

GSM Based Low Cost E-Billing System

Shrikant Kailas Pawar, Rohan Subhash Whavhal, Nitin Balashaeb Salunkhe

Abstract: The technology of E-metering (Electronic Metering) has gone through rapid technological advancements and there is increased demand for a reliable and efficient Automatic Meter Reading (AMR) system. This is increased demand for reliable and efficient wireless GSM energy meter and its associated web interface, for automatic billing and managing the collected data globally. The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter by the energy provider, also they can monitor the meter readings regularly without the person visiting each house. A GSM based wireless communication module integrated with electronic energy meter of each entity to have remote access over the usage of electricity. The PC with a GSM receiver at other end, which contains the database acts as the billing point. Live meter reading from the GSM enables energy meter is sent back to this billing point periodically and these details are updated in a central database. The complete information of electricity usage can be accessed through graphic user interface (GUI).

Keywords: Automatic Meter Reading System (AMRS) GSM, ARM, CCP.

1. INTRODUCTION:

Electrical power has become indispensable to human survival and progress. Traditional manual meter reading is still one of the most popular ways for meter reading. This meter reading by human operator is inefficient to meet the future demands due to various reasons such as rapid growth in Population, tedious location, environmental conditions etc. In traditional manual meter reading the system the utility usage is written on paper by workers, there is lots of chances of human errors. This will cost more to utility company. Also there are chances that of unavailability of consumer during utility workers visit. In such a case, Billing process will be pending and utility workers again require to visit consumer. Going to each & every consumer's house & generating the bill is very much difficult process & laborious task & require lot of time. It becomes very difficult in rainy season as well as at remote places where consumers are at remote place from utility providing companies. Moreover it is also difficult for utility workers to find out unauthorized connections or malpractices carried by consumers manually. In recent decades, Automatic Meter Reading is widely attracted many engineers and utility companies.

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AMR is not just replacing manual meter reading with an automatic procedure but has many advantages some of which below

- 1) Higher speed
- 2) Improved load profile
- 3) Automatic billing invoice
- 4) Real time energy cost
- 5) Load management
- 6) Alarm warning
- 7) Remote power switch ON/OFF
- 8) Tamper Detection

Although manual reading is yet the dominant meter reading method, AMR is expected to be common in future. Nowadays, different AMR schemes are continuously, involving, furthermore, integrating with the benefits of digital energy meter, contemporary AMR system is present more advanced and flexible features than their processors did in the past decades.

2. OBJECTIVE:

The objectives of our project are as follows:

- 1) To keep the information of Customer.
- 2) To keep the information of consuming unit of energy of current month.
- 3) To reduce the labor cost.
- 4) To make billing system efficient.

3. Methodology:

The figure shows the block diagram of AMR system. It basically consist three parts.

1. AMR interface, a hardware connected to meter or a network of meters, which gathers data from meter(s).
2. Center mainly a computer or network of computers, which collects the data sent by AMR interface.
3. Communication medium which enables communication between the AMR interface and the center.

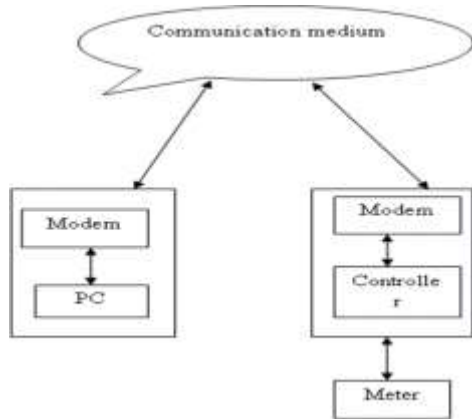


Fig.1: Block diagram of AMR.

Both interfaces and center are equipped with modems for possibility of communication.

AMR system can be categorized based on the medium used for communication: radio, telephone, power lines, GSM network, Internet or combination of some.

4. SYSTEM REQUIREMENT:

The proposed Low Cost E-Billing system is divided into two sections are as given below

- 1) Client side Device
- 2) Vendor Section Device

Firstly we are going to see the Client Side unit.

The client side device is going to use actual measurement of energy consumed by consumer or we can say subscriber.

