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# Power Theft Identification by using GSM Technology

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**ABSTRACT:** Today, power theft plays the key role in transmission losses of electricity from the generating station to the consumer end. About 30% of power produced is being theft. Though the electricity boards know that there is power theft in the area under their vigilance, they are not able to locate the area or location of theft. So, to identify the power theft and to communicate to the EB there needs a system to be developed. Here comes the system developed by us which will find the power theft if it happens and sends the information about the place of the theft to the nearby Electricity Board.

**KEYWORDS:** Power theft, Power Line Communication, Microcontroller, Multiplexer, GSM module, Digital Ammeter, Energy meter.

## I.INTRODUCTION

India, the largest democracy with an estimated population of about 1.1 billion, is on the road to rapid growth in economy. Energy, particularly electricity, is a key input for accelerating economic growth of the country. Today, the power theft is becoming a very serious issue in the power sector of the World. About 20-30% of the power produced is being theft. This causes a major loss to the Electricity boards. So it becomes inevitable task these days, during which power shortages occur frequently, to find a solution to identify the power thefts and to eradicate them.

## II.METHODS OF POWER THEFT

There are various methods by which power is being theft in the distribution lines. The most commonly used methods are:
1.Energy meter tampering
2.Illegal tapping from the distribution lines
3.Bypassing the feeders

### *A.ENERGY METER TAMPERING*

In meter tampering, the energy meter in the consumer side is made to malfunction by introducing materials which make the energy meter not to read its original readings. This is usually done by introducing magnets near the energy meter which work on electromagnetic principles, such that the magnetic forces are made to malfunction and hence the meter readings. So the meter reads the different readings, usually lesser readings than the original ones. Recently, a popular way to slow down a meter is the use of strong permanent magnets like rare earth neodymium magnets. In induction meters, a number of torques are balanced to get optimum linear characteristics. One of them comes from permanent magnet (N-S) braking the aluminium disc (Al). Neodymium magnets installed close to rotating discs may effectively boost braking torque. After removing this magnet, the meter starts to rotate much faster so “having already saved a lot", users complain about reading. Fortunately, utilities found a way to distinguish between malfunctioning meters and those previously treated with neodymium.

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### *B) ILLEGAL TAPPING FROM THE DISTRIBUTION LINES*

This is the very popular method of power theft which usually happens in the villages and in the industrial areas where the hooks, which are made of conductive materials, introduced directly into the distribution lines and hence the power is utilized without the licence. Though this method of theft is particularly dangerous, the power thieves do not care much about this and this method continues to be the favourite method for many.

### *C)BYPASSING THE FEEDER*

Usually the bypass supplies power to large and stable loads which will not trip fuses in the case of overload. It may be heating or air cooling, i.e. loads providing functions which may be also supplied in non electrical way. In the case of partial bypass, the rest of the circuits are supplied normally through the meter, so the bill, which is close to average, does not suggest a theft. The most efficient way to fight against such cases is to partner with crime stoppers. Nobody else knows better how people are powering their devices than neighbours.

## IV.POWER THEFT DETECTION

**Working principle:**

According to the principle of electric power transmission, the sending end current should be equal to the sum of the receiving end current provided that there is no leakage in the line. So when there is any discrepancy in this equation, then it can be concluded that the power should have been theft at some area between the input and the output.

**5.0)Components used:**

- AT89S52 Microcontroller
- Shift register, Counters
- Digital ammeters
- Multiplexers
- GSM module

## VI.DESCRIPTION OF THE COMPONENTS USED

### *A)89S52 MICROCONTROLLER*

This is a microcontroller which can be used for a variety of operations such as doing computations, signal generations, controlling appliances, etc.., A microcontroller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, and toys. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems. Some microcontrollers may use four-bit words and operate at clock rate frequencies as low as 4 kHz, for low power consumption (milliwatts or microwatts). They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just nano watts, making many of them well suited for long lasting battery applications. Other microcontrollers may serve performance-critical roles, where they may need to act more like a digital signal processor (DSP), with higher clock speeds and power consumption.

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Here we use 89S52 microcontroller. The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

***B)SHIFT REGISTER***

Shift registers are a type of sequential logic circuit, mainly for storage of digital data. They are a group of flip-flops connected in a chain so that the output from one flip-flop becomes the input of the next flip-flop. Most of the registers possess no characteristic internal sequence of states. All the flip-flops are driven by a common clock, and all are set or reset simultaneously. The basic types of shift registers are Serial In - Serial Out, Serial In - Parallel Out, Parallel In - Serial Out, Parallel In - Parallel Out, and bidirectional shift registers.

