

DETECTION OF ILLEGAL USAGE OF ELECTRICITY BY HOUSE HOLD CONSUMERS

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Abstract- Using illegal electricity for household is becoming common in India , people are using many unethical methods to steal electrical power which is causing a great loss in the revenue of government of India.. Power line communication (PLC) presents an interesting and economical solution for Automatic Meter Reading (AMR) . If AMR and PLC both are added together in power distribution a detection system for illegal electricity usage may be easily added in the existing PLC network . For the detection system, the second digitally energy meter chip is used and the value of energy is stored . If difference is found between two recorded data , an error signal is generated and transmitted via PLC network. The detector and control system is proposed. The architecture of the system and their critical components are given. The measurement results are given

INTRODUCTION

In many poor countries economic growth is hampered by inadequate and irregular supplies of electricity. Indian firms ranked electricity problems as the number one issue facing their businesses in the 2006 World Bank Enterprise Survey. The scarcity and unpredictable supply of electricity are in part results of widespread theft, as well as lack of adequate generating capacity. Given its high value, the relative ease with which it is diverted, and the difficulty of identifying individual offenders, theft of electrical power is easily accomplished as well as useful to enterprises and individuals. As a result, it is widespread across much of the developing world and the reason for huge revenue loss for government

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1. Various methods of illegal consuming electricity:

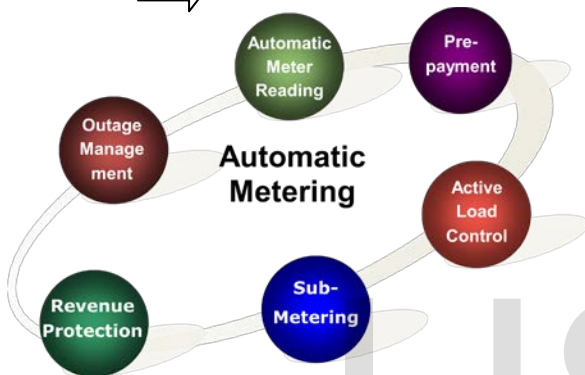
In illegal usage a subscriber illegally use electricity in the following ways,

- 1) **Using the mechanical objects:** A subscriber can use some mechanical objects to prevent the revolution of a meter, so that disk speed is reduced and the recorded energy is also reduced.
- 2) **Using a fixed magnet:** As is well known, the recorded energy is proportional to electromagnetic field. A subscriber can use a fixed magnet to change the electromagnetic field of the current coils
- 3) **Using the external phase before meter terminals:** This method gives subscribers free energy without any record.

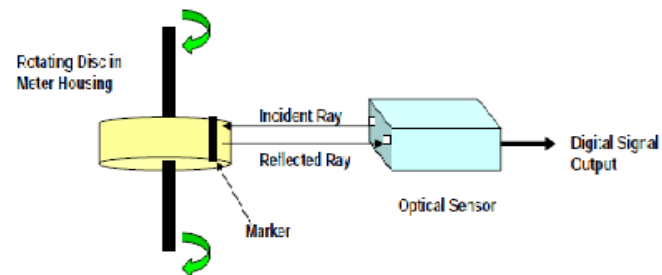
4) **Switching the energy cables at the meter connector box:** In this way, the current does not pass through the current coil of the meter, so the meter does not record the energy consumption

2 WAYS OF DETECTION:

2.1 Automatic Meter Reading (AMR):



Automatic meter reading, or AMR, is the technology of automatically collecting consumption, diagnostic,



and status data from water meter or energy metering devices (gas, electric) and transferring that data to a central database for billing, troubleshooting, and analyzing. This technology mainly saves utility providers the expense of periodic trips to each physical location to read a meter. Another advantage

is that billing can be based on near real-time consumption rather than on estimates based on past or predicted consumption. This timely information coupled with analysis can help both utility providers and customers better control the use and production of electric energy, gas usage, or water consumption.

AMR technologies include handheld, mobile and network technologies based on telephony platforms (wired and wireless), radio frequency (RF), or powerline transmission.

The AMR system starts at the meter. Some means of translating readings from rotating meter dials, or cyclometer style meter dials, into digital form is necessary in order to send digital metering data from the customer site to a central point.

In most cases, the meter that is used in an AMR system is the same ordinary meter used for manual reading but the difference with conventional energy meter is the addition of some device to generate pulses relating to the amount of consumption monitored, or generates an electronic, digital code that translates to the actual reading on the meter dials. One such technique using optical sensor is shown in above fig 2

Important components of AMR system are:

1) **Meter interface module:** with power supply, meter sensors, controlling electronics and a communication interface that allows data to be transmitted from this remote device to a central location. In many instances, this communication interface is bi-directional

and allows central office signals to be received by the remote unit as well. Every electric, gas or water meter must have such an interface unit to be remotely read. Some key components of the remote device may be shared by more than one meter without regard for the type of meter; i.e., electric, gas or water

2) Communications systems: used for the transmission, or telemetry, of data and control send signals between the meter interface units and the central office.

