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AN SMART LOAD MANAGEMENT SYSTEM FOR HOMES USING IOT

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ABSTRACT-*Advanced metering system is used to measure, collect, store, analyses and use power consumption information. At present, there is no official version standard released at home. The rapid development of smart grid puts forward higher requirements to its standardization .Series standards of advanced metering system need to be established. According to the construction progress and development trends of smart grid, it proposed specific requirements to its standardization. It launched the research of standard for smart metering equipment and power consumption information collection device. This system will avoid the heavy power usages in the homes. The system will also provide whenever power cut occurs means the reason sent through via SMS.*

KEYWORDS:**Power Theft, Maintenance Scheduling, Billing Problem**

I. INTRODUCTION

Electricity is the driving force behind the development of any country. With the fast increment in private, business, and modern customers of power all through the world, it has now turned out to be basic for utilities organizations to devise better, non-meddlesome, ecologically safe methods of checking utilities' utilization so right bills can be produced and invoiced. In the Web of Things (IoT) display, huge numbers of the living and non-living things that incorporate us will be on the web in some shape. Driven by the ubiquity of devices engaged by wire-less mechanical development, for example, Remote Bluetooth, Radio Recurrence Distinguishing proof, Remote Loyalty, installed sensor, IoT has moved out from its starting stage and it is quite the edge of changing the present settled between net into an all around highlighted up and coming Web. As of now there are very nearly nine billion between associated devices and it is assessed to touch just about fifty billion devices by 2020. There is consolidation of portable innovation into MSEB computerization framework because of the quickly propelling versatile correspondence innovation and the reduction in costs. We propose a framework that gathers the energy utilization from private and additionally corporate zones and send it specifically to the focal server where handling is done on that information for arrangement of bills. AMR framework can be separated into wire AMR framework and remote AMR framework as indicated by correspondence medium utilized. In existing framework for accumulation of energy utilization information is that the delegates of MSEB month to month comes and visit each private, take the preview and corporate and physically peruses the utilization information from the meter. This gathered information is recorded on a bit of paper alongside a depiction of the meter lastly submitted to the neighborhood MSEB office.

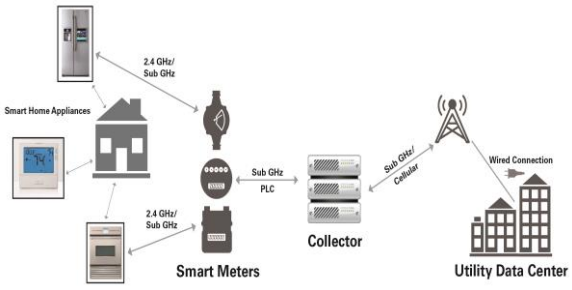


Fig 1.1 Architecture

There after the official's perused the preview and meter readings and afterward offers it to the neighborhood programming for charge figurings and age of bill. We as a customer at that point make the installment for the got charge. This procedure is so much tumultuous process. Man committed errors can be incalculable. HR squandered and

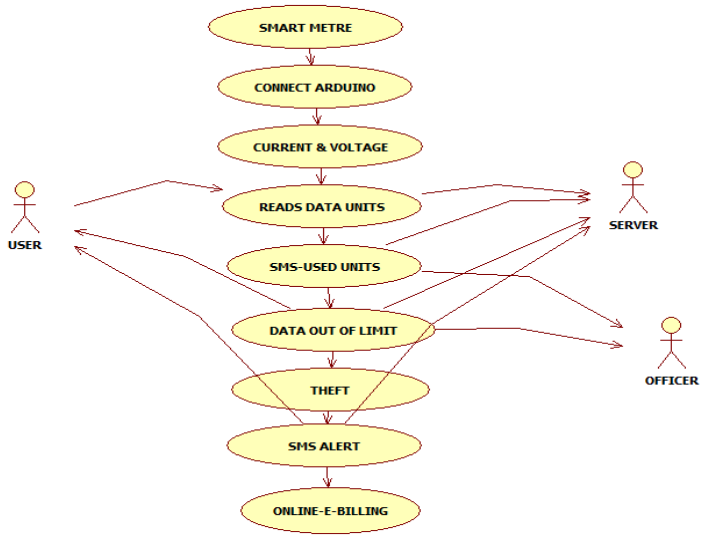


Fig1.2 USE CASE DIAGRAM

numerous different issues do happen. We at long last idea of building a framework that will do the above procedure naturally. Microcontroller is joined with our customary energy meters that will examine the meter perusing after specific period. Remotely, these meters perusing will transmitted to the brought together server alongside their special meter number. This information will be prepared by the server and consequently creates the bill. After age of charge it will send to each purchaser through SMS office.

II. System model

2.1 Smart meter Architecture:

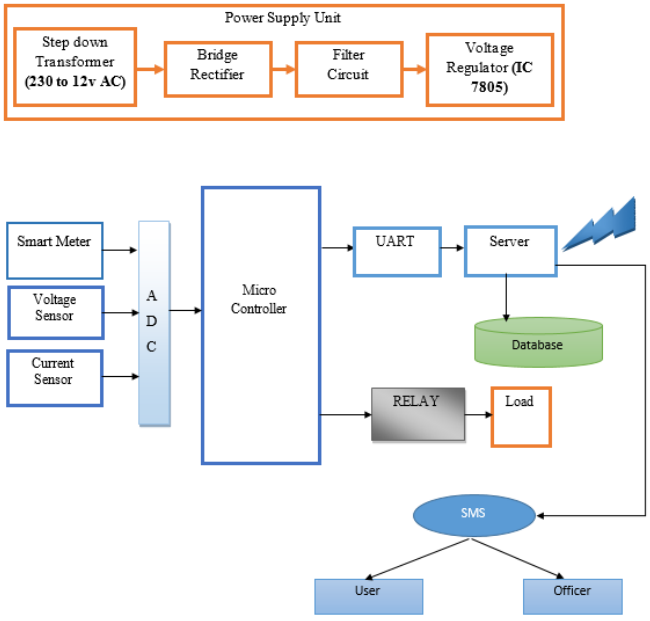


Fig2.1.1 Block Diagram

2.1.1 MODULE DESCRIPTION

- User Interface
- Analog measurement circuit
- Transmitting and receiving
- Data Storing
- Web application

