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# Energy Theft Detection System

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**ABSTRACT:** Electricity is most essential part of our lives. Most of electronic gadgets can't work without electricity. Peoples try to use electricity illegally to save their bills Electricity board of India has recorded around 27% and commercial losses, and it is found that the most common reason for this loss is energy theft. Energy theft is major problem across world. In India most cases of energy theft are founded in rural areas or undeveloped areas. To overcome this problem, it is necessary to detect faults in electricity meter and some suspicious activity with meter. So here, most important factor is to detect location of energy theft and find amount of energy they used illegally. Proposed system helps to overcome this problem. The system is consisted of two sections. One section focus on meter activity and another section is focus on communication between MSCB and owner of meter. If system senses any suspicious activity in meter, it will cut electricity of home and message of penalty will be send to user. And if fault in meter is detected then message of fault in meter will be send to user.

**KEYWORDS:** Meter, Current Transformer, GSM, fault, Load, distribution panel.

## I. INTRODUCTION

During generations, transmissions, and distributions it create many losses. Losses created during generation can be defined but losses which are crated during transmission and distribution are difficult to detect. Transmission & Distribution losses are calculated with the total load and the total energy bill. While technology is advancing, we should also be mindful of the increasing number of immoral activities. In most of places it is found that peoples try to use electricity illegally. Electricity theft is a social evil, and therefore must be stopped completely. Sometimes people illegally tap power lines to divert the power to the required destinations. There are many places where manual meter reading is done, and the meter reader is bribed to give false readings in order to lower the amount paid than the amount of power consumed.

To use the generated power as efficiently as possible, the energy consumption and losses must be closely monitored. Proposed system helps society to avoid illegal used of electricity using smart circuit and GSM module. In India, many peoples used electricity illegally to save electricity bill. This makes more wastage of electricity. Villagers are using electricity illegally in villages because of carelessness on the part of the MSCB. Farmers are also using electricity illegally beyond the permissible limits declared by government. Because of this, more power is wasted, and we have shortage of energy or even conditions such as load shading. Also, people can easily steal electricity from other homes and even from distribution centers. Therefore, we need smart meters that will eliminate these problems. It is observed that people often do not pay their monthly electricity bill, so there is a need for system that prevents illegal power use, sends messages about the monthly bill regularly, and detects where energy is stolen.

The main objective of this system is to prevent illegal use of electricity. It is also expected to resolve the problem of energy and safety. By controlling current from the distribution center to the energy meters of the users, this system will prevent wastage of electricity (energy). The system is divided into two sections, first is calculation and second is communication. In calculation section, measurement of current from distribution pole to home will be done and condition of energy theft and fault in energy meter will be check. And in communication section message to user and MSCB will be send using GSM module if there is theft of electricity or fault in meter is detected. After receiving message, user must pay penalty for illegal used of electricity. Important feature of system is, if energy theft or fault in meter is detect then electricity of that home will be cut. So, it will be helpful to avoid misuse of electricity and save energy.

## II. LITERATURE SURVEY

Somefun T.E.et al [17] has developed a system that is smart prepaid energy metering system using GSM to send message whenever energy theft is detected which system also provides facility of real time monitoring, so system will successfully detects and stops energy theft.



Neha Noren Parshad et al [14] has made a system of smart farm which is Wi-Fi enable which provides energy theft control along with monitoring of a farm , so whenever energy theft takes place buzzer will be beeped at that area and in smart farming the energy is produced by solar panel which will be helps in smart agriculture.

Weixian Li et al [15] has offered an system for energy theft detection which uses IOT for making smart home. This system detects the energy theft in area also informs that consumer. Generally, the system makes analysis of data of consumed energy to detect theft in particular area.

R. E. Ogu and G. A. Chukwudebe [10] has made a system for detecting a theft and controlling it which is cost effective system Proposed system is developed using IOT where user and authorised person can visualize the data on thingspeak app Muhammad Faraz Tariq, Amna Nawaz, Muhammad Yasir Jamal[2] has developed the system which will ring an alarm as the energy theft gets detected which makes use of relay so the system will automatically switch off the electricity of that particular user and hence energy theft can be stopped.

Srujana Uddanti<sup>1</sup>, Christeena Joseph<sup>2</sup>,P.C.Kishoreraja<sup>3</sup> et al [11] has offered a system which sends the energy consumption data to the cloud and also displays the same data on the LCD panel. Also, the EB person don't have to cut the power supply manually by visiting that place of energy theft , they can cut power supply from web page.

