An Advanced Power Theft Identifier using LabVIEW

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ABSTRACT *- Power theft is at the centre of attraction all over the world but power theft in India has a significant effect on the Indian economy, as power theft is considerably high in our country. The present thesis, Microcontroller based power theft identifier, introduce the concept of preventing the illegal usage of the electrical power. The purpose of an electrical power theft detection system is to detect an unauthorized tapping on distribution lines where as the existing system is not able to identify the exact location of tapping. The proposed system actually finds out the electrical line on which the tapping occured. This is a real time system. Wireless data transmission and receiving technique is used. So an additional facility of wireless meter reading with the same technique and cost. This system is also able to detect the power failure and cable is neccessary fault. All these datas will be monitored using LabVIEW and also get stored in the database.*

Keywords – Laboratory Virtual Instrumentation Engineers Workbench (LabVIEW), Power Theft Identifier, Wireless data transmission and receiving technique.

I. INTRODUCTION

Electricity theft is very common problems in country were population is very high and use of electricity are ultimately tremendous. In India, every year there is very increasing number of electricity theft s across domestic electricity connection as well as industrial electricity supply which results in loss of electricity companies energy and because of which we are facing the frequent problems of load shading in urban as well as rural areas so as to overcome the need of electricity for whole state. Generation, transmission and distribution of electrical energy involve many operational losses. Whereas, losses implicated in generation can be technically defined, but transmission and distribution losses cannot be precisely quantified with the sending end information.

The system prevents the illegal usage of electricity. At this point of technological development the problem of illegal usage of electricity can be solved electronically without any human control. This research paper is aimed at developing a system which monitors and detects incidences of power theft, whether in the form of connecting load directly to the power line or bypassing the energy meter thereby paying less than what is consumed or by changing connection of lines. In this system current transformer are used, here one current transformer is placed in input side of the post line. Other current transformer is placed at the distribution points of the house lines.

Consumer has theft the energy in our premises in some place. It has identified and prevents our team effort. Hence we have invented the theft detector as “theft master”. The output of CT values is given as input to PIC microcontroller convert analog inputs to digital. Then PIC compares the input current and the same of output current. If compared result has any negative values then this particular post is detected as theft point. This compared value is transmitted to electricity board, this value display in LCD display.

Nilesh Mohite, Rinkuraj Ranaware , Prakash Kakade February 2016 that have been developed detection a of power theft in every houses and in industry for different methods of theft. Electrical energy is very important for everyday life and spine for the industry. Electricity is indiscipline to our daily life with increasing need of electricity the power theft is also increasing, power theft is a problem that continues to plague power sector across whole country the objective of this paper is to design such a system which will try to reduce the illegal use of electricity and also reduce the chances of theft. This project will automatically collect the reading and also detect the theft This model reduces manual manipulation work and try to achieves theft control[4].

Vrushali V.Jadhav Soniya S.Patil Rupali V.Rane Swati R.Wadje that has been developed a technology in on the raising slopes, we should also note the increasing immoral activities. With a technical view, Power Theft is a non –ignorable crime that is highly prevent, and at the same time it directly affected the economy of a nation. Electricity theft is a social evil, so it has to be completely eliminated. Power consumption and losses have to be closely monitored so that the generated power is utilized in a most efficient manner. The system prevents the illegal usage of electricity. At this point of technological development the problem of illegal usage of electricity can be solved electronically without any human control[5].

Isizoh A. N, Asogwa T.C, Okide S. O,Nwobodo H. N (September 2014)that has been developed the design and analysis of apower theft location system which alerts a Power company in the event of theft or attempted theft of electrical energy. The system utilizes an electro-optical sensor incorporated into an energy meter to detect when the meter cover is opened. This triggers a series of actions within the system which eventually lead to the sending of a message containing the meter number and address from which the tampering originates to a computer which will be located at the Power Company’s office. This paper discusses in detail the steps undergone in realizing the work including the design calculations, implementation and testing. The design was made with reliable and readily available components in the market. The system was tested and the operations were found satisfactory[2].

II. OVERVIEW OF EXISTING SYSTEM

In this proposed system GSM technology used to transmit the meter reading to the customer and government with the required cost. This process will be happen when needed that means if SMS is received from authorized server mobile transmission between customer and government. Then the energy theft controlled by IR sensor, Bypass detection. Also cut the power supply automatically as per request of authorized server mobile.

