

# SMART ENERGY METER WITH LOAD CONTROL

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**ABSTRACT:-** *The present research work is dedicated to decrease the consumption bill providing by the energy meter reading to the users as the system of energy billing is error prone, time and labour consuming. The main aim of our proposed work is facilitate energy consumption units, power voltage, cost of billing and over voltage status in a smart way. The method deployed herein is the use of microcontroller (PIC16F877A) that is used to processing the data and displaying the results. The voltage sensing circuit (VSC) and current sensing circuit (CSC) is interfaced with the microcontroller and the data is thus displayed in LCD display and virtual terminal of Proteus software. Apart from that the data is transferred to the HyperTerminal with the help of DB9 connector and virtual serial port emulation (VSPE). The work is resolving in proteus software as well as in HyperTerminal a software of Docklite.*

**KEYWORDS :-** Energy meter, microcontroller, VSC, CSC, Proteus , HyperTerminal etc

## 1.INTRODUCTION

This paper describes a development towards the minimization of specialized errors and decrease in human reliance in the meantime. As electricity is one of the fundamental prerequisites for sustainment of comforts of life thus it ought to be utilized sensibly for its appropriate use. With the assistance of this task the month to month vitality utilization of a shopper will be gotten from a remote area specifically. In this way human effort expected to record the meter readings which are till now recorded by visiting every home exclusively is lessened. This outcomes in extensive loss of human hours and furthermore gives impressive insights in regards to the normal utilization of a locality with the goal that power supply can be made by these information.. This thought is economical efficient also in light of the fact that the meter reading can be gotten at a very low cost. The usage is done so that the data is send to the HyperTerminal whose perusing is to be noted and building power utilization perusing back to the vitality supplier remotely.

## 1.2 BLOCK DIARAM

The implementation of this work involves the software stages. The software aspect involves the programming and monitoring commands development. The block outline of the system is shown. The plan utilizes the standard of serial communication of microcontrollers. The controller takes readings from the meter and sends it to the hyper terminal with the help of DB9 Connector. DB9 connector empowered module is utilized to impart to the end client.

