

# Modern Methods to Arrest Power Theft

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**Abstract**— Fraud, which includes metre manipulation, unauthorised connections, irregular billing practises, and unpaid bills, is another name for stealing electricity. The majority of electricity theft, according to the financial data, involves power theft. Magnet locking and metre manipulation are not possible with contemporary electronic metres. As a result, connecting straight from the distribution lines is currently the most popular method of power theft. All power utilities struggle with the issue of dishonest customers using electricity.

In recent years, there has been a lot of effort put into developing accurate metrics for spotting bogus power usage. This study focuses on uncovering methods to stop power theft as well as recognise unreported power use.

**Keywords** – Power Theft,Electricity,Billing, Electric Metre and Power Loss.

## I. INTRODUCTION

Electricity is the most convenient and beneficial source of energy for contemporary man, without which the current social infrastructure would not be possible. When the magnitude of electricity grows, the stealing of this energy or the illegal intake of electricity from transmission lines can be prevented. Electricity theft is the most serious problem in recent years, causing enormous damages to power companies. Conditions are often worse in places like India; if we can avoid those thefts, we can save a lot of electricity. A detection system for electricity theft is used to identify unauthorised tapping on distribution lines.

Rewiring circuits to evade an electric metre or tapping into another customer's electrical wires can also result in theft. The suggested energy theft detection system aids in determining the source of theft by tapping on distribution lines with a piece of wire and counting current units by putting a wire before and after the metre reading unit. Electricity theft has been well documented around the world, but power theft in India has a tremendous impact on the Indian economy. A number of power thefts have occurred with the assistance of persons from all walks of life, including utility employees, consumers, leaders, political leaders, and high-level utility administrators.

## II. RELATED WORK

### 2.1 POWER SUPPLY MODULE

This existing device effectively drives each of the system components and the microcontroller in order to produce a constant voltage. A bridge-type rectifier, filter capacitors, regulators, and a 12V step down converter comprise it. The system is supplied with a 230V, 50 Hz load that must be regulated to 5V and 12V, accordingly. The current is then received by a 12V step-down transformer. The step-down transformer reduces the alternating current voltage from 230V to 12V at 50Hz. A bridge rectifier is connected to the transformer's output. The rectifier's four IN4007 diodes are mostly employed to convert AC into pulsating DC.

## 2.2 CADENCE READING MODULE

This device's top function is to read the customer's unit operation and display it on an TV screen. The energy cadence's affair is linked to the microcontroller, as is the metre reading unit's input. In this case, the LED on the energy metre that indicates consumption of one unit is resemblant coupled to the opto- interrupter. When a power unit is utilized, the opto- interrupter generates a signal and sends it to the microcontroller. The microprocessor is configured to track unit operation, and the same information is shown on the display panel.

## III. HARDWARE COMPONENTS

### 3.1 ARDUINO UNO

When power theft becomes apparent, Arduino sends a 5V operation voltage to the relay, decoupling the cargo from the power force and precluding farther power theft. This smart technology, as shown in Figure3.1 below, incontinently cautions and separates the force against the cargo, avoiding theft discovery.



Figure 3.1 Arduino Uno

### 3.2 RELAYS

When we discover power theft, we use the relay to unplug the load. When an operating voltage is applied to the relay by electromechanical concept, it quickly opens the network to which it is linked is shown in Figure 3.2 below.



Figure 3.2 Relay.

### 3.3 LCD DISPLAY(LCD)

The often used 16x2 LCD displays custom crazy characters, numerals, alphabets, and special characters. The LCD displays voltage, current, and power when there is no theft in the energy metre.If theft occurs, the message THEFT IS DETECTED appears.

### **3.4 BUZZERS**

A buzzer is a gadget that generates sound when a microcontroller activates it. The buzzer is connected to the relays out, while the software on the Arduino regulates the switch out. When the computer's Arduino transmits a trigger to the relay, the buzzer rises and emits a tone.

### **3.5 CURRENT TRANSFORMERS(CT)**

Using a current transformer, the current can be detected. In order to gauge the current flowing through a load, one CT is placed on the load side, while the other is placed on the supply terminals, where it measures the current given by the source.

### **3.6 POTENTIAL TRANSFORMERS(PT)**

In power metering applications, potential transformers are used to track single-phase and three-phase power line values. A potential transformer is used to account for the voltage that the power source imposes.

### **3.7 ESP8266 MODULE**

The ESP8266 module links the Uno board of Arduino to the internet, enabling monitoring authorities to obtain data over the internet. As seen in Figure 3.3, power theft equals power given minus power consumed. The power supplied originates from the transmission station. We can detect theft of power more precisely.



Figure 3.3 ESP8266 Module

### **3.8 BRIDGE RECTIFIER**

If theft occurs, there is going to be a severe voltage loss. The main function of bridge rectifiers is to transform AC into pulsating DC, which is then slowed down by capacitor-based filtering circuits. Using an adjustable potentiometer and resistors, the voltage level is lowered and set to 5 volts.

## **IV. THE PROPOSED MECHANISM**

Arduino, LCD, ESP module, and current transformers make up the circuit. High currents cannot be sensed by metres; therefore, current transformers (CT) are utilised. To determine the current flowing through a load, one CT is attached to the load side, while the other CT is linked to the supply endpoints to gauge the current coming from the source. The voltage provided by the source is measured using a potential transformer that is attached.

This circuit's crucial element is the Arduino controller. It gets current signals involving two current transformers, a potential transformer, and a bridge rectifier. The two CT and PT ratings that arise are combined to provide two separate Power values ( $P=V*I$ ).