2.1.2User Interface:

In the modern outline field of human– machine cooperation assumes an essential part. It is where connection amongst people and machines happens. Its objective of cooperation between a human and a machine at the UI is powerful activity. Information enabling the clients to control a framework. The user will perform either login or registration operation. After this operations get over he will go to the next phase. This allows the new user to register and open the application to the browser. This helps to monitor the actions that are happening in the home meter that could be traced by the officer and user. This ensures the security credentials so that issues that occur can be easily resolved. The registration can also be done by means of personal id also which is highly useful for illiterate people. This can be directly used by the user or officer by just typing their id in that text fields.

2.1.3 Analog measurement circuit :

Our main goal is to measure the power use of electronic equipment. ACS712 current sensor is connected between supply and load to measure the current flowing through the load. This current sensor is based on the principle of hall-effect. The principle states that whenever current carrying conductor placed in magnetic field, the voltage is created across its edges perpendicular to the direction of both current and magnetic field. The voltage generated is called as Hall voltage which is in microvolts. Proposed block diagram it is directly proportional to the current and magnetic field.ACS 712 current have inbuilt flag conditioner and channel circuit settles and intensifies the prompted Lobby voltage to a fitting level. The ADC channel of microcontroller peruses the deliberate current esteems. The deliberate information is sent to a controller for advance estimation.A relay is used for controlling action (e. g. on/off) of the electronic equipment. Relay circuit receives control signal from Arduino

2.1.4 Transmitting and receiving

At the point when that gadget is in the scope of information gathering it will get the information sent by transmitter in the heap side meter. For this one counter must be introduced in the Arduino. It will keep a record of energy devoured by stack over a given time (say one month).This recorded information will be send by transmitter UART. Accepting gadget will get the meter perusing and keep its record with buyer serial number. For this gadget ought to be in the scope of transmitter. Thus, service organization staff don't need to check each meter. He can take perusing without heading off to buyer's home

2.1.5 Data Storing

The human serious work is stayed away from and every one of the qualities is kept up on the local server. The correspondence medium is secure and altering of energy meters can be recognized effortlessly. In the event that a blunder happens in the framework, the incentive in the focal server won't be refreshed. Once the esteem refreshed crosses the limit time, the server can discover that something isn't right in the framework and can report the specialists in EB.

2.1.6 Web application

Since IoT is savvy contrasted with SMS, checking of energy meters at bring down cost is made conceivable. Every day utilization reports are produced which can be checked through application and additionally web-based interface. Likewise, clients can see their electric bills from their web application.

2.1.7 UML DIAGRAMS

2.1.7.1 Class Diagram

The class chart indicates how the distinctive substances (individuals, things, and information) identify with each other; at the end of the day, it demonstrates the static structures of the framework..A class diagram can be used to display logical classes. Class diagrams can also be used to show implementation classes, which are the things that programmers typically deal with. A class is depicted in the class diagram as a rectangle with three horizontal sections, as shown in above Fig. The upper section shows the class's name; the middle section contains the class's attributes, and the lower section contains the class's operations (or "methods"). The diagram has five main classes which give the attributes and operations used in each class.

2.1.7.2 Use case Diagram

An utilization case shows a unit of usefulness gave by the framework. The principle motivation behind the utilization case outline is to help advancement groups picture the utilitarian necessities of a framework, including the relationship of "performing artists" (people who will communicatewith the system) to essential processes, as well as the relationships among different use cases. The use case has two actors: user and server. User gives the image as input and server performs the operation.

2.1.7.3 Sequence Diagram

Grouping graphs demonstrate a point by point stream for a particular utilize case or even simply part of a particular utilize case. They are relatively clear as crystal; they demonstrate the calls between the distinctive protests in their grouping and can appear, at a point by point level, diverse calls to various articles. A grouping outline has two measurements: The vertical measurement demonstrates the arrangement of messages/brings in the time arrange that they happen; the level measurement demonstrates the question cases to which the messages are sent.

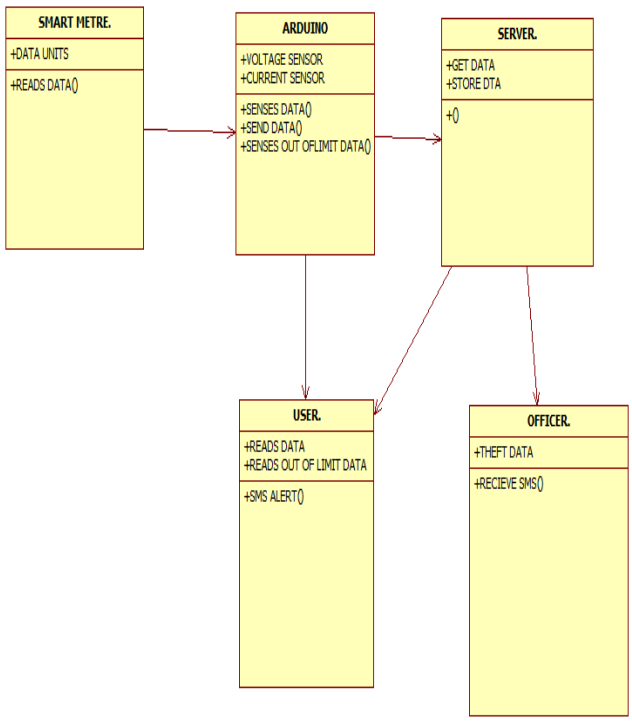


Fig: 2.1.2 class diagram

2.1.7.4 Collaboration Diagram:

Collaboration Diagram is a model used as interactions between classes in the object model. It also called Object Message diagrams. Collaboration diagrams are a technique which defines external object behavior. It includes the same information as message trace diagrams. it shows how objects collaborate by representing objects by icon and message passing as the labeled arrow.