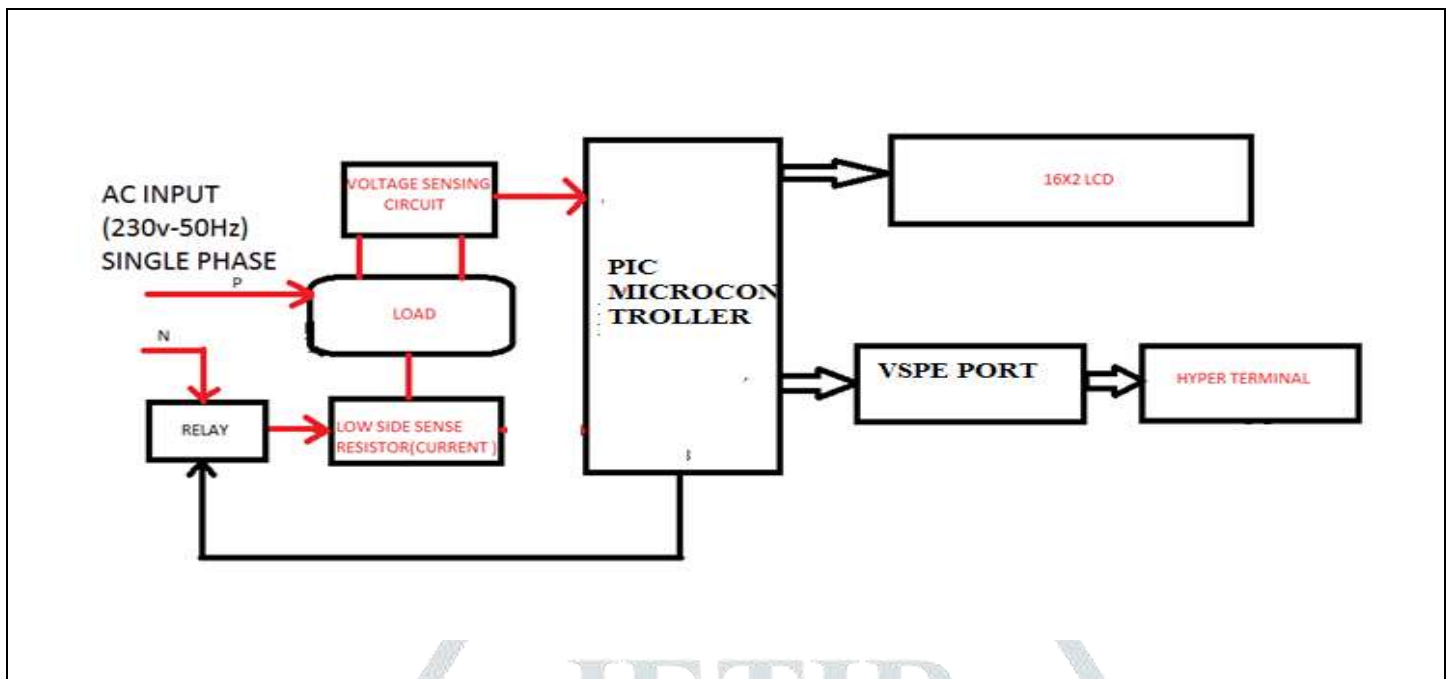


FIGURE 1.2 BLOCK DIAGRAM OF PROPOSED SYSTEM

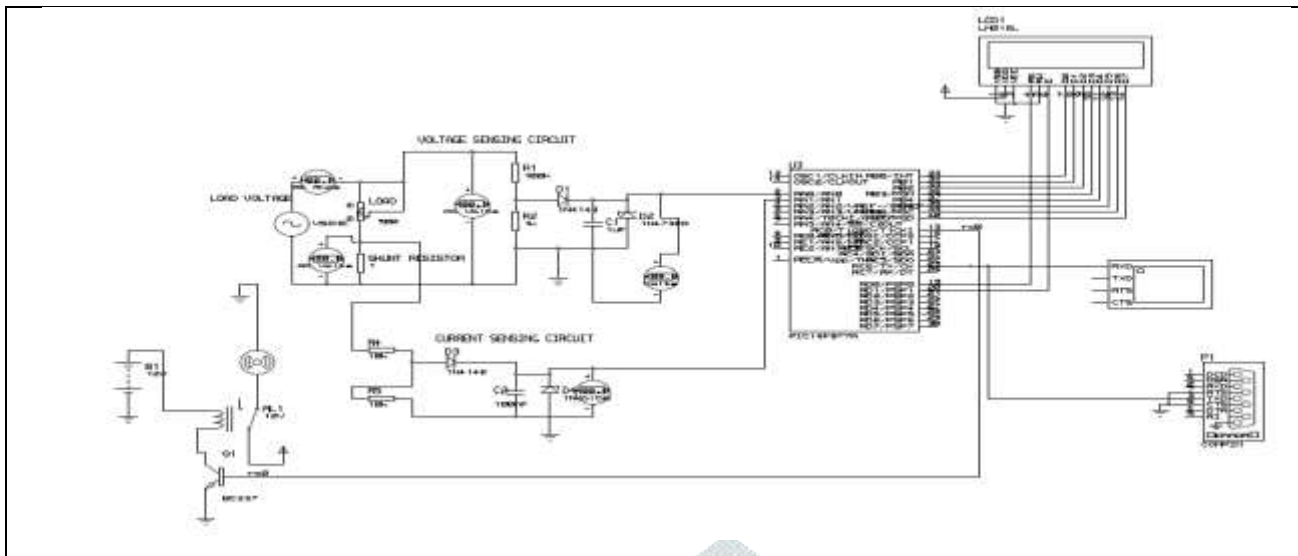
## 2. METHODOLOGY

In the existing system, electricity meter perusing for power utilization and billing is done by human laborers from home to home and working to structures. This requires enormous number of laborers and long working time to accomplish finish zone information accumulation and billing. Human laborers charging are inclined to perusing mistake as at some point the houses electric meter is set where it isn't effortlessly open. labour charging work is at some point likewise confined and backed off by natural condition. Paper billing has the propensity of losing in the post box. The expanded improvement of private lodging and mechanical structures in the creating nation such as, India require more human laborers and longer working hours to finish the use perusing errand. These builds the vitality supplier activity costs for meter perusing.

