MEASUREMENT AND INSTRUMENTATION(EEE2004)

SLOT: C1

"Digital voltmeter using Arduino"

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CERTIFICATE

This is to certify that this project "Digital Voltmeter using Arduino" is the bonafide work ***Pawan Sharma, Punit Kumar ,Shreyas Kuradagi , Vedatroyee Ghosh and Varun Singh Inda who carried out the project work*** under my supervision.

Acknowledgement

We like to express our sincere and heartfelt gratitude to Prof. Thamilmaran A Professor, Department of Instrumentation whose insight and tireless patience was invaluable in the successful completion of this project. The freedom and guidance given by her enabled us to have a enjoyable and valuable learning experience. We also thank the Dean, School of Electrical Engineering for giving us this learning opportunity. Finally we thank all the research scholars and staff affiliated to TT128 laboratory who have been part of this journey with us.

-Thank you

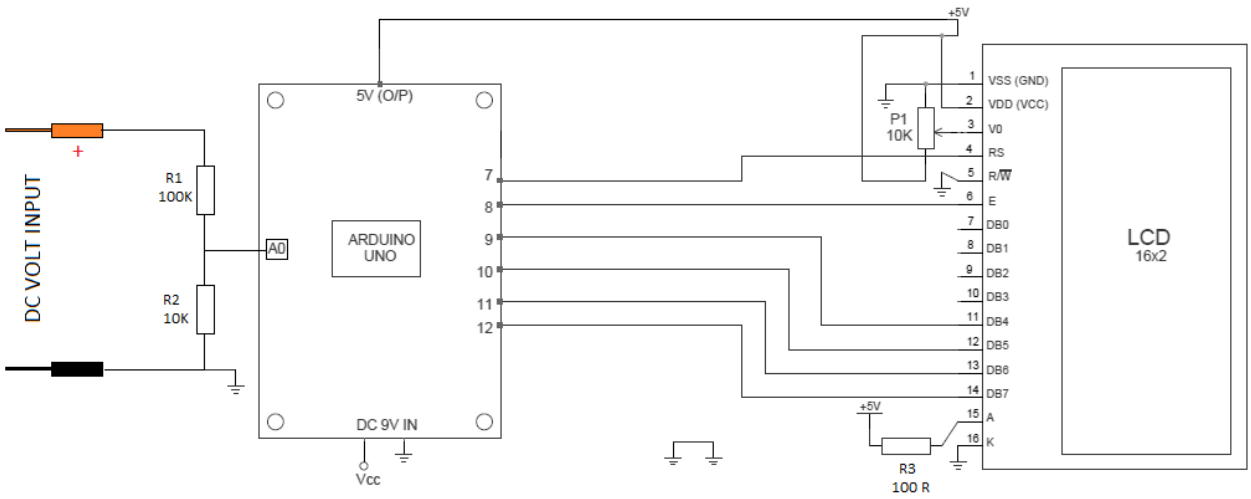
ABSTRACT

The objective of this project is to make digital meter using arduino which can measure voltage, current and resistance .This is done using voltage divider principle.

