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ENERGY CONSUMPTION MONITORING AND ALERT SYSTEM VIA IOT

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Abstract - The paper introduces a method for accurately measuring electricity consumption and associated costs, utilizing a device that displays readings on an LCD screen and sends SMS notifications to users with consumption details in rupees. The advancement of electronic meters, particularly with programmable meter-reading architecture (AMRS), has significantly contributed to energy and cost efficiency. This study proposes a user-friendly Internet of Things (IoT) based energy meter reading system with defect indication, aiming to prevent manipulation of electric bills by providing users direct access to their consumption data. The system comprises a GSM modem connected to an 8051-family microcontroller, which monitors electrical pulses, calculates consumption, and determines costs based on unit price, transmitting this information via SMS and displaying it on an LCD screen. Additionally, users can send messages to the system for load control. Unlike traditional digital meter reading systems, this technology enables remote access to electronic meters, accessible globally with proper authentication. The project offers benefits such as cost reduction, improved energy efficiency, and decreased manpower and time requirements, employing both hardware and software components.

Keywords: Energy Meters, GSM Module, Cloud Computing, Automatic Meter Readin

1. INTRODUCTION

The introduction underscores the inefficiency of traditional manual meter reading systems, especially in light of evolving residential development needs. It discusses the growing adoption of Automatic Meter Reading (AMR) systems across various sectors and emphasizes the importance of electronic utility meters in modernizing metering processes. Challenges associated with traditional electromechanical meters, such as inaccuracies and the need for physical presence to collect readings, are highlighted..These challenges become particularly acute in rural areas and high-rise buildings, leading to issues like unpaid bills and consumer absence. Despite the transition to electronic meters, these problems persist, indicating the need for a system that can deliver bills directly to users' mobile devices.The paper proposes a novel approach to postpaid electronic energy metering, wherein energy consumption is automatically sensed, recorded, and transmitted to the billing point via the GSM network. Subsequently, the collected data is processed to generate SMS bills sent to customers. This system is web-based, allowing registered users and authorities to monitor and analyze monthly bills remotely. The inefficiencies of traditional meter reading systems prompt the development of a GSM-based energy meter in the proposed system. This meter calculates bills based on consumed electricity units and sends notifications to both users and electricity departments, facilitating remote bill checking. Overall, the project aims to streamline energy meter reading processes, reduce manual labor, and provide users with convenient bill access via SMS notifications.

2. METHODOLOGY

2.1 Current Sensor

The device consists of a highly accurate Hall circuit with minimal offset and linearity, featuring a copper conduction pathway positioned near the die surface. This pathway allows an applied current to produce a magnetic field, which is then converted into a voltage proportional to the magnetic signal by the Hall IC. The close proximity between the magnetic field and the Hall transducer enhances the device's precision. The Hall IC, which utilizes low-offset and chopper-stabilized BiCMOS technology, is calibrated for accuracy post-packaging, ensuring the generation of precise and proportional voltage outputs.

Fig 2. Current Sensor

2.2 Arduino UNO

The Arduino UNO, named "one" in Italian, is the standard Arduino board, chosen for its initial release of Arduino Software and being the first USB board from Arduino. Manufactured by Arduino.cc, it features the ATmega328 microcontroller as its core. Renowned for its simplicity compared to other boards like Arduino Mega, it offers a range of digital and analog Input/Output (I/O) pins, along with compatibility with shields and additional circuits, making it highly versatile for various projects.

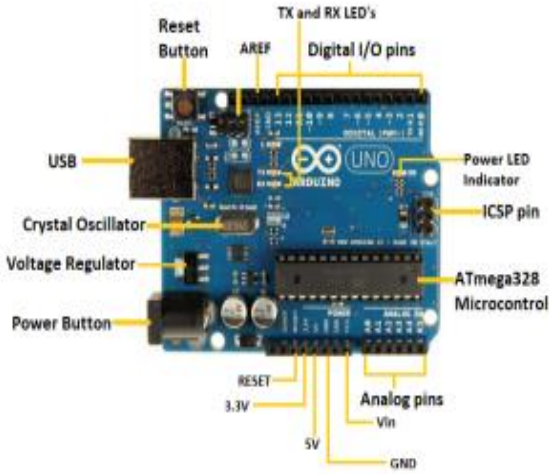

Fig1. Arduino UNO

2.3 GSM Module

A computer and a GSM-GPRS system have the capability to establish communication through a GSM/GPRS module. GSM, which stands for Global System for Mobile communication, is a widely used mobile communication architecture across many countries. GPRS, or Global Packet Radio Service, is also employed for data transmission within this system.

