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Power Theft Identifier with GSM Announcement

Ms. Thillainayagi[1], Mrs. P. Sujidha[2], Dr. M. Sarojini Devi[3], Dr. G. Vijayasri[4]
Assistant Professor, Department of Electrical and Electronics Engineering[1,2]
Associate Professor, Department of Electronics and Communication Engineering[3]
Associate Professor, Department of Physics[4]
Mohamed Sathak Engineering College, Kilakarai, India

Abstract: *Generation, transmission and distribution of electrical energy involve many operational losses. Whereas, losses implicated in generation can be technically defined, but transmission and distribution losses cannot be precisely quantified with the sending end information. 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. Surviving systems are 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 thesame technique and in same cost. This will protect distribution network from power theft done by tapping, meter tampering etc. The project has developed for identify the power theft from power line and save the energy by automatic on/off the street light according to the time set of RTC. In the electric board power theft identifier system, we will be having a current transformer which transmits the signal to microcontroller with the use of signal conditioning unit. One Current transformer will be available in the main line and the other one will be in the house. The current reading of the main line will be sensed by the CT1 and the current reading of the house will be sensed by the CT2.*

Keywords: Electricity theft, Illegal connections, Meter tampering, Smart meter, GSM

I. INTRODUCTION

There are many operational losses in generation, transmission and distribution of electrical energy. Whereas, losses implicated in generation can be technically defined, but transmission and distribution losses cannot be precisely quantified with the sending end information. This illustrates the involvement of nontechnical parameter in transmission and distribution of electricity. Overall technical losses occur naturally and are caused because of power dissipation in transmission lines, transformers, and other power system components. Technical losses in T&D are computed with the information about total load and the total energy bill. While technology in on the raising slopes, we should also note the increasing immoral activities. With a technical view, Power Theft is a non -ignorable crime and at the same time it directly affected the economy of a nation. Electricity theft a social evil, so it has to be completely eliminated. Power consumption and losses have to be closely monitored so that the generated power is utilized in a most efficient manner. The system prevents the illegal usage of electricity. At this point of technological development the problem of illegal usage of electricity can be solved electronically without any human control .The implementation of this system will save large amount of electricity, and there by electricity will be available for more number of consumer then earlier, in highly populated country such as INDIA. The project has developed for identify the power theft from power line and save the energy by automatic on/off the street light according to the time set of RTC. In the electric board power theft identifier system, we will be having two Current Transformers. One energy meter will be available in the main line and the other one will be in the house. The current reading of the main line will be sensed by the CT1 and the current reading of the house will be sensed by the CT2.The amount of current consumption can be seen through the display. The LCD display will be provided for viewing both the current values of the main line and the house. The sensed output signal is given to the signal conditioning circuit and then to microcontroller. Now the microcontroller compares both these signals. If both the signal values are equal then there is no power theft is detected. If not the microcontroller detects there is a power theft and send a signal to alarm for identification.

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II. EXISTING SYSTEM

In The existing systems for power theft detection involve various technological approaches and methods aimed at identifying and preventing unauthorized consumption of electricity. Here are some common methods used in power theft detection systems:

Meter Tampering Detection:

Power companies employ meters with tamper detection features. These meters can detect physical tampering, such as broken seals, magnets, or bypassing circuits, which are common methods used by individuals attempting to steal electricity.

Smart Metering:

Smart meters are equipped with advanced technology that enables remote monitoring and detection of abnormal usage patterns. These meters can detect anomalies in electricity consumption, such as sudden spikes or irregularities, which may indicate potential theft.

Data Analytics and Machine Learning:

Power companies analyze consumption data using advanced analytics and machine learning algorithms to detect patterns associated with power theft. These systems can identify deviations from normal usage patterns and flag suspicious activities for further investigation.

Grid Monitoring Systems:

Grid monitoring systems continuously monitor power distribution networks for irregularities, such as voltage fluctuations or unaccounted-for losses, which may indicate power theft or technical issues within the network.

III. PROPOSED METHOD

The proposed system describes how to prevent the Tampering of Meter and Bypassing the Meter. The principle gain of this device over the alternative systems proposed in advance is that the structures proposed formerly useful discover power theft but do no longer stop it. While this system prevents the theft which means if the defaulter attempts to theft the energy by way of bypassing or tampering, he will now not be capable of use the electricity. Consumer can only get right of entry to the power via proper energy meter.