The project model reduces the manual manipulation work and theft. Use of GSM in our system provide the numerous advantages of wireless network systems. The metering IC ensure the accurate and reliable measurement of power consumed. Hence we are trying to manipulate cost wise low when compared to other energy meter without automatic meter reading and theft control.

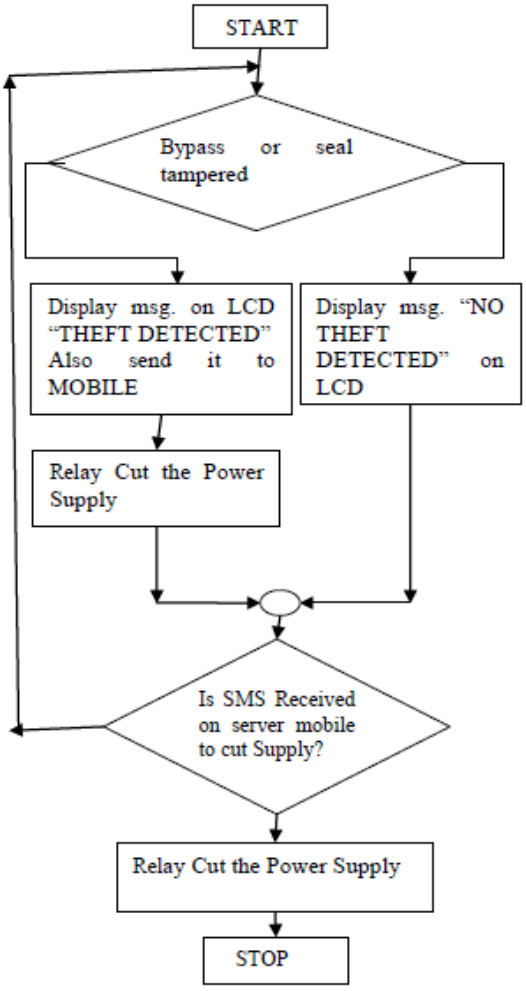

Figure 3.2 Flow Chart of Existing Method

III. PROPOSED SYSTEM- DETECTION OF POWER THEFT USING THEFT MASTER

The proposed system is useful for the electrical board and industries to find the power theft using theft master. Theft Master is nothing but a protocol that is designed with wireless network and special programming functions for identifying the power theft. These processes have three modules,

1. Consumer unit
2. Pole unit
3. EB office unit

The consumer units have two current transformers which are used to monitor the input and output current of energy meter. EB meter is used to measure the energy consumption by customer. When there is a problem this data (Both current value and energy value) is transmit to the pole unit with the help of ZIGBEE.

In pole unit the data received by ZIGBEE and give it to the PIC microcontroller, this PIC compare the consumer side Energy value with Master Meter value. If there is a difference means it considers it as a power theft and transmits this signal to the EB office through ZIGBEE. Here PT is used as a earth leakage voltage measurement. If there is any earth leakage voltage detection this information also sent to the EB office along with pole location. In EB office main unit have a ZIGBEE which is connected with PC. In PC we create a code

based on a LabVIEW, by using this is graphical monitoring is created by us with record update. The proposed system of the power theft detector has shown in fig 2.1, 2.2, 2.3.

