A Solution Regarding Extra-legal or Un-Metered Utilization of Electricity (Power Theft) For MSEB.

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***Abstract*- Power theft is one of the big problems for electricity distribution system. Power theft, at low voltage distribution finish could be a regarding issue because the distribution firms lose billions of revenues annually. With the appearance of good grid technologies, good meters with info Communication Technology (ICT) will offer an answer for detection and alerting the ability stealing. This paper presents the application of internet of Things (IoT) in power stealing detection and good meter observance. The conferred system is capable of detection power stealing because of meter bypass, meter change of state and direct line golf shot. The IoT based smart energy meter is based on Arduino. In this system we reduce the human participation in electrical energy maintenance. The theft of the electricity increases the costs paid by customer. Hence this system is used for the detection of theft. The Arduino checks the main meter and sub meter reading. If the difference between the main meter and sub meter is occurred then that theft has occurred message will be sent to register mobile number.**

Keywords: **Electricity Theft, Arduino, GSM, CT, MSEB (Maharashtra State Electricity Board).**

1. INTRODUCTION:

Now a days energy emergency is the major difficulties that the world faces. Power theft is one among the necessary problems that has got to be taken care within the distribution network. The best therapy for this is not the increases of energy production, but the actual use of available energy. It will be self-addressed because the distinction in power, between the generation and metered consumption. This power loss is assessed into technical losses and non-technical losses. Majority of the ability loss area unit unethical losses and area unit because of power stealing. Power stealing will be outlined because the extra legal or un-metered utilization of electricity from distribution utilities.

Energy theft can be in the form of deception such as meter tampering, illegal connections (bypassing meter connections), physical destruction of energy meters, stop the rotated disk of energy meters and fake billing. Energy theft cases are occurred in the most regions of the world. Approximately 102 countries faced the electricity theft concern due to poor infrastructure, political uncertainty, highly level corruption, low level government efficiency, appointments of non-technical staff, and deficiency of accountability, law and order situations. Figure 1 summarized the country's economy losses due to theft. There are two types of losses TL (technical losses) and NTL (non-technical losses) during the transmission of electricity. These are major issues in under developing countries and it has been very difficult task for electricity supply companies to hunt the individuals answerable for electricity stealing. The major electricity theft is occurred in NTL (non-technical losses) area of power sector. NTL are more difficult to measure because these losses are frequently occurred and electric power companies have no any recorded information to control the losses. These losses disturb the supply of electricity, rise power load on grid station and escalation bill imposed on customers. NTL include electricity theft, meter tampering, bill errors, un-meter connection, un-estimated consumer's accounts, false reading by meter readers, and slow the meter reading disk, ignore unpaid customers and metering errors. NTL are usually done by human being who is unaccountable for power companies. TL (Technical losses) are natural losses occurred regularly in power sector and these losses are produced by physical structural properties of power system. TL mainly consist with transmission line, transformers, substation and electrical network losses. TL losses are occurred due to lengthy single-phase lines, improper cable earthling at remote sides, poor power loading, and power over loading on transmission lines, poor quality cable and equipment.

• Commercial Losses are basically due to illegal consumption of electrical Energy, that is not correctly metered, billed and revenue collected.

• Commercial losses are caused by non-technical or commercial factors namely pilferage, theft, defective meters, error in meter reading, estimating unmetered supply of energy etc.

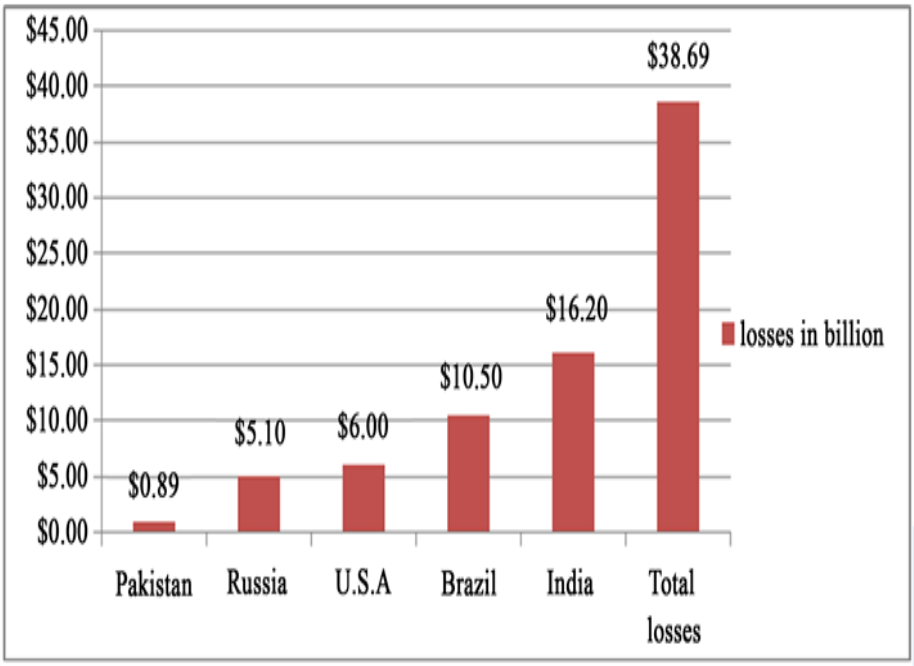


Figure 1.1 World economies losses billions of dollars per year by electricity theft.

