

Autonomous Electric Bill Generator

Mayuri Pramod Londhe¹ Archana Vasant Kandekar² Shamal Vijay Bhalerao³ Nutan Gorakh Kale⁴

^{1,2,3,4}U.G. Student

^{1,2,3,4}Department of Computer Engineering

^{1,2,3,4}Late G.N.Sapkal College of Engineering, Nashik

Abstract— Traditional metering method for retrieving the energy data is not convenient and the cost of the data logging systems is high. So we designing and developing Automatic meter reading (AMR) system. AMR system give the information of meter reading, power cut, total load used, power disconnect .This information is being sent and received by concerned energy Provider i.e. MSEB with the help of Global system for mobile communication (GSM) network . Energy provider receives the meter reading within a second without visiting person. AMR minimize the number of traditional visits required by employs of energy Provider Company. This system not only reduces the labor cost but also increase meter reading accuracy and save hugs amount of time.

Key words: Short message service (SMS), Automatic meter reading (AMR), Energy meter, Energy provider company, GSM

I. INTRODUCTION

Problem associates with traditional meter reading have been increased day by day, due to various reasons such as rapid growth in population, tedious location, environmental conditions etc. But with new developments of microcontroller, there are many improvements in automating various industrial aspects for reducing manual efforts. In traditional meter reading system in which utility usages are written on paper by workers, there is lot of chances of human errors. These will cost more to the utility company. Also there are chances that of unavailability of consumers during utility worker's visit for meter reading. In such cases, billing process will be pending & utility workers again require to visit to consumer. Going to each & every consumer's house & generating the bills is very labouries task & require lot of time. It becomes very much difficult in natural calamities especially in rainy season. Moreover it is also difficult for utility workers to find out unauthorized connections or malpractices carried out by consumers manually. This all will result in loss of revenue generation for utility company.

There are another type of customers also, for which not only continues electricity is matter but also about quality of power is also matter.

Considering all above pro & cons of traditional & automatic metering system, this study proposes a Autonomus Electric Bill Generator System. It uses Current & Power Transformer to read current & Voltage parameters of incoming electrical signal. After this, signal conditioning unit along with ARM-based embedded system (AES) is used to compute the power parameters. These computed power parameters are then sent to Utility company server through wireless communication method such as GPRS. Also data or signal from utility company server is received

through wireless communication module to ARM based embedded system (AES).

II. LITERATURE SURVEY

A. GSM Based Automatic Energy Meter System with Instant Billing:2014 E.Moni Silviya, K.Meena Vinodhini,

This system which measures the current consumption unit through IR sensor unit .The IR transmitter is placed in the rotating unit of the EB meter. The receiver photo diode is placed in a certain place which is used to find no of rotation. By getting the number of rotation we get the current consumption. After getting the current consumption the ARM processor will reduce the unit given for specific user.The unit here is taken as numeric value. If the unit is reduced to minimum value it will intimate the user through alarm and LCD unit. This system may be applied in Industrial control, medical system and access control.

B. Design of GSM Based Smart Automatic Energy Metering System: 2015, Kiran Mahale, Shraaddha Bansal

This system provides opportunities in implementing energy efficient metering technologies that are more precise & accurate, error less, etc. The implementation of GSM based smart automatic energy meter provides with many vital features as compared with the analog meter reading.

This system provides a full duplex communication between the electricity company and the load by sending in a lot of power parameters and control signal to reach the goal of load management and power need control. Based on GSM smart automatic power meter on supply automation can supply many capabilities such as efficient meter-reading, distribution, power control and monitoring, load organization and time of use rate. With quick growth of wireless mobile communication network, future use service will gradually concentrate on data communication service. GSM was developed wisely and has many real-time applications at current.

C. Real Time AMR & Control of Household Energy Meter with Zigbee communication: 2015, Dipti Yeolekar, H.H. Kulkarni.

In previous scenario of this System the human operator goes to the consumer's house, takes the photograph of meter reading and produces the bill. If the consumer is not available, the billing process will be pending and human operator again needs to re-visit the pending houses. Going to each and every consumer's house and generating the bill is a laborious task and requires lot of time. It becomes very difficult especially in rainy season. If any consumer did not pay the bill, the operator needs to go to their houses to disconnect the power supply. AMR is a process of automatically collecting consumption, diagnostic, and status data from energy metering devices and transferring that data

to a central database for billing, troubleshooting, and analyzing. This technology mainly saves power supply providers to reduce the expenses of periodic trips to each Physical location to read a meter. Another advantage as mentioned is that billing can be based on near real-time consumption rather than on estimates based on past or predicted consumption. This timely information coupled with analysis can help both utility providers and consumers for better control & use of Electrical energy. AMR technologies include handheld, mobile and network technologies based on telephony platforms (wired and wireless), RF (Radio Frequency) or power line transmission. Various AMR methods and technologies are developed using SCADA (Supervisory Control and Data Acquisition), Zigbee, GPRS and GPS etc.

D. Automatic Energy Meter Reading System Using GSM Technology:2016, Prof. S.R.Kurkute, Gopal Girase, Prashant Patil

The goal of this System is to help collect the meter measurement automatically and possibly send commands to the meters. Automation ranges from Connecting to a meter through an RS-232 interface for transmitting the meter measurements all the way from the meter to the utility company via GSM network. They use the digital energy meter in implies a times-sampled system. An analog to digital converter sampled current and voltage transducers output at a high frequency, translating real world waveforms to binary words that digital circuitry can understand and manipulate. Digital energy meters maintain their accuracy over a larger current range than the mechanical meter. These new meters are also stable over change in temperature, voltage and line frequency.

