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An Intelligent Load Management System for Smart Homes Using Smart Energy Meter

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Abstract: *Smart Meters plays a vital role in measuring energy consumed by every user with device details. But Privacy of the Users is not maintained. Automatic meter reading is a solution designed to automatically collecting consumption, diagnostic, and status data from utility meters and transferring the retrieved data to a central database for billing, troubleshooting, and analyzing etc. AMR solution is built essentially to monitor the energy usage and accessing the daily energy data which can result in better energy management. This paper describes the study about Automatic Meter Reading (AMR) in indoor environments, implementing a WSN (Wireless Sensor Network) is based on LORA technology. Automatic Meter Reading is used for remote collection of the utilities data. And these utilities may mean electricity data or any other. Our concentration will be on Electricity power monitoring system which can receive the electricity meter reading in wireless and calculating and sending the bill amount to the owner's mobile as SMS from the server in the EB office. 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. User behavior is monitored, Current Consumption is calculated. Device control Time & different modes of the control are all monitored. The main aim of the Project is to maintain the User Privacy. All the above information are stored & preserved securely. Current Sensor is connected to the device to verify the switching state of the device. Android Application is deployed to the customer for Payment System. Double Cost is charged in case of crossing Permitted maximum utility of Current. Power cut also performs in main server without sending line reader to cut the supply if user cannot pay the bill amount.*

I. Introduction

1.1 Overview

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.With the adoption of smart meters (SMs) in energy distribution networks the utility providers (UPs) are able to monitor the grid more closely, and predict the changes in the demand more accurately. This, in turn, allows the UPs to increase the efficiency and the reliability of the grid by dynamically adjusting the energy generation and distribution, as well as the prices, thereby, also influencing the user demands. SMs also benefit the users by allowing them to monitor their own energy consumption profile in almost real time. Consumers can use this information to cut unnecessary consumption, or to reduce the cost by dynamically shifting consumption based on the prices dynamically set by the UPs. SM deployment is spreading rapidly worldwide. In Europe, the adoption of SMs has been mandated by a directive of the European Parliament, which requires 80% SM adoption in all European households by 2020 and 100% by 2022. However, the massive deployments of SMs at homes have also raised serious concerns regarding user privacy. High resolution SM readings can allow anyone who has access to this data to infer valuable private information regarding user behavior, including the type of electrical equipments used, the time, frequency and duration of usage and even the TV channel that is being watched, as reported in. The privacy of smart meter data is more critical for businesses, such as data centers, factories, etc., whose energy consumption behavior can reveal important information about their business to competitors. As pointed out in, depending on the monitoring granularity different consumption patterns can be identified. With a granularity of hours or minutes, one can identify the user's presence, with a granularity of minutes or seconds one can infer the activities of appliances such as TV or refrigerator, and with a granularity of seconds one could detect bursts of power and identify the activity of appliances such as microwaves, coffee machines or toasters. Several methods have been proposed in the literature to provide privacy to SM users while keeping the benefits of SMs for control and monitoring of the grid. In user anonymization is proposed by the participation of a trusted third party. Propose sending the aggregated energy consumption of a group of users

and in users protect their privacy by adding random noise to their SM readings before being forwarded to the UP. Similarly, proposes quantization of SM readings. In all of the above work, privacy is obtained by distorting/ transforming the SM readings before being forwarded to the UP. However, energy is provided to the user by the UP, and in principle, the UP can easily track user's energy consumption by installing its own smart measurement devices at points where the user connects to the grid. It seems that no level of privacy can be achieved under such a strong assumption; however, users can conceal the patterns corresponding to individual devices and usage patterns by manipulating their energy consumption. This paper describes the study about Automatic Meter Reading (AMR) in indoor environments, implementing a WSN (Wireless Sensor Network) based on LORA technology. Automatic Meter Reading is used for remote collection of the utilities data. And these utilities may means electricity, gas, water consumption data or any other.

