Design and Implementation of Digital Ammeter with PIC Microcontroller

Md.Shalha Mucha

1808016

December 12, 2022

1 Abstract

Our venture is about plan of Digital ammeter. For this reason, we arranged this report which will give subtleties data about execution of Digital Ammeter utilizing PIC Microcontroller. Digital ammeters are instruments that action current stream in amperes and show current levels on an advanced presentation. These gadgets give data about current attract and current progression request to assist clients with investigating sporadic loads and patterns. The plan of advanced ammeter is planned utilizing PIC16F877A Microcontroller.

2 INTRODUCTION

The advanced circuit of the ammeter has numerous applications in electronic, electrical, and power electronic works. The current estimation is likewise utilized in microcontroller-based projects for overcurrent assurance in circuits. Notwithstanding this application, it very well may be utilized as a computerized ammeter circuit to quantify current in electronic tests. Microcontrollers or any microcomputer framework can not peruse current straightforwardly. They just sense voltage. Microcontrollers' rationale for high and low is likewise founded on the voltage level. Consequently, microcontrollers don't detect current straightforwardly. For that reason, we want to find the current in the voltage structure. The Shunt resistor is utilized to change over current into a voltage structure. At the point when the current goes through the shunt resistor, voltage shows up across the shunt resistor. This voltage can be effectively estimated with the assistance of a simple to advanced converter channel of the PIC16F877A microcontroller.

3 METHODOLOGY

The project was implemented using the microcontroller PIC16F877A IC and the full method will be discussed here

3.1 Implementation Setup

1. A 9V dc source is applied to a 40ohm load. Current passing through this load is measured with the help of a shunt resistor and PIC16F877A microcontroller.

2. we Used a shunt resistor because of measure the current. Microcontrollers or any microcomputer system can not read current directly. They only sense voltage. Microcontrollers logic high and low is also based on the voltage level. Therefore, microcontrollers do not sense current directly. That is why we need to find current into voltage form. The Shunt resistor is used to convert current into voltage form. When current passes through the shunt resistor, voltage appears across shunt resistor. This voltage can be easily measured with the help of analog to digital converter channel of PIC16F877A microcontroller. This measured voltage value can be converted back into current in programming using ohm's law formula: $V = IR$; so current can be easily calculated by using above Ohm's law formula: $I = V/R$; R= shunt Resistance. And V = voltage across Shunt resistance.

3. In this digital ammeter circuit project, 0.5 ohm shunt resistor is used. This Value is almost same as 0.47ohm resistance. To Design 0.5ohm resistor we used two 1ohm resistor with parallel Connection.

4. current = (current * 4.89)/0.47; This statement converts output voltage of ADC to current value by using ohm's law formula. Here 4.89 is the Resolution of this PIC16F877A microcontroller. Resolution = (Vref+ – Vref-)/(1024-1) (as it is 10 bit ADC) = 5/1023 ; PIC16F877A microcontroller can measure maximum 5v. = 4.887 mV ; Thus it means that for a change in 4.887mV, the binary output changes by 1.

5. 100K ohm resistor at the input of analog to digital converter is used to protect microcontroller from high current. This is because the current always follows a low resistance path. If you don't use any resistor there, the current will start to flow towards the microcontroller instead of the shunt resistor. It will damage microcontroller permanently.

6. 1N4733A Zener diode is used to protect microcontroller from over voltage appearing across it. This is because voltage greater than 5 volts may damage microcontroller permanently.

7. we used displays namely 16×2 LCD. Liquid crystal display is interfaced with the microcontroller to display measured voltage value. Built-in analog to digital converter of pic microcontroller is used to a measured analog voltage.

8. We used 8Mhz crystal. The job of the crystal basically is to generate a fixed frequency, which is given to the microcontroller as input. In some cases, the crystal frequency is passed through a prescaler to divide the frequency as per the requirements.

9. The program code for digital Ammeter is written using mikroC PRO compiler for pic. It is very easy to use to compiler for pic microcontroller. It have large set of libraries which makes microchip microcontroller very easy to use.

