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DEVELOPMENT OF AN INTELLIGENT GSM BASED AUTOMATIC METER READING SYSTEM

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Abstract-Traditional metering system for billing and monitoring is not convenient and automated. This paper is about to present an introduction to automated energy meter which is connected with automatic meter reading (AMR) system. Automatic meter reading system has the ability to monitor and send required data to the energy providing companies through global system for mobile communication (GSM) module. GSM based AMR system reduces the huge labour cost, data logging cost, saves huge time, provides data security, tempering alert feature, auto disconnect feature, power cut information feature and most importantly customers can pay bill by credit card, debit card or net banking without going to the bill payment branch. So GSM based AMR system is very effective approach for modern era.

Keywords: GSM, Automatic Energy Meter, Automatic Meter Reading, Online billing.

1. INTRODUCTION

Energy meter is a mechanical energy consumption reading meter which indicates the usage of energy in B.O.Tunit [1]. In a developing country, like BANGLADESH, about 90% energy meters are old fashioned and have old maintenance, billing system. The energy provider company send persons to record the total consumption of energy displayed in the energy meter at any day of every month. This meter reading is used for calculating electricity bill and sends this bill to the particular meter consumer by post. This process of recording and billing is very much sluggish and time consuming. In Conventional metering system people try to influence meter reading by adopting different corrupt practices. For these difficulties AUTOMATIC METER READING (AMR) is succour. AMR helps to get the accurate and updated data records, so the data logging system can easily store the data and utility provider company can easily calculate the electricity bill at their control room. AMR increases data security, improved customer service, reduced revenue losses, this system is used for sending the data with power disconnect/connect feature, power cut feature and tempering alert feature. AMR is a new effective process of monitoring and controlling domestic energy meter for the remote area or small villages where transportation system is utterly tough. This GSM based data logging and reading is swift, accurate, and efficient over the conventional system.

2. LITERATURE REVIEW

Automatic Meter Reading Technology had been done in different way. The previous works are implemented by different methods. One method is known as web services based automatic reading system which provides wide coverage, easier extension and maintenance system, real time operation [2]. Another method is measuring the voltage and current by using sensors and convert it into energy. This method introduced complex circuitry and interfacing problems. Another effective and reliable method of energy meter reading is microprocessor based automatic meter reading system [3]. This meter reading system will be very efficient for the utility companies as they are able to access, maintain and service it based on the existing telephone networks. It works by fully utilizing the personal computer's terminate and stay resident programming technique. It helps to establish communications between the remote meter reading units and the PCs in the utility provider control room. Thus this device is designed as a user friendly & window based user interface. After studying many about it we find some conclusion.

3. METHODOLGY

This paper is presented the development of GSM based automatic power meter reading system (GAPMR). GAPMR System consists of GSM Digital power Meters installed and associated with e-billing facility in every consumer unit. It's generally consists of standard digital kWh power meter additionally with embedded GSM module which sends power usage reading using SMS back to energy provider wirelessly by the GSM network. An e-billing system at the power provider side is used to manage all received SMS meter reading, real time update of the database, compute the billing cost and send the

billing information to its respective user through SMS [4]. This system is the remedy for all the problems like is labour consuming, electro-mechanical meters error, human reading errors while noting down the meter readings etc. This system will measure the meter reading in real time. Simultaneously the meter reading will send to the user and the electricity department with the user ID number. Electricity department of utility provider will store the track of each SMS meter reading and the appropriate bill gets generated according to the usage of electrical power at the last day of the month. The bill is forwarded to user from the server. So we can say that it's the simple and easy method to the user for paying the bill.

4. SYSTEM OVERVIEW

The block diagram of Fig. 1 shows the total functional overview of GSM based AMR system. For implementation of AMR system, each and every meter is identified by a different Identification (ID) number allotted according to a SIM unique service number. From this fig. 1, we see that microcontroller interfaced with GSM and ENERGY METER. Pulse and B.O.T unit is increased continuously with the continuous consumption of energy. This system continuously monitors every meter reading daily or on request and sends to central server of Energy Provider Company. Each meter reading is saved in database server through the SMS gateway. Energy Provider company generated a bill after a month by calculating the total consumption of energy and send it to the individual consumer by e-mail or by post [5]. Consumers may pay the bill in different possible ways. Energy Provider Company can send power cut information and power consumption information through AMR and SMS. On the other hand, this SIM number can also be used for the identification of consumer and retrieving details of the consumer of the particular SIM registered.
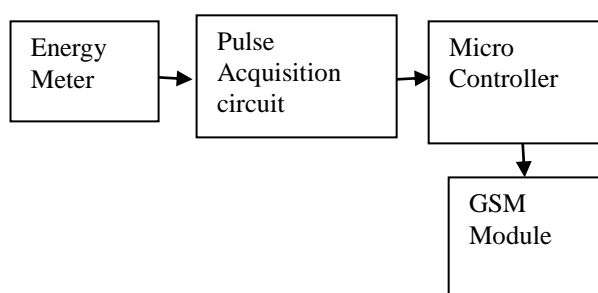