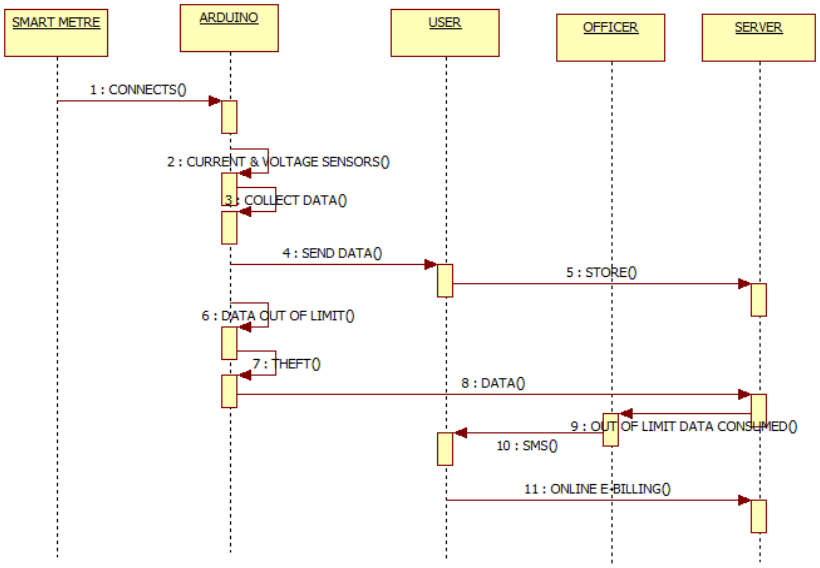


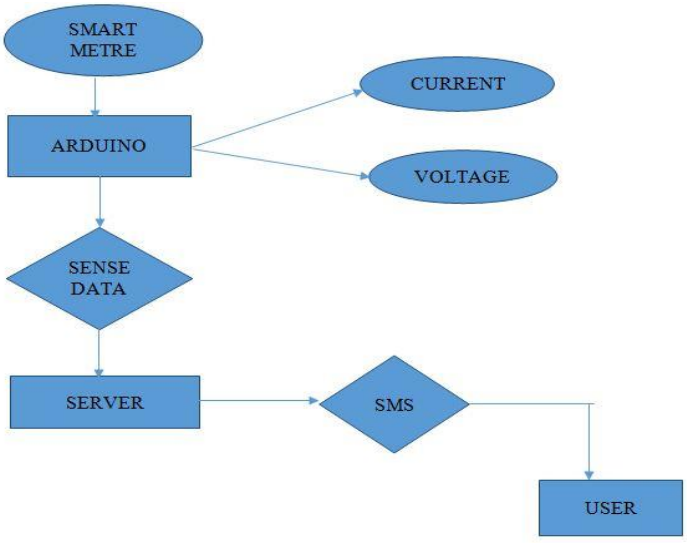
Fig: 2.1.3 sequence diagram

2.1.7.5 Data flow Diagram

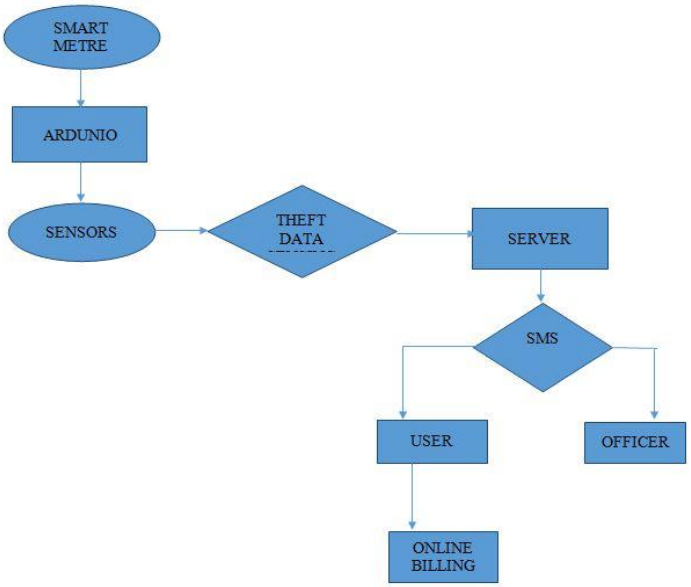
Level 1

2.2 SYSTEM REQUIREMENTS

Level 2



Level 3



2.2.1 HARDWARE REQUIREMENT:

- Microcontroller
- ADC
- UART
- Voltage Sensor
- Current Sensor
- Ethernet Shield
- PC
- Relay
- Power supply unit
- Processor : Pentium Dual Core 2.3GHz
- Hard Disk : 500 GB or Higher
- Ram : 2GB(Min)

2.2.2 SOFTWARE REQUIREMENT:

- Embedded C
- Arduino IDE.
- Operating System : Windows 7 or Higher
- Languages used : Java (JSP, Servlet), HTML
- Tools : JDK 1.7, Net Beans 7.0.1, SQL yog
- Backend : My SQL

2.2.1.1 Arduino:

Arduino is an open-source stage platform for building hardware projects. Arduino consists of both a physical programmable circuit board (frequently referred to as a microcontroller) and a bit of programming, or IDE (Integrated Development Environment) that keeps running on your PC, used to compose and transfer PC code to the physical board.

