GSM BASED PREPAID ENERGYMETER

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Abstract: In recent years many attempts have been made to design the energy meter with instant billing technique but till now the designed energy meters are not efficient and do not provide replacement. Now-a-days the numbers of Electricity consumers are increasing in great extent. It is hard to handle and maintain the power due to growing requirements. Maintenance of the power is an important task as the human operator goes to consumer's house and produces the bill as per the meter reading. This paper presents a prepaid energy meter to facilitate energy consumption measurement and to know consumer's maximum demand. The prepaid energy meter concept is shown by Proteus software simulation. The major components are Arduino microcontroller, Voltage and Current transformer, LCD, Relay and a load. Electricity has become one of the basic requirements for people and widely used for domestic, industrial and agricultural purposes The energy billing system used nowadays are lab our and time consuming. Errors are inevitable at every stage of billing, some are human errors while noting down the meter readings, errors while processing the paid bills and the due bills. There is no proper way to know the consumer's maximum demand, usage details. This paper demonstrates the use of prepaid energy meter system. If we use this system it will be beneficial for the consumer to manage power. It is easy to operate and cost effective. Another advantage of the prepaid system is that the human errors in taking meter readings and processing bills can be reduced to a large extent.

IndexTerms - Prepaid Energy Meter, Atmega32, Sim 900, LCD, embedded system

I. INTRODUCTION

GSM technology is used so that the consumer would receive messages about the consumption of power (in watts) and if it reaches the minimum amount, it would automatically alert the consumer to recharge. This technology holds good for all electricity distribution companies, private communities, IT parks and self-containing housing projects. The development of GSM infrastructure in past two decades made meter reading system wireless. The GSM infrastructure, which has national wide coverage, can be used to request and retrieve power consumption notification over individual houses and flats.

To recharge the meter, consumer needs to buy electricity in advance according to his/her requirement. The consumer can buy electricity through various vending options. This will be in form of a scratch card with a code printed on it. The consumer punches the code into the meter either directly or through an in-home display using a key pad. The meter is credited with the amount of recharge bought and supply is switched on automatically at load side. Third section gives the comparison between the existed models based on the literature review. Fourth section is about the design implementation of the idea and the fifth section is the conclusion. M. Wassim Raad, Muhammad Sallou [1] proposed, Electricity theft is common in India. This leads to monetary loss to the supply company and energy wastage due to misuse of electricity. Just like we recharge our mobiles with some amount and are entitled to talk until we run out of balance in our account. The balance is deducted as per the time Usage according to pulse rate. Similar concept is now applied to electricity billing, where we can recharge our accounts with some amount and this amount is burned as per the usage in accordance with the current. Energy tariff.. Over the past few years, smart cards have achieved a growing acceptance as a powerful tool for security, identification, and authorization. Financial card issuers are moving to replace magnetic stripe cards with chip cards to reduce counterfeiting and fraud. The increasing computational power placed on the chip along with advances in cryptography has made the smart card a very powerful tool for identification. The advent of multi-application smart card operating systems for both contact and contact less applications has put smart cards on the edge of information technology. This paper features a 3-tier smart card secure solution for a novel prepaid electricity system. The proposed system uses an IP-based controller in addition to a power meter, providing efficient online control of the amount of electricity consumed by the user. The user will be notified if his credit balance goes below certain threshold.

Tariff Update (WTU) schemes. In addition, this system also implements Prepaid Billing which would go a extended way in making consumers conscious of the energy they use and be more economical. This device uses ATMEGA 328P Micro Controller for computational purposes, GSM Modem and RF Module for data transfer and updates. The prototype model of this proposed energy meter was developed and was validated with various loads in our laboratory during 19-1-2016 to 25-1-2016(Scale down period as 2 months). It proves, this device is user friendly, make consumers conscious about the amount of energy they spend and help to conserve the already depleting resources. The automation of billing system eliminates labor resources involvement, hence is more accurate.Pasdar A, Mehne HH [8] proposed, Now-a-days technology has developed to a large extend. At the same time the need for systems with automation and high security are preferred. So, by using one of the best technologies available I am designing a prepaid electricity meter system for commercial and domestic purposes. Traditional 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 labor operators and long working hour to achieve complete area reading and billing. Human operator billing are prone to reading errors as sometime in houses the electricity power meter is placed in location where it is not easily accessible . Labor billing job is sometime also restricted and is slowed down by bad weather conditions. By using this project we can avoid such problems. In this project I am building a prepaid electricity meter that will be able to conduct money transactions through wireless technology in order to enable the user to recharge his account from home. User interface consists of LCD which displays the power consumed and amount of bill to be paid and will sound an alarm when the balance goes below a certain amount. The amount can be paid using GSM. Prepaid meters are already present in the market and are used extensively in several African and European countries. Also, it will help utility companies in keeping a check on electricity theft SMS; smart energy meter. Crossley D [9] proposed, In the electricity industry, the term 'demand-side management' (DSM) is used to refer to actions which change the electrical demand on the system. Task XV of the IEA DSM Programmed, and consequently this report, are concerned with a particular type of DSM – "network-driven DSM". Network-driven DSM comprises demand-side measures used to relieve network constraints and/or to provide services for electricity network system operators. MZ, Islam S [10] proposed, Smart meter is an advanced energy meter that measures energy consumption in residential, commercial and industrial facilities with additional information related to the power system. This paper aims to review system functions of the latest smart meter technology which in corporate Advanced Metering Infrastructure (AMI).

