Prepaid Energy Meter with GSM Technology

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ABSTRACT: This paper presents the design and modelling of a GSM-based Energy Recharge System for prepaidMetering with an android application for a user registration. The present system of energy billing in India is error prone and also time and labour consuming it is involved other issue like electricity theft. The paper aims to design and develop an intelligent energy metering system that can efficiently control the amount of electricity consumed by the user.Electricity users can by specific amount of energy to use it only when they needed. This is achieved by interfacing energy meter with GSM technology .The system also alerts when recharge is finished. A new interactive user friendly graphical user interface is developed using java Errors get introduced at every stage of energy billing like errors with electro-mechanical meters, human errors, processing errors. The aim of the project is to minimize the error by introducing a new system of Prepaid Energy Metering using GSM. The GSM module provides a mode of communication between the user/ and provider. This will enable the user to recharge his/her electricity account from home. We can easily implement many add-ons such as energy demand prediction, real time dynamic tariff as a function of demand and supply and so on.

KEYWORDS: : Energy meter, GSM technology, Microcontroller (AT89S51), Prepaid Energy Meter, Relay, Load, Transformer, Android Application

I. INTRODUCTION

The traditional method of electricity billing system involves meter readers to periodically visit every house to take readings. There are many issues related to this method such as taking wrong readings, lack of meter readers, and houses in very remote areas, meters in inconvenient location and so forth. Many technological advancement have been carried out..

GSM technology is used so that the consumer would receive messages about the consumption of power (in watts) and if it reaches the minimum amount, it would automatically alert the consumer to recharge. Apart from making readings using GSM communication, billing system is needed to be made prepaid to avoid unnecessary usage of power. It 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.

II. RELATED WORK

Mr.Nazir Bin Abdullah [1], developed an automatic meter reading system (Automation of ResidentialElectricity Cut off Using Embedded Controller). In 2012 for domestic user. In this project he used GSMmodem for transmitting and receiving information, both sides means user side and energy provider side. Mr. Hung Cheng Chen [2] proposed a wireless automatic meter reading system in 2012. In thisproject he used ZigBee module on both sides. This technology is chip and low cost. Mr.Alauddin Al –Omary[3] develop an automatic meter reading system using GPRS technology. In 2011. MR.LI Quan Xi [4] design an automatic meter system based on ZigBee and GPRS system. In 2010. Mr.H.G..Rodney Tan [5] develop an automatic power meter reading system using GSMnetwork.in 2007.In this system GSM digital power meter installed in every consumer unite and electricity ebillingsystem at the energy provider side.

Mr.MejbauiHaque [6] develop a microcontroller based single phase digitalprepaid energy meter for improved meter and billing system. Amit Jain [7], proposed a prepaid meter using mobile communication in2011

III. LITERATURE SURVEY

This project is useful for billing purpose in Electricity board and in water authority. Instead of going to every house & to recharge the electric meter and taking the readings.. This system uses Java Basics software, which is designed as the client application to send SMS using the Modem, then process and stores the data. In this client application we have functionality like register new user,login.After login we have two options like make recharge and history.In this project the micro controller & the GSM unit is interfaced with the Energy meter of each house. Every house has a separate number, which is given by the corresponding authority.

The GSM unit is fixed in the energy meter.The amount of consumption is stored in memory authority as SMS. Using this software we can send the SMS through Modem to that particular number which is assigned by these authorities and wait for the response. On other end the modem will receive the data in the form of a command and informs the controller to supply the electricity The number assigned by the authorities is Unique