### 2.1 PROPOSED WORK

The project consists of a Power meter reader system with HyperTerminal as well as LCD. The energy department needs to send its employees every month in order to take energy meter readings. This is an expensive as well as a time consuming system. Our project determines a more efficient way to get energy meter readings. Both Electricity Company as well as user gets their energy meter readings via LCD and hyper terminal. User can also control the system. The energy meter is interfaced to a microcontroller. The energy meter readings are also read by the microcontroller and displayed on an LCD Screen, this data is also sent to hyper terminal via DB9 connector through the VSPE is interfaced to the micro-controller. On receiving particular user request it sends required signal to the microcontroller in order to do counting for required operation. It can switch loads On/Off as desired.

. Smart meters has been designed for various features like remote monitoring of energy consumptions, remote turn ON/OFF power supply, with time varying pricing system, capable of monitoring power quality etc. Developments in information management and remote monitoring technology can play a vital role in energy management. Smart meter reading cooperate both utilities and consumers in power management, giving them detailed information about power consumption. This article proposes the advance features & application method of a smart metering system compared over traditional Energy meters which can address issues in the power distribution.



**FIGURE 2.1 CRICUIT DIAGRAM OF SMART ENERGY METER WITH LOAD CONTROL**

This paper also makes the consumer an active part of Energy Management duly monitoring the various parameters like voltage, current, power factor etc., directly in the Smart meter, (or) in the PC through VSPE and necessary precautionary measures can be taken to improve power factor, and to minimize energy loss. with time changing estimating framework, , fit for checking power quality and so forth. Advancements in data administration and remote observing innovation can assume a crucial job in vitality administration. Smart meter perusing participate the two utilities and buyers in power administration, giving them definite data about power utilization. This article proposes the development highlights and application strategy for a shrewd metering framework looked at over conventional Energy meters which can address issues in the power dispersion. This paper likewise makes the buyer a functioning piece of Energy Management properly checking the different parameters like voltage, current, control factor and so forth., specifically in the Smart meter, (or) in the PC through VSPE port and vital prudent steps can be taken to enhance control factor, and to limit energy loss

### 3. WORKING

The energy meter is connected with the power supply .a auxiliary supply is given to the microcontroller area The meter and microcontroller are connected to each other to complete the task. In this meter a predefined reset is set for the load utilization and when the client comes at the set point hand-off will gets off. The signal can be any of the language which is fused with the system. A LCD is connected with this system which consistently demonstrates the present status of load utilization.

Energy meters are electronic instruments used to gauge the measure of electric vitality utilized by purchasers in a circuit inside a living arrangement zones, industry or business at some random time. They are frequently adjusted in the unit of electric energy, kilowatt-hour (kWh). Condition 1 demonstrates the scientific articulation for the result of the power devoured and the time of utilization while Equation 2 and 3 communicates the connection between power, vitality and time.

$$P=I*V \dots\dots\dots (1)$$

$$E=I*V*t \dots\dots\dots (2)$$

$$E=P*t \dots\dots\dots (3)$$

Where; E= Energy in kilowatt-hour, P= Power consumed in kilowatts, t= time in hours. The major challenge encountered in the existing metering system is the energy theft which reduces the efficiency of electricity transmission in the world

The working of the above circuit of Smart based energy meter with load control is explained as follows :

- The voltage sensing circuit converts AC voltage across load to be measured by microcontroller
- The low side current shunt resistor is used to measure current consumed by load
- With the help of measured values power can be calculated as

$$P = \text{VOLTAGE} \times \text{CURRENT}$$

- From the power we can calculate energy as

$$\text{ENERGY} = \text{POWER} \times \text{TIME}$$

$$\text{COST} = \text{ENERGY} \times \text{TIME}$$

- In case of if the measured energy value increases over predefined value one relay will be cut-off supply to the load
- After that the calculated values are send through microcontroller to the LCD display
- From LCD display data will be send to the hyper terminal through the DB9 connector and virtual serial port emulation

## 4.RESULTS AND DISCUSSIONS

This describes the assessments did of the system from simulation path through to conclusive development. Detailing the outcomes acquired from simulation Prior to the development of the work, the circuit was first structured utilizing Proteus design suite. The Proteus Design Suite is a Windows application for schematic catch, recreation, and PCB organize designs. It might be very well in various courses of action, dependent upon the proportion of plans being delivered and the necessity for microcontroller