Proposed system:

The present power usage reading is made manually by moving to the consumer locations. This requires large number of labor operators and long working hours to accomplish the task. Manual billing is sometimes restricted and delayed by bad weather conditions. The printed billing also has the tendency of getting lost. Over the last few years, Smart (Prepaid) Energy Meter has been proposed as an innovative solution aimed at facilitating affordability and reducing the cost of utilities. This system block diagram is shown in figure. The energy billing system used nowadays are labour and time consuming. Errors are inevitable at every stage of billing, some are human errors while noting down the meter readings, errors while processing the paid bills and the due bills. There is no proper way to know the consumer's maximum demand, usage details. This paper demonstrates the use of prepaid energy meter system.

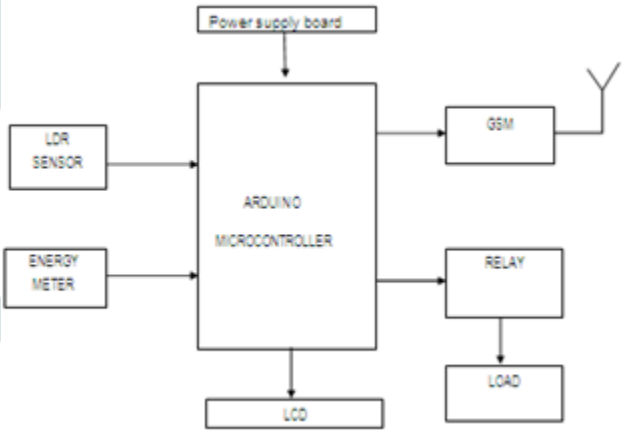

Fig 1: Block Diagram of GSM Based Prepaid Energy Meter

If we use this system it will be beneficial for the consumer to manage power. It is easy to operate and cost effective. Another advantage of the prepaid system is that the human errors in taking meter readings and processing bills can be reduced to a large extent.Basically like in a mobile phone recharging, the consumer buys a recharge card and gets some energy units in return of the balance amount. The balance amount will keep reducing for every unit of energy consumed and once zero, the power supply would be automatically cut off. The amount deducted for every unit of energy consumed can be controlled.The conventional method of electricity billing involves a person from the distribution unit reading the number of units of electricity consumed in the energy meter, conveying this information to the distribution unit and then preparing the bill according to the units consumed for a fixed amount of time. This can prove quite tedious as it involves various tasks like reading, then preparing the bill. Still accuracy cannot be guaranteed as there can be errors in human reading. Even though digital meters are being replacing conventional electromechanical meters and provide much accurate readings, still the problem of deliberately making a false reading can exist (political reasons). Despite this, the task of billing for every consumer is a time consuming job for the distribution grid. Also the consumer can deliberately consume more amount of power than required and still refrain from paying the bill and nothing can be done to severe the electric power supply. The distribution unit according to the peak hours. The GSM technology is used so that the consumer would receive messages about the consumption of power (in watts) and if it reaches the minimum amount, it would automatically alert the consumer to recharge. This technology holds good for all electricity distribution companies, private communities, IT parks and self containing housing projects.

CIRCUIT DIAGRAM OF GSM BASED PREPAID ENERGYMETER: Circuit connections for this Wireless Electricity Meter Reading Project, are shown in the diagram; we have used a Arduino UNO for processing all the things used in project. A liquid crystal display is used for displaying the status of Units and

remaining balance. Data pins of LCD namely RS, EN, D4, D5, D6, D7 are connected to Arduino digital pin number 7, 6, 5, 4, 3, 2. And Rx and Tx pins of GSM module are directly connected to the Tx and Rx pins of Arduino respectively.

