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Automated Load Shedding and Notification to the Consumer Using GSM (Smart Power Grid)

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Abstract: Our aim of this project is to automate the load shedding and notifying the customer about the load shedding using GSM, according to the timings which is set in the PC. And also for reading electrical energy consumed by the user in units and this data is also provided to the electrical department (Power Grid) using ZigBee technology for billing purposes. Power Grid can send the monthly bill amount over SMS to the User. Once the user gets the bill amount on his mobile, he has to pay the bill before due date, if he fails the power to the User is made cut off by sending an SMS to the Unit installed at the User side. The proposed system integrates a Global Service Mobile (GSM) Modem, along with ARM Microcontroller. A Flash magic will be running on the PC which is used to set the START Time and END Time for each area, this time is then used by the ARM microcontroller to turning ON/OFF the supply in specified time intervals to each area. The GSM alerts to concerned Consumers of that area immediately about when the power supply will be provided again to that area. An Alpha numeric LCD is used to display the Current local time, Status of the System and the Units used.

Keywords - Automation, Load shedding, ARM Microcontroller, Embedded System, Energy meter, Opto-coupler, Automated billing, Smart Power Grid.

I. INTRODUCTION

The technic to of reducing power usage and energy consumption by both consumers and businesses has never been stronger. A rise in population, increased investments, and growing economy all put a high demand on electricity consumption which cannot be possible from the present capacity. One year of energy consumption can now beat the energy production rate of the previous half-century.

Demand response instead relies on specific devices, to reduce power, ON or completely shut down high-energy-usage machines and components during peak demand times, or otherwise balance, usage between high- and low-demand cycles. This strategy is often referred to as load shedding.

Load shedding is the system which is designed to distribute the available power to consumers. If it is used effectively, can help both the utility company and the customer to conserve energy and reduce costs. This helps to reduce brownouts, which can occur when energy usage exceeds the amount of energy that is available. Managing the power consumption and more evenly spacing it allows power companies to avoid scaling for additional power production.

The energy provider is responsible for signaling that it's time for customers to make the necessary adjustments to power-consuming devices. This is accomplished by directly notifying Customers about load shedding time interval.

Till now to generate the electricity bill man power is used and also to cut off the power, if the User fails to pay the bill on or before Due Date, again man power is required. Once user pays the bill, to get the power connection back he might require to wait a day.

The proposed system is designed to address all these problems efficiently and avoids manual intervention in generating electricity bill and to automate the power cut off and power connection to the user.

II. PROBLEMS OF STATEMENT

In our Project we are going to focus on two major problems

Automatic load shedding of particular areas on Daily Basis.

Automatic Billing of Particular Consumers on Monthly Basis.

Let us discuss in brief regarding towards the problem.

A. Automatic load shedding of particular areas on Daily Basis.

1) As we know manual load shedding is a process where an Operator can't maintain regularity in load shedding on daily basis.

2) So in this paper we are going to discuss about how load shedding can be done automatically on a certain period of time each day on daily basis.

B. Automatic Billing of Particular Consumers on Monthly Basis.

1) Manual electricity billing as lot of drawbacks such as it takes lot of time to distribute billing to every consumer of a particular area and also sometimes billing may not reach the destined consumer.
2) So here going to discuss about how billing is done automatically in time and also proper action is taken on consumer's load based on their bill payment.

III. POSSIBLE SOLUTIONS

A. Load shedding

1) When there is deficit in power for particular area, automatic load shedding is done for a particular period on daily basis. When automatic load shedding is done then notification message is send to every consumer of that area.

B. Electricity billing

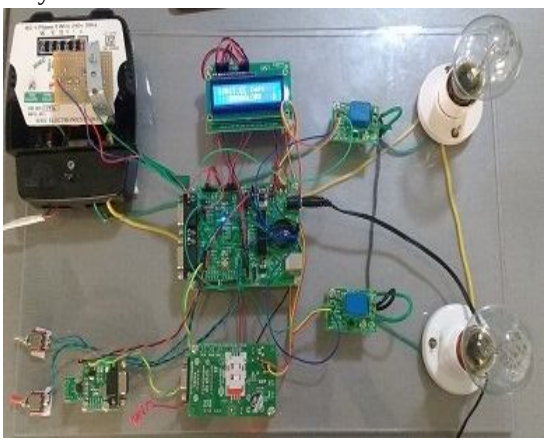
1) In order to avoid the problems comes under manual billing, Automatic billing is done by using suitable methods on monthly basis. By using messaging technology billing information is send to the customer and if consumer fails to pay intended amount in time proper action is taken.