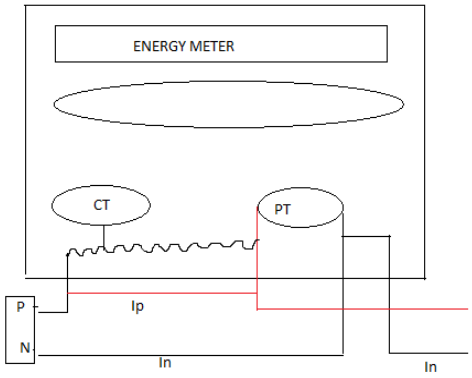
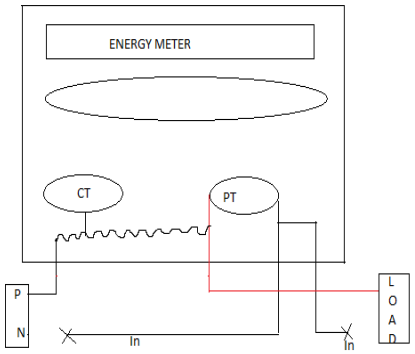
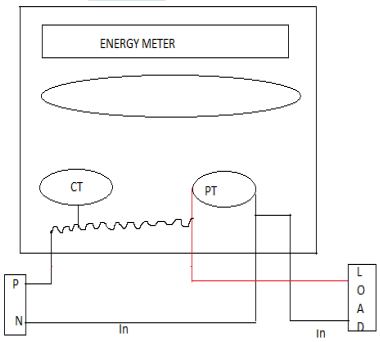
Shorting The Phase Line (Bypassing)	Disconnection the neutral line	Tampering using magnet
		
When a consumer shorts the current coil of the meter the total current flows through the shorted path, so the meter cannot detect the current flow through it. Electrical power is given by the equation $P = VI$ where; P: stands for power absorbed or delivered, I: for current through the device, V: for voltage across the device. So, if the current coil of the meter is shorted here I=0 ultimately leading to P=0.	A more common method of tampering analog meter is disconnecting the neutral line. In this condition, the meter cannot detect any voltage difference across the supply line and neutral line. As V=0 here, power will be zero by according to P=VI formula. So, no energy consumption will be shown by the meter.	We know that aluminium disk is revolving by the magnetic flux produced inside the device due to current flow. If a magnet is kept in the path of this flux, the magnet interferes with the flow of flux. So, the produced flux cannot help the aluminium disk rotate. In this case, the disk is stopped or revolves slower producing a smaller number of revolutions than that it should give. Therefore, accurate energy consumption is not shown in the meter.

Figure 1.2 Methods of stealing electricity.

DHBVN FACT SHEET

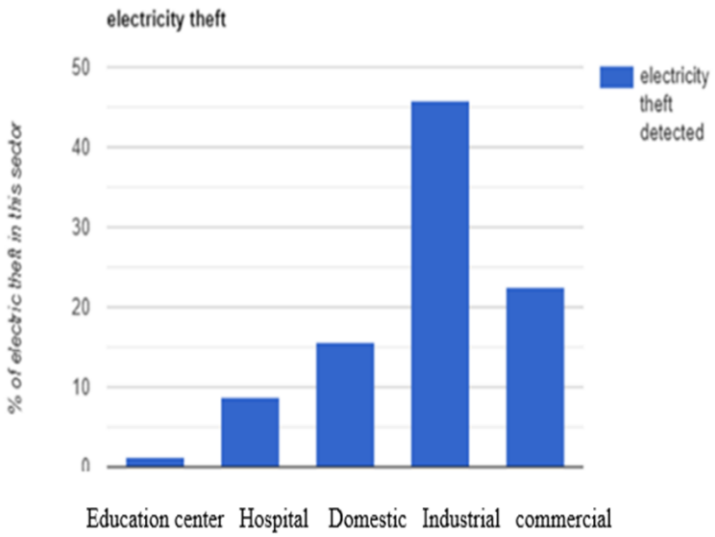
Year	Theft cases	Penalty imposed	Fine collected
2022-23*	13,242	₹51.21 cr	₹31.22 cr
2021-22	45,470	₹156.65 cr	₹78.70 cr
2020-21	48,791	₹163.66 cr	₹85.83 cr
2019-20	26,369	₹82.29 cr	₹54.04 cr
2018-19	19,868	₹86.24 cr	₹45.11 cr
2017-18	56,127	₹166.74 cr	₹86.40 cr

(*Till August 2022)

THE TIMES OF INDIA

MUMBAI: MSEDCL managing director Vijay Singhal on Wednesday announced setting up of ten more special squads for power theft detection across the state. He informed the media that in just three months, from April to June, MSEDCL squads had detected a huge number of power thefts to the tune of Rs 131 crore.

