GSM BASED PRE-PAID ENERGY METER WITH BILLING SYSTEM

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Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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This is to certify that this project entitled "GSM BASED PRE-PAID ENERGY METER WITH BILLING SYSTEM" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical & Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfilment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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ABSTRACT

Automation in the distribution field permits utilities on actualizes all the adaptable control for distribution systems, which can be used to upgrade efficiency, reliability, quality of electric service. Automation not only upgrade those qualities but also reduces human effort and saves time. Under and over voltage problem is one of the common type of problems which leads most of the insulation and appliance damage throughout our country. In this report we are going to show how under and over voltage problem leads a system into catastrophic situation and also describe how those problems can be minimized economically using automation with a GSM module followed by SMS alert in distribution system.

This paper presents an idea of fault locating method with highly computational method. The project also presents some guidelines for design of fault location and remote indication, for reducing power outages and reducing heavy loss of revenue. The paper proposes fault location model for underground power cable using microcontroller. The aim of this paper is to determine the distance of underground cable fault from base station in meters. This paper uses the simple concept of ohm's law. When any fault like short circuit occurs, voltage drop will vary depending on the length of fault in a cable, as the current varies. A set of resistors are therefore used to represent the cable and a dc voltage is fed at one end and the fault is detected by detecting the change in voltage using Analog to Digital converter and a microcontroller is used to make the necessary calculations so that the fault distance is calculated and will be displayed in the LCD display. In addition, a message in the form of SMS about the fault location will be sent to the concern person mobile through the GSM modem which is also interfaced to the controller.

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LIST OF ABBREVIATION

Name	Elaborations
GSM	Global System for Mobile Communication
SIM	Subscriber Identity Module
LCD	Liquid Crystal Display
GPRS	General Packet Radio Service
AC	Alternating Current
LED	Light Emitting Diodes
DC	Direct Current
IC	Integrated Circuit
PCB	Printed Circuit Board
SMS	Short Message service
USART	Universal Synchronous Asynchronous Receiver Transmitter
BPS	Bits Per Second
MXE	Message centre
BSS	Base Station System
CT	Current Transformer

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The project “GSM Based Prepaid Energy Meter” the Electrical metering instrument technology. 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. 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 by the distribution unit according to the peak hours.

1.2 Problem Statement

Every time a customer end-user of currently used meters wants to recharge their energy meter they would have to go all the way to the utility company to purchase electricity and receive a statement that is then must be taken back to the location of the meter and is inserted through a keypad. This is a very monotonous process for electricity recharge particularly if the location of the meter is far from the utility company. Further, in case the electricity runs out the period of time the building where the meter is installed stays. offline until it is once more recharged may be critical depending on the facility itself home, hospital, mainframe server…etc. The aim of the research is to automate the prepaid billing of energy meter. In this paper, the consumer end is user friendly and the customer recharges their balance at ease. At utility end, the retrieval of consumer balance becomes much easier and more accurate.

1.3 Scopes

An electricity meter provides an interface between the utility and the customer. Successfully implemented, this meter will benefit the end customer as well as the electric utility in that the customer can recharge his account wirelessly from his home using an SMS

to recharge. The device will show the remaining balance so that the user knows how much he has consumed and can plan ahead and know when he needs to refill the account and also provide the utility companies to collect the expenses from customers in advance, so that, they will no longer have to deal with late payments or non-paying bill by the customers. And also help to reduce electricity theft.

1.4 Objective

The project is to design and construct an intelligent prepaid energy meter that will be able to dictate any bypass by energy theft as well as to recharge the meter through GSM technology. The objectives include:

i) To design a power supply unit Voltage sensing device that automatically adjusts the power factor of the electricity supply through its calibration.

ii) ii) To design a voltage sensing device that automatically adjusts the power factor of the electricity supply through its calibration and current sensing device to measure the accurate current consumed by the load.

iii) iii) To program a device using the AT-MEGA328 microcontroller that will measure current voltage and effectively calculate the power consumed from the load.

iv) iv) To Program and configure the Global System for Mobile communication (GSM) module to effectively send receive message which is compatible with all mobile network operators.

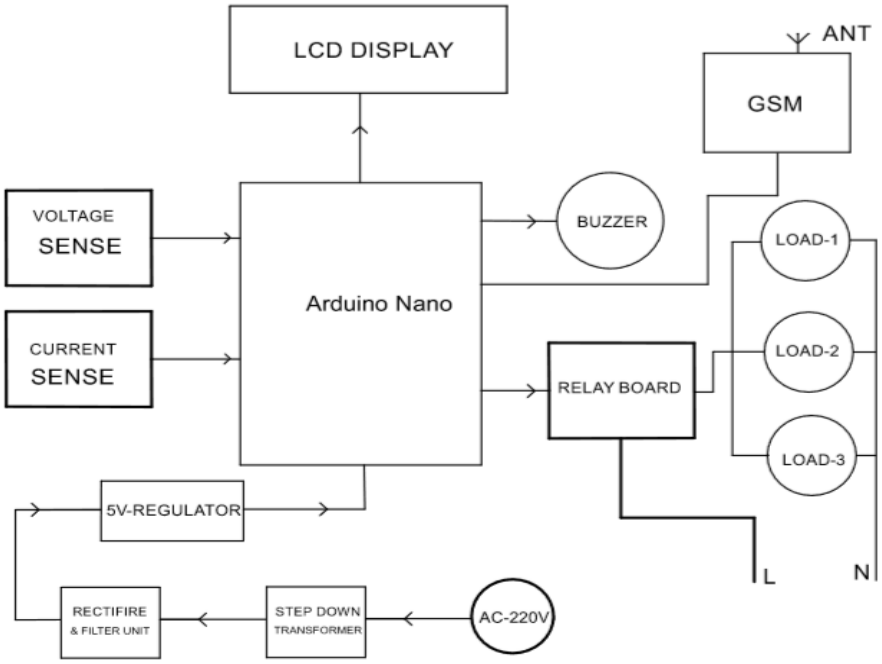
v) To design a circuit that disconnects the load when the unit is exhausted.

vi) To evaluate result based on the energy consumption of the measured values and the intelligent system

1.5 Methodology

The GSM-Based prepaid energy meter is recharged for some amount and can be maintained as input to the Arduino Nano ATMEGA328. The ATMEGA328 is programmed that power supply will be switched OFF by using relay when the recharged amount used up. The GSM communication module is used to send a message to the customer about the units of power

wasted and their balance and also LCD display is used to display the balance amount.



BLOCK DIAGRAM : PRE-PAID ENERGY METER

1.5 Project Outline

This Project is organized as follows:

Chapter 1: Introduces, Problem statement, Objectives, Methodology, Project outline

Chapter 2: Reviews the literature Introduction, Literature contributions, project summary, Mobile telephony.

Chapter 3: Describes the hardware development part of Introduction, Pin diagram, program, Relay driver, Relay, Oscillator configuration, Circuit diagram, SIM300 module, Product concept, Application interface, Serial interface etc.

Chapter 4: Hardware Development, Circuit diagram, Result, Advantage Cost of Estimate, Summary.

Chapter 5: Results and discussion, presents the result and its discussions such as Simulation result & Hardware result

Chapter 6: The benefits of GSM Based Prepaid Energy Meter

Chapter 7: It gives the future scope and conclusion

CHAPTER-2

LITERATURE REVIEWS

2.1 INTRODUCTION

Energy Meter is a device that measures the amount of electrical energy consumed by a residence business an electrical power device. They are typically calibrated in billing units and the most common one 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 and 3,600,000 joules. Electricity meters operate by continuously measuring the instantaneous voltage (volts) and current amperes. The product of which gives the instantaneous electrical power watts which are then compact next time to give energy used. A Prepaid Energy Meter enables power utilities to receive electricity bills from the consumers before to its consumption. The prepaid meter is also associated with prepaid recharging ability and information change with the utilities.

2.2 Review

Metering is very important in modern life. Four steps are involved, in on-going typical metering system. First, a meter records the amount of electricity consumed by the consumer. After that a person catch image of meter for each user, then it is given to the computer system to calculate the charges for each consumer n bill distribution. Meter reading collection is most difficult persuasive. To record reading of meter a worker visits each house regularly. Many meters are inside the house so; the worker needs to revisit the houses. Also, this method is very old, it gives opportunity for improvement. First of all, more workers are required for recent systems because they are required to visit frequently to collect the reading. Moreover, the process takes time because the collection may not be completed when workersvisit first time. Finally, accuracy cannot be ensured due to human errors. In the existing system, either an electronic energy meter or an electromechanical meter is fixed in the proposition for mapping the usage. The meters currently in use are only able of record-keeping kWh units. The kWh units used then still have to be recorded by meter scholars monthly on foot. The recorded data need to be provided by a meter reading company. For preparing the meter reading the company needs to first link each recorded power usage datum to an account holder and then determine the amount owed by means of the particular tariff in use. The conventional method for collection of energy consumption data is that particular the representatives of electricity board monthly come and visit every residential and corporate and manually reads the consumption data from the meter. The data is recorded on a fragment of paper along with a snap shot of the meter and finally submitted to the local electricity board office. There after the officials reads the snap shot and readings of the meter and then feed it to the local software for bill calculations.Finally, the bills are dispatched. We as a consumer then make the payment for the received bill [1]

2.3 Literature Survey

A Real time redaction of a GSM Based Prepaid Energy Meter and Control System utilizing slaver home Mythology" deal GSM Based Prepaid Energy Meter Control System, which could give the offices of keeping up uniform. A software operating system is utilized for cell phones that incorporate a working framework, middleware and key implicational features. We proposed a framework commitment to the advancement of nursery generation in country. The proposed arrangement includes the advancement of incorporated framework for mechanize the trickle treating watering system in greenhouse.