4 Requirements of Components:

- PIC 16F877A microcontroller
- LM0162
- 9V battery (Quantity:2)
- Crystal (8MHz)
- Diode (1N4733A)
- Capacitor (22 PF)
- Bread Board
- Male to male wire (Quantity:30)
- Male to female wire (Quantity:10)
- Battery connector (Quantity:2)
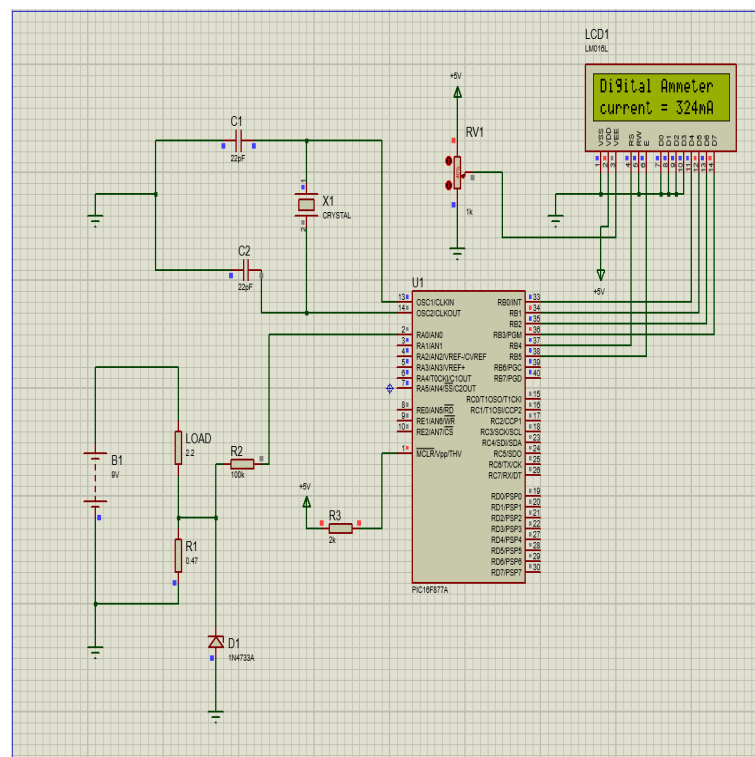- Resistor

5 Circuit Diagram:

Figure 1: Circuit diagram for Digital Ammeter

5.1 Described Steps:

i)First of we implemented our project in Proteus software. After successfully simulation in Proteus then we started implementation of Circuit.

i)firstly we connected the series circuit with 40ohm load and 0.47ohm shunt resistance. A 9V dc source is applied to this circuit.

ii)Connected 100K ohm resistor at the input of analog to digital converter is used to protect microcontroller from high current.

iii)Also connected 1N4733A Zener diode is used to protect microcontroller from over voltage appearing across it.

iV)Connected all the completed circuit with PIC microcontroller.

v)As we used displays namely 16×2 LCD, connected all pin with PIC to Show output current.

vi) Now writeThe program code for digital Ammeter using mikroC PRO compiler for PIC with Respect to Connection. It is very easy to use to compiler for pic microcontroller.

vii) Make sure to tick the following system libraries found in the Library Manager before compiling the code:

• ADC

• Conversions

• Lcd

• Lcd$_C onstants$

vii) verified the code in MikroC compiler and it showed code was written successfully.

Viii) After writing code , download the hex file code from MikroC compiler. It will be loaded in PIC microcontroller.

ix) And finally load the hex file code in PIC microcontroller using Pikkit2.

x) now we are ready to check the output current in LCD. Connect 9V battery to the main circuit and show the desired output

6 Software Implementation:

6.1 Code:

```
1  sbit LCD_RS at RB4_bit;
2  sbit LCD_EN at RB5_bit;
3  sbit LCD_D4 at RB0_bit;
4  sbit LCD_D5 at RB1_bit;
5  sbit LCD_D6 at RB2_bit;
6  sbit LCD_D7 at RB3_bit;
7
8  sbit LCD_RS_Direction at TRISB4_bit;
9  sbit LCD_EN_Direction at TRISB5_bit;
10 sbit LCD_D4_Direction at TRISB0_bit;
11 sbit LCD_D5_Direction at TRISB1_bit;
12 sbit LCD_D6_Direction at TRISB2_bit;
13 sbit LCD_D7_Direction at TRISB3_bit;
14
15 float current;
16 char curr[4];
17
18 void main() {
19
20     PORTA = 0;
21     TRISA = 0X01;
22     PORTB = 0;
23     TRISB = 0;
24     Lcd_Init();
25     ADC_Init();
26     Lcd_Cmd(_LCD_CURSOR_OFF);
27     Lcd_Cmd(_LCD_CLEAR);
28     Lcd_Out(1,1,"Digital Ammeter");
29     delay_ms(1000);
30     while (1)
31     {
32         current = ADC_Read(0);
33         current = (current * 4.89)/0.47;
34         inttostr(current,curr);
35         Lcd_Out(2,1,"current = ");
36         Lcd_Out(2,11,Ltrim(curr));
37         Lcd_Out(2,14,"mA");
38
39     }
40 }
```

