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Electricity and Power Theft Detection

Saurabh Singh¹, Krishna Yadav², Harjeet Matharu³, Prachi Singh⁴, Anvita Birje⁵

B.E Student, Department of Electronics and Communication Engineering, Thakur college of Engineering and Technology, Kandivali, Maharashtra, India¹

B.E Student, Department of Electronics and Communication Engineering, Thakur college of Engineering and Technology, Kandivali, Maharashtra, India²

B.E Student, Department of Electronics and Communication Engineering, Thakur college of Engineering and Technology, Kandivali, Maharashtra, India³

B.E Student, Department of Electronics and Communication Engineering, Thakur college of Engineering and Technology, Kandivali, Maharashtra, India⁴

Assistant Professor, Department of Electronics and Communication Engineering, Thakur college of Engineering and Technology, Kandivali, Maharashtra, India⁵

ABSTRACT: This paper proposes the study the Electricity and Power Theft Detection which aims to detect any theft related to electricity. Electrical energy is very imperative and important for everyday life and acts as a spine for the industry. Electricity is in discipline to our daily life and plays an important role in every possible way and so with increasing need of electricity the corresponding power theft concerning electricity is also increasing. Power theft is a major problem that continues to plague power sector across the whole country. The objective and motive of this project is to design a system in order to avoid the displeasure for the users from theft, bill irrespective of the use of the electricity due to theft. This project deals with theft control system in energy meter. To provide a solution over this, radio frequency is used to send the signal to the electricity board. The measuring of energy meter and monitoring of IR sensor is required and it is done with a AT89s52 microcontroller. The informative system will be very helpful for the electricity board to monitor the entire supply and the correct billing accordingly without any mishap or inconvenience. This model reduces the manual manipulation work and theft control and this leads to precision regarding billing information. In order to integrate the various parts together we must first properly understand the working of the different parts that is to be integrated together. A brief study is alone on the components and the technology which we are going to use in our project and the implementation of this system will save large amount of electricity, and in turn electricity will be available for more number of consumer then earlier which will very beneficial since it increases the availability of electricity by reducing the theft related to electricity.

KEYWORDS: Microcontroller, Transistors, Capacitors, Integrated Circuits, Diodes, Resistors, Transformer, Relay and Liquid Crystal display

I. 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 we can prevent this theft related to electricity then we can save lot of power which will in turn be very beneficial. The normal practice for power theft is to short input output terminals or to place magnet on the wheel in case of old meters. So by sensing current flow through the line and energy feedback we can prevent it using circuit breaker. In this system a micro controller is interfaced with an energy metering circuit current sensing circuit, RF communication and a contactor to make or break power line. In normal condition micro controller reads energy pulses and current signals. If

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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 microcontroller trip the o/p using relay. This information is sent to substation using wireless communication. In section II Literature survey is discussed. Furthermore in section III, IV, V, VI Proposed system and Methodology, Results and Discussions, Future Scope and Conclusions are discussed. At the end References are mentioned.

II. LITERATURE 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 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 meters.

2.1 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.

2.2 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.

2.3 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.

2.4 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.

2.5 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

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current flows out of the meter without going into the circuit that allows the meter to record consumption and this leads to power theft. There is no existing system for automatic power theft detection. There are many modern tools that assist in power theft identification like Tamper proof seals and labels, meter leaders, Tamper resistant screws, Check meter and remote meter readers, Tamper alarms and sensors.

2.6 REMOTE THEFT BY USING GLOBAL POSITIONING SYSTEM

The global positioning system is a satellite based navigation system made up of network of satellite placed in to the orbit. GPS works in any weather conditions and in any part of the world for 24 hours a day.

III. PROPOSED SYSTEM AND METHODOLOGY

3.1 HARDWARE UTILIZATION

The Hardware utilized in this project are Microcontroller, Transistors, Capacitors, Integrated Circuits, Diodes, Resistors, Transformer, Relay and Liquid Crystal display

