Hi-Tech Energy Meter with Automatic Load Control

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Abstract

This is basically an automation of the energy providing system. Our proposed system will automatically send the data of the digital energy meter to the service provider with the help of the GSM modem once in a day and hence the system will report the service provider once in a through SMS. The same system can be used to check the last reading consumed by the consumer, when demanded by user through the same GSM modem. The device can also be used to control the load by energy provider with the help of relay circuit and system will also be provided with an LCD display which will update the consumers with different information’s regarding tariff change or sudden power off.

Keywords: Energy meter, Atmega328 microcontroller, GSM module, LCD display

I. INTRODUCTION

Electricity is the driving force behind the development of any country. With the rapid increase in residential, commercial, and industrial consumers of electricity throughout the world, it has now become imperative for utilities companies to devise better, non-intrusive, environmentally-safe techniques of gauging utilities consumption so that correct bills can be generated and invoiced. Traditionally, the electricity meters are installed on consumer’s premises and the consumption information is collected by meter readers on their fortnightly or monthly visits to the premises. The GSM Power Meter Reading and Control System takes advantage of the available GSM infrastructure nationwide coverage in the country and the Short Messaging System cell broadcasting feature to request and retrieve individual houses and building power consumption meter reading back to the energy provider wirelessly and the control system will monitor the power of the appliances which consumes more power than its predefined limit. If the power increases to the predefined limit the control system will control the power by means of different techniques for different types of loads like resistive and inductive load so as to reduce unnecessary power consumption of appliances. This system is used to save the energy at the same time the energy provider can connect or disconnect the power supply to the home if there is an irregularity in the payment of the electricity consumed bill with the help of the same GSM modem. There are some objectives made by us for the research project: (1) To design a project which continuously monitors the meter reading and sends the message to electricity department. (2) To design a mechanism which monitors and controls the power appliances from the ends. (3) An LED display with a speaker which will report the latest updates to the consumers regarding tariffs and if there is a sudden power cut. (4) The GSM modem will report to the service provider modem on daily basis and at the end of the month analysis of the energy consumed is done tariffs and vats are included and bill are sent to the consumers inform of mail SMS and hardcopy in the billing address provided by the consumers.

II. PROBLEM STATEMENT

Sometimes the meters are installed inside people’s homes and, if the consumer is not at home, the meter-reader cannot record the fortnightly or monthly consumption and then the utilities of company has to resort to considering the average bill-amount of the previous months as an indicator of the likely consumption for the current month. This results in burden for both consumer and the electricity supply company. In addition, Hiring of a number of meter readers by companies and providing means of transportation to them is an expensive burden on the companies’ budgets. Moreover, these visitors of the may use vehicles to
reach the consumers’ premises which will cause the environmental pollution. The meter readers may make some mistake in reading the consumed unit which will lead to false billing due to human error. The SMS has extended their service to content providers to deliver a wide variety of services to mobile phone users. SMS is one of the convenient mean of communication especially for reminder, notification, and a short note when the mobile phone user is not expect to answer or respond immediately. Our system takes advantage of the available GSM infrastructure nationwide coverage in the country and the Short Messaging System (SMS) cell broadcasting feature to request and retrieve individual houses and building power consumption meter reading back to the energy provider wirelessly and the control system will monitor the power of the appliances which consumes more power than its predefined limit.

III. PROPOSED SYSTEM

To implement this system, we are using an ATMEGA328 microcontroller of Atmel Corporation. The digital energy meter which generates the pulses as well as count the energy consumed is used. The digital energy meter is having a LED which blinks for a specific number of times to indicate the energy consumed. From the energy meter we are taking the calibrate pulse out for counting it in the atmega328 microcontroller. For this process, we have used opto-coupler which will isolate the led to the microcontroller and convert it into 5 volts which is considered as logic 1 by controller. After having the pulse, we have used the conditional statement in the programming so that whenever the pulse will come the result of units will be incremented by 1. We have considered 3200 pulses as 1 unit because in the energy meter there is a description given by the maker that 3200 pulses is equal to 1 unit. So, these counts of unit is multiplied by specific number which is the number of rupees per unit and then it will displayed to the specified port or interrupt which have the 16*2 display. Then the output will be displayed on the LCD display. The system reads these pulses and after counting specific number of pulses it increments the internal counter by one which indicates the number of units consumed. The system also contains a relay circuit and an LCD display which is interfaced with the modem and the control circuit. Instead of using the UART module, the GSM module is connected to the RxD and TxD pins of the controller. Now if, service provider will send specified message to GSM module which is connected to controller the reading and its calculated rupees will automatically send to the service provider appropriately. So, when one will request for the consumed energy, one will get the message of the detailed information about reading. The same result is also displayed on the LCD for the consumer to know about its consumed electricity. If now, the service provider detects that the previous bills are pending for a specific user, the message will be sent by the service provider, which results in disconnection of energy supply for that user. For this purpose, the supply goes further to home/office through a relay circuit, which is again controlled by ATMEGA 328 microcontroller. The service provider can now inform the customer regarding the current bill or status using the customer’s registered phone number by either a message.

IV. DESIGN

The design of system are including two implementations.
- Hardware Implementation
- Software Implementation

A. Hardware Implementation:

A large part of the project involved choosing the appropriate hardware components to take the meter reading from the meter and send it to user and to server remotely and to control the power consumption and provide a wireless link. As result, we have chosen ATMEGA 328 as microcontroller, GSM module as a wireless link and relay circuit to interface the controller and the load.
1) Energy Meter:

Electricity meter is an electronic single-phase multi-tariff meter, which measures active and reactive energy. We are using a simple analog energy meter for taking out the calibrate pulse for counting and calculation.

2) Pulse out Circuitry:

To make this circuit, we are using the opto-coupler for taking the calibrate pulse out from the energy meter.

3) ATMEGA 328 Microcontroller:

Instead of using the whole Launchpad or the circuit board we are using only the controller so because of that the circuit is very inexpensive and easy to make. As it is a high level controller to load the program in it is quite simple and as well as the interfacing of the components.

The ATMEGA 328 is 8-bit MCU has 32KB programmable flash memory, 2k bytes of static RAM, 1k bytes of EEPROM memory, 3 timer/counters and serial communication port. This unit is the heart of the complete system. It is actually responsible for all the process which is being executed.

4) GSM Module:

This GSM modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS control, data transfer, remote control and logging can be developed easily.

We have used GSM 300 module. Instead of using its RS232 port, we are directly connected RxD and TxD pins of the GSM module which is already given in the module to the microcontroller. Instead of using GSM 900 module, we have implemented it by GSM 300 module. The only difference between the two is that GSM 900 has more cost than GSM 300. In addition, GSM 900 operates in 4 bands and enabling GPRS for internet data logging. But in our project we do not want more range so that we have used the GSM 300 module.
B. Software Implementation:

For developing the programming, one use several software available in market. But, we used the arduino studio to implement our program because arduino studio has the libraries having the functions of GSM and LCD display.

V. CONCLUSION

A complete working prototype of this system is being done to demonstrate an automatic power meter reading using the GSM network. The project is having the facility of getting the meter reading at any time by the customer request. Power meter is no difference from existing analogue or digital meter installation the complete e-billing system help in easy billing and delivering of the bill in form of SMS. The system is effective reliable and efficient wireless automatic power meter reading with automatic load control. Thus it reduces the operation cost and human operator meter reading, making the system error free with the help of the GSM modem, the only drawback with the system is that it way sometimes leads to slow delivery of message to the distribution side GSM modem.

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