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ELECTRICA

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Abstract - *This paper proposes an IoT based system for the automation of electricity meter. Normally, for billing purposes, electric utilities use electric meters installed at consumer's premises. The measurements are recorded at the end of each billing period within an acceptable degree of accuracy. A significant error in the meter recording can affect the consumer adversely. For the United Kingdom, any installed electricity meter should accurately record the consumed energy, but it is permissible to underread by 35% . Even the consumers themselves use many ways to tamper the meter, thereby providing a wrong indication of the energy consumed. In this paper, general consensus regarding the energy meter monitoring and billing system is given due importance along with the effort to reduce human resources, power theft. The exact method for tracking and monitoring is employed using GSM module and TL494. Moreover, programming languages are introduced to store details regarding the consumers, to send messages to the mobile phones, to promote online bill payment and for the efficient utilisation of the existing resource thereby reducing their wastage.*

Key Words: **IoT, LM 393, Real time checker**

1. INTRODUCTION

India is the world's third largest producer and fourth largest consumer of electricity. The measurements proves that the total electricity generation (utilities and non utilities) in the country was 1,433.4 TWh. The gross electricity consumption was 1,122 kWh per capita in the year 2016-17. Even though India has become power surplus country there are many problems faced in the energy sector. There was a lot difference between the demand and generation(of electricity).Power systems faced many losses(technical and commercial).Even the latest technologies were not well efficiently utilised. Government, academia and different other institutions depends on different aspects of IoT. Internet of Things(IoT) brings about many revolutionary innovations by connecting several smart objects. These devices are embedded with a 'sensor' that transmits data between each other .AMR(Automatic Meter Reading) is the technology that focuses ,mainly on automatic collection of status data and transmitting that data for billing and other purposes. The advantage of this technology is that billing is based on real time consumption and is not based on present or past data. An advancement made to the AMR technology enables the collected data(meter reading) to be stored in a database ,thereby enabling its usage in future.

In our proposed system there are mainly three modules; meter reading, tracking and bill generation. LM 393 collects LED blinking on the electric meter. Real time checker will check for a particular date and the unit of electricity consumed till then will be used for electricity bill calculation. GSM module is used for sending the SMS regarding the consumption to the consumer and server. Bill generation is proceeded by proper extraction and processing of the consumed unit making the facility for online bill payment.

2. LITERATURE SURVEY

Nikhil V.Patil et.al., proposed the system Intelligent Energy Meter which provides solutions for maintaining power quality ,provides superior metering and billing system thereby controlling the power theft in [1]. The Smart energy meter is one of the development in conventional energy meter. The development of wireless billing would save money, time and labour. IEM has four major functions which itself is categorised into three such as power theft ,power quality and unpaid bills. Power theft can be detected using SMS alert system. In addition to this ,the per day power consumption of the customers can also be predicted .The IEM provides solution to improve power quality and protects appliances from overvoltage and under voltage with automatic circuit tripping feature. The method provides a solution that will detect the zone and probable consumers which are involved in power theft. The isolation of unpaid customer is an additional facility.

H.E.Amhenrior et.al., proposed a method for automatic tamper detection in [2]. The system incorporates wireless disconnection and connection of load capabilities as the existing system could not be connected and disconnected to and from the load. The components are single phase prepayment energy meter and the supply authority global system for mobile communications(GSM) capable device platform. The energy theft arising from meter tampering can be reduced and it owns the facility for reporting tampering in real time.

Manisha V Shinde, Pradip W Kulkarni proposed Automation of Electricity Billing Process in [3].This system incorporates a method in which meter reading is done for the electricity, gas or water consumption where meter is used to record the consumption of this energy. In today's scenario, area decided for the energy provider employee to take the meter reading in terms of snapshot of meter and submit these photos to the main office which are used to read the readings and accordin

gly bill is generated but in this whole process due to human intervention accuracy is not achieved. For this purpose AMR (Automatic Meter Reading) concept is developed in which automatic collection of readings, transmission and sending bill to customer is done easily. This technology mainly saves utility providers expense of periodic trips to each physical location to read a meter, so that efficiency, reliability and effectiveness increases. In this paper AMR is used efficiently as camera fixed in front of energy meter of each house will capture the image of meter when it gets command to capture and send this image to energy provider office wirelessly where it undergoes preprocessing and recognition of digits which are further used for generation of bill. This bill is again send to the respective meter owner as a massage using GSM module.

