



SMART METER PRIVACY WITH RENEWABLE ENERGY BASED WIRELESS POWER TRANSFER USING LoRa

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Abstract

Smart Meters play a vital role in measuring energy consumed by every user with their device details. The inside attacker i.e the tenants staying at home may be able to access the electricity price information, network infrastructure information, and other information communicated through protocols. We proposed a renewable energy based wireless power transfer smart billing system using Internet of Things (IOT) with android application for Electricity Bill (EB) payment. The devices used in my project are LoRa (Long Range), PIC control and Meter box. By implementing we measure the current consumption in every home using LoRa and then transfer those meter values to the electricity board server. The total amount will be calculated on EB server and thus the notification is sent through the SMS. User can pay their bill amounts using mobile application and the users are also notified with an alert message when the usage of power consumption exceeds the premium limit. The meter readings can be viewed from distant places by using this LoRa technology. LoRa enables long-range transmissions (more than 10 km in rural areas) with low power consumption. Also a solar panel is placed at the roof top of the house which converts the sun's rays into electricity. This electricity can then be used to supply renewable energy to your home or business. Hence this acts as an inverter at the time of power shut down. To make the system even more comfortable Wireless power transfer (WPT) systems are also used in my project this allows power to be transferred from one electrical network to another without the need for wires or exposed contacts. For a large number of diverse applications, this feature is highly advantageous, and in certain cases has enabled new applications to be realized. Further, WPT is poised to play a vital role in the worldwide drive to electrify transportation systems and, thus, become ubiquitous throughout technologically advanced future societies. Hence Power can be transferred over short distances (near-field transfer) by the method of WPT. Similarly power theft is also detected. With the advent of smart meters, the frequency of collecting household energy consumption data has increased, making it possible for advanced data analysis, which was not possible earlier.

Keywords: meter readings, EB home, android application, meter data, secure communication, premium maximum limit.

INTRODUCTION

Technology essentially spares utility gives the cost of intermittent outages to every area to peruse a meter. Another preferred standpoint is that charging can be founded on close constant than on appraisals based utilization. This auspicious data combined with investigation can help both utility suppliers and clients better control the utilization and creation of electric vitality, gas use, or water utilization. With the appropriation of savvy/smart meters (SMs) in vitality dispersion arranges the utility providers (UPs) can screen the lattice more, and anticipate in the request more precisely. It utilizes the UPs to expand the efficiency and the unwavering quality of the grid by powerfully altering the vitality era and conveyance, costs in this manner, likewise influencing the user requests. SMs likewise benefit the clients by permit them to screen their own particular vitality devour profile continuous [2]. Customers can utilize this data to cut pointless utilization, or to diminish by moving utilization in view of the set by the UPs. SM arrangement is spreading quickly around the world. In Europe, the reception of SMs has been commanded by an order of the European Parliament, which requires 80 percent SM appropriation in every single European family by 2020 and 100 percent by 2022. Notwithstanding, the monstrous arrangements of SMs at homes have additionally raised genuine concerns in regards to client protection. High SM readings can permit who has entry to this information to gather important private data in regards to client conduct, including the sort of electrical supplies utilized, the time, recurrence and length of utilization and even the TV channel that is being watched, as announced in. The protection of is more basic for organizations, whose energy utilization conduct can uncover vital data about their business to rivals. As pointed out in, depending on the monitoring granularity different consume patterns are identified. With a granular of hours or minutes, one can identify the user presence, with a granular of second or minutes one can derive the exercises of apparatuses, for example, TV or fridge, and with a granularity of one could distinguish blasts of force and recognize the action of apparatuses, for example, microwaves, espresso machines [3].