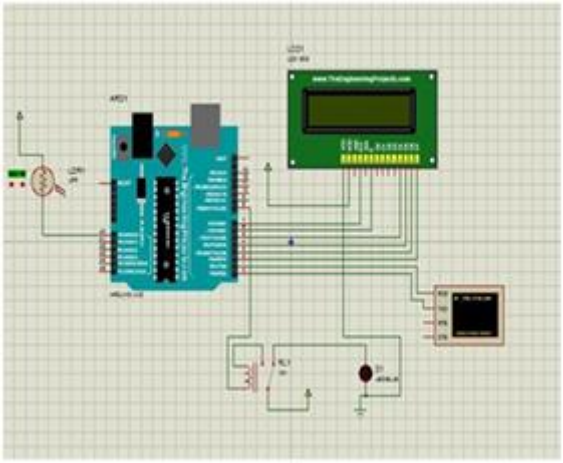

Fig.2.Circuit Diagram of GSM Based Prepaid Energy Meter

And GSM module is powered by using a 12 volt adaptor A relay is used for switching electricity connection which is connected at pin 12 of Arduino though ULN2003 relay driver.

CONNECTION OF ARDUINO WITH ENERGYMETER:

First user need to buy an Analogue Electricity Energy Meter**.** After it user needs to open it and find the Pulse LED or Cal LED's terminals (cathode and Anode). Now solder two wires at both the terminals and take it out from the energy meter and then close energy meter and tight the screws. The working of this interfacing of prepaid energy meter with GSM modem system would be explain by connecting the lamp as a load at the output side of the energy meter. First, when we would be switch on this system then this would be asking for modem initialization. For modem initialization, we would dial the modem no. from any mobile phone and send the message to the system. By doing this the system has registered the mobile no. In this project the Microcontroller based system continuously records the readings and the live meter reading can be sent to the Electricity department on request. This system also can be used to disconnect the power supply to the house in case of non payment of electricity bills. A dedicated GSM modem with SIM card is required for each energy meter.

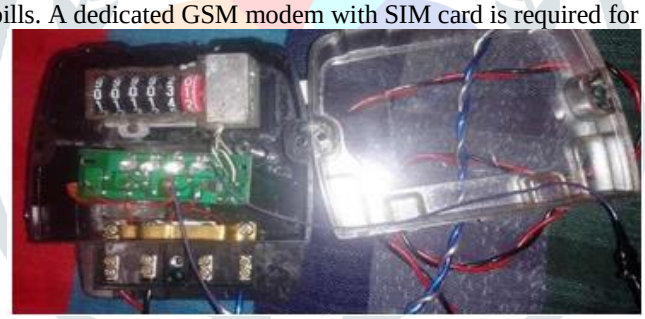

Fig.3. Connection of Arduino with Energy Meter

The microcontroller pulls the SMS received by phone, decodes it, recognizes the Mobile no. and then switches on the relays attached to its port to control the appliances. After successful operation, controller sends back the acknowledgement to the user's mobile through SMS. The coding emphasis the fact that it reduces human labour but increases the efficiency in calculation of bills for used electricity .the user will have an universal number and they can recharge outlets of electricity board .the acknowledgement of recharged coupon detail will come to notice of the consumer and also will get displayed in LCD module.

The Microcontroller AT89S52 acts as the primary controller. The primary controller collects information from energy meter as well as from the smart card. Here, switches are used instead of the IC. Smart card, which is the switch, gives information about the limitation of units. The energy meter reading is compared with the smart card information by the microcontroller. Depending upon the result, the microcontroller will activate the buzzer if the credit is low and the Controller will trigger the Relay if the credit goes very low. The relay is the switching device to cut off and restore power supply. The LCD is interfaced to microcontroller using parallel port connection. The microcontroller based system, continuously records the readings.

The coding emphasizes the fact that it reduces human labour but increases the efficiency in calculation of bills for used electricity. The user can be notified about the low balance in their credit with the help of the GSM module. The GSM uses its own network for the transfer of information. The programming makes use of messaging features of GSM AT command. And, once the relay is triggered, the electricity supply will be cut off.

