CONTROLLING OF POWER THEFT AND REVENUE LOSSES BY USING WIRELESS TECHNIQUES

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Abstract— In these days, generation of electricity is not met up to the need of men. There is large number of power thefts from domestic and industrial supply lines. This Paper is to limit such thefts, by letting the Monitoring and Control Room to know the theft and also the location of theft. Monitoring and   Control   Room is kept known about the situation of the system at every instant. This wireless system is used to overcome the theft of electricity via bypassing the energy meter and hence it also controls the revenue losses and utility of the electricity authorised agency. There is always a contract between the consumer and the supplier that the consumer will pay for the electricity consumed by him. But in India near about 32 % of the electricity is consumed but not paid for it i.e. it is being stolen by the consumer hence the need of a system arises that would overcome this theft of electricity but mostly the electricity is being stolen via bypassing the energy meter hence this system recognizes such type of theft of electricity. 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. The implementation of this system will save large amount of electricity, and there by electricity will be available for more number of consumers then earlier, in highly populated country such as INDIA.

Keywords— G.S.M, Zigbee, PIC-Microcontroller, PC, Digital Energy Meter,Power Theft, Power Monitoring.

INTRODUCTION

The theft of the electricity is the major concern of the transmission and distribution losses in the supply of the electricity [2] worldwide. Mainly the electricity is being stolen via bypassing the energy meter therefore this wireless system utilizes to overcome this type of the theft of the electricity and is very beneficial for the authorised agency to control its revenue loss as all of us know that the cost of fuel is increasing day by day hence the intensity of stealing the electricity and using it as a substitute is also increasing therefore it is needed much to design a system that can detect the theft of the electricity [4].

There are two types of techniques to deliver the information to the authorised agency to control the theft of the electricity via bypassing the energy meter [12].

a. Wired techniques-

1. Electrical cables 2.Coaxial cable 3.Optical fibres

b. Wireless techniques-

1. ZIGBEE technology 2.GSM technique 3.WI-FI 4.Wi-max, Infrared rays 5. Bluetooth

Here this system utilizes the technique named zigbee, G.S.M., because all the problems are associated with the wired techniques. There are a lot of problems related with the wired techniques such as installation problem, complexity and cost also matters in the case of long haul. The main problem associated is about the rural areas where it's really very much difficult to install the wired system to convey the information. Wired networks require lot of setup and maintenance cost.

In this paper we implemented using zigbee technology because of its effective communication, self-healing networks, low power Consumption, zero traffic and we selected other communication network to be GSM to send SMS to authorities in case of theft, because GSM has a built in transport layer encryption, which is supported by most network providers. GPRS offers a number of security enhancements over existing GSM security. The standards themselves also offer technical features, which a network operator may choose to use. Aside of that, a different form of security might be desired in addition to the provided transport layer security.

II. FACTORS THAT INFLUENCE ILLEGAL CONSUMERS

There are many factors that encourage people to steal electricity, of which socio- economic factors influence to a great extent in stealing electricity. A common notion in many people is that, it is dishonest to steal something from their neighbour but not from the state or public owned utility company [9].
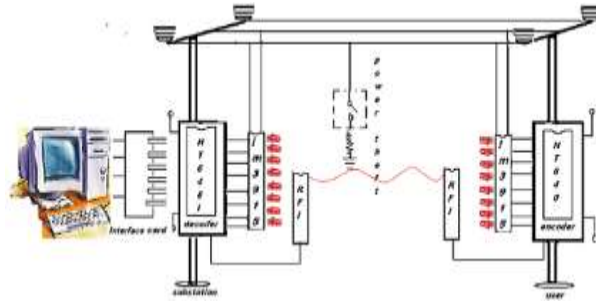
"Fig 1: Block Diagram of Power Theft Detection System"

In addition, other factors that influence illegal consumers are:
Higher energy prices deject consumers from buying electricity. In light of this, rich and highly educated communities also steal electricity to escape from huge utility bills. Growing unemployment rate show severe lower illiteracy rate in under developed communities has greater impact on illegal consumers, as they might not beware of the issues, laws and offenses related to the theft. Weak economic situation in many countries has implied its effect directly on common man [10]. In view of socio economic conditions of the customer electricity theft is proportional to the tariff of electricity utilization. Countries with weak enforcement of law against electricity theft have recorded high proportion of theft. Corrupt political leaders and employees of the utility company are responsible for billing irregularities.
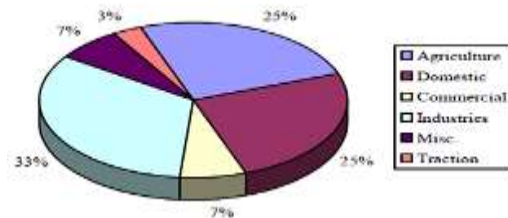
"Fig 2: Electricity consumption in different sectors in India"