Fig.1: Block diagram of GSM based AMR system

5. HARDWARE DEVELOPMENT

5.1 Working principle for hardware design:

The advanced Automatic Meter Reading system includes Digital Energy meter, Microcontroller, MAX232, GSM module and Mobile Phone. The Digital energy meter produces LED blinking. Every 1KWh energy consumption, creates 1000 Blinking. The LED blinking which creates pulse output is transferred to microcontroller for further calculation of unit addition and does the functions according to the program loaded in it . MAX232 establishes a relation for data transferring between microcontroller and GSM module. GSM module sends data to supplier end. Supplier end receive data through Mobile Phone.

5.2 Energy unit calculation:

Electricity meters, without exception, use a technique of generating pulses to indicate the amount of energy they have measured. Each pulse indicates a specific number of watt-hours (or VA hours, VAR hours etc). These pulses are transmitted in a number of different ways from the meter [6].
a) On older meters, energy is recorded by counting the number of passes of a black mark on the surface of a spinning metal disc.
b) By a flashing LED.
c) As a direct electrical output (Typically TTL).
d) Some of today's newer meters will even include highly advanced reporting mechanisms such as Ethernet/Bluetooth interfaces.
 The meters are used to measure a wide range of energy, from watt-hours to Gig watt- hours. The total pulses generated can represent different quantity of energy. This amount of energy is specified by the meter manufacturer which is known as the meter Constant (sometimes referred to as 'k'). For example, a specific meter can normally generate 100 pulses for every Kwh measured. Another may generate the same number of pulses per megawatt hour measured. Whatever the condition or criteria, the calibration system must have the ability to have this number set within its system in order that it can calculate the correct amount of energy from the pulse count [7]. The energy meter produces frequency impulse known as the meter Constant (sometimes referred to as 'k') for per unit power consumption which is shown in meter by LED blink. Here we used a meter which rating is for per unit power consumption is 1000 impulse/kWh.
1 kWh is needed for 1000 impulse. So 1 impulse for electricity consumption=1/1000=0.001 kWh.

5.3Total Circuit Description

The main necessity of this circuit arrangement is to calculate the number of LED blinking in a month. A LDR receive the blink and convert it in a pulse through comparator and counted by microcontroller (PIC 16F877A). This microcontroller is also used to calculate the total unit for every month and then to send the amount of total unit to the supplier's office using GSM technology .After getting every pulse the microcontroller starts to add an amount of 0.001 unit with the previous unit. The function of addition for unit consumption continues until a command for reset is given. A message about the usage of Kw will received through the GSM modem after every month. The MAX232 will receive the signal by using the port number of 2 of the male female connecting port. MAX232 will send the received signal through the PIC16F877A microcontroller. Next step involves the data transmission through GSM module. The microcontroller send the unit data through the MAX232.This logic information is processed into the

MAX232 for transmission compatible to the RS232 level for serial communication [8]. All the information necessary for consumer, those are received via GSM technology is saved in the memory of the PIC 16F877A called EEPROM. The size of the EEPROM is 8k byte. Clock frequency of the microcontroller can be selected as the necessity of the data processing. During the time of loading hex file into the microcontroller by the loader, this frequency is selected. Fig. 2 shows the total circuit diagram and practical circuit arrangement of Automatic Meter Reading System is shown in Fig. 3.
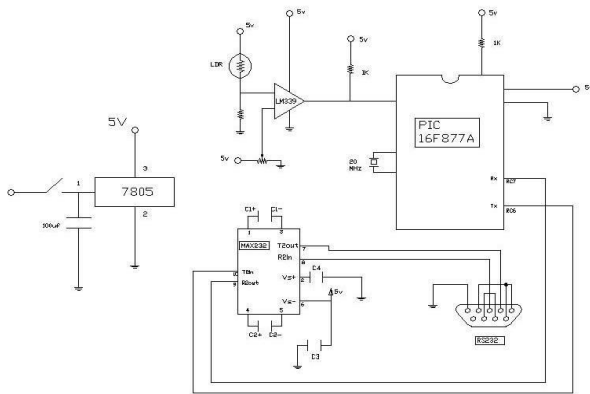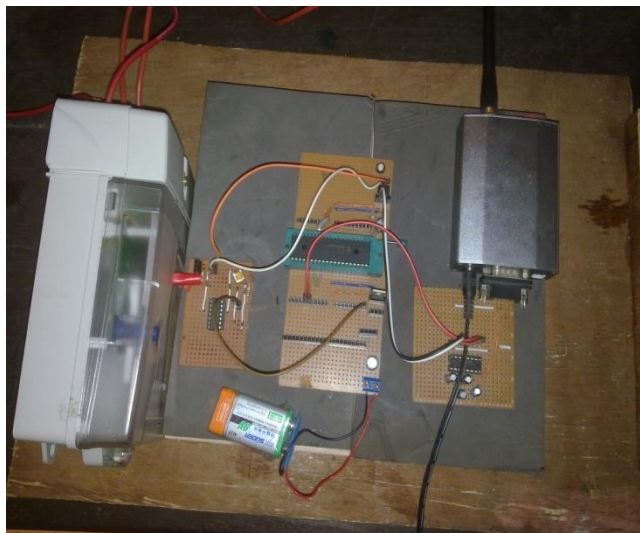