2.4 Summary

The system consists of four main parts which is microcontroller circuit or Arduino Nano, GSM based, Current Transformer circuit and also mobile phone. This project used Arduino Nano, Sim800L GSM Modulo and using Library software for the programming. The purpose of this project is to prevent the express bus driver from driving over the permitted speed limit as well as to educate the drive to obey the regulation; therefore, the accident can be prevented.

CHAPTER 3

ANALYSIS OF THE HARDWARE COMPONENTS

3.1 Introduction

GSM Based Prepaid Energy Meter a simple mechanism to detect and maintain the current and voltage sensing or any other container by cut off in the prepaid energy meter automatically disconnect the load. In this project a microcontroller or Arduino Nano with UART circuit is interfaced with Library supporting GSM module sends SMS to the mobile to control the electrical device. The microcontroller decodes the received message and does the required action. The protocol used for the communication between the two Library users. The microcontroller pulls the SMS received by phone decodes it recognizes the mobile number and then switches on the relays attached to its port to control the appliances. After a successful operation the controller sends back the acknowledgment to the users mobile through SMS. SMS will be silently ignored if the mobile no is unwarranted.

3.2 List of Components

The GSM based prepaid energy meter has the following main components:

i. Power Supply
ii. Transformer
iii. Bridge Rectifier
iv. Sim800L GSM Module.
v. Arduino Nano ATmega328
vi. Connecting Wire.
vii. Breadboard.
viii. Regulator IC
ix. LCD
x. Resistor
xi. Capacitor
xii. Relay
xiii. LED Diode
xiv. Switch
xv. Rectifier Diode
xvi. Battery
xvii. Current Transformer (CT)

xviii. Buzzer
xix. Light
xx. Holder

3.3 Power Supply

Power supply is the reference to a source of electrical energy. A device or a system that Supply electrical or other types of energy to an output load is called a power Supply unit. The term is the most commonly applied electrical energy supplies, less Often to mechanical ones, and occasionally to others. This power supply section is required to convert AC signal to DC signal and also to decrease 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 (no frequency) with the amplitude of +5V and +12V for various applications. In this section we have Transformer, Bridge rectifier, are connected serially and voltage Regulators for +5V and +12V (7805 and 7812) via a capacitor (1000μF) in parallel are Connected parallel as shown in the circuit diagram below. Each voltage regulator output is again is connected to the capacitors of values (100μF, 10μF, 1 μF 0.1 μF) are connected parallel through which the corresponding output (+5V or +12V) are taken into consideration.

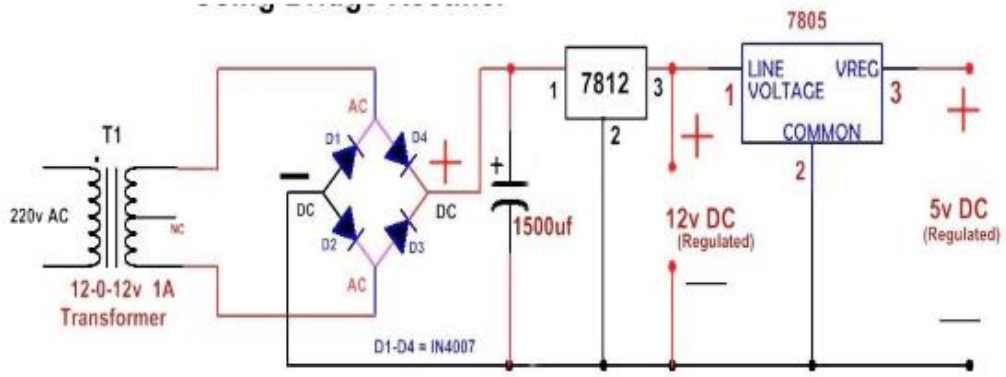


Fig: 3.1 AC to DC converter power supply

3.4 Transformer

A transformer is a device that transfer electrical energy from one server to another circuit inductively electrical conductor changing current in the first circuit and primary site create a change in mechanical field is magnetic field induced a change in voltage in the second circuit by adding a lot to the secondary circuits one can make current flow in the transformers transforming energy from One circuit to the other the secondary induced voltage of an ideal transformer is scared from the primary,Vp by a vector equal to the ratio of the number of turns of wire in the in their respective Find the equal the ratio of the number of terms of the order in their respective winding VP/VS=NP/NS

3.4.1 Basic Principle

Transformer is based on two principles that an electric current can raise a magnetic electromagnetism and the second plane that is changing magnetic field in a coil of wire raise voltage across the end of the coil by changing the current in the primary coil it changes the intensity of the magnetic field in the changing magnetic field and 2nd AC voltage across the secondary. A simplified transformer design is shown below the primary and secondary coils a very high magnetic field sure that most of the magnetic lines by primary current and first-floor second required as well as the primary.

The most of the magnetic field lines raise by the primary current are within the iron and pass through the secondary coil as well as the primary coil.

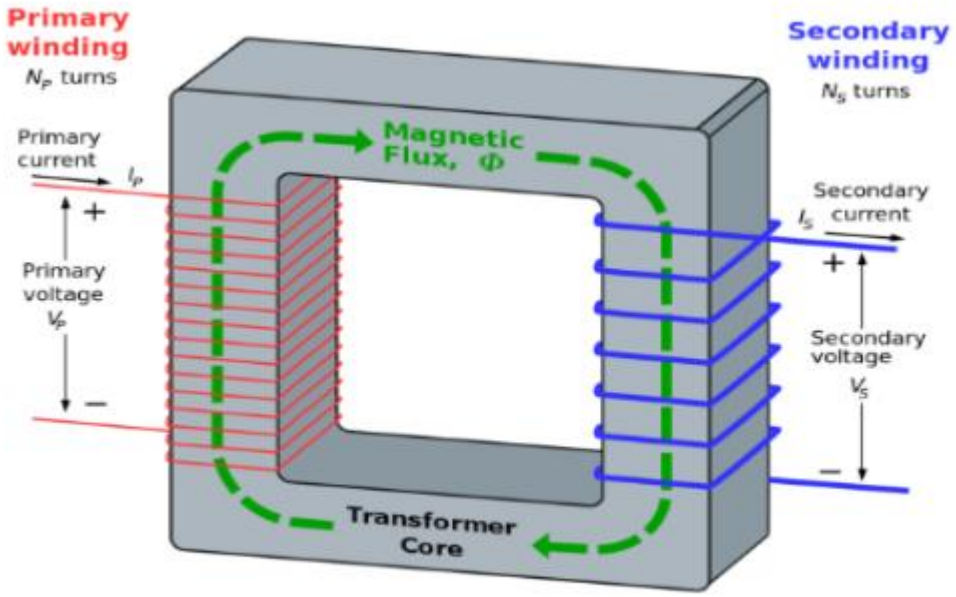


Fig: 3.2 Step Down Transformer

Induction law The voltage raise across the secondary coil may be calculated from Faraday's law of induction, which states that:

$$\text{Vs} = Ns \frac{d\Phi}{dt}$$

Where Vs is the instantaneous voltage, Ns is the number of turns in the secondary coil and Φ equals the magnetic flux through one turn of the coil. If the turns of the coil are oriented standing to the magnetic field lines, the flux is the product of the magnetic field strength B and the area A through which it cuts. The area is constant, being equal to the cross-sectional area of the transformer core, whereas the magnetic field varies with time according to the excitation of the primary. Since the same magnetic flux passes throughboth the primary and

secondary coils in an ideal transformer, the instantaneous voltage across the primary winding equals.

$$\mathrm{Vs}= Ns\,\frac{d\Phi}{dt}$$

Taking the ratio of the two equations for VS and VP gives the basic equation for stepping up or stepping down the voltage

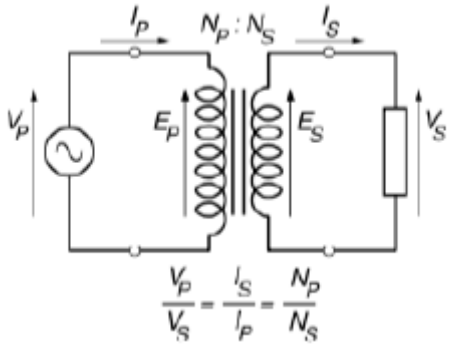
$$\frac{\mathrm{Vp}}{Vs} = \frac{Np}{Ns}$$

Ideal power equation If the secondary coil is attached to a load that allows current to flow, electrical power is transmitted from the primary circuit to the secondary circuit. Ideally, the transformer is perfectly efficient; all the incoming energy is transformed from the primary circuit to the magnetic field and into the secondary circuit. If this condition is met, the incoming electric power must equal the outgoing power.