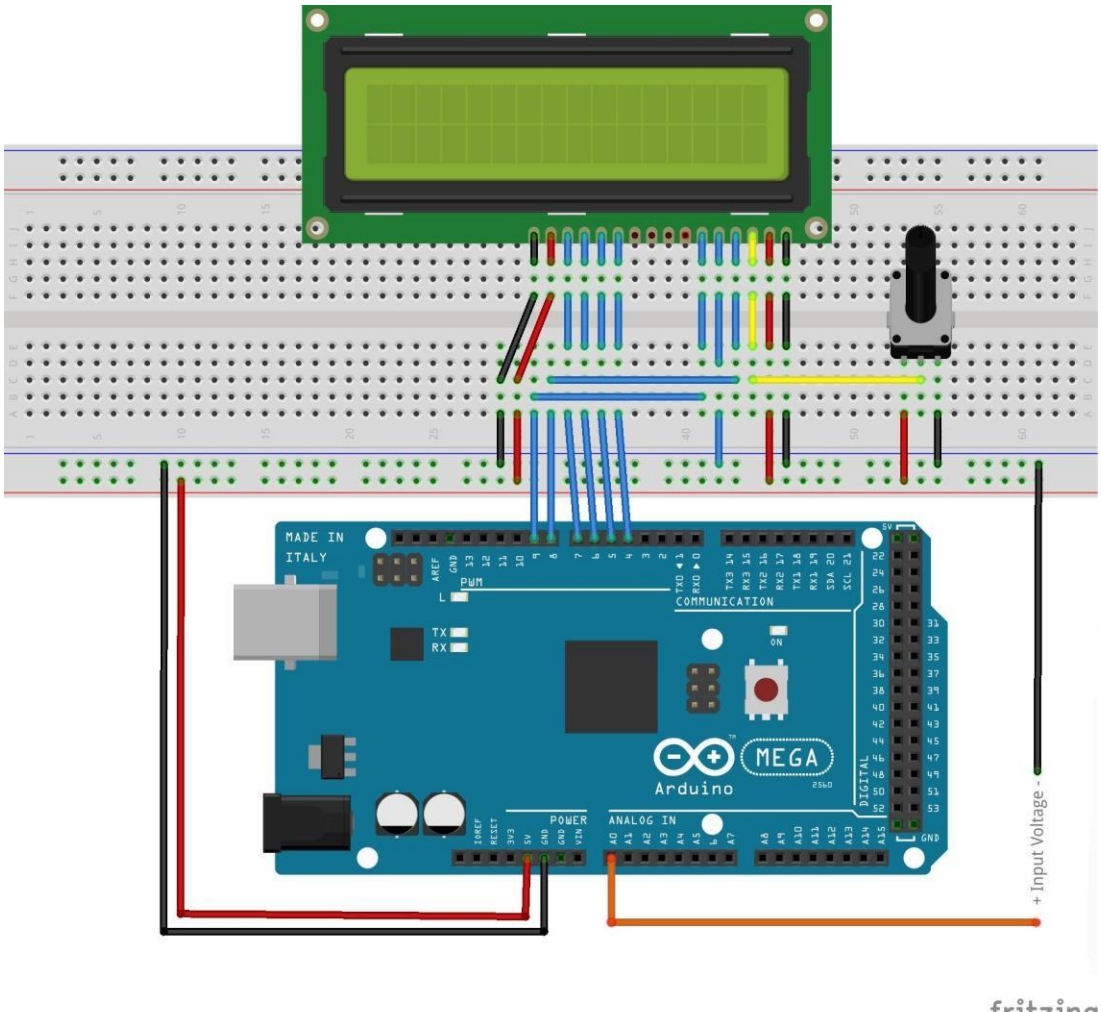
A Voltmeter is an instrument used for measuring the electrical potential difference between two points in an electrical circuit. Technically speaking, all voltmeters are basically ammeters (device that measures current in an electrical circuit), as they measure current rather than voltage. A Voltmeter is an instrument used for measuring the electrical potential difference between two points in an electrical circuit. Technically speaking, all voltmeters are basically ammeters (device that measures current in an electrical circuit), as they measure current rather than voltage. Analog Voltmeters generally have an error percentage of 5% and the parallax error is often an issue. But analog voltmeters can be used to measure ranging from few volts to several thousand volts .To overcome the defects of analog voltmeters, Digital Voltmeters are introduced. Unlike analog voltmeters, which scale and a pointer to show the measured voltage, digital voltmeters directly display the measured voltage numerical on a digital display .The percentage of error in digital voltmeters is usually less than 1% and the accuracy can be increased in precision digital voltmeters with high speed measurement and option of storing the values in a memory.

In this project, an Arduino based Digital Voltmeter which can measure voltages up to 50V is designed.

CIRCUIT DIAGRAM



CIRCUIT DIAGRAM OF Voltmeter



IMPORTANT CIRCUIT COMPONENTS

- Arduino uno
- 16x2 LCD (Liquid Crystal Display)
- 10 kohm potentiometer
  breadboard
- Male connectors
- jumper wires
- LM358 IC

(It can handle 3-32V DC supply & source up to 20mA per channel.)

