

SMART ENERGY METER WITH READING INDICATION USING GSM

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Abstract - This paper proposes the smart energy meter with reading indication using GSM it developed to decrease the electricity consumption bill by providing the energy meter reading to the user with an alert message before increasing of unit charge. The reading from Utility administration as SMS is being received by smart energy meter programmable interface and the action is performed by the meter according to provided information Microcontroller can be used to monitor and record the meter readings. In case of a customer defaulter, no need to send a person to utility cut-off the Utility can cut off and reconnect the customer connection by short message service. A PC with a GSM receiver at the other end, which contains the database acts as the billing point. Live meter reading from the GSM enabled energy meter is sent back to this billing point periodically and these details are updated in a central database. Furthermore, the customer can check the status of electricity from anywhere. It provides ease in taking the meter readings, accuracy.

Key Words: ARM7 controller, energy meter, GSM, Voltage sensor, visual studio.

1. INTRODUCTION

Electrical metering instrument technology has come a long way from what it was more than 100 years ago. From the original bulky meters with heavy magnets and coils, there have been many innovations that have resulted in size & weight reduction in addition to improvement in features and specifications. Resolution and accuracy of the meter have seen substantial improvements over the years. Introduction of the digital meter in the later part of last century has completely changed the way Electrical parameters are measured. Starting with Voltmeters & Ammeters, the digital meter has conquered the entire spectrum of measuring instruments due to their advantages like ease of reading, better resolution and rugged construction. Of particular significance is the introduction of the Electronic Energy Meter in the mid eighties. Now a days, the energy consumption and energy distribution has become a big subject for discussion because of huge difference in energy production and consumption. In this regard, energy consumers are facing so many problems due to the frequent power failures;

another important reason for power cuts is due to the unlimited energy consumption of rich people. In this aspect, to minimize the power cuts and to distribute the energy equally to all areas, some restriction should have over the power consumption of each and every energy consumer, and according to that the Government should implement a policy, by introducing Autonomous Energy Meters everywhere in domestic sector. Hence, the need has come to think on this line and a solution has to be emerged out. Smart energy meter can easily take readings and we can reduce the miss usage of power and also here we majorly decrease the bill of user by alerting them with a alert message before doubling the unit charge.

2. EXISTING SYSTEM

In existing system either an electronic energy meter or an electro-mechanical meter is fixed in the premise for measuring the usage. The meters currently in use are only capable of recording kWh units. The kWh units used then still have to be recorded by meter readers monthly, on foot. The recorded data need to be processed by a meter reading company. For processing the meter reading, company needs to firstly link each recorded power usage datum to an account holder and then determine the amount owed by means of the specific tariff in use many systems built on various platforms have been proposed by different research groups all over the world for Automatic Meter Reading. Tele watt meters were implemented to transmit data on monthly basis to a remote central office through a dedicated telephone line and a pair of modems. A microprocessor or DSP-based meter is used in this to measure the electricity consumption of multiple users in a residential area. A master PC at the control centre was used to send commands to a remote meter, which in turn transmitted data back, using the Power Line Communication technique. These techniques were mainly implemented in areas that had a fixed telephone network. Bluetooth energy meters were designed and implemented in some areas where several meters in close proximity, communicated wirelessly with a Master PC. In this measurement technique that encompasses the GSM network as a mean of transmitting energy data is more relevant. The GSM network offers most coverage in most developed and developing countries. This method is also effective in rural areas, which are not densely populated, and in which, most people do not

have access to a fixed telephone network. So in a country like India we need to focus more on this method as it can be implemented very easily and effectively. In this system PIC controller is used to control .

output pulses from the metering IC are counted using the default timer of PIC MCU. The signal from meter through Octocoupler is normally high and the high to low transition of this voltage wave indicates the occurrence of a pulse. The counting of low pulse is an inefficient method as improper grounding issues may even be counted as a pulse by the device. So the produced pulse is reversed before applying to the counter. A TTL compatible inverter circuit is used for this purpose.

3. PROPOSED SYSTEM

In Existing system PIC is used for controlling In proposed system we are using ARM7 microcontroller this system developed for automatic reading and instant billing and for utility off and on before and after paying bill. PIC Microcontroller needs more clock cycles compared with ARM7 micro controller so its operation speed is low and PIC having separate memory spaces for RAM and program memory but ARM7 having Harvard architecture. C compiler choice is limited in PIC but in ARM7 compiler is more suitable for any operation it also more efficient in console functions.