Description: Arduino:

The Arduino is open-source, which means hardware is reasonably priced and development software is free. This guide is for students in ME 2011, or students anywhere who are confronting the Arduino for the first time. For advanced Arduino users, prowl the web; there are lots of resources. The Arduino programming language is a simplified version of C/C++. If you know C, programming the Arduino will be familiar. If you do not know C,

no need to worry as only a few commands are needed to perform useful functions.An important feature of the Arduino is that you can create a control program on the host PC, download it to the Arduino and it will run automatically.

Fig.4.Arduino

Remove the USB cable connection to the PC, and the program will still run from the top each time you push the reset button. Remove the battery and put the Arduino board in a closet for six months. When you reconnect the battery, the last program you stored will run.

Arduino Hardware:

The power of the Arduino is not its ability to crunch code, but rather its ability to interact with the outside world through its input-output (I/O) pins. The Arduino has 14 digital I/O pins labeled 0 to 13 that can be used to turn motors and lights on and off and read the state of switches.Each digital pin can sink or source about 40 mA of current. This is more than adequate for interfacing to most devices, but does mean that interface circuits are needed to control devices other than simple LED's. In other words, you cannot run a motor directly using the current available from an Arduino pin, but rather must have the pin drive an interface circuit that in turn drives the motor. A later section of this document shows how to interface to a small motor.To interact with the outside world, the program sets digital pins to a high or low value using C code instructions, which corresponds to +5 V or 0 V at the pin. The pin is connected to external interface electronics and then to the device being switched on and off. The sequence of events is shown in this figure.To determine the state of switches and other sensors, the Arduino is able to read the voltage value applied to its pins as a binary number. The interface circuitry translates the sensor signal into a 0 or +5 V signal applied to the digital I/O pin. Through a program command, the Arduino interrogates the state of the pin. If the pin is at 0 V, the program will read it as a 0 or LOW. If it is at +5 V, the program will read it as a 1 or HIGH. If more than +5 V is applied, you may blow out your board, so be careful.

Interacting with the world has two sides. First, the designer must create electronic interface circuits that allow motors and other devices to be controlled by a low (1-10 mA) current signal that switches between 0 and 5 V, and other circuits that convert sensor readings into a switched 0 or 5 V signal. Second, the designer must write a program using the set of Arduino commands that set and read the I/O pins. Examples of both can be found in the Arduino resources section of the ME2011 web site.

PIN DESCRIPTIONS OF ARDUINO:

VCC: Digital supply voltage.

GND: Ground.

Port B (PB7:0) XTAL1/XTAL2/TOSC1/TOSC2: Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the

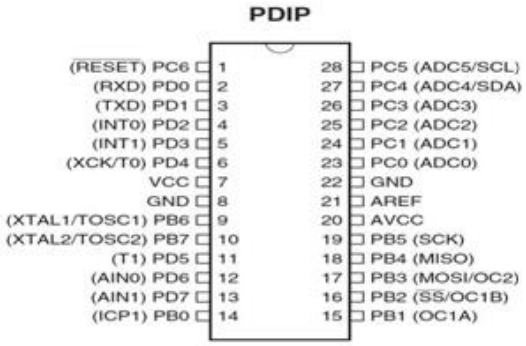

Fig.5.Pin Diagram of Arduino

clock is not running. Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit. Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier.If the Internal Calibrated RC Oscillator is used as chip clock source, PB7..6 is used as TOSC2..1 input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set. The various special features of Port B are elaborated in

”Alternate Functions of Port B” on page 76 and ”System Clock and Clock Options” .

Port C (PC5:0): Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The PC5..0 output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running.

PC6/RESET: If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 differ from those of the other pins of Port C. If the RSTDISBL Fuse is un programmed, PC6 is used as a Reset input. A low level on this pin for longer than the minimum pulse length will generate a Reset, even if the clock is not running. The minimum pulse length is given in Table 28-3 on page 308. Shorter pulses are not guaranteed to generate a Reset. The various special features of Port C are elaborated in ”Alternate Functions of Port C” .

Port D (PD7:0): Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running. The various special features of Port D are elaborated in ”Alternate Functions of Port D”

AVCC: AVCC is the supply voltage pin for the A/D Converter, PC3:0, and ADC7:6. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter. Note that PC6..4 use digital supply voltage, VCC.

AREF: AREF is the analog reference pin for the A/D Converter

ADC7:6 (TQFP and QFN/MLF Package Only): In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

OVER VIEW: The ATmega48PA/88PA/168PA/328P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega48PA/88PA/168PA/328P achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.The AVR core combines a rich instruction set with 2 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 one 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.