Fig: 2.2.1Arduino UNO

2.2.1.2 DC VOLTAGE SENSOR

A DC voltage sensor will be able to determine and even monitor and measure the voltage supply. DC Voltage Sensors are used to measure the potential difference between the ends of an electrical component. This can be used to measure the DC voltage in the circuits. The sensor is mechanically fixed by soldering the secondary circuit pins to the PCB. The primary connection can also be integrated in the sensor.

Fig 2.2.2 DC VOLTAGE SENSOR

Pulsating voltage with a galvanic insulation between primary and secondary circuits. The voltage detector indicates the presence of a voltage higher than a limit. The Voltage Sensors are equipped with a micro controller that greatly improves the sensor accuracy, precision and consistency of the readings. They are supplied calibrated and the stored calibration (in Volts) is automatically loaded when the Voltage Sensor is connected.

2.2.1.3 CURRENT SENSOR

A current sensor is a device that detects electric current (AC or DC) in a wire, and generates a 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.

Fig 2.2.3 CURRENT SENSOR

2.2.1.4 RELAY

A relay is a switching device, which is worked both electrically and mechanically.The majority of the industrial application devices have relays for their effective working. Relays consist of an n electromagnet and furthermore an arrangement of contacts. The switching system is carried out with the electromagnet. There are likewise other operating principles for its working. but, they differed by their applications. A large portion of the devices has the use of transfers. The principal activity of a relay comes in places where just a low-power signal can be utilized to control a circuit.

Fig 2.1.4 RELAY

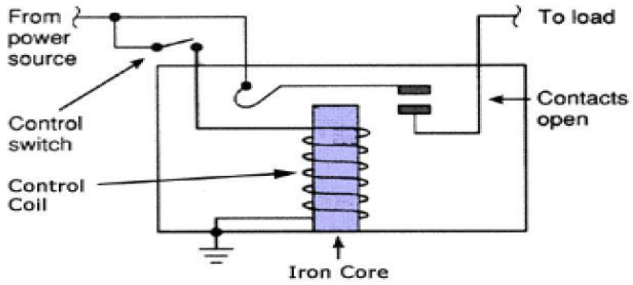
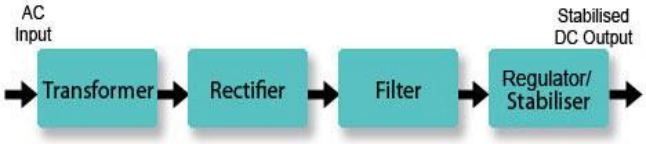


Fig 2.1.5 INNER SECTION OF RELAY

2.2.1.5 POWER SUPPLY

Power supply is a reference to a source of electrical power. A device which supplies electrical energy to an output load is called a power supply unit or PSU.



III CIRCUIT DIAGRAM:

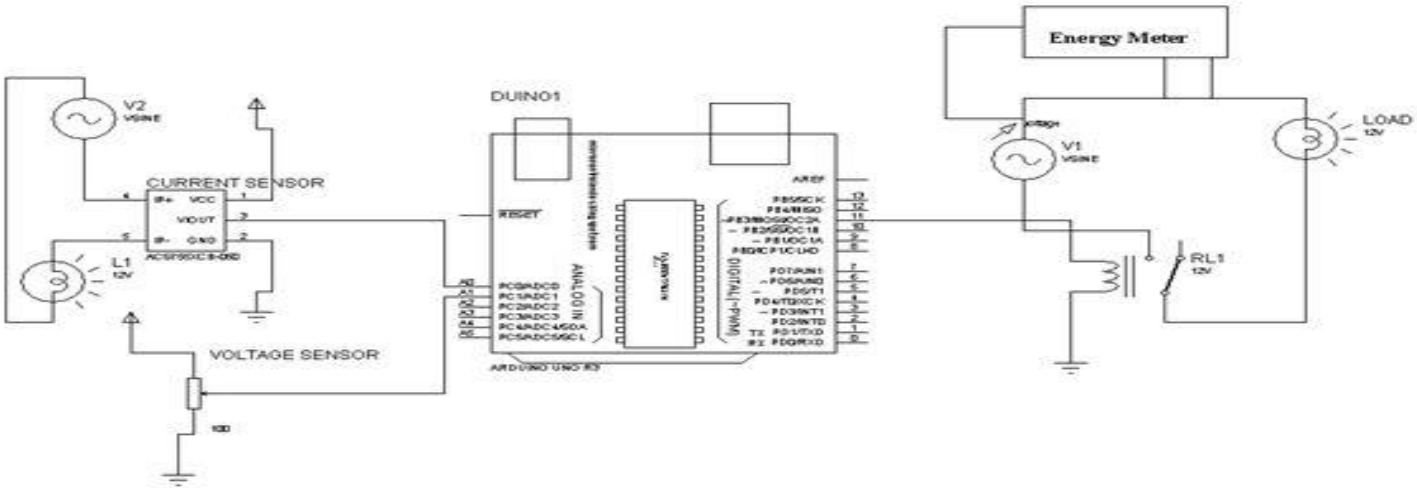
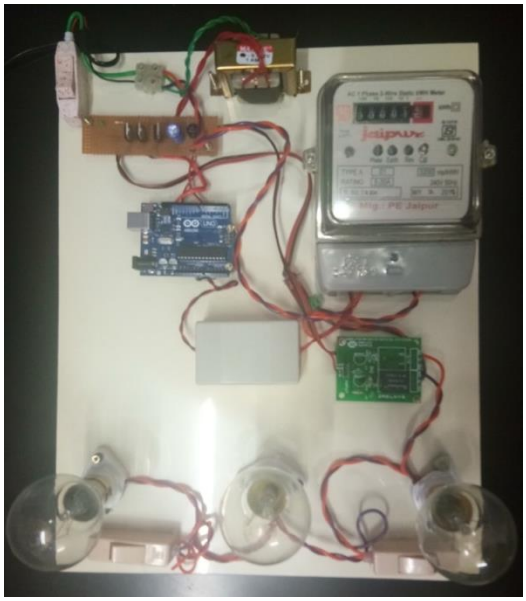