This proposed system operate with high speed and it will sends the message before increasing of unit charge by using data provided in the main server system for this here using GSM system which uses GPRS network for connecting. Present unit charge for residential is:

Consumption	unit charge
First 50	1.45
50-100	2.60
101-150	3.25

So, these will increase electricity bill more so by using this proposed system we can reduce majorly. It is useful for both the user and electricity board it reduces human needs by providing services using cellular network and visual studio.

4. WORKING

This project consists of following blocks ARM7 controller is central for all controlling of this smart energy meter. Energy meter is another important one in this system which is used for live reading of electricity consumption and which is interfaced with controller to communicate with server and which operates according to server commands. Total blocks of this system is shown below:

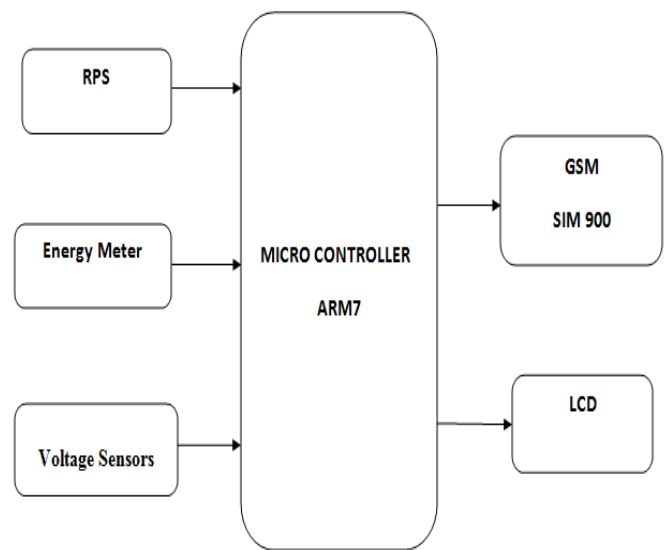


Fig-1: Block diagram of proposed system.

The smart energy meter working is here to give a consumed units to the user and indicate the units to the user before reaching reference units that reference unit is fixed by the server of main pc at that reference unit .unit rate will be increase so before reaching that point smart meter indicates to the user for this purpose in this system ARM7 and energy meter and GSM network are using. In the power supply unit we used power supply circuit which required to convert AC signal to DC signal and also to reduce the amplitude of the signal. The available voltage signal from the mains is 230V/50Hz which is an AC voltage, but the required is DC voltage with the amplitude of +5V and +12V for various applications.

In this section we have Transformer, Bridge rectifier, are connected serially and voltage regulators 7805 and 7812 for +5V and +12V via a 1000µF capacitor in parallel are connected parallel. Each voltage regulator output is again is connected to the capacitors connected parallel through which the corresponding output +5V or +12V are taken the LPC 2148 is operating with 3.3v so by using an adaptor which converts 230v to 5v dc is connected we connect either ac or dc converted adaptor in LPC 2148 we have bridge rectifier which converts into dc if we given supply in ac. The LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access

control and point-of-sale. In this single phase analog energy meter is used to connecting load and getting consumed units input and output connections are given as shown in bellow figure.



Fig-2: Single phase analog energy meter

Input is given to the meter from the main power supply which is 230v for home appliances this is given to meter from the bottom side phase and neutral the meter starts counting when power supply is ON phase LED indicates supply position whether it is ON or OFF and in this energy meter we having call LED this call LED blink 3200 times per one unit after one unit micro controller reads consumed units and counter will get increase one unit we set the certain time that is one month after that one month it sends SMS to the user by using GSM.

GSM module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication is an architecture used for mobile communication in most of the countries. Global Packet Radio Service GPRS is an extension of GSM that enables higher data transmission rate. GSM module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces for computer.

Mobile Termination is interfaced with the GSM mobile network and is controlled by a baseband processor. It handles access to SIM, speech encoding and decoding, signaling and other network related tasks. The Terminal

Equipment is an application processor that deals with handling operations related to keypad and screen.

