# Development of Electricity Theft Detection Using Smart Meter in Power Distribution Network Based On Wireless Technology

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**ABSTRACT:**

It is realized that the innovative headways are expanding at a speedier pace. However, the usage of advances in different segments is low. It is realized that power burglary frequently happens in different spots. So we propose a framework where we ceaselessly screen the power theft utilizing sensors. The Input voltage to the framework and the yield voltage drawn by the load is additionally checked. The sensor esteems are continually checked. On the off chance that power burglary is recognized, at that point an alarm message is given to the client utilizing GSM Module. The alarm message gives the time when burglary happens and furthermore the present sensor esteems.

## I. INTRODUCTION:

In intelligent energy metering framework as proposed in examine with the capacity to convey remotely, command data's are sent to the meter by means of SMS and the meter answers with the pertinent vitality utilization readings again through SMS. Along these lines it permits both the power supply organizations and the client to have a superior observing of the energy extracted by the load. Energy has been a vital calculated worldview for future vitality utilize. Step by step instructions to influence vitality to utilize more productive and viable is exceptionally basic for future social and financial improvements because of constrained accessibility of non-sustainable power source assets and costly methods for securing sustainable power sources [1].

In the course of the most recent couple of years, Smart Energy Meter has been proposed as an imaginative arrangement went for encouraging moderateness and diminishing the cost of utilities [2]. The past energy meter has mechanical development with different wrong, tedious and unreliable meter perusing strategies. The issue with this framework is that it requires more human work, timing and causes blunder. So there is a need of vitality meter which will give bill to user both as an SMS alongside other inbuilt highlights, for example, tamper proof, blame discovery and so forth [3]. Furthermore, the online approach produces cautions about utilizations of energy as and when required by a predefined estimating structure through a call/email/short instant message.

Operational misfortunes bring about with vitality appropriation which is essentially arranged into either specialized or non-specialized in nature. The creators in depicted power robbery control by computing NTL > 5%, anyway the outer control area disengagement of legitimate customers is a major issue. The key inspiration of this examination is the vitality emergency of our nation since long time. One of the principle explanations for power lack in Pakistan is the Power Theft. In spite of knowing the whereabouts of the people and associations who are engaged with carrying out this wrongdoing, the power organizations are defenseless to stop this threat. In the event that the line men attempt to remove the power supply, they are annoyed and debilitated. An essential part in regards to brilliant lattice, is played by Advanced Metering Infrastructure (AMI) related with layman's life. As of late, numerous clever electronic gadgets like computerized blame recorders, defensive transfers and so forth are acquainted with be

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connected to keen meters. These IEDs screen the status of operational exercises ceaselessly. In case of an issue, the user responds speedily and confines the effects to a base by disconnecting the framework.

## II. TYPES OF DIFFERENT COMMERCIALLY USED ENERGY METERS:

### 1. Electromechanical Energy Meter

It is the most broadly utilized energy meter which ascertains the electrical energy or units consumed by load based on the mechanical energy of the plate or rotor.

### 2. Digital Energy Meter

The vast majority of the old electro-mechanical meters are being supplanted by new electronic meters which are more exact in taking the readings.

The advanced energy meter has tackled a significant number of the issues with electro-mechanical energy meters. The significant weakness of the computerized vitality meter is that it does not address the charging which is a work expending process.

## III. SYSTEM DESIGN AND ARCHITECTURE:

This system displaying the information about the energy consumed in terms of units, and if any theft occurs that will be displayed in the website. Hence every user can check the information anywhere globally. Thing speak web page is used for displaying the information of the system. In this IOT based meter reading system is designed to continuously monitor in the meter reading and service provider. The system consists of voltage sensor to monitor the incoming voltage.

And also the voltage and current consumed by the loads are monitored using the Voltage sensor and the Current sensor. The sensor values are monitored and if the variation between the voltage and current sensor in the incoming and outgoing is very large, then the theft message is provided to the concerned person.

