



## INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

### READING OF ENERGY METER WITH LOAD CONTROL AND SECURE SWITCHING USING PASSWORD BASED RELAY CIRCUIT

*Mr. Ankush S. Alone<sup>1</sup>, Mr. Yogesh p. Bawangade<sup>2</sup>, Prof. M .D. Ghatole<sup>3</sup>*

<sup>1</sup> **Mr. Ankush S. Alone**, Department of Electrical Engineering (Electronic and Power) Dhamangaon Education Society's College of Engineering and Technology, Dhamangaon Rly

<sup>2</sup> **Mr. Yogesh p. Bawangade**, Department of Electrical Engineering (Electronic and Power) Dhamangaon Education Society's College of Engineering and Technology, Dhamangaon Rly

<sup>3</sup> **Prof. M .D. Ghatole**, Department of Electrical Engineering (Electronic and Power) Dhamangaon Education Society's College of Engineering and Technology, Dhamangaon Rly

#### ABSTRACT

Energy is very essential part in every human life and it's utilization is more important in electrical sector. From this essential requirement advancement in information technology tools which provide the automatic solution for the process of electricity metering and also remotely control the load. This paper present a reading of energy meter, load control and secure switching based on microcontroller with building automation system to implement remotely control the load by home phone. The password based relay circuit is used to ensure the secure switching by the user. The system is developed for the user query and setting of energy consumption rates remotely by this way we can reduce the cost of final consumer as well as properly conservation of energy.

**Keywords**— *Microcontroller, GSM, Meter, Relay, Electricity owners SMS from GSM*

#### INTRODUCTION

In day to day life , the power and energy sector of any country plays a important role in the improvement of domestic, industrial, agricultural, telecommunication, and education sectors. Electricity is the essential requirement for living a comfortable life and it has to be properly used and managed. The electrical metering instrument technology has come a long way from what it was more than 100 years ago. From originally bulky meters with heavy magnets and coils, there have been many innovations that have resulted in size & weight reduction and also, improvement in features and specifications of meters. An electric meter or energy meter is a device that measures the amount of electrical energy supplied or consumed by a residence, business or machine. The most common type is a kilowatt hour meter. When used in electricity retailing, the utilities record the values measured by these meters to generate an invoice for the electricity consumed. They may also record other variables including the time when the electricity was used. Modern electricity meters operate by continuously measuring the instantaneous voltage (volts) & current

(amperes) and finding the product of these to give instantaneous electrical power (watts) which is then integrated against time to give energy used (joules, kilowatt-hours etc). The meters fall into two basic categories namely the electromechanical meter and the electronic meters. The most common type of electricity meter is the Thomson or electromechanical induction watt-hour meter, Resolution and accuracy of the meter have seen substantial improvements over metering instrument technology. Presently, microcontrollers are playing a major role in metering instrument technology.

The Automatic Meter Reading system is intended to remotely collect the meter readings of a locality using a communication system, without persons physically going and reading the meters visually.

Traditional meter reading for electricity consumption and billing process is done by human operators from house to house and building to building. This requires a lot of human labor and longer working hours in order to achieve complete area coverage of data reading and billing services. Human operator billing services could be hindered by bad weather conditions and also in some buildings, the

electric power meter is placed in a location that is not easily accessible (the consumer room). Labor billing job is sometimes also restricted and slow by bad weather condition. The increase in development of residential housing and commercial buildings in developing countries such as Nigeria, require more human operators and longer working hours to complete the meter reading.

### Global System Mobile (GSM)

GSM is a second generation cellular system standard. A GSM based wireless communication module is integrated with an electronic energy meter of each entity to have remote access over the usage of electricity. A GSM channel is a very useful means of communication, as sending data as Short Messaging Service (SMS) turns out to be a very handy tool due to its good area coverage capability and cost effectiveness. GSM networks operate in four different frequency ranges. Most GSM networks operate in the 900 MHz or 1800 MHz bands. Some countries in the Americas use the 850 MHz and 1900 MHz bands because the 900 and 1800 MHz frequency bands were already allocated. The rarer 400 and 450 MHz frequency bands are assigned in some countries, where these frequencies were previously used for first-generation system.