Fig 3.1 Circuit diagram for Smart meter



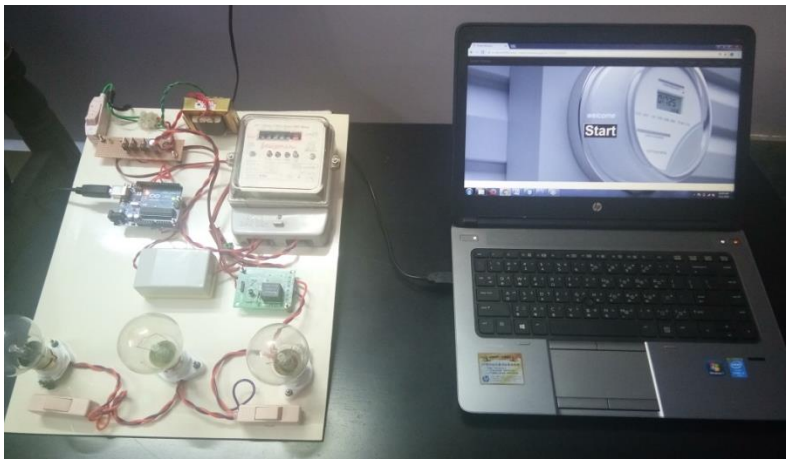


Fig 3.2 KIT setup for Smart meter

IV SOFTWARE DESCRIPTION

4.1 The Java Programming Language

Java is a universal programming language that is simultaneous, class-based, object-oriented, and particularly intended to have a few usage conditions as could be expected under the circumstances.

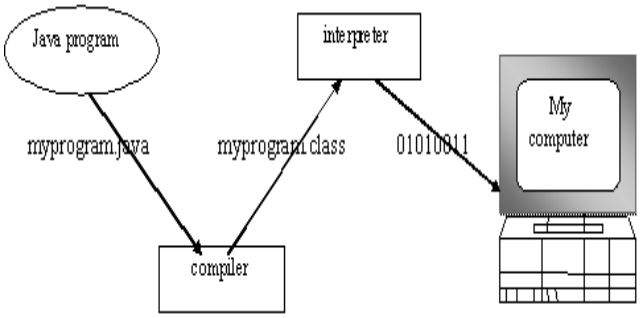


Figure 4.1.1: Java Virtual Machine

4.2 Database: MySQL

MySQL is a database management system (DBMS). A database is a structured collection of data. To access, manipulate, and process data stored in a database, you need a DBMS. Because computers are very effective at handling large amounts of data, database management plays a central role in computing. But more than being a DBMS, MySQL is a relational database management system (RDBMS). A relational database stores data in separate tables rather than putting all the data into one large repository. Doing so adds tremendous speed and flexibility. Amazon.com and eBay.com are examples of complex e-commerce solutions that depend on database

applications to transact business with their customers and partners. MySQL is easy to use, yet extremely powerful, secure, and scalable. And because of its small size and speed, it is the ideal database solution for Web sites.

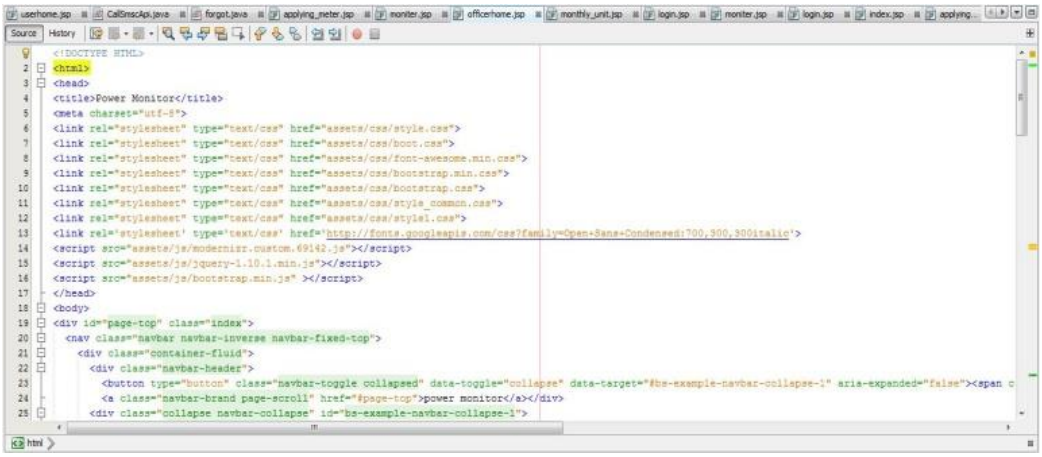


Figure 4.1.2: Sample program

V WEBDESIGN

5.1 USER Web PAGE:

5.1.1 Home Page:-

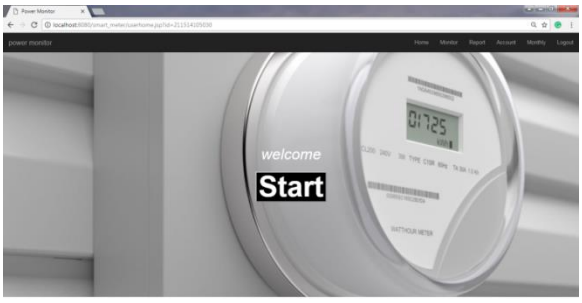


Fig 5.1.1

5.1.2 User Signup Page:-

The user can register their details in SMART METER website user sign-in page.