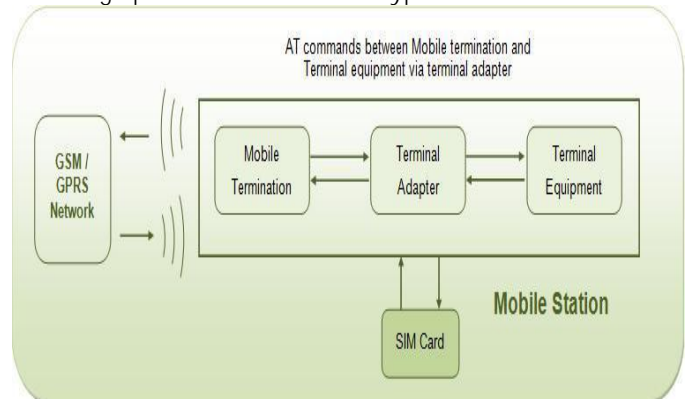
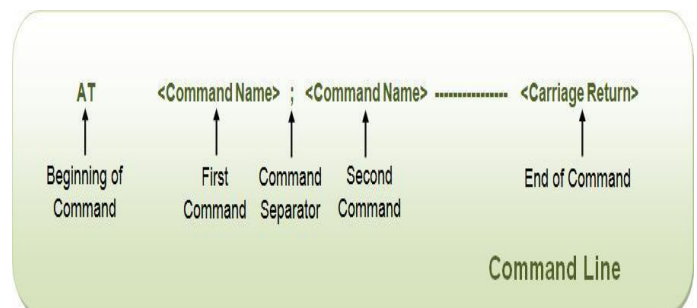


Fig-3: Interfacing GSM with mobile station

The Terminal Adapter establishes communication between the Terminal Equipment and the Mobile Termination using AT commands. The communication with the network in a GS mobile is carried out by the baseband processor.

In this system we used SIM 300 for communication and initialized GSM using Attention commands after initializing we giving commands to operate that commands are given based on our requirement.



Multiple at commands can be sent to modem in a single command line. The commands in a line are separated by a semi-colon .

LCD is used here to display the all initialization and for showing output. A liquid crystal display is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other. Here we are using 16x2 lcd it displays

16 letters in 2 lines .connecting it to ARM7 by using 8 datalines it display continuously 8 words.

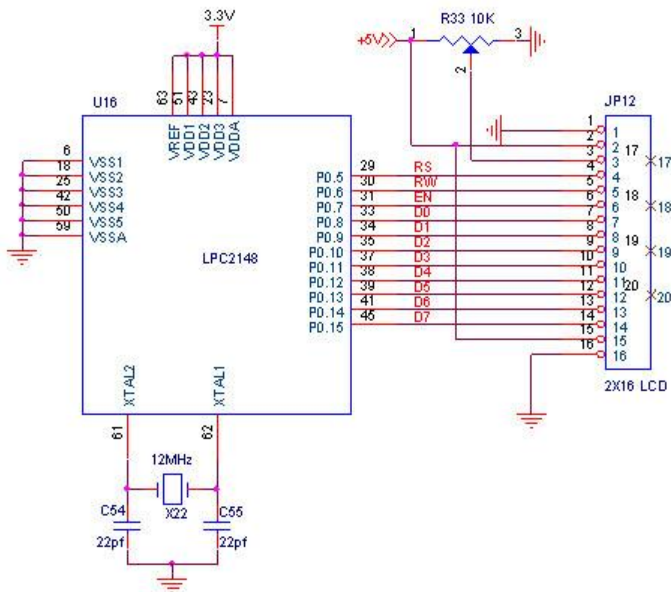


Fig-4: Interfacing of 8 bit LCD with ARM7 controller

By using general purpose ports interfacing LCD to the controller LPC2148 controller crystal frequency is 12mhz. By using keil software writing a program with a c compiler in programming we are write a instructions as per the LPC2148 instruction set and program is written to get consumed units and to get voltage indication and generating bill to the user and when bill is not paid by the consumer utility will off automatically for this we providing relay circuit.

A relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. A relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in a broad sense, a form of an electrical amplifier. By using this switch operation we cut the utility and connect utility after paying the bill. when bill was not paid counter value decreases to zero relay will stop the utility , when the payment is cleared server sends message to the GSM sim for on the supply that message is predefined in the program. we fixed the value into our program before increasing of unit charge we send a alert message to the user with that message user will alert and greatly reduces the unit charge and get less amount of consumption bill. A web oriented GUI designed especially for billing, manages all received SMS readings, updates the database regularly, computes the monthly bill amount, and notify the consumer his bill details through SMS. It also publishes the bill in the designed web portal and consumer can log for getting the usage details any time. Printed postal mails can also be provided for respective consumer. Authority can log for bill preparation and analysis of any collected data.

Information portal helps to assist the smart meter to log consumption data to the database. Microsoft Visual Studio 2008 IDE is used to develop the web portal. Data base used is Microsoft SQLServer2005.