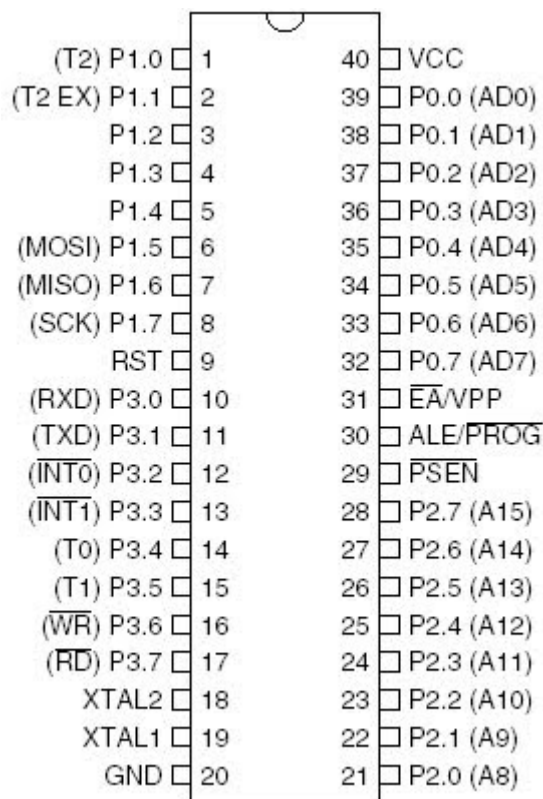


Fig.1: Microcontroller

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Fig.2 Liquid Crystal Display



Fig.3 Crystal

3.2 GAP ANALYSIS

In order to determine which technologies needed to be developed and which technologies are available to be adopted, a gap analysis was conducted. This gap analysis focuses on several desired capabilities of the final product. If a capability can be acquired without conflicting with another capability using a currently available technology, then there is no gap. If there is no such technology, then one must be developed in order to attain the desired set of capabilities. These gaps between available and unavailable technologies must be understood before system development begins in order to determine the feasibility of the project. The Earlier technique to identify Electricity theft detection and identification of power was based on using High voltage Distribution System (HVDS). Here in this system generally the distribution line consists of 230v, but as per the need we will have to step-up the line voltage to 350v by an voltage regulator. Therefore the line consists of 350v now. But when it comes to distribution side, the voltage is again stepped down to 230v ac. If anyone tries to tap or direct hooking from line whenever the voltage is at 350v in distribution side then the electrical apparatus will get damaged due to 350v. But in this technique where with the increase in the voltage of transmission, the insulation required between the conductors and the earthed tower increases. This increases the cost of line support. If voltage of transmission increases then more clearance is required between conductors and ground. Hence higher towers are required. Thus it does not have any provision mode which causes confusion and inconvenience to the user. In our project, Electricity theft can be easily determined by using RF technology between substation end and User end. This makes it a User Friendly process.

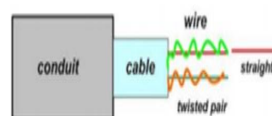


Fig.4: Power Line Cable

3.3 PROBLEM DEFINITION

In this project wireless technology is used to monitor theft in Electricity meter. An electric meter is a device used for measuring the amount of electrical energy supplied to a residential or commercial building. Due to the increasing cost of electricity, the electricity related theft increases and thus tampering and security in electric meters has become a

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major concern for government agencies across the globe. Ineffective and inefficient present methods of detecting and preventing Power and electricity theft cause a revenue loss along with damage to personal and Public property.

3.4 METHODOLOGY

We have designed 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.

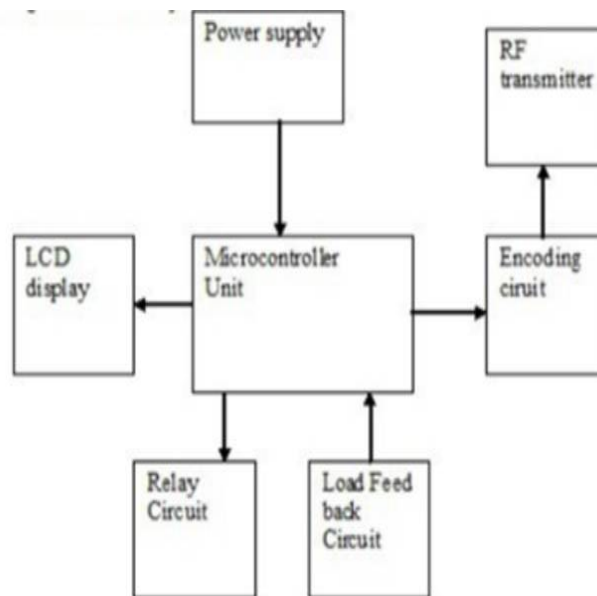


Fig.5: Block Diagram of Installed System

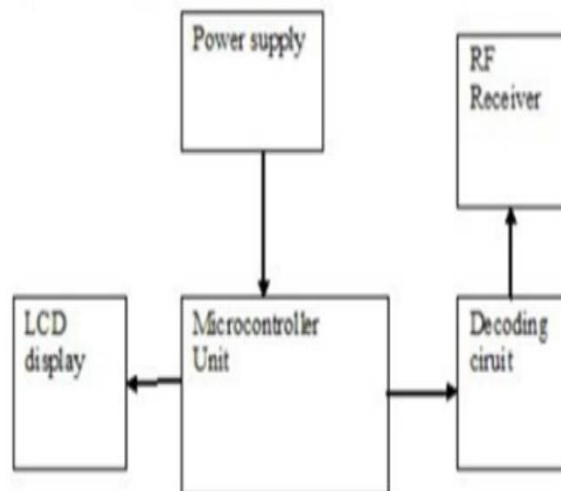


Fig.6: Block Diagram of Remote System

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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. HT12E 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 output 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.