III. METHODS OF POWER THEFT
Methods used to commit theft fall into the e following broad categories:
i. Connection of supply without a meter following disconnection for non-payment or by "squatters" occupying empty properties.
ii. By passing the meter with a cable. It coveted into the supply side of the metering installation (i.e. the meter terminals, the metering cables, the cut-out or the service cable).
iii. Interfering with the meter to slow or stop the disc, including use of electrical devices which stop the meter or cause it to reverse (so-called 'black boxes)**.**
iv. Interfering with the timing control Equipment used for two rate tariffs to obtain a cheaper rate. Methods (iii) and (iv) usually involve removal of official (certification) seals and/or company seals. There effect on the customer's economic situation [8]-[10].

IV. POWER MONITORING SYSTEMS
Consider a distribution system shown in conceptual diagram. Two single phase loads L1 and L2 are supplied from two different phases. M1 and M2 are the energy meters that measure power consumed by these loads over a period. Pole based system (P) have been installed to detect power theft [7]. There are three different types of systems to monitor power sent.
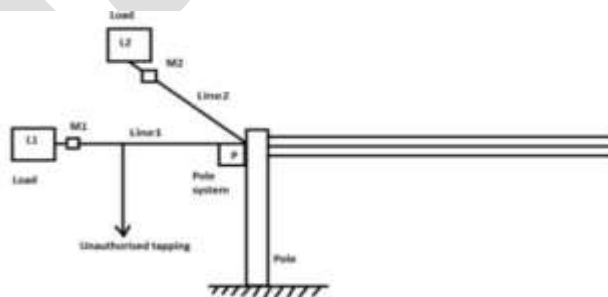
"Fig 3: Conceptual diagram L1, L2 Single phase loads M1, M2 Digital energy meter"

.i. Pole based system: It consists of Wireless data receiver, Micro-controller, Digital energy meter. Digital energy meter will measure power sent over each line for a certain time period.

ii. Pole Side Energy Meter: One energy meter is installed in a pole based system. This meter is capable to measure a power sent over each line connected to that pole

iii. Load Side Energy Meter (M1, M2):
Meter is installed on load side to measure a power consumed by load over a time. Also it has an additional feature of transmitting that data to receiver using wireless technique ZIGBEE network.

iv. Power theft detection: Suppose there is tapping done by any unauthorized person on the line to connect his appliance. Over a certain period there will be difference between meter reading and pole based reading.