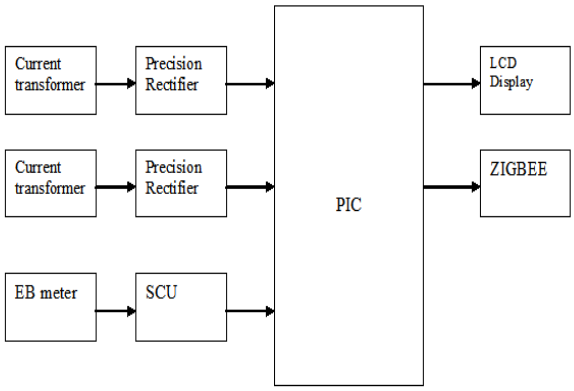

Figure 2.1 Proposed Block Diagram of theft master – Consumer Unit

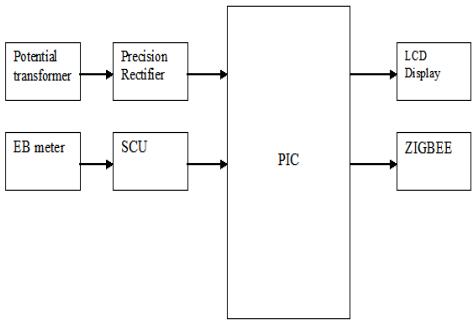

Figure 2.2 Proposed Block Diagram of theft master – Pole Unit

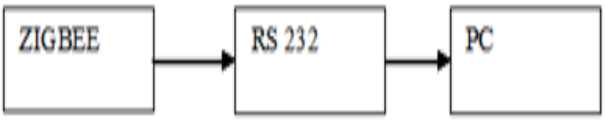

Figure 2.3 Proposed Block Diagram of theft master – EB Office Unit

IV. MODEL DESCRIPTION

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), current that flows in only one direction, a process known as rectification. Rectifiers have many uses including as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid state diodes, vacuum tube diodes, mercury arc valves, and other components. A device which performs the opposite function (converting DC to AC) is known as an inverter. When only one diode is used to rectify AC (by blocking the negative or positive portion of the waveform), the difference between the term diode and the term rectifier is merely one of usage, i.e., the term rectifier describes a diode that is being used to convert AC to DC. Almost all rectifiers comprise a number of diodes in a specific arrangement for more efficiently converting AC to DC than is possible with only one diode. Before the development of silicon semiconductor rectifiers, vacuum tube diodes and copper(I) oxide or selenium rectifier stacks were used.

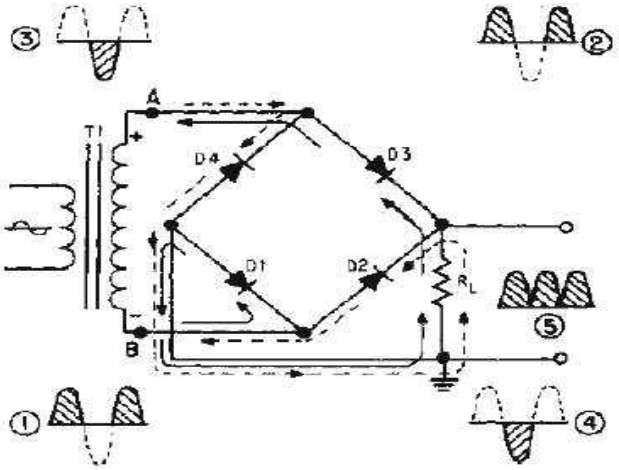

Figure 4.1 Bridge Rectifier

The L298- Dual Full- Bridge Driver is an integrated monolithic circuit in a 15- lead Multi watt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

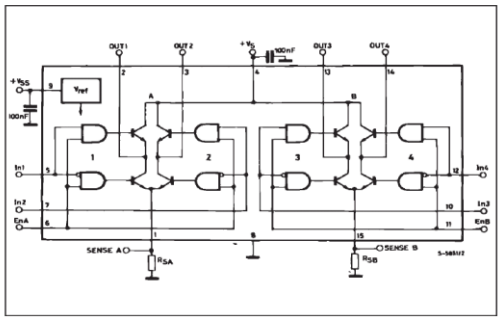

Figure 4.2 Block Diagram of Dual Full-Bridge Driver

The power supply should be of +5V, with maximum allowable transients of 10mv. To achieve a better / suitable contrast for the display, the voltage (VL) at pin 3 should be adjusted properly.

A module should not be inserted or removed from a live circuit. The ground terminal of the power supply must be isolated properly so that no voltage is induced in it. The module should be isolated from the other circuits, so that stray voltages are not induced, which could cause a flickering display.

