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Development of a High Precision Digital Volt Meter

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ABSTRACT: In modern electronics laboratory a voltmeter with high precision and digital display mechanism is an essential device. This paper describes the mechanism of a voltmeter that can measure voltage up to 30.00 V with a resolution of 10mV. In this voltmeter the achieved accuracy is quite good so that it can be used where precise voltage measurement is required. The circuit is based on ATmega328 microcontroller. It uses a 16*1 LCD for displaying the voltage magnitude to be measured. Because of the very simple circuit, it finds applications in labs, machines, instruments etc.

I. INTRODUCTION

A voltmeter is an instrument used for measuring the electrical potential difference between two points in an electric circuit. A voltmeter finds its importance whenever voltage is to be measured. At first analog voltmeters were very popular among the people for taking the reading of the voltage. On later period, digital voltmeters were introduced and became popular. Here we present an easy-to-build and accurate digital voltmeter that has been designed using the ATmega328P microcontroller. It can be used in measuring DC power supplies panels and where it is necessary to have an accurate indication of voltage. In this work, the voltmeter is designed to be operated within 0~30V range with 10mV precision. The circuit is a very simple one. It mainly consists of a voltage divider circuit, and a 16*1 LCD display which are interfaced to the 8 bit microcontroller ATmega328P.

II. WORKING AND CIRCUIT DIAGRAM

The digital voltmeter mainly consists of ATmega328 microcontroller and a LCD display. The unknown analog voltage to be measured is connected to one of the ports of Microcontroller. The ATmega328 consists of an inbuilt ADC which converts the voltage to a digital value. The microcontroller is programmed to convert this digital value again to the value of applied voltage. The value is then displayed through a LCD display. ADC is specified in number of counts. We have designed for 1024 counts with 10mV/bit resolution. The voltmeter designed can measure up to 30.00V with 0.01V precision.

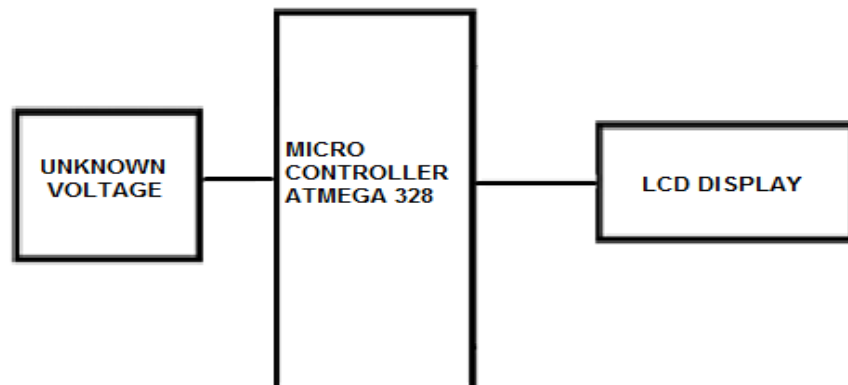


Fig. 1 Block Diagram

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When the supply is given, the controller initially checks whether the applied voltage falls within the required range. If yes, the applied voltage is displayed on the LCD. Else the controller waits till a voltage that falls within the rated range is applied.

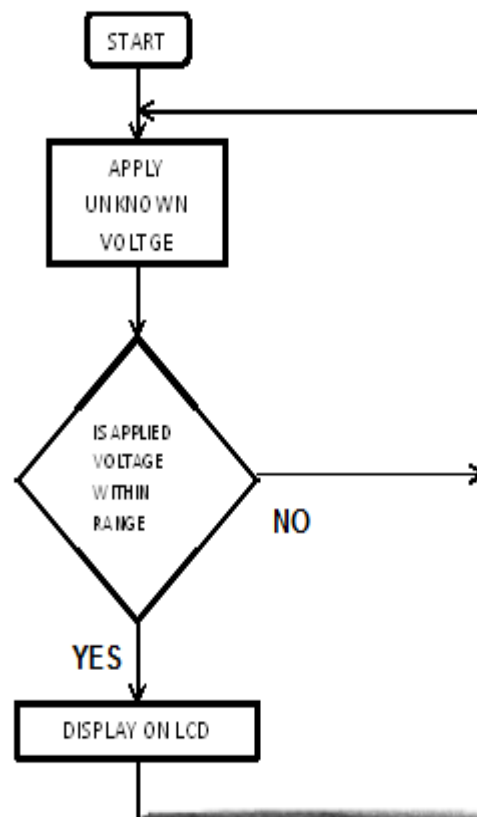


Fig. 2 Program Flowchart

The voltage that is to be measured is given to a voltage divider circuit. It is given to the A0 port of the ATmega328P microprocessor. The analog value is initially converted to digital value using an inbuilt ADC. The ADC output is checked whether it is within the rating of the voltmeter, i.e. 0-30V. If the applied voltage is within the rated value, the value is multiplied with the multiplication factor and is given to the LCD where the given voltage is displayed.