The block diagram of client side unit is as given below

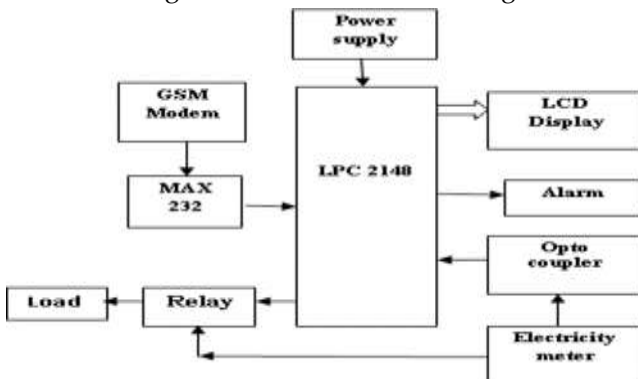


Fig.2: Block diagram of Client side Device.

The client side device is actually transmitter module. This module is capable of reading the power consumed per hour as well as sending the information to remote database.

1. Power supply:

In order to make microcontroller and GSM module and other devices get power from power supply, which as the combination of rectifier and regulator. The rectifier converts the AC power to DC, Here we have used Bridge rectifier because,

- 1) Higher efficiency than half wave Rectifier
- 2) Robust.
- 3) Have higher stability

The output of this rectifier is unregulated DC voltage. To regulate this power we have used 7805 voltage regulator. The 7805 gives stable output of +5 volt DC.

2. LPC 2148:

The microcontroller gathers data from energy meter. It not just collects the data but also calculate the energy consumed by client. It sends the data to remote database through GSM Module.

3. GSM Module:

Quad band intelligent GSM/GPRS Modem suitable for long duration data transmission. To implement AMR system a GSM Modem is connected to a microcontroller which would transmit data from a meter to cell phone and also receive command from cell phone to energy meter. The modem will send unit or pulses (power consumption) on regular interval or on request. AT command set which stands for attention terminal are used by energy meter to communicate with GSM modem.

4. MAX 232: MAX232E/MAX241E line drivers/receivers are designed for RS-232 and V.28 communications in harsh environments. The MAX 232 is used as mediator between GSM Module and microcontroller.

LCD Display-It is a display device which displays the information provided to it. Its shape and size varies from application to application.

LCD used in our project is 16 X 2 display in which 16 implies no. of characters and 2 implies no. of rows. It also provides wide range of display functions. It also provides low power consumption. It displays the number of units of energy transmitted

5. Optocoupler IC MCT2E:

In our project, we need to provide electrical isolation between them. This isolation is provided by the signal conditioner circuit which is actually MCT2E.

This is all up to Client side unit, now the vendor side module.

Block diagram of Vendor unit

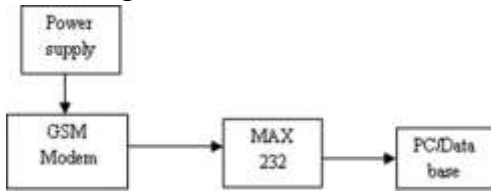


Fig.3: Block Diagram of Vendor Side Unit.

At Vendor side or we can say remote database includes GSM Modem and computer which has an GUI for controlling and data collection purpose. The vendor unit sends the information about bill amount, due date of bill and other important information like whether to continue the supply of electricity to client or break the supply. It also sends reminder message to client, which displayed on LCD screen and at the time on cell phone of registered number.

Circuit Diagram

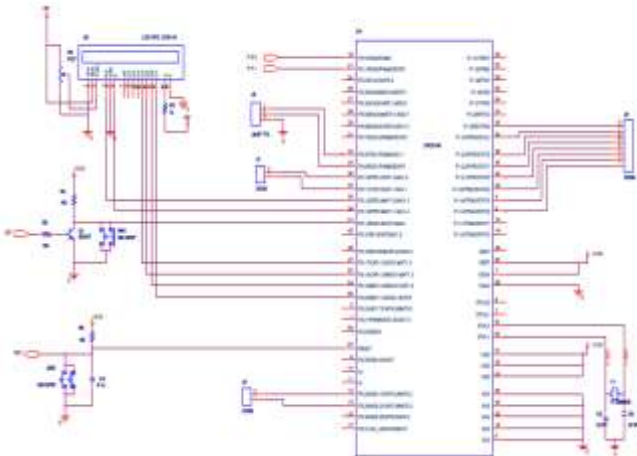


Fig 4: Circuit Diagram of client side unit

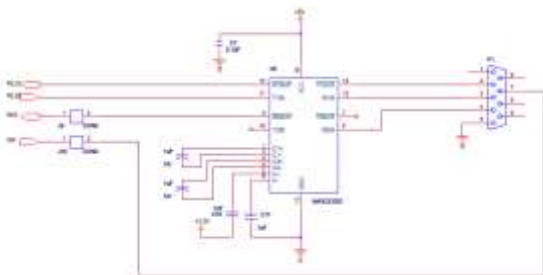


Fig.5: Circuit diagram of interfacing GSM modem with LPC 2148.

