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ADVANCED METERING INFRASTRUCTURE TRIPPING SYSTEM

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Abstract - *The power distribution monitoring is an important research in electric power systems and electricity stealing defense is one of the chief step in distribution network reconstruction. Electricity stealing is a long term problem, however each power supply department has made a huge investments of man power and material, the phenomenon of defending stealing electricity has increased and not abated and the method of electricity. Theft is continuously increasing and improving. The behavior of electricity theft not only makes the power industry suffering huge financial losses but also threatens the main power supply security and reliability. In this project, we show that how it is possible to give automatic information to head office about electricity theft and its tripping.*

Keywords- *Power theft, GSM module, Meter tampering, Theft detection and Power tripping, e-bill*

1. INTRODUTION

Electricity becomes a vital part of human development. After the tremendous growth of electricity science, technology and life style steps to a new era. Now it's impossible to think about a world without electricity. Today, our demand of power is growing beyond the production of electricity. Studies says that a part of produced electricity is lost during transmission. A major part of power loss is by theft. Electricity theft can be termed as fraud which can be in the form of meter tampering, illegal connections, billing irregularities and unpaid bills [1].In India electricity theft is a very common problem, since the users of electricity are ultimately tremendous. Mostly power theft is done by bypassing or tamper the meter and by direct tapping from line.

In the past, various methods has been introduced to detect and control the power theft. A recent research conducted by Mr.M.V.N.R.P.Kumar,Mr.P.G.Desai,Mr.AshtoshKumar,Mr.A.V. Athelekar,Mr.M.P.Nanawere [2] monitors about 30-35 percent of profit earned by the electrical board goes waste due to electric power theft. Previous attempt to monitor the activities has not resulted in efficient manner due to some of the illegal practices of some of these employs and consumers. This research aims at reducing all these difficulties by fabricating a simple system to send a message whenever there is a power theft activity at a certain location.

Sahoo, Sanujit, [3] has proposed a temperature predictive model which uses smart meter data and data from distribution box meters to detect electricity theft in a particular location. The model was tested for varying amounts of power thefts and also for different types of circuit approximations.

Shete "GSM Enabled Embedded System for Energy Measurement and Billing". This paper revealed that development of measuring instrument that enhances the measurement of electrical parameters as well as sending these parameters to service providers by using GSM technology. The energy meter system can be incorporated with embedded microcontroller with GSM port to transmit the data. This data fed and integrated into energy management systems located at Power Company.

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 for motors and all the other farm related work which requires electricity. But now days it is not limited in villages but also industrial area as well as consumer side comes under power theft. There are various modes of power theft such as 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 meter .

1 BOGUS SEAL AND TAMPERING OF SEALS In this method people and other domestic customers drill holes into meter boxes and attempt to stop the counter wheels from turning which leads to theft of electricity. Another method of Power theft is by using a strong magnet and keeping it in front of the disc in the energy meter and thus arresting the rotation of the disc and connecting the load directly to the power line bypassing the energy meter.

2 METER TAMPERING, METER TILTING, METER INTERFACE AND BYPASSING Many people either use elaborate bypass system or tamper with internal

mechanism of the meter and for this they usually install a bypass system at the weather head where the entrance cable attaches to the house and then runs to the other side of the house and also to the other side of the meter. Customer can decide when they want electricity to run through the meter and when they want it to run through the bypass by placing a switch on the bypass. Customer tampering with the internal mechanisms of the meter can simply lead to bending of the wheel to create a drag. Alternatively they can also tamper with the meter's polarity to accomplish a similar objective. They also can modify registration of electricity by placing resistors in the meter.

3 CHANGING CONNECTION In this method thief try and aims to steal the electricity by making some arrangement inside the meter body e.g. reversing the motor. It involves the installation of a remote-controlled device in the electronic meters which allows consumers to switch the meter.

4 DIRECT TAPPING FROM LINE In our project we are going to design a system which will limit the illegal use of power which is theft directly from the supply. In this technique thief directly try to take power from the transmission line.

