



## ELECTRICITY THEFT DETECTION FOR SMART GRID SECURITY USING SMART METER SYSTEM

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**Abstract**—Power theft at substation is the biggest problem now days, which causes huge loss to electricity boards. In this system a microcontroller is with HT12E (encoder) wireless power transferring to HT12D (decoder) of wireless decoder which is glass wearable device, wireless communication & a contactor to make or break power line. If current is high & energy pulses are not coming then it designates power theft. So, microcontroller trip the output utilizing relays. This information is sent to substation utilizing wireless communication. Over power consumption caused due to theft of power supply in substation. If there transpires to be a connection of theft power supply lines then over supply occurs. In this project, a micro controller is connected wirelessly to HT12 encoder with an energy metering circuit, current sensing circuit, HT12E communication link, & a contactor to make or high-power supply line. At the substation end, a HT12D decoder is connected with a HT12E (encoder) which links to communicate with all high power supply a buzzer in normal condition. If any power theft happens a person can easily can note theft area through glass of wearable device. In which theft of power supply will be displayed. If current is drawing & energy pulses are normal, then no power theft is being done & the output is connected.

**Keywords**—HT12E transmitter, HT12D receiver, Relay, Micro-controller, buzzer and load cells.

### I. INTRODUCTION

Electricity theft is at the center of focus all over the world but electricity theft in India has a significant effect on the Indian economy, as this figure is considerably high. While technology in on the raising slopes, we should also note the increasing immoral activities in substation. With a technical view. The system prevents the illegal usage of electricity. At this point of technological development, the problem of illegal usage of electricity from the substation can be solved electronically without any human control. An electric substation is a power supply to all users of current where it used for measuring the amount of electrical energy supplied to a commercial or residential building. Due to the increasing cost of electricity, security and tampering in electric meters has become a major concern for government agencies over the globe. Electric meters can be manipulated, thus causing them to stop, even bypassing the meter. Consumers those who are tamper with electric meter, effectively and efficiently use power without paying for it. This theft or fraud can be dishonest as well as dangerous. Electric substation security is made as major issue in many countries today. Wireless Power Theft Monitoring Unit use remote monitoring method to prevent power theft. It is necessary to present this method to electricity department. This Unit also use technology of wireless to monitor wireless substation reading. If there will be difference in wireless reading and installed meter reading, then it is easy to detect thief.



## II. ELECTRICITY THEFT

There are various factors that work behind the reason for electricity theft. Among them, some are stated below

- Lack of ethics and patriotism is the main reason.
- In most underdeveloped and developing countries, low economic growth is the cause of power theft.
- Low literacy rate could also be a reason. If the person is illiterate then he might not be aware of such various methods of theft and thus gets deceived by hackers.
- If the law against power theft is feeble, then it influences power theft.
- Sometimes biased utility service providers also create adulterated report for their own benefit.

### A. *Different ways of electricity theft:*

There are mainly three ways of electricity theft in general

**1) Theft from Electromechanical meter:** Some ways of stealing electricity from Electromechanical Meter are underneath:

- Getting connected straight to the distribution line avoiding meter.
- Connecting the neutral line directly to the ground.
- Stick solenoid with the KWh meter.
- Stop the meter coil rotation by incorporating any kind of disc.
- Damaging the rotator coil of the meter.
- Swapping the I/P and O/P. But these problems can be solved using the smart meter.

**2) Smart Meter Theft:** A crucial way off stealing electricity from smart meter is by making meter reading slow. Here partial electricity is stolen to run higher energy consumption machines. Also there are some other ways of stealing electricity from smart meter like:

- Tapping power straight away from the feeder line by avoiding the meter.
- Changing the built-in calibration system of the meter.
- Tampering the meter.
- Connecting the neutral line of the meter with ground.
- Physically damaging the meter

### B. *Different mechanisms to reduce the electricity theft:*

Electricity theft from smart meter can be divided into three main criteria:

**1) Reduce Physical Damage:** As consumers can steal electricity from smart meter by physically damaging the meter, this theft can be reduced by using hard plastic encasement. This hard plastic encasement is a type of meter seal. This transparent plastic covers serve as a warning which helps to reduce electricity theft.

**2) Caught theft by preserving privacy:**

In maximum computational scheme, consumers share their data regarding the usage pattern with the utility service providers. It becomes a great threat to customer as it reveals the consumer's privacy. Some authors had described various procedures to reduce electricity theft from smart meter by preserving consumer's privacy.

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### III. DETAILED SYSTEM DESIGN

#### A. Nano Microcontroller:

Here are few of its basic features which you must know if you are thinking to work on this great microcontroller board: It has 22 input/output pins in total. 14 of these pins are digital pins. Nano has 8 analogue pins. It has 6 PWM pins among the digital pins. It has a crystal oscillator of 16MHz. Its operating voltage varies from 5V to 12V. It also supports different ways of communication, which are: Serial Protocol, I2C Protocol, SPI Protocol. It also has a mini USB Pin which is used to upload code. It also has a Reset button on it.