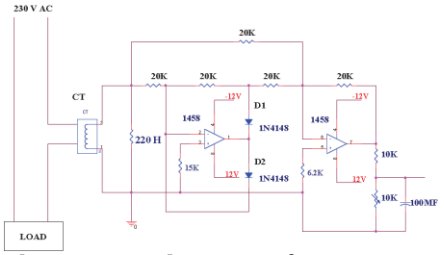

Figure 4.3 Schematic Explanation of Current Measurement

This circuit is designed to monitor the supply current. The supply current that has to monitor is step down by the current transformer. The step down current is converted by the voltage with the help of shunt resistor. Then the converted voltage is rectified by the precision rectifier. The precision rectifier is a configuration obtained with an operational amplifier in order to have a circuit behaving like an ideal diode or rectifier. The full wave rectifier is the combination of half wave precision rectifier and summing amplifier. When the input voltage is negative, there is a negative voltage on the diode, too, so it works like an open circuit, there is no current in the load and the output voltage is zero. When the input is positive, it is amplified by the operational amplifier and it turns the diode on. There is current in the load and, because of the feedback, the output voltage is equal to the input.

In this case, when the input is greater than zero, D2 is ON and D1 is OFF, so the output is zero. When the input is less than zero, D2 is OFF and D1 is ON, and the output is like the input with an amplification of $-R_2 / R_1$. The full-wave rectifier depends on the fact that both the half-wave rectifier and the summing amplifier are precision circuits. It operates by producing an inverted half-wave-rectified signal and then adding that signal at double amplitude to the original signal in the summing amplifier. The result is a reversal of the selected polarity of the input signal.Then the output of the rectified voltage is adjusted to 0-5v with the help of variable resistor VR1. Then given to ripples are filtered by the C1 capacitor. After the filtration the corresponding DC voltage is given to ADC or other related circuit.

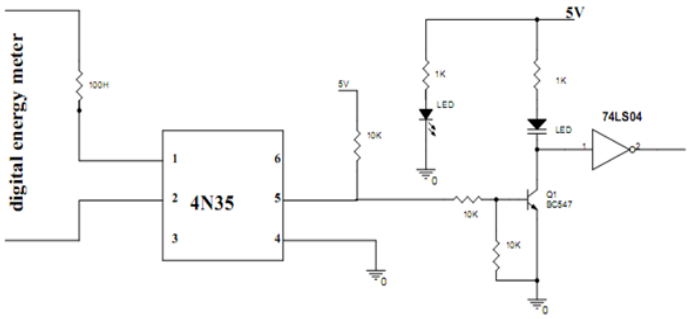

Figure 4.4 Schematic Diagram of digital energy meter

This circuit relates to measure the energy consumption through Digital energy meter. Here we are taken the output from digital energy meter and given to the 4N35 opto-coupler IC input. The opto-coupler is nothing but an isolation circuit. That is AC Line Digital logic isolator, which useful in AC line detection over short circuit prevention. 4N37 (short) consists of a gallium arsenide infrared emitting diode coupled with a silicon phototransistor in a dual in−line package. In that IC output will be always low. When input comes from energy meter gives logic high as output. If this IC output is low means the output of BC547 is High, so the LED behind that operation is in Off condition also the input given to controller also low. When the output of 4N37 is high means the output of BC547 is Low, so the LED behind that operation is in On condition also the input given to controller also high. Like this whenever the input comes from digital energy meter, the LED on board will glow, also the input to controller is changing their logic from high to low. Otherwise the output of circuit remains high condition. The output logic is inverted through 74LS04 which is placed on the circuit at final point. So through the logic changes we can measure the unit of consumption.

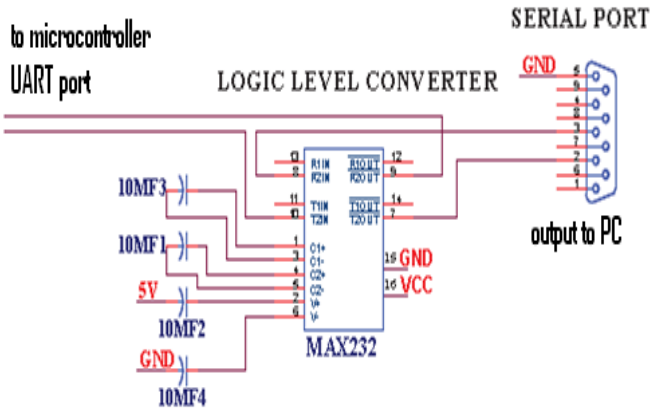

Figure 4.5 Schematic Diagram of RS232 Communication

In communications, **RS-232** is a standard for serial binary data interconnection between a *DTE* (Data terminal equipment) and a *DCE* (Data Circuit-terminating Equipment).