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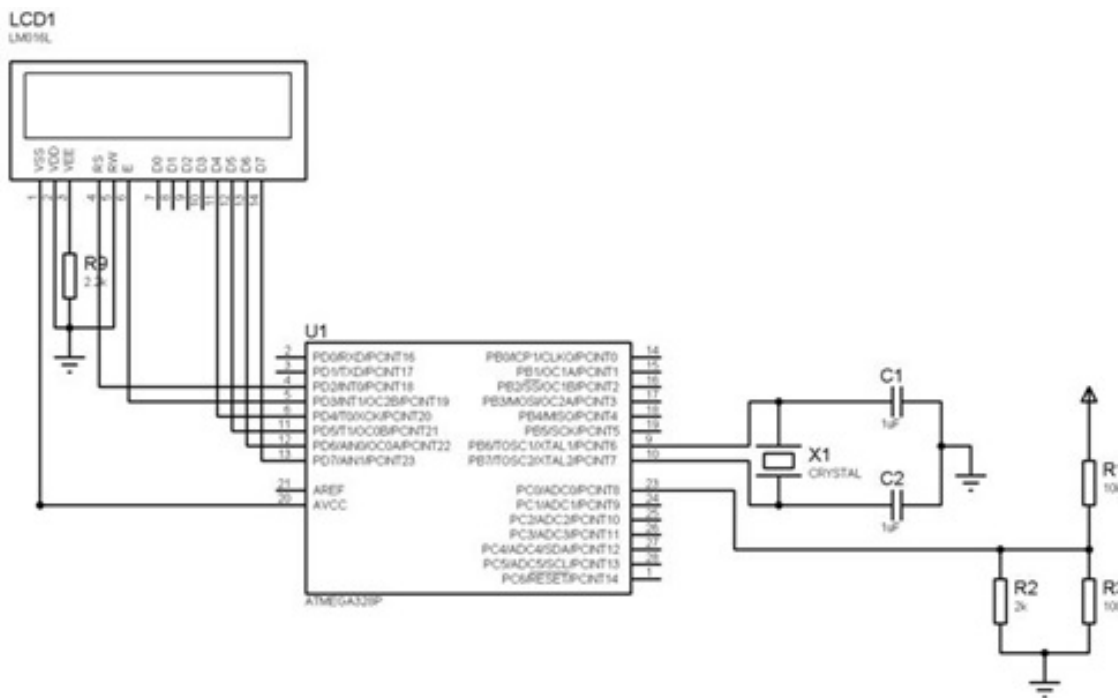


Fig. 3 Circuit Diagram

III. CONCLUSION

The digital voltmeter performed as expected. The biggest hurdle we had to overcome with this project was interfacing the micro controller with the hardware components. We feel that this digital voltmeter is very marketable because it is easy to use, comparatively inexpensive due to low power consumption, and highly reliable. This digital voltmeter is therefore particularly useful in industries, laboratories, research etc.

Digital Voltmeter gives readings as numerical display. They also provide outputs that can be transmitted over distance, can activate printers and typewriters, and can feed to computers. These integrate outputs for monitoring, controlling, transmitting, and printing of data. Advanced systems are often connected to computers, allowing for automation, optimization of processes, and prevention of malfunctions and critical failure safeties. Chemical plants can convert measurements to voltage, and control and monitor temperature, pressure level, or flow. Medical equipment, such as x-ray machines, may use this tool to make sure the voltage of the equipment is in the proper range.

Digital voltmeters have a number of advantages when compared to their analog counter parts. The most obvious benefit is the ease of use when reading the digital display. Inclusion of electric amplifiers and attenuators can extend measurable ranges. A digital model has superior resolution and higher order of accuracy. It can also indicate negative quantity when polarity is reversed. Analog meters are more fragile and susceptible to damage.

IV. ACKNOWLEDGEMENT

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