Development of a Novel Resistance Measuring Device with Digital Display

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ABSTRACT: Measurement of resistance has much more of an importance as part of a bigger project like touch screens using resistive method, Contact detector, etc than as an individual project. The resistance measurement device is a device that can be used to measure the resistance of resistor that is placed between the two leads of the device. The system is fully controlled by the 8 bit microcontroller ATmega328P. A simple electronic circuit with two resistances connected in series is used.One of the resistance is kept as a base reference resistor and the second resistor is assumed to be the variable unknown resistance.

 Keywords: Atmega 328, Microcontroller

I. INTRODUCTION

   We know that if a voltage,V is dropped across two symmetrical resistors (R1 and R2), the voltage will be equally dropped in both resistors. i,e half of the voltage (V/2) will be dropped in each resistor.

Similarly, let us assumes a voltage of 10 Volts is dropped in a resistance of 10ohm connected in such a way that one 5ohm resistance and five numbers of 1ohm resistance is connected in series, the voltage drop will be such that a 5volt will be dropped in the 5ohm resistor and the rest 1ohm resistors will have 1 volt dropped in each. From this we can come to a conclusion that if there are only 2 resistors (R1 and R2) connected in series and a voltage is applied across that, the voltage will be dropped in the resistors in such a way that the ratio of voltage drop will be proportional to the ratio of the two resistance(R1/R2).
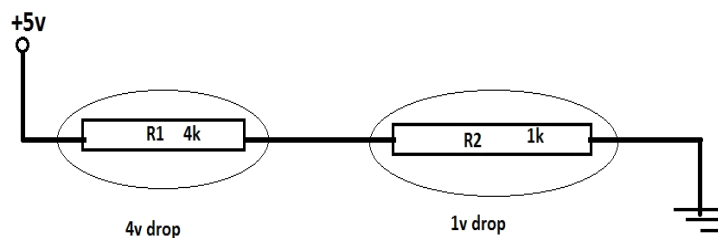
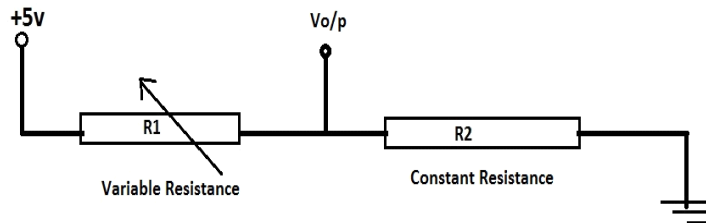Now let us take the value of voltage applied to the resistors be a constant of 5volts. Also let us take one of the two resistors (say R2) as a constant. Now the voltage drop across the constant resistance R2 (base reference resistor) will be dependent only on the variable resistance R1.

II. COMPONENT PARTS

A) ARDUINO DUEMILANOVE BOARD(ATMEGA 328)

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can be communicating with software running on your computer (e.g. Flash, processing, maxmsp.) The boards can be assembled by hand or purchased preassembled; the open-source ide can be downloaded for free. The arduino programming language is an implementation of wiring, a similar physical computing platform, which is based on the processing multimedia programming environment.