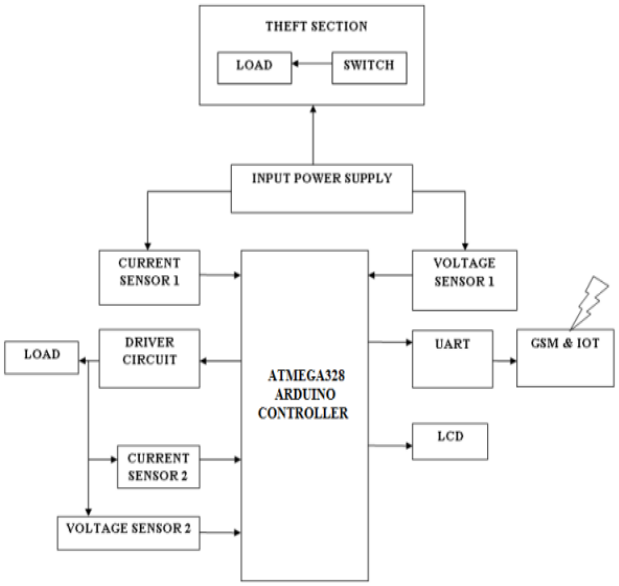


Fig.1. Block representation of System Architecture

The message consists of the current sensor value and the time when the theft is occurred. This indicates the theft of power in home.

## IV. NEED FOR INTERNET OF THINGS:

The IOT module here acts as a source of internet for the microcontroller. The IOT module here has a set of format for updating the data. The IOT consist of an ESP8266 module for establishing Wi-Fi connectivity between the Smartphone and the ESP-8266 module. Whenever a personal-hotspot is established, then the mobile data is shared to the controller. The system here continuously transmits the sensor data (Voltage Sensor and the Current Sensor) using UART protocol. Whenever the data is received by the IOT module, it pushes the sensor data to the cloud. So whenever a user wants to monitor his energy meter readings, then the user can view the data from the Webpage dedicated to the particular IOT module.

## V. MICROCONTROLLER - PIC16F877A:

The term PIC, or Peripheral Interface Controller, is the name given by Microchip Technologies to its single – chip microcontrollers. PIC micros have grown to become the most widely used microcontrollers in the 8- bit microcontroller segment.

The PIC16F877A CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C5x, PIC12Cxxx and PIC16C7x devices. It features 200 ns instruction execution, 256 bytes of EEPROM data memory, self-programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.

**Special Microcontroller Features**

- Flash Memory: 14.3 Kbytes (8192 words)
- Data SRAM: 368 bytes
- Data EEPROM: 256 bytes
- Self-reprogrammable under software control
- In-Circuit Serial Programming via two pins (5V)
- Watchdog Timer with on-chip RC oscillator
- Programmable code protection
- Power-saving Sleep mode
- In-Circuit Debug via two pins
- 10-bit, 8-channel A/D Converter
- Brown-Out Reset
- Analog Comparator module

**Peripheral Features**

- 33 I/O pins; 5 I/O ports
- Timer0: 8-bit timer/counter with 8-bit prescaler
- Timer1: 16-bit timer/counter with prescaler
    - Can be incremented during Sleep via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules
    - 16-bit Capture input; max resolution 12.5 ns
    - 16-bit Compare; max resolution 200 ns

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- 10-bit PWM
- Synchronous Serial Port with two modes:
  - SPI Master
  - I2C Master and Slave
- USART/SCI with 9-bit address detection
- Parallel Slave Port (PSP)
  - 8 bits wide with external RD, WR and CS controls
- Brown-out detection circuitry for Brown-Out Reset

The simplest microcontroller architecture consists of a microprocessor, memory, and input/output. The microprocessor consists of a central processing unit (CPU) and the control unit (CU).The CPU is the brain of a microprocessor and is where all of the arithmetic and logical operations are performed. The control unit controls the internal operations of the microprocessor and sends control signals to other parts of the microprocessor to carry out the required instructions. Memory is an important part of a microcomputer system.