5 BY USING REMOTE SENSING DEVICE while the electricity department came up with the idea of installing electronic meters to avoid large instances of meter tampering, some unscrupulous consumers have managed to find an ingenious way around this as well. Some of the method to do so involves the use of a remote control to switch one's meter on or off. In fact this news came as a big shock to the electricity department itself who had been claiming that their new electronic meters were absolutely tamper proof. This technique, developed by some local electricians, involves the installation of a remote-controlled device in the electronic meters which allows consumers to switch the meter off at will. This radio frequency circuit is installed inside the electronic meters by first heating the seals and then taking them off and then opening the meter to plant the circuit and at the end sealing it back again. Each circuit has a frequency and a remote matching that frequency is given to the customer which works just like a normal television remote. This circuit is usually installed between the neutral and phase wires that go inside and come out of the meter. When the circuit is switched on then the incoming Problem Identification in Existing System

1) Due to over usage of electricity many peoples are suffering lot by lack of power supply.

2) Many imports and exports are stopped due to power cuts, which result in down of trade market.

3) Generating the bill - The Electricity board Employee is going to each and every house and takes the reading and generating the bills. It will take lot of time and laborious task.

4) Disconnect the power supply- If the consumer did not pay the bill means again one of the Electricity board employees should go to consumer place and disconnect the supply.

5) Corruption on meters - If there is an interconnection between consumer and electricity board department, then the person is giving the wrong reading to the consumer and he / she gets some money from the corresponding consumers. So, it gives the huge loss.

6) Manual operator cannot find the un-authorized connections or malpractices carried out by the consumer to reduce or stop the meter reading/power supply.

7) The human error can open an opportunity for corruption done by the human meter reader. So the problem which arises in the billing system can become inaccurate and inefficient.

Another design proposed by Saurabh Singh, Krishna Yadhav and colleagues[4], the system in such a way so that it finds out the power theft by monitoring the total power consumption and also by receiving the delivered power data that includes data delivered to a number of users. It will guide and help us to find if power theft has occurred by determining the amount of difference between them. RF transmitter and RF remote controls are built using HT12E and HT12D chips. The remote control is built using RF encoder chip HT12E that will generate different codes. These codes will be transmitted by 434 MHz RF transmitter. At the receiving end these codes will be received by 434 MHz RF receiver and decoded by RF decoder chip HT12D.Sensors will give signal to HT12E and in response to the signal HT12E will respond accordingly. It is a 18 pin IC. Its functioning includes conversion of bit data input to serial output. It has 12 address lines to send data to particular receiver. Output of HT12D is connected to MCU at port pin no 1 to 4. In this project we are using UHF frequencies of RF. LED's connected at port 2 pin p2.0,p2.1,p2.2,and p2.6. LCD rs, rw, en are connected to p2.5, p2.4 and p2.3. HT12 E and HT12D s pin 1 to 9 connected to ground. These are address pins of HT12E and HT12D. Pin no 10 to 14 of HT12E are inputs of IC and 17 no pin is the output pin. Pin no 10 -14 of HT12D is the Ouput pin and pin no 14 is input pin. Crystal pin of HT12E is 15 and 16. In this project we will make one transmitter and RF

receiver. RF remote control is built using HT12E and HT12D chips. The remote control is built using RF encoder chip HT12E that will generate different codes. These codes will be transmitted by 434 MHz RF transmitter. At the receiving side these codes will be received by 434 MHz RF receiver and decoded by RF decoder chip HT12D.

In this project, the electricity theft is detected and monitored by comparing the current consumed and current arrived. Basically, it consists of two current sensors. One sensor (S1) is present at the pole from where the power is supplied to the homes and the other current sensor (S2) is present at the homes. Power supplied by the S1 and S2 are compared by the Arduino. If the difference between the two is more than the particular value, then a relay which is interfaced with the processing unit will switch off the power supply of the homes. One more relay is interfaced with the Arduino to activate the GSM calling. Through this, the information of the theft is sent to the respective sub-stations. When the message of ALERT reaches the substation then a tripping message will send to the controller of the particular location and the power is tripped.