NOTE: once the user can register their detail in the web application, the Electricity board authority/admin will approve it otherwise the user can't login to their page

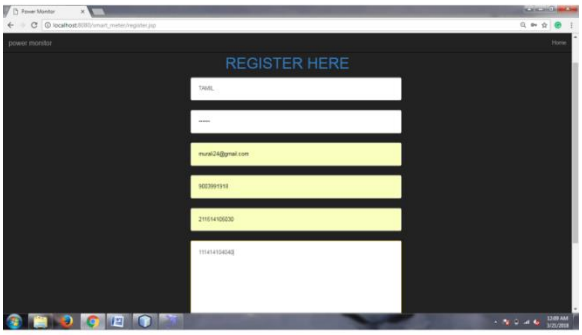


Fig 5.1.2

5.1.3 User Power Monitor Page:-

The user can monitor their daily power usage/energy consumption through this website, on this website the user can monitor their energy consumption in three ways

- NORMAL USAGE MONITOR
- OVERVOLTAGE USAGE MONITOR
- THEFT MONITOR

And also the server can send a total power consumed by the user with the amount

5.1.4 Normal Usage Monitor Page:-

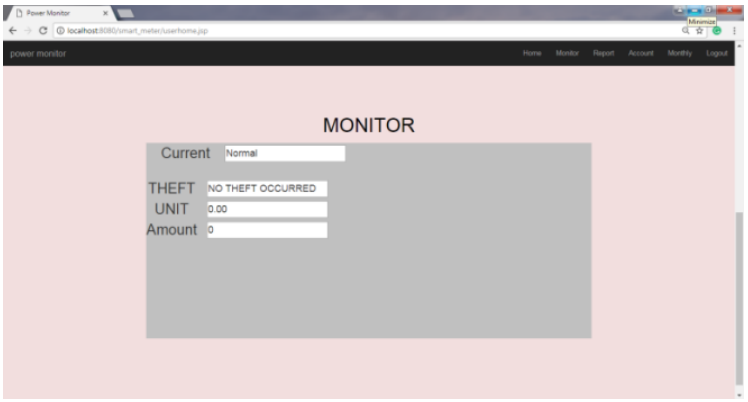


Fig 5.1.3

5.1.5 Overvoltage Usage Monitor Page:-

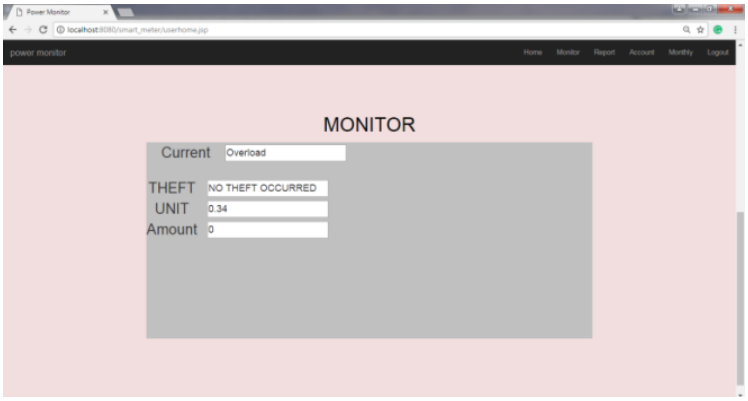


Fig 5.1.4

5.1.5 Theft Monitor Page:-

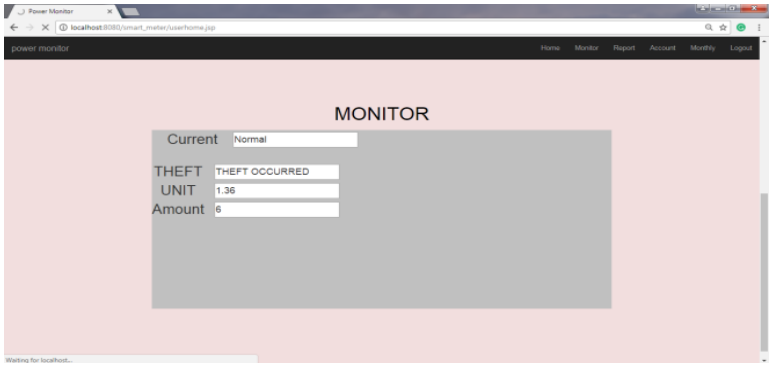


Fig 5.1.5

5.1.6 Total Unit Monitoring Page With Online Pay Option:-

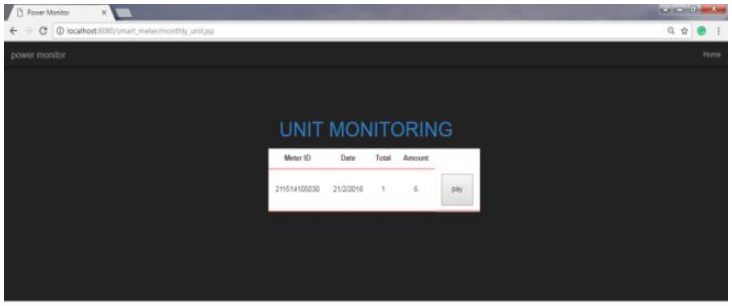


Fig 5.1.6

5.1.7 User Account Linking Page:-

The user can directly link their bank account to electricity board for online payment option