Depending upon the application we can classify memories into two groups: program memory and data memory. Program memory stores all the program code. This memory is usually a read-only memory (ROM). Other types of memories, e.g. EPROM and PEROM flash memories are used for low-volume applications and also during program development. Data memory is a read/write memory (RAM).

## VI. CIRCUIT DIAGRAM:

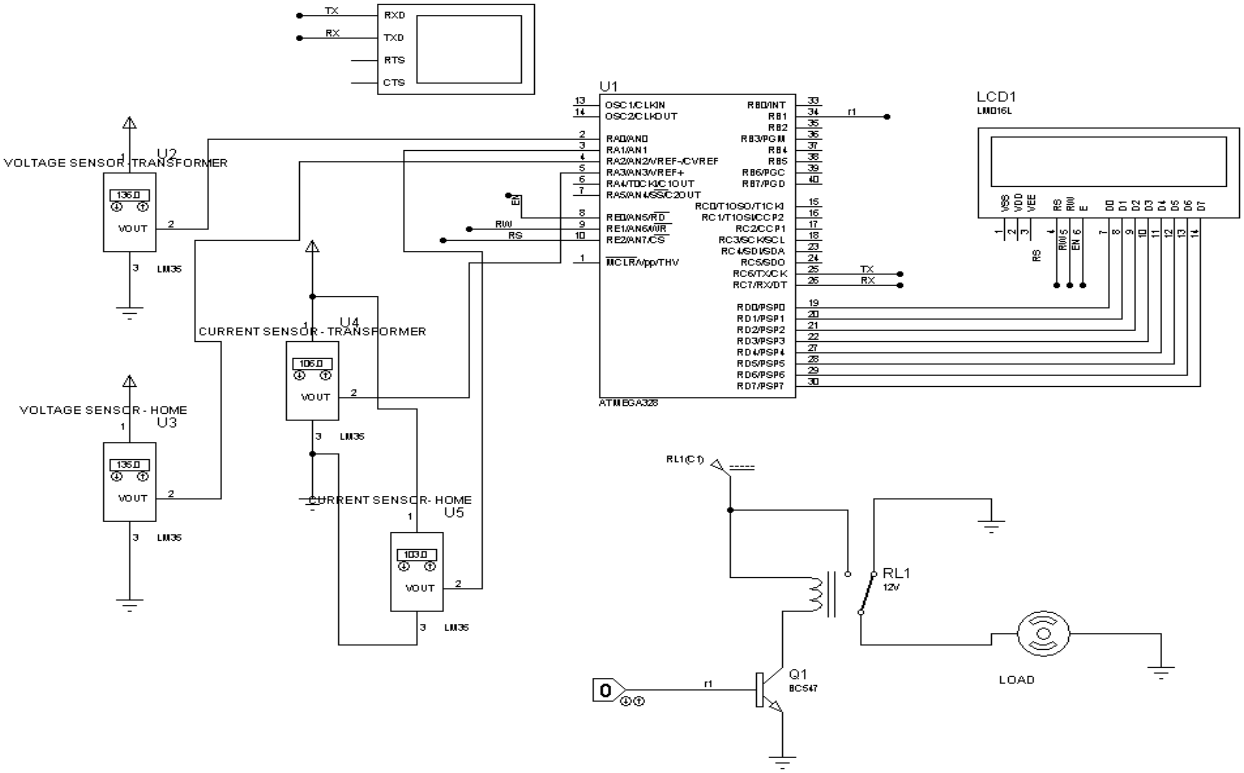


Fig.2. Circuit Diagram

## VII. SIMULATION DIAGRAM:

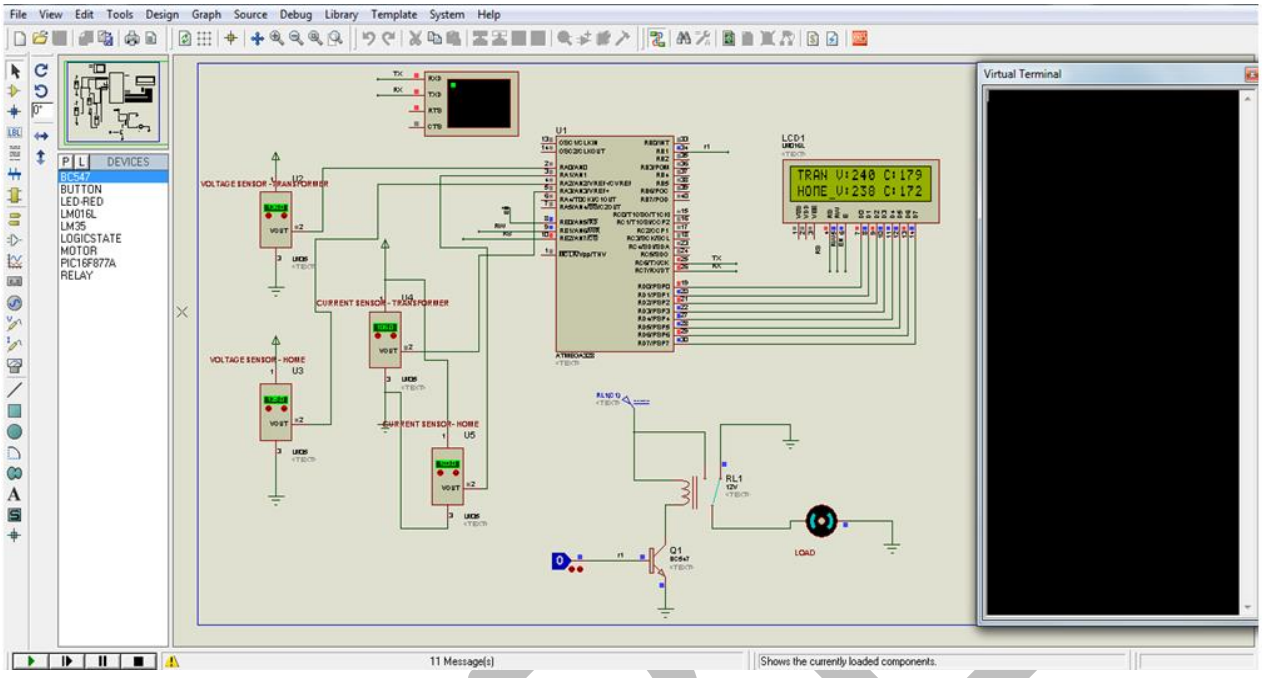


Fig.3. Simulation Diagram

## VIII. CASE STUDIES:

Theft of electricity is the criminal practice of stealing electricity. It is a crime and is punishable by fines and/or incarnation. It belongs to the non-technical Losses.Non-specialized losses which are caused by the activities of the outer influence framework and comprise fundamentally of Electricity Thefts and as well as by non-payment of bills by the customers. As Due to the increment in the theft of electricity, India is on the run of losing billions of Rupees, in the year 2012, the World Bank assessed, that the electricity theft diminishes, India's GDP by approximately 1.5%. An investigation by NDTV India also presumed that 40% of the electricity in India is unpaid.

**Theft of Electricity deals with IE Act 2003, Amended Act 2007 U/s Section 135 of the Electricity Act.**

- **Tapping Wire: –** By Causing or Making any connection with Overhead or Underground cables or service wires; or
- **Tampering Meter:-** Which can be done by Simply Installing or Using a Tampered Meter, or a Current Reversing Transformer, Loop Connection or Any other Device or Method which interferes with the Accurate or Proper Calibration, Registration, or Metering of the Electric Current or Otherwise Which results in a way where the electricity is stolen or wasted; or,
- **Damaging the Meter:-** Damaging or otherwise Destroying of an Electric Meter, Equipment, or Apparatus, causes or allows any of them to be at the stage of being damaged which can be the reason of interference with the accurate metering of the electricity; or,
- **Unauthorized Use: -** The Usage of electricity for the purpose other than for which the usage of electricity was authorized.