Other advantage added to this system is billing system, which is an another problem facing by our Government. As we know there introduced many proposed system to fasting the billing system through Iot and using another technology but here we combining the whole system ie.,both detecting and billing. Our system works in real time and this will help for fast action by utility and consumer side

2. PROPOSED SYSTEM

The proposed system is designed to prevent the electricity theft happening in the present scenario. The increasing rates of the per unit electric power, because of theft of electricity due to this the electricity supplier companies are not able to recover the invested amount, thus they have to undergo a large loss of revenue and thus, they increase the rates of electricity unit which the consumer has to pay. The proposed system will prevent the theft of electric power as much as possible. This system will not only detects the theft of electricity but also trace the location of theft and will trip the power supply of stolen power and also notify the nearest substation authority about this theft with exact location of the theft. The system also provide e-billing facility.

The design system consist of 2 current sensors, one will be installed as the domestic meter which will monitor and indicate the current consumption of the house, and other will be installed inside the distribution box on the line the connection, which will indicate the current consumption of the line which starts from the distribution box and ends up at the house. There will be a processing unit which is programmed accordingly and with the help of 2 sensors of a connection this unit can identify theft, if it identifies theft then the system automatically cut of the power supply of that particular connection and will notify the nearest substation that theft has been occurred at this location.
The another theft is between poles, i.e., direct tapping from line. Here also we use two current sensors, one at the first pole and the other on the next pole. Here the current sensors measure the current difference between the two poles. The Arduino will send the message to the nearby service provider center about the theft if the current difference is beyond a particular value. One additional feature which is added is e-billing. It will provide details about the total unit consumed and billing rate to the consumer as well as to the service providers.

By sensing current flow through the line and energy feedback we can prevent power theft. In this system by an Arduino is interfaced with an energy metering circuit current sensing circuit, RF communication and a contactor to make or break power line. In normal condition Arduino reads energy pulses and current signals. If current is drawing and energy pulses are normal then no power is theft. If current is drawing and energy pulses are not coming then it indicates power theft. So Arduino trip the o/p using relay. This information is sent to substation using wireless communication like GSM technology.

When the theft is alerted at the substation, suddenly the tripping message is given back to the consumer section. Here the tripping is given to the theft between the pole and the house. To reconnect the supply the message is given from the substation through a message to the consumer section after a few minutes. For receiving the message at the consumer side we requires a power supply to the system. For the same purpose we provide another power supply like battery to the GSM.

The message like penalty for the theft and billing details can be communicated between the service provider and the consumer. It can alert the consumer about the billing status and their consuming rates. The details of the consumer is secured in the system of the service providers. There will be secured password for the communication between the consumer and the service provider.

3. BLOCK DIAGRAM

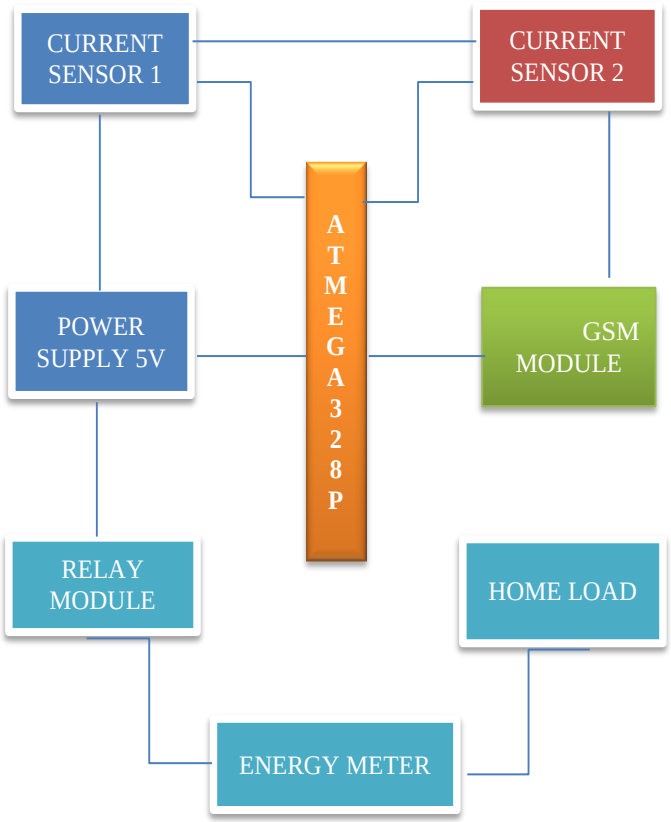

Fig .a. Proposed system

4. METHODOLOGY

The circuit consist of Arduino, GSM, LCD, current sensors and relay module. To detect the power theft between the pole and the meter is done by using two current sensors, one is connected at load side to measure the load through the load and the other sensor is connected at supply terminals to measure the current supplied by the source.

