GSM Based Electricity Meter with Instant Billing System

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Abstract- The GSM-based electricity meter with an instant billing system is a project designed to provide an efficient and convenient method for monitoring and billing electricity consumption. This system utilizes the Global System for Mobile communication (GSM) technology to enable remote monitoring and control of electricity meters. The main objective of this project is to overcome the limitations of traditional electricity metering systems, such as manual meter reading and delayed billing processes. By integrating GSM technology, the system enables real-time communication between the electricity meter and the utility provider, allowing for instant meter readings and billing calculations. The proposed system consists of three main components: the GSM-based electricity meter, a central server, and a user interface. The GSM-based electricity meter is installed at the consumer's location and is equipped with a GSM module, which enables it to transmit meter readings to the central server. The central server receives the meter readings from multiple electricity meters and performs billing calculations based on predefined tariff rates. The server also stores the consumption data for future reference and generates instant bills for each consumer. These bills can be sent to the consumer's mobile phone via SMS or accessed through a web-based user interface. The user interface provides consumers with access to their consumption data, billing information, and payment options. Consumers can view their current and historical electricity usage, monitor their bills, and make payments through various payment gateways integrated into the system. The GSM-based electricity meter with an instant billing system offers several advantages over traditional metering systems. It eliminates the need for manual meter reading, reduces billing errors and delays, and provides consumers with real-time information about their electricity consumption. Additionally, it enables utility providers to optimize their billing processes and improve overall customer satisfaction.
Key Words: Automatic Meter Reading System (AMRS); GSM; PIC; Short Messaging System (SMS); Visual Studio .NET; C#.

1. Introduction

The GSM-based electricity meter with an instant billing system is a modern approach to electricity metering and billing, aimed at overcoming the limitations of traditional systems. In conventional setups, electricity consumption is monitored through manual meter readings, which are prone to human errors, delays, and inconvenience for both consumers and utility providers. This project introduces a solution that leverages GSM technology to provide real-time metering and instant billing capabilities. GSM, or Global System for Mobile communication, is a widely used cellular communication standard that enables wireless communication between devices over long distances. By integrating GSM modules into electricity meters, this project establishes a seamless connection between the meter and a central server, allowing for automated and immediate transmission of consumption data. The core objective of the GSM-based electricity meter with an instant billing system is to streamline the metering and billing processes, enhancing accuracy, efficiency, and convenience. With real-time communication, utility providers can eliminate the need for manual meter readings, reducing the associated costs and potential errors. Consumers can enjoy the benefits

of instant billing, receiving accurate and up-to-date information about their electricity usage. The system comprises three key components: the GSM-based electricity meter, a central server, and a user interface. The electricity meter, equipped with a GSM module, records the consumption data and wirelessly transmits it to the central server. The central server processes the received data, calculates the billing amount based on predefined tariff rates, and generates instant bills. Consumers can access their billing information, consumption history, and payment options through the user interface. By implementing this project, utility providers can optimize their billing processes, improve revenue management, and enhance customer satisfaction. Consumers can have a better understanding of their electricity usage patterns; monitor their bills in real-time, and conveniently make payments through integrated payment gateways. Overall, the GSM-based electricity meter with an instant billing system revolutionizes traditional metering and billing practices, bringing automation, accuracy, and convenience to the electricity management process. It sets the foundation for a more advanced and intelligent system that empowers both consumers and utility providers in managing electricity consumption efficiently.

2. Literature review

The literature review reveals that GSM-based electricity metering with an instant billing system has garnered significant attention in recent years. Researchers have explored the benefits and challenges associated with these systems, shedding light on their potential to enhance efficiency and accuracy in electricity management. One key advantage of these systems is the ability to remotely monitor and control electricity meters through GSM technology, eliminating the need for manual meter reading. This enables real-time data collection, reduces labor costs, and improves the accuracy of meter readings. Real-time data transmission facilitates instant billing calculations, minimizing delays in generating bills and providing customers with up-to-date information on their electricity consumption. By automating metering and billing processes, GSM-based systems improve billing accuracy by eliminating human errors associated with manual readings. This, in turn, enhances transparency in billing and increases customer satisfaction. Consumers are empowered with real-time access to their consumption data, allowing them to make informed decisions about energy conservation and effectively manage their bills.
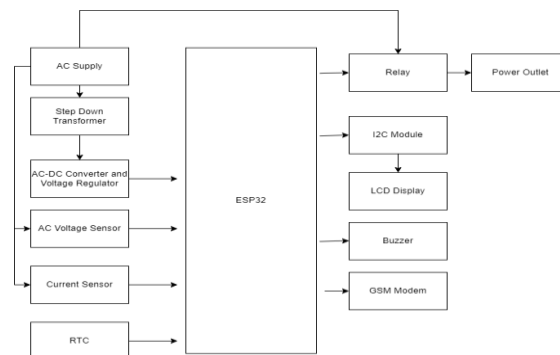
3. Methodology

Fig1. Block diagram

The brief technique to carry the assignment is as proven beneath. The complete challenge is divided into one-of-a-kind modules in order that the mistakes can be minimized at the end. The technique to hold the project is as proven underneath.

The short technique of the project is discussed beneath. The challenge become finished in following steps and subsequently assembled to form a fully operating machine.

1) Material survey and selection: This changed into the primary and maximum essential step of the undertaking. The marketplace survey was finished to locate the most suitable hardware for the assignment and the maximum appropriate one was selected for the assignment. This worried choosing a proper microcontroller, sensors and GSM module.

