Electricity Theft: Reason and Solution

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Abstract- *With the electric industry undergoing change, increased attention is being focused on power supply reliability and power quality. Power providers and users alike are concerned about reliable power, whether the focus is on interruptions and disturbances or extended outages. Monitoring can provide information about power flow and demand and help to identify the cause of power system disturbances. The proposal in this paper is to monitor the power consumed by a model organization such a household -consumers from a centrally located point. Monitoring the power means calculating the power consumed exactly by the user at a given time.*

The power consumed by the user is measured and communicated to the controlling substation whenever needed by the person at the substation. The feedback from the user helps in identifying usages between authorized and unauthorized users which helps in controlling the power theft, one of the major challenges in current scenarios. Communication between user/household and substation can be of wired and wireless. This project 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.

Key Words: ATmega 328 Microcontroller, Electricity theft, Electric pole, Relay, Current sensor, Hooking detection.

1.INTRODUCTION

In 2008 the number of devices on the internet exceeded the number of people on the internet. It is estimated in 2020 there would be over 50 billion devices connected. Sensors and microprocessors are recording and transmitting data to the Internet. Rapidly increasing Internet-connected sensors means that new classes of technical capabilities and applications are being created. Constant monitoring is deepening the understanding of the internal and external worlds encountered by humans. Arduino is an open source tool for developing computers that can sense and control more of the physical world than desktop computer. It is an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. The software is written in C or C++ programming language. The Arduino development board is an implementation of wiring, a similar physical computing platform, which is based on the processing multimedia programming environment. (Arduino 2011a.)This single chip microcontroller has a microprocessor, which comes from a company called Atmel. The chip is known as an AVR. The AVR chip is running at only 16 MHz with an 8-bit core, and has a very limited amount of available memory, with 32 kilobytes of storage and 2 kilobytes of random access memory.

2. LITERATURE SURVEY

Author A.H. Nizar in 2004 has given the Vigilant Energy Metering System (VEMs) which is an energy management system that can fight Electricity Theft.

Author J. W. Fourie, and J. E. Calmeyer in 2016 has described the Illegal consumption of electricity can be detected by using a remote check meter based on the amount of losses and time stamp of the check meter.

Author dChun-Lien Su, Wei-Hung Lee Chao-Kai Wen in 2008 has described a methodology based on distribution state estimation to detect customer tampered data.

3. Project Description

3.1 Current Sensor

The Wilson WCS2720 has precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. Typical load detection and management, switch mode power supplies, and over current fault protection. The device is not intended for automotive applications. The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging.

3.2 Microcontroller

Here we use ATMEGA328P-PU this is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. This ATMEGA328P-PU has rich instruction set with 32 general purpose working register .It has 23 Programmable I/O.Pin 0 and 1 is connected to the transmitter and the receiver of PLC module Pin no 2,3,5 of is connected to the Pin no 11,12,13,14 of PLC module respectively ,Pin no 7 ATMEGA is connected timer 555 so that it can take count read by the meter and display on the LCD. These controller units are the heart units in respective circuits. Both the controllers has built in ADC channels which are used to check the current rating.

3.3 Voltage Regulator

As we require a 5V we need LM7805 Voltage Regulator IC.

 7805 IC Rating:

• Input voltage range 7V- 35V

 • Current rating Ic = 1A

 • Output voltage range V_{max}=5.2V ,V_{min}=4.8V

4.WORKING PRINCIPLE

The project demonstrated here is to show the mechanism of electricity anti-theft system. A pack of parallel connected bulbs is used as load while the programmable circuit operating the supply controlling relay is based on Arduino. The principle used behind detecting overloading is voltage comparison.

The project has the following execution cycle:

1) The project will be connected at the primary coil of an additional transformer which will have its secondary coil connected between the main line and loads while the loads (a pack of bulbs is used as load in the demonstration) will be connected to the main line via relay interfaced to main line through secondary coil of the additional transformer. This additional transformer shall work like a voltage sensor in the circuit.

2) The Arduino based circuit will show the status of the main line as overloaded or not on an LCD display. The LCD display section is however optional and added for testing and demonstration purpose only.

3) When system detects over load condition which will be transferred as a HIGH signal to the voltage comparator interfaced pin of Arduino, the board will output signals to trigger the relay circuit.

4) The relay will cut off the power supply from the main line and the whole system will get shut down.