IV. RESULTS AND DISCUSSIONS

4.1 SIGNIFICANCE

The daily reports and complains concerning the theft related to Electricity can be brought under control and also eliminated to a larger extent · in most of the cases the consumers where not know about the theft of electricity in his/her electricity meter so due to this project the consumers will also be benefitted since now they will aware of any mishap or theft in their electricity meter. Also with the help of this project we can reduce the total illegal use of power and hence save electricity for both present and future use. The system only requires a onetime installation cost and then can be used for lifetime without any inconvenience.

4.2 ALGORITHM

The Testing and Troubleshooting algorithm is carried out as follows:

1. Prepare the complete hardware by mounting as per the circuit diagram.
2. The software is prepared for microcontroller (DEPENDING ON MODEL)
3. Required programming is done and after programming the IC was put on PCB.
4. A 5 volt Dc supply from the power supply was connected to the hardware after the soldering of circuit is over
5. Lastly the problem occurred during testing was initiated.

4.3 TESTING AND CALIBRATION

To begin with the test we have to firstly inspect visually the PCB for proper connectivity and then we have to apply power supply to the bare board checking all the Vcc and ground tracks. Next we have to mount the components step by step keeping its size, width, weight etc it to consideration.

4.4 TESTING OF POWERSUPPLY

For power supply we have used regulator IC 7805. It has 3 pins that is input, output and ground. Input range of IC 7805 regulator varies from 7.5 to 35 volt and the maximum current is about 1 ampere. The current more than 1 ampere tends to damage the IC. To check the functioning of the IC we can apply any voltage within range and at the output we must get 5 volt reading. Also vary the input voltage or output current and check the output voltage and if must give a constant 12 volt reading. If both the above mentioned condition is satisfied then we can consider the IC to be good.

4.5 TESTING OF MICROCONTROLLER

In microcontroller testing we will first have to check whether all 40 pins are properly attached with IC or not. After doing so the next step would be to check the crystal circuit connection and reset the circuit. While we test the microcontroller it gets reset because voltage was less. Thus microcontroller was getting hanged. On more capacitor is added of 1000µf. At first we used 100µf, but it was not sufficient and good enough and hence we used 1000µf since it was giving its associated ideal result as we expected.

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4.6 CHECK SYSTEM BEFORE INSTALLATION

Installation of the system is the most important step and extra care must be taken before we install the system. If the system is not in working state then it is not recommended and also worthless to run the application. So before installation of the application, it has to be checked whether the system is working or not. It should be taken care that power does not fluctuate when the system is installed because it can damage the system and hence the fluctuation of power should be eliminated so as to begin with final installation of the system. Lastly we should ensure that the connection is made properly.

4.7 RESULTS

The Final Project was tested and the following were 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 there is a theft of electricity between the Transmitter and Receiver then the person in charge of Substation end will automatically come to know about the theft of electricity in the system.