IV. SIMULATION DIAGRAM

The simulation diagram of proposed system is as follows:-

The hardware kit having connectivity of other hardware components with microcontroller which has been shown with the help of simulation diagram.
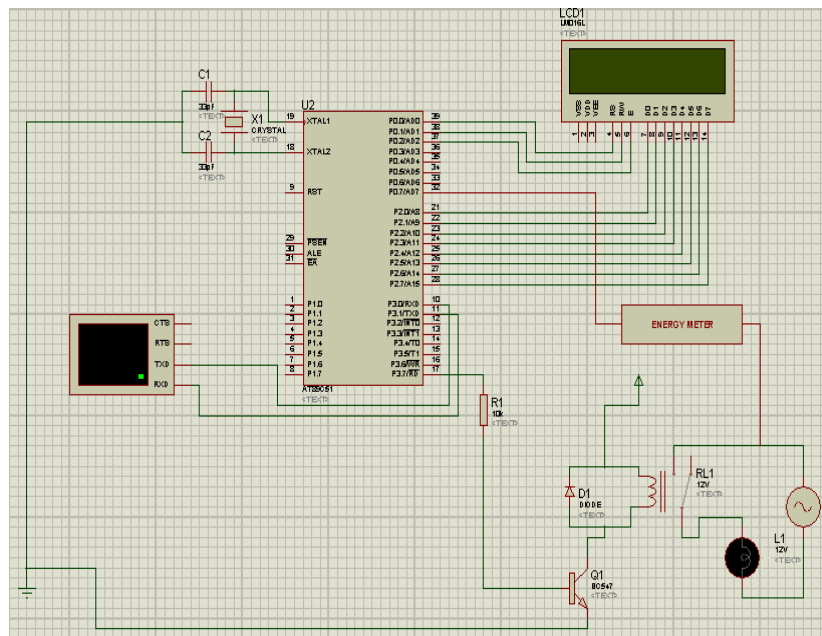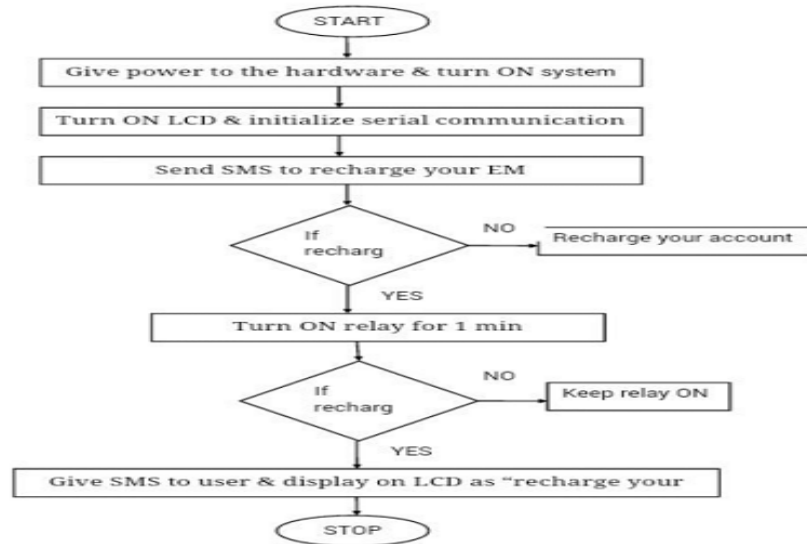

V. FLOWCHART OF SYSTEM

The step by step working of our system in graphical form is shown below:-

Graphical representation of flow of working of an our system is represented using the flowchart.

VI. EXISTING SYSTEM

In existing system electric meter is placed in each house.In this system man power is required for taking readings but such system involves many issue like taking wrong readings and electricity theft.reading made by human are prone to errors.in such system if we doesn't use energy then also bill is monthly comes.that mean we pay without using energy. The kWh units used then still have to be recorded by meter readers monthly, on foot. The recorded data need to be processed by a meter reading company. For processing the meter reading, company needs to firstly link each recorded power usage datum to an account holder and then determine the amount owed by means of the specific tariff in use

VII. PROPOSED SYSTEM

This mechanism, essentially, requires the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available credit is exhausted then the electricity supply is cut-off by a relay. Readings made by human operators are prone to errors. This project addresses the above mentioned problems. The proposed system will first register the user. For making recharge the user must have to login to the system. The username and password must enter to login then it will check for the user is authenticated or not through server. It can able to recharge through client android app only if the user is authorized user. After recharge ends it will cut off the electricity.

VIII. WORKING

The proposed model has the AT89S51 microcontroller as Central Processing Unit. The whole system is interfaced with AT89S51 microcontroller. The GSM modem is serially connected with the controller which is the major communication module between User and provider. The GSM uses its own network for the transfer of information. Special coding in embedded c is used for programming AT89S51 microcontroller using programmer Hardware along with MP-LAB IDE software. The relay acts as switching device to cut off and restore power supply.

The LCD is interfaced to microcontroller using parallel port connection. In this project the Microcontroller based system continuously records the readings and the live meter reading can be sent to the Electricity department on request. This system also can be used to disconnect the power supply to the house in case of non-payment of electricity bills. A dedicated GSM modem with SIM card is required for each energy meter.

