

Smart Alternative Metering Strategy for Minimizing Electricity Thefts and Meter Tampering

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Abstract

Electricity theft is the Short of User's Consumption from the Power Supplied in the Distribution System. The current system has technical losses and Non-Technical losses in Electric types of equipment and Circuits. Using the data from the Power Corporation of Uttar Pradesh (India's Most Populous state), Electricity Theft is Gradually increasing in these 10 years(2000-2009). There are many possible ways in which people are exploiting electricity, Though the Government is using a different approach to eradicate electricity theft, common civilians coming up with a new strategy to steal. Those Information will be discussed in this paper, which we have gathered by Empathizing with People and Electricians. The Electric Board is facing different types of hardship due to the thefts. This Paper Discusses the types of thefts, Losses, and possible solutions to overcome the thefts with a Smart Metering Method.

Keywords: Electricity thefts, Technical and Non-Technical Losses, Empathize, Smart Metering

I. INTRODUCTION

With our current technology or Strategy which is in usage for metering, the Usage of Electricity has no feature to detect the Thefts of Electricity in the User End. Also, in the Transmission and Distribution circuits, the technical loss can only be predicted, when the Non-Technical losses like Exploitation of Electricity play a role in this effect of the revenue of power utilities which is mainly depending on the losses at the distribution end. Electricity Theft is a Huge factor in Non- Technical Losses. Generation stations and Transmission lines were working hard to attain and Maintain the Production volume to the Required volume in the User End. In Some ends, Metered data and the Usage of electricity contradicts so the lack of data makes it harder for the analysts and Workers to meet the requirement of electricity. Production, Transmission, and Distribution Expense is calculated and the Tariff cost is Decided, Using the Bill paid by the Users, the Expense in Compensated, due to the Non-Technical Losses like exploitation, Investments in the Electricity Sector Increases. So, we came up with a Metering strategy to Minimize the thefts. The Device and the Strategy will be discussed below in this Paper.

A. Objectives

- 1) To Introduce a Strategy to avoid Electricity thefts.
- 2) To Avoid people from Tampering the Meter.
- 3) To Develop a Cost-Effective meter that could relay the Information to the Electric Board or Billing Station.
- 4) To Provide Exact Data of Consumption Volume, and to Meet it with the Production volume.

II. METHODOLOGY

The Usual Methodology carried by the Research Persons is Reading Related Research articles, reading Books, referring to Journals, and Browsing the Internet, but in our case, the types of electricity thefts, a mindset of people who steals electricity though it is Punishable, and other can only be Known by Emphasize. Direct communication with the people and the Electricians will give us huge data for further researches and Discussions.

III. PROBLEM STATEMENT

A. Lack of Consumption data.

The Equilibrium point between Production and Demand(Consumption) has to be maintained, for that maintenance separate operator(TSO) will be appointed in the Distribution centers that will monitor 24x7. In case of thefts the exact demand cannot be known, if the distribution center feeds the Electricity just based on the bills, the equilibrium point cannot be attained because the Electricity consumed by theft wasn't in the bill. This event may lead to 'Black-out' since the demand is higher than the fed current due to lacking electricity consumption data. Currently, Regulating(increasing and Decreasing) production rate is used to avoid black-outs.

B. Excessive expense in Production and Transmission.

Billing and tariff are imposed based on the investment made in the production, Transmission, Distribution, maintenance. In case of thefts, the proper money will not be returned

C. Non-Technical Loss

Usually, Technical losses can be identified and eradicated using a common research approach but the losses which come due to the thefts cannot be identified and the eradication cannot be done on the feeder's side, Hence It can be termed as Non-Technical loss.

IV. ELECTRICITY METERING AND TAMPERING

An energy meter measures the amount of electrical energy supplied to a residential or commercial building. The common unit of measurement made by a meter is the kilowatt-hour, which is equal to the amount of energy used by a load of one kilowatt in one hour.

A. Classical Metering method and Thefts.

Classical meters in other words Electromechanical Meter. An Analog Based Meter, which has a DC Motor Based on the Usage of Electricity the revolution will be carried by a Metal Disc which gears the Counter using that the Unit will be Measured. The Magnetizing influence over the Disk allows it to revolve but it's one of the Drawbacks which lets the people steal the Electricity. By placing the entire meter Upside down, The Magnet will hold the disc from revolving, resulting in the Counter to Stop. That's how the tampering of the Electro-mechanical energy meter will help in Exploiting Electricity.