Statistics made available to the media on Wednesday showed that in 2019-20, 9250 cases of power theft worth Rs 98 crore were detected. In comparison, in 2020-21, 7169 cases and Rs 87 crore worth power theft were detected and in 2021-22, 13,370 cases were detected for electricity pilferage worth Rs 264 crore.



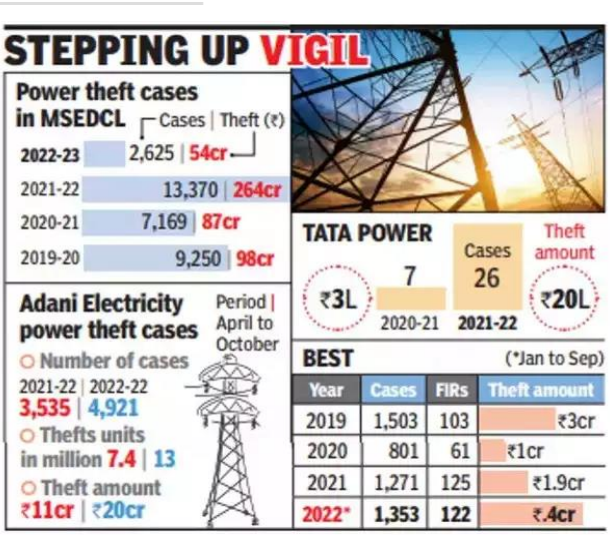


Figure1.3 Cases of electricity stealing

❖ **Need:**

- Commercial losses are too high in the distribution System
- Efficiency of distribution system reduces
- Losses are directly related to amount of energy generated
- This causes more Co2 Emissions and effects on environment.
- Benefit to consumers because honest consumers do not pay for dishonest consumers.

