

# An IoT Based Tamper Prevention System for Electricity Meter

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**Abstract** - The existing domestic electricity meter systems face many problems like electricity theft. Theft of electricity is unethical as well as criminal practice of stealing electrical power. It is one of the major challenges faced by power companies. In this paper, we present an IoT based Tamper Prevention System for Electricity Meters. This system will provide automatic disconnection of electricity if any tampering activity by human involvement is detected. Electricity theft is a problem to government as well as common people. Several innovative steps have been taken to minimize the incidents of theft of energy or tampering of meter. This embedded system using Internet of Things technology comprises of ESP826612E Wi-Fi module for the connectivity and controller functions. A Current Sensor and Solid State Relay are used for sensing and actuation. Thus this system uses wireless technology to detect tamper activity and disconnect the electricity connection of consumer.

**Key Words:** Electricity theft, Internet of Things, Thing speak platform, tamper detection, Adafruit io.

## 1. INTRODUCTION

Electricity is the most versatile and efficient form of energy. The usage of electricity is practically loss-free as well as non-polluting. Electricity can be produced with entirely renewable methods, such as wind, water and sunlight. It is weightless, easier to transport and distribute, and it represents the most efficient way of consuming energy. Power utilities lose large amount of money each year due to fraud by electricity customers. Utilities experience significant revenue fatalities due to losses. Average power loss in India exceeds 26%. Losses of some of the state utilities in the country are more than 30%.

Several technical as well as non-technical losses are faced by power companies. Technical losses are those occurred due to  $I^2R$  power losses and non-technical are those which occur due to tampering of electricity meter. Electricity theft has several disadvantages for operator as well as consumer. In this research paper, to address this issue, a tamper-proof smart energy meter using Internet of Things (IoT) is proposed. This project promises to overcome the nagging electricity theft challenges.

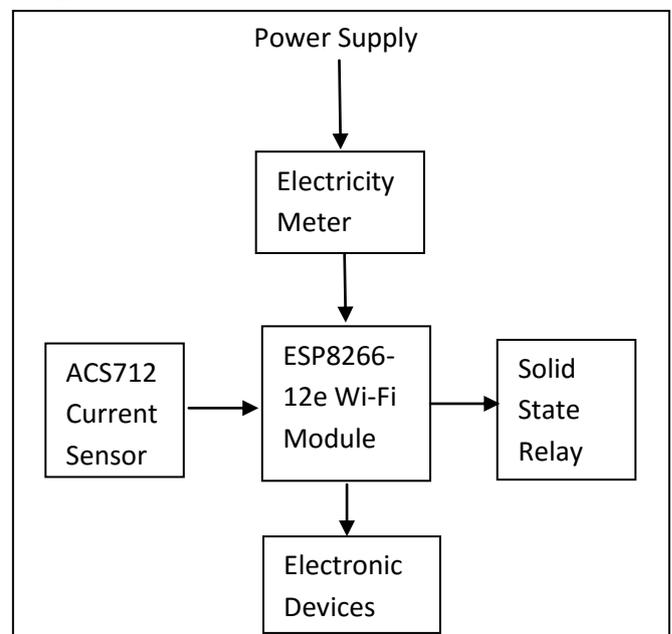
### 1.1 Method and Material

We are designing an IoT based tamper prevention system prototype. Meter is kept in a box with the display and key

portions of the meter exposed. The IoT Tamper Prevention System will be inside the meter box. Any attempt of tampering will cut off the electric supply and a message will be sent to the distributor's office displaying the exact location and time where the tampering is detected.

### 1.2 System Development

The system architecture of intelligent energy meter is shown in figure below:



## 2. LITERATURE SURVEY

### EXISTING SYSTEMS:

There are many methods which are used for theft detection. These methods include load profile analysis of customers to detect abnormal energy consumption patterns. But these methods cannot be used to detect energy thefts when there is a complete bypass of electricity meters. In such cases, electricity losses are calculated by using energy balance between the energy supplied from the distribution transformer and the energy consumed at the consumer's end.