V. PROPOSED SYSTEM BLOCK DIAGRAM:
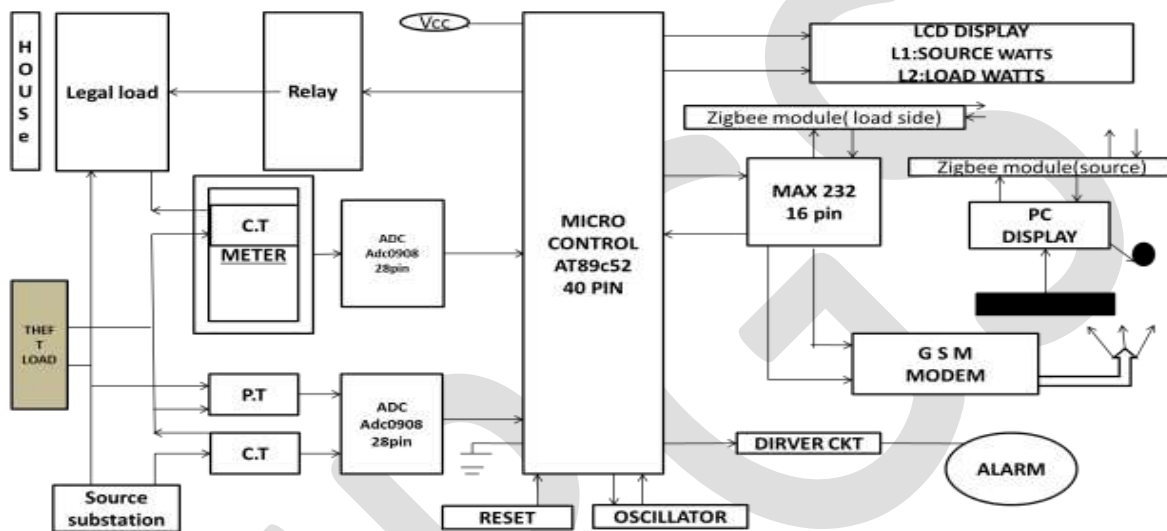
"Fig 4: Block Diagram of Proposed System"

Microcontroller: - This is the main control section. It processes all the input data, take decision and operate proper relays to control the switching.

User Interface: - This unit provides the facility to user to change certain parameter like max current, unit id, no of max load etc.

Display driver and LCD display: - The display driver is used to control the LCD display. LCD display is interfaced with controller through display driver which is used to show the different parameters.

Buzzer driver and buzzer: - The buzzer is used to generate different warning tones. Buzzer driver is used to drive the buzzer.

Voltage Transformers: The voltage transformer is one in which "the secondary voltage is substantially proportional to the primary voltage and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections..

Current Transformers: A current transformer is defined as "as an instrument transformer in which the secondary current
is substantially proportional to the primary current (under normal conditions of operation) and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections. **Signal Control Unit: -** This unit converts analog signal to digital signal. The analog signal of C.T, P.T gets converted into digital signal through signal control unit which gives input to the microcontroller digital signal.

G.S.M Modem:-
The active signal of max 232 sends to GSM (Global Service Mobile) and this signal is send to the number which is set in the program in the form of S.M.S (Short Message Service).

VI. IMPLEMENTATION OF PROPOSED SYSTEM
We can detect power theft wirelessly. Illegal usage of electricity can be solved electronically without any human control, using Radio frequency (RF) Technology. Electric Power is transforming from transmitter to the receiver at that time if load is apply in between transmission of power and if difference is find between the transforming and receiving power then there is stealing of power from unauthorized person. i.e., whenever energy 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.

A. Automatic Meter Reading To Use Prepaid Energy Meter System
Now a day utility company personnel goes at every house to take the readings of meters for billing purpose. It will create problem when consumer is out of Town or home is locked due to other reasons. This system of wireless meter reading is based on the same principle of wireless data transmission that is used in power theft detection [5]-[6] Utility company personnel will have a device consists of wireless data receiver with microcontroller and display.
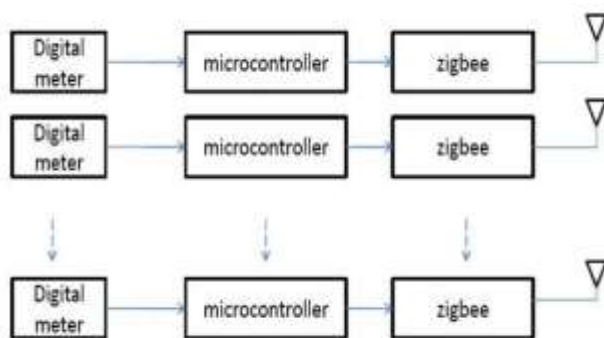
"Fig 5: Block Diagram of Base Station Unit"

The Base station unit will consists of a zigbee module attached with a Transceiver micro-strip antenna and a microcontroller attached to digital meter. The frequency of communication will be in 900 MHZ. the data will transmitted to the central station at regular intervals. The end station consists of an ARM micro controller receiving data from different PIC micro controllers through Zigbee receiver. The data thus received is processed and calculated the exact amount of power consumed by specific customer [1].