TNEB reveals that electricity, worth several crores of rupees, is stolen every year. TNEB usually hits the headlines when it opens new power stations or when power outages during peak summer, attracting consumers' ire. But what not many know is that its **Enforcement wing**, which is on the job round the clock, brings to book errant consumers who indulge in power theft.In the financial year 2016- 2017, the enforcement wing detected 3,833 power thefts, leading to a provisional assessment of Rs.28.83 crore and compounding fees of Rs.3.20 crore. In the financial year 2017 – 2018, Enforcement inspection led to detection of 1.23 crore stolen units of power resulting in provisional assessment of Rs.32.76 crore and Rs.3.56 crore compounding fees. In the same period, the 4881 thefts detected, the highest was in domestic connections, followed by commercial services with the Low Tension industrial and agricultural thefts respectively. In contrast, only 2 thefts were recorded in the High Tension sector. Power theft methods include direct hook, direct tapping , bypassing meter, meter tampering, meter tilting, seal tampering, affixing bogus seals, reversing Connections, neutral cut/neutral by-pass, damaging meters and metering equipment, illegally restoring disconnected supply, un-authorized use of electricity and malfunctioning of meter reading through external applications. Chennai Enforcement Division in 2016- 2017, Inspected 43363 number of services and detected 1091 nos of thefts leading to a provisional assessment of Rs.763.62 lakhs and compounding fees of Rs.86.54 lakhs. In the financial year 2017- 2018, Inspected 45361 number of services and detected 1315 nos of thefts leading to a provisional assessment of Rs.869.16 lakhs and compounding fees of Rs.100.195 lakhs.

## IX. EXPERIMENTAL SETUP:


Fig.4. Meter Tampering

An electricity meter is used to measure the amount of electricity supplied to a residential or commercial building. Meter tampering or bypassing is when you make the meter to either stop functioning, under-register or even stop registering how much electricity your house/building consumes. This is usually done by people to avoid paying for the electricity that they use. This is theft and is very dangerous because the risk of injury or even death by electrocution while doing it is high, as tampers do not apply the same safety measures that Eskom does.

Meter tampering shall be defined as tampering with or bypassing the Cooperative's meter or equipment, or other instances of electric service diversion such as physically disorienting the meter, attaching objects to the meter to divert or bypass electric service or, insertion of objects into the meter and other electrical.

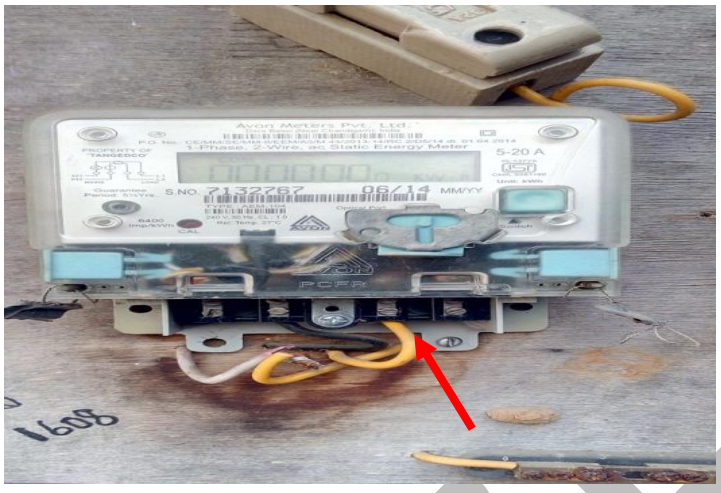

Fig.5. Meter Bypass

and mechanical means of tampering with, bypassing, or diverting electric service.

Once a meter is bypassed it immediately stops operating normally, meaning that if there is an electrical fault inside your premises it will not be picked up and the electricity supply will stay on without tripping. This is a serious safety hazard to people and animals in the building, and can result in electrocution or fire.

The tampering and bypassing of meters by electricity customers remains one of the reasons Meters gives for their failure to reduce collection losses in metered areas. Meter tampering and bypass refers to the practice of interfering with meters such that the readings are not reflective of the actual electricity consumed by the customers.