***C)CURRENT TRANSFORMER***

Current transformer is a device which is used for measuring the current flowing through the lines. Current transformers, together with voltage transformers (VT) or (potential transformers (PT)), are known as instrument transformers. When current in a circuit is too high to directly apply to measuring instruments, a current transformer produces a reduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments. A current transformer also isolates the measuring instruments from what may be very high voltage in the monitored circuit. Current transformers are commonly used in metering and protective relays in the electrical power industry. The data from the current transformer is converted in to digital form by using ADC.

***D)MULTIPLEXER***

The multiplexer is a device which gives the output according to the select input given to it. If there are $2^N$ inputs to the multiplexer then it gives only one input to be given as output depending on the 'N' select inputs. This multiplexer is of two types: parallel multiplexer, serial multiplexer. In the parallel multiplexer, N set of n-inputs can be given and only one n-set input can be obtained in the output. In case of serial multiplexer, if N inputs are given then only one output can be obtained.

***E)GSM MODULE***

Global System for Mobile Communications or GSM is the world's most popular standard for mobile telephone systems. This ubiquity means that subscribers can use their phones throughout the world, enabled by international roaming arrangements between mobile network operators. GSM differs from its predecessor technologies in that both signalling and speech channels are digital, and thus GSM is considered a second generation (2G) mobile phone system. This also facilitates the wide-spread implementation of data communication applications into the system. The GSM standard has been an advantage to both consumers, who may benefit from the ability to roam and switch carriers without replacing phones, and also to network operators, who can choose equipment from many GSM equipment vendors. GSM also pioneered low-cost implementation of the short message service (SMS), also called text messaging, which has since been supported on other mobile phone standards as well. The standard includes a worldwide emergency telephone number feature.

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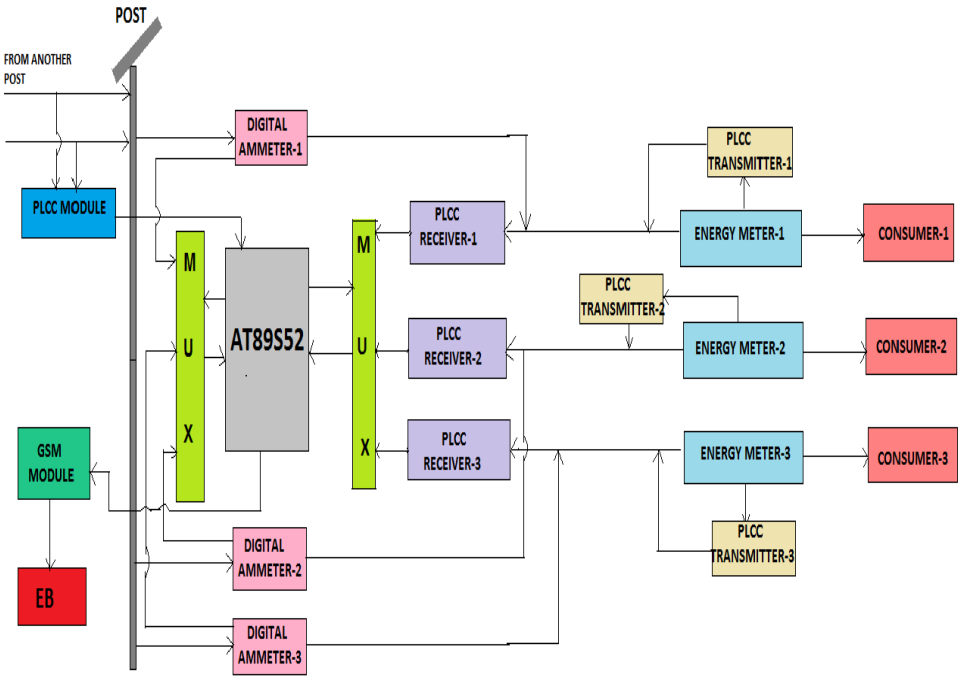
## VII.OVERALL BLOCK DIAGRAM

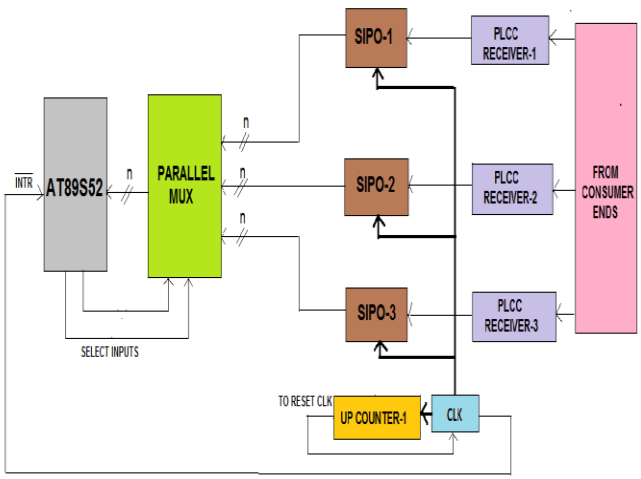



## VIII.WORKING

Here we introduce a system, which will detect all the three kinds of theft said above.