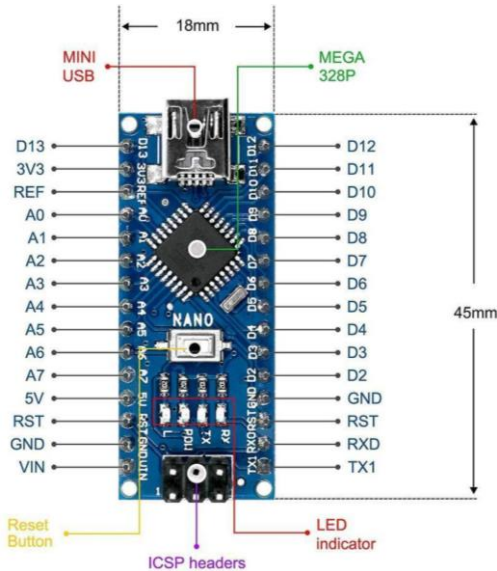


Figure 1: pin Diagram for Nano controller

#### B. 12V Power Supply

12V power supplies (or 12VDC power supplies) are one of the most common power supplies in use today. In general, a 12VDC output is obtained from a 120VAC or 240VAC input using a combination of transformers, diodes and transistors. 12V power supplies can be of two types: 12V regulated power supplies, and 12V unregulated power supplies. 12V regulated power supplies come in three styles: Switching regulated AC to DC, Linear regulated AC to DC, and Switching regulated DC to DC.

#### C. LCD Display

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs)

#### D. Buzzer

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.



Figure 2: Buzzer

#### E. Voltage Regulator

The **voltage regulator IC 7805** is actually a member of the 78xx series of voltage regulator ICs. It is a fixed linear voltage regulator. The xx present in 78xx represents the value of the fixed output

voltage that the particular IC provides. For 7805 IC, it is +5V DC regulated power supply. This regulator IC also adds a provision for a heat sink. The input voltage to this voltage regulator can be up to 35V, and this IC can give a constant 5V for any value of input less than or equal to 35V which is the threshold limit.

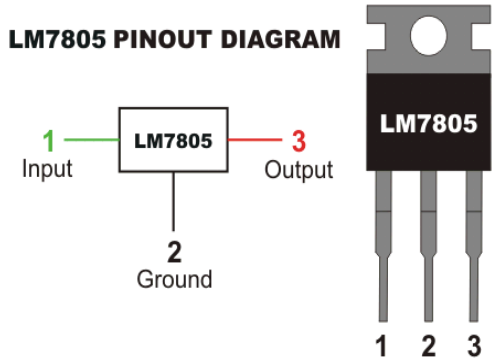


Figure 3: Regulator

*F. Rf Module(Transmitter And Receiver)*

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

Table No:1 RF Transmitter

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data input pin	Data
3	Supply voltage; 5V	Vcc
4	Antenna output pin	ANT

Table No:2 RF Receiver

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data output pin	Data
3	Linear output pin; not connected	NC
4	Supply voltage; 5V	Vcc
5	Supply voltage; 5V	Vcc
6	Ground (0V)	Ground
7	Ground (0V)	Ground

*G. Voltage Sensor*

The voltage developed across the reference resistor or sensor is buffered and then given to the amplifier. The sensor's output voltage can be expressed as