Input Power =IpVp = Output Power = IsVs

Giving the ideal transformer equation:

$$\frac{\mathrm{Vp}}{Vs} = \frac{Np}{Ns} = \frac{Is}{Ip}$$



Input Power = IpVp = Output Power = IsVs

Giving the ideal transformer equation

$$\frac{\mathrm{Vp}}{Vs} = \frac{Np}{Ns} = \frac{Is}{Ip}$$

If the voltage is increased (stepped up) (VS > VP), then the current is decreased (stepped down) (IS < IP) by the same factor. Transformers are efficient so this formula is a reasonable approximation. If the voltage is increased (stepped up) (VS > VP), then the current is decreased (stepped down) (IS

<IP) by the same factor. Transformers are efficient so this formula is a reasonable approximation. The impedance in one circuit is transformed by the square of theturn ratio. For example, if an impedance ZS is attached across the terminals of the secondary coil, it appears to the primary circuit to have an impedance of

$$Zs\left(\frac{Np}{Ns}\right)^2$$

This relationship is reciprocal, so that the impedance ZP of the primary circuit appears to the secondary to be

$$Zs\left(\frac{Np}{Ns}\right)^2$$

3.4.2 Detailed Operation

The facilitated description above ignores several workable factors in exceptional. The primary current required to set up a magnetic field in the core and achievement to the field due to the current in the secondary circuit. Models of an ideal transformer typically assume a core of negligible reluctance with two windings of zero resistance. When a voltage is applied to the primary winding some small current flows driving flux around the magnetic circuit of the core. The current required to create the flux is termed the magnetizing current. Since the ideal core has been assumed to have near-zero reluctance, the magnetizing current is negligible, although still required to create the magnetic fieldthe magnetizing current is ignorable, although still required to make the magnetic field. The changing magnetic field produces an electromotive force (EMF) across each winding. Since the ideal windings have no impedance, they have no connected voltage drop, and so the voltagesVp and Vs measured at the terminals of the transformer, are equal to the similar EMFs. The primary EMF, acting as it does in competition to the primary voltage, is sometimes termed the "back EMF". This is due to Lenz's law which states that the induction of EMF would always be such that it will oppose improvement of any such change in magnetic field.

3.5 Bridge Rectifier

The diode of the bridge rectifier is a classification of four diodes in a bridge shape that provides the same polarity of output voltage for any polarity of input voltage. When used the most common application for conversion of alternating current (AC) input into direct current (DC) output is called a bridge rectifier. A bridge rectifier provides full-wave rectification from a two-wire AC input following in lower cost and weight as compared to a centre-tapped transformer design but has two diode drops rather than one. Thus, displaying reduced efficiency over a centre-tapped design for the same output voltage.

3.5.1 Basic Operation

When the input connected at the left corner of the diamond is positive with respect to the one connected to the right-hand corner current flows to the right along the upper coloured.

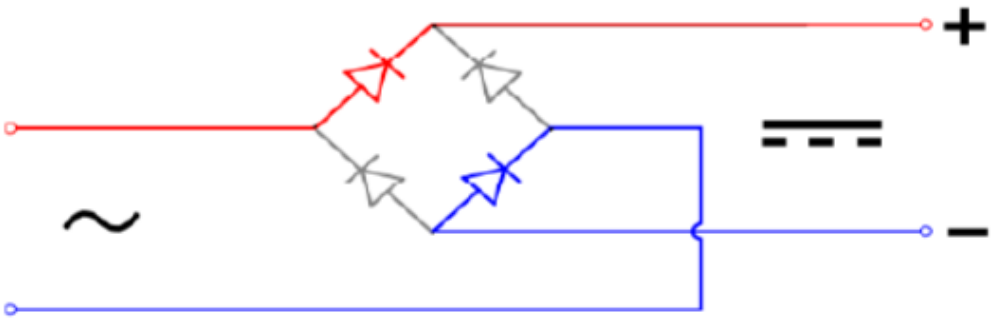


Fig: 3.3 Positive Half Cycle

path to the output and returns to the input supply via the lower one. When the right hand corner is positive relative to the left hand corner, current flows along the upper coloured path and returns to the supply via the lower coloured path.

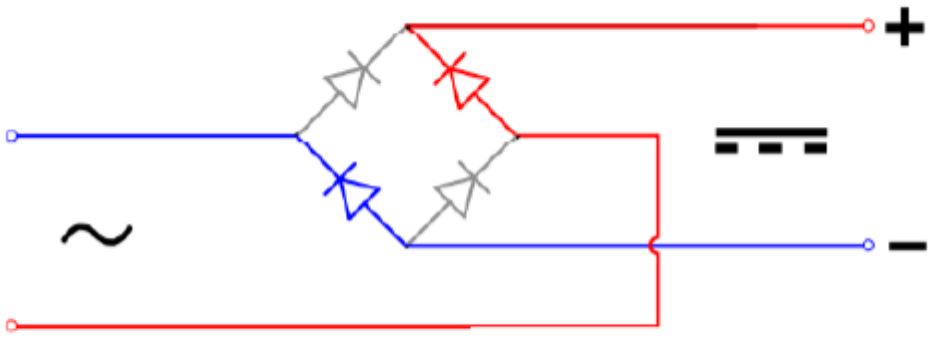


Fig: 3.4 Negative Half Cycle

In each case, the upper right output continues positive with regard to the lower right one. Since this is true whether the input is AC or DC this circuit not only generates DC power

when supplied with AC power. It also can accommodate what is sometimes called "reverse polarity protection". That is it authorizes normal functioning when collections are installed behind or DC input-power supply wiring has its wires crossed and shields the circuitry it powers against the harm that might happen without this circuit in place. Previous to the availability of combined electronics such a bridge rectifier was always assembled from discrete components. Since about 1950 a single four-terminal component receiving the four diodes connected in the bridge shape became a standard business component and is now prepared with different voltage and current ratings.

3.5.2 Output smoothing (Using Capacitor)

For many applications particularly with single phase AC where the full-wave bridge serves to convert an AC input into a DC output, the addition of a capacitor may be the significant cause of the bridge alone supplies an output voltage of fixed polarity but pulsating magnitude (see diagram above).

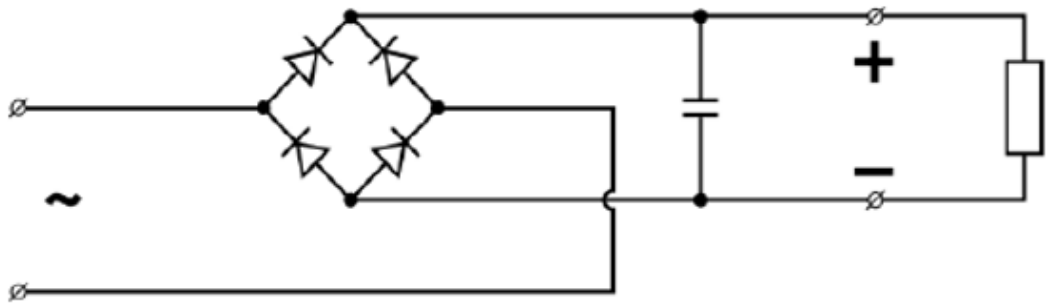


Fig: 3.5 Full Wave Bridge Rectifier

The function of the capacitor known as a storage capacitor smoothing capacitor is to lessen the change in the smoothly rectified AC output voltage waveform from the bridge. One example of smoothing is that the capacitor gives a low impedance track to the AC element of the output decreasing the AC voltage across an AC current through the resistive load. In light technical terms, any decrease in the output voltage and current of the bridge manages to be vacated by the loss of charge in the capacitor. This charge flows out as the supplementary current through the load. Thus, the change of load current and voltage is decreased relative to what would occur without the capacitor. Increases of voltage correspondingly store excess charge in the capacitor thus directing the change in output voltage/current rectifier output smoothing. The reduced circuit shown has a welljustified respect for being the serious cause of some applications. The capacitor can retain a deadly charge after the AC power source is removed. If supplying a serious voltage, a practical circuit should include a reliable way to safely discharge the capacitor. If the normal load cannot be confirmed to perform this function maybe cause of it can be disconnected the circuit should include a bleeder resistor connected as close as practical across the capacitor. This resistor should use a current large enough to discharge the capacitor in a reasonable time but small enough to bypass needless

power waste. Cause of a bleeder sets a lowest current drain the command of the circuit defined as interest voltage change from lowest to highest load is improved. However, the improvement is of unimportant magnitude. The capacitor and the load resistance have a typical time constant $\tau = RC$ where C and R are the capacitance and load resistance gradually. As long as the load resistor is large enough so that this time constant is much longer than the time some designs, a series resistor at the load side of the capacitor is joined. The smoothing can then be improved by adding supplementary stages of capacitor-resistor pairs often done only for sub-suppliers to critical high-gain circuits that tend to be sensitive to supply voltage noise. The idealized waveforms shown above are seen for both voltage and current when the load on the bridge is resistive. When the load includes a smoothing capacitor both the voltage and the current waveforms will be hugely changed. While the voltage is smoothed as explained above current will flow through the bridge only throughout the time when the input voltage is higher than the capacitor voltage. For example, if the load represents an average current of n Amps and the diodes conduct for 10% of the time. The average diode current throughout conduction must be 10n Amps. This non-sinusoidal current leads to harmonic distortion and a low power factor in the AC supply.