A few strategies have been proposed to give security to SM clients while keeping the benefits of SMs for control and observing of the matrix. In client, anonymization is proposed by the interest of a trusted outsider. Propose sending the totaled vitality utilization of a

gathering of clients and in clients by adding arbitrary commotion to their SM readings before being sent to the UP essentially, proposes quantization of SM readings. In the majority of the above mentioned work, protection is gotten by bending/changing the SM readings sent to the UP. Notwithstanding, vitality is given, and on a basic level, the UP can without much of a stretch track clients introducing its own brilliant at focuses where the client interfaces with the lattice. It appears that no amount of security can be accomplished under such a solid presumption; nonetheless, clients can cover the examples to individual gadgets and utilization designs by control their vitality utilization. This can be accomplished either the vitality utilization after some time by methods for a capacity gadget, for example, an electric auto battery, or by considering the accessibility of an alternative energy source (AES) [4]. An AES can show an association with a moment vitality lattice, for example, a micro grid, or a renewable vitality source, for example, a sunlight based board. This paper depicts the learning about Automatic Meter Reading (AMR), executing a WPT (Wireless Power Transfer) in view of LoRa technology. Programmed Meter Reading is utilized for remote accumulation of the utilities information. Our fixation will be on Electricity control checking framework which can get the power meter perusing in remote and ascertaining and sending the bill add up to the proprietors portable as SMS from the server in the EB office [5]. Automation of electric meter is exceptionally important to diminish the workload and need for people to physically check the meter. Innovations for remote transmission of information including the security related issues. Smart Grid (SG) and the many advancing difficulties in the brilliant matrix security. Insider dangers in savvy lattice can trade off a considerable lot of the security objectives of a framework. Advance metering infrastructure (AMI) arrangement of the brilliant matrix can have insider assaults at the client endpoint [6]. Validation and approval of clients, the intelligent electronic devices (IED), savvy meters, and outdoor field equipment (OFE) various sorts of clients and distinctive passwords for every part. The KA78XX/KA78XXA arrangement of three-terminal positive controller is accessible in the TO-220/D-PAK bundle and with voltages, as an extensive variety of utilizations [7]. Each sort utilizes inner current restricting, warm close down and safe working region insurance, indestructible. In the event that satisfactory warmth sinking is given, they can convey. Albeit planned principally as voltage controllers, these gadgets can be utilized with outside parts to get customizable voltages and streams. RS232 standard is a non concurrent serial specialized strategy. The word serial means sent one piece at once. Offbeat reveals to us that the data is not sent in predefined schedule vacancies. Information exchange can begin at any offered time to recognize when a message begins and closures [8]. Also a solar panel is placed at the top of the house which acts as an inverter at the time of need.

RELATED WORKS

Toward the next generation of recommender systems

Around the up and coming era of recommender systems a review of the best in class and conceivable expansions presents array of recommender frameworks and depicts the dog lease strategies that are normally classified into the accompanying three primary classifications: content-based, communitarian, suggestion approaches. Different constraints of current proposal strategies and talks about that can enhance suggestion capabilities and make prescribe frameworks relevant to a scope of uses. These augmentations incorporate, a change of comprehension of clients and things, of the relevant data into the proposal, bolster for multi criteria evaluations, and an arrangement of and less meddlesome sorts of suggestions

Recommender systems with social regularization

Although Recommender Systems have been comprehensively broke down in the previous decade, the investigation of social-based suggest frameworks just began. In this paper, going for giving a general strategy to enhance recommender systems by joining interpersonal organization data, we propose a network factorization structure with social regularization [9]. The commitments of this paper are four-fold (1) We expand how interpersonal organization data can benefit recommender frameworks; (2) We translate the contrasts between social- based recommender frameworks and trust-mindful recommender frameworks; (3) We coin the term Social Regularization to represent the social requirements on recommender systems, and we methodically represent how to outline a lattice factorization and (4) general, which can be effortlessly reached out to consolidate other relevant information, like social tags etc. The empirical investigation on two substantial informational indexes shows that our methodologies beat other best in class techniques

EXISTING SYSTEM

In this framework the inside assailant can access, adjust meter readings and can see private data of the client at the client endpoint. Similarly, inside attacker can access the price of information on electricity, infrastructure information on network, and other informations communicated through protocols. Employees from EB office have to manually come and check the readings of the EB Meter which is a tedious task.