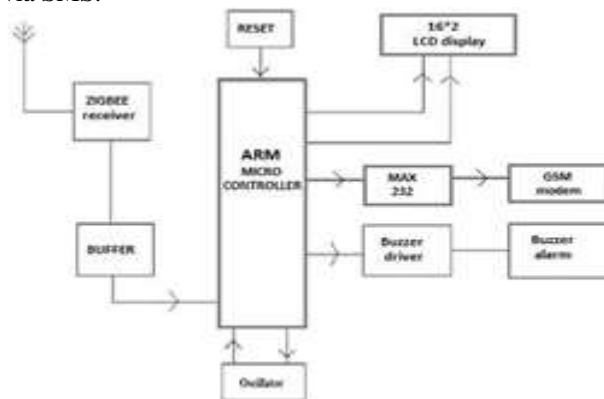**B.Zigbee Module Used To Receive And Send Data With Long Distance**
In this paper we implemented using Zigbee technology because of its effective communication, self-healing networks, low power consumption, zero traffic and they can handle over 60000 devices and more over Zigbee communication installation require no special permissions in most of the places. It uses unlicensed 2.4 GHz ISM band which is available worldwide. ZIGBEE has range between 10 m to 2 km and it works well with networks such as Wi-Fi [12].

It consists of Load, current transformer, voltage transformer, PIC micro controller, and a Differential Relay. The household load [3] supplied is connected in series to the AC supply mains through a switch which is operated by the action of a relay. Current transformer is used to measure the current required for the user and the voltage transformer is used to measure the voltage of operation for the user. The measured values are given to the PIC micro controller which has inbuilt ADC with RISC architecture to convert the analog values to the digital values. These values are stored in microcontroller registers and the information is transmitted to the receiver, whenever there is a request for the data from the remote controlling station. Oscillator is provided to the microcontroller for the clock signal and the reference voltage is given for the each of the IC used.

The receiver part of this prototype consists of an ARM micro controller, Zigbee receiver LCD display and alarm to pop out theft case, and also an external GSM modem to inform theft case to authorities via SMS.
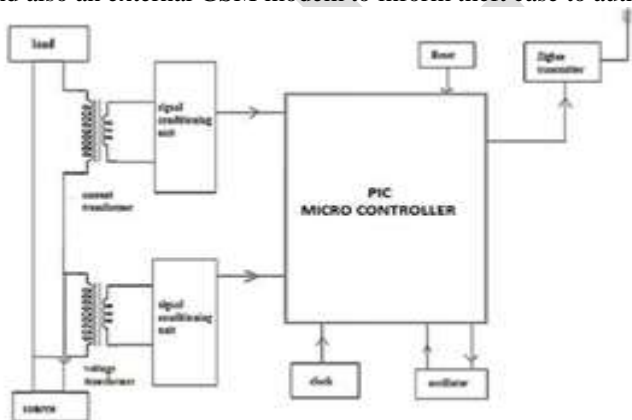
"Fig 6: Transmitter Block Diagram"   "Fig 7: Receiving Block Diagram"

C. To Use Arm Type Micro-Control Advanced Version of Pic Micro control
i.8051, PIC and AVR have Harvard architecture (separate memory spaces for RAM and program memory). ARM has von Neumann architecture (program and RAM in the same space).

ii. ARM has a 16 and/or 32 bit architecture. The others are byte (8-bit) architecture.

iii. 8051 and PIC have limited stack space - limited to 128 bytes for the 8051, and as little as 8 words or less for PIC. Writing a C compiler for these architectures must have been challenging, and compiler choice is limited.

iv.8051, AVR and ARM can directly address all available RAM. PIC can only directly address 256 bytes and must use bank switching to extend it, though using a C compiler conceals this. You still pay a speed penalty though.

v. 8051 and PIC need multiple clock cycles per instruction. AVR and ARM execute most instructions in a single clock cycle.

vi. 8051 and AVR are sufficiently similar that an AVR can usually replace an 8051 in existing products with practically no hardware change. Some AVRs are made with 8051 pin outs to drop right in. The Reset polarity is the main difference.

CONCLUSION

  In this prolonged discussion it clearly explains the impact of electricity theft in day to day life and how this illegal activity affects the country's economic growth. Overall scenario provides the working nature of the existing system and also the proposed idea. In the traditional electrical system, countries like India, no more monitoring system for supervise the distribution line and individual consumer. The proposed architecture describes the smart system that automatically updates the usage level and also figure out the hot need of the energy conservation in the high demand time. Population burst and severe economic degrade leads to the illegal activity like electricity theft. This updated phenomenon gives the solution to the energy theft. Every year due to electricity theft hundreds of crore of money have lost in India. To avoid such inconvenient and unwanted situation so many operations have been done in the past era. This proposed idea has somewhat polished and advanced technique compare to the previous techniques. SMS alert is one of the latest trends that it reduces the processing time and very much useful to save the energy for the future need.

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