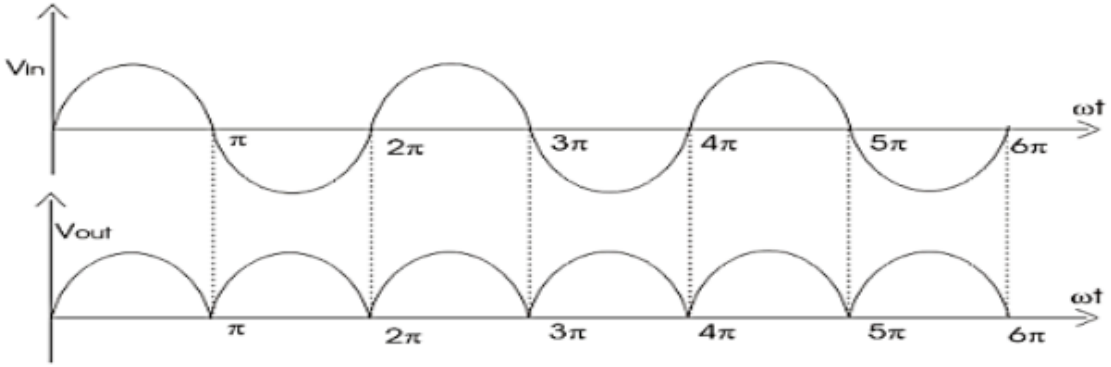


Fig:3.6 Full wave Bridge Rectifier wave shape

In a practical circuit when a capacitor is directly connected to the output of a bridge diode must be sized to withstand the current wave that happens when the power is turned on at the peak of the AC voltage and the capacitor is fully discharged. Sometimes a small series resistor is included before the capacitor to limit this current though in most applications the power supply transformer's resistance is now enough. Output can also be smoothed using a choke and second capacitor. The choke tends to hold the current (rather than the voltage) more constant. Due to the comparably high cost of an effective choke. related to a resistor and capacitor this is not employed in advanced equipment. Some initial console radios built the speaker's constant field with the current from the high voltage ("B +") power supply which was then routed to the consuming circuits permanent magnets were regarded too low for the great performance to build the speaker's constant magnetic field. The speaker field coil thus performed 2 jobs in one. It acted as a choke filtering the power supply and it created the magnetic field to operate the speaker.

3.6 SIM800L GSM Module



Fig: 3.7 SIM800LGSM Module

3.6.1 Description

SIM800L series modules support Hyper Text Transfer Protocol application. Which provides a mode to alternate of HTTP server? The basic application contains GET, POST, HEAD methods. it also supports proxy server, redirection, broken transfer resuming functions. SIM800L series modules support File Transfer Protocol application. Which provides a mode to interact with FTP server? The basic application contains GET, PUT methods, it also supports broken transfer resuming function. PUT method supports

Features:

Power supply: Voltage range: 3.4V`4.4V

Power saving: SLEEP mode is 0.7mA (BS-PA-MFEMS=9).

Band: GSM type, Small mobile station

four frequencies: EGSM900, DCS1800, GSM850, PCS1900, can automatically search the four frequency bands. You can also set the frequency band through the AT command. Accord GSM Phase 2/2+

Transmit power:

- Class 4 (2W): GSM850, EGSM900
- Class 1 (1W): DCS1800, PCS1900

GPRS connection features:

- GPRS time slot default is 12
- GPRS time slot default is 12
- GPRS mobile station level is B

Temperature range:

- Working temperature: -40 ℃ ~ +85 ℃
- Storage temperature: -45 ℃ ~ +90 ℃
- GPRS data characteristics:
- GPRS data downlink transmission: maximum 85.6 kbps
- GPRS data uplink transmission: maximum 85.6 kbps
- Coding formats: CS-1, CS-2, CS-3, and CS-4
- Support for PAP (password authentication protocol) protocol for PPP connections
- Embedded TCP/IP protocol □ Support packet broadcast control channel (PBCCH)
- CSD transmission rate: 2.4,4.8,9.6,14.4kbps
- Support unstructured supplementary data service (USSD)
- Circuit switching (CSD): CSD transmission rate: 2.4,4.8,9.6,14.4kbps
- MT, MO, CB, Text and PDU models
- Short message (SMS) storage device: built-in SIM card
- Speech coding mode:
- Half rate (ETS 06.20)
- Full rate (ETS 06.10)
- Enhanced full rate (ETS 06.50 / 06.60 / 06.80)
- Adaptive multi rate (AMR)
- Echo cancellation
- Noise suppression

Serial port: Debug port: For debugging

- Supporting the full function of the standard serial port
- Transmission rate support from 1200bps to 115200bps
- AT command and data can be sent through the serial port
- Support for RTS/CTS hardware flow control, and can be opened or closed by the software flow control function
- Supports the GSM 07.10 protocol of the serial port multiplexing function
- Support automatic baud rate detection function from 1200bps to 115200bps

Software upgrade:

- Communication record management:
- Support types: SM, FD, LD, RC, ON, MC.
- SIM application toolkit: Support class SAT 3, GSM 11.14 Release 99
- Real time clock (RTC): Support
- Time function: AT command set
- Software upgrade: Upgrade software via serial port or USB port

3.7 Arduino (NANO) ATMEGA328

3.7.1 Description

The Arduino NANO R3 is the latest version after the Demilune with an improved USB interface chip. Like the Demilune, it not only has an expanded shield header with a 3.3V reference and a RESET pin (which solves the problem of how to get to the RESET pin in a shield) AND a 500mA fuse to protect your computer's USB port, but ALSO an automatic circuit to select USB or DC power without a jumper! The Uno is pin and code-compatible with the Demilune, Demilune and older Arduinos so all your shields, libraries, code will still work. The R3 (3rd revision) of the NANO has a few minor updates, with an upgrade to the USB interface chip and additional breakouts for the i2c pins and an Ire pin Each Arduino ordered from Ada fruit still comes with 4 rubber-bumpers that will help protect the board when you want to place it on a table. (Also keeps the Arduino from sliding around.



Fig: 3.8 Arduino (NANO) ATMEGA328

Arduino is some open-source electronics prototyping platform based on flexible, easy-to use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be standalone or they can communicate with software running on a computer (e.g. Flash, Processing, Max/MSP).

Table 3.1 Microcontroller Operation

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 Ma
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by boot