CIRCUIT DESIGN

Pin 1 and 2 (Vss and Vdd) of the LCD power supply pins for display. They are connected to ground and +5V supply respectively. Pin 3 (Vee) of the LCD is the contrast adjust pin of the display.It is connected to the wiper terminal of the 10KΩ POT while the other terminals of the POT are connected to +5V supply and ground respectively.

'The next three pins of the LCD arecontrol pins. Pins 4 and 6 (RS and E) of the LCD are connected to digital input/output pins 2 and 3 of Arduino respectively. Pin 5 (RW) of the LCD is connected to ground.

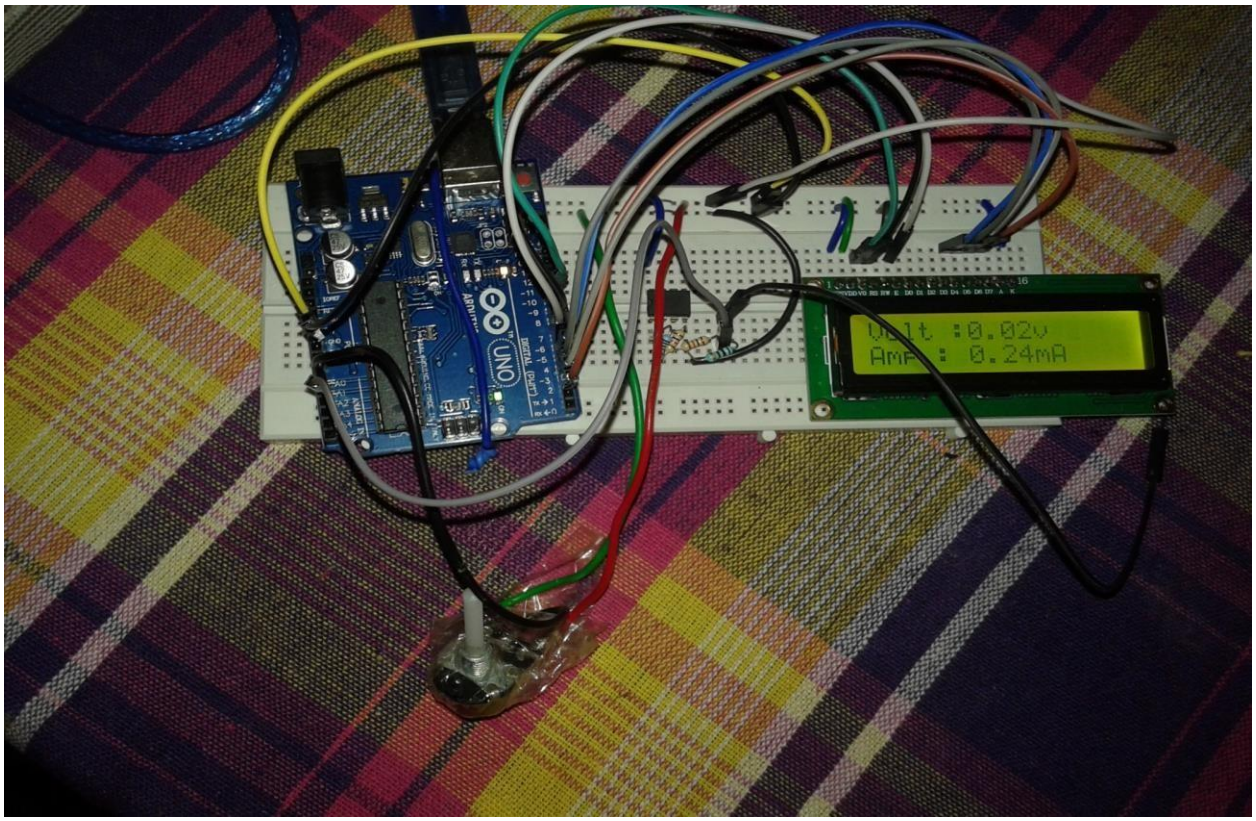
The next connections are with respect to data pins. The LCD is used in 4-bit data mode and hence data pins D4 to D7 are used. Connect pins 11 to 14 (D4 to D7) of the LCD are connect ed to digital input/output pins 4 to 7 of the Arduino. Pins 15 and 16 are the supply pins of the backlight LEDs. Pin 15 (LED+) of the LCD is connected to +5V supply through a current limiting resistor of 220Ω. Pin 16 (LED-) of the LCD is connected to ground.In the first circuit, which is used to measure voltages up to 5V, there are no additional connections and the volta -ge to be measured is connected directly to the analog input A0 of the Arduino UNO. • In the secod circuit, which is used to measure voltages up to 50V, we need to connect a voltage circ- uit additionally. The output of the voltage divider circuit consisting of 100KΩ resistor and 10KΩ resistor is connected to the analog input pin A0 of the Arduino UNO with other end of the 100KΩ resistor connected to the voltage to be measured and the other end of the 10KΩ resistor