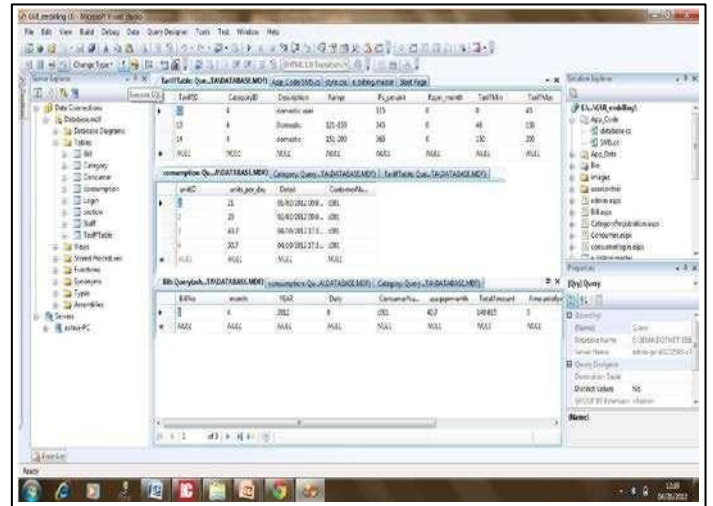


Fig-5: Database details.

Users are categorized as administrator, staff and consumer. Any user can log using the user login option available in the web site. Administrator can perform category registration, section addition, tariff updates, staff registration and message setting. After the initial login the administrator can connect the GSM modem to the web portal through serial port. Initially required hardware configurations have to done for the modem setup. Then by selecting the corresponding port administrator can connect it to the system for accepting SMS from meter.

Once it is connected it will remain as connected for the whole system and continues receiving SMS till the administrator disconnects it using the disconnect option. Different staff members under the administrator are registered using the member registration option provided to the administrator. The registered staffs are assigned to a particular section and they are registering the consumers under them. Registered staff member can login and add any number of consumers under his section. Also he is responsible for preparing the bills of consumers under him. By simple selection of consumer name and month, automatic bill generation occurs by auto processing of the background data.

5.RESULTS

When power supply is given to the controller and controller take the readings from meter and send SMS to the user after every month. Below snaps are taken before utility off and on and when power supply on it will sends bill and consumed units to the user. When

user not paid the counter will reaches to zero and power will off that is shown in below snap shot.

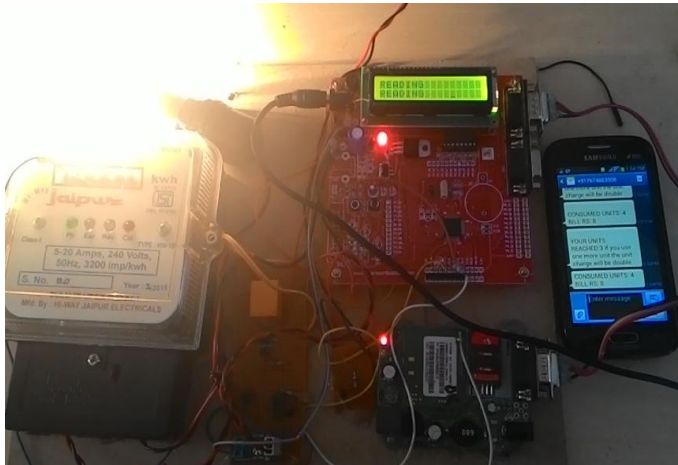


Fig-6: Sending messages to the user when supply is on and sends alert message before increasing unit charge.

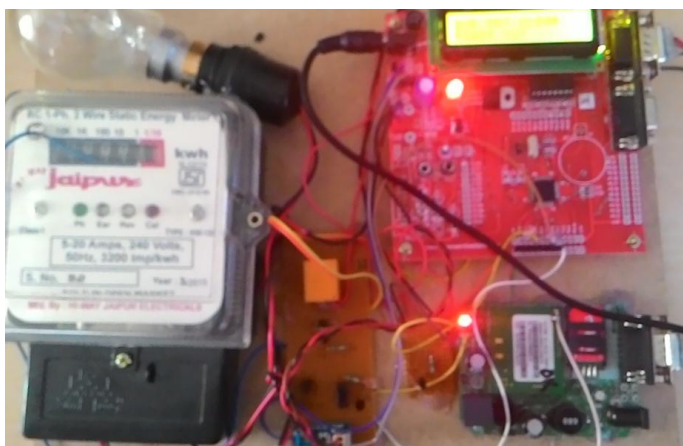


Fig-7: when user not paid the bill main supply to the meter was stopped.

5. CONCLUSION

Smart energy meter with reading indication has been developed by using GSM. Which is more useful to consumer for billing and maintaining less bill payment and it decreases the human needs for paying and other issues related to billing. We can extend it for industrial purposes also by interfacing three phase meters but the circuit have to modify for getting proper voltage to the controller.

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BIOGRAPHIES



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