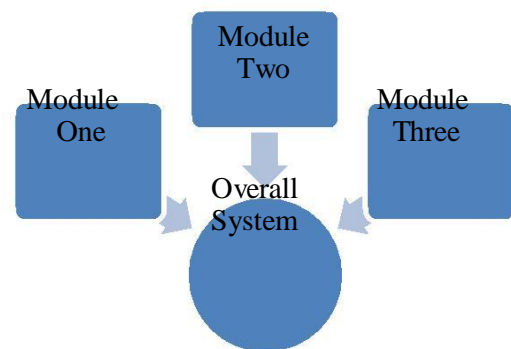
### Secure Switching Using Password

A password is a word or string of characters used for user authentication to prove identity or access approval to gain access to a resource and should be kept secret from those not allowed access. User names and passwords are commonly used by people during a log in process that controls access to protected computer operating systems, mobile phones, cable tv decoders, automated teller machines (atms), etc. A typical computer user has passwords for many purposes; logging into accounts retrieving e-mail, accessing applications, databases, networks, web sites, and even reading the morning newspaper online. A log in window for a website requesting a username and a password. Despite the name, there is no need for passwords to be actual words; indeed passwords which are not actual words may be harder to guess. Some passwords are formed from multiple words and maybe called a pass phrase. The term passcode is sometimes used when the secret information is purely numeric, such as the personal identification number (PIN) commonly used for ATM access. Passwords are generally short enough

to be easily memorized and typed. Most organizations specify a password policy that sets requirements for the composition and usage of passwords, typically dictating minimum length, required categories (e.g. Upper and lower case, numbers, and special characters), prohibited elements (e.g. Own name, date of birth, address, telephone number etc).

### LITRETURE SURVEY

- Yunus, M. et al,(2009) proposed a traditional meter reading method for retrieving the energy data used. A Hybrid system automatic meter reading (AMR) was developed.
- Yong, H. et al (2011) designed an efficient home energy management system based on automatic meter reading.
- Amer,W. et al (2010) developed a Comprehensive e-monitoring, e-management and e-billing system with zoom-in & zoom-out capabilities to reduce the electricity distribution losses for developing countries.
- Kwang ,W.H. et al (2008) developed a load allocation system based upon automatic meter readings.
- Kulkarni, B. (2012) implemented a GSM based automatic meter reading system utilizing an ARM controller.



**Fig 1. Modular Framework of System**

### Circuit Diagram

A 220v to 12v AC step down transformer was attached to the Vero board and a power cable connected to the transformer, for connection to electricity. A full bridge rectifier consisting of four diodes in a bridge configuration

## WORKING

A top-down design approach was used where the overall system was broken down into smaller modules to handle different areas of the study. Proteus was used to draw and test the hardware design.

### Module One:

A building automation system was developed for three power points.

### Module Two:

A microcontroller based meter reader with load control capacity was developed and interfaced with the BAS.

### Module Three:

A password relay circuit was interfaced with the final system to provide secure switching.

was then connected to the transformer to convert the AC input to DC output. A 7805 voltage regulator was then connected to the bridge rectifier to stabilize the voltage at +5v with capacitors 470µf for smoothing after rectification 0.1µf for filtering the ripples soldered to its input and output pins respectively. Four 12V relays were used for the implementation of this section of the hardware. Each relay was connected to a transistor (Ca45) and a resistor in series to amplify electric signals and prevent short circuit respectively. Each of these series connection was then connected to one of the output ports of microcontroller.

The relays require +12V for operation and are powered by the transformer. If the mains supply delivers low voltage then the transformer voltage may drop below +12V and the relays may not function efficiently. Logically, when one (+5V) is output on one of the bits, the corresponding relay is activated. The live terminal input of each plug point is wired across the common and normally open terminals of the relays, thus the power to the plug point is switched on or off depending on whether the relay is active or not. The open terminals of 3 relays were connected to a 3-input inductive regulator with inductance coil winding. The inductance coil functions with variance in power levels with respect to its number of turns, thus the highest number of turns is equivalent to the highest reactance and results in lowest power and vice versa. This requires a lot of human labor and longer working hours in order to achieve complete area coverage of data reading and billing services. Human operator billing services could be hindered by bad weather conditions and also in some buildings, the electric power meter is placed in a location that is not easily accessible (the consumer room). Labor billing job is sometimes also restricted and slow by bad weather condition.

## Fig. 2 Power Unit

The microcontroller was then carefully placed on the Vero board. Its output pins B0 to B4 were then connected to the inputs of the relays respectively. The Microcontroller pins were then connected to the output of the voltage regulator making the microcontroller permanently enabled with +5v. An 8MHz crystal was connected to the pins for clocking of the microcontroller. Pin A2, A3 and the ground pin were connected to receive, transmit and ground pins of the USB to serial Bridge respectively. The serial communication between the PIC and the GSM module was achieved by the use of a UART. A MAX232N line driver is used to convert the 0 to +5V TTL levels to RS232 levels. The TX (transmit) pin of the cable was connected to the input pin A2 (pin 1) of the microcontroller while the RX (receive) pin of the cable was connected to the output pin A3 (pin 2) of the microcontroller. The monitoring and management interface of the wireless automatic meter reading system. It is code with the Visual Basic Program language developed by Microsoft.