The registration must be done at client side app and then login using username and password if the login is successful it check for the entered user is authorized or not at server side then if it is authorized user then only recharge can be made. Otherwise it will not able to login. For storing database PHP language and MySQL database is used.
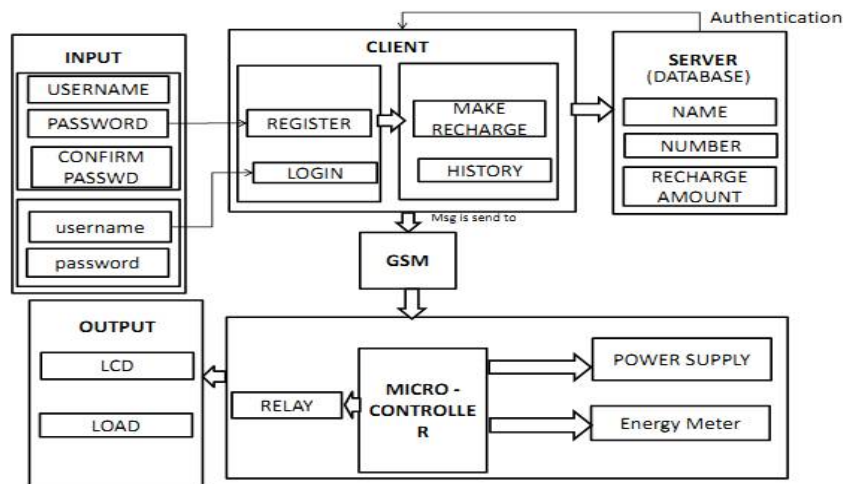
IX   **BLOCK DIAGRAM OF SYSTEM**

We are creating an java client application for interacting with hardware kit.Using server we send message to app then app will send message to GSM which is in the hardware kit.That message will receive and the according to available recharge system will work.

XI   **ALGORITHM**

ALGORITHM 1:-
Step 1: Start the program.
Step2: Interface LCD and Keypad to the AT89S51 Microcontroller
Step 3: Initializing the LCD.
Step 4: Enter the card number.
Step 5: Configure the GSM and send number to the server.
Step 6: If the number is valid then receive the recharged amount through GSM.
 Step 7: If the number is invalid then enter the correct number.
Step 8: When the electricity is consumed, then the recharged amount will get decremented.
Step 9: When 80% of the recharged is consumed, then the user will get a warning message to recharge the EnergyMeter.
Step 10: When the recharged money gets over, the relay cut-off the household power supply.
 Step 11: Stop the program

ALGORITHM 2:-
Step 1: Open client android application
Step 2:Make user Registration
Step3: Using user name and password do login
Step 4: After login make recharge
Step5: If authentication is done by sever then recharge is done display msg on lcd
Step 6: Check history to see whether recharge is added or not
Step 7: Stop