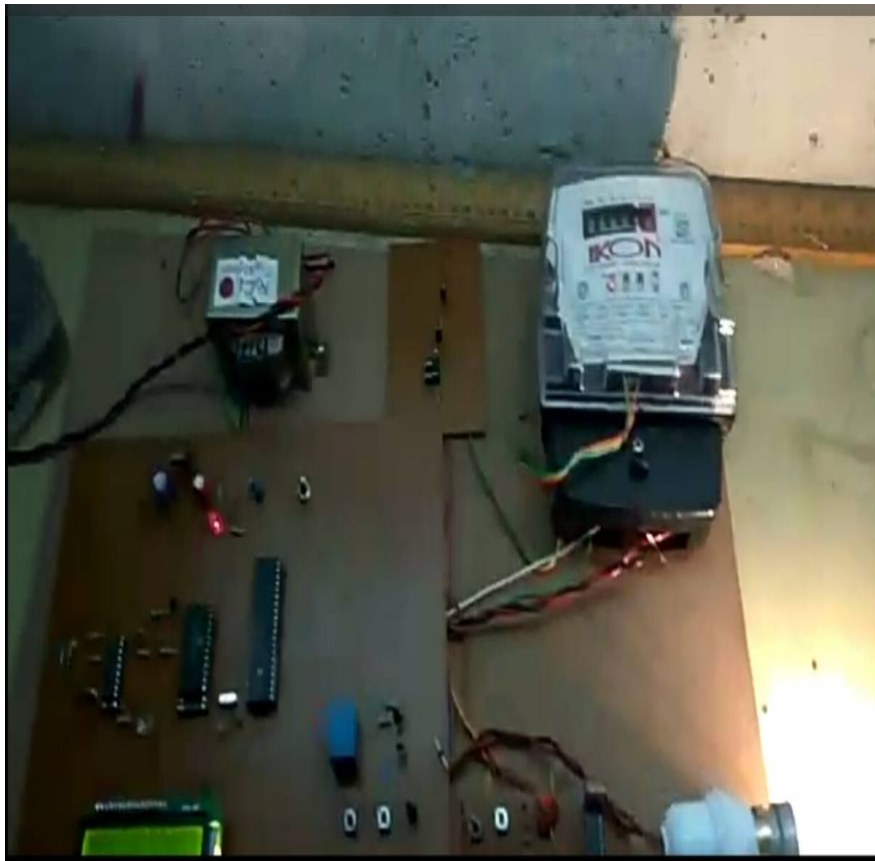


Fig.7: Connection of Entire project

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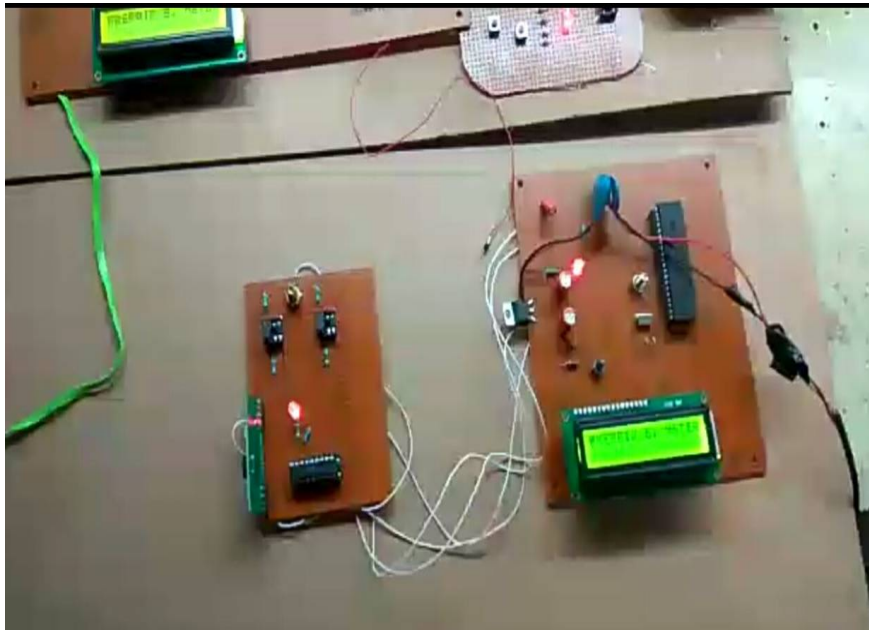


Fig.8: Indication of power theft through Red LED

V. FUTURE SCOPE

It requires only one time installation cost after installation this can be used with ease for lifetime which acts as a great advantage. This project can be implemented in industries and any such places which require a large amount of electricity which will ensure that no wastage or any related theft of electricity takes place. It will completely eliminate the power theft and will increase revenue for the Government and contribute to the betterment of the society. We can make this project more users friendly by introducing a GSM module and also by using other low cost components. 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. Also we can enhance the system in a way such that it will keep the track of the time about when the theft of electricity took place and will also indicate the about of electricity that was lost due to theft. It will also identify the medium and mode through which loss of electricity took place.

VI. CONCLUSION

There have been may electricity related theft and in this way we will bring it under control and also design the microcontroller based power theft identifier. The major motive of designing such system is that it will eventually and ultimately reduce the illegal used of electricity and will save lot of money because it directly affects the economy of nation as well as the consumer who suffers a lot of loss due to power theft. Thus this system will be beneficial to consumer as well as for government. The best thing about this project is that it will require only one time installation cost and can be used in future with ease without any future investments. Thus this project will be a great advantage and relief to all the consumers and the entire nation as a whole.



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