The main component of this circuit is Arduino controller. It receives current measures from the both sensors by the means of bridge rectifier. Then it compares those two current magnitudes by the conditional operator. Since there is no theft load, then the two sensors gives almost same values. Here the system is in the healthy condition. The Arduino cannot access the current signal.

Power tapping can by detecting by comparing the current distributed to the line and the power actually consumed by the load. The difference in the value indicates an error and this error signal is given to a controller which in turn inform the utility and they send tripping message to the system and there by theft is reduced.

If any trapping is done between the poles, then the sensors show different values. The source current is more than the actual current. If there is any deviation more than the specified value then the controller sends message to the utility side and the authorities get the correct information about the exact location of theft and they can reach there within the time.

The GSM is used for sending text message to the substation members by placing their mobile number in code. LCD is used for the purpose of display. It shows the status of source current and also the amount of current that is deviated. GSM module will send the text message to authority/ person whose mobile number is given in the program according to the signal given by the Arduino controller.Here the internet communication layer that enables the entity to communicate with their device, and sometimes enables device to communicate with each other. By using above technique the crime of stealing power may be brought to an end.

5. HARDWARE IMPLEMENTATION

The power supply is the basic unit in every electrical and reducedonics projects circuit, which is used for providing the required power to the microcontroller and other components in the circuit. Generally, this power supply block consists of step-down transformer, center tapped rectifier, and IC 7805 voltage regulator. Microcontroller in the Arduino requires 5V power supply. The microcontroller block can be considered as the main block of the entire circuit. It is programmed to control all the components to perform the desired operation. Here, in this proposed system ATMEGA328p is used and programmed using Arduino software. The energy meter is interfaced with the Arduino using an interfacing device called Optocoupler. The 230V AC power supply is given to operate the loads. Primarily, we need to register the authorized mobile number with the electricity consumption meter. This, registered mobile number can monitor the meter system. In this energy meter, SIM in the GSM modem sent the message showing the theft detection to KSEB office at the time of tampering. An LCD module is used to display the current difference and alert. The system also shows the power unit consumed and the bill status. If there tampering done on the distribution lines, immediately a message which consists of the details of location is sent to the electricity office.

When the theft is done the GSM sends message to the

service agency phone number with minimal delay in the SMS reception successively an action will be appropriated by the authority.

6. DISCUSSION AND FUTURE SCOPE

The proposed system is cost efficient and scalable. The assembly of the proposed system is on the go and is devised to detect the meter tampering automatically and is easy to interface with other methods of detecting the fraud after advancements. The theft is reported by a real time SMS curb to the power pilferage with less delay in the segment making it effective. It is advisable for the government agencies to integrate a system that can check whether the module is not unmounted or stolen so that the primary intension of this module is not effected.

Many other modifications like usage indication can be added to the system. This would help to control the usage of electricity and thereby save our energy.

Furthermore we can also modify the project in many ways like we can introduce a concept of IOT through which the customer will notified if any unwanted interruptions or threat is sensed in their electric meter which will give a sense of control to the customers. It will also identify the medium and mode through which loss of electricity took place.

7. CONCLUSIONS

Even though there are many methods to detect electricity theft ,they are unable to find the correct location during direct theft. This problem is solved in this system. This system is able to find the correct location with the help of real time GSM technology and fast responsing sensors. This system also gives us a collective idea about each consumer's consumption rate. Our project also helps in bill collection. Thus revenue loss to the system will reduce, the collection of electricity bill has become a huge task these days due to increase in population, this can be made easy by online and sending the generated bill directly to the consumers. By using this method the power thefts will be minimized and there by reduced to the electricity board.

The system has the following features:

1. Simply constructed integrated & logical circuit
2. Easy to assemble
3. Useful in preventing electricity theft
4. Make easy bulky process of the detection of electricity theft.

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