3.7.2 Circuit Diagram of Arduino (NANO) ATMEGA328

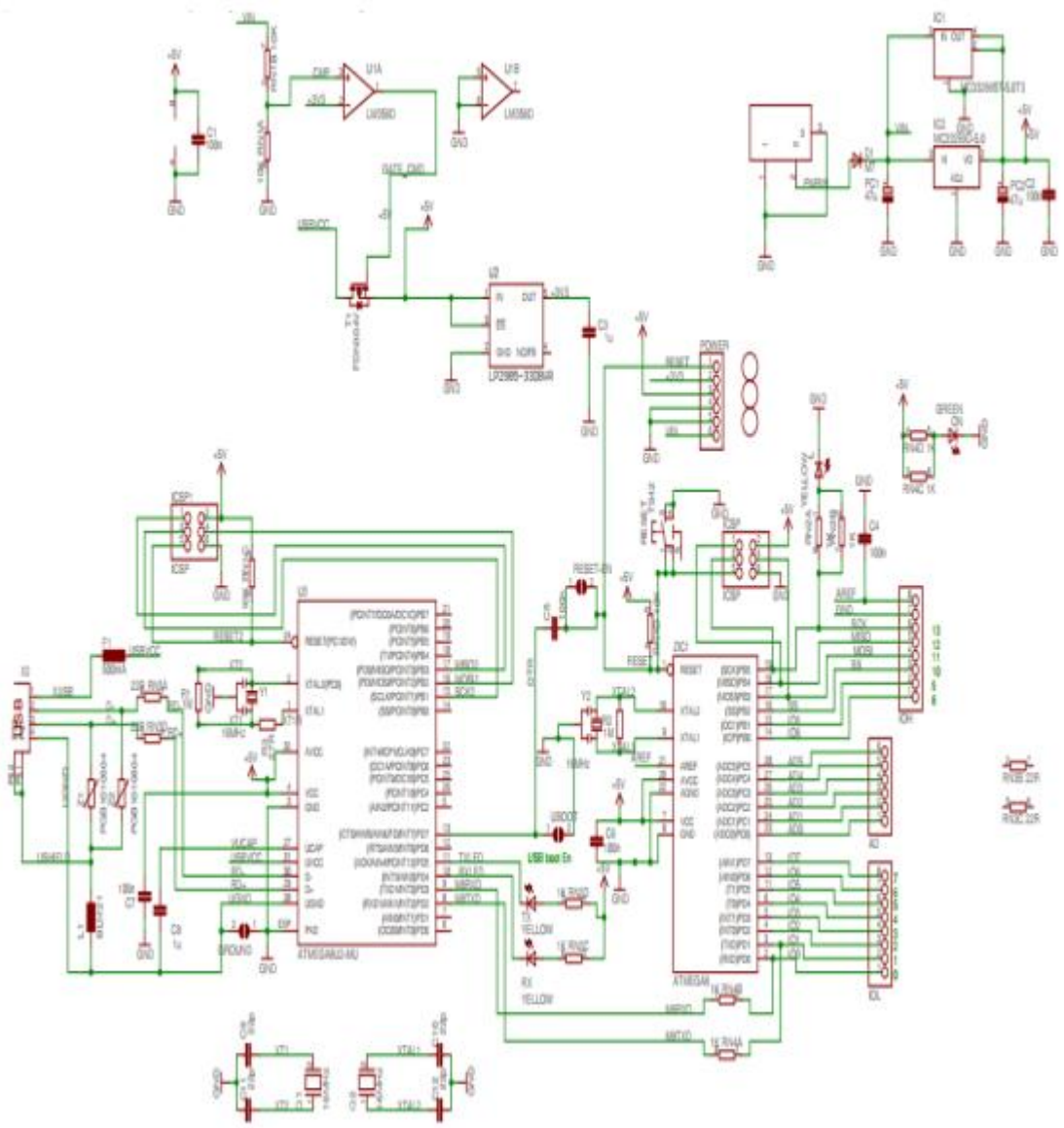


Fig: 3.9 Circuit Diagram of Arduino (NANO) ATMEGA328

3.7.3 Pin Diagram of Arduino (NANO) ATMEGA328

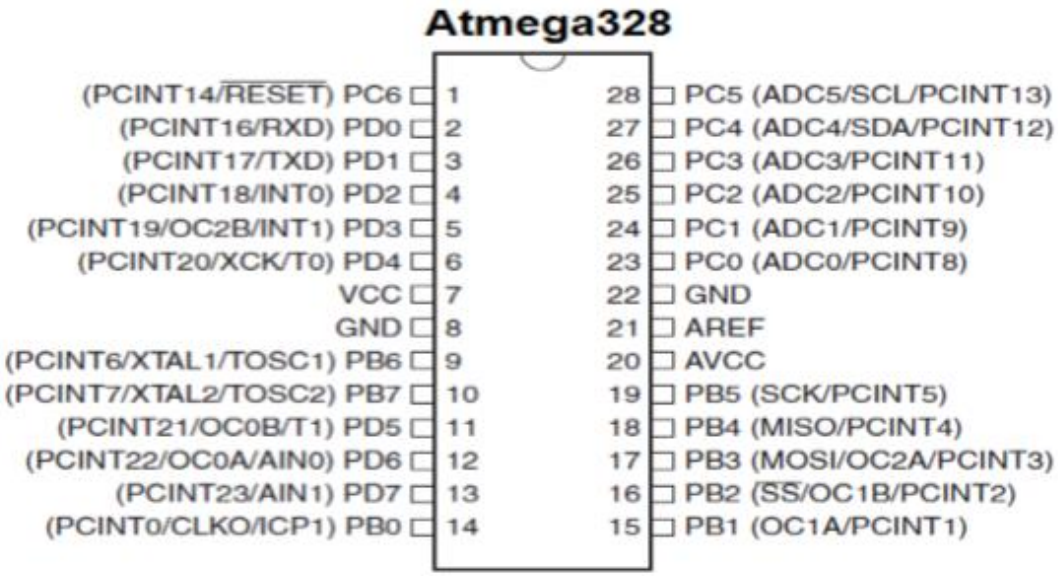


Fig: 3.10 Pin Diagram

3.7.4 Pin description of AT MEGA 328

Table: 3.2 Function

Pin Number	Description	Function
1	PC6	Reset
2	PD0	Digital Pin (RX)
3	PD1	Digital Pin (TX)
4	PD2	Digital Pin
5	PD3	Digital Pin (PWM)
6	PD4	Digital Pin
7	Vcc	Positive Voltage (Power)
8	GND	Ground

9	XTAL 1	Crystal Oscillator
10	XTAL 2	Crystal Oscillator
11	PD5	Digital Pin (PWM)
12	PD6	Digital Pin (PWM)
13	PD7	Digital Pin
14	PB0	Digital Pin
15	PB1	Digital Pin (PWM)
16	PB2	Digital Pin (PWM)
17	PB3	Digital Pin (PWM)
18	PB4	Digital Pin
19	PB5	Digital Pin
20	AVCC	Positive voltage for ADC (power)
21	AREF	Reference Voltage
22	GND	Ground
23	PC0	Analog Input
24	PC1	Analog Input
25	PC2	Analog Input
26	PC3	Analog Input
27	PC4	Analog Input
28	PC5	Analog Input

3.7.5 Arduino Works

I. Load control using Arduino Nano

II. GSM is also control by Arduino

III. Arduino Phone, a do-it-yourself cell-phone

IV. Low-cost data glove for virtual reality applications

V. Voltage & Current quality testing platform

VI. Automatic titration system based on Arduino Nano

3.8 LCD (20×4)

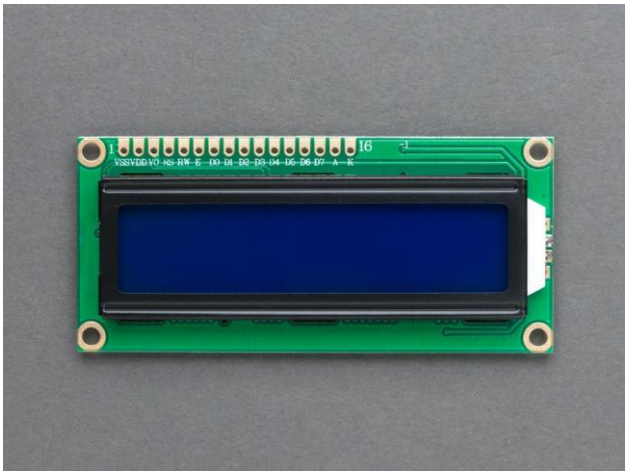


Figure: 3.11 LCD 20×4

3.8.1 Pin Configuration

Table 3.3 Pin Configuration

Pin No	Pin Name	Description
1	Vss (Ground)	Ground pin connected to system ground
2	Vdd (+5 Volt)	Powers the LCD with +5V (4.7V – 5.3V)
3	VE (Contrast V)	Decides the contrast level of display. Grounded to get maximum contrast.
4	Register Select	Connected to Microcontroller to shit between command/data register
5	Read/Write	Used to read or write data. Normally grounded to write data

		to LCD
6	Enable	Connected to Microcontroller Pin and toggled between 1 and 0 for data acknowledgement
7	Data Pin 0	Data pins 0 to 7 forms a 8-bit data line. They can be connected to Microcontroller to send 8-bit data. These LCD's can also operate on 4-bit mode in such case Data pin 4,5,6 and 7 will be left free.
8	Data Pin 1	
9	Data Pin 2	
10	Data Pin 3	
11	Data Pin 4	
12	Data Pin 5	
13	Data Pin 6	
14	Data Pin 7	
15	LED Positive	Backlight LED pin positive terminal
16	LED Negative	Backlight LED pin negative terminal

3.8.3 Features of 20×4 LCD Module

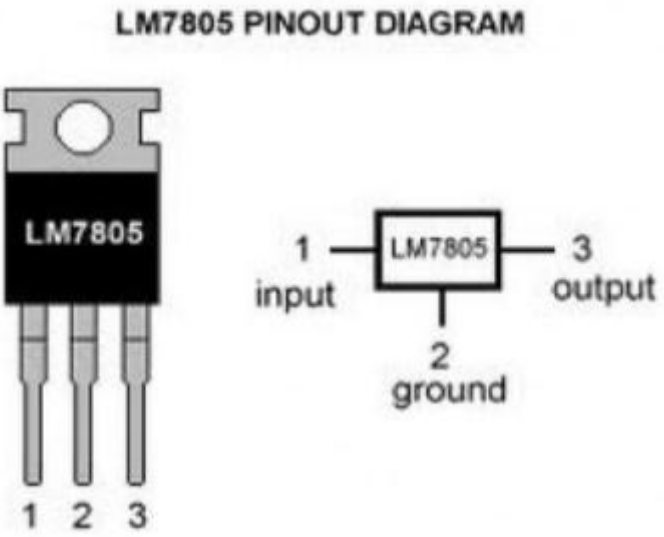
- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is built by a 5×8-pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backlight
- 20*4 Display Equivalents Dot Matrix

LED Display, 7-Segment LED Display, OLED Display, TFT LCD Screen Display

3.9 Fixed Voltage Regulator:

A LM7805 Voltage Regulator is a voltage regulator that outputs +5 volts. An easy way to remember the voltage output by a LM78XX series of voltage regulators is the last two digits of the number. A LM7805 ends with "05"; thus, it outputs 5 volts. The "78" part is just the convention that the chip makers use to denote the series of regulators that output positive voltage. The other series of regulators, the LM79XX, is the series that outputs negative voltage. So: LM78XX: Voltage regulators that output positive voltage, "XX"=voltage output. LM79XX: Voltage regulators that output negative voltage, "XX"=voltage output. The LM7805, like most other regulators, is a three-pin IC. Pin 1 (Input Pin): The Input pin is the pin that accepts the incoming DC voltage, which the voltage regulator will eventually

regulate down to 5 volts. Pin 2 (Ground): Ground pin establishes the ground for the regulator. Pin 3 (Output Pin): The Output pin is the regulated 5 volts DC.



