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A Review on IOT Based Power Theft Detection and Control Systems

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Abstract: Power theft detection and control system using Internet of things present an efficient and less costly way to transfer the power consumed by the consumer wirelessly as Electricity consumer dishonesty is a serious problem faced by all utilities. This wireless technology is used to overcome the theft of electricity which can be done by using excess amount of power beyond the limit of meter. In this paper, main purpose is to monitor the power consumed by a model organization such as household consumers, various industries etc. Detection and control of power has been done by calculating the power consumed by the user at a given time with the help of meter. Electricity meter consists theft detection unit which will notify company side in the event of meter tempering or theft practice occur in electricity meter and also it will send information regarding theft detection by using modem and the theft detected will be displayed on the terminal screen or window of the company side, so that they send message to the registered contact number of the customer as a warning. Due to this, customer receive the warning message even though they are continue using the excess power then Electricity board section will cut the power supply of the customer. IOT operation can be performed by Wi-Fi device which sending meter data to the web page through the IP address. The IOT based concept are used so that Electricity board section continuously monitor the consumption of power and billing information that is calculated using microcontroller.

Keywords: Internet of things, detection, electricity theft, microcontroller, IP address, electricity meter.

I. INTRODUCTION

Power utilities lose large amounts of money each year due to fraud by electricity consumers. Electricity fraud can be define as a dishonest or illegal use of electricity equipment or service with the intention to avoid billing charge. It is difficult to distinguish between honest and fraudulent customers. Realistically, electric utilities will never be able to eliminate fraud. It is possible, however to take measures to detect, prevent and reduce fraud [1]. Investigations are undertaken by electric utility companies to assess the impact of technical losses in generation, transmission and distribution networks, and the overall performance of power networks [2]–[5]. Energy monitoring cannot be done efficiently mainly because consumers are not aware of their energy consumption. They will get an idea about their consumption only when the electricity bills are issued [6].

The installed capacity of the electricity sector in India is 329.23 Giga Watts as of August 2017, which includes renewable and non renewable sources. The per capita electricity consumption in India in 2016-2017 was 1,122 kWh [7]. The IOT has recently become universal to highlight the vision of a global structure of interconnected physical objects. As more number of electricity-consuming products coming into daily lives, such as electrical vehicles (EVs) and advanced heating, ventilation, and air conditioning systems, load demand increases dramatically and power required at high amount[10]. So in this paper proposed an power theft detection system to detect the theft which is made by the most common way of doing the theft and that is , by using excess power beyond the limit of meter. At this point of technological development the problem of illegal usage of electricity can be solved electronically without any human control along with that meters are connected to the internet using IOT concept.

So there is a provision for the consumers to track their energy consumption from time-to-time so that they can control their consumption as they desire. This method is useful for both the consumer and the supplier. This system allows the supplier to disconnect the connection from a distant server in case the consumer fails to pay his/her electricity bill. This method eliminates the need of human power during disconnection and reconnection of the load. Another major advantage of this method is that it will inform the supplier side about any theft that is happening in the system.

II. LITERATURE SURVEY

The literature survey describes the various methods of power theft detection and control. A brief description of various methods given by different authors is given below.

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In [12], a new approach towards Nontechnical loss (NTL) detection in power utilities using artificial intelligence based technique and pattern classification technique in order to detect and identify load consumption patterns of fraud customers. In this system customer committing fraud activities before the two year period will not be detected by the FDM. In [13], [14] and [15] Various theft detection method have been proposed, based on consumer not paying the bill, bypassing the poles, reception of misused Energy, tapping on transmission line as explained .In [16], finds out on which electrical line there is a tapping. This is a real time system. Wireless data transmission and receiving technique is used. This will provide an additional facility of wireless meter reading with the same technique and in same cost. This will protect distribution network from power theft done by tapping, meter tampering etc. 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.

In [17], incidents of energy theft in which dishonest customers would lower their electricity bills by tampering with their meters. The physical attack can be extended to a network attack by means of false data injection (FDI). A hybrid detection framework is developed to detect anomalous and malicious activities so that the network observability and detection accuracy can be improved by means of grid-placed sensor deployment .The limitation of the proposed method is limited to a one-player attack.

PLC's are used for high performance installation protection system. It can be obtained only at the cost of highly complex relay scheme. Design of an Electric Energy Meter for long-distance data information transfers which based upon GPRS is proposed in [18]. These systems can't be implemented so easily because the regular use of GPRS is still a dream to the common people. A GSM based concept is used to generate bill is available as SMS at the time of generation itself and hard copies are available to the consumer as postal mail. A soft copy can be send to the consumers e-mail if consumer is registered with his e-mail address [19].

