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AUTOMATIC ENERGY BILL SHOWING ON SINGLE PHASE ENERGY METER

Rupali T. Bansode
Assistant Professor, Electrical Engg., FTC Sangola, India
rbansode1991@gmail.com

Dhanraj D. Daphale
Assistant Professor, Electrical Engg., SVERI Pandharpur, India
daphale3d@gmail.com

Pallavi M.Bile
Assistant Professor, Electrical Engg., FTC Sangola, India
Pallavibile93@gmail.com

ABSTRACT
This paper presents the way of billing which shows that there is no need of any human being for billing purpose. It can be done automatically with the help of microcontroller program. In this paper a cost effective novel single phase digital energy meter is developed with the help of Microcontroller which is capable of calculating true value of active, reactive, apparent power, power factor and energy consumed. The designed meter is simple, portable and easily reconfigurable according to specific need. The parameters calculated are transmitted to the billing on energy meter display. In this for the we communicate to eliminating the need for the utility personnel calculate meter reading without any manual calculations. This data gets logged in and is used for generating bills and can also be used for analysis in the order to improve the power quality and understand the load and use pattern. The detailed bill generated easily and show to display of single phase energy meter.

Introduction

An electricity meter we are using for the measurement of what quantity of electric energy taken by a residence, business, or an electrically powered device. There are two types of meters- electromechanical and Electronic. The most commonly used electrical energy meter is known as electromechanical induction watt-hour meter. The operation of electromechanical induction meter is to count the number of revolutions of a non-magnetic disc which is electrically conductive. The power can be measured by this device because it is proportional to the speed of rotation. The energy can be measured by number of revolutions because both are proportional to each other. The LCD or LED display is used to show how much energy is consumed by electronic meter. Electronic meters along with billing can also use for record parameters of the load and supply for example current and maximum demand rate, voltages, power factor and reactive power used etc. In these days, the customers are unsatisfied services that are provided by the MSEB. Nowadays, an

employee from electricity office visits every house periodically, takes the reading of meter and submits these readings at main office. These readings are used to generate the bill. Due to human interventions in all these processes there are chances of error. For instance, if the house is closed for a long time then the average of reading of meter is taken by the office. In such a case it is require that customer must go to the office to correct the bill. The traditional method of electricity billing process requires a large number of labors for the collection of data and billing. There are chances of losing the printed electricity bill in the mailboxes. If the weather conditions are not good the billing through human being is slowed down. Hence an Automatic Electricity Billing method can be used which is an effective method of data collection, data processing and calculation of bill. Automatic electricity billing is a technology in which information is collected from the energy meter. Bill is calculated from the meter itself.

Block diagram:

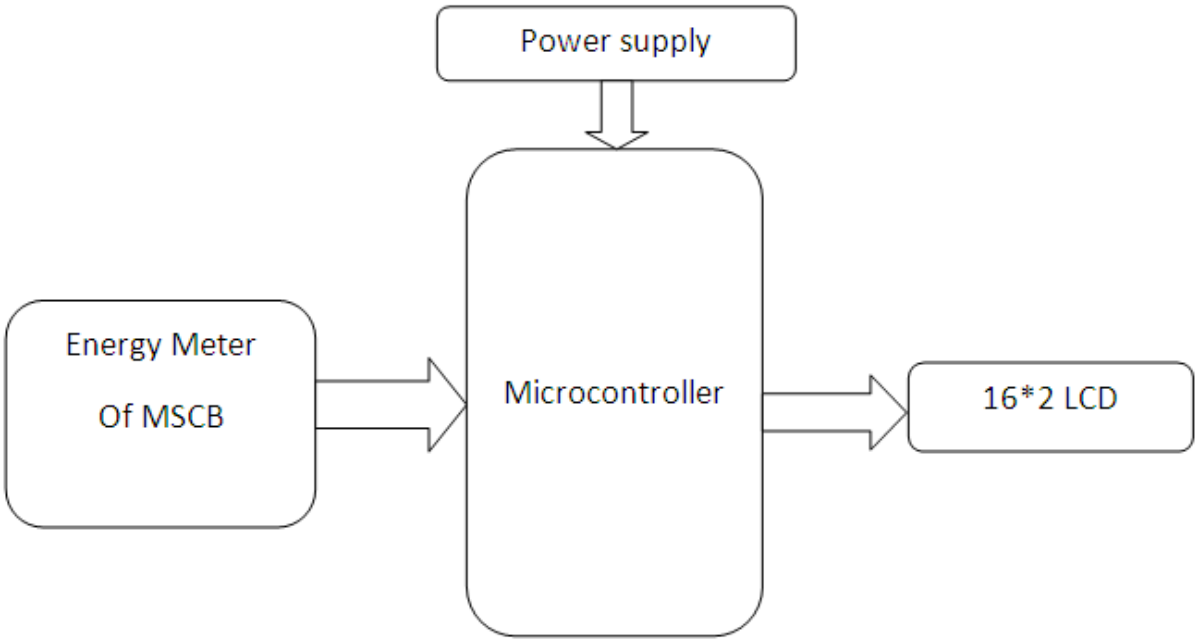

Figure 1: Block diagram of Automatic energy bill showing on single phase energy meter

This figure shows the block diagram of Automatic energy bill showing on single phase energy meter.Which indicates that the microcontroller AT89C51 Microcontroller is used for the energy

meter.The microcontroller is supplied through electrical supply. The energy meter of MSEB which is provided in our primes is connected with microcontroller.There is 16*2 LCD display is provided for the display purpose.

Circuit diagram:

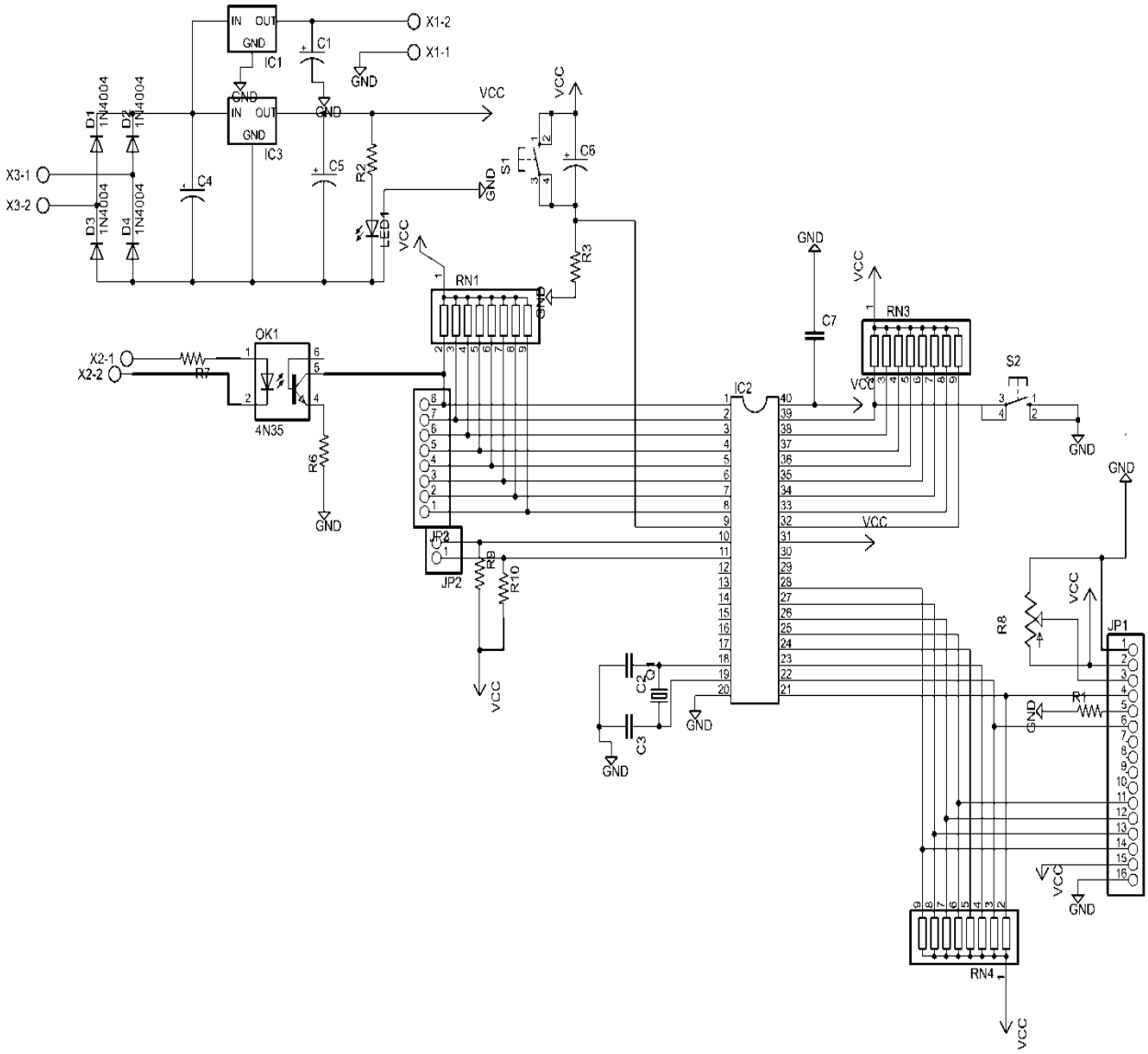

Figure 2: Circuit diagram of Automatic energy bill showing on single phase energy meter

The above figure shows the circuit diagram for Automatic energy bill showing on single phase energy meter. In this figure all the components are shown on the matlab Simulink .This Simulink model is the

Simulink of the hardware model and hence give result equivalent to it. This model uses the no.of diodes,capacitors,regulator,resistors,LED,microcontroller etc.

System Development Working

Requirements

Electrical and thermal requirement

The PCB designer must be aware of the circuit performance in critical aspects of the same concerning electrical conditions and the environment to be used in.

Mechanical requirement

The designer should have the information about physical size of the board, type of installation of board (vertical/horizontal). The method of cooling adopted, front panel operated components etc.

Component placing requirement

All components are too placed first in a configuration that demands only the minimum length for critical conductors. These key components are placed first and the others are grouped around like satellites.

Component mounting requirements

All components should be placed parallel to one another as far as possible .i.e. in the same direction and orientation mechanical over stressing of solder should be avoided.

Layout Methodology

For proper layout design minimal steps to be followed are:

Get the final circuit diagram and component list.
Choose the board types, single sided / double sided / multilayer
Identify the appropriate scale for layout.
Select suitable grid pattern.
Choose the correct board size keeping in view the constraints.
Select appropriate layout technique, manual / automated.

Document in the form of the layout scale.

Art Work

Art work is scaled configuration which is accurate of the printed circuit from which the master pattern is made photographically.

Art Work Rule

Rules followed while selecting art work symbol takes:
There should be Minimum spacing between conductor and pad is 0 / 35 mm in 1:1 scale.
There should be Minimum spacing between parallel conductors is 0.4 mm in 1:1 scale.
The non-PTH solder pad area should not be less than 5 sq.mm.
For maximum temperature rise of 20 °C. The width of current carrying conductors should be determined.

General Art Work Rules

It is assume that conductors are parallel to any one of the edge of the board when there is higher conductor density. When conductors are placed in other direction preference should be given to the 45° direction or to the 30° / 60° direction. Whenever conductors have a sufficient space they can be run in any direction so as to achieve sorted possible interconnection.
Equally distributed spacing is to be provided when three or more conductors run along a direction and / or between two pads. Minimum spacing is provided when three or more lines run along a direction and / or between two pads. The diameter of solder pad required to be approximately 8 times the drilled hole.

Used software for programming:

We have used Micro c for programming and debugging in that 8051. The mikroC PRO for 8051 is a tool which powerful, feature-rich for 8051 microcontrollers. When we use it there is no need of compromising performance or control of 8051.It provide the programmer the easiest solution to developing applications for embedded systems,.8051 and C fit together well: 8051 is the most popular 8-bit chip in the world, used in a wide variety of applications, and C, prized for its efficiency, is the natural choice for developing embedded systems. MikroC PRO for 8051 Gives

us a features of highly advanced which match with IDE, ANSI compliant compiler it also gives us broad set of hardware libraries, comprehensive documentation, and plenty of ready-to-run examples.