III. SYSTEM ARCHITECTURE

AEBG System Architecture is as shown in fig 1. As shown in figure, AEBG is sub-divided in to five sub-parts:-

- a) Signal Sampling Unit (SSU)
- b) Relay Control Unit (RCU)
- c) ARM – Based Embedded System (AES)
- d) Wireless Communication Module (WCM)
- e) Utility Control Center (UCC)

A. Signal Sampling Unit (SSU)

The main problem of measuring analog quantities such as voltage & current is solved by using Power transformer (PT) & Current Transformer (CT). The analog quantity of voltage as well as current on the primary side of transformer is proportionally transformed on the secondary via power Transformer (PT) & Current Transformer (CT).

B. Relay Control Unit (RCU)

This Unit consists of Proactive relay, breaker control circuit & breaker. It is an interrupting device used for fault interruption & load switching.

Relay Control Unit is used to shutting off the electric power supply when the signal from AES because due date is over.

C. ARM Based Embedded System (AES)

This is heart of the system. A conventional power measure instrument is not able to give required information about power quality. So in order to calculated Root Mean Square

value of voltage and current, power factor, real power, reactive power and apparent power, it is appropriate to use microprocessor to design digital reading meter.

D. Wireless Communication Module (WCM)

The Wireless Communication Module (WCM) in AEBG is the system is mainly composed of different subsystem such as - central monitoring station and GSM network. Central monitoring station is consist of GSM modem. The wireless remote communication between ARM Based Embedded System (AES) station and Utility Control Center (UCC) is done by the GSM network. A GSM module assembles a GSM modem with standard communication interfaces like RS-232 (Serial Port), USB etc., so that it can be easily interfaced with a computer or a microcontroller based system.

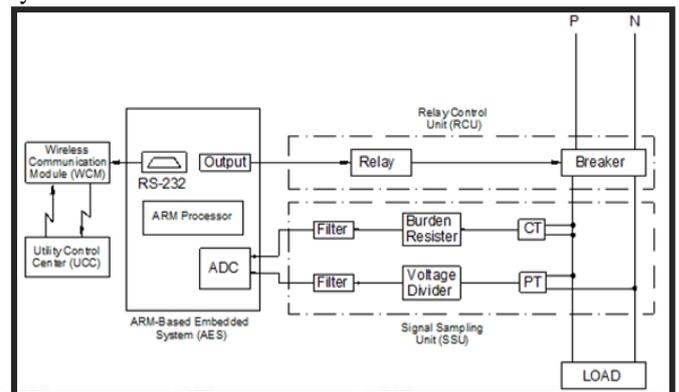


Fig. 1: Autonomous Electric Bill Generator System Architecture

E. Utility Control Center (UCC)

Utility Control center (UCC) is the central sarvar used for information processing & data exchange between various AES systems through wireless communication module (WCM).Utility Control Center (UCC) is connected with AES through GSM Module in WCM. It will receive the billing Units from ARM Based Embedded System. & UCC send the command signal to AES if Customer is fail to pay the bill in due date to cut off the power supply line to customer.

IV. RESULTS AND DISCUSSIONS

The System has RF sensor for reading units of meter. The sensor values are captured by microcontroller and send to MSEB server by using Qtel M95

V. HARDWARE

A. AT89S52 Microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the indus-try-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a

highly-flexible and cost-effective solution to many embedded control applications.

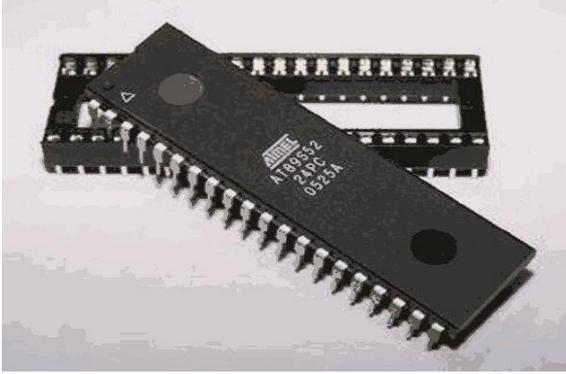


Fig. 2: AT89S52 Microcontroller

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

B. GSM Modem

GSM modem is wireless modem that works with GSM wireless network. It is widely used communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at various frequency bands.

GSM system was developed as a digital system using time division multiple access technique for communication purpose.



Fig. 3: GSM Modem

C. Features of GSM modem

- 1) Improve spectrum efficiency
- 2) International roaming
- 3) Compatibility with integrated services digital network
- 4) Support for new services
- 5) High quality speech.

D. Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as Solid-State relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers, they repeated the signal coming in from one circuit and re-transmitted it on another circuits.

Relays were used extensively in telephone exchange and early computer to perform logical operation.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called Contactor



Fig. 4: Relay

VI. CONCLUSION

By using this embedded system along with GSM module, provide automation for electrical distribution system. Along with this, it provides better accuracy in meter reading, better control over distribution & management.

Same system can be expanded for multipurpose like water & natural gas. Also many users can share same system.

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REFERENCES

- [1] GSM Based Automatic Energy Meter System with Instant Billing: E.Moni Silviya, K.Meena Vinodhini, April 2014
- [2] Design of GSM Based Smart Automatic Energy Metering System: Kiran Mahale, Shraddha Bansal. March 2015
- [3] Real Time AMR & Control of Household Energy Meter with Zigbee communication: Dipti Yeolekar, H.H. Kulkarni, March 2015
- [4] Automatic Energy Meter Reading System Using GSM Technology: Prof. S.R.Kurkute, Gopal Girase, Prashant Patil, march 2016.