

SMART E-BILL GENERATION USING PLC

A.PRIYANKA¹, G.SAHITHI², SNEHA³, K.RAMANJANEYA REDDY⁴

1(Assistant Professor, Electronics and communication engineering , AITS , Rajampet

Email : priyanka3aluru@gmail.com)

2(Electronics and communication engineering , AITS , Rajampet

Email : gsahithi944@gmail.com)

3(Electronics and communication engineering , AITS , Rajampet

Email : snehasandy05@gmail.com)

4 (Electronics and communication engineering , AITS , Rajampet

Email : reddy2077@gmail.com)

ABSTRACT:

In the contemporary world, intelligent control is adopted in all fields like communication, home gadgetry, medicine etc. Unfortunately, the service providers of electricity are still using the usual methods for getting the information of energy consumed by the customer. The traditional method of energy meter billing is a long outdated, ineffective and time consuming one. Technology of e-metering (Electronic Metering) has gone through rapid technological advancements and there is increased demand for a reliable and efficient system i.e. Automatic Meter Reading (AMR). This paper presents the smart E-bill generation using PLC and its related features for making the job of metering easier.

The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter to the energy provider. Also it enables the energy provider to monitor the monthly meter readings without the person visiting each house. In this the GSM is incorporated with the energy meter through which the message is directly received by the consumer and the monitoring system and this system also enable the consumer to know his meter readings at the end of every month all the way through a simple SMS to his subscribed phone number. This mode of the system provides flexibility to the customer to pay his due amount on the very day on bill generation.

Keywords : *GSM PLC , Electronic meter*

1.INTRODUCTION

1.1 PROGRAMMABLE LOGIC CONTROLLER

In general the process control system is made of a group of electronic devices and equipment that provide stability, precision and remove the harmful conversion statuses in production processes. As a result of fast progress in the technology, many difficult operational tasks have been solved by linking PLC's and possibly a computer.

Beside connections with the instruments like operating panels, motors, sensors, switches, valves and such possibilities for communication among instruments are so great that they allow high level of utilization and process coordination

as well as greater flexibility in realize the process control system. In automated system, programmable logic controller is usually the central part of process control system. With the execution of a program stored in program memory the PLC continuously monitors status of system through signals from the input devices. Based on logic implemented in program, PLC tells which actions need to be executed with output instruments. To run more complex processes it is possible to connect more PLC controllers to a computer.

1.2. ARCHITECTURE OF PLC

The architecture of plc is same to that of the usual industrial used pc. The main difference that appear is PLC's contain input and output

devices. Input devices mainly constitute of Limit switches, temp switches, push buttons, A/D, logic and BCD converters. The output comprise of D/A, BCD converters solenoids and alarms. The construction is well explained in the following:

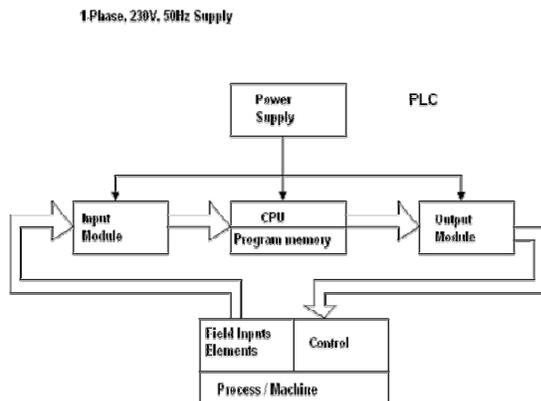


FIG.: Architecture of PLC

The PLC is fundamentally programmed interface between field input elements like limit switches, sensor, push-buttons etc... and final control elements like actuators, solenoid valves, drives, LED's, hooters etc. This interface is called as the programmable logic controller and it consists of the following:

- a. Input modules
- b. CPU with processor and program memory
- c. Output modules
- d. Bus system
- e. Power supply

1.2.1 Input module

The input module acts as a interface among field control inputs and CPU. The voltage or current signals generated by sensors, limit switches, push buttons etc are applied to the terminals of the input module helps in the following ways Depending upon nature of input signal coming from field, the input module could be

1. Analog input module.

2. Digital input module.

- The typical analog current input modules are 4 to +- 20mA, 0 to +- 20mA and the analog voltage input modules are 0 to +- 50mV and 0 to +-10V.
- The typical digital input modules are 24V DC, 120V AC and 230V AC.