In this paper with the help of presented proposed system it is possible to avoid meter reader visit and revisit for recording the meter reading to each house. Also if consumer gets faulty bill he has to go to Electricity Board office to correct it and be in long queue. This is avoided by taking photo of meter reading with camera and sending these readings to server wirelessly. The database is kept updated which is hard to maintain now a day's manually. This is real time system and take reading of meter in a very less time. Also as customer is getting message of bill printing can be avoided to reduce paper wastage.

V.Preethi ,G.Harish proposed the system Smart Energy Meter in [4]. SEM is an electric device having energy meter chip for measuring the electric energy consumed and a wireless protocol for data communication. In this meter, the LCD will continuously display the energy utilized and the corresponding amount will be displayed on the LCD continuously and the details will be provided to the controlling base station.. Zigbee is used for maintaining the communication between user/household and substation. Theft cases are reported using GSM network, by sending SMS to the local authorities . This meter can work as either prepaid or post-paid meter. The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter. Also the meter reading can be monitored regularly without the person visiting each house.

The progress in technology about electrical distribution network is a non-stop process. The meter reading can be continuously monitored using wireless meter reading system and the same technology employs shutting down the power supply remotely whenever the consumer fails to pay the bill. It is user friendly and reduces the maintenance cost. It displays the corresponding information on LCD for user notification. The advantages of SEM are it requires less manpower, there is no need to chase payments, power theft detection is possible, bill is sent to the consumer with due date, the meter can act as either prepaid or postpaid meter, can minimize the power consumption in a house.

3. SYSTEM OVERVIEW

3.1 Meter Reading

Electrica employs LM 393 light sensor for collecting the meter reading from the electric meter.

3.2 Tracking

The pulse count would be stored and proceeded to the server and consumer via GSM module.

3.3 Bill Generation

The signals are extracted and the electricity bill is calculated after arithmetic and logical operations. The calculated bill is made available to the consumer thereby making the online payment easier.

Apart from the above specified major objectives, many other enhancements can be achieved in the future such as voltage regulation, automation of lighting system in a room etc .

4. PROPOSED SYSTEM

The proposed system is entirely divided into two sections .

1. Consumer
2. Server.

The proposed system consists of the following components :

4.1 LM 393

The LED blinking on an energy meter is used for acquiring the data for obtaining the unit consumed .LM 393 is compatible with all logic and allows sensing near ground. The device is characterised by high precision comparators. There are two output values for sensors:

1.Analog value- Arduino read the analog value on A0 to A9, and from 0 till 1023. AO (Analog Output) is the pin name on many sensor board.

2.Digital value-0 and 1 symbolises the digital value.

When the LED blinks,the output of LM393 goes from 0 to 1(digital value).

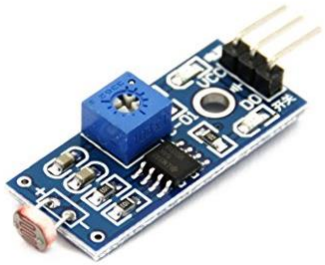

Fig 1: LM 393 light sensor

4.2 ARDUINO UNO

Arduino UNO is an open-source platform .It is widely used nowadays because of its less cost .Both microcontroller and a piece of software, Integrated Development Environment(IDE) constitute an Arduino. Arduino incorporates another facility which enables a newly programmed code to be uploaded without the need of an external hardware programmer.

Fig 2: Arduino UNO

4.3 REAL TIME CHECKER

The real time checker plays a major role in the proposed system. The real time checker will check for a particular date and when that date arrives, the units consumed until then will be taken for the bill calculation. Thus real time checker plays an important role in generating the electricity bill on a particular time basis(here on a monthly basis).

Fig 3: Real time checker

4.4 GSM MODULE

A GSM module requires a SIM card to be operated with .GSM module and Arduino UNO are connected to each other and different programs can be loaded into the GSM module after establishing the connection. An SMS containing the information regarding the consumer id and the unit consumed will be sent to the server via GSM module. Another GSM module at the server end will receive the SMS.

Fig 4: GSM module SIM 900

The datas regarding the consumers will be stored in the MySQL database at the server side. The signals are extracted and processed to generate the bill.