Function Tables

EACH DRIVER

INPUT TIN	OUTPUT TOUT
L	H
H	L

H = high level, L = low level

EACH RECEIVER

INPUT RIN	OUTPUT ROUT
L	H
H	L

H = high level, L = low level

Figure 4.6 Schematic Diagram of MAX 232 IC

V. RESULT AND DISCUSSION

Nowadays, energy distribution/consumption has become a big subject for discussion because of huge energy theft. Theft in this case refers to a deliberate attempt to steal considerable amount of energy by ensuring no/low energy recording in the metering device. Hence, there is a need to think in this line and proffer a solution to this ugly trend.

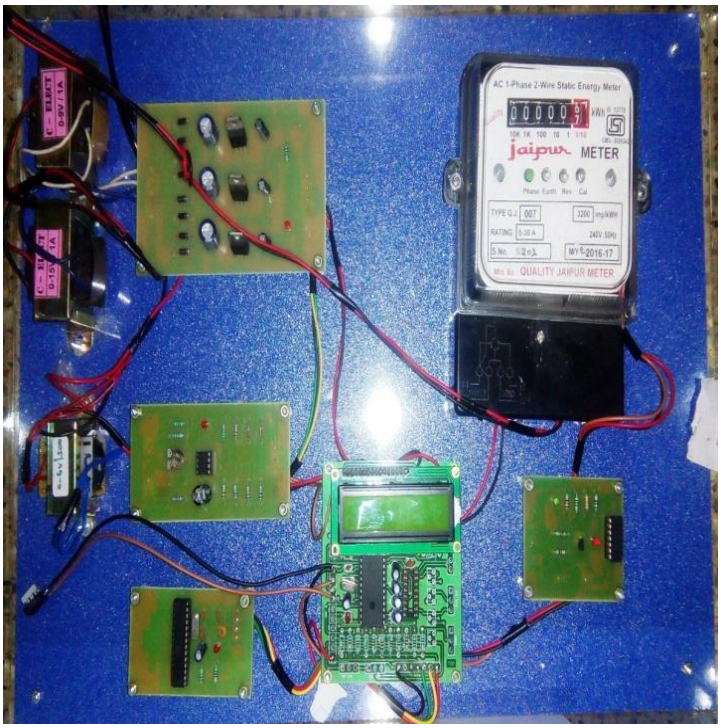

Figure 4.7 Master Unit

Figure 4.8 Pole Unit

Figure 4.9 EB Office Unit

Hardware Requirements:

- Scientific instruments and Data acquisition devices
- Sensors and Cameras
- Motors and actuators
- Familiar programming model for all hardware devices
- Portable code that supports several deployment target
- Processor : Pentium IV
- Speed : 2.5 GHz
- RAM : 1 GB RAM
- Hard Disk Drives : 40 GB
- Monitor \ LAPTOP : 15” Color Monitor

Software Description:

Lab VIEW 12V is a highly productive development environment for creating custom applications that interact with real-world data or signals in fields such as science and engineering. The net result of using a tool such as LabVIEW is that higher quality projects can be completed in less time with fewer people involved. So productivity is the key benefit, but that is a broad and general statement.

To understand what this really means, consider the reasons that have attracted engineers and scientists to the product since 1986. At the end of the day, engineers and scientists have a job to do – they have to get something done, they have to show the results of what they did, and they need tools that help them do that. Across different industries, the tools and components they need to succeed vary widely, and it can be a daunting challenge to find and use all these disparate items together.