Disadvantages

- 1) Waiting time is increased
- 2) Less security
- 3) Man power is required
- 4) Less effective

PROPOSED SYSTEM

In the Proposed System we identify the role of user and verify their the identification of each user. The OTP is sent to user mobile phone for verifying the actual user. Finally a shared secret key is generated between the user and the device for secure communication. After authentication, user can view and pay their EB bills through mobile application remotely. The EB Meter is attached with LoRa transmitter and the Meter Data is sent to EB Server through LoRa Technology. Android Application is deployed to the customer for the Payment purposes. In case of crossing the permitted maximum limit of power consumption, charges are increased as per the government rules. Also a solar panel is placed at the roof top of the house which converts the sun's rays into electricity. This electricity can then be used to supply renewable energy to your home or business. Hence this acts as an inverter at the time of power shut down. To make the system even more comfortable Wireless power transfer (WPT) systems are also used in my project this allows power to be transferred from one electrical network to another without the need for wires or exposed contacts.

Advantages

- Waiting time is decreased
- High security
- Reliable
- High data transmission rate
- More effective

Hardware Requirement

The hardware requirement serves as the basis for the implementation of the system and should therefore be a completed specification of the whole system. They are used by engineers dealing with software for the system design. It shows what the systems do and not how it should be implemented.

- Processor: Core i3/i5/i7
- RAM: 2-4GB
- HDD: 500 GB
- Embedded Fabrication Kit

Software requirement

The software requirements are the specifications of the system in correspondance to the documented requirements. The software requirements of the system includes both definition and a specification of requirements. It is a set of what the system should do rather than how it should do it. The software requirements provide a basis for creating the software requirements specification which is useful in estimating cost, planning team activities, performing tasks and tracking the team's progress throughout the development activity.

- Platform: Windows Xp/7/8
- Front End: Java-JDK1.7, Android- sdk and Eclipse, Apache tomcat
- Back End: MYSQL
- Embedded C

IMPLEMENTATION DETAILS

User registration

In this Module every user will be Register with the Server so user has to give User Name, Password, Address, Mobile number and other details. In the Login module mobile user can login by their User Id and password and make request for their home, office or electric bill details. This request will send to the central server mobile and collect data from it and response to the end user

