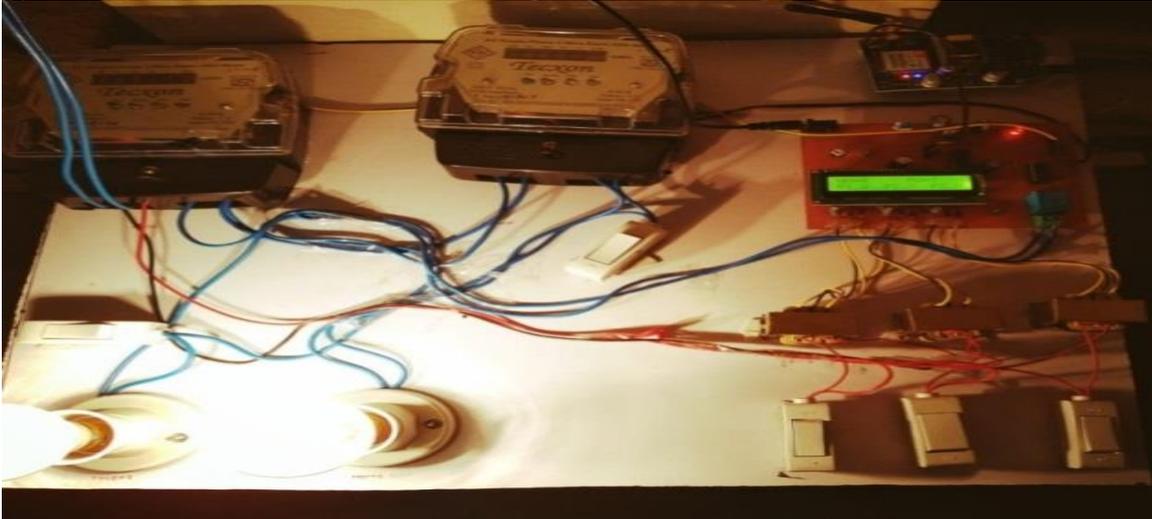

Fig 5.1 Resulting Project

Result

The Final Project has been tested and the following are the obtained results:

1. If there is no electricity theft between the Transmitter and Receiver end then the Project works in the Normal Mode.

2. If electricity theft observed between Transmitter and Receiver end then SMS is generated for the service provider by GSM. As shown is below image. Also power cut off automatically of that consumer.

3. This system facilitate automatic billing system via SMS, phase Fault alert of relevant location to service provider via SMS.

6. References

[1] T.B. Smith, "Electricity Theft: a Comparative Analysis, Energy Policy". 32(18), pp. 2067 – 2076, 2008

[2] S.Nunoo and J.C. Attachie, "A Methohology for the Design of an Electricity Theft Monitoring System", Journal of Theoretical and Applied Information Technology, Vol. 26 No 2,pp. 112-117, April 2011.

[3] S.patil, G.Pawaskar, K.patil., "Electrical Power Theft Detection and Wireless Meter Reading", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, issue 4, pp. 1114 – 1119, April 2013

[4] "Anti Electrical Theft and Trouble Shooting Through Mobile",International Journal of Advancements in Research & Technology.

[5] G.L. Prashanthi and K.V. Prasad., "Wireless Power Meter Monitoring with Power Theft Detection and Intimation System Using GSM and Zigbee Networks", IOSR Journals of Electronics and Communication Engineering(IOSR - JECE).

[6] N.P.Wandhare, S. D. Kondra, K. H. Gulhane and K. J.Dave, "Automatic Load Balance and Theft Detection System".International Journal of Application or Innovation in Engineering &Management(IJAIEM).

[7] F. Jamil," Comparison of Electricity Supply and Tariff Rates in South Asian Countries." Available at: http://www.efsl.lk/reports/electricity_supply_south_asian_countries.pdf[Accessed 18th July 2014], 2011.

[8] P. Ranjan, N.Mehra, T.A.More and S.Bokand,"Wireless Design for Power Theft Monitoring", International Journal of Computer Technology and Electronics Engineering(IJCTEE),Vol. 2, Issue 2,pp. 119-122.

[9] P.R. Malhotra and R.Seethalakshmi, "Automatic Meter Reading and Theft Control System by Using GSM", International Journal of Engineering and Technology(IJET),Vol 5, No 2, pp.806-810, Apr – May 2013.