### 4.1 DESIGN PROCEDURE IN ISIS

**Step 1:** Click on ISIS software and select the New design in File menu an outlined sheet will be opened

**Step 2:** Select the component mode ‘

**Step 3:** Select the Pick from Libraries. The categories of components available and a search option to enter the part name. type the keyword and that in the design library

**Step 4 :** After selection of components will be displayed in the design library

**Step 5 :** Start the design

### 4.2 VIRTUAL SERIAL PORT EMULATOR

This virtual COM port programming permits making a unlimited number of virtual ports that will be quickly perceived by programming and equipment you introduce. No real equipment sequential ports are possessed when utilizing this application. In the meantime, made virtual ports work indistinguishable route from real ones giving strict baud rate copying and full Hand Flow control support. Applications speaking with made virtual ports treat those ports a similar way they would speak with real ports. desktop. click on the virtual serial port emulator and click on the device type and select pair between COM1 and COM 2 as shown below and start the emulation by clicking on the emulation button

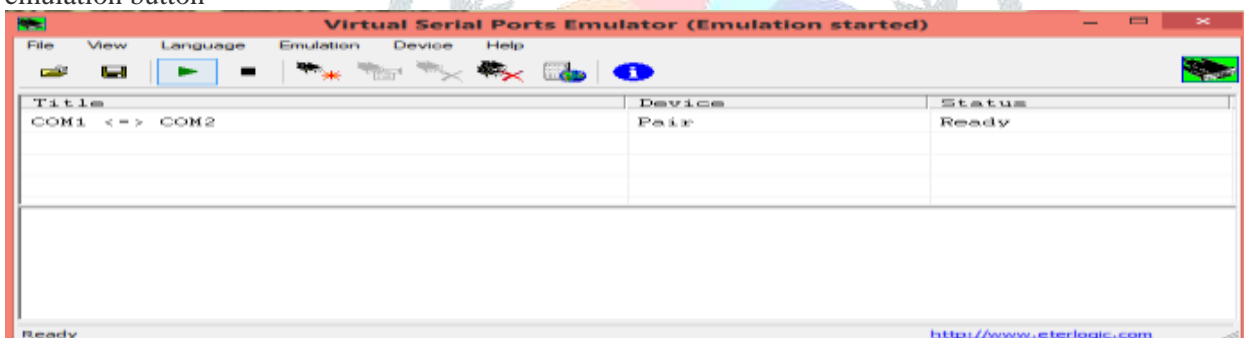


FIGURE 4.2 VIRTUAL SERIAL PORT

### 4.3 DOCKLITE

Docklite will work with the COM correspondence ports given by your Windows working system. Physically, these ports will be RS232 SUB D9 interfaces much of the time. Be that as it may, it is additionally conceivable to utilize Docklite for other correspondence models, for example, RS485 and RS422, which have an alternate electrical plan to RS232