XII   **RESULT AND DISCUSSION**
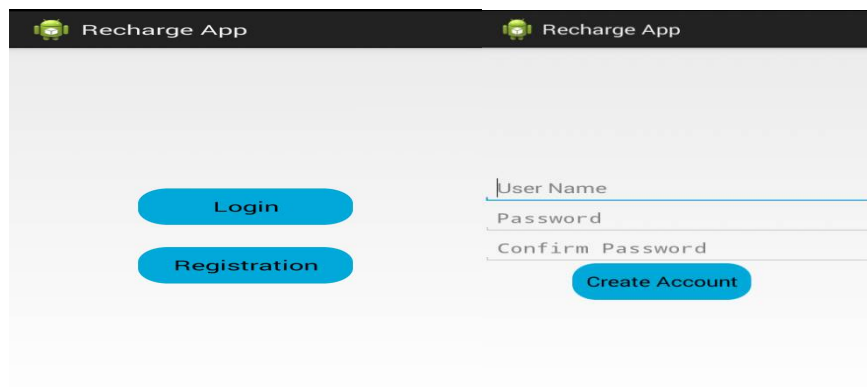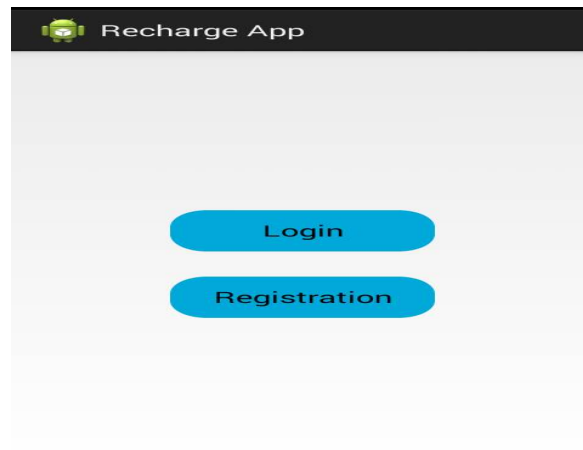
Step1: Open application and make registration-
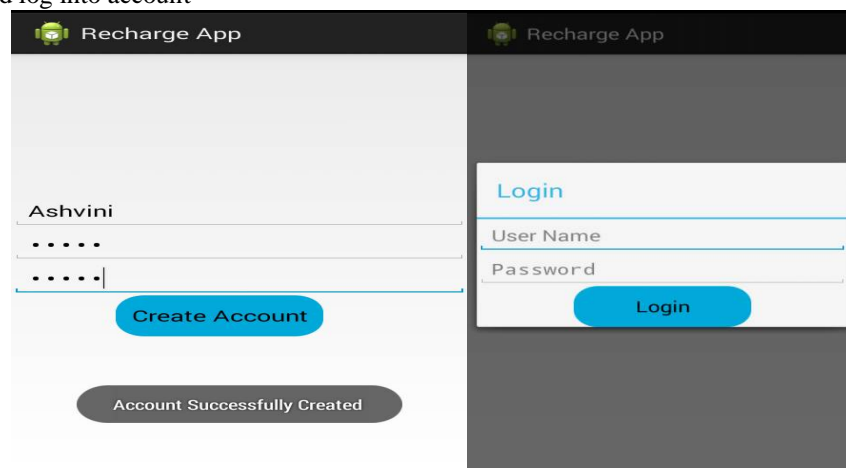You have to enter login id and password to login.

2.create account and log into account

3.loginand click on make Recharge.
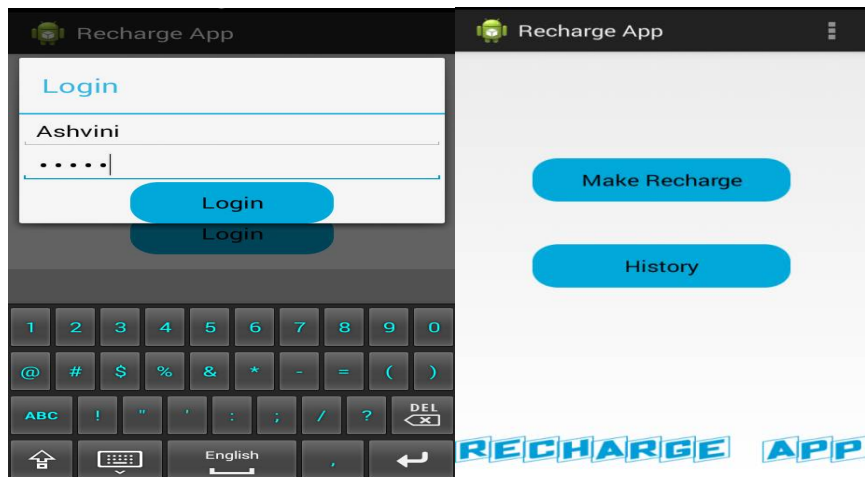
4.Insert data and click on Done.
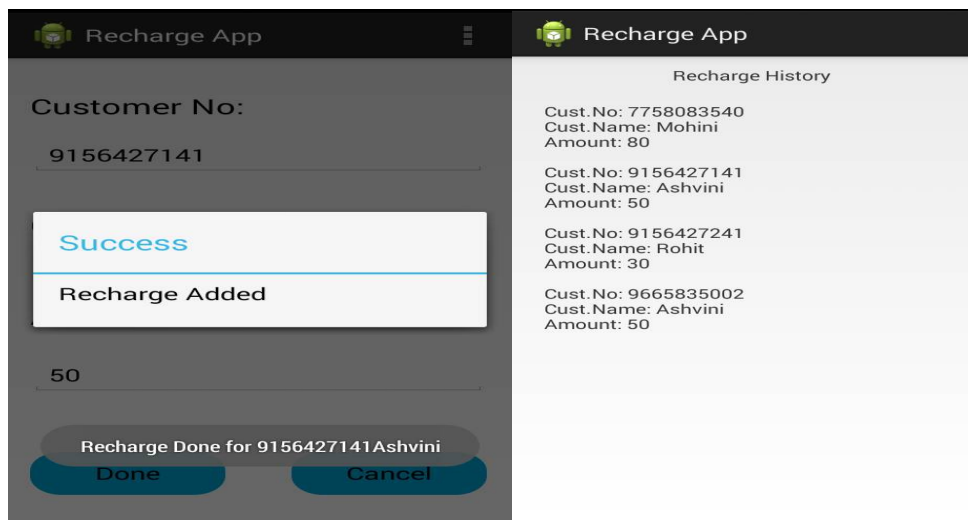
At server side:-
Get All Records:-In this the records of all the recharge made will be displayed.

```php
<?php
define('HOST','mysql.hostinger.in');
  define('USER','u376740691_user');
  define('PASS','database');
  define('DB','u376740691_db');
  $con = mysqli_connect(HOST,USER,PASS,DB);
$username = $_GET['username'];
    //Creating sql query with where clause to get an
specific employee
    $sql = "select * from allRecharge where username
='".$username."'";

//echo $username;
//echo $sql;
    //getting result
    $result= mysqli_query($con,$sql);

    //pushing result to an array
      $r= array();

      if ($result->num_rows > 0) {
      // output data of each row
      while($row = $result->fetch_assoc()) {
      array_push($r,array(
          "username"=>$row['username'],
          "mobile"=>$row['mobile'],
          "amount"=>$row['amount'],
        ));
      }
      } else {   echo "0 results"; }

    //displaying in json format
    echo json_encode(array('result'=>$r));
```

```php
<?php
define('HOST','mysql.hostinger.in');
  define('USER','u376740691_user');
  define('PASS','database');
  define('DB','u376740691_db');
  $con = mysqli_connect(HOST,USER,PASS,DB);

    $username= $_GET['username'];

    //Creating sql query with where clause to get an
specific employee
    $sql = "SELECT * FROM login WHERE
username='$username'";

    //getting result
    $r = mysqli_query($con,$sql);

    //pushing result to an array
    $result = array();
    $row = mysqli_fetch_array($r);
    array_push($result,array(
          "username"=>$row['username'],
          "password"=>$row['password']
      ));

    //displaying in json format
    echo json_encode(array('result'=>$result));

    mysqli_close($con);
?>
```

