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GSM Based Prepaid Energy Meter Using 8051 Microcontroller

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Abstract: *This paper presents the design and implementation of a GSM-based prepaid energy meter using the 8051 microcontroller. The system enables users to recharge credit remotely and monitor energy consumption in real-time via GSM communication. It uses the AT89S52 microcontroller, GSM modem, and MAX232 level converter, integrating them into a robust prepaid metering system. Once the prepaid credit depletes, the system automatically disconnects the power supply and notifies the user via SMS. This approach provides a reliable, efficient, and user- friendly energy billing solution that eliminates manual meter reading.*

Keywords: GSM, Prepaid Meter, 8051 Microcontroller, Energy Billing, SMS Alert

I. INTRODUCTION

With the growing demand for smarter energy management systems, the need for automated and transparent billing mechanisms has increased. Traditional energy meters often suffer from inefficiencies like manual reading errors, delayed billing, and lack of consumer control. This project addresses these challenges by introducing a GSM-based prepaid energy meter. Using GSM technology, users can recharge and monitor their electricity usage remotely. This paper discusses the system's architecture, component selection, and practical implementation.

This system works on prepaid energy meter which is utilized for sensing the energy automatically consumed at home. GSM SIM 300 is the interface in this system, which will make the interaction between the user and the energy meter.[1] This paper describes an approach of transmitting the consumed electricity data and bill using GSM modem. Traditional meter reading is not fully efficient and more time consuming for meter readings and further processing to generate bills as well as the user has to pay bills in queue at the counter which is very much time consuming as well as inefficient.[2] So, a system is required which collects meter readings automatically i.e. Automatic Meter Reading (AMR) systems. Its application lies in the household, commercial and industries. In this proposed method, the consumption of energy will be monitored by the prepaid energy meter automatically.[3] It records those readings continuously and transmits to the user through the GSM network. The GSM network sends a SMS (Short Messaging System) for electricity used and amount paid to the user.[4] The service will be quick, fast and in a no time costumer will get the updated bill.

II. METHODS AND MATERIAL

The proposed system comprises an 8051-based microcontroller (AT89S52), GSM module, MAX232 interface, LCD, relay switch, and power supply unit. The GSM module enables communication with the user, while the microcontroller handles control logic and hardware interfacing. The energy consumption is detected using a calibrated electromechanical meter with pulse counting. The prepaid balance is stored in EEPROM and updated with every unit consumed. The system disconnects the load automatically when balance reaches zero and notifies the user.

A GSM-based prepaid energy meter using an 8051 microcontroller involves measuring energy consumption, managing prepaid credits, and sending alerts via GSM. The system uses an energy meter to track consumption, an 8051 microcontroller to process data and manage prepaid credits, and a GSM module for

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communication and alerts. Key materials include the 8051 microcontroller, a GSM module, an energy meter, a relay, and a display unit.

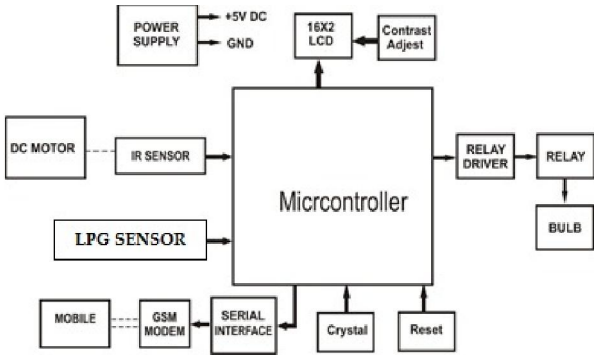
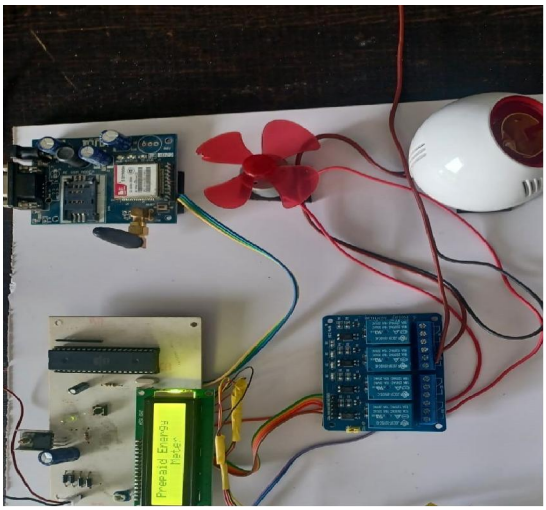


Fig. Block Diagram

III. RESULTS AND DISCUSSION

The system was successfully implemented and tested under various load conditions. The GSM module accurately sent and received SMS updates regarding energy usage and balance alerts. Load disconnection on zero balance worked reliably with the relay. Overall, the project achieved its goal of providing a low-cost, user- friendly prepaid energy billing solution.



IV. CONCLUSION

The GSM-based prepaid energy meter using 8051 microcontroller is an effective solution to the limitations of traditional billing systems. It empowers users to monitor their consumption and eliminates dependency on manual readings. The proposed design can be enhanced further by integrating mobile apps or IoT cloud services for broader scalability.

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