1.2.2. OUTPUT MODULE

The output module acts as the connection between CPU along with output devices located in the field. The field devices may possibly be relays, contactors, lamps, motorized potentiometers, actuators, solenoid valves, dampers etc. These devices will actually control the process.

The output module converts output signal delivered by CPU into an appropriate voltage level appropriate for a output field device. The voltage signal provided by CPU could be 5V or 9V, but output module then converts this voltage level into 24V DC, or 120V AC or 230V AC etc. Thus output modules on receiving signal from processor switch voltage to particular output terminals, this makes the relays or representing lights connected visual display unit to turn ON or OFF. Same as the input module an output module could be analog or digital. The choice is based on the voltage ranking of field output device is analog then the analog output module is required and its digital like contactor coil or lamp then the digital output module is necessary. Typical analog output modules are 4 to +- 20mA or 0 to +- 10V and the digital output modules are 24V DC, 120V AC, and 230V AC or relay output.

1.2.3 CENTRAL PROCESSING UNIT

The CPU consists of the following efficient parts:

- a. Arithmetic Logic Unit
- b. Program memory

- c. Process image memory (i.e. internal memory of CPU)
- d. Internal timers and counters
- e. Flags

The input system can consists of Digital, Analog and counter unit Output system is constituted with Digital and the Analog output modules. The memory (external) will be communal with the CPU for its internal usage and a two way connections also exists.

In some programmable logic controller systems, there will be the hand shaking signals which confirm the healthiness of every module. In such PLC's there are two ways of communication system exists between ALU and the I/Os. The power supply will feed to I/Os and as well as the CPU and the correlated modules at a bus level.

Arithmetic Logic Unit (ALU)

- A. ALU is a controller of PLC
- B. The following operations should be carried out by ALU are :
 - a. It arranges analytically the input of external signals and also data.
 - b. It performs various logic operations with data.
 - c. It also performs calculations.
 - d. It takes account of a value of the internal timers and also counters.
 - e. It takes an account of the signal states stored with in the flags.
 - f. It stores signal states of input in Process of the Input Image (internal memory of the CPU) before the each program scanning cycle.
 - g. It stores the result of the logic operation in process Output Image (internal memory of CPU) during program scan.
 - h. It arranges output of the result.

1.2.4 BUS SYSTEM

Bus system is the path for transmission of

signals. In the PLC's, it is responsible for the signal exchange between the processor and the input / output module.

1. Address bus is that enable the selection of the memory location or module.
2. Data bus that carries data from the modules to processor and vice versa.
3. Control bus is that transfers control and timing signals for synchronization of the CPU's activities within the programmable controller

1.2.5 POWER SUPPLY

It generates the voltage required for electronic modules of PLC from the main supply. Typically 1 phase, 230V AC supply is converted into 24V DC supply by the power supply module. It should be noted as CPU needs 24V DC input and voltage required by the PLC hardware is 5V DC etc. is generated by the CPU.

2. PROPOSED SYSTEM

In this the GSM is integrated with the PLC through which the message is directly received by the consumer and the monitoring system simultaneously.

2.1 BLOCK DIAGRAM

The below outline shows the block plan of smart E-Bill generation using PLC.

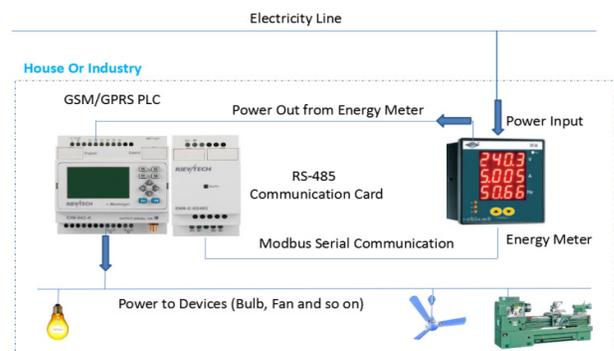


FIG. : Block Diagram

- The PLC will control all the devices in the home.