Insert Record And Make Recharge:-
Here you can get the all information about login ,no,recharge made.

```php
<?php
  define('HOST','mysql.hostinger.in');
  define('USER','u376740691_user');
  define('PASS','database');
  define('DB','u376740691_db');
  $con = mysqli_connect(HOST,USER,PASS,DB);

  $username = $_POST['username'];
  $password = $_POST['password'];


  $sql = "insert into login (username,password) values
('$username','$password')";
  if(mysqli_query($con,$sql)){
    echo 'success';
  }
  else{
    echo 'failure';
  }
  mysqli_close($con);
?>
```

```php
<?php
  define('HOST','mysql.hostinger.in');
  define('USER','u376740691_user');
  define('PASS','database');
  define('DB','u376740691_db');
  $con = mysqli_connect(HOST,USER,PASS,DB);

  $username = $_POST['username'];
  $mobile= $_POST['mobile'];
  $amount= $_POST['amount'];


  $sql = "insert into allRecharge (username,mobile,
amount) values ('$username','$mobile', '$amount')";

  if(mysqli_query($con,$sql)){
    echo 'success'; echo $sql;
  }
  else{
    echo 'failure';
  }
  mysqli_close($con);
?>
```

XIII   FUTURE SCOPE

In the present time of 21st century we have no space for errors or faults either in any technical system or in general applications. Prepaid energy meter is an advantages concept for the further. It's facilitates the exemption from electricity bills. Electricity coupons will be available at nearby shops.

The word prepaid means "pay before use" one of the advantageous feature of this concept prepaid energy meter is used to prepaid the ongoing supply of electricity to homes, offices etc

XIV   CONCLUSION

The design of Smart Energy meter using GSM technology can make the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available credit is exhausted then the electricity supply is cut-off by a relay. This reduces human labour and at the same time increases the efficiency in calculation of bills for used electricity. Smart energy meters will bring a solution of creating awareness on unnecessary wastage of power and will tend to reduce wastage of power. This module will reduce the burden of energy providing by establishing the connection easily and no theft of power will take place. This paper work exposes the purpose of energy monitoring and controlling by implementing prepaid system. It is hoped that this work helps the consumers for better energy management and its utility in the distribution system for economic liability of the Electrical Boards

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BIOGRAPHY

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