

DESIGNING AND DEVELOPMENT OF GSM BASED ENERGY METER

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***Abstract**-Traditional metering method for retrieving the energy data is not convenient & the cost of the data logging systems is high. In this paper it presents the development of a fully automated energy meter which is having capabilities like remote monitoring & controlling of energy meter. In this paper, we can introduce the design & development of GSM based energy meter. This system is beneficial for remote monitoring & control domestic energy meter. This system provides the information of meter reading, power cut, total load used & power disconnect through SMS. This information is being sent & received by concerned Energy Provider Company with the help of Global System for Mobile Communication (GSM) network. Energy provider receives the meter reading within a second without visiting person. So, there is required less employees of Energy Provider Company. This system increases meter reading accuracy, decreases both labor cost & huge amount of time.*

Keywords: Microcontroller, Short Message Service (SMS), Energy Meter, Energy Provider Company, GSM.

1. INTRODUCTION

At present, most of the houses of our country have the traditional mechanical watt hour meters and the billing system is not automated. A few percent of digital energy meter is used. At the end of each month a person from the energy provider company goes to every house and takes the meter reading manually. This requires a large number of labor & longer working hour to complete the task. Sometimes they are not do their job properly for bad weather condition. After collecting the data, the energy provider company can calculate the electricity bill & the bill send to the customer house by post or SMS. If any consumer cannot pay the bill, the employee from the energy supplier company needs to go their house to disconnect the power supply. It is inefficient way for measuring power consumption. For conventionally, people attempt to handle skillfully meter reading by choosing various kind of illegal practices like current reversal, bypass meter etc. There is a huge amount of loss in government money. In this project, we introduce smart energy meter by using GSM technology [1]. So power line communication and Zigbee technology also use for meter reading. The stability and reliability of meter reading data are low of power line communication because the carrier wave signal (power/telephone line) is very easily disturbed by noise [2]. The ZigBee devices are extremely limited in resources including processing, memory, and power, short operating range [3]. GSM based automatic meter reading system is a success. AMR eliminates any possibility of gas theft.

Automatic meter reading (AMR) system is an effective

way of data collection, that allow substantial saving through the reduction of meter read, greater accuracy, allow frequent reading, improved billing, reduced tempering. It provides better customer services, by sending alert of power cuts and consummation updates [4]. AMR is the technology for remote monitoring and to control domestic energy meter and reduces current pilfering. This paper presents a network communication technology which enables electricity transmission Company to read the meter reading regularly without the person visiting each house by using GSM communication technology. AMR system is very useful for remote area or small villages which are not connected by any means of transport such as an island or remote precinct. This GSM based data collection system can be very swift, accurate and efficient.

2. LITERATURE REVIEW

According to [5], Automatic Meter Reading (AMR) technologies, electrical utilities (EUs) have been exploiting their own infrastructure to bill their customers in an efficient and economical way. Since the amount of data that has to be send is quite low related to the available time to perform this task, AMR applications have been demanding low bit rates. At this moment, EUs are exploring and demanding other services as load and alarm management, remote monitoring and disconnections, etc. In this context, the Low Voltage modems should provide more throughout while keeping the cost of the hardware low. The results of this low complexity AMR technology are that in order to deploy

an AMR network, the cost of the equipment on the customer premises and the added value services that the system provides are two key factors in its business case. According to [6], it describes the different methods by which distribution transformer loads can be allocated for power-flow studies. Individual distribution loads are calculated using four different methods of allocation. The results of the power-flow studies are compared to those determined using the actual customer meter readings.

The purpose of enhancing the management level of the meter reading of power enterprises, web services based GPRS automatic meter reading system is put forward the characteristics of GPRS technology and Web Services technology are analyzed, and the architecture of web services based GPRS automatic meter reading system. According to [7], the characteristics of GPRS technology and Web Services technology, described and it introduced how to build the Web Services based GPRS Automatic Meter Reading System with these technologies. This system has such merits as: real time, wide coverage, open and easy to maintenance and extension. At present, this GPRS Automatic Meter Reading System has gained good application in practical work and been proved to be correct.

In [8], a microprocessor-based automatic meter reading system is implemented, which provides a cost-effective, reliable, and interference free data transfer between remote meter reading units and the utility control center. The meter reading and management processes are free from human involvement. Based on the existing telephone networks, it is very flexible for the utility companies to access, service and maintain this meter reading system. A user friendly and window based user interface is designed which fully utilizes the personal computer's terminate and stay resident programming technique to achieve communications between the remote meter reading units and the personal computers in the utility control center. This paper describes the hardware design of the remote reading unit and the software implementation of the communication module and user interface.

