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## A Review On Energy Pilfer Age And It's Control Techniques

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**Abstract:** Power line communication (PLC) presents a good model for communication through conventional wires from automatic meter reading (AMR) in data generating end to data collection end. This review paper represents a economical and feasible analysis of detection of power pilferage from transmission lines and controlling the same using Internet of things (IoT). This review model presents a assured promise against vandalism and for non- vulnerability of data with collection of instant and accurate value of data. Various analyses on methods of detection of exact location of power capacity provide improved achievement result of the proposed goal of prevention of power pilferage.

**Index terms-** Power pilferage, PLC, AMR, ZigBee, Global System for Mobile Communications (GSM), wireless sensornetwork (WSN), IoT.

### I. INTRODUCTION

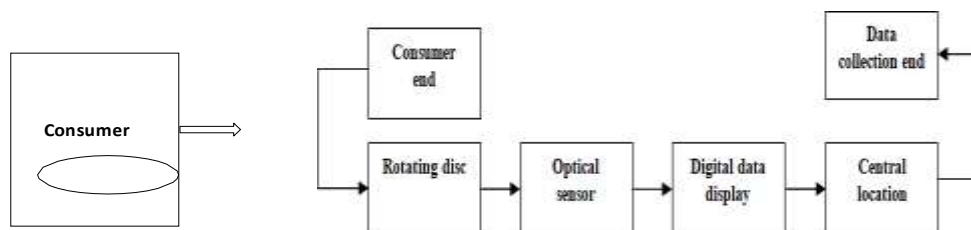
INDIA, one of the largest developing democracy in the world with an estimated population of about

1.06 billion, is on the way for tremendous rapid growth in economy. Power is the one of the major key economical factor to decide country's development. Power generation by itself for meeting demands of own is a major challenging issue. Power rapacity is a non ignorable crime that is a major issue and at the same time, it directly affects the economy of nation. Power theft detection and control is the need of the hour than power. The theft of electricity is a punishable act and power utilities are losing billions of rupees in this account. If an Automatic Meter Reading system via Power line Communication is set in a power delivery system, with a detection system for recording consumption of payable amount of power, which is thieved, power can be saved .periodical monitoring of the power system is required for prevention of illegal electricity usage. Power line communications (PLC) has many new service possibilities on the data transferring via power lines without use of extra cables. Automatic Meter Reading (AMR) is a very important application in these possibilities due to every user connected each other via modems, using power lines. Our review is to design to identify power theft and report it to Electricity Board and store the data constantly forever. Automation has made the art of living, comfortable and easy. Embedded systems had made this automation more efficient. This paper consist of eight sections including introduction. Section II discusses existing metering sytem, Section III

discusses about methods of energy pilferage, Section IV gives about AMR, Section V Plc , Section VI Detection methods and Section VII about acquisition and storage of data and Section VIII Futre scope and conclusion.\

## II. EXISTING SYSTEM

The existing system has energy meter placed in each household for calculation of power consumed. Energy meter is a device which calculates energy units consumed by the consumer. Energy units are basically calculation of power consumed over a time period of connected loads. Energy meters measure the voltage and currents, calculate their product and give instantaneous power. This power is integrated over a time interval, which gives the energy utilized over that time period, for which fixed the units consumed. The units consumed is manually verified in person by worker of electricity board, he takes the reading carries to the billing and data collection cost per unit is allocated and consumers pay for centre, everything is done by man power, which caused errors, financial loss as power is the need of hour for economic growth of the country. Mainly errors in carry forward of data occurs, secondly theft of power happens, which goes unidentified. The pilferage of power is very prone in existing meter by various methods technically and lay-man methods [1]. This existing method can be improvised for detection and controlling of pilferage of energy and increases the accuracy of each consumer's consumed detail. Fig (1) shows existing system which is used in daily basis. customers the option to analyze their energyusage data.



**Fig 1 Existing model for existing meteringsystem**

## III. METHODS OF ENERGY PILFERAGE

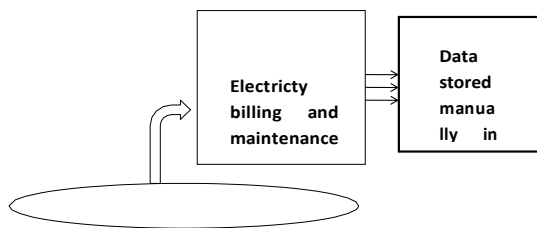
In illegal usage a subscriber illegally use electricity in the following ways [2],

- 1) Using direct hooking : Tapping from direct power line before it reaches the meter box.
- 2) Using a fixed magnet: A subscriber can use a fixed magnet to change the electromagnetic field of the current coils.
- 3) Changing terminals: This method givessubscribers free energy without any record.