Two stages of communication in AMR System

1) Meters and Data Concentrator Unit (DCU): Communication channel used between meters and DCU is Power Line.

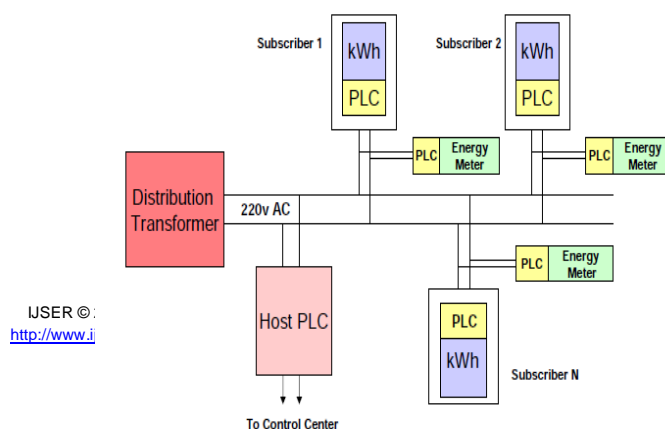
2) DCU and Host Central Station (HCS): Communication channel used between DCU and HCS is the standard GSM, CDMA, RF or PSTN Network.

3) Central office systems equipment: including modems, receivers, data concentrators, controllers, host upload links, and host computer. Many utilities have for some time been taking advantage of electronic meter reading systems using handheld data terminals that communicate with a central controller via phone lines. There is great similarity between the host side electronic meter reading and automatic meter reading system function.

2.2 POWER LINE COMMUNICATION (PLC):

Power Line Communication (PLC) is a communication technology that enables sending data over 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. An electronic board (for powerline communication – PLC AMR) is inserted in power meter. Power meter's rotating disk's mark or LED indicator is read using the optical sensor on the powerline communication module (PLC AMR). Meter data is automatically transmitted to concentrator through the existing power line. PLC AMR concentrator: one three-phase PLC AMR module services almost any number of power meters, connected after a transformer and communicating through powerline. PLC AMR concentrator may be installed anywhere in the serviced buildings, and control the powerline communication (PLC) node. The powerline (PLC AMR) concentrator continuously polls electricity meters, and communicates the collected AMR data to the central office using phone line or GSM. It is possible to read AMR data from PLC concentrator manually using hand held. We generally have 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 common place. 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. When the controlling multifunctional power meter or power quality monitor is installed at the power substation, our PLC AMR system compares electricity import with the sum of individual consumers' consumptions, indicating leakages and abnormal consumption of reactive energy.

3. DETECTION AND CONTROL SYSTEM:

The system given in the above given Fig 3 has only one distribution transformer network and should be repeated for every distribution network. Although the proposed system can be used uniquely, it is better to use it with automatic meter reading system. If the AMR system will be used in any network, the host PLC unit and a PLC modem for every subscriber should be contained in this system. In the given Fig the host PLC unit and other PLC modems are named PLC(Subscriber1), PLC(Subscriber2), PLC(SubscriberN) and are used for AMR. These units provide communication with each other and send the recorded data in kilowatt-hour meters to the PLC unit. In order to detect illegal usage of electrical energy, a PLC modem and an energy meter chip for every subscriber are added to an existing AMR system. As given in Fig 3 PLC(Subscriber1), PLC(Subscriber2), PLC(SubscriberN) and energy meter chips belong to the detector. The detector PLCs and energy meters must be placed at the connection point between distribution main lines and subscriber's line.

Since this connection point is usually in the air or at underground, it is not suitable for anyone to access, such that its control is easy. The main procedure of the proposed system can be summarized as follows. PLC signaling must be in CENELEC standards

3.1. SIMULATION:

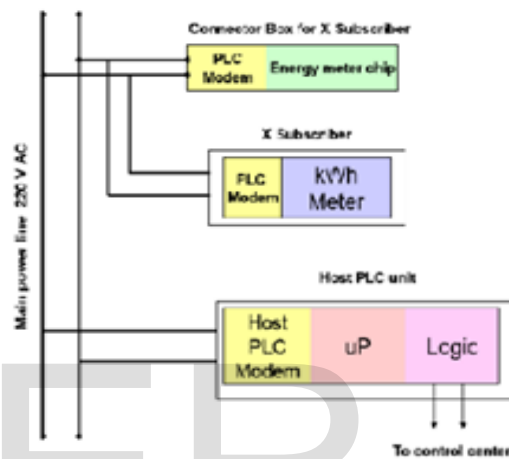
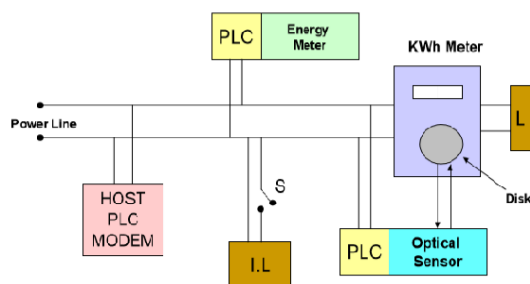