Today, the Internet of Things has become a popular term for describing scenarios in which Internet connectivity and computing capability extend to a variety of objects, devices, sensors, and everyday items. While the term "Internet of Things" is relatively new [20]. The concept of combining computers and networks to monitor and control devices has been around for decades. Effective data fusion techniques develop for improving occupancy monitoring accuracy is proposed in [21] using a multitude of sources for the occupancy collection of data, IR sensors are used for the detection of existence of the persons and it will count the people in the buildings entering. IOT comes into picture with the involvement of smart phones, and Wi-Fi APs. A novel design method of minimizing the queue is discussed in [22], the electricity billing counters and to restrict the usage of electricity automatically, if the bill is not paid and also reduce the loss of power and revenue due to power thefts and other illegal activities. This module will reduce the burden of energy providing by establishing the connection easily and no theft of power will take place.

In [23] and [24] system eliminates the human involvement in electricity maintenance. The system is inefficient in terms of monitoring our energy consumption. Also, the provision for generating bills automatically is limited and inefficient.

III. CONCEPT AND DESIGN

The concept of Internet of Things (IOT) from its initial stage changing the current Internet into well featured upcoming internet. At present there are billions of gadgets (approximately nine billions) interconnected gadgets and one prediction is that it will reach up-to fifty billions gadgets in 2020. The IOT based smart energy meter comprises mainly 4 modules (units).

1. Micro controller unit
2. Theft detection unit
3. Meters unit
4. Wi-Fi unit

In the design of this smart electricity meter the microcontroller is used, which are placed at the consumer end for the purpose of theft detection and storing the data. This data is transferred using IOT ESP3866 Wi-Fi. In the current scenario the need is to access the characteristic of device remotely but in a reliable manner. To achieve the characteristic of device remotely we need to connect a device (here electricity meter) to internet by providing IP address to it. In this paper we have concentrated on the theft detection, optimum utilization of power and convey the energy consumption information to the user end. The IOT based Power theft detection and control systems contain meter at consumer end consist the power supply, meter unit, theft detection unit and Wi-Fi unit. We can see in the block diagram as shown in figure-1, the supplier end consists the power supply, meter unit, current sensor, microcontroller, Wi-Fi module, theft detection unit and LCD.

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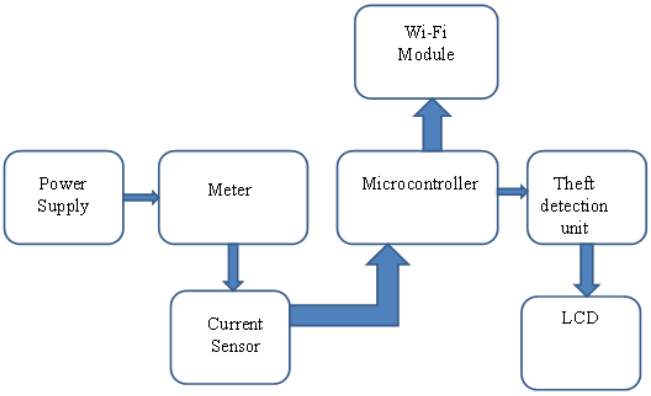

Figure-1: Block diagram

IV. PROCESS AT CONSUMER END

At the consumer end, power supply unit supply the power to those entire component which requires power. Microcontroller acquire the relevant information from the electricity meter and also perform the control process and sends the required information such as number of units consumed with the help of Wi-Fi unit. The purpose of LCD module is to get visual information about the number of units, temperature and Wi-Fi configuration.

V. PROCESS AT SUPPLIER END

At the supplier end, if any theft is detected the theft detection unit acts as a modem and it sends the necessary command. If consumer used the power beyond the limit of meter or fails to pay the electricity bill amount within the time limit mentioned by the supplier the disconnection and reconnection can also done by sending the appropriate command to the controller.

VI. COMPARISON BETWEEN EXISTING ELECTRICITY ENERGY METERING METHOD AND SMART ELECTRICITY ENERGY METERING METHOD

(a) Existing Electricity Energy Metering Method: - As we know in our country the electricity energy billing duration is either end of one month or end of two months. During the month electricity consumer cannot how much power consumed, they can know at the end of one or two months when the bill issue. The major drawback of this method is user cannot manage the power consumption. Another disadvantage of this system is theft caused by excess amount of power can be done easily and such practices are happening and increasing rapidly which is one of the major causes of power crises.

(b) Smart Electricity Energy Metering Method: - In this method we try to eliminate the drawback and limitations of existing electricity metering method. In this method there is a provision for the supplier that they can monitor the power consumed by consumer to find the exact location where theft occurred at the time when theft occurred and provides the information at the event meter tempering and power theft. Such information will be very useful to control the practices of power theft and reduce the power crises. Also it is helpful if consumer fails to pay their electricity billed amount within the time period mentioned by the supplier, the supplier can be disconnect the power automatically from the distant end.

This method is not only providing the facility to supplier end but also it is more helpful to consumer end also. As there is a provision for the consumer that they can see their power consumption time to time so they have an opportunity to manage the power consumption as they desire.

VII.CONCLUSION

IOT based Power theft detection and control systems were proposed in this paper. The system would provide a simple way to detect an electrical power theft without any human interface. In this system we are looking forward to implement smart meter. As the Indian Government has also proposed formation of Smart Cities which will have a effective energy management, transportation, waste disposal and resource conservation strategy using primarily Internet of Things based sensors as done globally[23][24].

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