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Smart Electricity Meter Data Intelligence for Future Energy System

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ABSTRACT: This article proposes and analysis the system which is used for energy meter billing and monitoring. The system is fully Internet of Things (IOT) based and highly desirable in field of energy. In this system consumer can do power management by knowing energy usage time to time. The customer needs to pay the bill on schedule, if couldn't, the electric power connectivity can be turned off autonomously from the distant host. The article explains the modeling and working of different units of the system and also discussed the basic components and their functions such that IOT and its working, microcontroller(ARDUINO UNO) and its architecture ,RTC,IOT and its features, GSM system, Relay and LCD display and its interfacing with microcontroller.

I. INTRODUCTION

In general, a traditional grid is an electric system that carries power generators to a large number of consumers. In a power grid, consumers might be uninformed and non-participate with the power system. while there are some drawbacks (eg., poor visibility, slow response time, lack of situational awareness) caused by the closed nature of the system in a power grid, the demand for electricity has gradually increased. To satisfy the demand and address these challenges, smart grid which is an evolved power grid that integrates advanced computing and communication technologies into power grid has emerged.

Advanced metering infrastructure (AM) plays a crucial role in smart grid by enabling bidirectional communications of precise measurements and fast reports between energy consumers and producers. But, there might be challenges for AMI due to the smart meters with limited resources (eg., small memory, limited bandwidth). For example, it might be difficult for smart meters to support fast sampled power signals, i.e., $\sim$ 1kHz in real-time , necessary for power disaggregation, due to the undesired high energy consumption and the board bandwidth requirements. In addition, assuming that there exits malicious devices which perform impersonation attacks, it is vulnerable to the attacks due to the nature of wireless broadcast, It may cause serious economic loss and instability of the power by manipulating power signals. For example, a utility of Puerto Rican suffered huge economic losses which are about $400 million by malicious manipulating of smart meter readings.

II. LITERATURE SURVEY

1.“SMART METER PRIVACY FOR MULTIPLE USERS IN THE PRESENCE OF AN ALTERNATIVE ENERGY SOURCE”,Jesus Gomez Deniz Gunduz (2013-IEEE).

Smart meter (SM) privacy is studied assuming that the SM readings, which report the amount of energy each user gets from the grid to the utility provider (UP) at each time instant, cannot be tempered. The privacy is measured by the amount of information about the users' energy profile leaked to the utility provider through the SM readings. Privacy can be achieved thanks to the existence of an alternative energy source (AES), whose energy generation profile is known to the UP only statistically. Assuming that a single AES with a given power, generation capacity serves

multiple users, the optimal exploitation of the energy generated by the AES in order to maximize total user privacy is characterized.

2. SMART METERS IN SMART GRID: AN OVERVIEWJixuan Zheng ,Li Lin ,David Wenzhong Gao(2013-IEEE)

Smart meter is one of the most important devices used in the smart grid (SG). The smart meter is an advanced energy meter that obtains information from the end users' load devices and measures the energy consumption of the consumers and then provides added information to the utility company and/or system operator. Several sensors and control devices, supported by dedicated communication infrastructure, are utilized in a smart meter. This paper outlines some smart meter's aspects and functions of smart meter. In addition, it introduces two basic types of smart meter system's communication technologies: Radio Frequency (RF) and Power Line Carrier (PLC) and recent advances with regard to these two technologies. This paper also presents different policy and current status as well as future projects and objectives of SG development in several countries. Finally, the paper compares some main aspects about latest products of smart meter from different companies. Index Terms-- Mesh Technology, policy objective, Power Line Carrier (PLC), Radio Frequency (RF), smart meter, Value Proposition.

3. DESIGN AND IMPLEMENTATION OF SMART ENERGY METERM Swamy, R Pravallika(2017-IJIRCCE)

The main concept of this project is to design and implement the smart energy meter system in houses and in many public places. Here this system has functionality of both prepaid and post paid system inbuilt in it. This system has a GSM that is used in sending the sms to the owner of house or any place where he gets the e bill of his electricity consumption. Here the bank account of the person is linked to his current billing system. Therefore the bill will be deducted from his account and he gets two sms about the amount. one from his bank and another from current billing system.This paper presents a smart energy meter for an automatic metering and billing system. In this meter energy utilized and the corresponding amount will be displayed on the LCD continuously and communicated to the controlling base station. The feedback from the user helps in identifying the usages between authorized and unauthorized users which helps in controlling the power theft. Communication between user/household and substation is done using Zigbee. GSM network is used for sending SMS to the local authorities regarding theft cases. 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 by the energy provider. Also they can monitor the meter readings regularly without the person visiting each house.

4)A PARALLEL MULTI-APPLIANCE RECOGNITION FOR SMART METER Lien-Chun Wang and Chin-Feng Lai,Wei-Ting ,Yu-Sheng Chiu (2013-IEEE)

This study proposes a non-invasive smart meter system that considers the power use habits of users unfamiliar with electric appliances, and can be used by inserting the smart meter into an electrical circuit. This study also creates a database mechanism, appliance recognition classification, and a waveform recognition method, in order to solve the large data volume problem in current appliance recognition systems. In comparison to other appliance recognition systems, the low-end embedded system chip used in this study has low power consumption, as well as high expandability and ease of use. This experiment is different from the research environments of other appliance recognition systems by considering parallel multi-appliance recognition and general users' habit of using power. This study will not make any assumption of power utilization in the experiment. The total system recognition rate is 84.42%, and the total recognition rate of a single electric appliance is 93.82%, proving the high feasibility of this study.