Arduino UNO counts the pulses and calculate the used energy.

3600 pulses = 1 unit of electricity.

Amount per unit = Rs.3

Total amount = unit consumed * 3.

5. IMPLEMENTATION

5.1 BLOCK DIAGRAM

Consumer unit

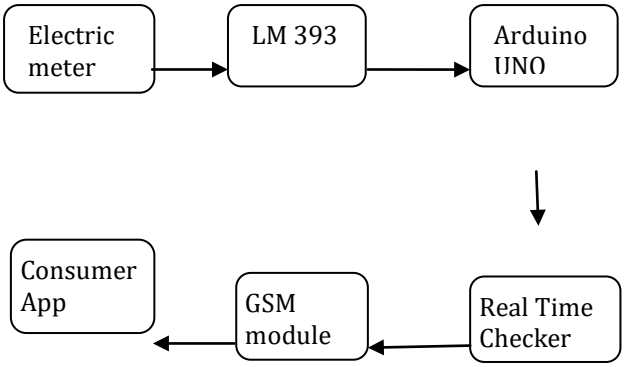

Fig 5: Block diagram of consumer unit

Server unit

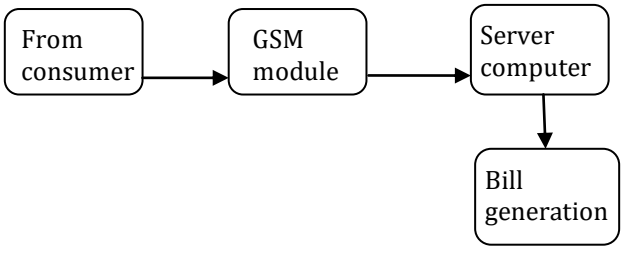

Fig 6:Block diagram of server unit

LED blinking on the electric meter is fed as input to LM 393 light sensor which outputs a digital signal. X times blinking of LED installed on meter will be considered as 1 unit consumption of electrical energy .The meter constant is cross checked by actually counting the blinking of LED e.g. one unit should be registered by the meter in 3600 impulses i.e. 3600 times blinking of LED or ½ unit should be registered in 1800 impulses or ¼ unit should be registered in 800 impulses and so on. Pulse count will be stored and proceeded to server and customer via GSM module. Further proceedings involves extraction of these signals. Later the unit consumed will be used for bill generation.

5.2 HARDWARE IMPLEMENTATION

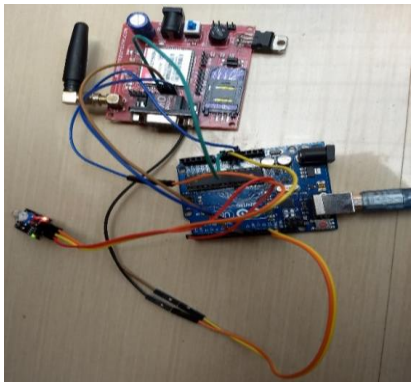

Fig 7: Hardware connection of the proposed system

5.3 SOFTWARE IMPLEMENTATION

The proposed system mainly incorporates two applications.

1. All messages coming to the consumer's mobile number are retrieved ,but only those messages which is in a specified format is fetched and uploaded to the website at the server's end.