Nilesh Mohite et al[9] has developed energy theft detection system , after detecting the power theft message will be sent to board and the authorised person cuts off the energy of that location automatically. This system insures the reliability and the accuracy.

G. L. Prashanthi, K. V. Prasad et al [6] designed power meter monitoring which is wireless system also with power the detection they used ZigBee networks and GSM to send message of energy theft to the board or authorised person. System also keeps track of the data of amount of power consumed by the user .

Tanvira Ismail et al [5] made the system where the message will be sent automatically to the electricity management and board after detecting power theft using GSM technology and same system will keep track of the data consumed by user on timely basis.

Vinu V Das et al [1] when the user has not paid the bill in the specified time, the wireless meter reading system automatically disconnects the load.

Abhinandan Jain, Dilip Kumar, Jyoti Kedia et al [3] energy meter system sends SMS to specific meter corresponding to their demand , this SMS is received by microcontroller through GSM modem.

Nabil Mohammad, Anomadarshi Barua and Muhammad Abdullah Arafat et al [4] for sending and receiving messages we are using GSM modem hardware is designed using LPC2148 microcontroller.

S. Anusha, M. Madhavi and R. Hemalatha et al [7] IR sensor is placed at a position of a screw if this screw is placed from its position then a message is sent to the user, energy theft is controlled by this sensor.

Srujana Uddanti<sup>1</sup>, Christeena Joseph<sup>2</sup>,P.C.Kishoreraja<sup>3</sup> et al [8] when the key will be pressed by the keypad it will be sent to the remote locations where the key will be decoded and the amount will be credited to the user's account.

R Kalavani, M Gowthami, M. Savitha and N Karthick et al [12] message will be sent as soon as the tampering happens and with it further details will also be provided.

Amar Pawade, Nadeem Shaikh, Bhushan Chowdhuri and Ansari Shariq et al [13] all the details like time,voltage, energy, price and service is provided on a virtual display.

V.Somasekhar and R. Puviarasi et al [16] if opened for illegal activities an ultrasound sensor finds about it from this the microncontroller gets a message and further a SMS is sent to the user about the tampering of the energy.

Mr.P.Leninpugalhanthi , Nidheesh.s, Mamtha R.V , Keerthana .I, MrR.Senthil Kumar et al [18] sends an email to the authorized person if found any faults in the energy meter.

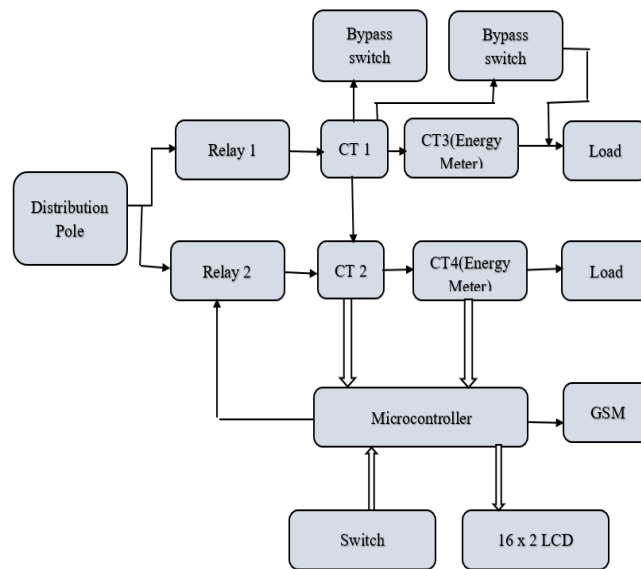
Dhanashree Patil et al [19] whenever any theft detection is encountered it is detected by the hall sensors which notify the microcontroller which then communicates with IoT.

### III. METHODOLOGY

The paper proposed system which will be helpful for electricity board to find out illegal use of electricity. The proposed system is divided into three sections. One is for regular billing, second is for checking electricity fault and third is for checking fault in energy meter. System will send a message of regular bill after taking five reading. And if system detect illegal used of electricity at user side by tapping main wire or bypassing in energy meter, it will consider all this situation as a theft and electricity of that home will be cut and owner of that home will have to pay penalty to electricity board.

System will also check fault of meter at user side, if it senses fault in meter, and electricity of home will be cut. It will send message to user and MSCB office. After receiving message, MSCB officer will come to repair meter.

A block diagram of the system is shown in the following figure.