- 4) Switching the energy cables at the meter connector box: In this way, the current does not pass through the current coil of the meter, so the meter does not record the energy consumption.
5. Tampering: Damages the EM meter and causing physical damage. Therefore, this problem should be resolved by electronics and control techniques.

#### IV. AUTOMATIC METER READING (AMR)

Automatic Meter Reading (AMR) lets you automatically collect consumption, diagnostic and status data from your electric devices and then transfer that data to a central database for billing and analysis [3]. Consumption (usage) information can be transmitted from an AMR device directly to the energy supplier, meaning manual meter readings are generally no longer required. Interfacings can also be developed with following block [4]. Fig (2) represents how digital data is been converted from analog data. The collection of this data ensures more accurate bills, and gives



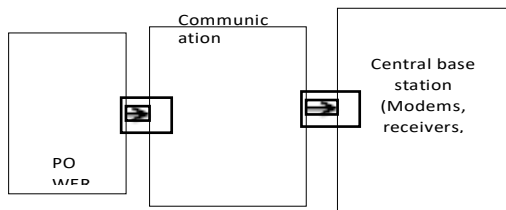
**Fig 2 AMR -digital data conversion**

Faced with mounting pressure to reduce operating expenses and increase profitability, many utilities are looking to automated meter reading (AMR) systems to help maximize the distribution and consumption of some of the world's most valuable resources. AMR allows the automatic collection of data. The measurement and collection system is commonly referred to as advanced metering infrastructure (AMI). The traditional utility meter displays energy usage as an accumulation of counts (KWH) presented to a display, which is used to calculate the monthly bill [5-6]. Automatic meter reading systems consist of three primary components. Fig 3 represents AMR block diagram. The components are:

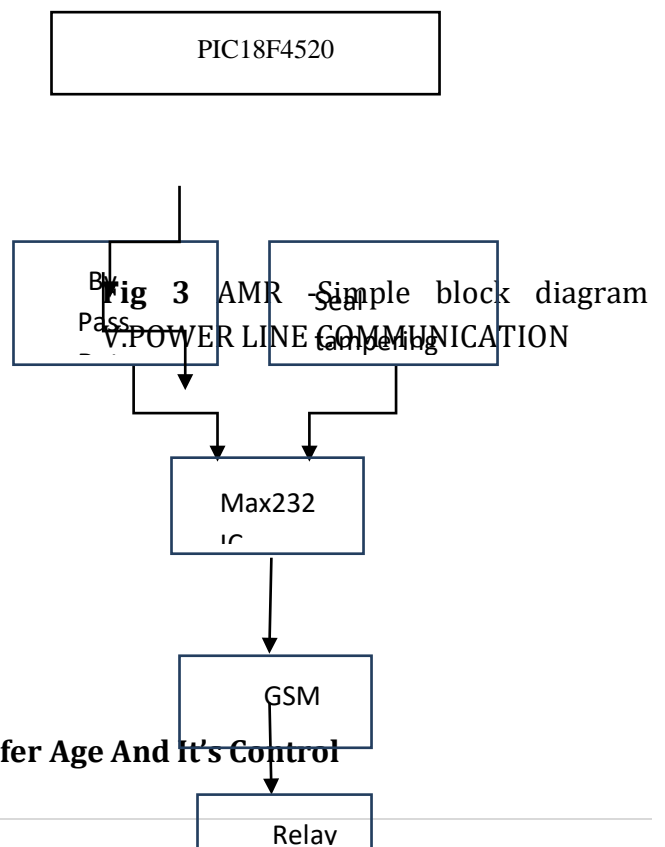
1. Meter interface module: This metering consists of meter interface module with power supply, battery backup, controlling module and a communication interface that allows data to be transmitted from this remote device to a central location (data collection centre). This communication interface is bi-directional and allows central office signals to be received by the remote unit as well.

2. Communications systems: This used for the transmission of data and control of sent signals between the meter interface units and the central office. Typically, such communications take in the form of telephone, radio frequency (RF), using GSM, GTCL AMR Unit With GSM/PSTN modem Building 1 2 3 30 RS485 /Pulse network GSM/PSTN modem TCP/IP LAN Server Wireless Network GSM / PSTN and over hard wire cable. The system components in the communications system depend on the communication media used.

3. Central office or Master Location Monitoring System: This system includes communication modems which work as a Tran receivers, computer, data concentrators, controllers, host upload links, and host computer.