Smart Meter Privacy with an Energy Harvesting Device and Instantaneous Power Constraints by Giulio Giaconi and Deniz G¨und¨uz, H. Vincent Poor, et al., discussed about A smart meter (SM) periodically measures end-user electricity consumption and reports it to a utility provider (UP). Despite the advantages of SMs, their use leads to serious concerns about consumer privacy. In this paper, SM privacy is studied by considering the presence of an energy harvesting device (EHD) as a means of masking the user's input load. The user can satisfy part or all of his/her energy needs from the EHD, and hence, less information can be leaked to the UP via the SM

Yilin Mo, Tiffany Hyun-Jin Kim, Kenneth Brancik, Dona Dickinson, Heejo Lee, Adrian Perrig, and Bruno Sinopoli, et al assume that existing solutions can be directly applied to emerging engineering domains. Unfortunately, careful investigation of the unique challenges presented by new domains exposes its idiosyncrasies, thus often requiring new approaches and solutions. In this paper, we argue that the Bsmart[grid, replacing its incredibly successful and reliable predecessor, poses a series of new security challenges, among others, that require novel approaches to the field of cyber security.

Ishtiaq Rouf∗, Hossen Mustafa∗, Miao Xu, Wenyuan Xu†, , Rob Miller , Marco Gruteser, et al., Researched on smart meters has shown that fine-grained energy usage data poses privacy risks since it allows inferences about activities inside homes. While smart meter deploymentsare very limited, more than 40 million meters in the United States have been equipped with Automatic Meter Reading (AMR) technology over the past decades. AMR utilizes wireless communication for remotely collecting usage data from electricity

Also GEORGE **W. HART** determined the energy consumption of individual appliances turning onand offin an electric load, based on detailed analysis of the current and voltage of the total load, as measured at the interface to the power source. The approach has been developed to simplifr the collection of energy consumption data by utilities, but also has other applications. It iscalled nonintrusive to contrast it with previous techniques for gathering appliance load data, which require placing sensors on individual appliances, and hence an intrusion onto the energy consumer's property.

Andr´es Molina-Markham, Prashant Shenoy, Kevin Fu, Emmanuel Cecchet, and David Irwin, et al., used Household smart meters that measure power consumption in real-time at fine granularities are the foundation of a future smart electricity grid. However, the widespread deployment of smart meters has serious privacy implications since they inadvertently leak detailed information about household activities. In this paper, we show that even without a priori knowledge of household activities or prior training, it is possible to extract complex usage patterns from smart meter data using off-the-shelf statistical methods.

II. Existing System

In existing system a person is assigned to visit each house and note the meter readings manually, which can cause human error and can open an opportunity for corruption done by the human meter reader. Thus the billing system can become inaccurate and inefficient. This is also a time consuming process.

Smart Meters plays a vital role in measuring energy consumed by every user with device details. But Privacy of the Users is not maintained. Consequently, the insider attacker can get access to modify meter readings and can view private information of the customer at the customer endpoint. Similarly, insider attacker may be able to access the electricity price information, network infrastructure information, and other information communicated by protocols.

We propose a system using IOT with android for EB payment system. The devices which use in our project is LORA, PIC control, Meter box. In our implementation we measure the current consumption on every home using LORA and transfer those meter values to EB server. The total amount will calculate on Eb server and send notification through an SMS. User can pay the amount using mobile application. We schedule the limit for EB payment when user cross the limit people will get alert for limit cross.

In order to overcome the problems in the existing system a technique has been developed to read electricity meter readings from a remote server automatically. LORA equipped with microcontroller is connected with the Household EB meter to calculate the EB meter reading. Another LORA Module is connected

with the EB Server, which receives the Meter Readings from the Household EB meter through 2.4 GHZ Frequency. The current sensor is most importantly analyze the power load value of the particular device. An EB value is automatically updated to the server and calculates the amount to be paid in the EB Server database. Mobile phone is connected in the main EB Server, which then sends the SMS to the House Owner regarding the amount to be paid and Units consumed.