5. SOFTWARE REQUIRED:

Keil μVision4

The μVision4 IDE is a window-based software development platform that combines a robust and modern

editor, project manager, and makes facility. μVision4 integrates all the tools you need to develop embedded applications including C/C++ compiler, macro assembler, linker/locator, and a HEX file generator. μVision4 helps expedite the development process of your embedded application by providing the following:

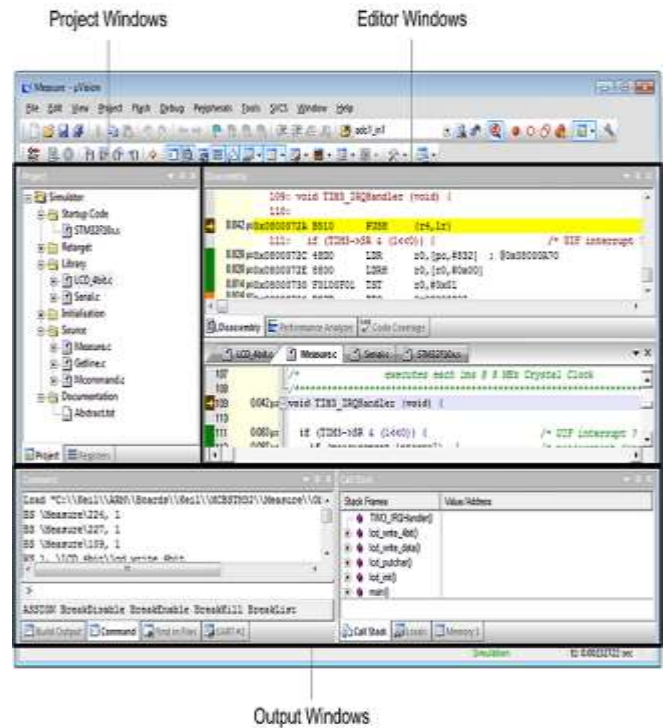


Fig.6: Main window of Keil μVision4.

The μVision4 Simulator is the only debugger that simulates most on-chip peripherals. μVision4 combines a Project Manager, Make Utility, Debugger, and a modern Editor into a single user interface environment.

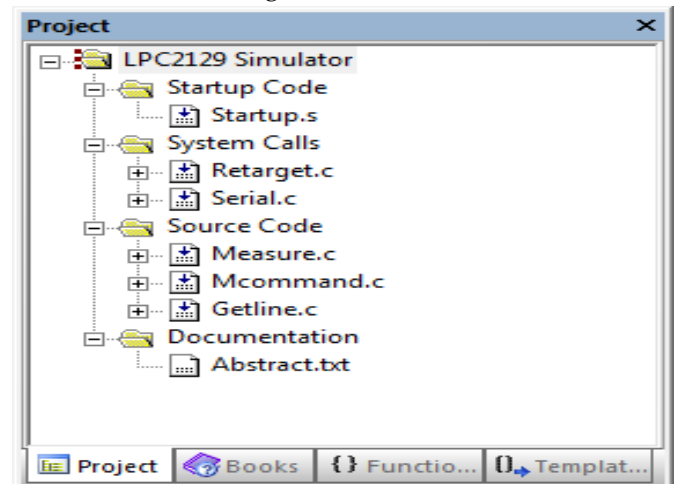


Fig.7: Project window of Keil μVision4.

Flash Magic-

NXP Semiconductors produce a range of Microcontrollers that feature both on-chip Flash memory and the ability to be reprogrammed using In-System Programming technology.

Flash Magic is Windows software from the Embedded Systems Academy that allows easy

Access to all the ISP features provided by the devices.

These features include:

- Erasing the Flash memory (individual blocks or the whole device).
- Programming the Flash memory.
- Modifying the Boot Vector and Status Byte.
- Reading Flash memory.
- Performing a blank check on a section of Flash memory.
- Reading the signature bytes.
- Reading and writing the security bits.
- Direct load of a new baud rate (high speed communications).
- Sending commands to place device in Boot loader mode.