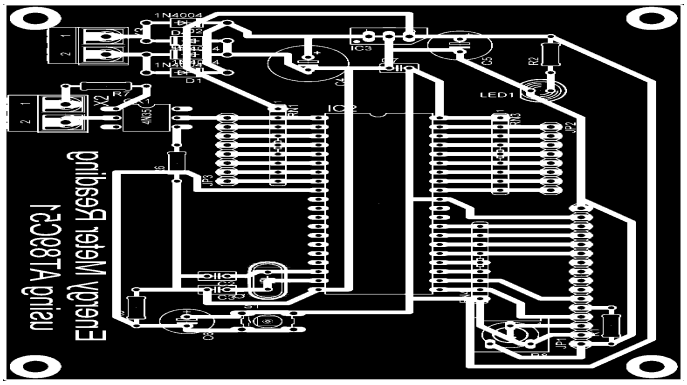

Figure 3: PCB layout

Component List.

Table 1: Component List

SR.NO	Name of component
1.	Energy Meter
2.	AT89C51 Microcontroller
3.	Opto Isolator
4.	Pull-up resistor
5.	Crystal oscillator
6.	Regulated Power Supply
7.	Diodes
8.	Capacitors
9.	Regulator 7805
10.	LED
11.	LCD 16x2
12.	PCB
13.	Variac
14.	Push Button
15.	Resistors

Energy Meter:

Figure.4 Single phase energy meter

LED Pulse Generation On Meter

In electricity meters, the energy consumed is normally measured in fraction of kilowatt-hour (kWh) pulses. This information we can use to accurately calibrate any meter or to report measurement during normal operation. To serve both of these tasks efficiently, the microcontroller must accurately generate and record the pulses number. This is a general requirement to generate these pulses with relatively little jitter. Although time jitters are not an indication of bad accuracy, because when the jitter is averaged out, it can give a negative impression of the overall accuracy of the meter.

The sample code uses the average power to generate the energy pulses. The SD24 interrupt is accumulating the average power. This is nothing but it is converting it to energy. The pulse is generated when accumulated energy crosses a threshold. In the next interrupt cycle the magnitude of energy above this threshold is stored, and new energy amount is added. Because the average power tends to be a stable value, this way of generating energy pulses are very steady and free of jitter.

The threshold determines the energy tick specified by the power company and is a constant, for example, it is in kWh. In most meters, the pulses per kWh decide this energy tick. For example, in this application, we are setting the number of pulses generated per kWh to 1600 for active and reactive energies. The energy tick in this case is 1 kWh/1600. Energy pulses are generated and

also indicated through LEDs on the board. There is control is provided over the pulse through Port pins are toggled for the pulses. The average power is in units of 0.01 W and 1 kWh threshold is defined as:

1 kWh threshold = 1 / 0.01 × 1 kW × (number of interrupts/sec) × (number of seconds in 1 hour) = 100000 × 3906 × 3600 = 0x14765AAD40.

AT89C51 Microcontroller

Advantages

It is a smaller computer

Has on-chip RAM, ROM, I/O ports...

Pin Diagram

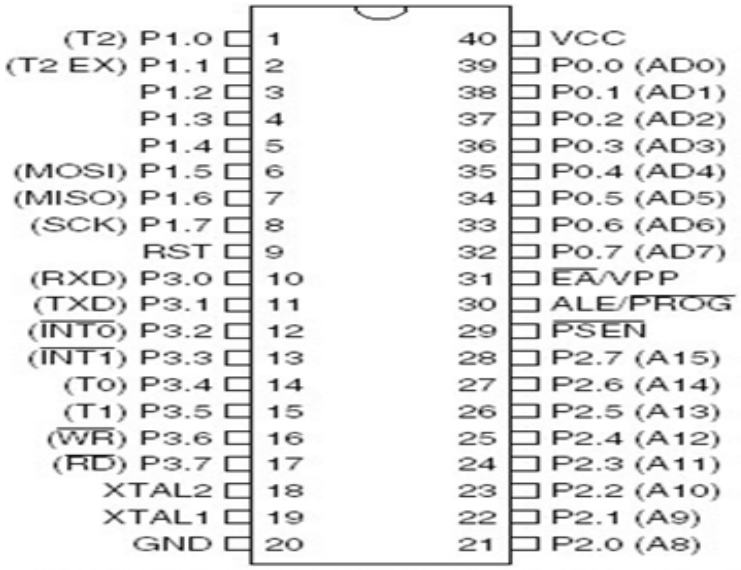

Figure.5 Pin diagram of AT89C51 Microcontroller

This figure shows the pin diagram of microcontroller AT89C51.This is the main component of the energy meter.The all other component is need not to be expalined in detail.The microcontroller is programmed using c-program.By using the program microcontroller works for automatic energy billing.Here is the progamming for the microcontroller is provided.