ATmega48PA/88PA/168PA is a low-power CMOS 8-bit microcontroller based on the AVR® enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the Atmel ATmega48PA/88PA/168PA achieves throughputs approaching 1MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. The device is manufactured using the Atmel high density non-volatile memory technology. The on-chip ISP flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional non-volatile memory programmer, or by an on-chip boot program running on the AVR core.The ATmegaPA/88PA/168PA/328P provides the following features: 4/8/16/32K bytes of In System Programmable Flash with Read-While-Write capabilities, 256/512/512/1K bytes EEPROM, 512/1K/1K/2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte-oriented 2- wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Interface, 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.The device is manufactured using Atmel’s high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed In- System through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot program running on the AVR core. The Boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8- bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega48PA/88PA/168PA/328P is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications. The ATmega48PA/88PA/168PA/328P AVR is supported with a full suite of program and system development tools including: C Compilers, Macro Assemblers, and Program Debugger/Simulators, In-Circuit Emulators, and Evaluation kits.

Power supply to Arduino: The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an

AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follow**s:**

VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin

Block diagram of ATMEGA48PA/88PA/168PA/328P:

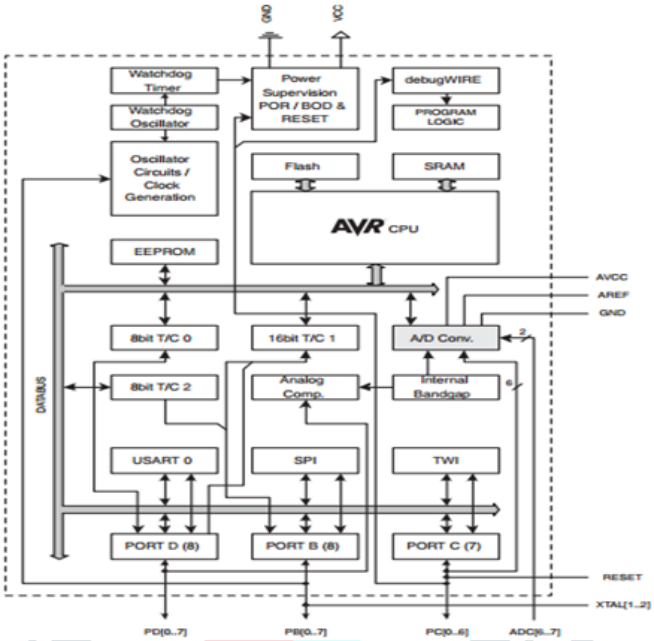

Fig.6.Blockdiagramof ATMEGA48PA/88PA/168PA/328P

5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.

GND. Ground pins.

Memory: The ATmega328 has 32 KB (with 0.5 KB used for the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output: Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode(), digital Write(), and digital Read() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kilo ohms. In addition, some pins have specialized functions:

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip

External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write() function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library

LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference function. Additionally, some pins have specialized functionality

TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

There are a couple of other pins on the board:

AREF. Reference voltage for the analog inputs. Used with analog Reference.

Reset. Bring this line LOW to reset the microcontroller**.** Typically used to add a reset button to shields which block the one on the board.

Communication:

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB

and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino boardThe RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Uno's digital pins.

Programming:

The Arduino Uno can be programmed with the Arduino software (download). Select "Arduino Uno from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials. The ATmega328 on the Arduino Uno comes preburned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files). You can also bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available.Automatic Software

RESET: Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nano farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment.This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half second or so, the boot loader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

RESULT ANALYSIS

Working Analysis:

Now-a-days the numbers of Electricity consumers are increasing in great extent. It is hard to handle and maintain the power due to growing requirements. Maintenance of the power is an important task as the human operator goes to consumer's house and produces the bill as per the meter reading.

The AC mains are fed to the transformer, which steps down the 230 Volts to the desired voltage. The bridge rectifier follows the transformer thus converting AC voltage into a DC output and through a filtering capacitor feeds it directly into the input (Pin 1) of the voltage regulator. The common pin (Pin 2) of the voltage regulator is grounded.The output (Pin 3) of the voltage regulator is first filtered by a capacitor, and then the output is taken. Make the circuit on a general purpose PCB and use a 2 Pin (5A) plug to connect the transformer input to the AC mains via insulated copper wires. The current transformer is connected in series and the potential transformer in parallel with the line. Two comparators are used as Zero Cross Detectors for the current and voltage signals. The zero cross detected signals of the current and voltage are applied to the interrupt inputs of the microcontroller to measure the phase difference between two signals. The microcontroller can therefore evaluate the power factor at the measurement terminals.The system is comprised of three phases, in the first phase the user send a request for electricity through SMS, in second phase service provider receive SMS and perform matching function and in third phase in service provider recharge the meter. Embedded system means microcontroller is the interface of meter and GSM modem. So that it continuously monitors electricity consumption. In this complete approach communication established between power station, meter and user using a GSM modem.

