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RFID Based Smart Electricity Bill Payment And Energy Sharing System Through IoT

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Abstract - *The aim of the paper is to minimize the queue at the electricity billing and to restrict the usage of electricity automatically, if the bill is not paid. The work system adopts a totally new concept of "Prepaid Electricity Card". This technology holds good for all companies and home. The meter is important in making the consumer having sense about his/her energy consumption. This paper is aimed at developing a prototype of a management system for an energy meter. The designed energy meter consists of an RFID reader, a microcontroller, a LCD and an IoT. An RFID reader is used to read the Customer's information. The LCD display will display the Energy and the amount for the Energy. The IoT technology is used to send the information about the consumption of power (in watts) to the server page and during the month end, it would automatically alert the consumer to pay the amount. If the customer didn't pay the bill before due date the connection cut through IOT from EB Office. Also the payment can be done using the prepaid RFID Given to the user and also it will give alert when the amount in the card reduce to the cutoff level. The implementation of this paper will help in better energy management, conservation of energy and also in doing away with the unnecessary hassles over incorrect billing. The automated billing system will keep track of the real time consumption and will leave little scope for disagreement on consumption and billing.*

Key Words*: *RFID, IoT, GSM, Prepaid Bill Payment, Smart Meters

1.0 INTRODUCTION

In the present billing system the distribution companies are unable to keep track of the changing maximum demand of consumers. The consumer is facing problems like receiving due bills for bills that have already been paid as well as poor reliability of electricity supply and quality even if bills are paid regularly. The remedy for all these problems is to keep track of the consumers load on timely basis, which will held to assure accurate billing, track maximum demand and to detect threshold value. These are all the features to be taken into account for designing an efficient energy billing system. The present project "IoT Based Smart Energy Meter" addresses the problems faced by both the consumers and the distribution companies. The paper mainly deals with smart energy meter, which utilizes the features of embedded systems (i.e.) combination of hardware and software in order to implement desired functionality. The implementation of this paper will help in better energy management, conservation of energy and also in doing away with the unnecessary hassles over incorrect billing. The automated billing system will keep track of the real time consumption and will leave little scope for disagreement on consumption and billing.

1.1 OBJECTIVES

- Smart meters have been designed for various features like remote monitoring of energy consumptions, remote turn ON/OFF power supply through IoT.
- Smart Meters are an electronic measurement devices used by utilities to communicate information for billing customers and operating their electric systems.
- RFID used for bill payment purpose like smart card.
- To reduce load shedding problem ,we introduce less load sharing on the time of power cut.(i.e)minimum amount of load per house like one light and one fan on peak hours.

2.0 EXISTING SYSTEM

In the existing system, electricity meter reading for electricity usage and billing is done by human workers from home to home and building to buildings. This requires huge number of workers and long working time to achieve complete area data collection and billing. Human workers billing are prone to

reading error as sometime the houses electric meter is placed where it isn't easily accessible. Labor billing job is sometime also restricted and slowed down by bad environmental condition. Paper billing has the tendency of losing in the post box. The increased development of residential housing and industrial buildings in the developing country such as for example, India require more human workers and longer working hours to complete the usage reading task. These increases the energy provider operation costs for meter reading.

3.0 PROPOSED SYSTEM

- IoT based energy meter system.
- Smart Meters are an electronic measurement devices used by utilities to communicate information for billing customers and operating their electric systems.
- Current Sensor used to calculate the Energy Consumptions.
- RFID used for bill payment purpose like smart card.
- Smart meters have been designed for various features like remote monitoring of energy consumptions, remote turn ON/OFF power supply through IoT.

3.1 ADDITIONAL FEATURE

Total bill amount and due date is send to the customer through GSM. Normally Power cut will happen in an area for long hours. This will affect the children and the aged people in the home. To reduce this problem we introduce less load sharing on the time of power cut.(i.e) minimum amount of load per house like one light and one fan on peak hours.