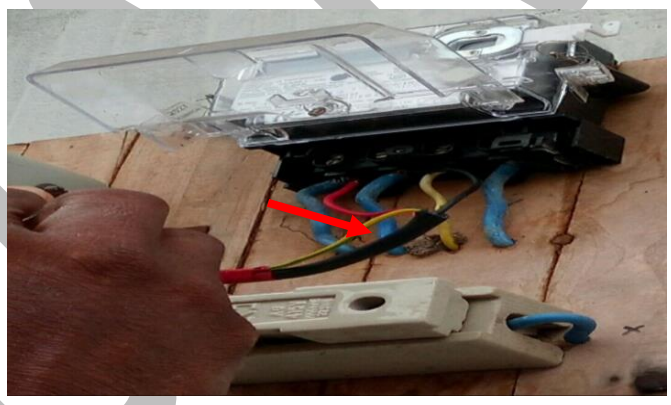

Fig.6. Direct Tapping In Single Phase Meter

Tapping is the most used method. 80% of global power theft is by direct tapping from the line. The consumer taps into a power line from a point ahead of the energy meter. This energy consumption is unmeasured and procured with or without switches.

Many times it is not possible to inspect all the areas where hook line is there or not. Many people use electricity years after year's illegal way (using hook lines). Now a days there are more modern techniques to steal electricity. Many times in outskirt /sensitive areas, it is not possible to go there for hook line inspection. In this way a huge amount of electricity has been used without paying a bill. This is one of the most important reasons for running State Electricity Corporation running in loss.

Fig.7. Direct Tapping in Three Phase Meter

One way is, we can install a smart meter the transformer at the substation and on everything it connects to. Except for a few losses, it is simple matter to see when there is more electricity delivered to the substation than the sum of all the smart meters.

The consumer taps into a power line from a point ahead of the energy meter and energy consumption is unmeasured and procured with or without switches.

The images explain the three phase and single phase tapping of the EB meters. The above image (Fig.6) shows the tampering in Three phase. The bottom image (Fig.7) shows the tampering of Single phase EB meters. The tapping here is performed by directly connecting the power lines from main to the Loads to the home.