**Fig 1:**System block diagram

Current Transformer is the main part of the block diagram. It also contains different blocks such as microcontroller (PIC 16F877A) which takes all decision regarding to controlling and monitoring. Next block is LCD interfacing with controller. Next block is DP (Distribution Panel) which consists of two relays through which every house connected to another current transformer in energy meter. Function of blocks of system is as follows:

1. **Current Transformer (CT) :** Transformers used for measuring alternating current are known as current transformers. In its secondary, it produces a current that is proportional to the current in its primary. It is used for measurement and protection purposes. CT used for the measurement of AC current by taking the samples of higher currents of the system. In this system CT is used for measuring current at distribution and user side, i.e. in energy meter of home.
2. **Microcontroller (PIC16F877A) :** This is one of the most renowned microcontrollers in the industry. In addition to being very convenient to use, this controller is also very easy to program. It is used for controlling operation and communication between system and user.
3. **GSM:** SIM 800A GSM module is used for communication purposed. It is connected to microcontroller. By using GSM, message of different conditions will be share with MSCB and owner of meter.
4. **Relay :** SPDT relay is used for switching purposed. It is connected with microcontroller and CT. When microcontroller send pulse to relay, it will be activated and switching will be done.
5. **Switch:** Here switch is used for checking conditions of energy theft and fault in meter. Here we are using three switches for showing different conditions. When user press particular switch, condition associated with that switch will be occur.
6. **Load:** In this system we are using electric light (bulbs) as a load.
7. **LCD Display:** LCD display is used for indication purpose only. It shows reading and average current of distribution pole and energy meter for five readings.





Following figure shows flowchart of system. Here CT1 is connected at home side and CT2 is connected to distribution pole. All conditions are check based on average current of user side CT and distribution side CT. Here we took reading for five times.

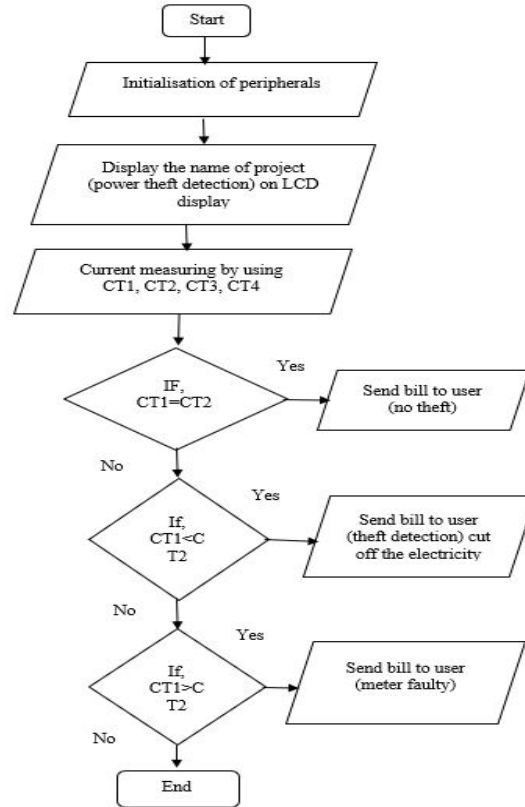


Fig 2: Flowchart of system

#### IV. RESULT GENERATION

In this system we designed model of two home. Here one home is considered as an ideal home, where no theft of electricity or fault in meter will occur. And in second home, conditions of theft occurring, or faulty meter will be check. There are three section to the proposed hardware. Main circuit, Communication section and Transmission section.

1. **Main circuit:** it is most important part of system. It consists of controllers, power supply, relays. Main circuit is connected with distribution side and home side CT. communication section is connected with microcontroller for sending message. Current coming from distribution side and home side will be calculated in main circuit and all decision will be taken by controller. Following figure shows PCB layout of main circuit.