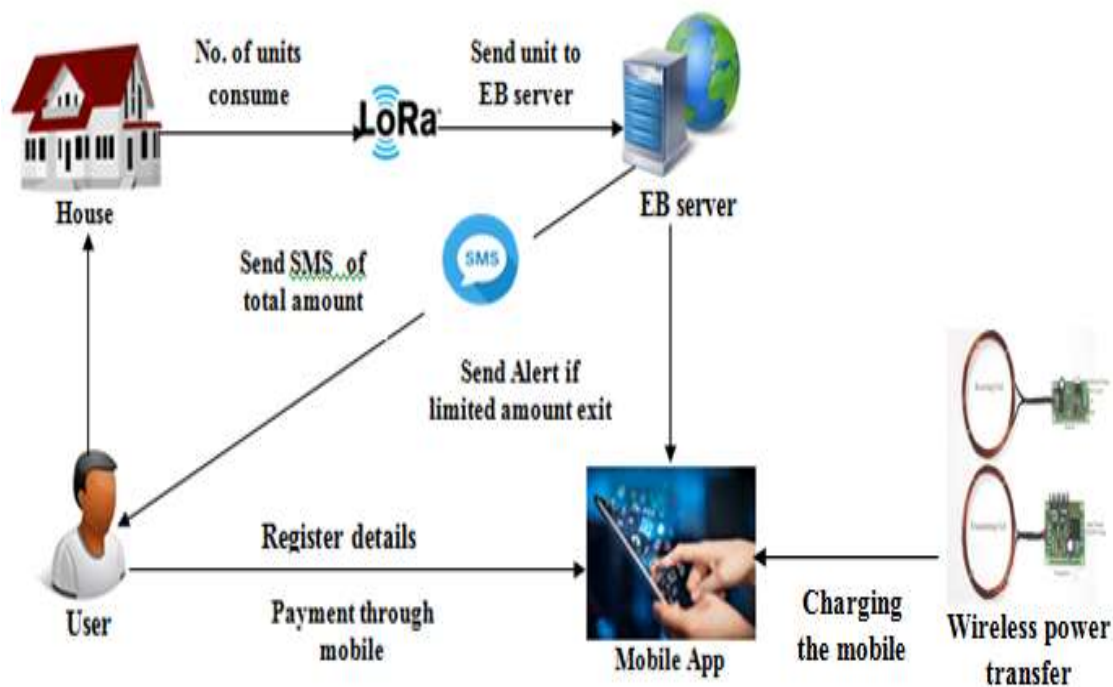


Figure-1. System architecture.

User behaviour monitor

In this module we monitor the behaviour of the user, the usage of the current monitoring, TV programming monitoring and if the current charge go beyond the limit it will be charged according to the government rules.

LoRa communication

In this module we use the advance technology LoRa, through LoRa we can able to transfer the file through light, so in this project we deployed a LoRa communication for data communication between the EB meter and Server.

Android payment system

User can give the payment through online itself. So that this process reduces the standing time of the customers to pay their bill amount and this payment system is developed by android application so that the user can pay by his/her android mobile phone.

WPT transmission

Wireless Power Transfer (WPT), wireless power transmission, wireless energy transmission, or electromagnetic power transfer is the transmission of electrical energy without wires. Wireless power transmission technologies use time-varying electric, magnetic, or electromagnetic fields. When the phone is set on the pad, a coil in the pad creates a magnetic field which induces a current in another coil, in the phone, charging its battery.

OUTPUT AND RESULT

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C:\Users\SriKanth\Desktop\ABE - EB\JAVA\Meterreading>set classpath*.;com.jar;mysql-connector-java-3.2.0-alpha-bin.jar;SMS
App.jar;log4j-1.2.17.jar;httpmime-4.1.3.jar;httpmime-4.0.3.jar;httpcore-4.1.4.jar;httpcore-4.0.1.jar;httpclient-4.0.3.jar;
commons-logging-1.1.1.jar;commons-httpclient-3.1.jar;commons-httpclient-3.1.jar;SMS.jar;C:\Program Files (x86)\Java\jdk1.
6.0_10\lib;

C:\Users\SriKanth\Desktop\ABE - EB\JAVA\Meterreading>set path*.;C:\Program Files (x86)\Java\jdk1.6.0_10\bin;

C:\Users\SriKanth\Desktop\ABE - EB\JAVA\Meterreading>javac *.java
Note: login.java uses or overrides a deprecated API.
Note: Recompile with -Xlint:deprecation for details.

C:\Users\SriKanth\Desktop\ABE - EB\JAVA\Meterreading>java EBMainServer
Values updated.....
Sending msg to=>9094999841
Msg =>Your%20Unit%20is%20....4%20cost%20is%
log4j:WARN No appenders could be found for logger (org.apache.http.impl.conn.SingleClientConnManager).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Message sent
Your Unit is .....4
Sending msg to=>9094999841
Msg =>Your%20Unit%20is%20....4%20cost%20is%
Message sent
Your Cost is .....8

```

Figure-2. Cost estimation and SMS



Figure-3. Prototype model.

CONCLUSIONS

In this paper, we have proposed a smart meter which would be automated using LoRa technology so that the manual checking of Electricity Bill can be avoided. In addition to that a user authentication and authorization scheme for various types of devices in the SG, this scheme can be easily applied to different user roles, such as auditors, operators, and etc., who are capable of accessing different devices in the SG system, as each user-role is computed dynamically based on attribute-based access control using a SHA256 hash function with (mode of access, department, location, SDP) attributes provided by each user. Our plan empowers two-figure verification so that a rebel gadget couldn't re-utilize the past caught data of a real client. A bi-direct cryptography-based is produced between the client and the gadget for further secure correspondences inside a session. Hence the proposed plan is efficient for power consumption through solar panels, power transfer and wireless charging by wireless power transfer also for both, correspondence and calculation overheads in examination with the current plans and can crush some notable outcast assaults and insider assaults with the help of the LoRa technology.

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