3.2 ADVANTAGES

- The system designed reduces the efforts of manual data collection of energy meter.
- Also, data which is received at service provider side is easy to manipulate for bill generation and other such tasks.
- Power cut off through online.
- As the energy meter is digital, accurate parameters can be obtained.
- As the payment can be done then and there, it eliminates the queue at the EB station

4.0 BLOCK DIAGRAM

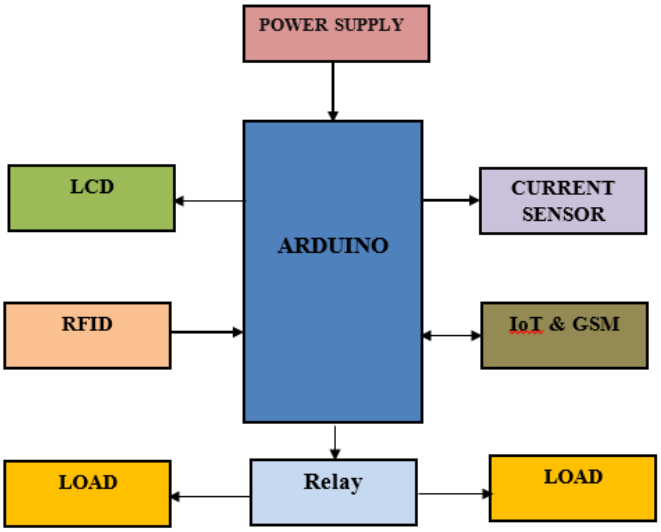

Fig 1: Block diagram of Proposed system

5.0 SYSTEM DESCRIPTION

A) Cost calculation: Based on the energy consumption readings, the cost for the corresponding energy consumption is calculated and displayed instantaneously in the LCD display.

B) Data transmission: The cost and power consumption data is transmitted to the server page through the IoT module integrated along with the GSM module and the user is notified of the bill to be paid.

C) Bill payment: Bill payment is done using rechargeable smart card on the RFID reader. Power supply is ensured on the successful payment otherwise, user is notified on the cut-off and the power supply is cut-off using the same IoT module and micro-controller from the server.

D) Power sharing : Under the conditions of more demand in the power grid ,instead of total power cut-off, the user is ensured the power of basic light loads and the power supply for heavy loads are cut-off until stable condition is regained. It is done by observing the current consumption ratings of the loads used. In this way, power under the conditions of increased demand is shared effectively. If the minimum load level is exceeded by the consumer, the

power shared to the consumer is cut-off through IoT from the utility.