FIG .4 ILLEGAL DETECTOR SYSTEM FOR ONE SUBSCRIBER

detection system of illegal electricity usage is shown in Fig4. It contains a host PLC modem, an energy meter chip and its PLC modem, an electromechanical kilowatt-hour meter and its PLC modem, and an optical reflector sensor system. The host PLC unit is loaded at the same phase of the power grid. The energy value at the electromechanical kilowatt-hour meter is converted to digital data using an optical reflector sensor. The disk speed of the kilowatt-hour meter is counted and the obtained data is sent to the PLC modem as the energy value of the kilowatt-hour meter. At the system model, an illegal load may be connected to the power line before the kilowatt-hour meter via an S switch. While

only a legal load is in the system, two meters are accorded each other to compensate for any error readings. The host PLC unit reads two recorded data coming from metering PLC units. If the S switch is closed, the illegal load is connected to the system, and therefore two recorded energy values are different from each other.



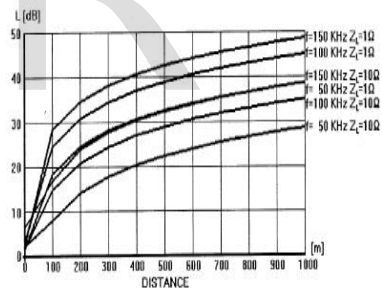
The host PLC unit is generated when it received two different records from the same subscriber. This is the detection of the illegal usage for interested users..

Data signaling between PLC modems has a protocol, which includes a header, address, energy value data, error correction bits, and other serial communication bits such as parity and stop bits. The protocol may also be changed according to the properties of the required system and national power grid architecture. The above Fig 5 shows the detection system for an electromechanical kilowatt-hour meter system. In the digital energy meter system, the recorded energy may be received in the digital form directly using the port of the meter. Therefore, there is no

need for an optical reflector system in digital meters.

4.REVIEW OF DETECTOR SYSTEM:

The proposed detector system is the equipment and procedure for controlling more remote stations from a master control station. It includes PLC modems, energy meters, control logics, and the system software. The PLC modems are host and target modems for two-way communications to and from the host station and the remotely controlled targets. The energy meters include metering chips and some circuit elements; the control and logic units compare and generate the error signal in the Illegal usage.



The system software has two parts: assembler program for the micro controller and the operating software for the management of the overall system. Operating software may be downloaded from a PC and should be placed in the main center of the system.

An AMR system including an illegal detector performs the following functions.

- 1) Every user has two PLC modems; one is for AMR and the other is used to send the data from second energy meter chip to host PLC

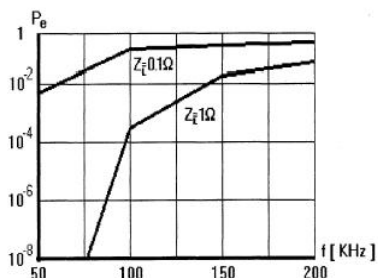
modem.

2) An energy meter must be installed in the connection box between a home line and main power lines.

3)The host PLC unit must be placed in the distribution transformer and the configuration of the addressing format of PLC signaling must be designed carefully.

4)The system has two values of the energy consumption for every user, so if there is a difference between them, an error signal is generated for the illegal user,

5)The proposed equipment is the only one distributed in the power network. So this system should be repeated for all distribution power networks. All host units in each distribution transformer may be connected to only one main center station via phone lines, fiber-optic cable, or RF links.



Results and the variations of the measurements are shown in Fig. The relations between frequency, length, and bit-error probability are given in these figures

5.Conclusion: The current monitoring system employed is very poor in performance. The theft occurring in the power distribution

sector shows the need of a power cop or an all-time vigilant system that catches the illegal users when they start using the tampering techniques. The cheapest way is the use of power line carrier communication for automatic meter reading. The user, knowing that he is being watched all the time, will not try to do any tampering and if he is caught, he will lose the power supply in the next moment. The existing system can be modified to perform the required functions. So the automatic meter reading using the power line carrier communications is the forthcoming technology in the electric power sector

6.REFERENCES

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