Fig. 2: Total Circuit Diagram.

Fig. 3: Practical circuit arrangement of Automatic Meter Reading System

5.4 Output Data Unit in Mobile Device
The output Data Unit (Energy Unit in KWh) which is extracted and calculated by microcontroller is then transferred through GSM Module (BENQ MOD 9001) to desired mobile device. A photograph of output data unit in mobile device is shown in Fig. 4.

6. SIMULATION
The entire circuit arrangement is in simulation software is shown in the Fig. 5. This is the combined small form of the whole metering system in the simulation software for performing the simulation process [9]. The microcontroller performs the functionof total unitcalculation after getting pulse from the energy meter. The energy meter is not shown in this arrangement. The pulse output from energy meter IC is given by adding a pulse generator that generates pulse. A 20*4 LCD display is connected to the microcontroller for showing the information necessary for consumer consideration. This microcontroller also connected to a GSM module by using MAX232 for serial communication. In Fig. 5 these equipment's are not shown because of convenience of simulation. Instead of GSM module a virtual terminal is used for message verification.
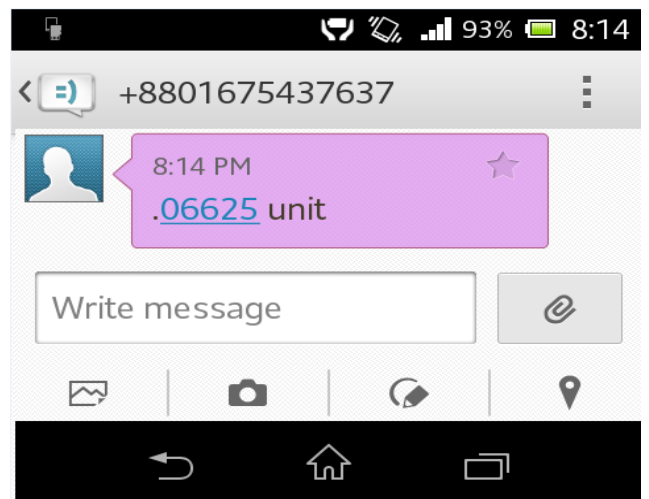

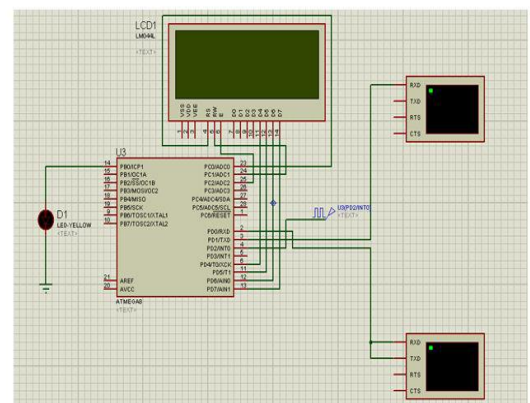Fig. 4: Output Data Unit in Mobile Device.

Fig. 5: Circuit arrangement in simulation software.

6.1 PERFORMANCE ANALYSIS
Table I is produced to analyse the performance of this project. 1 hour data is been taken from both energy meter LCD Display and this project output; where a 200Watt bulb is used as load.

Table 1: Energy Meter Data analysis

Time After	Data From Energy Meter	Data from this Project(Unit)

	LCD Display (Unit)	
10 minute	.03	0.032
20 minute	.06	0.063
30 minute	.10	0.098
40 minute	.13	0.1296
50 minute	.16	0.1576
60 minute	.19	0.1859

7. CONCLUSION

GSM based AMR system is very useful and fruitful for both consumer and service provider, which has a good feature of installation, implementation and operation. This GSM based AMR system will be economical and great amount of money and time can be saved by implementing it. AMR systemreduces human made errors and complexity of billing system in an adorable range and also provides different additional facilities such as tempering alert, power disconnection alert, and power disconnect feature due to payment due. Consumer can be informed about personal usage of energy by sending a SMS. This system is totally secure, reliable because this system is accessed only by authorized consumer of particular SIM number. It helps to increase the revenue by paying bills in time and detect the dishonest consume.

8. REFERENCES

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