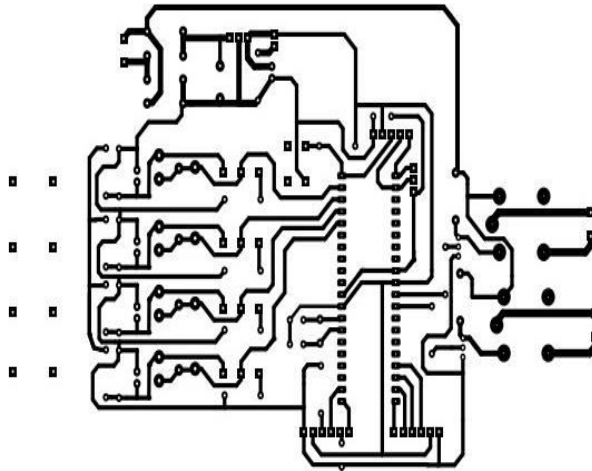


Fig 3: PCB layout of main circuit

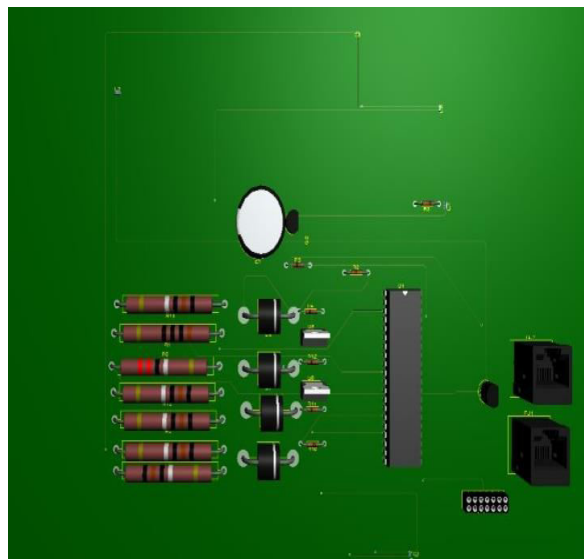


Fig 4: 3D PCB layout of main circuit

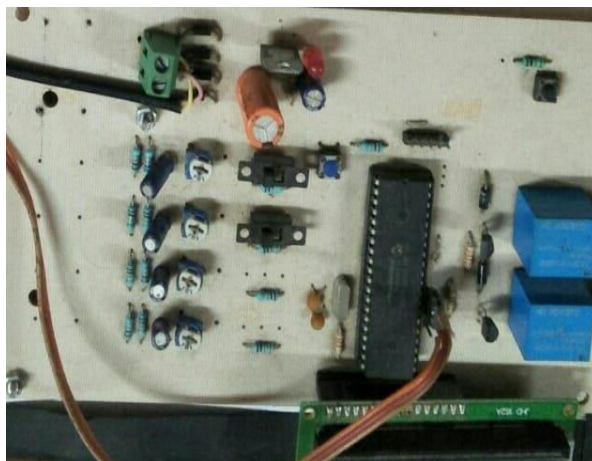


Fig 5: Actual main circuit



2. **Transmission section:** Transmission section is consisted of four current transformers. Two current transformers are connected at distribution pole(DP) of area and other two transformers are placed with energy meter of home. The function of transmission section is to continuously calculate current transmitted by distribution pole and current receive at home side. If any variation is detected, it will give to controller. And controller will check conditions of theft and fault in meter. Here we considering if current of distribution side is more that current at home side, it will be considered as a theft of electricity. Next condition is, if current at home side is more than distribution side, then it will be considered as fault in energy meter. And if current at both sides are equal then no theft or fault in meter occurred.

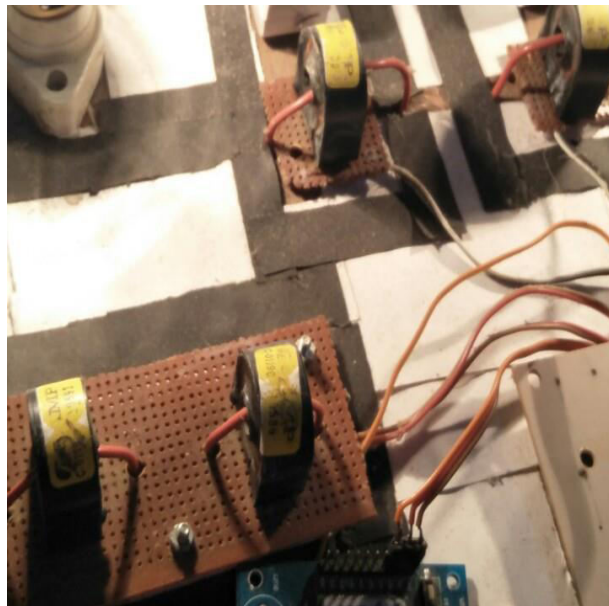


Fig 5: Transmission Section

3. **Communication section:** communication section is consisted of GSM module. GSM is connected with controller. After receiving signal from controller, message will be sent to users. Following figure shows communication circuit.

