IoT Based Prepaid Energy Meter

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Abstract: *The billing process for electricity consumption currently used is a very long process and requires a lot of manpower. Usage and requirements of electricity are increasing rapidly and also the dependency on electrical appliances is increasing. Energy billing in India is done by going to every consumer's house and generating the bill. The Electricity Board is unable to keep track of the demand of consumers. For overcoming all the difficulties present in the system a fully automated billing system is proposed i.e., "Prepaid Power Billing Using Adaptive Meter". The billing process will be in terms of prepaid energy billing in which the customer has to pay first and then use it. The recharging can be done and can also be operated from any remote place without accessing the energy meter physically. This meter needs to be recharged similarly to a mobile phone, payment for recharge can be done on the app, and can monitor the amount of deduction, energy consumption, frequency, voltage, and power fluctuation. Users can control the energy consumption from a remote location if any appliance is not in use. This project will be implemented in a prototype model which will be able to introduce the smart billing system to the customers and also helps the Electricity Board to work efficiently.*

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I. INTRODUCTION

The usage of electricity is increasing day to day and also electrical appliances are coming into the market more often. Even automobile companies are interested in producing electric vehicles. These days electricity become more essential for the sustainment of human life. In our country still, there are places where there is a lack of electricity and also in some rural areas, electrical theft through the meters is still in practice. To avoid such issues, brought this Prepaid Energy Meter Based on IoT to improve our Electricity Board policies of distribution in a better way. Our meter works on the pulse which is created according to the consumption of electricity by the consumers. A smart energy meter is an electronic device that measures the most accurate amount of electricity consumed by a residence business or any electrically powered device. The billing process gets easier with this method and lots of manpower will be reduced for the billing process. With this, the link can be done through an app developed. Even the electricity board can have the charity of demand. Consumers will also be happy they can operate the load and monitor the meter.

II. IoT Based Prepaid Energy Meter

The main objective of the IoT based prepaid energy meter is to bring transparency in billing and usage between customers and the electricity board. It also conserves energy and can help in operating the load from remote locations.

2.1 Existing System

Distribution and maintenance of electricity are owned by the local state electricity board, users will get the power from the electricity board. The electricity usage of a user is calculated by calculating the kilowatt-hour of electricity used over the period of a month. I work from the electricity board take the reading by visiting work to do and generate a with a device. The recipients pay the bills by their favourable payment option and the post-paid method of payment the electricity is very inefficient as it can be used wrongly. They don't even pay for months which results in loss of electricity and the loss of the electricity board as well. It cannot monitor real-time energy usage. The usage of electricity by consumers is uneven and it can't be identified. Even when the consumer is failed to pay the bill on time on the time it will result in a loss of money to the electricity board and the government as well.

2.2   Proposed System

Smart meters will continuously monitor and send feedback on data to the customers. We will develop an android application that is connected to the electric meter and at the time of installation of the device staff will generate a unique identification number for the user with that number user can install the app and recharge the meter. With this method, users can also monitor the power supply. Users can have the balance and then use the electricity until the balance is completed. If the balance is completed then the electricity supply to the load is cut off by the relay. Using the app, we can operate the supply which is given to the load. The newly created device and the user will be linked together. The user will recharge the device so that units will be purchased according to the amount paid. Using a relay, we can on/off load supply so that the balance amount can be saved for future use.
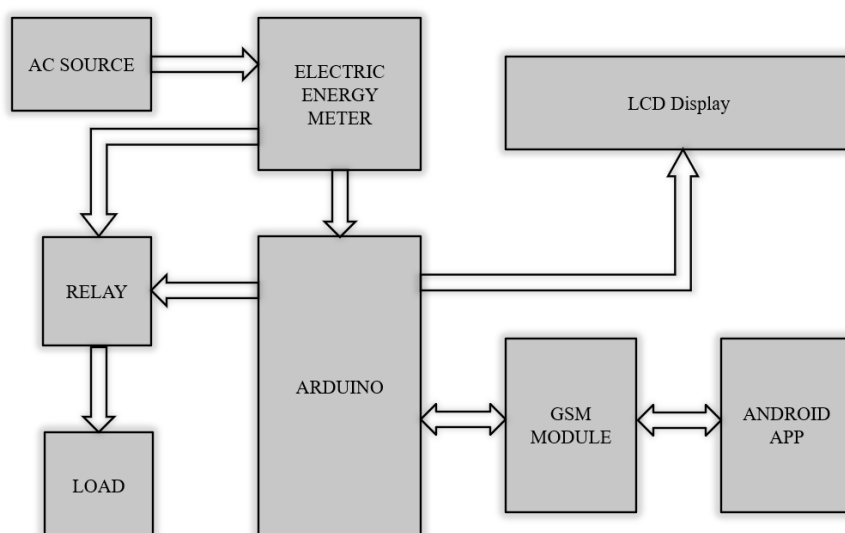
The above figure represents the complete block diagram where the energy meter is first connected to the supply and relay well as to the Arduino. The control will be done with code dumped in the Arduino and USB port.

III.   Hardware Setup

In this, an Energy Meter, two bulbs, one fan, one relay, one Arduino Nano, one GSM model, a microcontroller, and a graphical user interface display.

An energy meter is connected to the AC supply integrated with the Arduino nano and also with a relay. This model is developed by using IOT technology it has Arduino nano as the CPU which is used to interface all other components that are required for the prototype model. The GSM modem is used as a communication model between the user and provider by correcting it serially with the controller. The GSM uses its network to transfer the data. Arduino is used to get power programming of an ATMega328P microcontroller by special coding. The relay act as a switching device that is used to cut off and restore the power supply. A graphical LCDs the mqtt status, SIM status, Wi-fi status, and also the balance of the energy meter with respect to the number of units consumed by the load. Various types of loads are used to connect the energy meter, through the software application which is developed by the admin and is used to control the load consumption from remote locations.