B. Modern Metering Method and Thefts.

To overcome many drawbacks of the Electro-Mechanical Energy Meter and also for increasing the Accuracy of the Measurement in this decade Electronic Meters was introduced which manufactured without DC Motors but with the CT(Current Transformer). The current Transformer is the most commonly used Sensor. Current Transformer can Measure up to very high current and consumes very low power. Above all, they believed that this meter can not be Tampered with and Exploited, but people found different Tampering methods. The Liver Switch will be turned off, by then the meter will detect no usage of Electricity Using a Two More Conductive Wires the line will be taken from the instance of line connected to the Meter which is Apart from the Meter, then the two conductive wires will be connected to the Residential supply while the Liver is left turned off. This will let the users use the Electricity effectively without paying for the usage. Though this activity will come under Punishable, Most Common People prefer to Exploit Electricity which may help them Financially.

V. THEFT CONTROLLING METHOD

There's Lot of advances were introduced in the Energy Meters but still, there are some technical things which have to be ratified to Avoid Tampering and Exploitation. In our System, the Energy Meter will be Displaced from the typical Position to Avoid Tampering. Our system will be Installed out from the Resident and on the top of the Electric, Poles where it makes it very Hard for Common people to Tamper the Energy meter for Exploiting. This system's Further Characteristics will be Discussed Below in the System Overview.

VI. SYSTEM OVERVIEW

A. Detection Unit.

In this System, the Detection unit will not possess any sort of New Modifications. For the Case of measuring the usage of Electricity, Existing CT is Lot more than enough. Since the objective is to Avoid tampering and theft alone. But for inheriting the data from from the Meter to the R Pi is not possible by connecting or by coding but by monitoring the the LED in the meter, using it blinking phase.

B. Integrating R Pi and the Meter.

The blinking LED is Monitored using an LDR, the Blinking rate data can be used to measure the Electricity usage.

C. Communication Unit

To make the billing method So easier, the usage details and the Tariff will be sent to Electric Board or billing stations using IoT Technology. This feature is already in use in this internet Era, in our system we have no other go for billing but IoT. Since the Meter is placed out in the Air the billing has to be made Online. A classical method of billing is not Feasible in our Case. That can even be made possible by designing the system with Digital Display at the Bottom of the Pole or in the resident this can help the user to know about the Usage but to make it Cost-effective sticking to the IoT is the Better Choice.

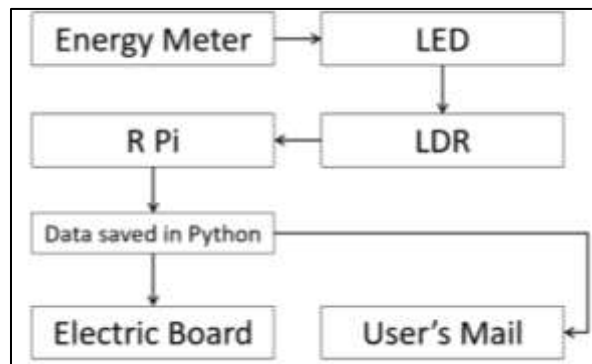
D. High-Voltage Protection

In typical Meters, there will be always a fuse to avoid Household appliances from bursting due to Voltage fluctuations. The Fuse box will considerably huge and it is Placed in the Metering Board but apart from the Energy Meter. In our system, the entire system will be constructed within a Case, but the fuse will be situated down in the House where the line reaches the house. To make it So compact and to hang it out in the Pole.

E. System's Protection Layer

This Research involves Electricity, even very small negligible factors may lead to Fatal Accidents. Since this system has to be hanged out in the Air, the Rainy season is a Major Concern. On other hand, The life and durability of the Product will be questioned. Keeping in mind that the System has to be insulated and to endure the effects of Seasons, the system's Case will be constructed with 3 different layers. An Insulating, durable, ceramic outer layer and metal pieces inside the box to hold the system materials firmly.

VII. BLOCK DIAGRAM



Block Diagram 1

The LED in the typical energy meter is interfaced mechanically with an LDR sensor, the intervals between the blinks will be detected and recorded by the raspberry pi. Based upon the tariff fed already in the R Pi, the raspberry pi will process the Number for that it has to be programmed to get the amount to be paid. The Python IDLE environment will be used for coding. Once the monthly usage is detected the final number will be sent to the Board as well as the users' mail ID or an exclusive website using in which payment portal can even be prompted.

VIII. WORKING AND OPERATION

Common Modern meter will be the metering unit of this system and the reading will be recorded and sent to the Board on monthly basis. For this process, Raspberry Pi can be used because of its economical price and precision in the result. Monthly usage will be sent to the electric board and the user for transparency of the system for Payment. The processed number can be sent to the Board using FTP Client, Many flexible and safe SFTP is available everywhere. FTP stands for file transfer protocol and SFTP stands for SSH file transfer protocol. The SSH will have to be turned on in R Pi for sending and receiving the data. That can be turned on using Pi Configuration from the menu bar. In our case, we will use the 'FILEZILLA' FTP Client, while running FileZilla on the PC, we should be known about the IP address, user name, and the password for FTP execution. In the Filezilla FTP Client, enter the IP address, user name, password in the new site tab. Once the usage data is received by the board, they can feed it to their website for payment prompt.