Flash Magic provides a clear and simple user interface to these features and more as described in the following sections.

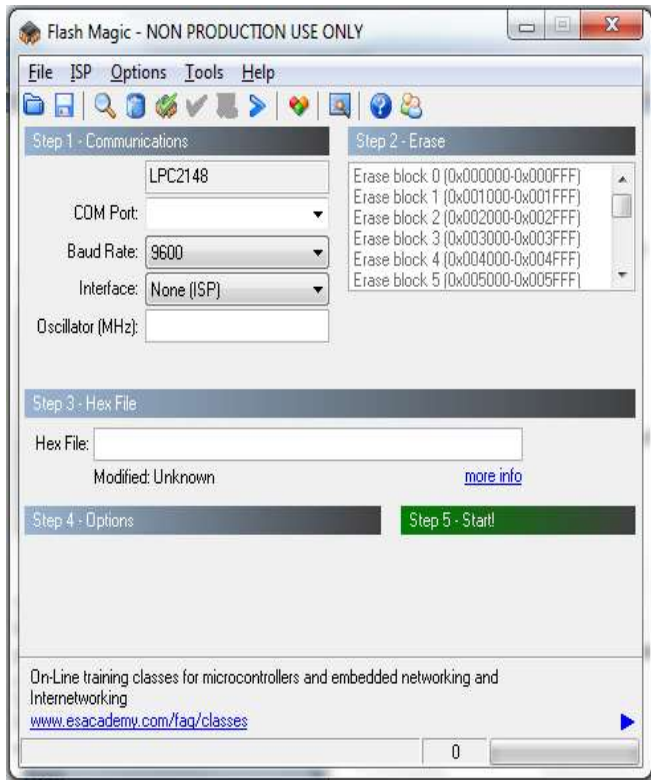


Fig:8: Flash Magic.

6. SYSTEM FEATURES:

LPC 2148 Features-

- 1) 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 2) Two 10 Bit ADCs provide a total of 6/14 analog inputs, with conversion time of 2.44usec per channel.
- 3) Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input.
- 4) Multiple serial interfaces including two UARTs (16C550)
- 5) Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- 6) Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input.

SIM 800 Features-

- 1) Operating voltage 3.4V-4.4V
- 2) Typical power consumption in sleep mode is 0.7mA
- 3) Frequency bands Quad band: GSM 850, EGSM 900, DCS 1800, PCS 1900.
- 4) The frequency band can be set by AT command
- 5) Compliant to GSM phase 2/2+
- 6) Transmitting power class 4(2W)

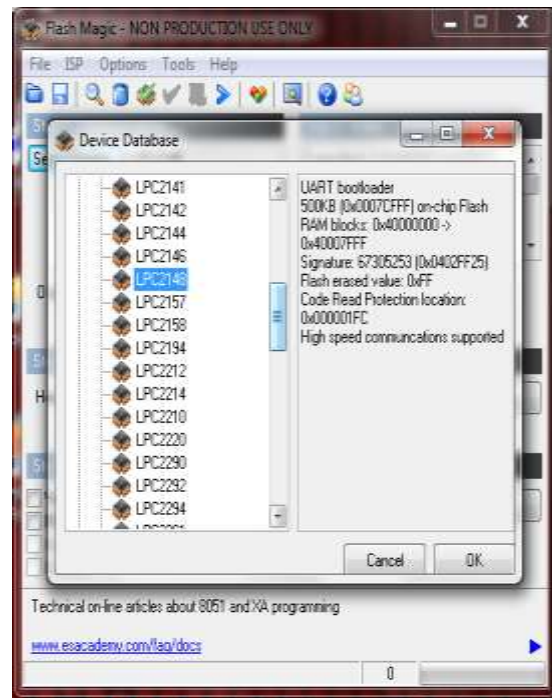


Fig:9: Flash Magic Device Database.