III. Designing of new System

3.1 Architecture Diagram

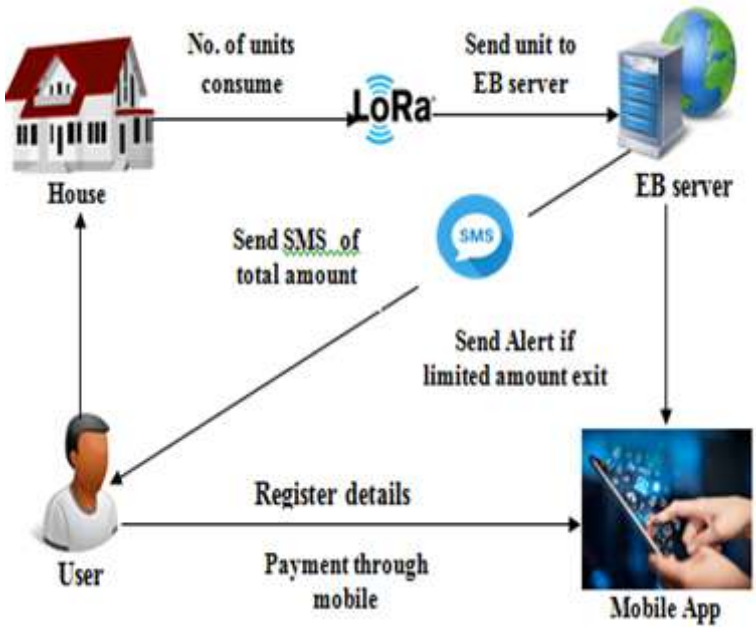


Fig 3.1 Architectural Diagram of proposed system

3.2 Block Diagram

3.2.1 Eb Meter Section

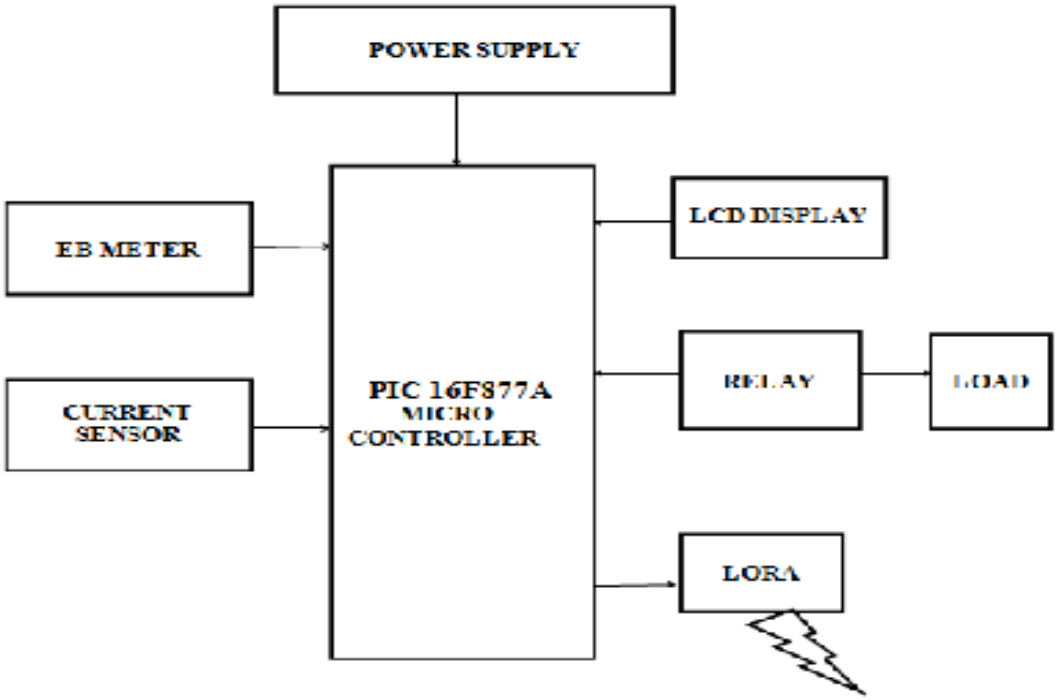


Fig 3.2.1 Block diagram of EB Meter Section

3.2.2 Eb Office Section

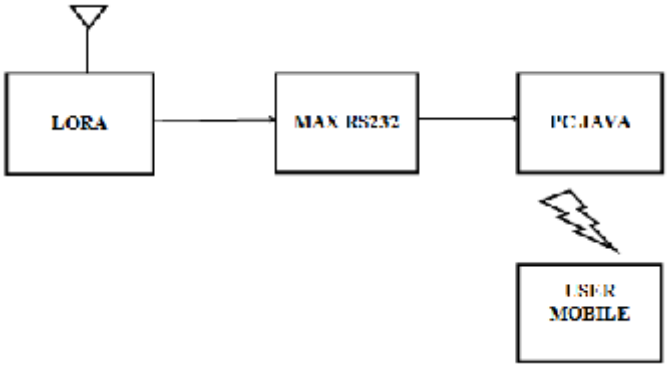


Fig 3.2.2 Block diagram of EB Office Section

It is High performance RISC CPU machine. ONLY have 35 simple word instructions. Operating speed: clock input (200MHz), instruction cycle (200nS).Up to 368×8bit of RAM (data memory), 256×8 of EEPROM (data memory), 8k×14 of flash memory. Wide operating voltage range (2.0 – 5.56) volts.2 8 bit timer and one 16 bit timer is available10bit multi-channel A/D converter Synchronous Serial Port (SSP) with SPI (master code) and I2C (master/slave). 100000 times erase/write cycle enhanced memory.1000000 times erase/write cycle data EEPROM memory.

3.3 Description of PIC

3.3.1 Architecture of PIC

It is High performance RISC CPU machine. ONLY have 35 simple word instructions. Operating speed: clock input (200MHz), instruction cycle (200nS).Up to 368×8bit of RAM (data memory), 256×8 of EEPROM (data memory), 8k×14 of flash memory. Wide operating voltage range (2.0 – 5.56) volts.2 8 bit timer and one 16 bit timer is available10bit multi-channel A/D converter Synchronous Serial Port (SSP) with SPI (master code) and I2C (master/slave). 100000 times erase/write cycle enhanced memory.1000000 times erase/write cycle data EEPROM memory.

