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DESIGNING OF GSM BASED AUTOMATIC METER READ (AMR) SYSTEMS FOR RESIDENTIAL NATURAL GAS METER

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Abstract*- The main energy resource in Bangladesh is natural gas. A huge amount of gas is misused every year due to direct connection in resident without any meter. Recently a pilot project was taken to reduce the misuse of this valuable asset. A domestic energy management system provides effective positive behavior change by offering end users direct and ambient feedback based on their monitored energy consumption and experiences. Traditional metering method for retrieving the energy data is not convenient and the cost of the data logging systems is high. So this paper presents of design of Automatic meter reading (AMR) system. AMR system is a boom for remote monitoring and control domestic energy meter. AMR system give the information of meter reading, total gas used, gas flow disconnect and tempering on request or regularly in particular interval through SMS. This information is being sent and received by concerned gas transmission and distribution Company with the help of Global system for mobile communication (GSM) network. Energy provider receives the meter reading within a second without visiting person. In our proposed design we use Optical Character Recognition module (OCR) through media interface unit (MIU) with traditional diaphragm meter to get electrical output.*

Keywords: Optical Character Recognition module (OCR), Short message service (SMS), Automatic meter reading (AMR), Diaphragm meter, MIU, GSM.

1. INTRODUCTION

A Gas meter is a device which is used to measures the consumption of gas of any residence or other industrial establishment. In Conventional metering system to measure consumption the gas transmission and Distribution Company hire persons who visit each house and record the meter reading manually. These meter readings are used for bill calculation and this bill sent to consumer house by post. This is only a sluggish and laborious. Recently in Bangladesh inaugurated prepaid gas meter as a pilot project for the residential consumers of the capital's Lalmatia and Mohammadpur areas. In this area each users are allowed to use 158 cubic meter of gas a month at cost of 5.16 TK/cubic meter. On the contrary in previous non metering system each user can use unlimited amount of gas at 450TK/month [1]. In conventionally metering system people try to misuse the continuously firing to save a fire stick or to dry the cloths. This metering system becomes very difficult especially in rainy season. If any consumer did not pay the bill, the gas transmission and distribution worker needs to go to their houses to disconnect the gas supply. It is inefficient way for measuring gas consumption. The output of a gas meter using OCR module is same as Electrical Energy meter. 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 succor. 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 gas transmission and distribution 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.
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2. SYSTEM DESCRIPTION

Fig.1 shows the complete system description. In

this system each and every meter is provided a particular ID number (i.e.ID1230001 in fig.1). This ID number is provided according to SIM card unique service number. This system continuously monitors every meter reading daily, weekly, monthly or on request and sends to central server of energy Provider Company. The meter reading is stored in database server through SMS gateway. After billing calculation a bill is issued by energy Provider Company which can be sent either by email, by web account or by post. Customers can pay the bill using net banking. AMR also sends the information of power cut and power consumption through SMS. This SIM card service number is used to identify and retrieve customers detail for billing and identification purpose.
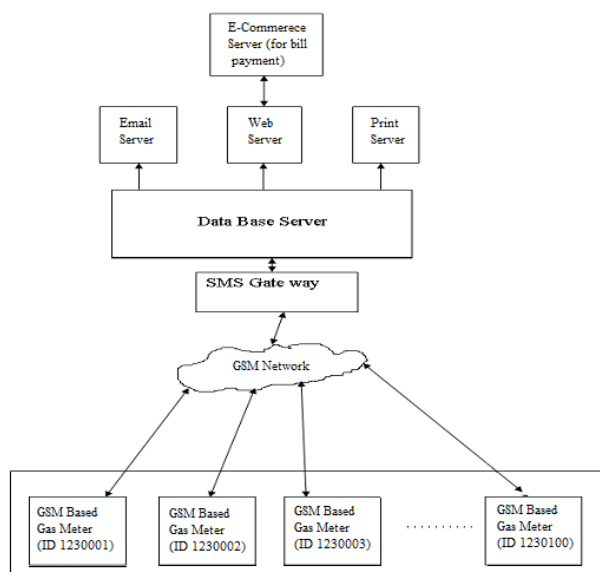

