

GSM BASED SMART ENERGY METER

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ABSTRACT:*Energy distribution and consumption in a judicious manner are important requirements for a sustainable life. The present system of energy billing is manual which has many drawbacks such as excessive use of manpower, human errors and inability of users to keep a track of their energy consumption. These all drawbacks result in increase of the overall cost of present conventional procedure. Similarly, power theft is also one of the biggest issues in power distribution. For precise use of electricity, development in technology is our foremost requirement which will make our existing system more reliable.*

To overcome the existing drawbacks, GSM based smart energy meter has been introduced. This system will help in the minimization of technical errors and reduce human dependency at the same time. This system will give automatic reading, automatic billing, real-time monitoring, per load reading and billing. It will control different electrical appliances, and will reduce power thefts. This GSM based smart energy meter will reduce the errors in reading and billing, automatic switching thus makes this system user friendly. It will be a milestone in the development of smart grid in India.

1.INTRODUCTION

In present day scenario, electricity is the prominent essential need for human population. Its demand is increasing day by day. Human population is totally dependent on electricity. Modern technology needs a huge amount of electrical power for its various operations. The GSM based design helps us to measure energy, automatic reading billing along with automatic control of electrical appliances with help of smart phone. All the readings and measurements are taken in the digital domain, so the use ADC and measurement results are displayed in LCD. This can calculate the total cost of energy consumed as well as cost of energy consumed per load. Then the data calculated is sent as SMS via GSM module to consumers smart phone. Along with it this GSM will send an

alert SMS to utility company there is any kind of tempering with energy meter. This device will reduce man power hence, reduced cost, reduce technical errors. This project is for domestic use only.

Generally, when people leave their homes in a hurry, they often forget to switch off the household appliances such as lights, fans etc. In recent days, various newspaper reports that showed suicide attempts of persons who received several times more amount of electricity bill than they really consumed came in the form of articles. This shows wastages of electricity in almost every household and various statistical and technical errors which are a burden on our pocket as well as our mind thus unbal-

ancing the budget. These problems are prevailing at a wider range in our society.

In conventional type of meter, there is no monitoring concept over energy consumption as well as it consists of lot of technical errors. Generally, it is found that energy meter is not showing the proper consumption of energy. At present utility companies send their representatives once for recording the reading and twice for providing bill to customer. Moreover sometimes correct bill does not reach us and even not on proper time i.e. before last date of bill deposition.

Individuals should have the choice to live without fear and the confidence to carry out any business without fear of insecurity. System created in this study offers security while maintaining the privacy of individuals. Additionally, it uses a simple circuit. The traditional surveillance system is associated with various challenges and costs associated with energy use. An energy effective moveable system is preferable, during an occurrence of burglary. The system, therefore, allows people be more independent and feel secure in their everyday activities. Further, it sends out an alert signal, making it better than the currently used system.

2. TECHNOLOGY

GSM is a mobile communication modem; it stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the

data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates. There are various types of GSM module available in market so we can select the one according to our requirement and functioning required. The main point for selecting a GSM is the frequency at which we need the module to operate. It depends mainly on country in which it needs to be used. Like in India the operating frequency of GSM transmission is around 900 MHz. so in such places we take module like SIM 900 or SIM 800 variants.

The MCT2XXX series opto-isolators consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line package. It is used as power supply regulators, digital logic inputs and microprocessor inputs.

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F

voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ± 30 -V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels. The driver, receiver, and voltage-generator functions are available as cells in the Texas Instruments library.

The Atmel AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in a single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega328/P provides the following features: 32Kbytes of In-System Programmable Flash with

Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), three flexible Timer/Counters with compare modes and PWM, 1 serial programmable USARTs, 1 byte-oriented 2-wire Serial Interface (I²C), a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the

device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. In Extended Standby mode, both the main oscillator and the asynchronous timer continue to run.

Atmel offers the QTouch library for embedding capacitive touch buttons, sliders and wheels functionality

into AVR microcontrollers. The patented charge-transfer signal acquisition offers robust sensing and includes fully debounced reporting of touch keys and includes Adjacent Key Suppression technology for unambiguous detection of key events. The easy-to-use QTouch Suite toolchain allows you to explore, develop and debug your own touch applications.

3. CIRCUIT DIAGRAM

Energy distribution and consumption in a judicious manner are important requirements for a sustainable life. The present system of energy billing has many drawbacks such as excessive use of manpower, human errors, and inability of users to keep a track of their energy consumption and increase in the overall cost of this procedure. Similarly, power theft is also one of the big issues in power distribution.

To overcome these existing drawbacks/flaws, GSM based smart energy meter has been introduced. This system will help in the minimization of technical errors and reduce human dependency at the same time. This system will give automatic reading, automatic billing, real-time monitoring, per load reading and billing. It will control different electrical appliances, and will reduce power thefts.