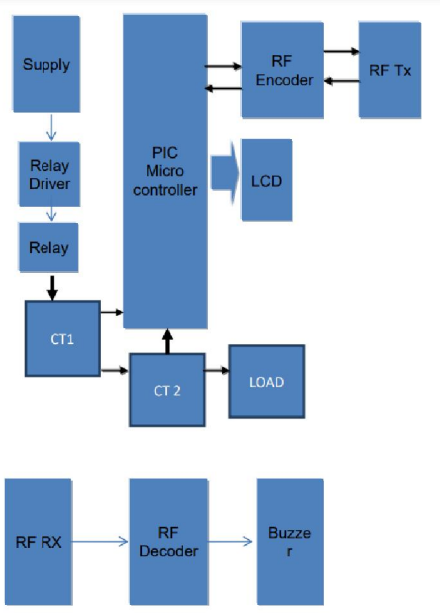

Fig.3.1 Block Diagram of Proposed Topology

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Theft Control Measures:

Protection against tampering

In this system if the customers or professional ones try and open the energy meter and tamper it to expose low or no energy consumptions. To remove this trouble, one leaf switch is used at establishing aspect of the proposed energy meter. Output of switch is attached to outside interrupt pin of microcontroller. In everyday conditions, the transfer can be closed and the Microcontroller will discover 5V as its outside interrupt pin. If consumer attempts to open the energy meter the switch might be opened and the Microcontroller will detect 0V at its external interrupt pin. If this occurs, the microcontroller disconnects the electricity without delay and additionally sends this records to the electricity board and consumer with the assist of GSM modem..

Protection against tapping the meter

In this proposed system to save you from tapping, modern transformers are used one after the other inside the distribution junction and sub junction. The output voltages of CT1 and CT2 are furnished to the ADC inputs of Microcontroller. If the distribution line energy is more and sub junction electricity is much less, then there might be difference among the output voltages of CT1 and CT2. The Microcontroller compares the voltages of CT1 and CT2 and if any considerable difference is observed, it disconnects the electricity immediately the usage of the Relay and additionally sends the information to the power board through GSM.

Power supply

The input to the circuit is applied from the regulated power supply. The AC input that is 230V from the main supply is step down by the transformer to 12v and is fed to a rectifier. The output obtained from the rectifier is a pulsating DC voltage. S So in order to get a pure DC voltage, the output voltage from the rectifier is fed to a filter to remove any AC components present even after rectification .Now this given to a voltage regulator to obtain a pure constant dc voltage

ESP32 Microcontroller

ESP32 is a series of low-cost, low-power on a chip microcontroller with integrated Wi-Fi and dualmode Bluetooth. The ESP32 series employs a Ten silica XtensaLX6 microprocessor in both dual-core and core variations and includes in-built antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules. ESP32 is created and developed by Espressif Systems a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process. It is a successor to the ESP8266 microcontroller.

Optocoupler

An optocoupler is essentially an optical transmitter and an optical receiver connected by a nonconductive barrier. It uses beam of light to transfer energy from one circuit element to another, and it can handle incoming voltages of up to 7500V.

Electromagnetic Relay

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. Relays allowone circuit to switch a second circuit which can be completely separate from the first.

GSM Module

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.