$$V_{out} = \frac{R_M}{R_M + R_F} \times V_{ref}$$

Here, the output voltage is

$$V_{out} = \frac{A}{4} V_{ref} \delta$$

**Connection and arrangements**

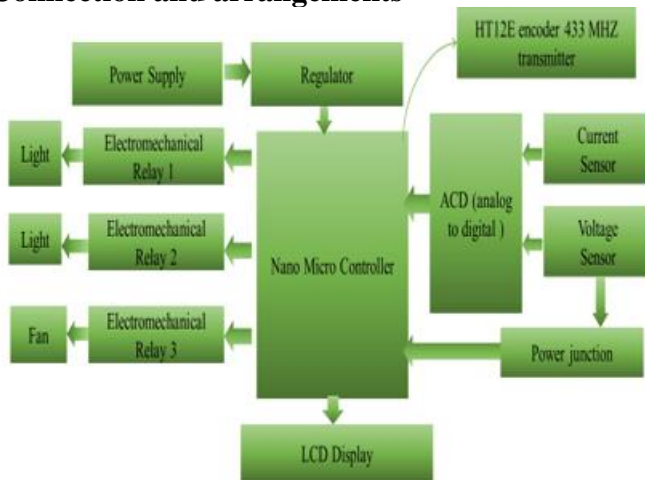


Figure:4 Transmitter Block level demonstration of the system on

- 12V of power supply is given to regulator. This regulator will reduce power supply to 5V and gives to microcontroller.
- A micro-controller will give instruction to the whole process, which place an important role.
- An 5V of power supply is given to all the 3 Electromechanical relays. If more amount of power supply is given to electromechanical relay. Then 3<sup>rd</sup> electromechanical relay will automatically cutoff supply by knowing that theft of power supply has been occurred.
- A power junction is connected with micro-controller to give flow of current in once direction with that an voltage and current sensor are used.
- A voltage and current sensor will check supply is in constant level or not by converting digital signal to analog signal to the micro-controller.
- An HT12E wireless communication device is connected to transmit signal to HT12D the receiver will receive the signal and display that power theft is identified.
- An LCD Display is connected with micro-controller for displaying data of power theft.

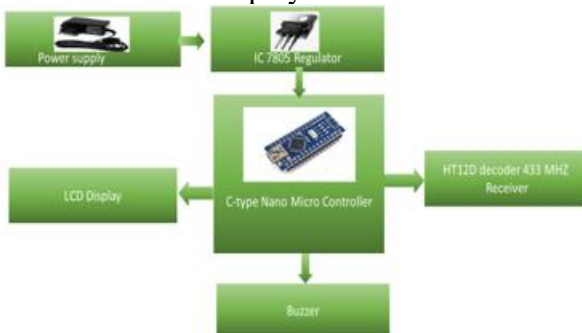
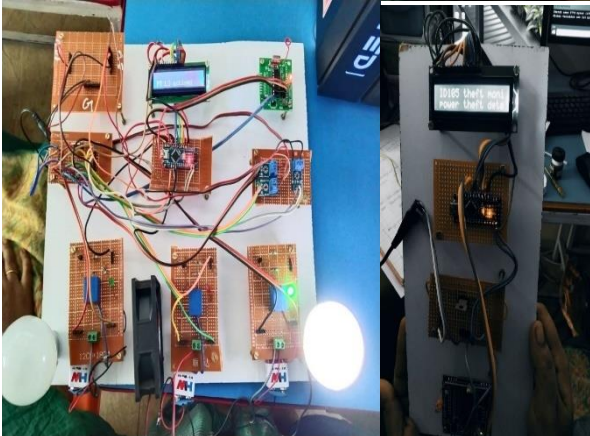
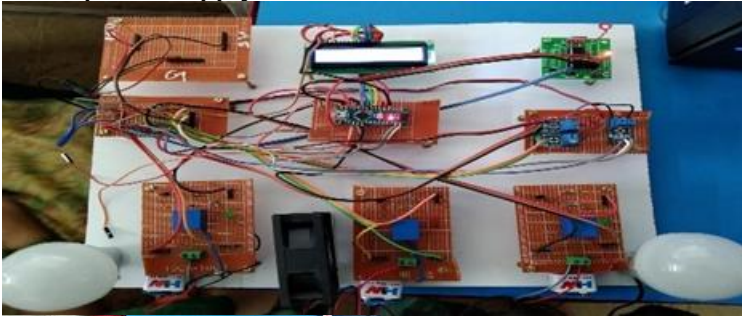


Figure:5 Receiver Block level demonstration of the system on

- In receiver an SMS alert will received to authorized person with help of GSM.
- In receiver 12V of power supply is given to regulator. A regulator which gives an constant supply of 5V
- An HT12D (decoder) will receive an information through wireless communication if power theft is occurred by HT12E (encoder).
- An micro-controller is also used in receiver for controlling all device and for passing and collecting information from devices.
- An Buzzer will given beep sound if power theft is identified.
- Power theft in any area can be identified easily by a wearable device (glasses). In this total amount power theft will is bedisplayed in glasses.

#### IV. RESULT

This project aims to combat power theft at substations by employing a wireless system with HT12E transmitter and HT12D receiver, interfaced with microcontrollers. Through current sensing and energy metering circuits, any deviation indicative of power theft triggers a response, including activating a buzzer, sending SMS alerts, and displaying theft information on wearable glasses. Ultimately, this system enhances surveillance and detection of power theft, safeguarding the integrity of the power supply network.



#### IV. CONCLUSION

- This project aims to combat power theft at substations by employing a wireless system with HT12E transmitter and HT12D receiver, interfaced with microcontrollers.
- Through current sensing and energy metering circuits, any deviation indicative of power theft triggers a response, including activating a buzzer, sending SMS alerts, and displaying theft information on wearable glasses.
- Ultimately, this system enhances surveillance and detection of power theft, safeguarding the integrity of the power supply network.
- In developing countries electricity theft is a common practice, as they do not pay utility bills to a government company in case of electricity.
- This project concludes that after using this system one can simply monitor the load consumption by every consume.
- One can also control the power theft by using this project. It saves time as well as help to maximize profit margin for utility company working in electrical distribution network.

#### V. REFERENCES

The template will number citations consecutively within brackets



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