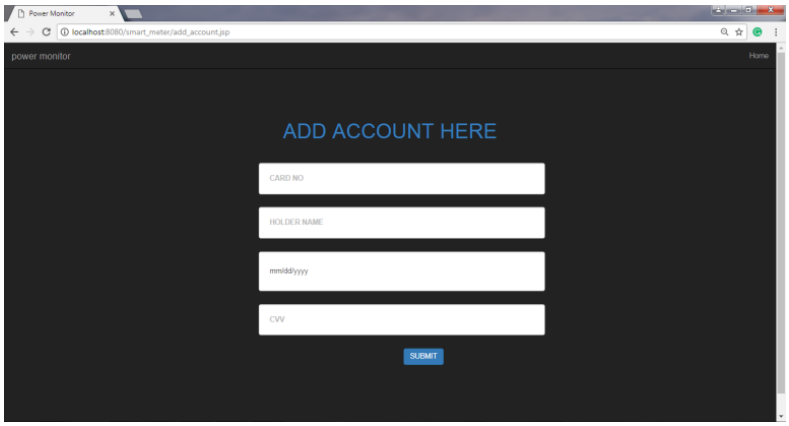


Fig 5.1.7

5.1.8 User complaint page:-

The user can complain regarding power supply quality like a low voltage problem, etc this information will be stored directly in admin database.

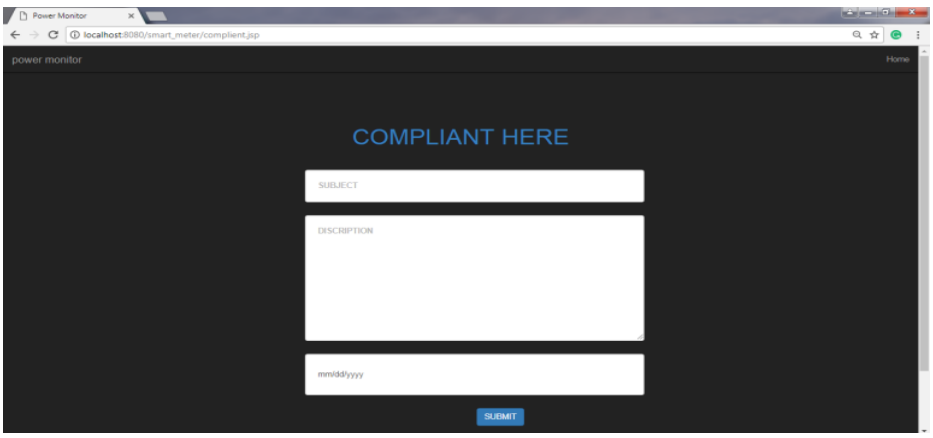


Fig 5.1.8

5.1.9 Forgot option:-

When the user can forget their password use this option to retrieve their login password.

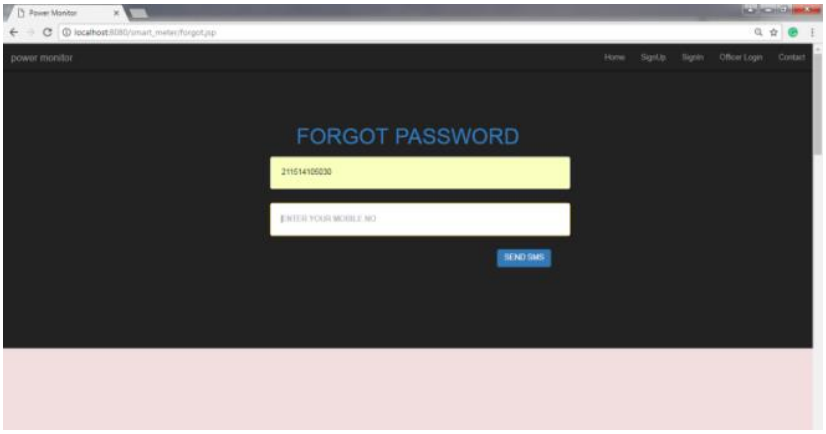


Fig 5.1.9

5.2 OFFICER Web PAGE:-

The officer page is login only by electricity board authority members/ Admin. This page is used to monitor the total power consumption by the user and also find if the theft occurred in that particular place