B) POWER SUPPLY
5 volt supply is given to the circuit through the USB port of a laptop/desktop
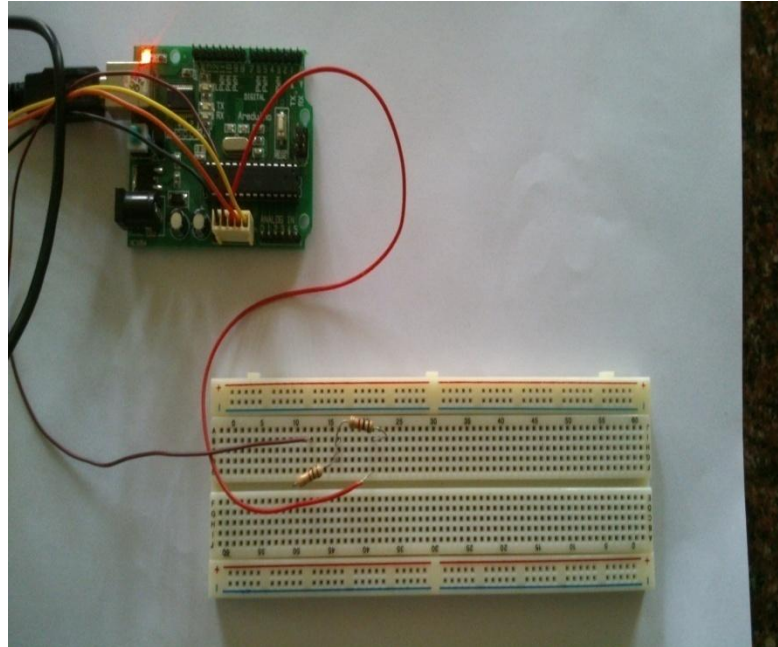
III. CIRCUIT DIAGRAM
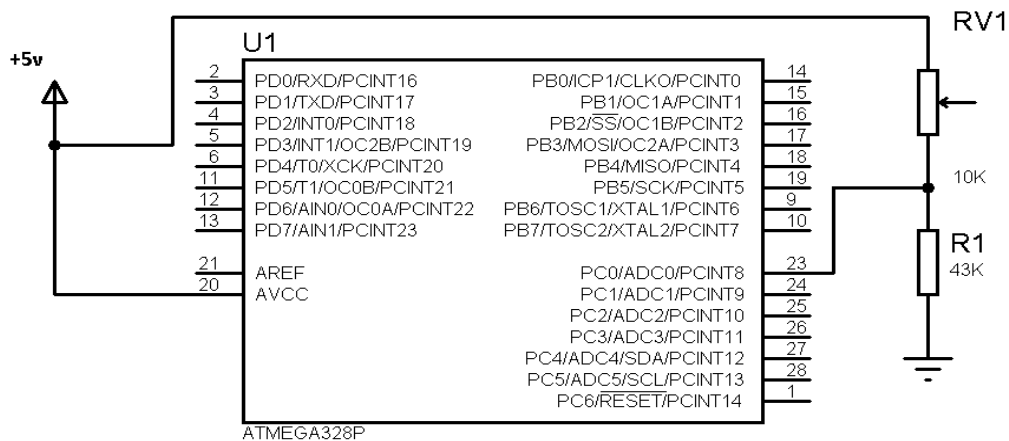
IV. **WORKING**

We plot a graph between the variable resistance R1 and the voltage drop across base reference resistor we can obtain a graph which is approximately linear. From the graph unknown resistance value is found(Fig.1).

Resistance measurement using micro controller is done based on observations of the voltage drop ratio on 2 series resistances. The graph with voltage drop on reference resistance on Y-axis and unknown resistance value on X-axis is plotted initially for calibrating the device. The graph obtained is a hyperbola. Calculation of co-ordinates is much easier if the graph is a straight line. In order to straighten up the graph we need to increase the base reference resistance to a value more than at least 4 times the maximum resistance reading expected. The design of this device is such that to measure a range of resistance from 0 to 10kohm. So the base reference resistance should be 40kohm(Fig.2).

The system comprises an 8 bit microcontroller ATmega328P. This is one of the popular Microcontrollers. The micro controller waits for command from a computer connected to it through a USB cable. The micro controller start the reading process only when a character "r" is send to it through the hyper-terminal of windows operating system. The hyper-terminal is used to serially send and receive data to and fro serial communication ports. When the read command is received from the computer, the micro controller reads the voltage drop at the base reference resistance. And with respect to the voltage drop, by proper arithmetic calculations unknown resistance value is identified and is send back into the computer through the same serial communication path. The received data is shown to the user as output.