C Programing

Program

Version:0.9 StartHTML:0000000105 EndHTML:0000013041
StartFragment:0000001197 EndFragment:0000013025

```
// Lcd module connections

sbit LCD_RS at P2_0_bit;

sbit LCD_EN at P2_1_bit;



sbit LCD_D4 at P2_2_bit;

sbit LCD_D5 at P2_3_bit;

sbit LCD_D6 at P2_4_bit;

sbit LCD_D7 at P2_5_bit;

// End Lcd module connections /////////////////



sbit RLY1 at P3_0_bit;

sbit RLY2 at P3_1_bit;

sbit SW1 at P1_0_bit;

sbit SW2 at P1_1_bit;

sbit SW3 at P1_2_bit;

//////////////////////////////////////////

char text1[] = "COUNT=       ";
```

```
char text2[] = "UNIT =       ";

unsigned int x1,x2,Dinx;

char dig0,dig1,dig2,dig3,s1,s2;

bit d1,d2;


////////////////////////////////////////////////////////////////////////

////////////////////////////////////////////////////////////////////////

 void conv(void)

 {

 Dinx =x1;

 dig0 = (Dinx % 10) ;

 dig1 =((Dinx /10) %10) ;

 dig2 =((Dinx /100))%10 ;

 dig3 =((Dinx /1000) %10) ;


text1[7]=dig3+0x30;

text1[8]=dig2+0x30;

text1[9]=dig1+0x30;

text1[10]=dig0+0x30;

 }
```

```
////////////////////////////////////////////////////////////////////////////

void conv1(void)

{

Dinx =x2;

dig0 = (Dinx % 10) ;

dig1 =((Dinx /10) %10) ;

dig2 =((Dinx /100))%10 ;

dig3 =((Dinx /1000) %10) ;


text2[7]=dig3+0x30;

text2[8]=dig2+0x30;

text2[9]=dig1+0x30;

text2[10]=dig0+0x30;

 }

////////////////////////////////////////////////////////////////////////////

void main()

{

P2=0x00;

P0=0x00;

P3=0x01;
```

```
P1=0xFF;
 x1=0;
  x2=0;
 RLY1=0;
 RLY2=0;

 Lcd_Init();                    // Initialize Lcd
 conv();
   conv1();
 Lcd_Cmd(_LCD_CURSOR_OFF);          // Cursor off
 Lcd_Out(1,1,text1);                // Write text in first row
  Lcd_Out(2,1,text2);
 Delay_ms(100);

while(1)
{
 while(SW1 == 1);
            {
            //x2=0;
            x1=x1+1;
```

```
        conv();
        conv1();
        Lcd_Cmd(_LCD_CURSOR_OFF);        // Cursor off
        Lcd_Out(1,1,text1);              // Write text in first row


    if(x1==3200)
      {
        x2=x2+1;
        conv1();
       x1=0x00;


      Lcd_Out(2,1,text2);


      }
       }  while(SW1 == 0);
}
```

Conclusion

This paper present a model for Automatic bill calculating meter using 8051. It is demonstrated for measuring the electrical energy consumption of an electrical load for single phase system. This microcontroller based energy meter prototype which is implemented to provide upto 0.4 amp load from a 230 volt to neutral voltage. The process of reading of energy meter is done by LCD which is more simpler than that for analog meter . This energy meter has the potential to change the traditional billing system. This energy billing system is designed to help the energy

distribution companies to reduce costs and increase profits, to improve metering and billing accuracy and efficiency, and to contribute the energy in a sustainable way. The test results obtained by the model is quite satisfactory and found to be having very much less error then the experimental tolerance level. This has been observed that the system is quite stable and do not show any error or instability during its operation.

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