Fig.1: GSM based AMR system

3. DESIGN OF AMR

Fig.2 shows a block diagram of AMR. AMR Continuously monitor and record the gas meter. This can be achieved by using microcontroller. Figure 2 show that microcontroller unit is interface with gas meter and LCD. Microcontroller unit continuously monitor the meter and pulses display on LCD. That's give the information of power consumption in a house. For the information of power cut microcontroller unit is interface with RTC clock and relay. For communication purpose microcontroller unit is also interfaced with GSM modem by using MAX 232.
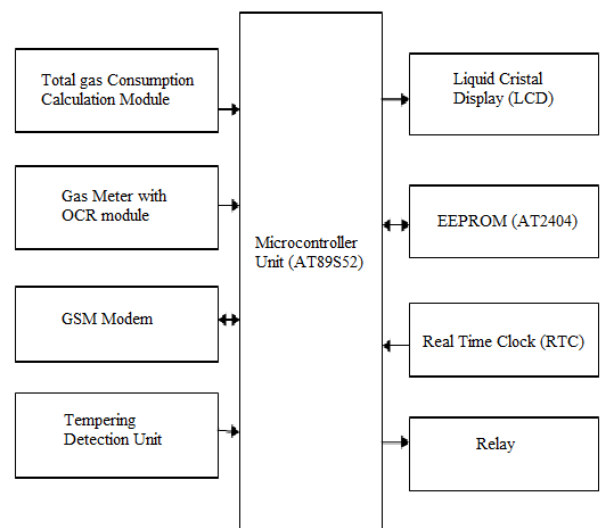

Fig.2: GSM based automatic gas meter reading system

3.1 Microcontroller Unit

Microcontroller unit is used for controlling of complete AMR system. The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable flash memory. The AT89S52 provides 256 bytes of on-chip RAM 8K bytes of flash Memory, 32 I/O lines, watchdog timer, two data pointers, three 16-bit timer/counters a full duplex serial port, on-chip oscillator, and clock circuitry.

3.2 Gas meter with OCR module

OCR (Optical Character Recognition) also called Optical Character Reader is a system that provides a full alphanumeric recognition of printed or handwritten characters at electronic speed by simply scanning. An OCR module needs to be right attached onto the display of a gas meter with the least four significant digits being focused and tested using the configuration tool. Fig.3 shows a gas reader prototype fitted in the kitchen where the OCR module is attached to the monitored gas meter [5].

Fig.3: Traditional diaphragm meter with OCR module

3.3 Liquid Crystal Display

A display is a computer output surface and projecting mechanism that shows text and often graphic images to the computer user, using a cathode ray tube (CRT), liquid crystal display (LCD), light-emitting diode, gas plasma, or other image projection technology. The display is usually considered to include the screen or projection surface and the device that produces the information on the screen.

3.4 Real Time Clock

In this project DS1307 serial real time clock is used for giving the information of date and time of power cut. DS 1307 have 56 bytes RAM. Address and data are transferred serially by 2- wire, bi-directional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The DS1307 has a built-in power sense circuit that detects power failures and automatically switches to the battery supply.

3.5 Relay Section

Relay circuits are interfaced with the gas meter and microcontroller. Relays allow one circuit to switch a second circuit which can be completely separate from the first. Relay circuit are used for switching the consumer's main consumption line between cut-off and supply mode. Actually relay is directly connected to a control valve with the supply. It is proved to be very helpful feature for Gas transmission and Distribution Company, who can remotely switch into cut off mode from power on mode of any consumer due to nonpayment of gas bills / has large outstanding dues. It can reconnect the supply after payment of dues.

3.6 Data Storage Unit

AT24C04 is electrically erasable programmable read only memory is used for the data stored in its 4KB Memory. EEPROM interfaced with the microcontroller by using 2 wire serial interfaces. If power cut off the content of RAM must be stored in EEROM, and when power will be back the energy meter will be start from its previous state [4].