IX. SCHEMATIC SETUP

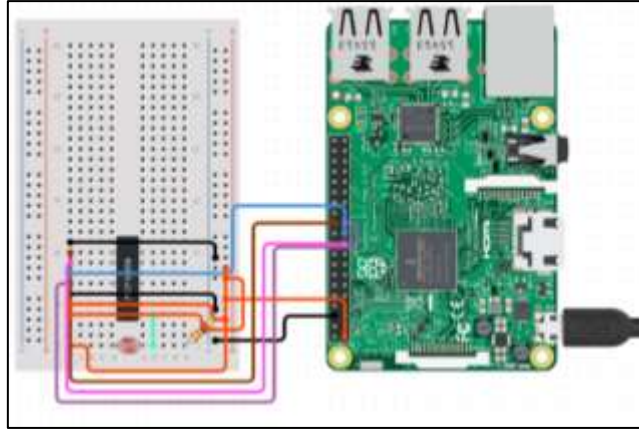


Fig. 1: Schematic setup of the system

MCP3008 8-Channel 10-bit ADC with SPI Interface will be connected with R Pi so we get a connection with LDR Sensor. RPi3B 3v3 is connected to BUS POS and RPi3B GND is connected to the BUS GND. A terminal of LDR connected to the BUS GND through a 10k ohm resistor, the other terminal of LDR is directly connected to the BUS POS without any Resistance.

X. EXPERIMENTAL SETUP

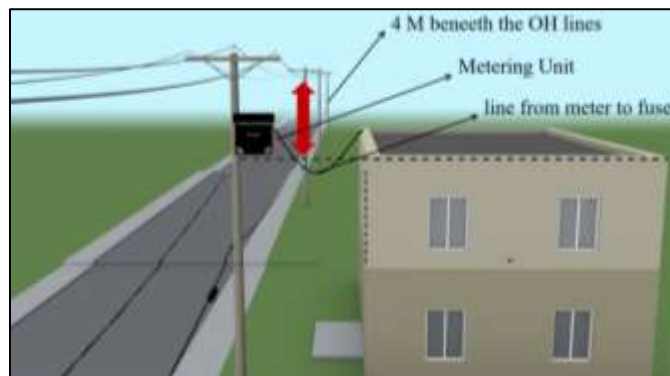


Fig. 2: Experimental setup

The metering unit will be installed 4 Meters beneath the overhead lines. The electricity usage is measured up in the pole, the line taken to the fuse inside the resident.

XI. LIMITATIONS

- 1) As per our system, the user will be intimidated monthly, since the meter is situated away from the user they cannot monitor the usage on daily basis. States like Tamil Nadu in India as a relaxation that the user need not to pay if their usage is below 100 unit, so most of the users try to limit the usage below 100 unit. Limiting the usage accordingly cannot be done in this system.
- 2) In case of errors in the meter or the line, even if it is a very minor error, the line in the area has to cut off. Because the meter is situated above the ground and near the Main over headlines.
- 3) This method is not applicable for dense areas where number residential house receives their electricity from the same pole.

XII. FUTURE WORKS

- 1) Live streaming of the electricity usage will have to be made accessible to the Users, so they can keep track of their usage for saving electricity.
- 2) The system has to be developed so compactly and in such a way that it could able to monitor 4 to 6 residents billings so by then it can be implemented in dense regions.

XIII. CONCLUSION

Every problem statement mentioned above has been ratified with this system, tampering with the electric meter is considered as the only reason for the theft, and it is avoided. Resulting in government electric board workers to reason proper data about the consumption.

REFERENCE

- [1] N.Mullai Rajan, S.V. Subadevi 2020 Volume 7 issue 4 entitled 'Car Event Data Recorder' - JETIR2004573. Journal of Emerging Technologies and Innovative Research. ISSN and UGC Approved. ISSN: 2349-5162. <http://www.jetir.org/download1.php?file=JETIR2005183.pdf>
- [2] N.Mullai Rajan, S.V. Subadevi 2020 Volume 8 Issue 4 entitled 'Strategy to Avoid the Wastage of Consumable Energy' - IJCRT200467. International Journal of Creativity Research Thoughts. ISSN: 2320-2882. http://www.ijcrt.org/viewfull.php?p_id=IJCRT2004489
- [3] N.Mullai Rajan, S.V. Subadevi 2020 Volume 7 issue 5 entitled 'Smart Environmental Monitoring System' - JETIR2005183. journal of Emerging Technologies and Innovative Research. ISSN and UGC Approved. ISSN: 2349-5162. <http://www.jetir.org/download1.php?file=JETIR2005183.pdf>