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III. SYSTEM DESIGN

Circuit Diagram of Proposed Method

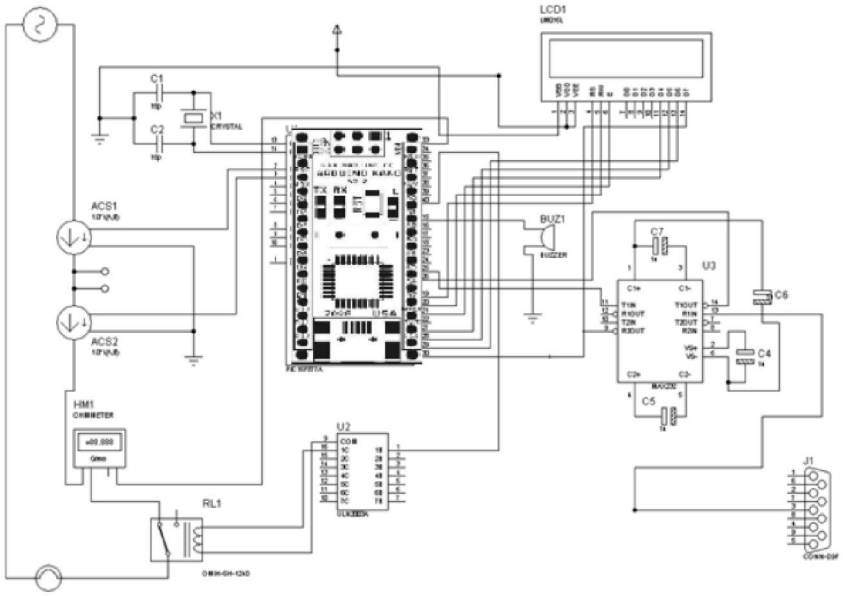

Fig 3.1 Circuit Diagram

When AC is applied to the primary winding of the power transformer it can either be stepped down or up depending on the value of DC needed. In our circuit the transformer of 230v/15v is used to perform the step down operation where a 230V AC appears as 15V AC across the secondary winding. In the power supply unit, rectification is normally achieved using a solid-state diode. Diode has the property that will let the electron flow easily in one direction at proper biasing condition. As AC is applied to the diode, electrons only flow when the anode and cathode is negative. Reversing the polarity of voltage will not permit electron flow. 58 A commonly used circuit for supplying large amounts of DC power is the bridge rectifier. A bridge rectifier of four diodes (4*IN4007) is used to achieve full wave rectification. Two diodes will conduct during the negative cycle and the other two will conduct during the positive half cycle. The DC voltage appearing across the output terminals of the bridge rectifier will be somewhat less than 90% of the applied RMS value. Filter circuits, which usually capacitor is acting as a surge arrester always follow the rectifier unit. This capacitor is also called as a decoupling capacitor or a bypassing capacitor, is used not only to 'short' the ripple with frequency of 120Hz to ground but also to leave the frequency of the DC to appear at the output. The voltage regulators play an important role in any power supply unit. The primary purpose of a regulator is to aid the rectifier and filter circuit in providing a constant DC voltage to the device. Power supplies without regulators have an inherent problem of changing DC voltage values due to variations in the load or due to fluctuations in the AC liner voltage. With a regulator connected to the DC output, the voltage can be maintained within a close tolerant region of the desired output. The regulators IC7812 and 7805 are used to provide the +12v and +5v to the circuit. PIC16F877A The relays are connected to microcontroller through ULN2003 relay driver IC. The ULN2003 has 16 pins. The 9th pin of ULN2003 is Vcc and 8th pin of the ULN2003 is GND. The 12V supply is given to the 9th pin of the ULN2003. The ULN2003 has 7 input pins (1-7) and 7 output pins (10-16). The ULN consists of Darlington arrays. The 1st pin of ULN2003 is connected to the 33rd pin of the PIC16F877A microcontroller. The 16th pin of the ULN2003 is connected to the relay, which drives the relay.

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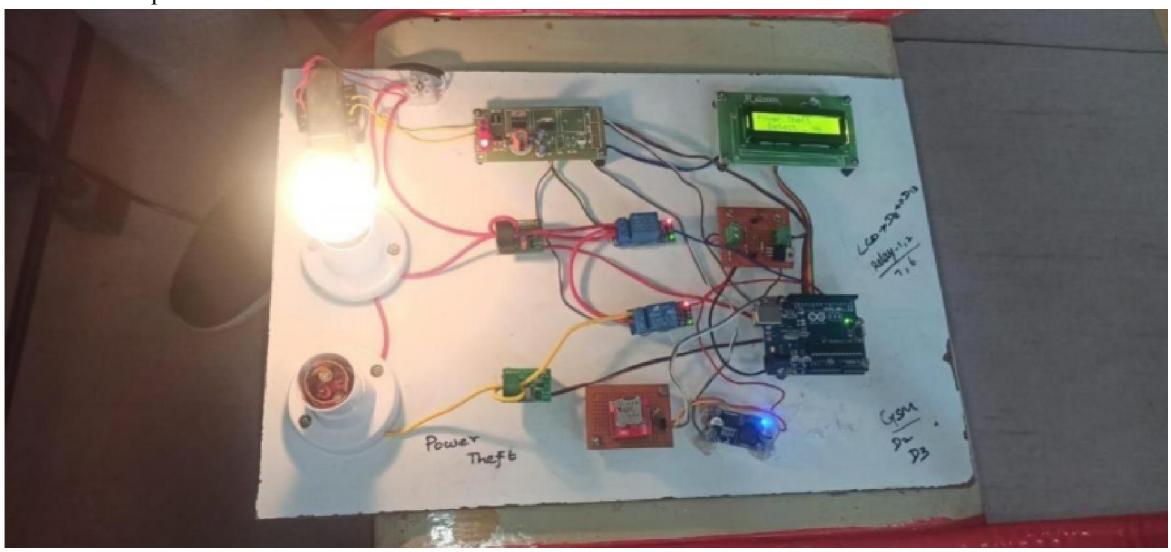
IV. HARDWARE DESCRIPTION

Hardware Description



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V. CONCLUSION

The project "POWER THEFT IDENTIFIER" has been completed successfully and the output results are verified. The results are in line with the expected output. The project has been checked with both software and hardware testing tools. In this work "CT, power supply, Relay, Relay Driver, RF Module and Microcontroller" are chosen are proved to be more appropriate for the intended application. The project is having enough avenues for future enhancement. The project is a prototype model that fulfills all the logical requirements. The project with minimal improvements can be directly applicable for real time applications. Thus the project contributes a significant step forward in the field of "PUBLIC SAFETY", and further paves a road path towards faster development s in the same field. The project is further adaptive towards continuous performance and peripheral up gradations. This work can be applied to variety of industrial and commercial applications.

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