## X. SIMULATION RESULT:

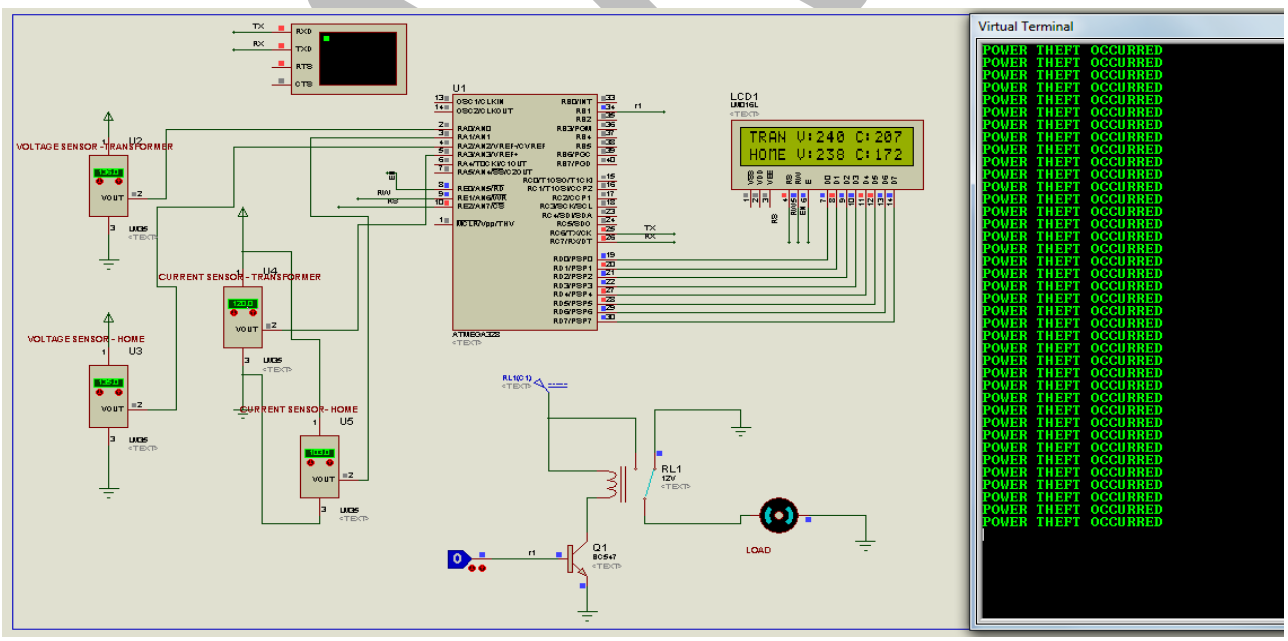


Fig.8. Simulation Result

The images explain the three phase and single phase tapping of the EB meters. The above image (Fig.6) shows the tampering in Three phase. The bottom image (Fig.7) shows the tampering of Single

phase EB meters. The tapping here is performed by directly connecting the power lines from main to the Loads to the home.

The output is visible in the LCD display circuit. The controller checks for the sensor values. As the controller detects the change in the source & load voltage and current, it displays the LCD as "CURRENT THEFT DET". And also the connection to the load is disconnected using the driver circuit

## IV.CONCLUSION:

The point of this exploration was to acquire change the current power frameworks of the nation by presenting another shrewd metering framework. For this reason, a GUI based shrewd vitality checking and controlling framework was proposed. The results talked about, and perceptions made in this exploration presumed that brilliant metering framework with IOT correspondence capacities will make the present power administration better and proficient from numerous points of view. This will empower the vitality providers to have the capacity to take fundamental activities against the offenders.

## References:

[1] D. Alahakoon, X. Yu, "Smart Electricity Meter Data Intelligence for Future Energy Systems: A Survey", IEEE Transactions on Industrial Informatics, vol. 12, No. 1, February 2016.
[2] Prabhu. R, Geetha. A, Vadivelan. P, Ilayabharathy. L, "Smart Energy Meter with GSM Technology and Self Thermal Printing Technology", IJETCSE, vol. 12, issue 1, pp. 58-66, December 2014.
[3] J. Jose, L. Mohan, Nijeesh U, T. C. Benny., "Smart Energy Meter", IJETT, vol. 22 No. 4, April 2015.
[4] Q. Sun, H Li, Z. Ma, C. Wang, J. Campillo, Q. Zhang, F. Wallin, J. Guo, "A Comprehensive Review of Smart Energy Meters in Intelligent Energy Networks", IEEE Internet of Things Journal, Vol. 3, No. 4, August 2016.
[5] B. Morvaj, L. Lugaric, S. Krajcar, "Demonstrating Smart Buildings and Smart Grid features in a Smart Energy City", IYEC, 3rd International Youth Confrence, July 2011.
[6] P. Mallet, P.-O. Grahstrom, P. Hallberg, G. Lorez and P. Mandatova, "Power to the people," IEEE Power & Energy Magazine, vol. 12, no. 2, pp. 51-64, 2014.
[7] V. C. Gungor, D. Sahin, T. Kocak, S. Ergut, C. Buccella,C. Cecati and G. P. Hancke A Survey on Smart Grid Potential Applications and Communication Requirements, IEEE Transactions on Industrial Informatics, Vol 9, No 1, Feb 2013
[8] V. C. Gungor, D. Sahin, T. Kocak, S. Ergut, C. Buccella,C. Cecati and G. P. Hancke, Smart Grid Technologies: Communication Technologies and Standards, IEEE Transactions on Industrial Informatics, Vol 7, No 4, Nov 2011
[9] J. Zhang, D. W. Gao and L. Lin, "Smart meters in smart grid: An overview", Proceedings of 2013 IEEE Green Technologies Conference, pp. 57-64, April 2013.

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