In [9], we propose a novel Automatic Meter Reading (AMR) system using the IEEE 802.15.4-compliant wireless networks. The mesh network based automatic utility data collection system (AUDCS) provides a cost-efficient solution by exploring the self-organization, self-healing capabilities of the mesh networks and utilizing the state-of-art semiconductor chips and the radio transceivers compliant with IEEE 802.15.4 standard. An IEEE 802.15.4 network may operate in either the star topology or the peer-to-peer topology. The peer-to-peer mode is chosen for the AUDCS system, as it is more flexible and robust than the centralized implementation based on the star topology. In the AUDCS system, each node has the capability of two-way communications and may relay or forward the data for the neighboring nodes within the transmit range, hence eliminating the need of installing dedicated communication nodes to collect data. In addition, mesh networking provides the self-healing function by

automatically re-routing via other neighboring nodes. The application data characteristics are exploited in the data gathering and dissemination to achieve better energy efficiency.

3. BLOCK SCHEMATICS

Fig.1 shows a block diagram of AMR. The block diagram of the design & development of GSM based energy meter is given above. The potential transformer & the current transformer are used to sense and measure the voltage & current of the supply input. These are the analog signals, which are converted into digital signals by internal Analog to Digital Converter (ADC) of the microcontroller. A LCD display is used to show the consumed energy, which is interfaced with the microcontroller. GSM is also interfaced with the microcontroller to monitor and control the energy meter. In this system, a particular ID number is provided for each and every meter. This ID number is provided according to SIM card number. This system continuously monitors meter reading on request through SMS and sends to central server of Energy Provider Company. A relay is used to operate the power on-off.

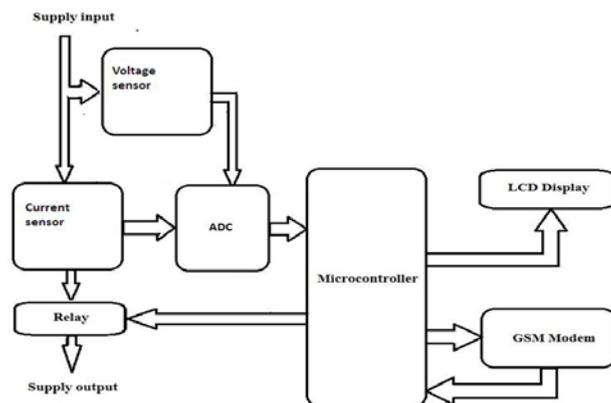


Fig.1: Block diagram of GSM based automatic energy meter reading system

4. CIRCUIT DESIGN AND CONSTRUCTION

A large part of the project involved choosing the appropriate hardware components to take the meter reading from the meter and send it to user and to server remotely and to control the power consumption and provide a wireless link. The initial idea was to search for an all-in-one solution that would have all the components integrated, allowing for the smallest size possible. Initially it was thought that a simple circuit could be built and attached to a microprocessor to control the power. But the cost of the circuit with microprocessor is very high. It was decided that designing a simple circuit, with the help of the microcontroller and would provide accurate power controlling and the measurement of meter reading. The following sections describe the research process as well as the implementation of these integrated circuits. Fig.2 shows that circuit diagram of connection of GSM based automatic meter reading system.

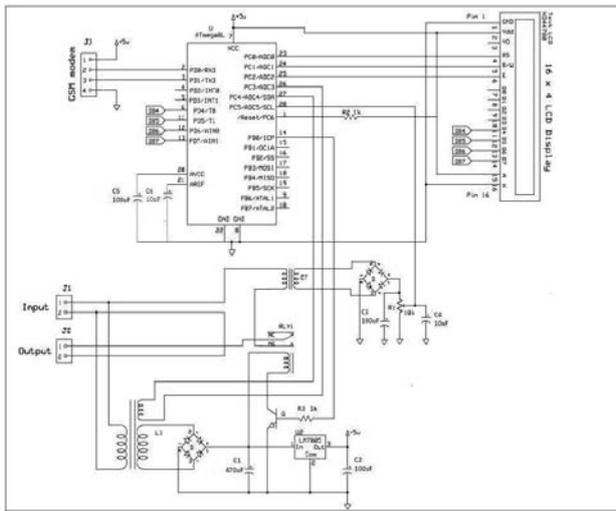


Fig.2: Circuit diagram of connection

5. SOFTWARE IMPLEMENTATION

Fig.3 shows that energy meter continuously display the pulse and unit according power consumption. When Energy provider company requires data for calculation of bill so they send a message to AMR. So, microcontroller unit receive a message and it read this message and also read user mobile number and check the authentication. If the number is authenticate; it read current data from EEPROM and sends the data to authenticated number. If system access mobile number is not authenticated; GSM based AMR sends a SMS alert to energy provider. It also provides the facility of power disconnect to customer that have large outstanding dues by sending a code to the energy meter. Microcontroller has a program of matching of this code to power disconnect code. If this code is match then power disconnect to respective meter. It also provides a facility to power re-connect due to deposit the outstanding previous bill amount by sending a code to the energy meter. Microcontroller has a program of matching of this code to power re-connect code. If this code is matches then power reconnect to respective meter. Power cut feature perform by using interrupt signal.