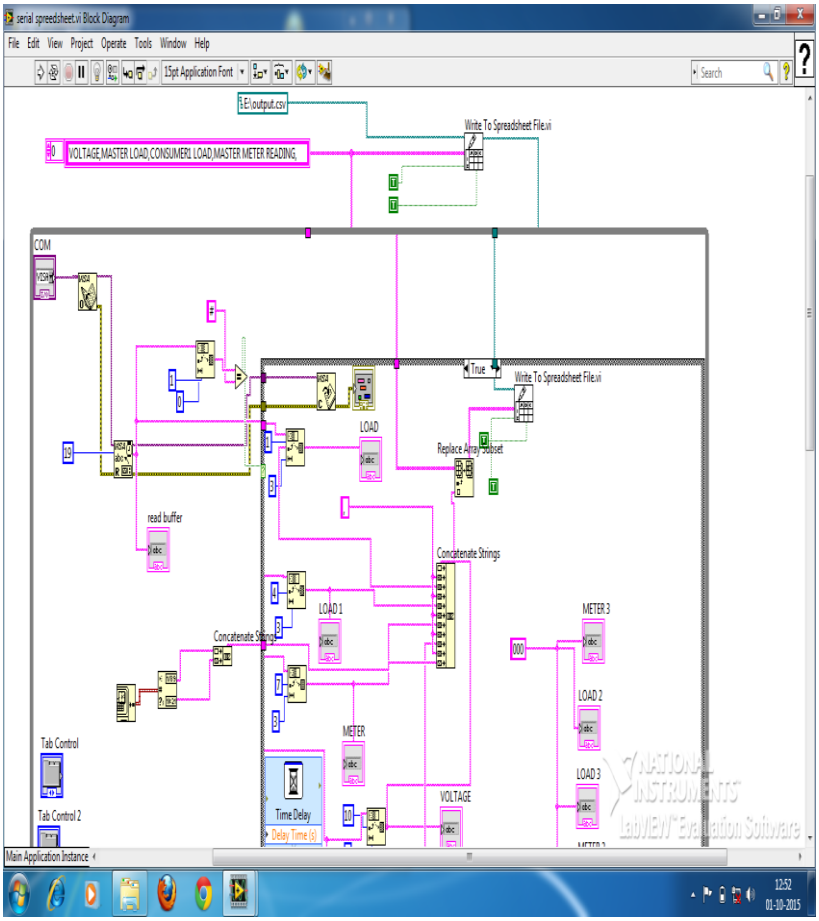

Figure 4.10 LabVIEW System coding

TABLE 1: SPECIFICATION

INPUT VOLTAGE	220- 240V
OUTPUT VOLTAGE	230V/9 V
SWITCH	DPDT
LOAD	400 WATTS
FREQUENCY	50 HZ

The system consists of three devices, one is placed in transformer section (main device), other device is placed in the domestic area (house) and last one is used to monitor the data which is placed in the control room. The household device displays the values of sub meter, input voltage and also displays the power failure, cable fault indication and sends these values to main device. The main device contains load values and main meter values and transmits these values in addition to the household device values to the control room. In the control room all the received data is monitored through lab view and also get stored in the database.

Figure 4.11 LabVIEW Screen- Normal load used by the customer

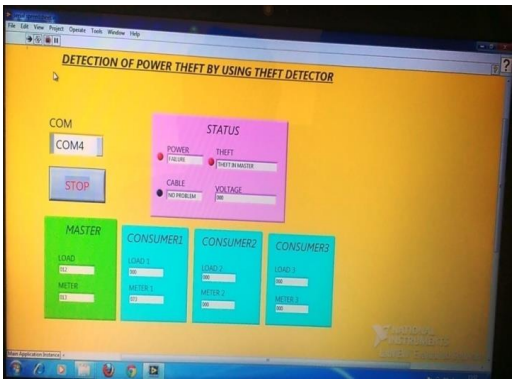

Figure 4.12 LabVIEW Screen- When power failure occurs

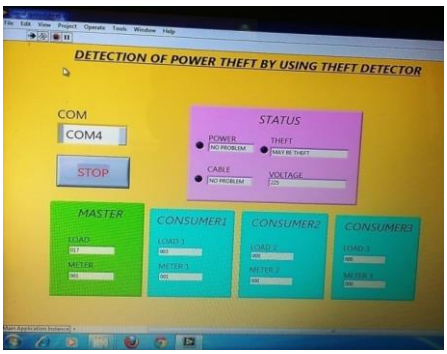

Figure: LabVIEW Screen- Showing that there may be theft.