The arithmetic formulae used is,
$Y = MX + C$

Where,   Y = y intercept (Voltage drop in base resistance)
$\qquad$ X = x intercept (Unknown resistance, R1)
$\qquad$ M = slope of line (slope of graph)
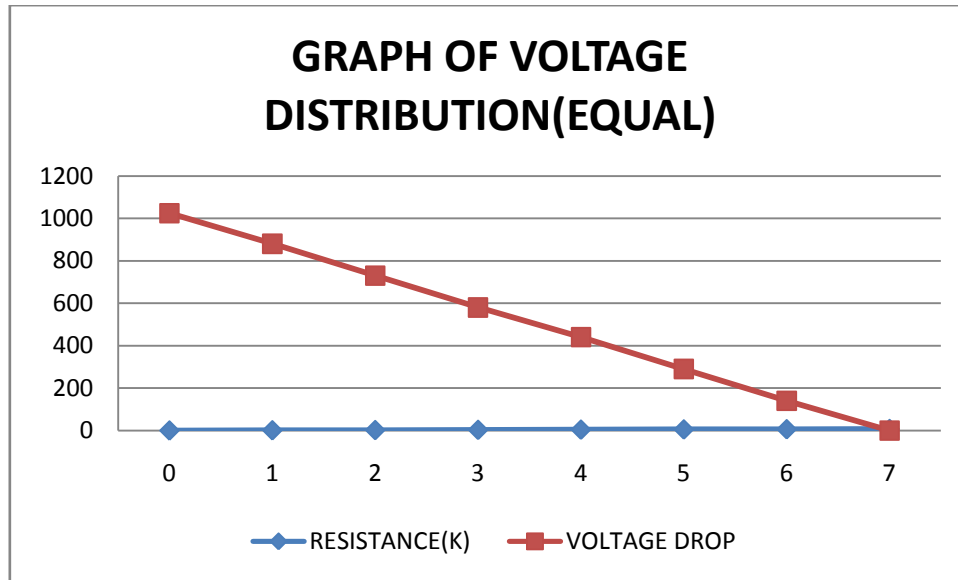$\qquad$ C = zero crossing y intercept (Reference voltage)

Fig.1 Voltage is equally ditributed and dropped if same resistors are serially connected to the voltage source
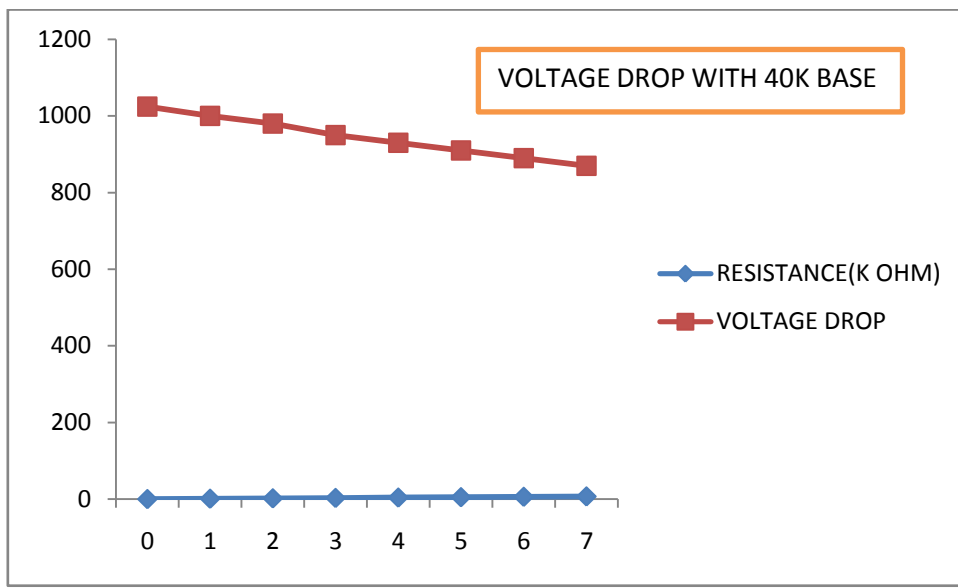

Fig.1 Graph plotting the voltage drop with 40K resistance as base

V. CONCLUSION

The resistance measurement device performed as expected. We were able to calculate resistance from 0k to 10k as specified in our proposal. Interfacing of the micro controller with the hardware components and a computer system was performed.The resistance measurement device can be used as part of any complex projects as a control system or a monitoring system. By drawing a further extended graph of larger resistance drops and corresponding base resistance we can obtain new constants for calculation and recaliberate the device to measure higher resistance value that can be even in mega ohm range.

Instead of setting up the device to read a constant range of voltages we can add a feature that can enable the user to change base resistance using switches and adjust the device to read resistances in ohms,kilo ohm more accurately.

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