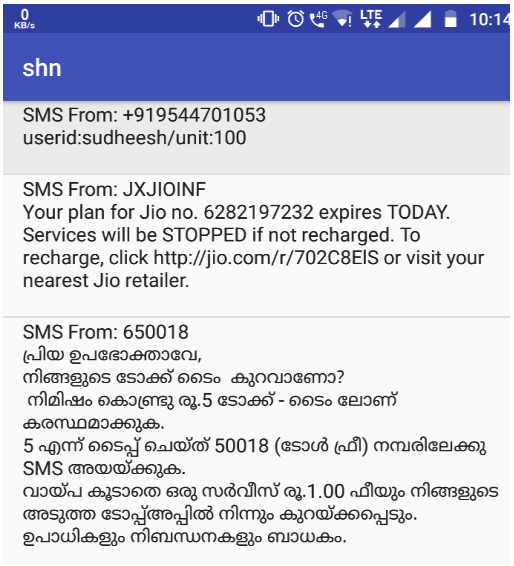

Fig 8: Fetching SMS of a specified format

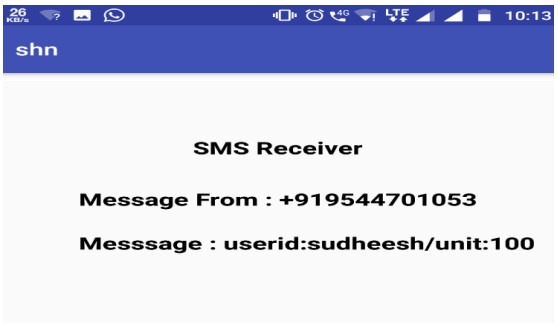

Fig 9:Fetched SMS to be sent to server

2. The second application mainly focuses on the consumers. It includes fields for the user's login and password. After login, the consumers would be able to view their basic details including name, contact details etc. He/she can also view the unit of energy consumed, the amount to be paid as electricity bill, the last date for paying the bill (with and without fine) etc.

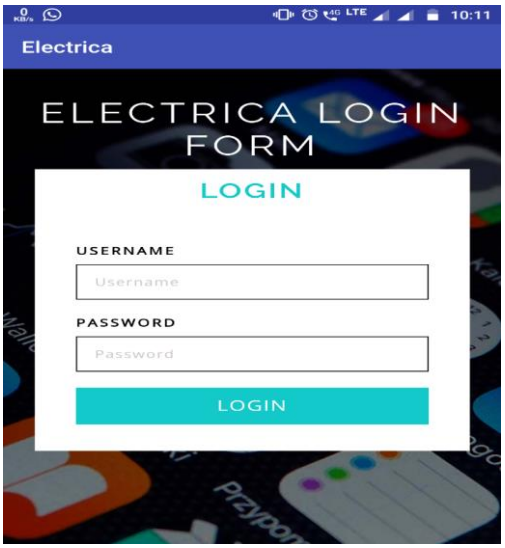

Fig 10: Consumer app

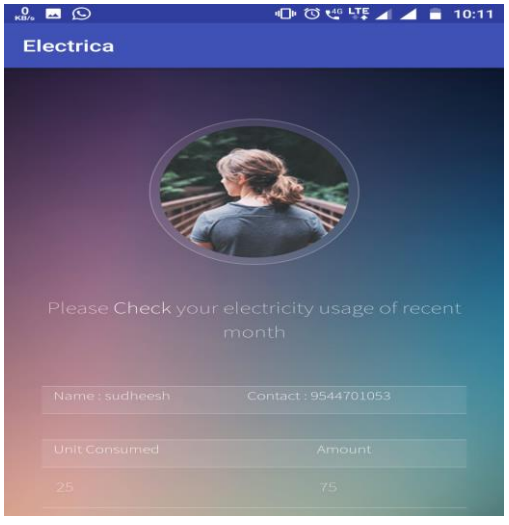

Fig 11: Information regarding the electricity usage.

6. ADVANTAGES

The software is supported to eliminate and in some cases reduce the hardships faced by the existing system.

The advantages of Electrica are:

1. It automatically generates the electricity bill.

2. The consumers need not wait in long queues at the electicity offices for paying bills.

3. It efficiently utilises the present technology thereby reducing the wastage of resources including the paper.

4. Electrica can lead to error free, secure, reliable and fast management system.

5. It can assist the user to concentrate on their other acti vit-ies rather to concentrate on the record keeping (about consumption of electricity).

7. CONCLUSION AND FUTURE WORK

Electrica has been developed to override or eliminate the problems prevailing in the existing system. It can assist the user to concentrate on their other activities rather to concentrate on the record keeping (about consumption of electricity). Thus it will help organization (here electricity

office)to maintain computerized records without redundant entries, so that their valuable data and information can be stored for a longer period with easy accessing and manipulation of the same.

'Electrica' is designed for benefiting the electricity board to carry out operations in a smooth and effective manner. Automation of the existing manual system saves time and thereby reduces the effort of the electricity board members. Online bill generation is an effective way to utilize the resources, preventing the excessive wastage of papers. This system is user-friendly making the people aware about the consumed electricity and also make online transactions for bill payment. Thus 'Electrica' is socially relevant in the way that it can be easily managed by both consumers and the electricity board. Future scope includes extending 'Electrica' to work on voltage fluctuation and for automatically controlling the lights in a building thereby enabling the concept of automatic light control system.

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