GSM Based Automatic Wireless Energy Meter Reading System

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ABSTRACT--The development of a GSM automatic power meter reading (GAPMRR) system is presented in this paper. This system consists of GSM digital power meter installed in every consumer unit. A GSM modem is connected to the energy meter. Each modem will be having its own sim.The sim card used is implemented in energy meter and it sends a message to the user about the due bill. A LCD is used in the hardware module for the user interface. The LCD displays the current usage and units consumed. Here the system operates in two modes. First mode is depends up on the time and the second mode is depends up on the usage of power. For every 30 days the information is sends to the electricity board office regarding the units by using GSM. The user can pay the amount just by knowing the given code which is fed in the meter. If that consumer does not payed the bill then from the EB(ELECTRICITY BOARD) office the power is switched off. `After paying the bill only the power is connected to that consumer by sending a command from the EB(ELECTRICITY BOARD) office. If in case the required units usages have achieved within 30 days then the power will be shut down and immediately and the SMS is sent to the EB(ELECTRICITY BOARD) office.

Keywords-GSM, Microcontroller, EB(ELECTRICITY BOARD) office, AMR (Automatic meter reading)

I. Introduction

In this project explained clearly about the billing system of energy meter through GSM. Traditionally in existing system the meter reading for electricity consumption and billing is done by human operator from houses to houses and building to building. This requires huge number of labour operators and long working hour to achieve complete area data reading and billing .Human operator billing occurs some errors,labour billing job is some time also restricted and is slowed down in bad weathers. In the proposed system AMR (Automatic Meter Reading) plays an important role for the above mentioned problems. Here for controlling the entire system the microcontroller used is PIC 16F877.In the EB(ELECTRICITY BOARD) meters there are two types, analog meters and digital meters. The analog meters are mostly used in olden days. These meter readings are calculated under the basis of the

number of rotations made by the rotating disc. The digital meter is the mostly used EB(ELECTRICITY BOARD) meters now a days. These meter works on the basis of the flash made by the LED and according to that reading the power is calculated. In our system the central EB(ELECTRICITY BOARD) office has immediate access to all consumer homes in a locality with the help of GSM modem. The EB(ELECTRICITY BOARD) meter present in each house is connected by wireless network with the EB(ELECTRICITY BOARD) office. This system is useful for billing purpose in electricity board authority. A GSM modem is connected to the energy meter .Each modem will be having its own sim.The sim card used is implemented in the energy meter and it sends a message to the user about the due bill. A LCD module is used to displays the current usage and units consumed. After usage of each unit the amount and total units will be incremented. This system works on two cases i.e. depends up on time and depends up on consumer units.The first case is for every 30 days how much of units consumed by consumer that information is sent to the EB(ELECTRICITY BOARD) office through sms by using GSM.The user can pay the bill amount just by knowing the given code which is fed in the energy meter

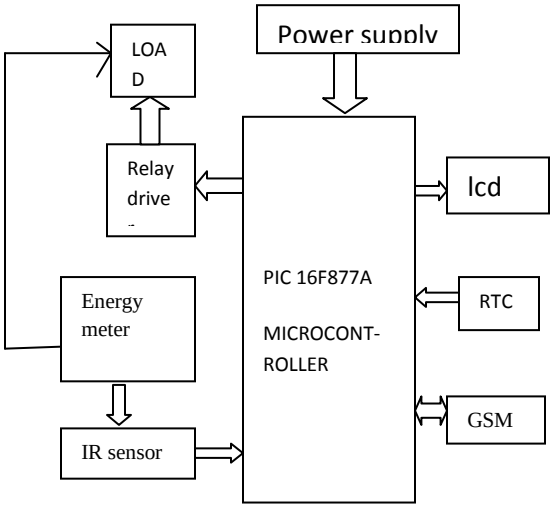


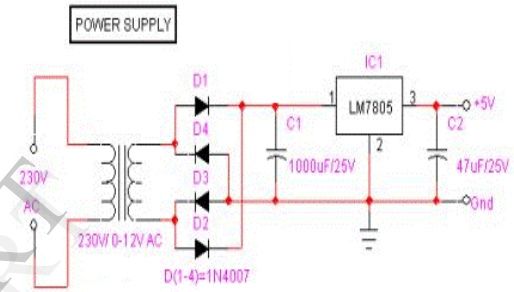
FIG: EB(ELECTRICITY BOARD) METER SECTION:

FIG: EB(ELECTRICITY M O BI L E **RD) OFFICE:**

II .Explanation of elements:

A. Power Supply for PIC 16F877A Microcontroller

This section describes how to generate +5V DC power supply



The power supply section is the important one. It should deliver constant output regulated power supply for successful working of the project. A 0-12V/1 mA transformer is used for this purpose. The primary of this transformer is connected in to main supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors , Which is further regulated to +5v, by using IC 7805.