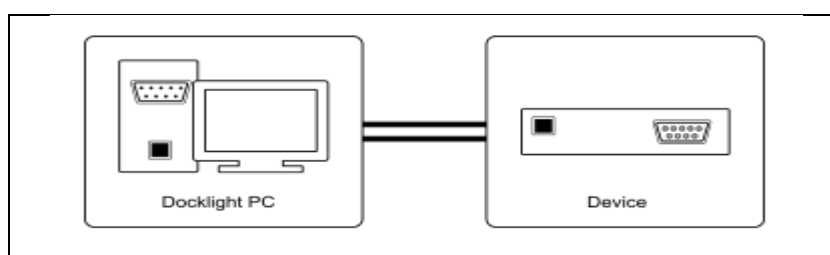


FIGURE 4.3 DOCKLITE PC SIMULATES DEVICE1 TO TEST DEVICE 2

### 4.4 SOFTWARE DESIGN

The program was composed in C# and afterward inserted on the microcontroller. The program was ordered utilizing MPLAB programming. This was done with the end user to perceive how the circuit would function under genuine conditions. The DB9 was likewise associated by means of VSPE ports to send information to the hyper terminal The MPLAB programming code of the smart energy meter with load control is shown as

```

#include <pic.h>
#include "pic_lcd.h"
#include "pic_serial.h"
#include "pic_adc.h"

#define key RB5

void mob_send();
//void mob_init();

unsigned char K[90],V1,C1,M,e2;

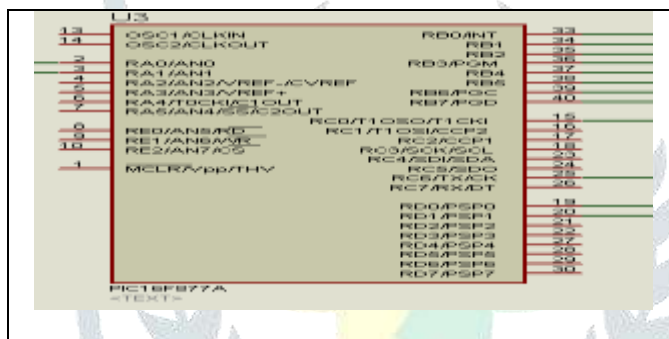
void main()
{
    ADCON1=0x0C;
    TRISD=0x00;
    TRISA=0xFF;
    TRISC=0x01;
    TRISA=0x03;
    LCD_Init();
    LCD_Display(0x80,"VOLT AND CURRENT",16);
    LCD_Display(0x80," THROUGH SMS ",16);
    Delay(5000);Delay(5000);
    LCD_Command(0x01);
    Serial_Init(9600);
    Serial(0);
    mob_init();
    LCD_Display(0x80,"VOLT",16);
    LCD_Display(0x80,"CURR:",16);
    while(1)
    {

```

FIGURE4.4 C PROGRAMMING FOR MICROCONTROLLER

### 4.5 WORKING PROCEDURE

The simulation will work on the following steps as mentioned below



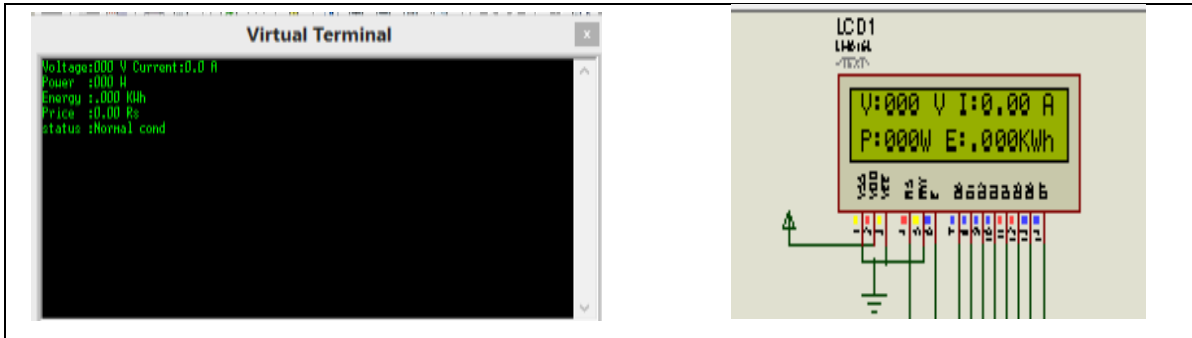
1. Double click on the PIC microcontroller and load the hex file



2. Hex file has been load and then click on the run the circuit
3. When the circuit will run the results will be displayed on virtual terminal as well as in LCD display 16x2
  - Power
  - Current
  - Voltage
  - Energy
  - Cost
  - Overvoltage status
4. Then the data is transferred from LCD to hyper terminal with the help of DB9 connector and VSPE com ports

**4.6 SIMULATION RESULTS**

**1. At NO LOAD CONDITION THE READING AT VIRTUAL TERMINAL AND DISPLAY IS SHOWN**



**FIGURE4.6.1 VIRTUAL TERMINAL AND LCD DISPLAY READING AT NO LOAD CONDITIONS**

**2. WHEN LOAD IS INCREASED THE VALUES OF POWER, CURRENT,ENERGY , COST DISPLAYED ARE AS**



**FIGURE 4.6.2 VIRTUAL TERMINAL AND LCD DISPLAY READINGS WHEN LOAD IS INCREASED**

From the above reading only we can easily calculate the power as it is displayed. We know that from the basic equation

$$P = V \times I$$

Here at voltage  $V = 220\text{v}$  and  
 Current  $I = 2.1 \text{ A}$   
 SO, Power  $P = 220 \times 2.1$   
 $P = 462 \text{ W} \dots\dots\dots \text{I}$