Voltage Regulator Pin Diagram

This series of fixed-voltage integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Each of these regulators can deliver up to 1.5 A of output current. The internal current-limiting and thermal-shutdown features of these regulators essentially make them immune tooverload. In addition to use as fixed-voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents, and also can be used as the power-pass element in precision regulators.

3.10 Resistor

A resistor expresses a fallen amount of resistance in a circuit. Resistance is a measure the flow electric current is reversed resisted. It is defined by Ohm's law which states the resistance equals the voltage distributed by the current the symbol for resistance is a diagonal line as shown under. The alphabet "R" is used in equation

Resistance = voltage/current or R = V/I Resistance is measured in Ohms. The Ohm is usually expressed by the omega symbol Ω.

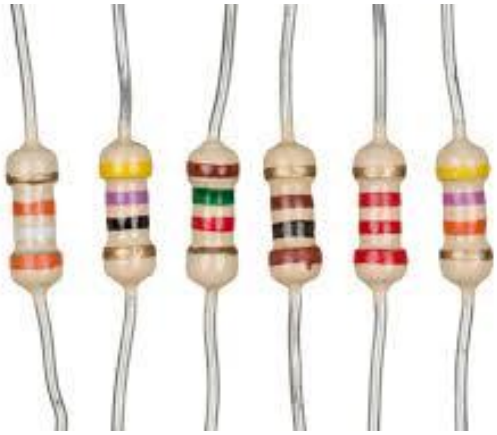


Fig: 3.13 Figure of Resistor

3.11 Variable Resistor

A variable resistor is a resistor of which the electric resistance value can be adjusted



Fig: 3.14 Variable Resistor

A variable resistor is in essence an electro-mechanical transducer and normally works by sliding a contact (wiper) over a resistive element When a variable resistor is used as a potential divider by using 3 terminals it is called a potentiometer. When only two terminals are used, it functions as a variable resistance and is called a rheostat. Electronically controlled variable resistors exist, which can be controlled electronically.

3.12 Capacitor

A capacitor expresses the amount of capacitance in the circuit. The capacitance is the capacity of an element to store an electrical charge. It is as the capacity to collect a charge. The capacitance is defined by the equation C = q/V Where q is the charge in coulombs and V is the voltage. in a DC circuit, a capacitor becomes an open circuit tackling any DC current from passing the capacitor. Only the AC current will move into a capacitor. Capacitance is measured in farads. The symbol for capacitance is two parallel lines. Seldom one of the lines is curved as shown below. The alphabet "C" is used in equations.



Fig: 3.15 Different of Capacitor

3.13 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Here used in three relay 5v, 12v, 12v.

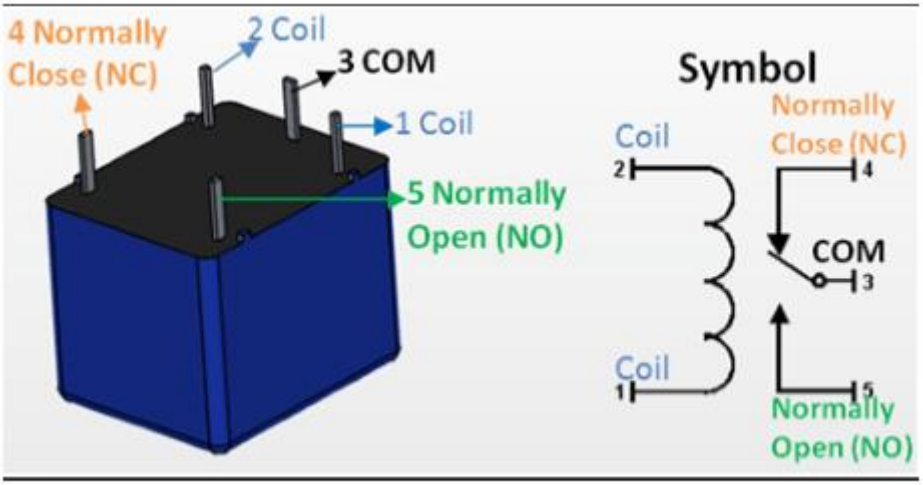


Fig: 3.16 Relay of Connection

3.14 DIODE

A diode contains two electrodes that act in much the same manner as semiconductors. The positive or p-type is usually the anode and the negative or n-type is the cathode. In other words, the cathode is negatively charged as compared to the anode. If the cathode is charged at the same or very similar voltage to the anode, current will not flow. In electronics, a diode acts similarly to charge carriers. Diodes can also be compared to check valves or switches. If liquid or water were involved instead of current, it would essentially be similar to water flowing upstream or downstream. Put simply, a diode tends to allow for upstream to downstream flow but not the other way around.

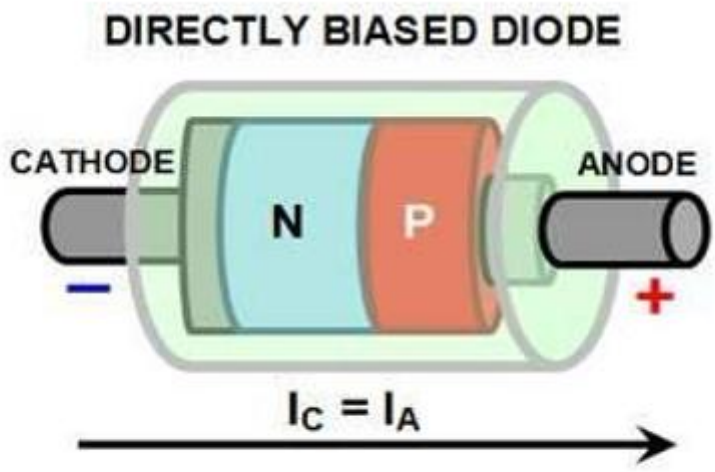


Fig: 3.17 Diode

To alter the direction of the flow, the cathode must be charged at a greater voltage than the anode. This is known as avalanche voltage, but despite the name, it does not always require a

large number of volts to change the direction. It can in fact be a difference of only a few voltages.

3.15 Current Transformer (CT)

A current transformer (CT) is used for measurement of alternating electric currents. When current in a circuit is too high to apply directly to measuring instruments, a current transformer produces a reduced current accurately proportional to the current in thecircuit, which can be conveniently connected to measuring and recording instruments. A current transformer isolates the measuring instruments from what may be very high voltage in the monitored circuit.

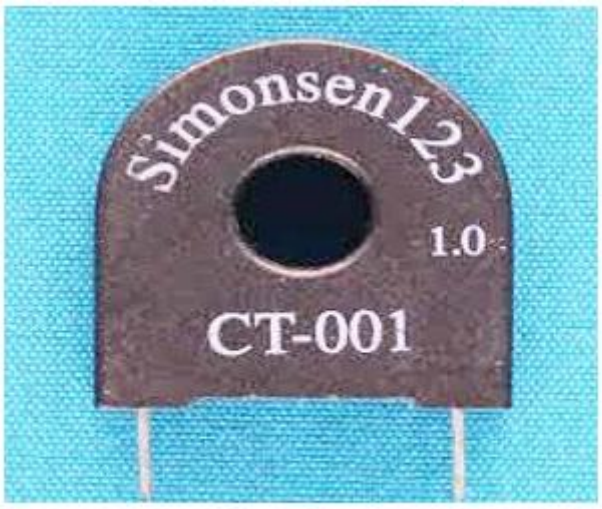


Fig: 3.18 Current Transformer (CT)

Product No: Simonsen123 CT-001-1.0 Installation: Vertical insertion or horizontal installation

3.15.1 Feature Application:

Electronics, instrument, position sensor.

Phase: Single

Usage: Measurement

Insulating medium: Epoxy Resin

Certification: RoHS, ISO 9001:2008

Size (mm)

3.15.2 Performance Parameter:

Product NO	Primary Current	Coil Ratio	Secondary Current	Load Resistance	Out Voltage	Accuracy	Phase Component	Quadrature Component	Max Current
CT-001-1.0	0~40A	1000:1	0~40mA	≤10 Ω	≤400mv	≥0.1%	≤0.1%	≤6	72A

Table 3.4 Performance Parameter

3.15.3 Security Parameters:

Primary winding and secondary winding :3kv/2mA/60Sec

Insulation Resistance: ≥500MΩ /500V DC;

Inflaming retarding up to the standard of UL94-VO;

Usage temperature: -40C~+85C Relative Humidity ≤95%

Operating Frequency: 1KHZ~70KHZ [8]

3.16 Transistor

A transistor is a device that controls current or voltage flow and works as a switch gate for electronic signals. Transistors consist of three floors of a semiconductor material each capable of providing a current. BC547 is an NPN bipolar junction transistor.

A transistor stands for transfer of resistance is commonly used to amplify current. A small current at its base controls a larger current at collector & emitter terminals. BC547 is mainly used for amplification and switching purposes.