3.3.2 POWER SUPPLY CIRCUIT

The hardware of project requires different power supplies 5 v. the interfacing devices will get the supply from main microcontroller

3.3.3 LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data

3.3.4 EB METER

The meter which is used for measuring the energy utilizes by the electric load is known as the energy meter. The energy is the total power consumed and utilized by the load at a particular interval of time. It is used in domestic and industrial AC circuit for measuring the power consumption. The meter is lessexpensive and accurate.

3.3.5 CURRENT SENSOR

A current sensor is a device that detects electric current (AC or DC) in a wire, and generate signal proportional to it. The generated signal could be analog voltage or current or even digital output. It can be then utilized to display the measured current in an ammeter or can be stored for further analysis in a data acquisition system or can be utilized for control purpose.

3.3.6 MAX232

MAX232 is used to convert TTL into RS232 logic level converter used between the microcontroller and the GSM board or PC .Our controller is operated at 5v but interfacing devices are worked with 12v so this IC will convert the level of 5v to 12v for transmitting while receiving convert 12v into 5v to the microcontroller.

3.3.7 RELAY

The relay circuit is nothing but switching unit. This unit switches ON when radio frequency is obtained by RF to DC converter otherwise it will be in OFF state. It also ON when vibration is obtained by piezo electric plate.