As this power is displayed in the virtual terminal display, in order to calculate energy from the power we had assumed a time of one hour

As we know that  $E = \text{POWER} \times \text{TIME}$   
 $E = 462 \times 1 / 1000$   
 $E = 0.462 \text{ KWh} \dots\dots\dots \text{II}$

For calculating the cost of the we had assumed per unit cost as Rs 2

SO, COST OF BILLING = ENERGY X COST PER UNIT  
 Cost =  $0.462 \times 2$   
 Cost of billing = Rs 0.924

**3. OVERVOLTAGE STATUS I, E NORMAL OR ABNORMAL CONDITIONS**

We had assumed this simulation for normal house so for normal house if current is less than 4 Amps then the status will be displayed as normal condition and if we take load as 10% then current will be more than 4 Amps and motor will be dripped off automatically and status will be displayed as abnormal conditions as shown below

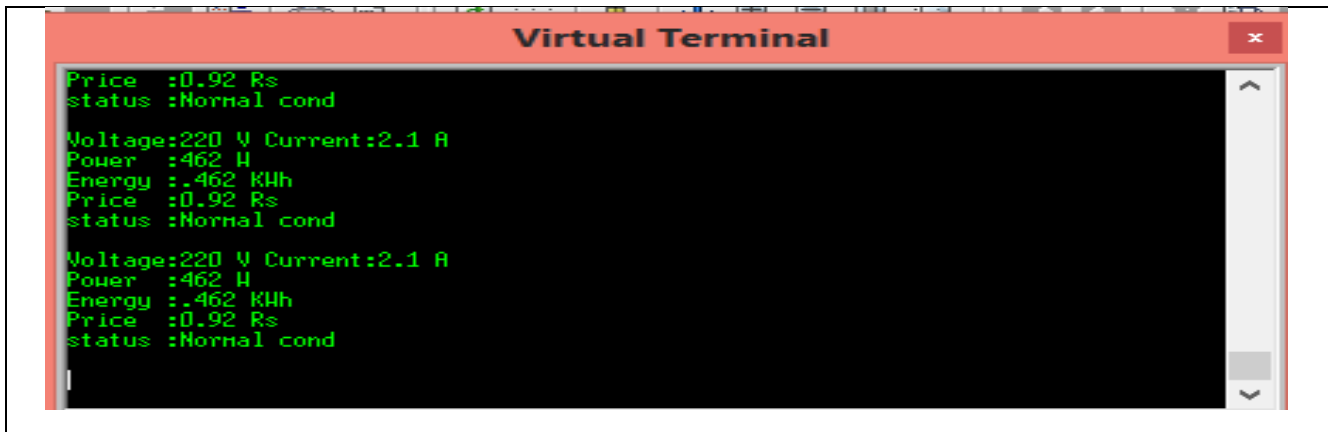
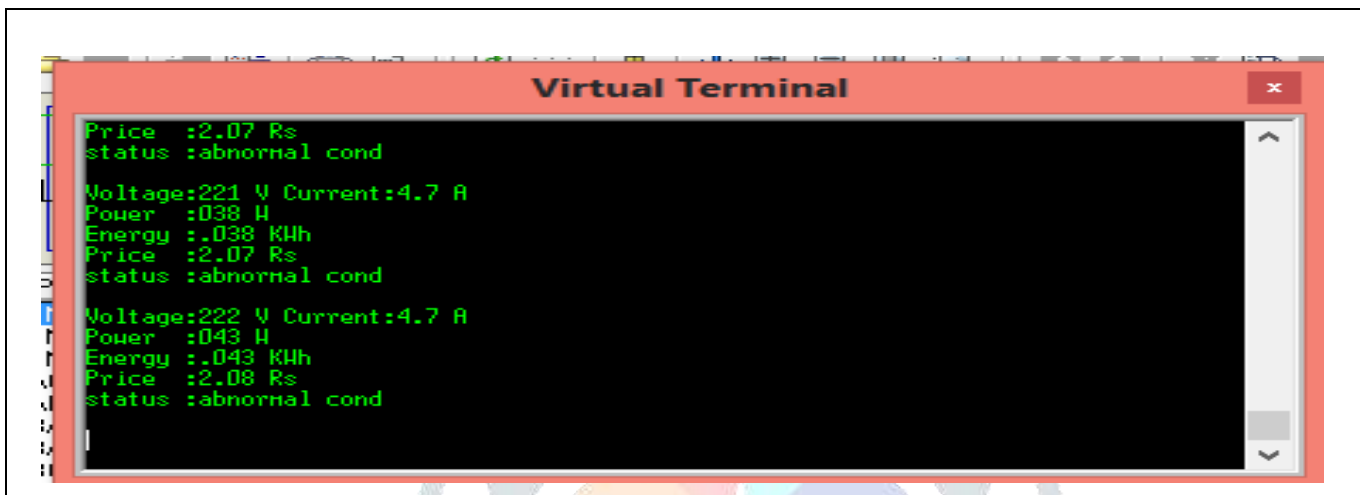
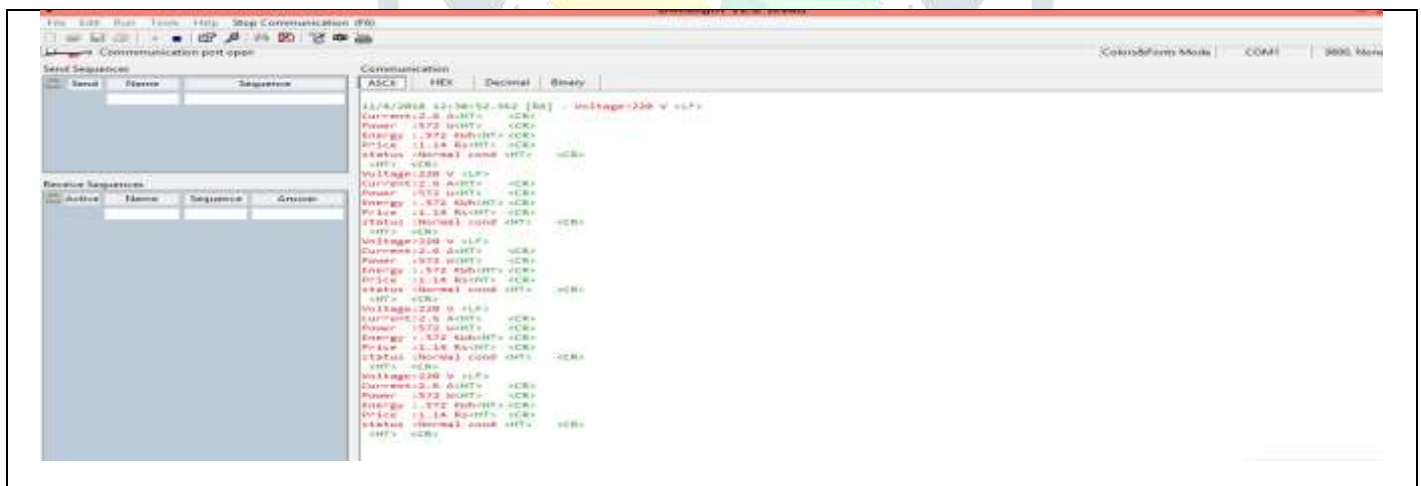