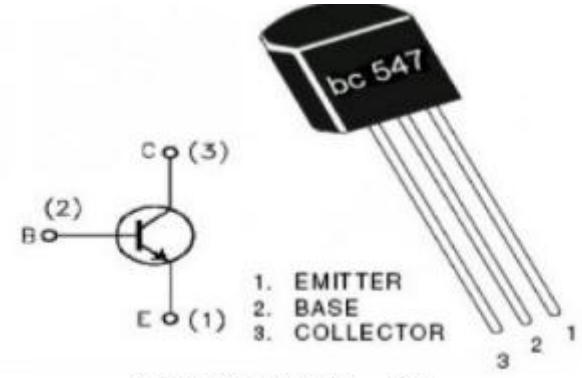


Fig:3.20 NPN Transistor

Specifications:

- BIPOLAR TRANSISTOR, NPN, 45V, TO-92
- Transistor Polarity: NPN
- Collector Emitter Voltage V(br)ceo: 45V
- Transition Frequency Typft: 300MHz
- Power Dissipation Pd: 625mW
- DC Collector Current: 100mA
- DC Current Gain hFE: 150
- Straight-lead housing [9]

CHAPTER 4

HARDWARE DEVELOPMENT

4.1 Introduction

The system was powered and operated upon using several possibilities they include making sure that the prepaid energy meter onlystarts when the prepaid meter has gone below the mark, and start. The seven segments display was also tested to make sure correct show was display on the seven-segment display screen the power unit. The sensors were also tested. This chapter will present all the results and calculations and relevant discussions.

4.2 Block diagram

4.3 Circuit Diagram

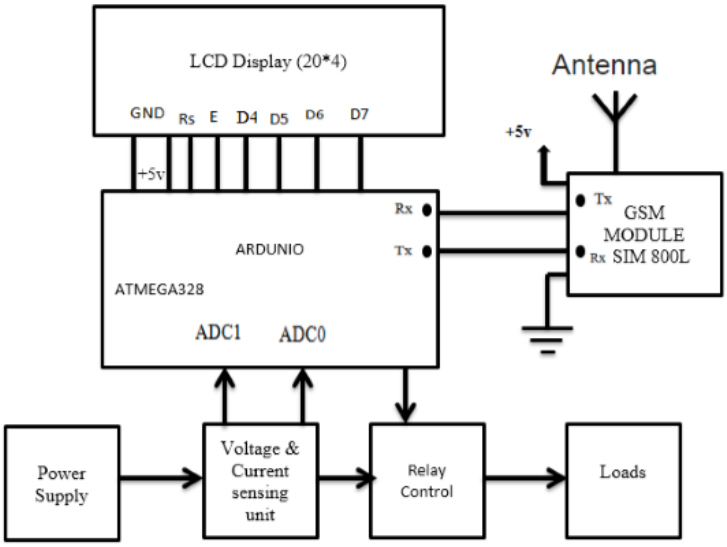


Fig: 4.1 GSM Based Prepaid Energy Meter

4.3 Circuit Diagram

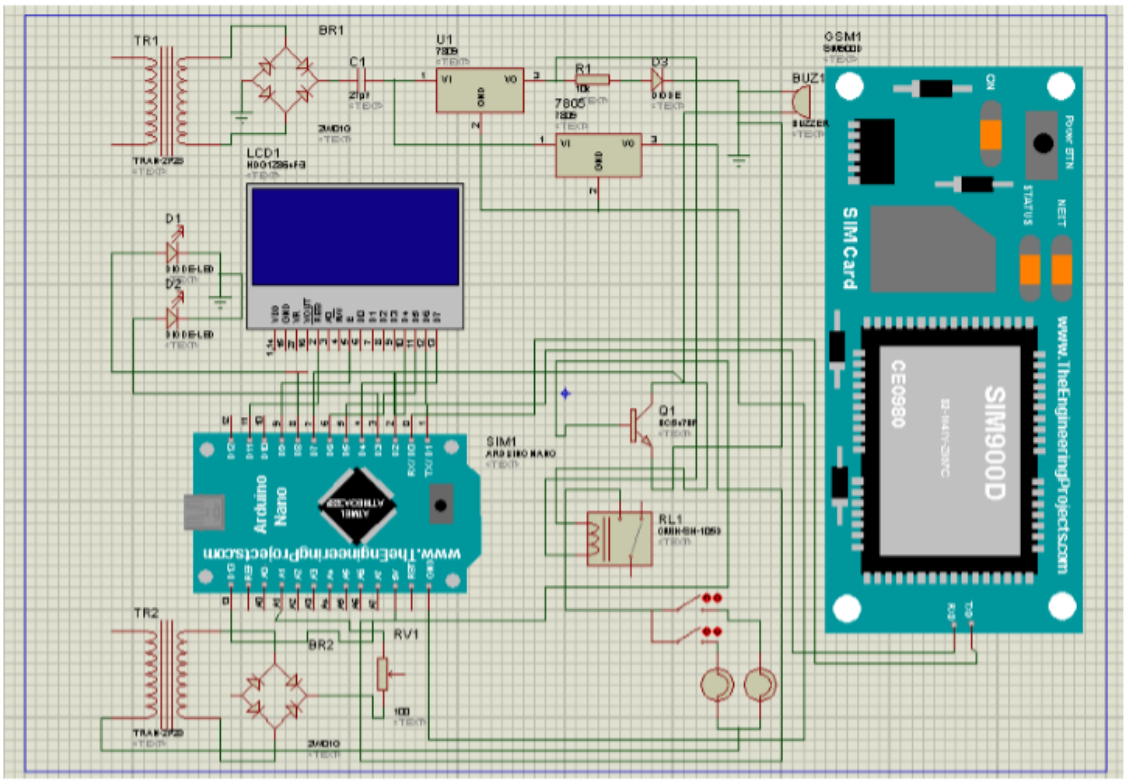


Fig: 4.2 Circuit Diagram of GSM Based Prepaid Energy Meter

4.4 Results

The experimental model was made according to the circuit diagram and the results were as expected. Some of the calculation shown given

Let, V=230v

Load1=60w

Load2=60w

T=1 hour=3600Sce

Per unit cost=0.25Tk

Power =(Load1+Load2)

=60+60

=120w

We know that, P=VI

I=P/V

=120/230

= .52A

Units=120/1000 kwh

= 0.12

Total Cost = Absorbed Unit*Per Unit Cost

= 0.12*0.25

= 0.03TK

4.5 Advantage of the proposed prepaid energy meter

A. Maintenance

It is an economical system that requires very less maintenance as weighed to conventional system as it has no complicated circuits and delicate mechanisms. This saves the additional maintenance cost.

B. Cost

The main advantage of the prepaid meter controller is it has very low cost than the conventional one available in markets. For example, some commercial controllers use microcontrollers which alone costs around Tk.1500. Some controllers even have a price range of Tk.2000-Tk.4000. But for our system, the components used are less in number and easily available. Hence losses will be less leading to a better efficiency.

C. Construction

The construction of a prepaid energy meter is very simple as it requires only a few components. The circuit involved is also relatively simpler.

D. Skill Required

Since the system of prepaid energy meter is simpler than the ones conventionally available, it can be easily made at home industries. The control software can also be easily operated by anyone.

4.7 Summary

The conventional controllers in market mostly use capacitive sensors and microcontrollers. These increase the cost as well as the complexity of the system. We have developed a rather simpler but efficient model of a GSM base prepaid energy meter.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 Introduction

The applications of GSM Based prepaid energy meter are quite diverse. There are many practical-life uses for the home and Industries. In such cases, a wireless connection is a better choice. Home and industries apparatus has been a significant issue where corruption is reducing and everybody wants to take proper measures to redress intrusion. In addition, there is required to automate research mobile phone. so that the user can take the advantage of technological support. This project presents a model that will give control to their company.

5.2 Hardware Result:

All the components were connected as per the circuit diagram. The figures below show the hardware connection and the output obtained.

Step 1: Power supply into the device and showing GSM base prepaid energy meter system ready

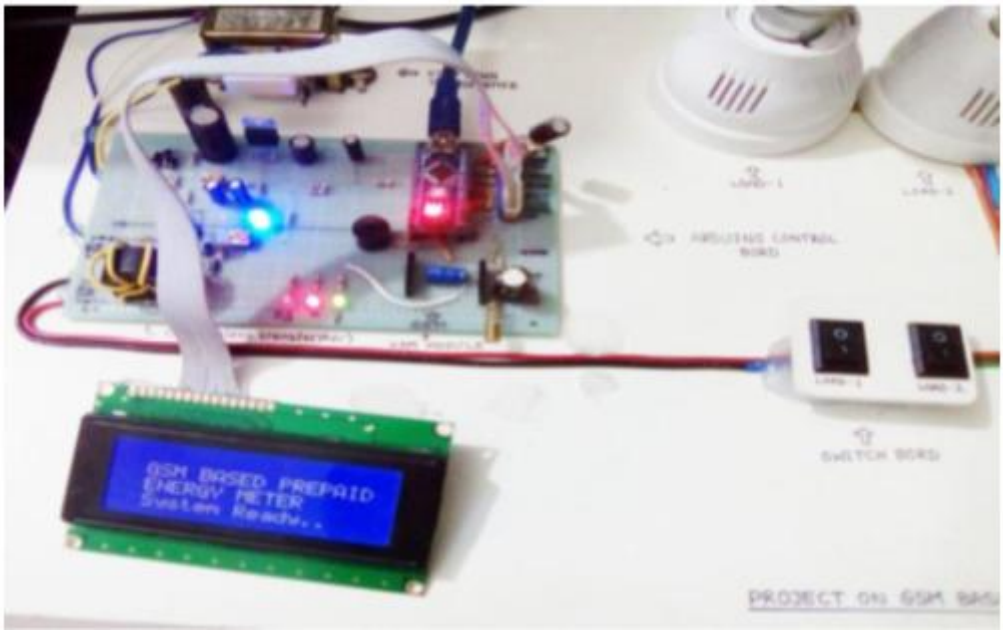


Figure: 5.1 GSM Based Prepaid Energy Meter System Ready

Step 2: Some times are taken then no load balance shows the display.