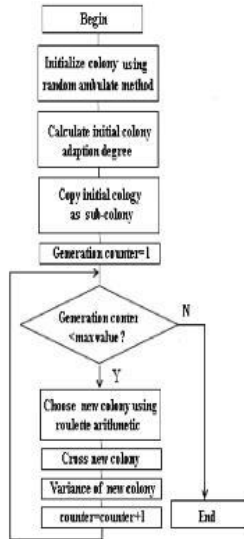
## Software Design

The software flow of meter reading CC2420 is initialized firstly, then the protocol stack is initialized and the interrupt is opened. After that program begins formatted the network, if the network is formatted successfully, and network coordination connect to computer, we can find the physical address of network coordination, network ID and channel number by software. Then network coordination is in operation state, if a node will add to the network, it will distribute a network number. If sensor node sends some data, it will judge that where the data come from and send the message to gateway (data collector). In sensor node, the program also initialize CC2420 firstly, then open the power of sensor and initialize protocol stack, begins send signal to add to network, wait for network coordination's answer, distribute simulation experiment of routing protocol based on genetic arithmetic is made

*For Engineering Applications and Technology EE (21-26)*



in MATLAB environment, describes the varying curve of best adaptation degree and average adaptation degree. The average available time extreme of route band from source node to aim node is 250ms, it shows that the routing protocol based on genetic arithmetic is convergent.



**Fig. 3. Genetic Arithmetic Flow Chart**  
**Hardware system**

It is coded with the Visual Basic Program language developed by Microsoft. At this central station, it receives multifunction electric meter data, and water meter data i.e. energy and water consumption. During experiment two houses were selected and the load was connected to demonstrate the working of model. An electric meter, measures amount of energy consumed by one house, while water meter measures amount of water consumed and transfers this measured data to next housings xbee .This data is then send to pc via RS 232communication format. The designed model used for experiment. We designed model which is concerned with main household utilities that are water, electricity distribution network. In this designed system, meters used for recording amount of family's consumption. In this system we have designed two nodes. As we know wireless sensor network consists of nodes, one house containing these meters can be considered as one node. Data i.e. consumption of one house is transferred to next house by using wireless sensor network. In this model



main office is considered as central node of a network.

#### **Fig. 4. Node Designed For Experiment** **PLC and SCADA**

Power line carrier (PLC), communications, supervisory control and data acquisition (SCADA), telephone modem, internet, Ethernet, embedded RF module, wi-fi, Bluetooth and zigbee established and developed to provide and demonstrate the solutions of efficiency, reliability and effectiveness of AMR. The above mention methods are either too expensive to implement and operate as it requires a complex setup of infrastructure, short operating distance and still requires field intervention of human operators.

#### **Advantages**

- i) The data collection and manipulation task becomes fast and easier.
- ii) The system designed reduces the efforts of manual data collection of energy meter.
- iii) This system in homes for remote control and monitoring by the homeowners.

#### **Disadvantages**

- i) Maintenance is high because use powers relay circuit.
- ii) It is highly in cost.
- iii) Telecommunication error is considered.

#### **Result and Conclusion**

In this paper a microcontroller based energy meter reader with load control capacity and secure switching using a password based relay circuit for application in homes for remote control and monitoring by the homeowners is discussed. The user can query the system via SMS to determine current load consumption as well as preset load consumption to requirements.

#### **References**

- [1] Arun, S., Sidappa "Design and Implementation of Automatic Meter Reading System Using GSM, ZIGBEE through GPRS". International Journal of Advanced Research in Computer Science and Software Engineering Research Paper. Volume 2, Issue 5, May 2013.
- [2] Bharat Kulkarni "GSM Based Automatic Meter Reading System Using ARM Controller" International Journal of Emerging Technology Advanced Engineering Website, Volume 2, Issue 5, May 2012.
- [3] Mr. Rahul Ganesh Sarangle, Prof. Dr. Udaypandit



Khot, Prof. JayanModi “Gsm Based Power Meter Reading AndControl System” International Journal of Engineering Research and Applications (IJERA)4, June  
– July 2012.

- [4] Li Quan-Xi, Li Gang “Design of remote automatic meter reading system based on ZigBee and GPRS” Proceedings of the Third International Symposium on Computer Science and Computational Technology (ISCSCT\_10) 14-15, August 2010.
- [5] Tariq Jamil, “Design and Implementation of a Wireless Automatic Meter Reading System” WCE 2008, July 2-4, 2008, London, U.K. IAENG Processing of the WorldCongress on Engineering 2008 Vol I. July 2-4, 2008, London.