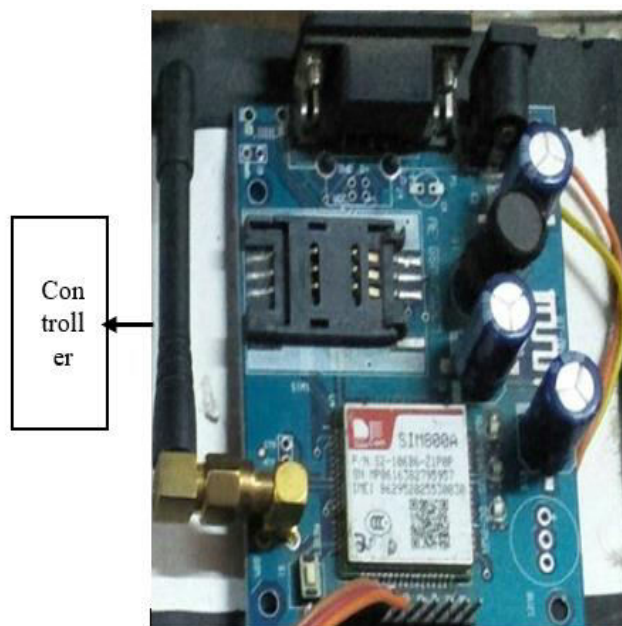


Fig 6: Communication Section



Using GSM, regular bill of electricity will be share with users. In this system, we are calculating bill for five readings. After five reading, message will be sent to user. And when theft at user side is detect, a message of theft detect with penalty will be share. And when fault in meter is detect, message of fault in meter will be send to user. Following diagram shows sample of message share with user for billing.

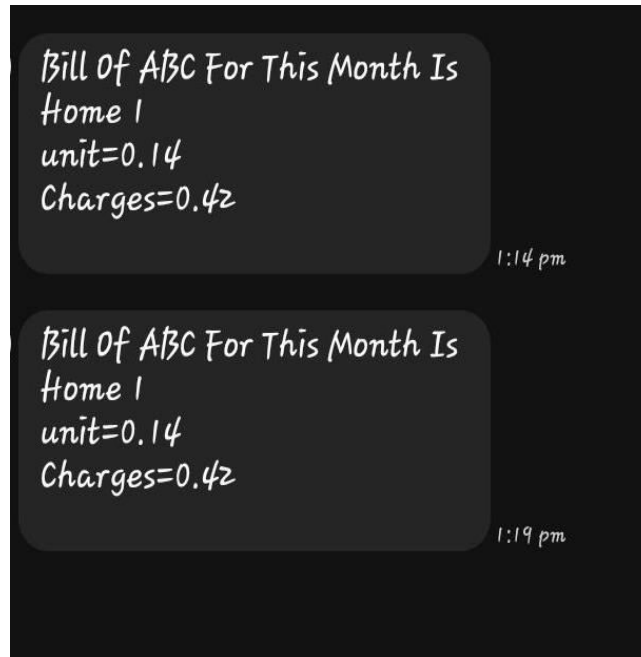
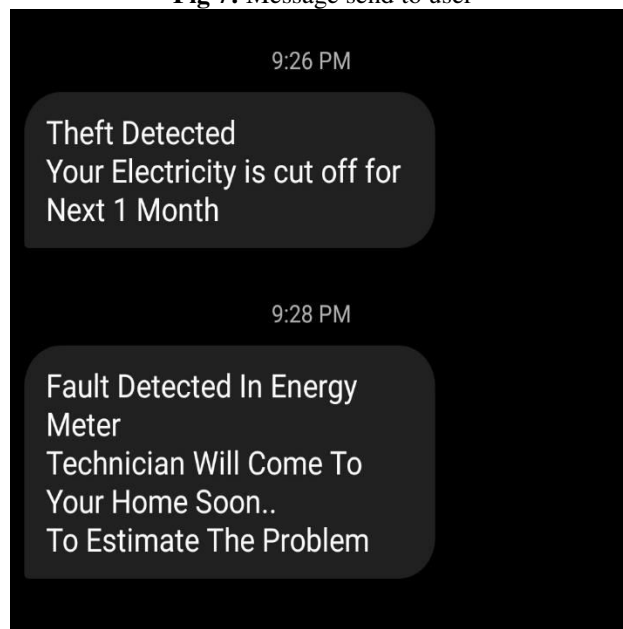