6. IMPLEMENTATION AND RESULTS

Fig.4 shows the prototype modal of GSM based energy meter. In this project the meter reading count continuously according to load connected. Accordance to their demand of meter reading energy Provider Company sends a SMS to the respective meter. Microcontroller receives this SMS through GSM modem so an interrupt signal occurred due to SMS. Microcontroller read pulse and unit from EEPROM and send the same to authorized number.

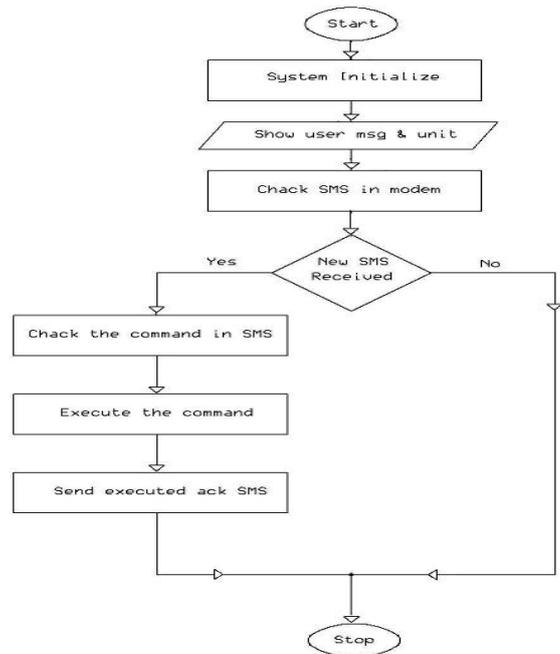


Fig.3: Power control system program flow



Fig.4: The physical view of implemented project when both the power supply and relay in "ON"

Fig.5 and Fig.6 shows the physical view of the system with respect to the command CM: CUNIT



Received SMS from energy meter



Send SMS from the server

8. REFERENCES

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Fig.5: Receive SMS from energy meter and send SMS from server

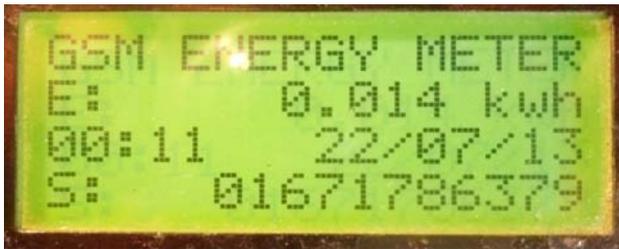
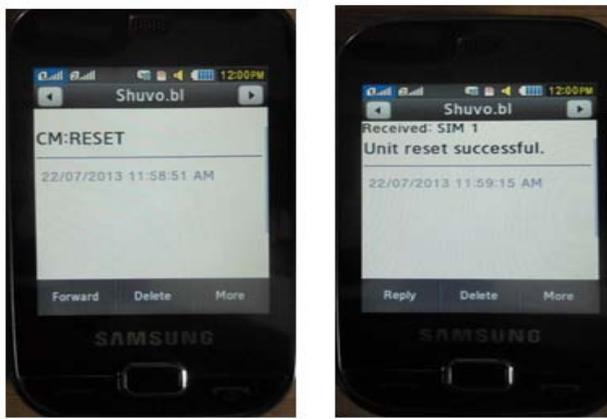


Fig.6: Meter reading of the current unit

Fig.7 and Fig.8 shows the physical view of the system with respect to the command CM: RESET



Send SMS from the server Received SMS from the energy meter

Fig.7: Send SMS from server and receive SMS from energy meter



Fig.8: Meter reading when Reset command is sent

7. CONCLUSION

This project presented a new horizon for both Energy Provider Company and the consumer. In our project, the microcontroller was used to control the whole system. In this system, it helps to get information of total energy consumption in every house. Because of only authorized Energy Provider Company can access the system, so the system is more secure. The project will bring a modern way in the energy metering system properly. With the implementations of this project, we can make the energy provider company to become more suitable and reliable by using our project. It also carries large economical values. We hope this project will build up a new way for both Energy Provider Company & the consumer.