5) After a shut down the system will wait for conditions to normalize and will resume the power supply as unauthorized loads are detached and relevant voltage is detected at the primary of transformer-based sensor circuit.
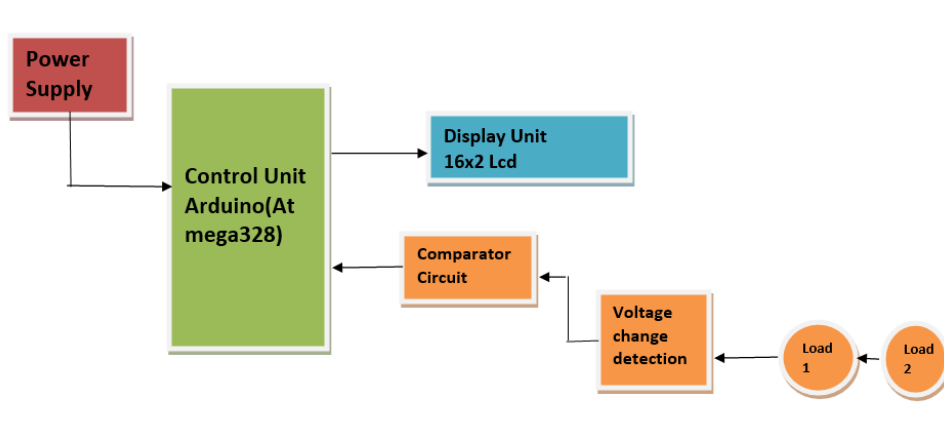

Fig-1: Block Diagram of electricity theft detection system

5. THEFT DETECTION METHOD

The simple formula behind theft detection is whenever input power is passing from supplier to the receiver, at that time if the total amount of power is not received by the receiver, then there is possibility of theft of energy.

ΣPsent = ΣPconsumed + Loss ....No Theft

ΣPsent $\neq$ ΣPconsumed + Loss ....Theft Occur

Here, Psent = Power measured by pole side energy meter

Pconsumed = Power measured by load side energy meter

6. RESULT

The successful development of the prototype hardware has been done and correctly tested for the purpose it is being implemented. When there is energy theft by hooking it inform the concern authority about the theft with amount of energy consumed in terms of watts.
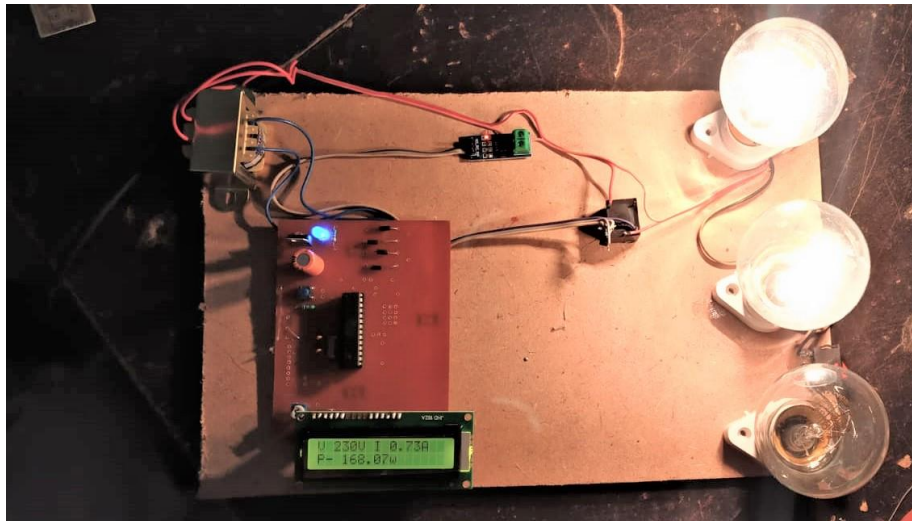

Fig-2: Working Model

7. CONCLUSION

This paper defines electricity theft in social, economical, regional, political, infrastructural, literacy, criminal and corruption points of view. This paper illustrates various cases, issues and setbacks in the design, development, deployment, operation, and maintenance of electricity theft controlling devices. In addition, various factors that influence people to steal electricity are discussed. This paper illustrates the effect of NTL on quality of supply, burden on the generating station and tariff imposed on genuine customer. 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. Utility company can keep a constant eye on its costumer. The project model reduces the manual manipulation work and theft .The government saves money by the control of theft in energy meter and also more beneficial for customer side and the government side. The metering IC ensures the accurate and reliable measurement of power consumed. Cost wise low when compared to other energy meter without automatic meter reading and theft control. The project better suits for displaying information in long distances, and the information can be sent, alter any time according to user requirement.

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