7. WORK FLOW CHART:

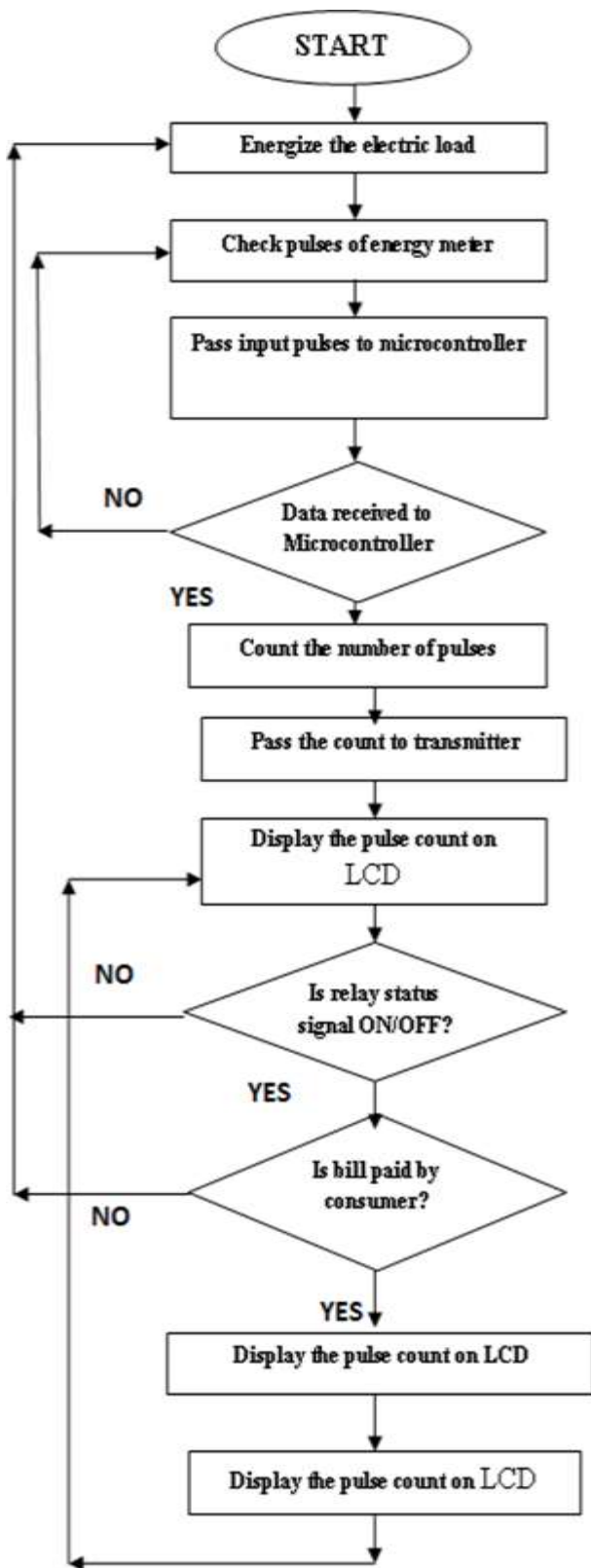


Fig.10: Flow chart of client side device.

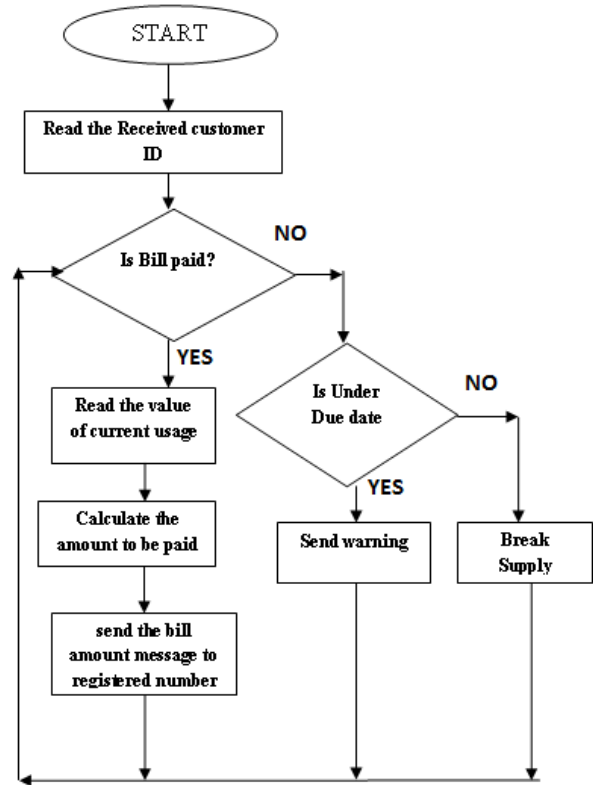


Fig.11: Flow chart of vendor device.

8. ADVANTAGES:

- 1) Save time.
- 2) Reduces labor cost.
- 3) Good security.
- 4) Eliminate paper bills and check writing.
- 5) Save money.
- 6) Convenience.

9. 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.

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