2.2 BLOCK DIAGRAM DESCRIPTION:

GSM/GPRS PLC:

It consists of a wide range of CPUs, expansions, trimmings and software particularly considered for the GSM/ GPRS wireless systems that is being used for the remote measurements, data logging, control, diagnostics and the object via SMS or CLIP calls. Configurable message sending from device with static or dynamic text and precise values contented area is suitable way of passing the important information to monitoring center or directly to a definite phone numbers. SMS sending or Call out can be done by change of binary input state, getting the alarm thresholds, marker state change, counters and the clocks.

In mostly the x-Messenger shall acquire the industrial design, practical set of the I/O possessions & easy use of the design software tools. Multiple possible analog signals(0..10VDC) (0...20mA), (PT100)inputs built-in module will make it probable to have a direct relationship of sensors which lowers the cost of the building system. Hence, it will directly work with the humidity sensors, water level sensor, flow sensors, smoke, gas, motion, shock and the noise detectors , etc.

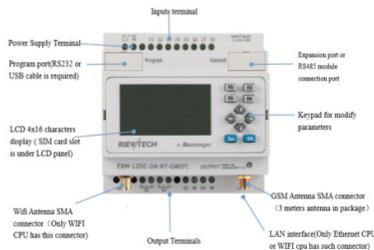


FIG : GSM PLC

- Parameters in program changing by means of a SMS by using cell phone.

- RTC, Timers and Counters High speed input
- Max.64 of the different short messages and voice alarms.
- Endorsement at Real Time Clock (RTC) at 25°C:100 hours
- 4-lines,16-character per line, hind light display and keypad is non-compulsory.
- typical Modbus TCP contact protocol is supported.
- 1RS232,1RS485, Ethernet interface is optional
- It is non-compulsory for the x-Messenger to act as a slave or master in confident Modbus communication network.

ENERGY METER:

An energy meter, electric meter, electrical meter, or energy meter is a device that procedures the amount of energy consumed by a house, a business, or an electrically motorized device. Electric utilities use electric meters installed at customers' property to measure electric energy delivered to their customers for billing purposes. They are usually calibrated in billing units, the most general one being the kilowatt hour [kWh]. They are frequently read once each billing period.

RS-485 communication card:



FIG : RS485 CARD

Communication is done by the MODBUS serial communication .Benefit of the MODBUS is that it can run over all communication media,

together with twisted pair wires, wireless, fiber optics, Ethernet, telephone modems, cell phones and the microwave. This means that a MODBUS connection will be recognized in a new or offered plant easily. In fact one growing application for the MODBUS is provided that a digital communications in older plants, using the accessible twisted pair wiring.

SOFTWARE EQUIPMENTS:

E-SMS CONFIG:

- 1) **Easy to use :**
 - Fast , easily realize and instinctual programming that requires no professional knowledge.
 - Self-taught made easier thanks to the user-friendly and on-line help channel.
 - Simulation mode that constantly represent the regulator operation.
- 2) **Powerful :**
 - In that we have 70 kinds of dissimilar functional blocks: counting, timing, comparison, display, logic etc can be associated in a program can be up to maximum of 512 blocks.
 - The interface supports 7 different languages like English, Russian, Czech, German, French, Spanish and Chinese.

EASY MONITOR :

Complete functions:

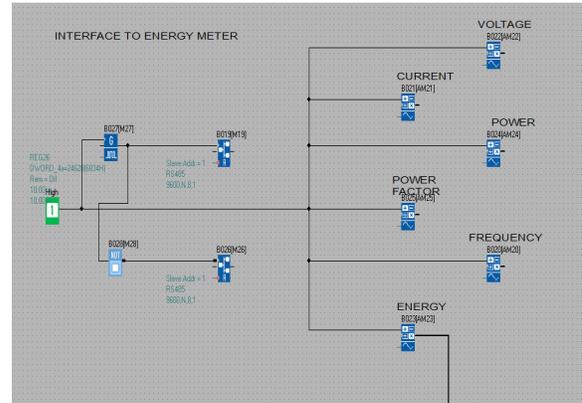
Includes the basic shape like drawing , development picture display , meter , past data compilation.

Powerful Communication :

Easy Monitor provides drives for the communication with PLCs projects of all PR, ELC and also EXM series CPU via RS232 ,

RS485, Ethernet/GPRS. existing protocol is the MODBUSRTU/TCP protocol.