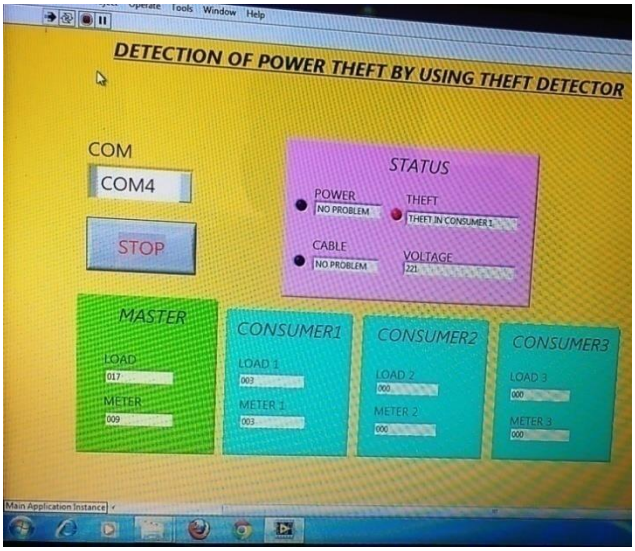

Figure 4.13 LabVIEW Screen- Confirmation of power theft.

The datas recorded by various units of the proposed system can be viewed in an Excel format for future reference.

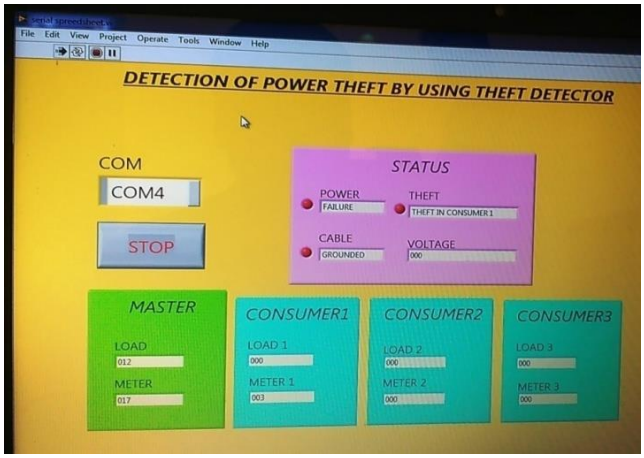

Figure 4.14 LabVIEW Screen- indicating Power failure and Ground condition.

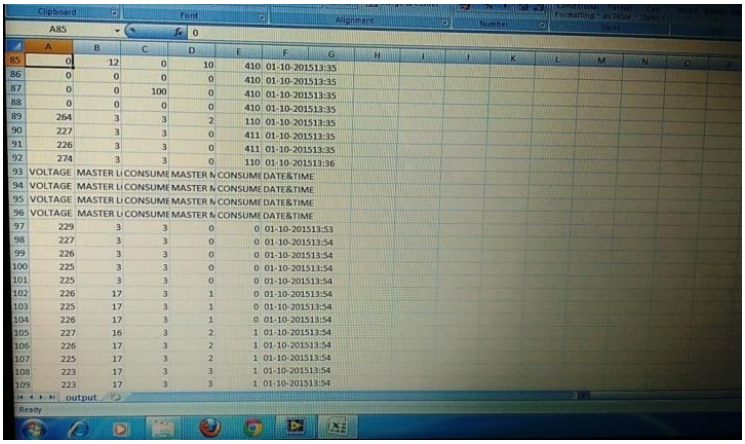

Figure 4.15 History of the database in Excel Sheet

VI. CONCLUSION & FUTURE SCOPE

The progress in technology about electrical distribution network is a non-stop process. New things and new technology are being invented. The proposed system found to be little bit complex as far as distribution network is concerned, but it's an automated system of theft detection. It saves time as well as help to maximize profit margin for utility company working in electrical distribution network.

In the proposed system, the principle of detecting power theft is based on the concept of power theft master. With such a system implemented in real, the need for regular vigilance can be avoided and power can be supplied at the economical rate, thereby improving the economy of a country.

In future, this project can be implemented and validated in remote areas. Future enhancements can be incorporated to suit the system for three phase electric distribution system in India. Along with all this new architectural components can be incorporated, so that the system can be completely used for optimizing the energy consumption. This method will reduce the energy wastage and save a lot of energy for future use. Instead of using wireless data transmission technique, one can use power line communication. In power line communication data signal is modulated on power signal and sent it through a same electrical distribution network. This will reduce the cost for separate communication line.

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