7 RESULT AND APPLICATIONS

Amperes are used to measure current flow in digital ammeters, which also show current levels on a digital display. In order to assist users in troubleshooting unpredictable loads and trends, these devices provide information regarding current draw and current continuity. The internal resistance is incredibly low, and they have both positive and negative leads. Digital ammeters are connected to a circuit in series, never in parallel, to allow current to flow through the meter. High current flow could be a sign of a short circuit, an accidental ground, or a broken component. Low current flow may be a sign of poor circuit current flow or high resistance. Alternating current (AC) and direct current (DC) levels can be determined with digital ammeters (DC).
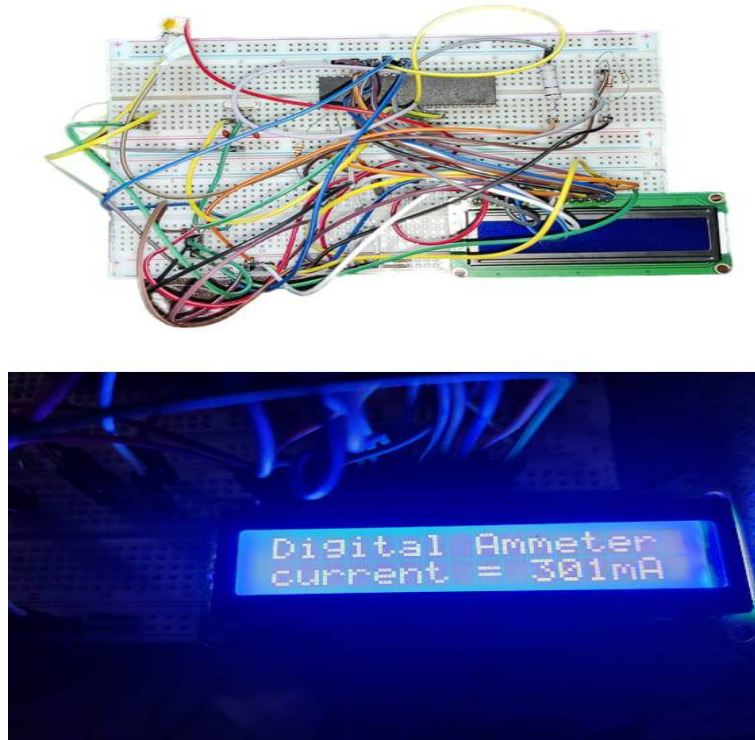

Figure 2: Digital Ammeter Implemention

The applications are:

• From businesses to educational institutions, this technology will be used.

• To make sure the flow of current is not excessively low or excessively high, these are used to measure the current flow within the building.

• The flaws of the building's circuits are frequently checked by electricians using these tools.

• To verify that the gadgets work properly, it is utilized in manufacturing and instrumentation firms.

8 Future Scope:

The scope of the ammeter we planned is 0A to 1A. The scope of the ammeter can be expanded by differing the shunt obstruction unequivocally. An accuracy "pico-ammeter" is an extremely unimportant instrument you track down in electronic labs nowadays. This actions flows down to the worth of $10^-12 A with huge accuracy.$

9 Conclusion:

The computerized multimeter shows the perusing in digits most times on a LED or LCD screen. This makes taking estimations significantly more precise. The advanced meter can quantify voltage better in view of their higher opposition of 1 M or 10 M . We effectively executed the venture anyway numerous enhancements should be possible to the task. We can build the scope of the ammeter by interfacing a reasonable low obstruction lined up with the ammeter. The precision of the ammeter can be expanded by estimating the changing current with an Interrupter. In this manner we can get 1 percent precision is to interfere with the current. This counteracts the zero offset

10 Reference:

1 Digital Ammeter Circuit
https://microcontrollerslab.com/digital-ammeter-pic/

2 Application of ammeter
https://www.ecstuff4u.com/2020/05/application-of-ammeter.html

3 Voltmeter and Ammeter using PIC Microcontroller
https://electrosome.com/voltmeter-ammeter-pic/

4 Digital Ammeter Circuit using pic 16f877a-acs712
https://circuitdigest.com/