The two power levels are practically the same because there doesn't exist theft load. The system is functioning properly here. Current signal cannot be accessed by the Arduino. So, we are limited to using voltage to connect the C.T. Here, a rectifier must be used to change the present signal into a voltage signal. The output over the resistor linked in the circuit for the rectifier may be considered as the voltage signal as the rectifier transforms an AC signal to DC signal. The bridge rectifier's input is linked to the auxiliary of the CT. To lessen the output's ripple content, a capacitor is utilised.

To keep the output voltage below 5V and prevent harm to the Arduino controller, two resistors, numbered 33k and 10k, are employed. The Arduino receives this voltage signal from the two current transformers and potential transformer through ADC, and the calibration may be used to determine the matching voltage.

In order to access the Arduino controller, the current signal from the C.T. and P.T. was converted to the voltage signal. In order the C.T. connected on the load side, follow the same steps as above. A programme is created to access the potentiometer voltage signals. The coding has conditions that must be met in order to compare the power magnitudes.

The controller sends a warning text via the LCD and via the Internet of Things if the deviation exceeds the minimal level. IoT is utilised to send alert messages to authorities through the internet. One kind of display device is LCD. It shows the voltage of the source as well as the present condition of the load and supplied power. People at the switchgear can learn regarding power theft and take required action against criminals thanks to the ESP module, which enables a board with an Arduino to make connections to the internet.

The transmission line buzzer starts buzzing when the buzzer detects power theft. The buzzer begins when the message has been relayed to the LCD.

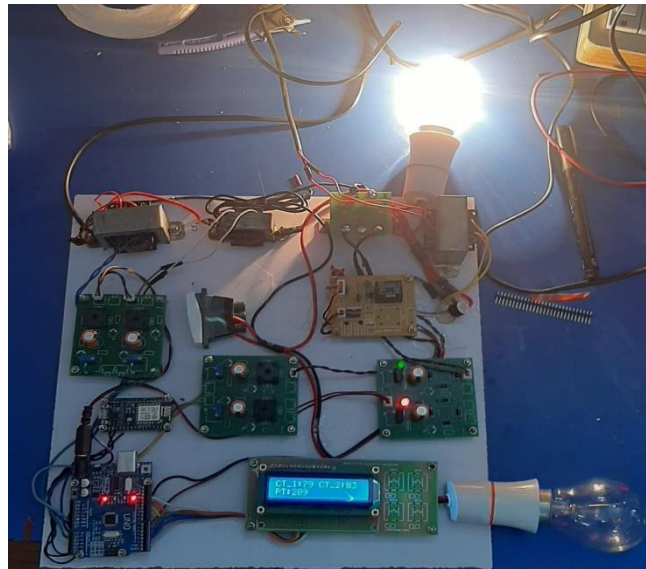


Figure 4.1 Proposed System

According to figure 4.1, by including a relay driver in the gearbox kit for power theft, the current flow from the converter to the specific location where power theft has been detected is stopped. The transmission line's power supply will be cut off. The theft may end before the authorities arrive at the precise place so that it may be stopped right away.

## V. RESULTS

This theft detection device measures voltage and current by hand. This study employs automation to carry out the experimental setup for theft. Voltage and current levels are measured with current transformers with potential transformers. They are then routed through bridge rectification devices and filters to remove any unwanted signals.



Figure 5.1 Current and Voltage Transformers Output Value

Analogue values are transformed to digital values using an A/D converter and then supplied to an Arduino board, whereupon the current as well as voltage levels are set using integrated C code. When an additional load is attached, the buzzer goes off, and the theft is discovered.

Table 5.1 Power Theft Detection

PT:230.77 CT:1.5	POWER THEFT ISDETECTED
PT:230.77 CT:1.6	POWER THEFT IS DETECTED
PT:230.77 CT:1.7	POWER THEFT IS DETECTED
PT:230.77 CT:1.8	POWER THEFT IS DETECTED

The load is wired to the potential plus current transformers, as seen in Figure 5.1 above. This transformer is used to measure the voltage and current values, as well as the voltage at the threshold and current value are encoded to the Arduino using C coding. If the current readings exceed the defined thresholds, the system will alert the page written in the software by means of the Internet of Things of the ongoing power theft.

## VI. CONCLUSION

To prevent power theft, we can receive a warning SMS via IoT. The offence of stealing electricity might be eliminated by using the Internet of Things (IoT), which leads to a boost in our motherland's economy and a reduction in power consumption shortages. This method reduces the huge financial and power losses triggered by the power of customers theft. Pursuant to this theory, electricity theft may be effectively reduced by detecting it and reporting it to authorities. When this method is applied to home

electric metres, it helps identify power theft in homes. The system under consideration can also be concealed in electric metres so that when the disparity between currents crosses an agreed-upon value, a notification is sent to the relevant authority in addition to the location of that area. The revised version of this method is used in gearbox wires to prevent wire hooking or bypassing.



Figure 6.1 LCD Output

Following the LCD's "POWER THEFT DETECTED" display, as seen in Figure 6.1 above, the supply to the output abruptly ceases. whichever is the industrial application, this technique is employed to halt power theft in numerous real-time applications. Additionally, by using the internet address, the Energy Board (EB) authorities can frequently maintain and monitor the public's energy use, and their unauthorised use may result in arrest within the EB office. With the installation of the the threshold relay, the power source power is brought back after the workplace for instance' inspection when excessive energy use is identified through observation of the voltage difference. The electrical separated relay instantly closes down the power to the particular lane where the suspected power theft takes place.

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