6.0 FLOW CHART FOR PROPOSED SYSTEM

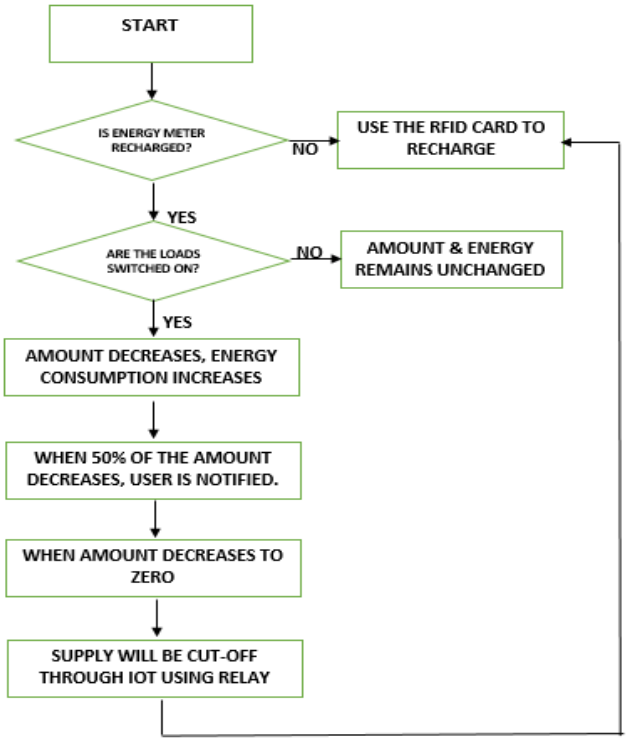

Fig 2: Flowchart for RFID Bill payment

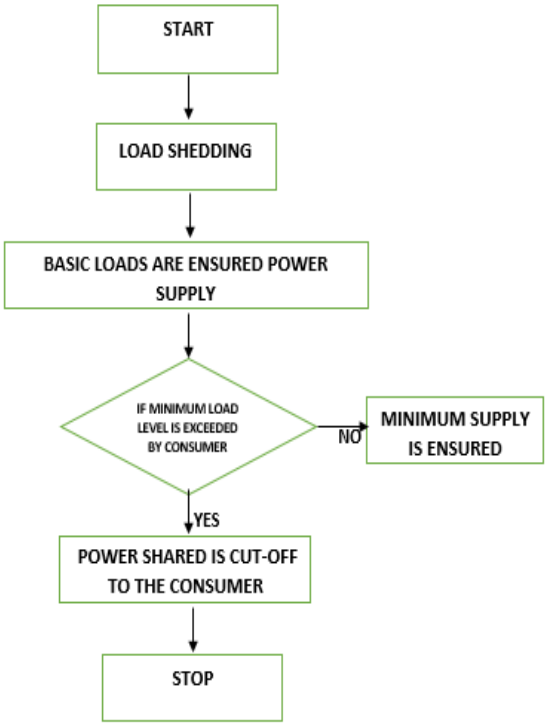

Fig 3: Flowchart for Power sharing

7.0 HARDWARE IMPLEMENTATION

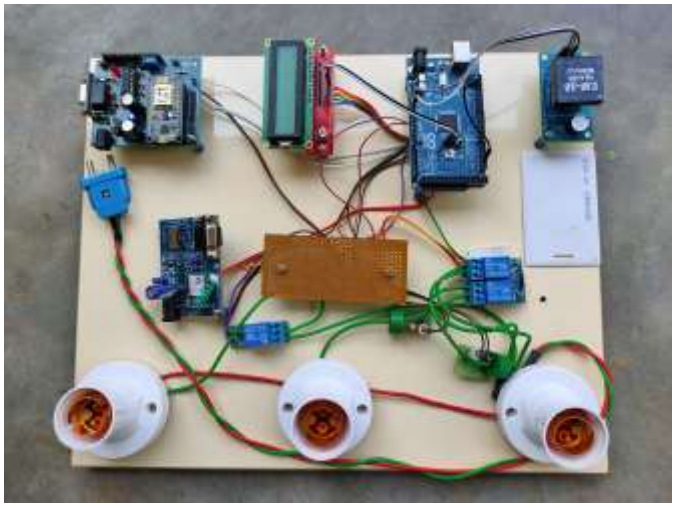

Fig 4: Hardware image of Proposed system

Fig 6 shows the image of actual hardware of the proposed system which has RFID reader for Bill Payment ,GSM Module for Notification to User, IoT Module for Load monitoring and sharing , Current sensors for Energy Calculation, LCD display to show Energy consumption and Amount and Arduino Mega to control the entire system.