2. METHODOLOGY:

2.1 COMPONENTS:

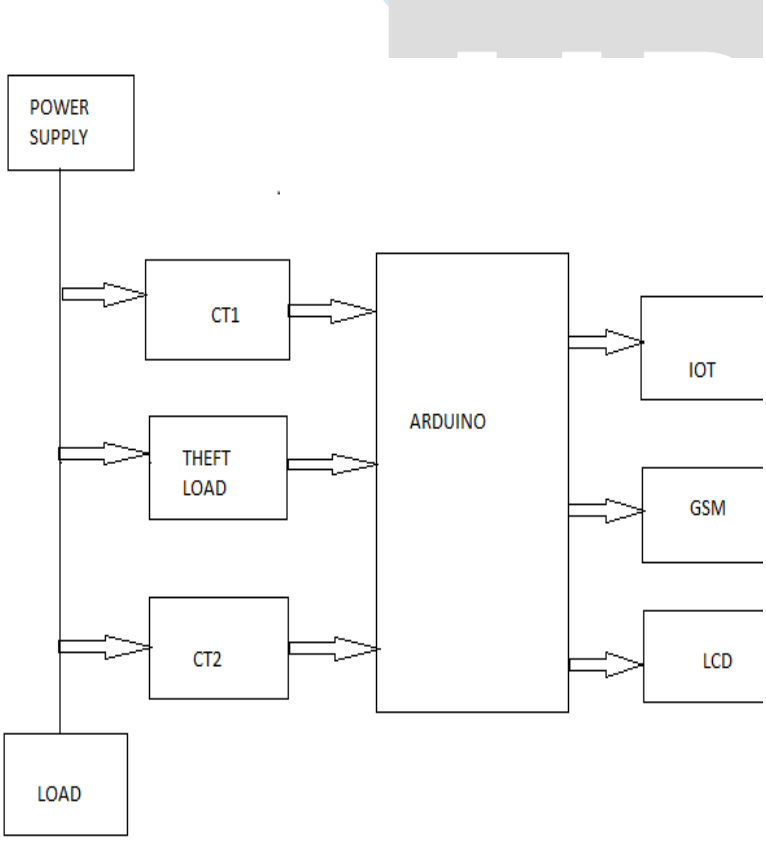
➢ **HARDWARE COMPONENTS:**

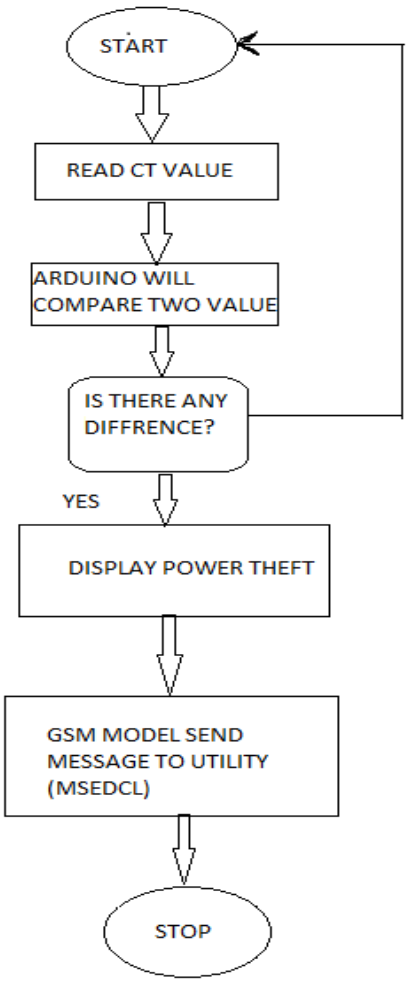
1) Energy Meter
2) Resistors and Capacitors
3) Current sensor
4) Transistors and Diodes
5) GSM Module
6) Cables and Connectors
7) Atmega Microcontroller
8) PCB and Breadboards
9) WIFI Module
10) LED
11) LCD Display
12) Transformer/Adapter
13) Push Buttons, Switch
14) IC and IC Sockets

➢ **SOFTWARE REQUIREMENT:**

• ARDUINO IDE
• Embedded C

2.2 PROPOSED SYSTEM:





3. WORKING:

The circuit consists of Arduino, GSM, LCD, ESP module and Current transformers. Meters cannot be used for high currents so current sensing is done by current transformers. Two CTs are used, one is connected at load side to measure the current through load and other C.T is connected at supply terminals to measure the current supplied by source.

The main component in this circuit is Arduino controller. It receives current signal from two current transformers by the means of bridge rectifier. Then it compares those two current magnitudes by the conditional operator. Since there is no theft load, the two C.T.s shows almost the same values. Here the system is in healthy condition. The Arduino cannot access current signal. So, we have to interface the C.T. by means of voltage only. Here we have to convert the current signal into voltage signal. It can be converted by placing a resistor in series and taking voltage across the resistor and passing that voltage signal to Arduino. Resistor is used because the secondary of current transformer should never be open circuited. The corresponding current can be obtained by doing calibration. Calibration can be done by connecting various loads and measuring different voltages and currents respectively we can also convert current signal to voltage signal by using a rectifier. As the rectifier converts AC signal to DC signal, the output across the resistor connected in the rectifier circuit can be taken as the voltage signal. The secondary of the C.T is connected to the input of bridge rectifier. Capacitor is used to reduce the ripple content in the output. A resistor is connected at the output side to measure the voltage across it. This voltage signal is given to the Arduino and the corresponding current can be calculated by the calibration. Thus, the current signal from the C.T converted to the voltage signal for the purpose of access to the Arduino controller. The same above procedure is also repeated for the C.T. connected at the load side. Program is written for accessing the voltage signals from the rectifier circuits. Condition is specified in the program for comparing the voltage magnitudes. If the variation is more than the specified value, that means the condition is violated. Then the control moves to the alert functions namely SMS.

If any tapping is done, i.e., power theft is happened, then two current transformers show different values. The source current is more than the actual load current. If there is any deviation more than the specified value then controller sends the signal to LCD, GSM and Internet of things. The GSM is used for sending text message to the substation members by placing their mobile number in the code. IoT is used for sending tweet to the officials through internet. LCD is used for the purpose of display. It shows the status of the load current and 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. The Esp module allows an Arduino board to connect to the internet, so that the people in the substation can know the information about the power theft through internet and allowing them to take appropriate action against the offenders.

4. ADVANTAGE:

- To Maintain Continuity of provide Real time observance.
- It will able to find meter tempering or bypass meter
- Prevent any external energy theft
- Online monitoring due to IOT
- SMS notification
- Accuracy in meter reading and improved security.
- Helps in successfully controlling energy use.
- Identified the theft status.

5. DISADVANTAGE:

- Require internet connectivity
- Some error may occur.

6. APPLICATION:

- Used in distribution system.
- Used for theft detection.

7. CONCLUSION:

The design, simulation and construction of a GSM-based power theft have been achieved. It has covered various forms of electricity theft which include unaccountability of servicemen, irregularities of billing leading to a reduction of funds by the utility companies has also been achieved as this work prevents one on one contact between the end

user and the workers. With remote monitoring of the meter reading and sending SMS, whenever there are abnormal readings, in the customer electricity meter, the developed system may able to help Utilities to reduce the incidences of household electricity theft.

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