III. METHODOLOGY

A. **S**mart power Grid consists of ARM7 LPC2148 Microcontroller, is the main part of the project which controls and drives all peripherals. The timings to the individual areas are set by using software Flash magic on the PC. Once the time is set the UI will start sending the data on to the UART of the ARM microcontroller through PC serial port. The data from the UI contains, Current local time, Customer Contact Numbers, information on whether to turn ON/OFF the supply to each individual areas.

B. The microcontroller receives this data and uses this to control each electro mechanical Relays, to display the current local time and Status of the System on the LCD (Liquid Crystal Display), and to send the notification message to the customers about the load shedding.

C. In the proposed system generation of electricity usage bill is made automated by reading the Watt Hour pulses using Opto-coupler and microcontroller. the Optocoupler Senses the pulse count, when each time the LED on energy meter flashes. the overall count is then send to the power grid through SMS using GSM. When the GSM at the Power Grid receives the SMS it calculates the bill amount for used Units by the User and send the billed amount and Due date info to the User to his mobile.



D. If the User fails to pay the bill in time, the power grid sends an SMS to the System installed at the User side. Once the SMS is received by the GSM at the User side (Customer side), the Microcontroller cut-off the power by triggering a relay which acts as a switch between power supply from the Grid and energy meter power input. when the customer pays the bill, automatically user gets the power supply back as the grid send SMS to trigger Relay. Thereby removes the manual intervention to cut off the power and to provide power supply back.

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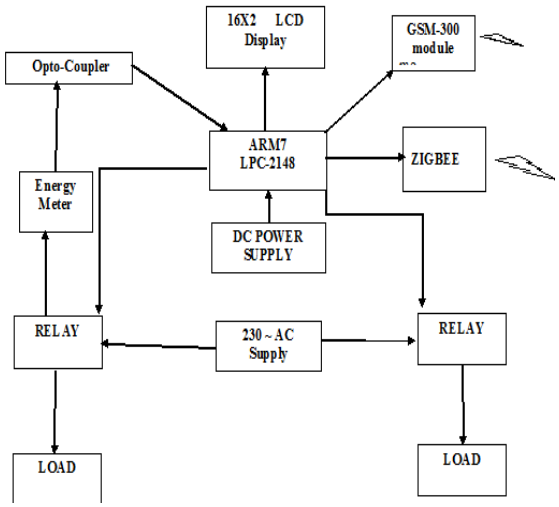

Fig 4.1 Smart Power Grid System

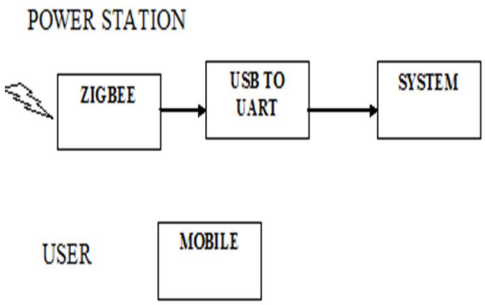

Fig 4.2 Power station and User mobile

IV. RESULTS AND DISCUSSION

A. This system is developed and implemented giving proper results. This project works to make the Load shedding system to automated. When the automated load shedding mode is working the power is supplied to one area and cut down to another area.

B. This projects can also works as Smart energy meter reading system, So it reads the electrical energy consumed by the user and sends that data to central power system.

C. This received data and corresponding charges is send to the used and System waits for Bill payment.

D. If the user pays the bill before the due date Supply to the user will be continued. If user fails to pay the bill before the due date The connection to the user will be disconnected by triggering the Relay.

V. ADVANTAGES AND LIMITATIONS

A. Advantages

1) SMS notification about load shedding helps the consumer to use power efficiently.

2) Removes manual intervention for generating electricity bill.

3) Automated control over the power connection at the user side.

4) It overcomes the difficulties of switching the load ON/OFF manually.

B. Limitations

1) Billing of consumer should be done with proper security to avoid from intruders.

2) Components required for bulk consumers is not cost effective and working will become complex.

3) Regular update should be done based on working requirements.

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VI. CONCLUSION AND FUTURE SCOPE

The smart power grid system helps in improving the quality and reliability of the power system. This smart grid system technologies and infrastructure are designed to be in place and will take care of all the challenges and vulnerabilities of the smart grid system. The system is technically feasible. Therefore, nothing should prevent the transition into the smart grid.