The GSM Module will automatically collect the data and also detect the theft. Here, the manpower is greatly reduced and also illegal power theft is controlled. The proposed System is hidden in a meter and as soon as the theft is detected an alarm message is sent to the respective officers or stations[9]. Fig 4 represents GSM MODULE



Power line carrier communications takes place in the same line that delivers electricity [7]. PLC technique involves injecting a high frequency AC carrier onto the power line and modulating the carrier wave with data originating from the source point or data generator used. Power

Line Communication (PLC) is a communication technology that enables sending data and power along existing power cables. This means that, with just power cables running to an electronic device (for example) one can both power it up and at the same time control/retrieve data from it in a half-duplex manner. Considering the pervasiveness of power lines, this means with PLC, virtually all line-powered devices can be controlled or monitored.

Electrical power systems vary in configuration from country to country depending on the state of the respective power generation and demand. The practice of using medium-voltage (11-to-33kV) and low-voltage (100-to-400V) power distribution lines as high-speed PLC communication means and optical networks as backbone networks is commonplace. Under normal service conditions, they can be broadly divided into open-loop systems, each with a single opening, and tree systems with radial arranged lines.

## VI. DETECTION METHODS

This review paper has analyzed detection methods of power theft location [8] using:

1. GSM module
2. Zig-Bee

### VI.1. GSM MODULE:

Fig 4 GSM module

[10] The input power is supplied to the PIC18F4520. It consists of Seal tampering unit, By pass detection unit, Power Measurement unit, GSM Modem & MAX 232 IC, LCD Display. GSM MAX 232 is built with dual band GSM Engine - SIM 900A. So, if any power theft detected sensing circuit will send power to the microcontroller which in turn send message to GSM through MAX

232. On receiving the power theft message, the controller sends a reply message to "cut off the power", then the supply is cutoff using the Relays. In LCD display when there is no theft detected, the 16x2 LCD display projects "NO THEFT DETECTED", if any theft is detected it displays "THEFT DETECTED" [11]. Generally,

the hardware of the automatic meter reading and theft control system by using GSM module our project at designing such a system which will automatically collect the reading and also detect the theft. Current transformer is used to measure the total power consumption for house or industrial purpose. This recorded reading is transmitted to the electricity board as per his

demand for transmitting the reading of energy meter GSM module is used. The energy theft is control by IR sensor; IR is placed in the screw portion of energy meter seal. If the screw is removed from the meter message is send to the electricity board. The measuring of energy meter and monitoring of IR sensor is done with a PIC microcontroller. Then bypass of meter is detected by using to CT. One is in energy meter another is placed on electricity pole.

## **VI.2.ZIGBEE MODULE:**

The ZIGBEE system consists of ZIGBEE Module, ATMEGA 32 microcontrollers, LCD Display and Software. The ZIGBEE system consists of ZIGBEE Module, ATMEGA 32 microcontrollers, LCD Display and Software. This protocol consists of Consumer side (CS) and Electricity Board Side(EB). CONSUMER SIDE – It consists of Energy Meter, Microcontroller, Voltage Sensors, LCD Display, Zibee Module, Power Supply Unit .When the meter is bypassed, the voltage sensor present there sent a meter tampering signal to the microcontroller

.ATMEGA32 coupled to the Zigbee Module .This enable the Zigbee Module to communicate with the substation via the transmitter present there.And it also displayed in the LCD Display of the meter. EB Side – From the EB station sending bills , cut off power and restore power supply can be done.

Overall Function of the Zigbee includes,

- 1) Normal ON-OFF condition.
- 2) Power supply monitoring.
- 3) Detection of theft
- 4) Record of Billing
- 5) Bill not paid power can be cut off from the Station.

## **VII.ACQUISTION AND STORAGE OF DATA**

The Internet-of-Things based EnergyMeter (IEM) is a device which is fixed on top of the regular household power meter and provides

detailed information about the electricity usage[10]. Modern power meters consists a OLED represented by Fig 5 which blinks every time a watt-hour is being consumed. The set-up includes a power supply represented by Fig 6 which has a SMPS and a regulator to obtain 3.3V. The driver and load circuit given by Fig 7 is made up of a TRIAC and an opto TRIAC. By knowing the household electricity usage, it is easy to extrapolate statistics and estimate precise cost. and a current sensor shown in Fig 8 .The IEM detects these flashes with the help of a interrupt, counts them, then the data is stored to the cloud with the help of a Wi-Fi module,given in Fig 9.Usually power companies provide an approximate data regarding electricity usage, the IEM provides data with resolution.