connected to the ground. • The ground terminal of the input voltage to be measured and Arduino UNO must be common.

WORKING-

In a digital voltmeter, the voltages to be measured, which are in analog form, are converted to digital form with the help of Analog to Digital Converters (ADC). Hence, the ADC feature of theArduino UNO is utilized in this project.In the first circuit, which is used to measure a maximum voltage of 5V, the input voltage is given to the analog input pin of the Arduino. Thereference voltage of the ADC is 5V. The ADC in Arduino UNO is of 10-bit resolution. Hence, the input voltage is calculated by multiplying the analog value at the analog pin with 5 and dividing the value with 210 i.e. 1024.
The range of voltages for Arduino UNOs analog input is 0V to 5V. Hence, in order to increasethis range, a voltage divider circuit must be used.In the second circuit,the range of the analog input of Arduino UNO is increased up to 50V by using a voltage divider consisting of 100KΩ resistor and 10KΩ resistor.With the help of the voltage divider circuit,the input voltage being measured is brought down to the range of Arduino UNOs analog input. The rest of the calculations are made in the programming part of the Arduino UNO.
In a digital voltmeter, the voltages to be measured, which are in analog form, are converted to digital form with the help of Analog to Digital Converters . Hence, the ADC feature of the Arduino is utilized in this project.In the first circuit, which is used to measure a maximum voltage of 5V, the input voltage is given to the analog input pin of the Arduino. The reference voltage of the ADC is 5V. The ADC in Arduino UNO is of 10-bit resolution. Hence, the input voltage is calculated by multiplying the analog value at the analog pin with 5 and dividing the value with 210 i.e. 1024. The range of voltages for Arduino UNOs analog input is 0V to 5V. Hence, in order to increase this range, a voltage divider circuit must be used. In the second circuit, the range of the analog input of Arduino is increased up to 50V by using a voltage divider consisting of 100KΩ resistor and 10KΩ resistor. With the help of the voltage divider circuit, the input voltage being measured is brought down to the range of Arduino analog input. The rest of the calculations are made in the programming part of the Arduino UNO

Result-



CODE-

```
#include <LiquidCrystal.h>
#define LCD_CONTRAST 10
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

void setup() {
  pinMode(LCD_CONTRAST, OUTPUT);
  analogWrite(LCD_CONTRAST, 110);

  Serial.begin(9600);
  lcd.begin(16, 2);
  lcd.print("Volt :");
  lcd.setCursor(0, 1);
  lcd.print("Amp :");
}

void loop() {
float  volt;
int reading;
float amp;
  reading = analogRead(A0);
  volt = 6.1 * reading / 1024;

  reading = analogRead(A1);
  amp = 6.1 * reading / 1024;
```

```
  amp = amp / 100;
  amp = amp * 1000;

  lcd.setCursor(6, 0);
  lcd.print(volt);
  lcd.print("v");
  lcd.setCursor(6, 1);
  lcd.print(amp);
  lcd.print("mA ");
  delay(500);
}
```

Application

An Arduino based Digital Voltmeter is designed in this project which can be used to measure different ranges of DC voltages. • The circuit can be extended to measure even AC voltages with slight modification in circuit and code.We are using this project to measure current and resistance also.

Inference-

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www.electronicshub.org/digital-arduino-voltmeter
https://circuitdigest.com/microcontroller-projects/arduino-digital-voltmeter
projectsdunia.blogspot.com/2016/02/make-digital-voltmeter-using-arduino.html