B.Serial Communication:

UART (Universal Asynchronous Receiver Transmitter) or USART (Universal Synchronous Asynchronous Receiver Transmitter) are one of the basic interface which you will find in almost all the

controllers available in the market till date. This interface provide a cost effective simple and reliable communication between one controller to another controller or betweenacontrollerandPC.

C.RS-232Basics:

RS-232 (Recommended Standard 232) is a standard for serial binary data signals connecting between a DTE (Data terminal equipment) and a DCE (Data Circuit-terminatingEquipment).TheRS-232 standard defines the voltage levels that correspond to logical one and logical zero levels. Valid signals are plus or minus 3 to 25 volts. The range near zero volts is not a valid RS-232 level; logic one is defined as a negative voltage, the signal condition is called marking, and has the functional significance of OFF. Logic zero is positive, the signal condition is spacing, and has the function ON. So a Logic Zero represented as +3V to +25V and Logic One represented as -3V to -25V.Usually all the digial ICs works on TTL or CMOS voltage levels which cannot be used to communicate over RS-232 protocol. So a voltage or level converter is needed which can convert TTL to RS232 and RS232 to TTL voltage The most commonly used RS-232 level converter is MAX232. This IC includes charge pump which can generate RS232 voltage levels (-10V and +10V) from 5V power supply. It also includes two receiver and two transmitters and is capable of full-duplex UART/USART communication.

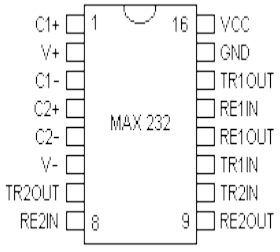


Fig. - MAX232 Pin Description

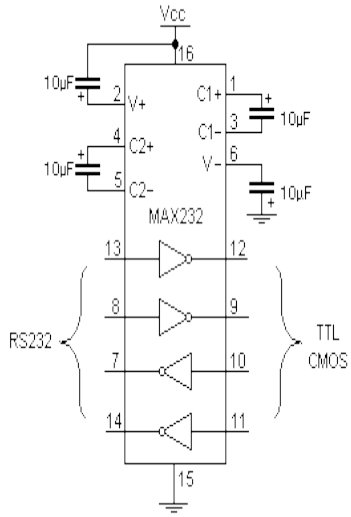


Fig. MAX232 Typical Connection Circuit

D.GSM Modem:

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. The working of GSM modem is based on commands, the commands always start with AT (which means ATtention) and finish with a <CR> character.The AT commands are given to the GSM modem with the help of PC or controller. The GSM modem is serially interfaced with the controller with the help of MAX 232. Here max 232 acts as driver which converts TTL levels to the RS 232 levels. For serial interface GSM modem requires the signal based on RS 232 levels. The T1_OUT and R1_IN pin of MAX 232 is connected to the TX and RX pin of GSM modem

E.RELAY

A relay is an electrically controllable switch widely used in industrial controls, automobiles and appliances. The relay allows the isolation of two separate

sections of a system with two different voltage sources i.e., a small amount of voltage/current on one side can handle a large amount of voltage/current on the other side but there is no chance that these two voltages mix up.

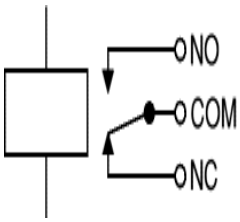


Fig: Circuit symbol of a relay

(a)OPERATION

When current flows through the coil, a magnetic field are created around the coil i.e., the coil is energized. This causes the armature to be attracted to the coil. The armature's contact acts like a switch and closes or opens the circuit. When the coil is not energized, a spring pulls the armature to its normal state of open or closed. There are all types of relays for all kinds of applications. When an command is received by the microcontroller to disconnect or reconnect the load then by using this relay the operation is performed.

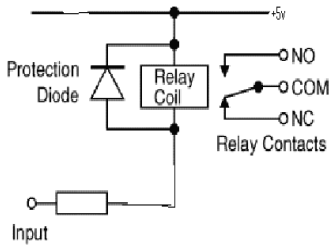


Fig: Relay Operation

F. Energy meter:

An electricity meter or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device. Electricity meters are typically calibrated in billing units, the most common one being the kilowatt hour. A periodic reading of electric meters establishes billing cycles and energy used during a cycle. In settings when energy savings during certain periods are desired, meters may measure demand, the maximum use of power in some interval The most common unit of measurement on the electricity meter is the kilowatt hour, which is equal to the amount of energy used by a load of one kilowatt over a period of one hour, or 3,600,000 joules.