3.7 Temper Detection Unit

Today energy theft is a serious problem due to energy theft heavy revenue losses are incurred by country. A tempering unit used for stop of this energy theft that sent the alert to gas Transmission and Distribution Company when tempering occurs. If any person tries to tempering with gas meter the tempering unit will be activated and as SMS alert send central server of the gas provider company.

3.8 GSM Modem

Quad-band intelligent GSM/GPRS modem suitable for long duration data transmission. To implement AMR system a GSM modem is connected to a microcontroller which would transmits data from a meter to cell phone and also receive commend from cell phone to gas meter. The modem will send unit or pulses (gas consumption) on a regular interval or on a request. AT commands set which stands for attention terminal are used by gas meter to communicate with the GSM Modem.

4. FLOW DIAGRAM OF THIS SYSTEM

Fig.4 shows that energy meter continuously display the pulse and unit according power consumption. When Gas Transmission and Distribution Company requires data for calculation of bill so they send a message to AMR.
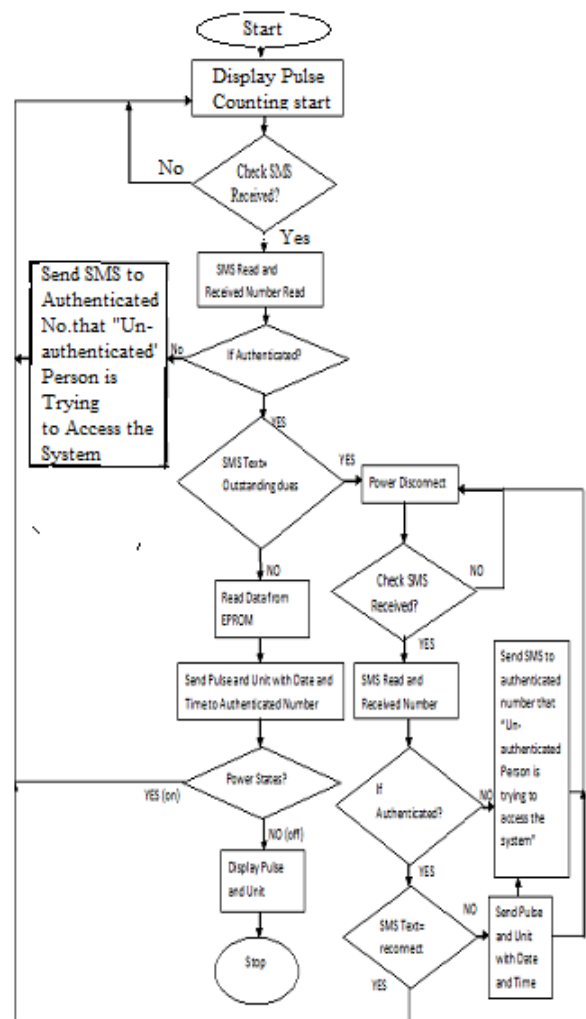·

Fig.4: Flow diagram of controlling program of AMR

5. CONCLUSION

In this paper, an automatic gas monitoring solution has been presented involving its hardware design. There is a lot of wastage of gas due to the consumer's lack of planning of gas consumption in an efficient way. Since the supply of gas is limited, as a responsible citizen, there is a need to utilize gas in a better and efficient way. The distribution company has to receive huge amounts in the form of pending bills, which results in substantial revenue losses and also hurdles to modernization because of lack of funds. The billing system is minimally able to detect theft and even when it does at the end of the month. Also, the distribution company is facing many problems in terms of losses. The distribution company is unable to keep track of the changing maximum demand for domestic consumers. The consumer is facing problems like receiving due bills for bills that have already been paid as well as poor reliability of electricity and quality even if bills are paid regularly. The remedy for all these problems is to keep track of the consumers consumption on a timely basis, which will help assure accurate billing, track maximum demand, and detect online theft and misuse. These are all the features to be taken into account for designing an efficient energy billing system. The paper incorporates these features to address the problems faced by both the consumers and

the distribution companies. In further research try my best to implement this conception.

6. REFERENCES

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