### *A.METER TAMPERING*

As said in above sections by using the principle said before, the sending current from the post should be equal to the load current in the consumer section. If this is not equal then it can be detected that there is power theft in that particular line. So the power theft can be found in this way. Here it is assumed that digital meters in-built with current sensors are present in the consumer sides. If analog meters are present then the ADC module is to be introduced.



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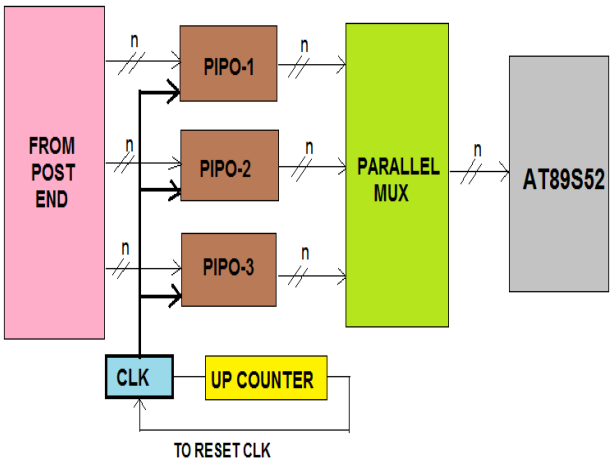
Here only the current is set to be measured. The sensor takes 20 mS to measure the one cycle of current. This current will be of 8-bit data. This digital data is sent through the PLCC transmitter and is received in the PLCC receiver module. This data is again sent to the serial-in parallel-out shift register, whose clock signal is for about 20 mS before it gets resetted. The time period of one clock signal is about 2.5 mS. This data from the shift register is again sent to the parallel multiplexer which gives output depending on the select inputs. The input to be selected is said by the microcontroller to the multiplexer. The select input to the multiplexer is given only after the external interrupt INTR of the microcontroller gets changed. This select input will be the address of the particular line. According to the select input given to the multiplexer, it gives the output. The outputs are sent to the microcontroller in each 1 mS. Thus the complete data of the consumers say about 20, is sent within 20 mS. If the consumers are 40 in number then the output is sent to the controller within 0.5 mS such that the input received and the processing speed of the controller remains the same to avoid data getting hanged.




In the controller, the data from the consumer end is compared with the data from the digital ammeter which is kept near the post.This data is of 8-bit and is selected by using the data from the post about the particular line is selected by using the address of the line. Now the data from sending end is sent to the controller in every 1 mS. The comparison of data from the consumer end and the post end will take place at a very high speed of about 20 micro-seconds in the microcontroller. But next data will be arriving after 1 mS only. So during this time interval, if there is any mismatch in the data in comparison, then the controller sends the address of the line and the post to the GSM module, which again sends the data to the Electricity Board. Usually the input is kept high for the GSM module. This can be made ready to receive data about the address of the line and the post by making it low using the ISR interrupt. This interrupt gets enabled when there is any discrepancy in comparison. This entire process of comparison takes about 20 mS and hence for receiving another set of data after 20 mS, the clock is reset by using the up-counter, i.e., after 8 clock pulses. Now it can be noted that the entire cycle of comparison takes about 40 mS. During the reception of the next cycle data i.e within 20 mS, the other two types of thefts are verified. Hence the power theft due to meter tampering or tapping from feeders can be identified and sent to the Electricity Board.

### *BILLEGAL THEFT FROM THE POSTS WITHOUT METERS*

This can be detected by adding all the data from the consumer side and comparing the same with that of the input to the post. Usually the digital ammeter data are added and compared. If there is any discrepancy in the comparison of these data then the GSM module is activated and then the address of the particular post is sent to the Electricity Board. This comparison is done once when all the data of consumer are compared for meter tampering.

### *C)ILLEGAL TAPPING IN THE DISTRIBUTION LINES*

To detect this type of theft, the sending end current from one post, say post A to the other post, say B is compared. If the data compared are not equal in this comparison then the addresses of the both posts is sent to the Electricity Board. This is usually done after the comparison of the above said two comparisons.

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## IX.ADVANTAGES

- All the types of power theft can be identified by using this system.
- This is a cost effective method to find the power theft.
- This system can be implemented in the existing power lines.
- Fault can be detected by using this system.

## X.CONCLUSION

There must be always connection between consumer end and the post. Cost of the GSM modules and the controllers can be brought down.Maintenance of the system gets tougher with large no of consumers.

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