Fig.7.GSM BASED PREPAID ENERGYMETER KIT

Pulse= (Pluse_rate*watt*time)/ (1000*3600)
Pulses=3200*100*60/1000*3600
Pulses = ~5.33 pulse per minute
PF= watt/(hour*Pulse)
PF=100/60*5.33
PF=0.3125 watt in a single pulse
Units= PF*Total pulse/1000
Total pulses in an hour is around 5.33*60=320
Units = 0.3125*320/1000
Units = 0.1 per hour
If a 100 watt bulb is lighting for a day then it will consume
Units =0.1*24
Units = 2.4 Units
And suppose unit rate is at your region is 5 rupees per unit then

You have to pay for 2.4 Units Rs:

Rupees= 2.4*5 = 12 rupees

Before proceeding for the calculations, first we have to keep in mind the pulse rate of energy meter. There are two pulse rates of energy meter first is 1600 imp/kwh and second is 3200 imp/kwh. So here we are using 3200 imp/kwh pulse rate energy meter.So first we need to calculate the Pulses for 100watt, means how many times Pulse LED will blink in a minute, for the load of 100 watts.So pulses for 100 watt bulb in 60 seconds, with energy meter of 3200 imp/kwh pulse rate can be calculated between the CT and the load, the relay is connected to disconnect the power in case the user runs out of balance, and finally the line is connected back to the neutral. The complete final code was written into the MCU, controlling the operation of the entire system, and it was run to test the meter.

Energy is the total power delivered or consumed over a time interval

Energy = power *Time=Voltage *Current*Time

UNITS	PRICE
0	0
2	8
3	12
4	16

TABLE1: CONSUMED PRICE PER UNIT

Fig.8.Alert messages with unit and price

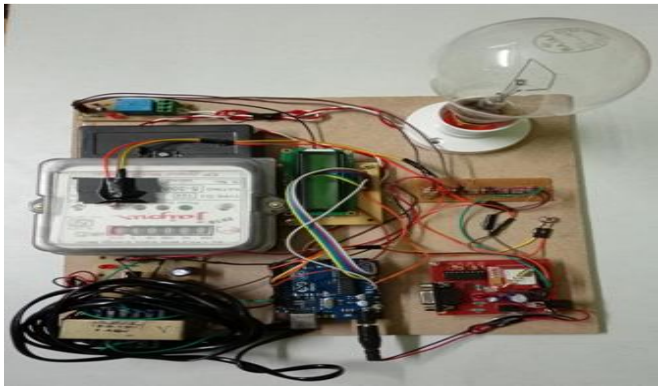

Fig.9.Over view of GSM Based Prepaid Energy Meter

The Energy Meter was tested with four Electric bulb of 220 volt was used as a load with 0.4A current. The supply voltage was between 210 V and 230 V. Energy measurement process is described step by step

The coding emphasis the fact that it reduces human labour but increases the efficiency in calculation of bills for used electricity .the user will have an universal number and they can recharge outlets of electricity board .the acknowledgement of recharged coupon detail will come to notice of the consumer and also will get displayed in LCD module. So this process will bring a solution of creating awareness on unnecessary wastage of power and will tend to reduce wastage of power. This module will reduce the burden of energy providing bye stabilizing the connection easily and no theft of power will takes place. The LCD display will display the used amount and balance amount that can be used

Conclusion:

The monopolistic power distribution market in Asia is gradually transforming into a competitive marketplace. Differentiation in service is going to be the key competitive factor to the improve market share in the deregulated power markets prepaid meters with their advantages over conventional ones are likely to help power distributors to differentiate and offer value –added services to consumers. Encourage consumers to opt for prepaid meters on a voluntary basis and offering tariff or non-tariff incentives to those consumers who prepaid their power changes would help the utilities to implement this system.In the present time of 21st century we have no space for errors or faults either in any technical system or in general applications. Prepaid energy meter is an advantages concept for the further. It‘s facilitates the exemption from electricity bills. Electricity coupons will be available at nearby shops. Prepaid means pay before use one of the advantageous feature of this concept prepaid energy meter is used to prepaid the ongoing supply of electricity to homes, offices etc.