3.3.8 LORA

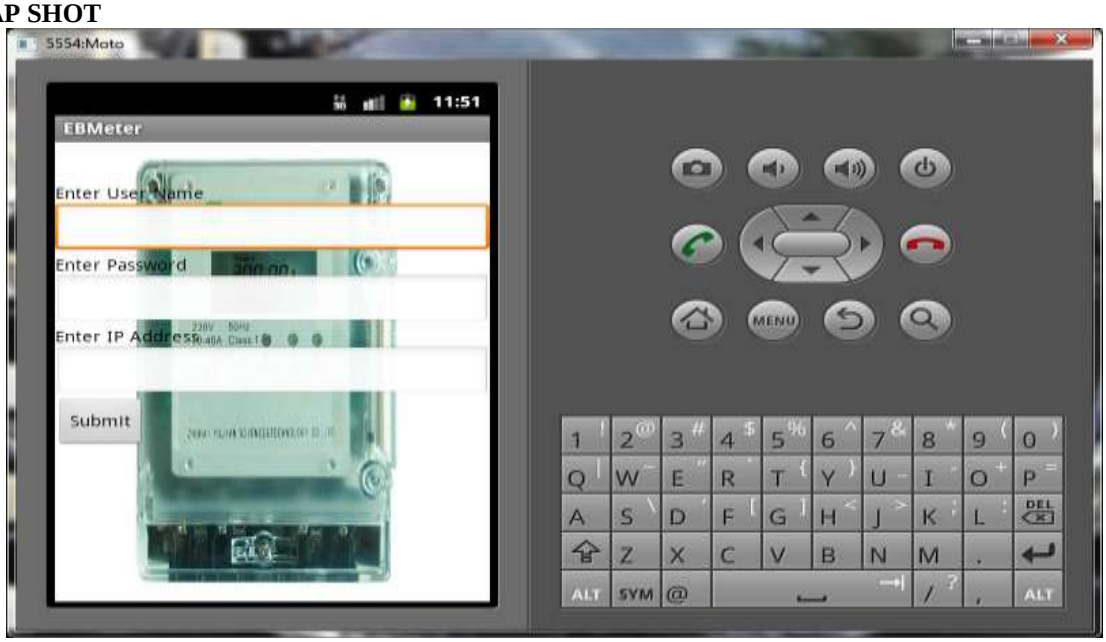
The **LoRa** Alliance is an open, non-profit organization dedicated to promoting the interoperability and standardization of low-power wide area network (LPWAN) technologies to drive implementation of the Internet of Things (IoT). ... The **LoRa**Alliance promotes its Long-Range WAN (LoRaWAN) protocol as an open global standard.