5)A REVIEW PAPER ON AUTOMATIC METER READING AND INSTANT BILLINGBhushan D. Sawarkar1 , Mrs. Snehal S. Golait(2013-IJARCCE)

The existing systems are either an electronic energy meter or an electro-mechanical meter which are currently in use is limited to record up to kWh units. The kWh units recorded by meter readers monthly, on foot which need to be processed by a meter reading company. For processing the meter reading, company needs to link each recorded usage data to the particular account holder and then determine the amount owed by means of the specific tariff in use. On basis of various platforms researchers proposed many system for Automatic Meter Reading (AMR). There are various wire-based AMR systems like Power Line Carrier (PLC) and Telephone Line Network (optical/ cable) and wireless AMR systems such as E-metering systems based on GPRS, Bluetooth, GSM. Design of an Electric Energy Meter for

long-distance data information transfers which based upon GPRS, but this system can't be implemented so easily because the regular use of GPRS is still a dream to the common man. A GSM based Energy meter with instant billing facility is introduced is efficient, but still the problem of missing SMS will degrade the accuracy and performance. A more reliable and user friendly system by creating web portal for multiple access using the advanced Visual studio .net frame work which will manage the data efficiently even if there is loss of SMS. It makes the design different from the previous proposals and also increases the throughput. The GSM/GPRS channel is a very useful means of communication as sending data as SMS turns out to be a very handy tool, due to its good area coverage capability and cost effectiveness.

IV. EXISTING SYSTEM

➢ There is manual monitoring of the energy consumption. No specialized app or web page for monitoring . Require employee to monitor.

V. DRAWBACKS OF EXISTING SYSTEM

➢ Manpower is required

➢ There is no time based monitoring

VI. PROPOSED SYSTEM

➢ Specialized application for monitoring energy with accurate consumption rate with respect to time. IOT provides faster data communication. Real time monitoring is possible.

VII. ADVANTAGES OF PROPOSED SYSTEM

➢ Manpower is not required
➢ Time based monitoring of the energy consumption.

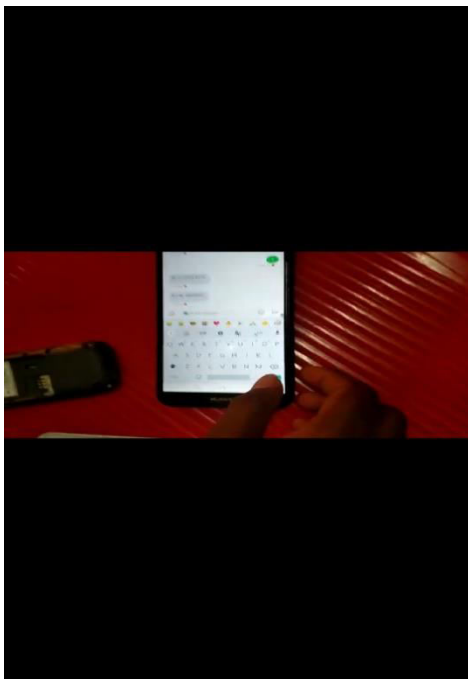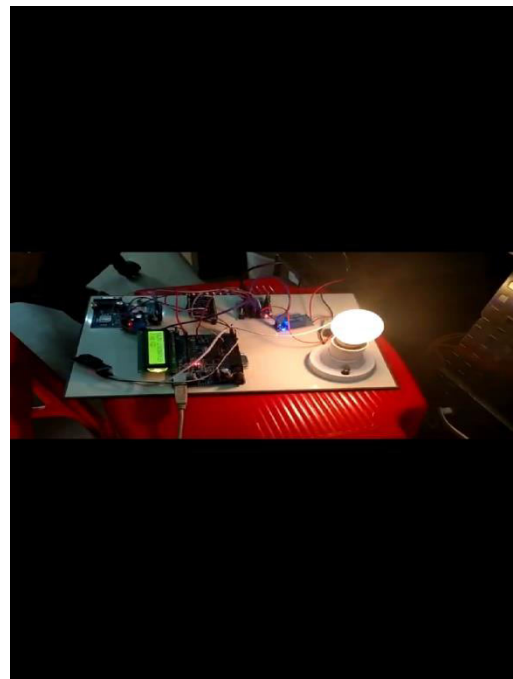## VIII. OUTPUT

FIG 1 SETUP OF PROJECT   FIG 2 WORKING OF PROJECT

IX. CONCLUSION

So it obvious that smart are here to stay and that the SG and smart metering will be a way of life in the future.these SG and smart meters will be a part of the much wider IOT (internet of things) in the future. It is also intergrates multiple aspects oh human needs and services to satisfy such needs and the analytical requirements discussed, such as the big data,real time analytics and it can be built into the process and workflows for the real time diagnostics.

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