PROGRAMMING:



The above logic is related to the values of current, voltage , power taken by the PLC from the energy meter.

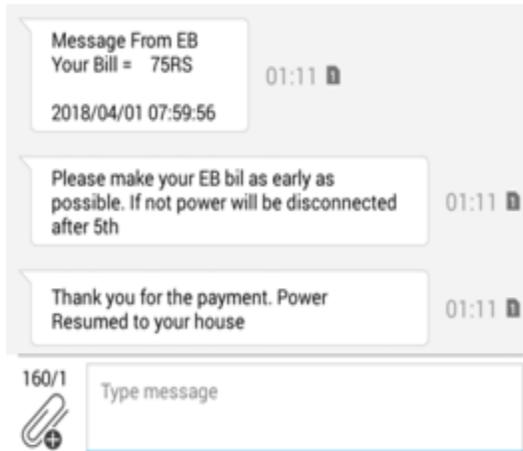
3.ADVANTAGES

- 1) Flexibility: One PLC can run many machines in industry
- 2) Maximum demand.
- 3) System automatically disconnect and connect the power based on the user billing system.
- 4) It remove the bribe in the EB billing which in turn yield good saving for the government.
- 5) Owner gets all the details directly into his mobile phone which will remove mal-practice in the billing.
- 6) System send message to the owner during low voltage and high voltage to avoid damage to the equipments.
- 7) By simply texting message to the PLC user can know the current power consumption.
- 8) With the centralized monitoring of all the data at one location , it is very easy to manage the load sharing by the EB.

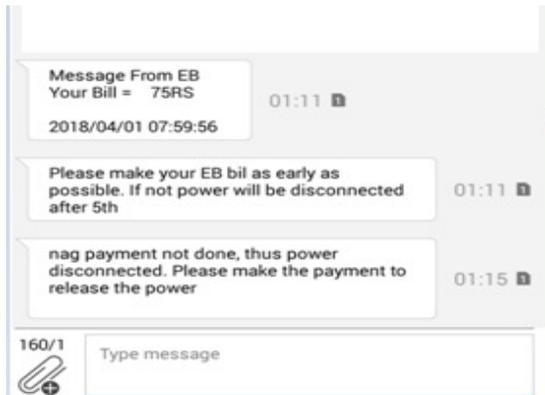
5.RESULT

The result is in the form of messages the message is sent to the registered mobile number

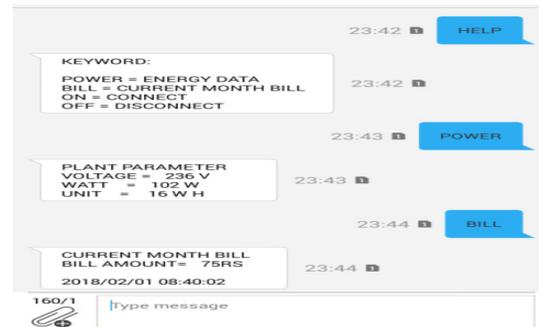
- i. In this case the bill is send as a message to the owner if he pay the bill.



- ii. In this case the bill is send as a message to the owner if he did not pay the bill.



- iii. This is an emergency case . It is for help



6. CONCLUSION AND FUTURE SCOPE

Now a days PLC are ruling the industries because of their wide usage in major industries. These replaced many conventional devices because of their advantages. The schedule taken here is limited due to the total number of inputs and outputs is being less. This limitation will be absent when the PLC was of industrial one. In this paper with the help of presented proposed system it is possible to avoid meter reader visit and revisit for recording the meter reading to each house. Also if consumer gets faulty bill he has to go to Electricity Board office to correct it and be in long queue.

In time a head this system will be used as the

- Sending message via E-Mail.
- Communicating through GPRS/Wifi.

7.REFERENCES:

- www.iosrjournals.org
- <http://ieeexplore.ieee.org>
- <http://www.sskdesign.in/Downloads>
- https://en.wikipedia.org/wiki/Programmable_logic_controller
- www.plcdev.com/book/export/html/9
- <https://en.wikipedia.org/wiki/GSM>
- <https://en.wikipedia.org/wiki/Modbus>