Fig 7: Message send to user



Power consumption





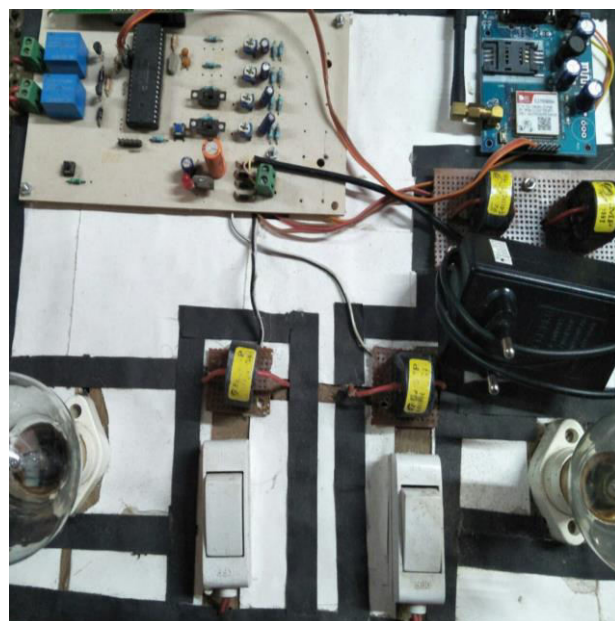
The proposed system is designed in such a manner that, it will be more efficient. Power consumption of different components are as follows.

Sr. no.	Components	Voltage	Current	Power
1.	Microcontroller	5V	8mA	40mW
2.	Relay (on)	3.5V	63mA	221mW
3.	Other components	5V	7mA	35mW
4.	GSM	3.2-4.5	400mA	2W
5.	Electric bulb	220	0.45A	100W

**Table 1:** Power consumption

### V. ANALYSIS

Energy theft detection system is helpful to electricity board to find out locations where peoples are illegally using electricity. Proposed system automatically calculates current consumption by users’ side, so there is no need to taking manual reading of bill. So it also saving time of electricity board. After ending of allotted time, bill will be directly sent to user. Many times happen that there is fault in energy meter, due to these variations in readings occur. Sometimes user have to pay additional bill due to fault in meter. So to avoid this, proposed system will also check fault in meter. If fault in meter is detect, then electricity of that home will cut and message of fault in meter will be share with user and MSCB office. The main objective of system to finding illegal used of electricity. If current at distribution side is more than current at home side, then it will be considered as theft. After detecting theft, message of penalty will be sent to user and electricity of that home will be cut until user pay penalty. Following figure shows actual circuit of energy theft system.



**Fig 8:** Actual System



## VI. COMPARISON BASED ON SELECTED PARAMETER

In our system we have focused on finding electricity theft and fault in meter. Our study finds out way to detect theft and find whether meter is faulty or not. We include all features in system in order to make system more helpful for electricity board, i.e. MSCB. The systems developed earlier like this, they were detecting theft of electricity and after that message is shared to user. But in proposed system we added one more feature that, it will also find whether meter is faulty or not. If fault in meter is detect, it will share message to user and MSCB and immediately electricity of that home will be cut.

## VII. CONCLUSION

This paper is majorly focused on finding locations where peoples are trying to use electricity illegally. According to study, it is found that in India, peoples live in villages uses electricity illegally by tapping main power line. Sometime due to fault in electricity meter, it shows wrong reading. Thus, it leads generation of wrong electricity wrong bill and users must pay additional charges. Due to this all problems, it leads wastage of electricity. Transmission losses are most important aspect in electricity generation and transmission. It also leads more wastage of electricity. So, there is need of system who closely monitor variation in power and senses illegal used of power. The proposed system is helpful to avoid illegal used of electricity. As we know, sometimes due to faulty meter users have to pay for wrong electricity bill. The energy theft detection system is also helpful to avoid this problem. If system detect fault in energy meter, it sends message to user and MSCB about fault in meter and cut electricity of home until meter get repair.

## VIII. FUTURE SCOPES

This article presents a prototype of a system which focuses on one of society's major problems: illegal used of electricity. It shows various modules additionally with hardware components. Enhanced functionality can be added to a product as new technology or user requirements emerge. The system is effective and productive, but there is always room for improvement. There could be an improvement in that by finding active numbers around power lines we can found real theft who use electricity illegally. By designing android app , user will directly see how much electricity they user per day. By using app , it will be easier to pay electricity bill.

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