Fig 3. GSM Sensor

2.4 Circuit Diagram

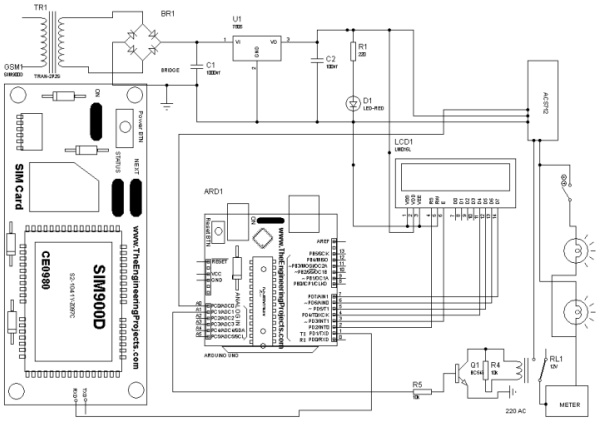

Fig 4.Circuit Diagram

2.5 Flow Chart

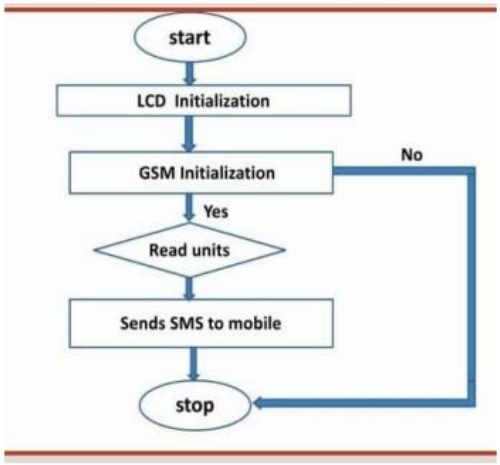

Fig 5. Flow chart

2.6 Procedure

In this study, we developed an energy meter using a current sensor and integrated it with a GSM Module, which requires a SIM card. Initially, the load, represented by a bulb, is powered using an adapter connected to the Arduino board.The current sensor measures the electricity flowing through the load and sends this data to the Arduino.

The Arduino, equipped with an LCD display, calculates the energy consumption based on the electrical pulses received. The number of pulses is indicated by LED flashes. The LCD displays both the consumed units and their respective price per unit. Additionally, via the GSM Module, an SMS containing the consumption details is sent to the user's mobile device.

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For communication with the processor or controller, the MODEM utilizes AT commands transmitted through a serial connection. These commands are sent by the controller or processor, and the MODEM responds accordingly. Various AT commands provided by the MODEM allow interaction with the GSM and GPRS cellular networks. Some tasks performed by a GSM/GPRS MODEM include receiving, transmitting, and deleting SMS messages using a SIM card, managing phonebook entries, and making, accepting, or declining voice calls.

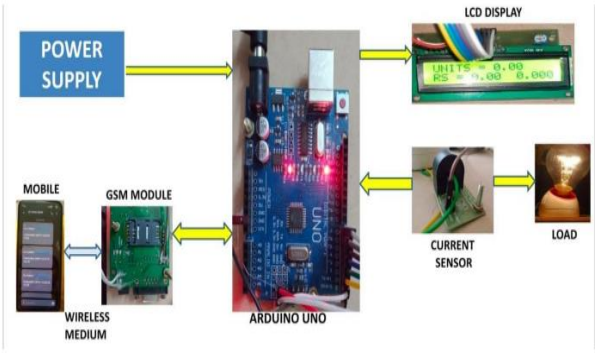


Fig 6. Block Diagram

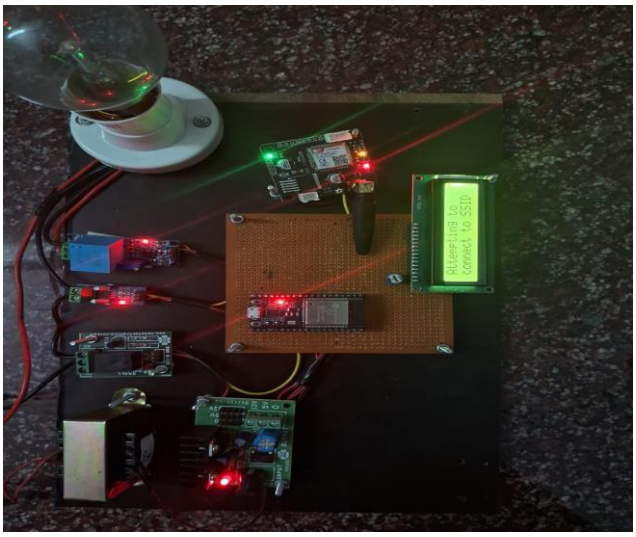
3. RESULTS AND DISCUSSIONS

Our proposed system showcases electricity usage data on an LCD panel and forwards this information to the user through an SMS, along with the corresponding cost in rupees. Continuously monitoring electrical pulses, the system calculates units of electricity consumption. It not only sends an SMS to the user but also notifies the service provider. Proper signals are ensured for the user to receive the electricity bill accurately.

Fig 7. Message of units and rupees of electricity consumed to the user's mobile

4. CONCLUSIONS AND FUTURE SCOPE

Electric utility companies utilize electric meters installed at customers' premises to calculate billing at the end of each month. Traditionally, an employee from the electricity department must physically visit the consumer's premises to record the meter reading. This system simplifies the process for the electricity department to access energy consumption data from the customer's ID, while also allowing consumers to monitor their own energy usage. The system accurately reads data from the energy meter without interference, enabling calculation of household energy consumption. This enhances transparency between providers and consumers.



Furthermore, to enhance the proposed system's functionality, users could be empowered to monitor their power consumption and receive alerts accordingly. Additionally, a web or mobile interface could be implemented to provide detailed information about energy consumption by individual devices in each room, along with energy-saving tips based on the gathered data. Real-time data could also be utilized to develop predictive models for future energy demand trends over specific time periods.

REFERENCES

[1] Sasanenikita N, “IOT based energy meter billing and monitoring system”, International research journal of advanced engineering and science.

[2] Anitha.k, prathik, Smart Energy Meter surveillance Using IoT,Institute of Electrical and Electronics Engineers(IEEE), 2019.

[3] Mohammad Hossein Yaghmaee Design and Implementation of an Internet of ThingsBased Smart Energy Metering 6th IEEE International Conference on Smart Energy Grid Engineering 2018.

[4] Ashna K & George SN, “GSM based automatic energy meter reading system with instant billing”, Proceeding of international multi conference on automation, computing, communication, control and compressed sensing (Imac4S), Vol.65, No.72, (2013).