5.2.1 Officer Login Page:-

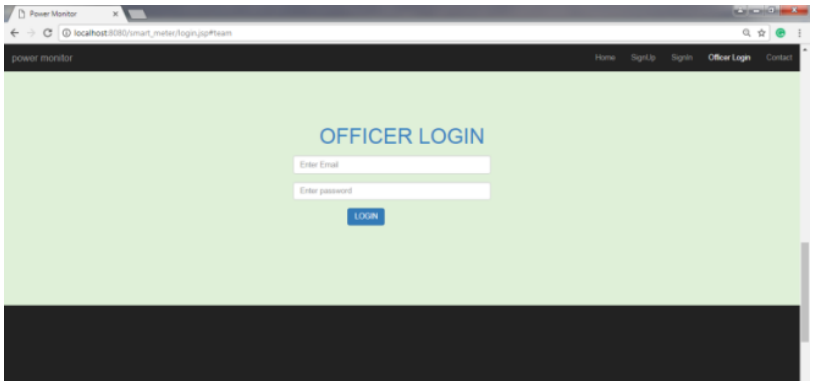


Fig 5.2.1 Officer signup

5.2.2 User Approval Page by Admin/Officer:-

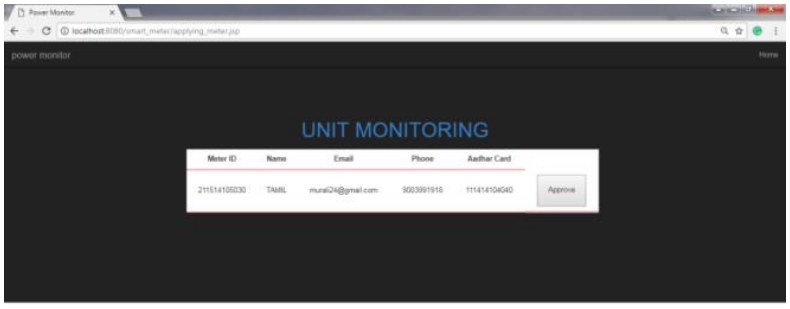


Fig 5.2.2 User approval

5.2.3 User Power Consumption Monitoring By Admin/Officer:-

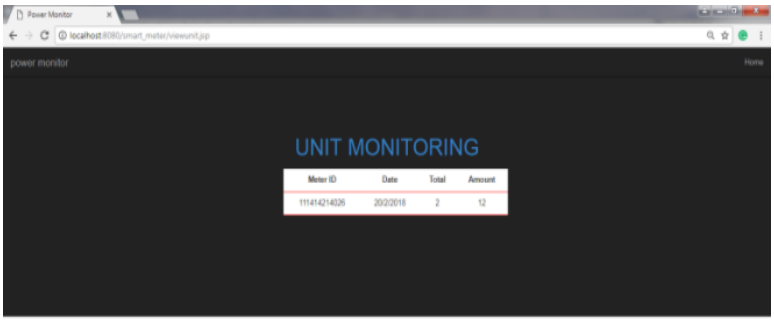


Fig 5.2.3 Unit monitering

5.2.4 User Complaint Viewed By Officer:-

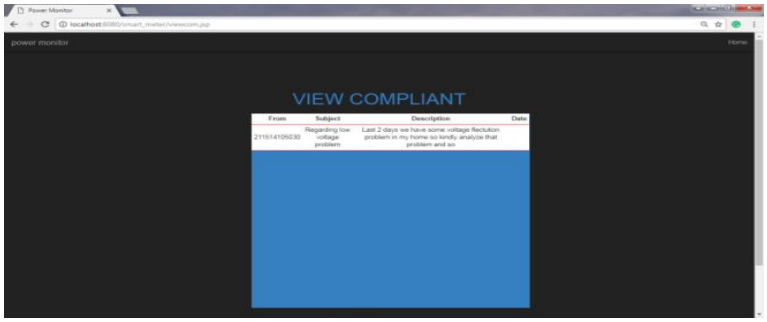


Fig 5.2.4

5.3 SMS FOR USER & ADMIN:

In this Smart meter the total unit consumed by user with amount will be sent by SMS through online database to user as well as electricity board admin, so that we reduce a manual error and manpower while taking reading, and also the server send if the user consumes more energy i.e SMS like "you have exceeded your allowed electricity usage please control".

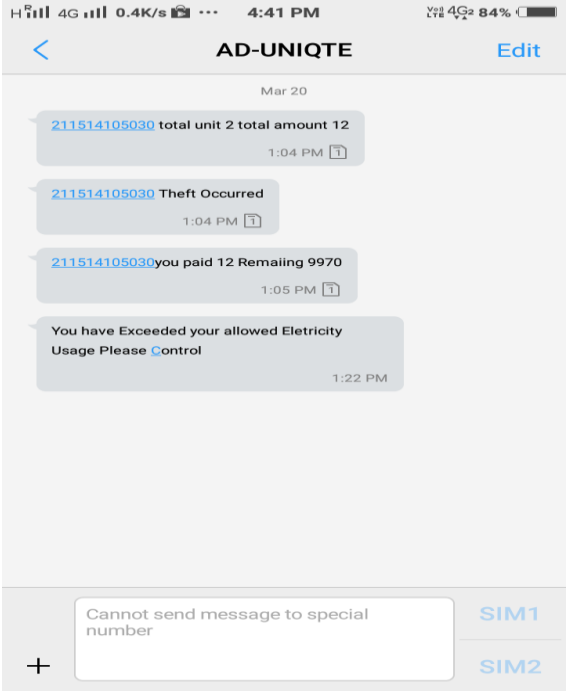


Fig 5.3.1 SMS received on user mobile

VI REALTIME PROTOTYPE/ Future Improvement:

In general a smart meter is a two way communication energy meter without any manpower between user and admin the first idea proposed for smart meter communication system is GSM, but this makes the network problem and increase manufacturing cost after some research they use IOT(Internet Of Things) technology i.e to use LAN /Ethernet connection. For real-time uses it is not possible to connect all users to a single LAN network server for that we need to introduce some new technology at low cost i.e "SMART GRID"

6.1 SMART GRID

The smart grid introduces the next level of communication between the user and the power suppliers. The current interface between the suppliers and the user is the meter, which has remained basically the same, technologically-speaking, for the past century, and cannot communicate information to or from the consumer. Smart grids allow power companies and consumers to gather precise information about the quantity and timing of household consumption and enable consumers to receive information, such as real-time pricing and emergency grid requests to lower energy consumption.

Fig 6.1.1 Model for communication between user and power supplier through smart grid

Fig 6.1.2 communication between household users, industries, power suppliers through smart grid

CONCLUSION

Along these lines, we have displayed web associated energy checking and controlling framework that builds familiarity with vitality utilization among devices and clients. Energy awareness enables the consumer to control the power condition of the devices according to their needs which limits the power utilized. In the coming future, every individual device will have their own identity that can share and convey the data over the IP network.

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