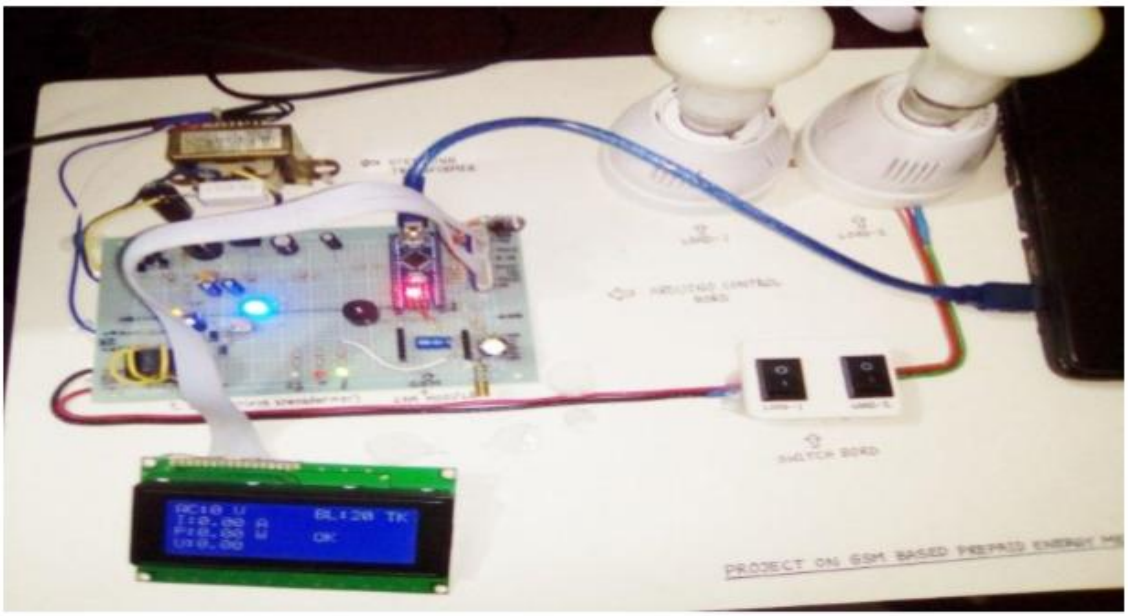


Figure: 5.2 No Load shows the balance

Step 3: When the balance high.



Fig: 5.3 Load Active

Step 4: When balance empty



Step-5: When the Balances recharge



CHAPTER 6

CONCLUSION

6.1 Introduction

The prepaid meters are likely to cut the cost of meter reading as no meter readers are required. In addition, they eliminate administrative hassles associated with disconnection and reconnection. prepaid meters could help control appropriation of electricity in a better way than conventional meters.

6.2 Benefits

6.2.1 Reduced Financial Risks

Since the payment is up-front reduces the financial risk by improving the cash flows and necessitates an improved revenue management system.

6.2.2 Better Customer Service

The system eliminates billing delay, removes cost involved in disconnection reconnection, enables controlled use of energy, and helps customers to save money through better energy management.

6.2.3 Power Sector Reforms

The upcoming competitive and customer focused deregulated power distribution market will force the market participants to make the existing metering and billing process more competent. This is likely to drive the prepaid market.

6.2.4 Consumer Behaviour

Consumers have not had any major problems with the existing post-paid system, and hence it is likely to be difficult to convince them to change over to prepaid system. Consumers might not appreciate the concept of "pay and use" as far as electricity is concerned because it might be perceived as an instrument to control common man’s life style.

6.3 Future Scope

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 simplified the exemption from electricity bills. Electricity coupons will be available at nearby shops. The word prepaid means ―pay before use‖ one of the advantageous features of this concept prepaid energy meter is used to prepaid the ongoing supply of electricity to homes, industries etc.

6.4 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

REFERENCES

1. http:// www.ijrat.org, retrieved on 01 June 2018
2. https://www.electrical4u.com/what-is-transformer-definition-working-principle-of-transformer, retrieved on 25 May 2018
3. http://www.wisegeek.org/what-is-a-diode.htm, retrieved on 01 June 2018
4. https://www.electrical4u.com/what-is-transformer-definition-working-principle-of-transformer, retrieved on 01 June 2018
5. http://www.wisegeek.org/what-is-a-diode.htm, retrieved on 02 June 2018
6. Wikipedia-GSM technology.
7. Data sheet of ATMEGA328
8. http://en.simonsen123.com/product/276920035, retrieved on 15 May 2018
9. https://potentiallabs.com/cart/bc547-transistor, retrieved on 15 May 2018

APPENDIX

```
#include<LiquidCrystal.h>
LiquidCrystallcd(11,9,7,6,5,4);
#define BUZ 2
#define LEDN 8
#define LEDL 3

int temp=0,i=0,cnt,cnt1;
char str[15];

void setup()
{
lcd.begin(16,2);
Serial.begin(9600);
pinMode(BUZ, OUTPUT);
pinMode(LEDN, OUTPUT);
pinMode(LEDL, OUTPUT);

lcd.setCursor(0,0);
lcd.print("  GSM PREPAID   ");
lcd.setCursor(0,1);
lcd.print("  ENERGY METER  ");
digitalWrite(BUZ, HIGH);
delay(60);
digitalWrite(BUZ, LOW);
```

```
delay(60);
digitalWrite(BUZ, HIGH);
delay(60);
digitalWrite(BUZ, LOW);
delay(60);
digitalWrite(BUZ, HIGH);
delay(60);
digitalWrite(BUZ, LOW);
delay(60);

digitalWrite(LEDL, HIGH);
lcd.setCursor(0,1);
lcd.print(" System Ready    ");
Serial.println("AT+CNMI=2,2,0,0,0");
delay(500);
Serial.println("AT+CMGF=1");
delay(1000);
digitalWrite(LEDL, LOW);
  //lcd.clear();

  SendMessage1();
}
////////////////////////////////////////////////////////////////////////////
////////////////////////////////////////////////////////////////////////////
void loop()
{
  DISPLAY1();
```

```
SENSOR();
  if(temp==1)
  {
check();
    temp=0;
i=0;
delay(10);
  }

  //////////////////////
cnt++;
  if(cnt> 250)
  {cnt1++;cnt=0;}
if(cnt1 > 10)
  cnt1=0;
  //////////////////////
}
////////////////////////////////////////////////////////////////////////////
////////////////////////////////////////////////////////////////////////////
void DISPLAY1()
{
lcd.setCursor(0,0);
lcd.print(" SYSTEM READY    ");
lcd.setCursor(0,1);
lcd.print(" INITIALIZING... ");

if( (cnt == 0)|(cnt == 1)|(cnt == 15)|(cnt == 16)|(cnt == 30)|(cnt == 31) )
```

```
digitalWrite(LEDN, HIGH);
    else
digitalWrite(LEDN, LOW);
}
////////////////////////////////////////////////////////////////////////////
void SENSOR()
{

}

////////////////////////////////////////////////////////////////////////////
 void serialEvent()
 {
while(Serial.available())
  {
if(Serial.find("#A."))
   {
digitalWrite(LEDN, HIGH);
delay(10);
digitalWrite(LEDN, LOW);
     while (Serial.available())
     {
       char inChar=Serial.read();
str[i++]=inChar;
       if(inChar=='*')
       {
        temp=1;
```

```
        return;
       }
     }
   }
  }
 }
////////////////////////////////////////////////////////////////////
void check()
{
if(!(strncmp(str,"rs50 bdt",5)))
   {
digitalWrite(LEDL, HIGH);
lcd.setCursor(13,1);
lcd.print("ON    ");
delay(2000);
     SendMessage2();
   }
if(!(strncmp(str,"rs100 bdt",6)))
   {
digitalWrite(LEDL, LOW);
lcd.setCursor(13,1);
lcd.print("OFF    ");
delay(2000);
   }

}
////////////////////////////////////////////////////////
```

```
//////////////////////////////////////////////////////
void SendMessage1()                    // fan on
{
Serial.println("AT+CMGF=1");
delay(100);
Serial.println("AT+CMGS=\"+8801715528642\"\r");
delay(100);
Serial.println("SYSTEM READY");
delay(100);
Serial.println((char)26);
delay(2000);
}
void SendMessage2()                    // FAN OFF
{
Serial.println("AT+CMGF=1");
delay(100);
Serial.println("AT+CMGS=\"+8801715528642\"\r");
delay(100);
Serial.println("BALANCE REFILLED BY TK 50.0 BDT.successful ");
delay(100);
Serial.println((char)26);
delay(2000);
}
void SendMessage3()                    // FAN OFF
{
Serial.println("AT+CMGF=1");
```

```
delay(100);
Serial.println("AT+CMGS=\"+8801715528642\"\r");
delay(100);
Serial.println("BALANCE REFILLED BY TK 100.0 BDT.");
delay(100);
Serial.println((char)26);
delay(2000);
}
```