2) Interfacing the GSM module to the microcontroller: on this step the GSM module become interfaced successfully to the microcontroller. The GSM module may be used in either of the configurations. In our project we've got used two GSM modems. One on the strength meter aspect and one at the billing management side.

3)Interfacing Relays to the microcontroller: on this section the relay board turned into interfaced to the controller to govern the energy supply primarily based on bill payment cycle of the consumer. If the customer fails to pay the invoice the power can be automatically cut-off

4) Interfacing LCD display to the microcontroller: The liquid crystal display is interfaced with the microcontroller which indicates the records regarding the power consumption and the billing quantity.

5) Programming the billing control gadget: on this phase the evolved system is programmed to develop a billing management device which connects with the hardware to study the consumptions and bills of the customers. This will additionally be used to disconnect the power if the patron fails to pay the bill. The dummy bank account is likewise developed on this phase which will deduct the stability from the consumer's account. If the person isn't always having sufficient stability a notification together with final date of price might be dispatched put up which the power supply could be robotically disconnected.

6) Improvement of computerized meter studying: on this phase the automated meter analyzing machine is developed which makes use of the modern and voltage sensor interfaced to the machine to study the strength intake and ship it using GSM modem to the billing government remotely. The hardware and the software are developed in this step.

7) Checking out: on this the complete project is assembled and examined. The man or woman additives developed are combined to make the absolutely operating GSM primarily based electricity meter with computerized billing.

Working principle
As shown within the block diagram the gadget includes an automated meter studying system and the GSM primarily based billing machine. The automatic meter analyzing system accommodates of the ESP32 controller board interface to the voltage sensor and the present day sensor to screen the electricity. The power fed on via the residence holds is monitored through analyzing the values from the present day sensor and the voltage sensor interfaced to the ESP32. the automated meter analyzing recorded through the ESP32 is then sent in well timed way to the strength manage board the usage of GSM modem. The RTC Modem is interfaced to the ESP32 to maintain music of the time and also generate the bills at the monthly foundation. The opposite system consists of the GSM modem that is interfaced to the pc and billing management gadget. The GSM modem at the billing control aspect receives the power intake readings form the automatic meter reading and continues a song of client's bill. Once in a while the bill is dispatched via SMS notification to the client together with the last date of the payment. If the price isn't received in the remaining records the billing management gadget has a provision for disconnecting the electricity supply of the house hold. Accordingly, this venture bureaucracy smart GSM based electricity meter with instantaneous billing.

Components
Hardware used
1) ESP32 Controller Board
2) Voltage and current Sensor Module
3) RTC module
4) GSM modem
5) LCD display
6) Buzzer
Software used
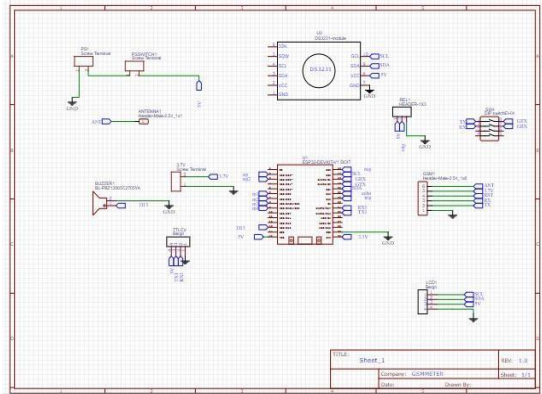1) Arduino IDE
2) Easy EDA
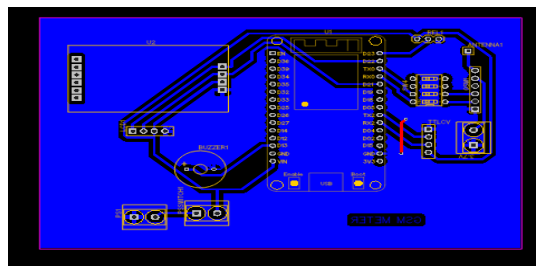3) Visual Studio Code

Fig2. Schematic diagram

Fig3. PCB design

3. Results and discussion

Inside the proposed machine the use of GSM might pass a protracted manner in making human beings conscious of the quantity of electricity they spend and assist to preserve the conventional depleting resources. The automation of billing machine gets rid of human involvement as a result extra accurate and reliable. The implementation of time of-day billing can manipulate using power on patron side to keep away from wastage of power which enables in reduction of electricity era expenses. The introduced automated deduction put up billing device minimizes the energy theft in a value-powerful manner. Automation of meter analyzing additionally gives the statistics of general load used in a residence on request at any time as well as to make purchasers to hold tune of electricity utilization. For this reason, the proposed machine is predicted to bring automation in electricity invoice studying and billing control.

4. Conclusion

A GSM-based power meter with an immediately billing machine is a smart meter that consists of GSM (worldwide machine for mobile Communications) era to speak with the software agency's server. The GSM module in the meter uses a SIM card to set up a Wi-Fi reference to the community and send usage facts to the server. The server then calculates the bill primarily based on the intake facts and sends it lower back to the meter through the GSM network. the main advantage of a GSM-based power meter is that it removes the want for manual meter readings, which can be time-consuming, errors-inclined, and high-priced. With the automatic meter analyzing gadget, the utility agency can get entry to real-time usage data and generate bills instantly, saving time and resources. This will also assist to lessen the possibilities of errors and disputes between the purchasers and the utility organization.

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