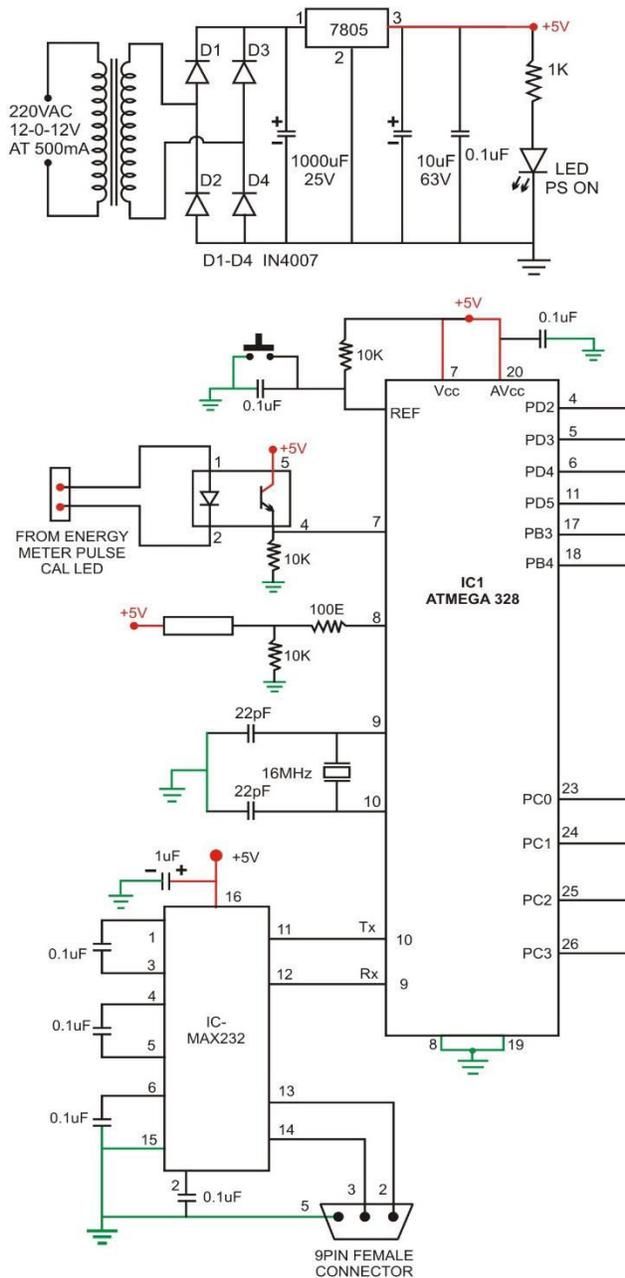


Fig.1. Circuit Diagram

The aim of GSM based smart energy meter project is to estimate energy consumed by the load with the help of a microcontroller and also calculate the traffic of the energy consumed. In this the microcontroller is interfaced with energy meter by using optoisolator. Energy meter gives pulses to microcontroller for counting and these pulses will be track by microcontroller consumed. A GSM module is used which is used to interfaced with microcontroller. In this project the user has to register his/her contact number in GSM module. This GSM is used to send SMS according to amount of energy consumed by the load and it can also be used electrical appliances. To make it more reliable power theft detection is also included in the system.

its biggest advantage. GSM is used which is not costly and have high work range.

There is lot of scope in the project to be expanded further.

1. Along with energy bill, water consumption bill can be sent to consumer this will reduce complications.
2. Real time tariff scheme can be implemented by displaying tariff rates every hour on LCD of Smart Meter.
3. A small printer can also be installed for printing of bills especially for rural areas.

4.FUTURE SCOPE

The project has great scope of future enhancement and implementation with different enhancements. With some modifications it could be used for several different purposes in future. It will reduce manual workand will improve the system with new technologies. More data can be stored precisely and is user friendly which is

5. CONCLUSION

By implementing this project, electrical appliances especially household appliances to be controlled can be enabled by smart phones from any place. The GSM based smart energy meter will reduce the stress to forget to switch off electrical appliances when people are leaving their homes. This will make the appliances user friendly. It will ease life of people. Automatic readings can be taken by utilities as well as real time monitoring also bill will reach customer automatically on their smart phones via messages, this will reduce expenditure on manpower and reduce overall cost of energy for utility companies. It will reduce technical errors as well as statistical errors. It will enable the customer to keep a check on overall energy consumption along with its individual energy consumption per load. The problem of excess amount of charge in bill due to technical errors will be eliminated by it. Along with it if there is some tempering with smart meter then SMS alert will be received by utility when power theft is detected. The GSM based smart energy meter will be a mile stone in development of Smart Grid in our nation.

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