FIGURE4.6.3(A) NORMAL CONDITIONS AND CURRENT IS LESS THAN 4 AMPS



(B) ABNORMAL CONDITIONS AND CURRENT IS MORE THAN 4 AMP

From this the data is transfer to hyper terminal a Dock lite software via VSPE as shown



### 5. CONCLUSION

Based on the above results we had found out the objectives i.e power, voltage, current, energy and cost of billing ,the microcontroller is used to processing the data here as we are using input circuit instead of energy meter. From that data we can calculate billing, Therefore it avoids human intervention, provides efficient meter reading, avoid the billing error and reduce the maintenance cost. It displays the corresponding information on LCD for user notification. This simulation data is send to the HyperTerminal with the help of Virtual Serial Port emulator. From this I conclude that in order to implementing this system we can also control the usage of electricity , this system to save time of consumer, the consumed energy with the corresponding price is displayed by Virtual terminal as well as in HyperTerminal.

## 5.1 FUTURE SCOPE

In future, we can interface a GSM modem to HyperTerminal software through RS232 USB cable which transfers data from HyperTerminal to the GSM. The electricity department and the user can get the readings of the energy meter of consumer via SMS. This GSM modem can also receive commands from the cell phone to control the owner's electrical loads. This makes flexible for both user and company.

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