### Theft Detection using SVM:

This system is used for detecting for detecting non-technical loss in electricity transmission. An artificial intelligence based

technique SVM (Support Vector Machine) is used. This method uses data mining techniques for feature extraction from old energy consumption data from consumers. This method uses the old profile data of consumers to identify any irregular electricity usage. As a result, some classes of consumers are produced who are shortlisted to be evaluated as suspects and inspection is done accordingly. This technique lacks the transparency of results.<sup>[5]</sup>

#### Theft Detection using RF transmission:

In this system, Radio Frequency (RF) transmission is used to establish the communication between the EB server side and the consumer end. The server can access the information about the measured units of consumed electricity at the consumer side. When the current transits from the distributor side to the consumer end, if the consumer does not receive the total amount of power, then there is a possibility of electricity theft. Then this information about the system is displayed through the Wi-Fi space to the EB server side.<sup>[2]</sup>

#### Theft Detection using GSM:

In this system GSM module is used to protect the electricity energy meter from the theft. A lever switch is used at the opening of the meter which is connected to interrupt pin of the ARM processor. Closed switch applies 3.3V to the interrupt pin and opened switch drives the voltage to zero. The switch normally closed when the meter box is closed. If someone tries to open or tamper with electricity energy meter, that switch gets opened and the interrupt pin gets triggered as 0V is sensed by it. The ARM processor immediately sends AT comments to GSM for sending SMS.<sup>[3]</sup>

#### PROPOSED SYSTEM:

In the system proposed in this research paper tampering of electricity meter is successfully detected using tamper prevention system developed by using Adafruit.io, Internet of Things and Thing Speak platform. In this system, a control unit is incorporated in the device so that once an electricity theft activity is detected; the unit sends the information to IFTTT. The system is highly implementable and can be used for real-time applications. Hence the shortcomings of existing system are overcome in the system proposed in this research paper.<sup>[1]</sup>

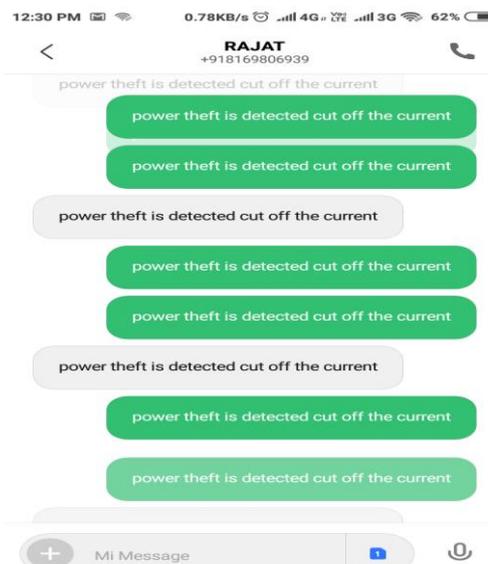
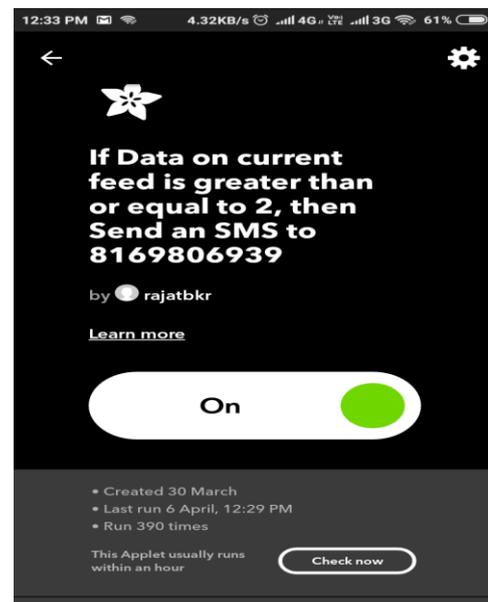
### 3. SYSTEM OPERATION AND SIMULATION

All components will be initialized when the power is turned ON. The system will check if connectivity interface is available. If it is available then it will continuously check the status of the current sensor. If any tampering is detected then the current sensor will send signal to processor which in turn will give appropriate instruction to other parts of system. It will send the information to the IFTTT platform.

The authorized person will also receive a text message stating that the electricity theft has been detected.

In this system, the status of the meter is continuously shown on the web page of the distributor. Thingspeak platform is used for this data collection and analysis. An account can be made on this platform and by login in to this account, time and location of the tampered energy meter can be viewed. Adafruit.io platform is also used to control the ON/OFF state of the devices.

Following figure shows the IFTTT after a text message is set to be received after tampering of meter was detected:



#### 4. CONCLUSION

Thus we created a system of electricity theft detection and alert to Electricity Board. In IoT based automated electricity system, the accuracy of the system depends on Internet connection, quality of the sensors and other hardware used in the system. These automated system designs will be very beneficial to our society as well as country's economic development as the electricity theft rates will be reduced. The system is efficient as it reduces human involvement, increases accuracy, prevent billing mistakes, provides theft detection. The study has been able to achieve its main objective to develop a sustainable platform to detect the electricity theft without human intervention by using and IoT based Tamper Prevention System for Electricity Meter.

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