Fig: Energy Meter

G .Real time clock (RTC):

Real Time Clock (RTC)is a clock that causes occurrences of a regular interval interrupts on its each tick(time out).An interrupt service routine executes on each timeout (overflow) of this clock. This timing device once started never resets or is never loaded with another value. Once it is set, it is not modified later. The RTC is used in a system to save the current time and date. The RTC is also used in a system to initiate return of control to the system (OS) after the preset system clock periods.RTC provide system clock and it has a number of applications. It is a clock that generates system interrupts at preset intervals. An

interrupt service routine executes on each tick (timeout or overflow) of this clock. This timing device once started is generally never reset or never reloaded to another value. The those stores seconds, minutes, hours, day, date, month, year and control these are the 8 pins of the RTC used in this system.

H.IR Sensor:

IR sensor is used in the system to sense the blinking of energy meter led and compare with the reference voltage .If the output of comparator is zero then the number of units counting will be incremented in the microcontroller. The IR sensor is placed in the top of the energy meter to sense the blinking of the LED in the energy meter.

I. Liquid Crystal Display (LCD):

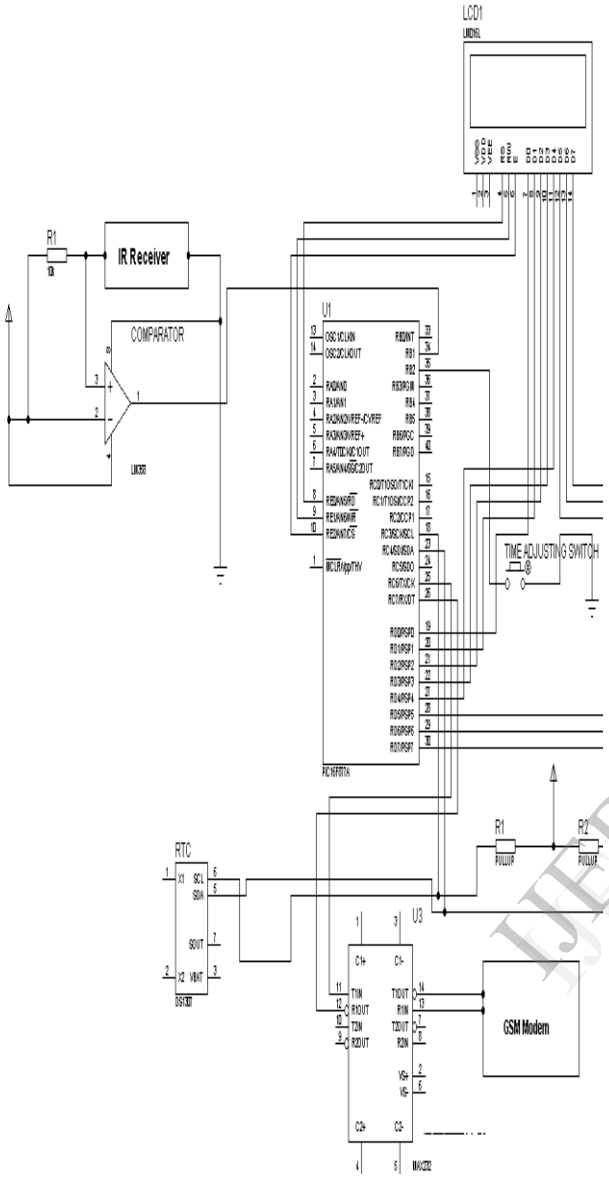
In this project the LCD used is HD44780 Character LCD .When the meter is working the LED glows. The LCD continuously displays the present date and time and consumer usage of power in terms of units. Every peak time the information regarding units is sent to the EB(ELECTRICITY BOARD) office the acknowledgement is shown in the LCD.So the main purpose of LCD is to displays the information. TO display any character on LCD microcontroller has to send its ASCII value to the data bus of the LCDLCD display used here is having 16*2 size. It means @lines each with 16 characters.

DS1307 (RTC) Real Time Clock IC (an I2C real time clock) is an 8 pin device using an I2C interface. It has 8 read/write registers

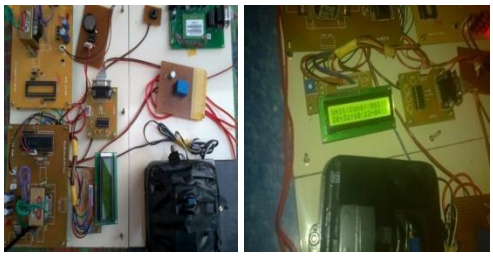
CONCLUSION:

The proposed system for energy meter billing is automatic without human intervention and consumer can directly know the amount has to pay.The electricity board can disconnect or reconnect the connection from remote place through the GSM modem. If the units consumed by the user crosses certain utilization of the power automatically switch off the load connected to it .so that we can reduce the wastage of power in the households etc..,

III. Internal structure Schematic Diagram:



IV.PICTURE VIEW OF KIT



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