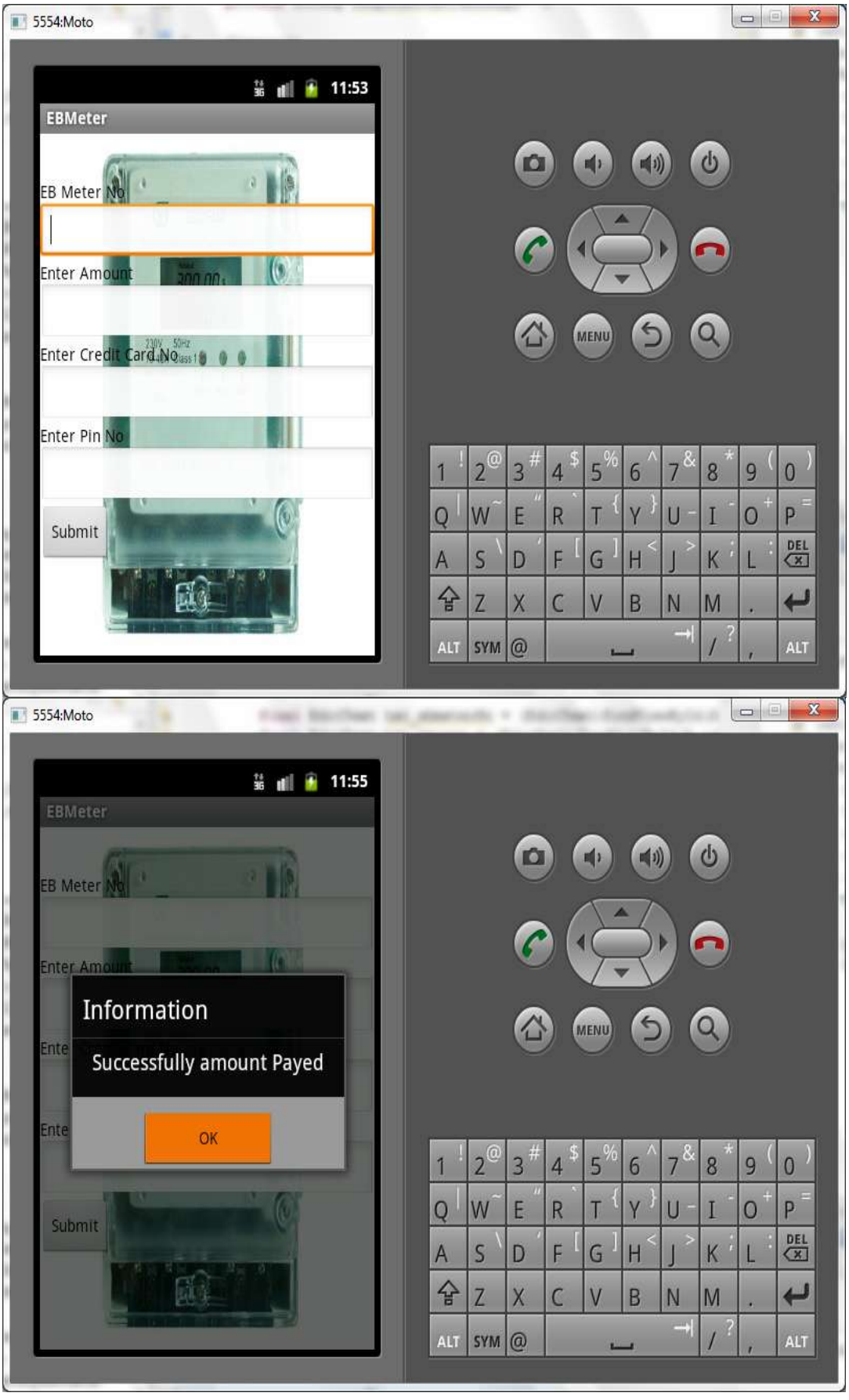
3.3.9 PC JAVA

Java is a programming language that developers use to create applications on yourcomputer. Chances are you've downloaded a program that required the Java runtime, and so you probably have it installed it on your system. Java also has a web plug-in that allows you to run these apps in your browser.

IV. Output

SNAP SHOT

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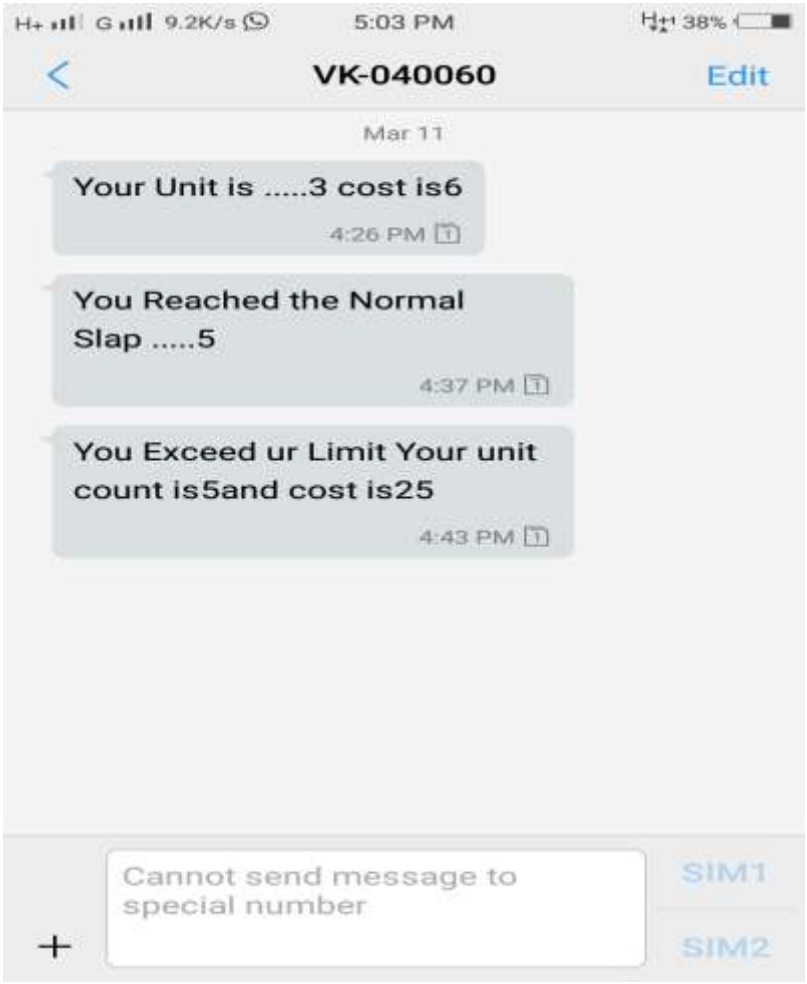

V. Conclusion

In this paper, we proposed a user authentication and authorization scheme for accessing many different types of devices in the SG. Also we have to implement the Lora technology for reading the eb meter values. Home appliances values are reading and sent to main electricity board via Lora. EB bill will pay the android application only. Once the cross the power usage means automatically will detect the double charged.

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