Here we used a graphical display to display the units, rupees, and the status of the sim and mqtt. When the balance becomes almost zero the loads get turned off automatically and turn on when you recharge the GSM.

If the consumer did not pay the energy bill within time, the utility can remotely disconnect the service of a particular consumer and after payment, the service continues to the consumer. So that weekend stop sending an employee to cut off energy from the network and again to reconnect their connection. We have connected the level switch for tampering attempt detect when anyone tries to open the meter cover the button will release and send information to the service provider.

IV. Software Support

Arduino IDE is used to develop power programming ATMega328P microcontroller. It is used to interface the various components within the Arduino Nano. A code is developed for every component interfacing within the Arduino IDE. By using MQTT serial an application called "Prepaid Meter" is developed for controlling and monitoring the total units consumed by the restrictive loads. Through the Android application, the connection between the energy meter and the two loads can be either connected or disconnected from any remote location whenever needed GSM module is interfaced with Arduino Nano such that it provides two-way communication between the application & Arduino nano by using AT commands. A text message is received by the admin. Whenever the system is ready to use. Notifications can be received by the user whenever the recharge of balance is low through the GSM interfacing. Recharging the energy meter can be done through the *60# with Normal text and also through the Android application.
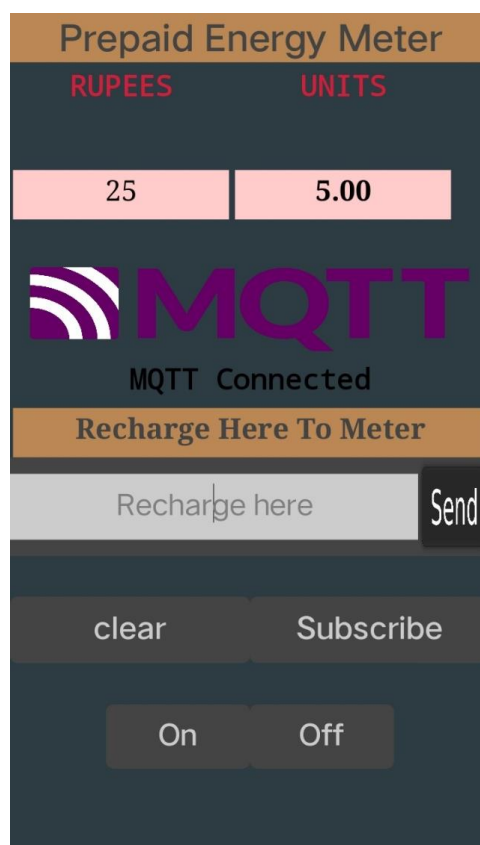
V. Result

Smart Energy Meter monitors the unit consumed and transfers the unit as well as the cost over the internet. It will help consumers to avoid the unwanted use of electricity. It can monitor real-time energy usage. It makes us possible to use power resources more efficiently. It can be operated from remote places using the app. Easy to the buy prepaid vouchers from most banking apps and retailers. It can combat meter-tampering via security-enhanced metering. Consumers only pay for the electricity that they use. The overall process in this will work on GSM. First, we switch on the load and connect the DC supply to the load then the system will get ready now we have to recharge it with an app and also possibly with the messages the system will be on until the balance we get a low balance message if the system balance is low and it gets turned off when the balances become zero. Manpower will be reduced with this energy meter which is more cost-effective. This project is mainly user-friendly and even the electricity department can have the clarity of demand required by the consumer and they will supply the power on time, accurately. The remote operation of this project will help the user in saving money spent on the electrical appliances in their place. The graphical display integrated into this project will help in user to understand the operation very easily and also the app helps the user to monitor the units consumed at the place. Users will also get messages as low balance or system ready with the help of the GSM model. Relay is responsible for this operation of on and off so that the meter tampering can't be done. In this way, this project is more efficient and also brings transparency between users and the electricity board.
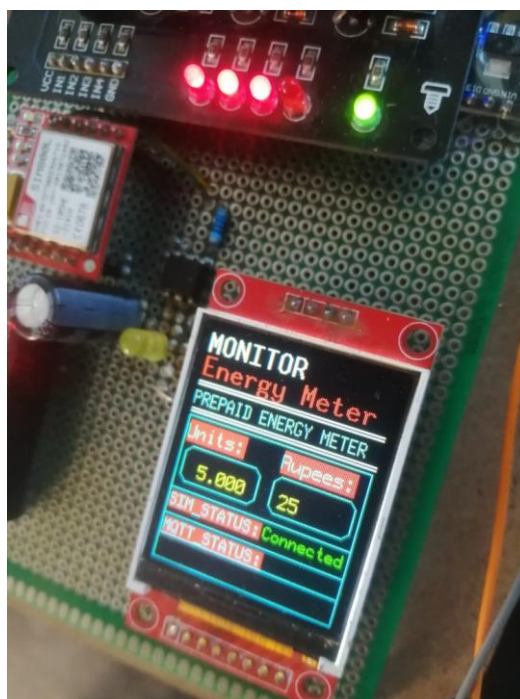
VI. Conclusion

These days of the energy system, designing strategies that help in effectively controlling energy consumption and avoiding energy wastage is very important. This is an Arduino nano based design and implementation of an energy meter using IoT. Here energy consumption is calculated by counting calibration pulses from the energy meter. In this system, electricity controlled -prepaid energy monitoring bill payment system electricity controlled prepaid energy monitoring bill payment system is designed to continuously monitor the meter reading to be handy and transfer the data to a central server which can be accessed from anywhere on a remote place at any time by an android app. Disconnection of electric service from a remote place is done through our designed android application.

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