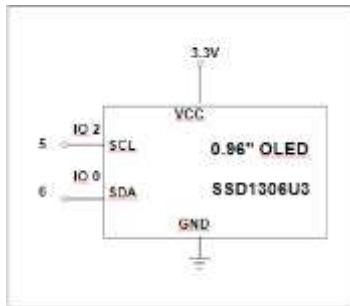


Fig 5 0.96" OLED

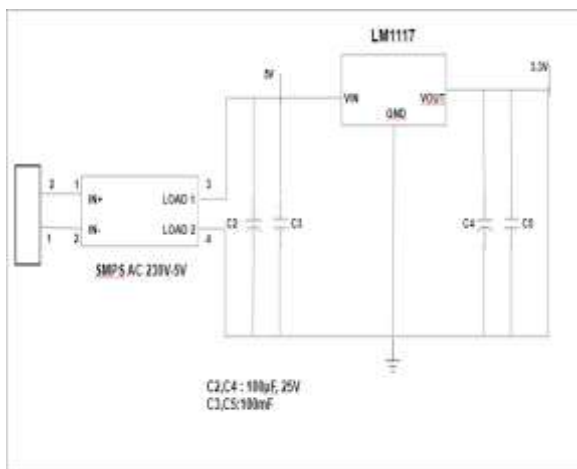


Fig 6 Power supply for IEM

Fig 7 Drive and load circuit

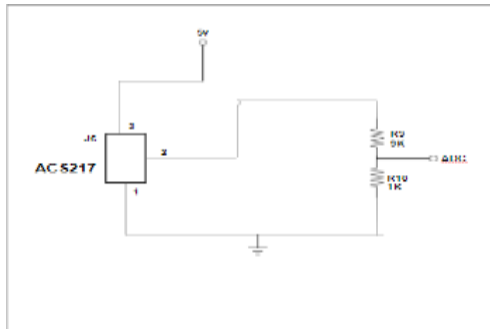


Fig 8 Current sensor VIII.FUTURE SCOPE AND CONCLUSION

The present review involves GSM/Zig- Bee with IoT. This system stores memories of documents of illegal pilferage of energy with prescribed details in external memory which is not assured of irretrievability. It can be far better when the data is stored in Cloud using clouding computing, which enables easy access of records anywhere anytime for tracking. With such a system implemented in future for real time, reduces the need for regular vigilance of tracking documents

,also it improves in more efficient way of detection.The review of AMR-PLC-GSM/Zig-bee-IoT integrated based power theft identifier system can still be improved in some ways. The proposed improved measures are listed below and this could serve as a means of aiding researches to carry out similar or related works.

- (1) In addition to the power theft information, a means of transmitting data indicating the consumer using high loads at particular time period can be incorporated into the system along with exact location.
- (2) A two way communication can be designed in such a way that a signal from the power distribution area can be transmitted which disconnects the main line from the meter if a use is unable to pay his/her bill on time or if the user is attempting power theft and illegal usage.



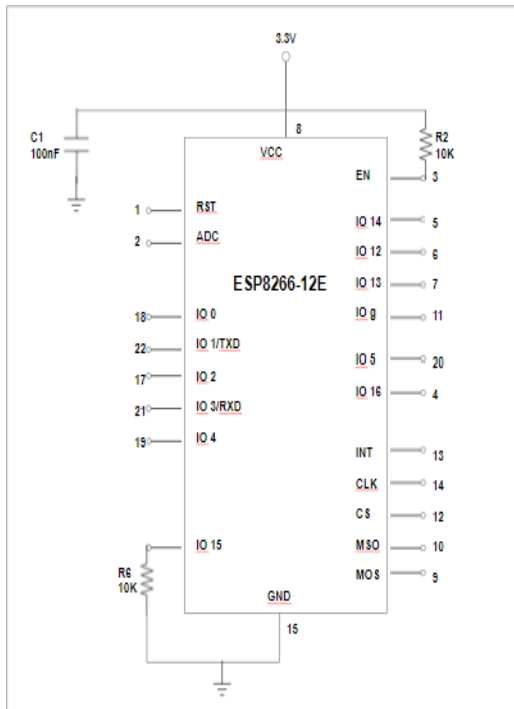


Fig 9 Wi-Fi module

The proposed review to determine illegal electricity usage via power line communications is presented, Results proved that if AMR and detector system are used together illegal usage of electricity might be detected. Once this proposed detection systems are tried in real power lines, the distribution losses in India can be reduced effectively

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