The proposed system works on wireless communication for real time data. and the efficiency is very high because every process from taking meter readings to sending it to the service provider, generating bills, sending bills to the customer via SMS and recharging any type of meter either prepaid meters or postpaid meters, updating data in database everything is automated.

Overall system is very fast since the microcontroller is used has very high processing ability and speed. The presence of gateway makes the grid system to be applicable to the greater distances.

The automatic generation of the bill at the beginning of every month and informing customers about their generated bills via SMS is one of the key features of this grid system and the provision of paying the electricity bill by sending a SMS is quite easy and helpful for them as recharging their energy meters is similar to **recharging** their cell phones.

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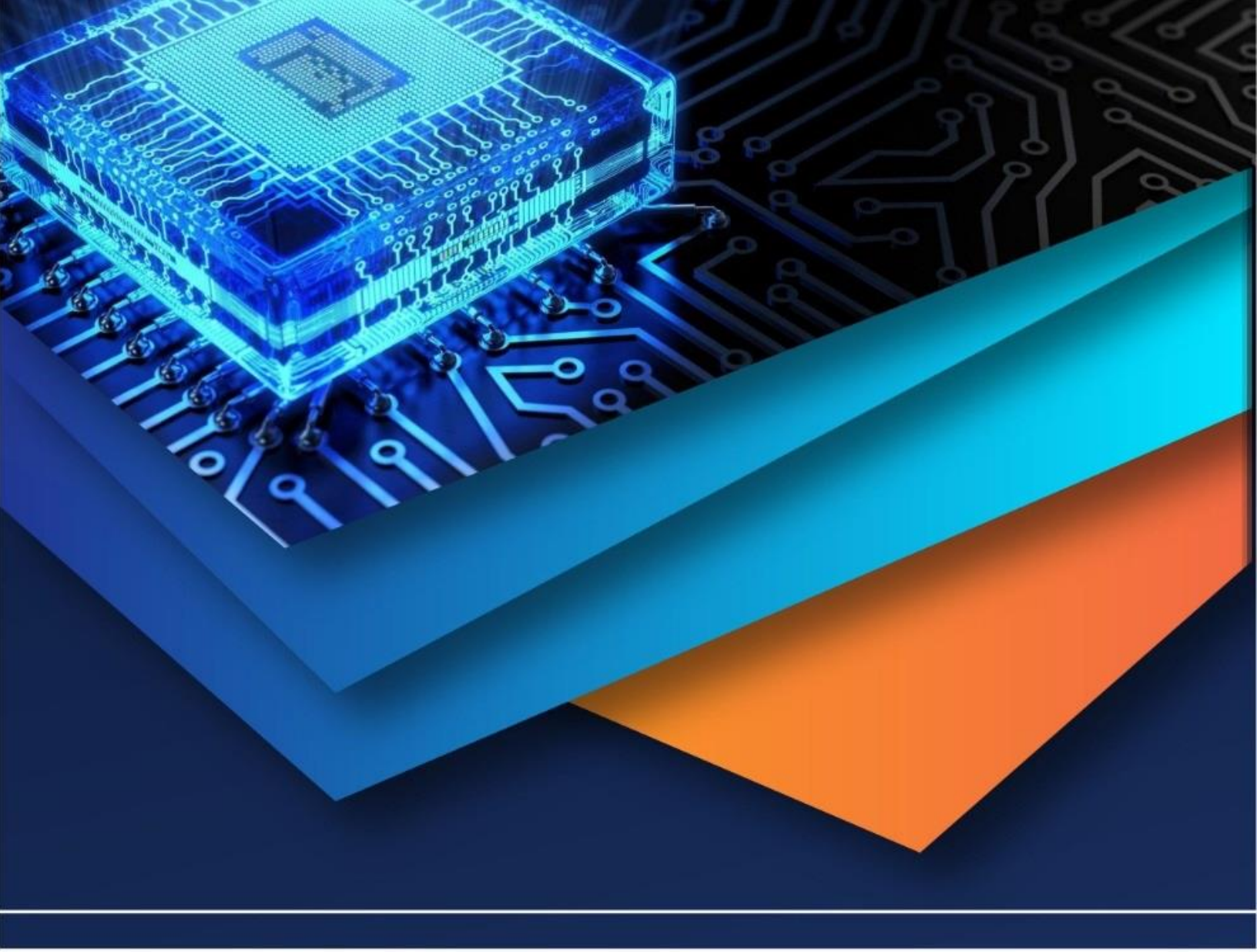

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