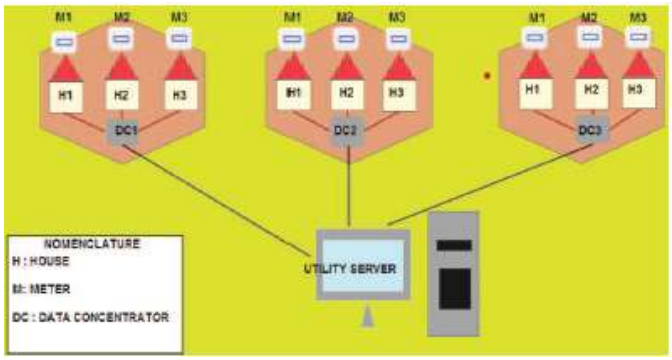

Fig 5: IoT connection between Utility and End Consumers

Fig 5 shows the demonstration of IoT connection between the Utility and End Consumers .The energy consumption of consumers' energy meter is updated to the host server in the distribution station and the loads are monitored continuously. Under load shedding conditions, load sharing can be done remotely from distribution station by turning on the consumers' energy meter to ensure power to basic loads.

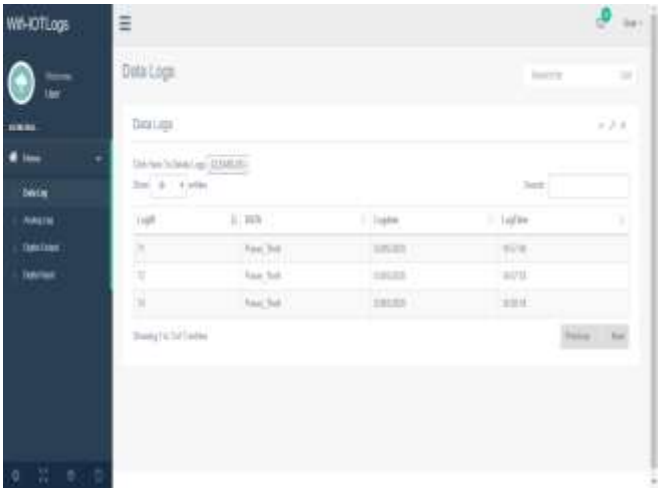

Fig 6: Data Log of Server page

Fig 6 shows Data log of server page using which the energy consumption of each consumers can be monitored. Whenever the user exceeds the minimum consumption level during load shedding conditions, it is updated in the server page and the power shared to the consumer is cut-off remotely through IoT module.

Fig 7: Control view of Server page

Fig 7 shows the Control view of server page using which under the conditions of load shedding, the consumer is ensured of minimum power supply for basic loads. This is done by remotely turning on the relay switch through IoT connected to basic load connection in the energy meter of the consumer.

Fig 8: Meter readings before switching ON the load

Fig 8 shows the meter readings before switching ON the loads connected to the IoT based Energy Meter. The image shows that the meter is in ideal condition and no load is switched ON. It implies that the meter runs only when the loads connected are switched ON and operated.

Fig 9: Meter readings after switching ON the load

Fig 8 shows the meter readings after switching ON the loads connected to the IoT based Energy Meter. The image shows that the meter is under operation and loads are switched ON. It implies that the meter runs when, the loads connected are switched ON and operated.

8.0 CONCLUSIONS

In this project, an Arduino and a IOT & GSM based smart prepaid energy meter has been proposed. Units are purchased by using GSM technology and those units are deduced according to electricity usage. This project presents a single-phase energy meter for domestic consumers with prepayment billing method. The significant preferred standpoint is the capacity of this system to update the current conventional meters into smart prepaid meters with a connection of Arduino and GSM (Prepaid Module).Cost is the main important factor of this work which is quite high but will reduce from 3 to 4 times after implementation of this project. Nowadays as power supply companies need labour for meter reading after implementing this, there will be no need of so many meter readers and lot of money will be saved. The idea of prepaid electricity bill prior its usage is being gradually accepted around the world, and that's why the market for prepaid energy metering is growing. After having many advantages, this project still needs more safety check and modification especially the GSM module for the network coverage of SIM which is being used, should

be strong so that the GSM can work properly. An IoT based smart power management system has been developed .This system monitors and controls the power consumption of home appliances automatically, manually, and remotely by using wireless network. The system is easy to design and consume less power, and provides at low cost with portable size.

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