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Arduino Based Customized Ohm-Meter for Industrial Utilization

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ABSTRACT: Ohm meter is an electrical instrument that measures electrical resistance, the opposition to the flow of current. Mili ohmmeter makes low value resistance measurements in Ohms (Ω). Earlier ohm meters were based on the meter movement known as galvanometer. Conventional Ohm meters available in market have complex and expensive circuit. They are not exclusively dedicated to measurement of Ohmic values, in milliohms. This system of Ohm meter based on Arduino is a device or instrument has less complex circuitry and considerable accuracy than conventional Ohm meters. The low value resistors are used in internal circuits of automobiles and other machine where accuracy is the major requirement. This system aims for the measurement of low value resistance with improved accuracy which can be extensively utilised by resistor manufacturing industries for testing purpose. Frequent Errors due to manual range selection in conventional ohmmeter is reduced as automated range selection of resistors during measurement. The measurement of resistance and automated range selection mechanism is implemented using Arduino Uno Rev 3. GSM module is used for providing database correspondence between vendor and customer.

KEYWORDS: Ohmmeter, Low Ohmic Value Resistors, Arduino UNO Rev 3, Selector Circuit, Constant current source, GSM Module.

I.INTRODUCTION

The ohm meter is an instrument that measures electrical resistance value. The conventional ohm meters available in market give reading on varied ranges of ohmic values. Precise result and cost effective instruments are always the need of industry. Our system of customized mili ohm meter is based on Arduino UNO Rev 3 is dedicated for measurement of low ohmic values which can be utilised by resistor manufacturing industries for testing. Use of Arduino makes this system innovative and superior to the conventional ohm meters available in market.

Measurement of low ohmic values is a challenge for conventional ohm meters which our system effectively deals with the use of Arduino. Circuitry of the ohmmeter includes three major modules are which are a power supply, selector circuit and current source and Arduino Uno Rev 3. The ohm meter available in market has manual range selection; our system provides an advantage of automatic range selection and displays the values on LCD. The GSM module will send message to the vendor and customer after completion of measurement of each batch of resistors. Thus system is cost effective and precise. It also renders quick results with updated database.

II. MAJOR MODULES

OHM METER: The ohmmeter is equipment used to measure an electrical quantity known as resistance. Ohmmeters are available in diversified constructions for various range of resistors. Resistance is the property of a component to oppose the flow of current. The ohmmeter with wide range of resistance measurement are available in market however the ohmmeter measuring low value of resistance are highly expensive due to its complex circuitry. Measurement of considerable high value resistance and low value resistance is a difficult task. The measurement of resistance using ohm meter can be accomplished by different techniques like kelvin double bridge method, ammeter voltmeter method or DMM two wire connection. The ohm meter efficiently works on the principle of Ohm's Law.

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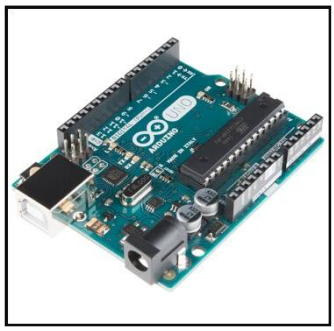

Fig. 1 Arduino UNO Rev 3

Fig. 2 GSM Module

ARDUINO UNO REV 3: Arduino Uno Rev 3 is a microcontroller based board as shown in figure 1. These systems provide set of digital and analog input output pins that can be interfaced to the various expansion boards and other circuits. Arduino can be programmed by C and C++ languages and program can be dumped by using Arduino software named as Arduino IDE 1.0.1. In customized ohm meter circuit Arduino Uno Rev 3 is used in which Rev 3 stands for revision 3. It has 14 digital input/output pins out of which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. The chief IC is the Atmega328P which is microcontroller IC with 28 pins. Simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

SELECTOR CIRCUIT AND CONSTANT CURRENT SOURCE: The selector circuit is an important aspect for the range selection of the resistance to be measured. The selection mechanism is automated using C programming with Arduino Uno Rev 3. The selector circuit is nevertheless a circuit with number of resistors connected in parallel which are reference to specify the range. The supply to this selector circuit is provided by the constant current source. Therefore the constant current source is another primary aspect of the ohmmeter.

GSM MODULE: A GSM module is a specialized type of module as shown in figure 2. It accepts a SIM card and operates over a subscription to a mobile operator just like a mobile phone. When a GSM module is connected to a computer this allows a computer to use a GSM module to communicate over the mobile network. GSM modules are used to provide mobile internet connectivity and it is also used for sending and receiving SMS and MMS messages. In the customized ohmmeter circuit GSM module is used to send messages to the vendor and customer after the completion of measurement of each batch of resistors placed as per the order.

III. SYSTEM MODEL AND FLOW

The majors section of this ohmmeter is the power supply, Arduino UNO Revision 3, selector circuit along with the constant current source, Liquid Crystal Display and the GSM module. The Arduino with 20 input output pins is interfaced with LCD i.e. Liquid Crystal Display. The LCD used has orientation of 2 rows and 16 columns. The connection between the Arduino and LCD is in mode 4 which refers to the correspondence of 4 pins of LCD out of 8 with the Arduino PWM pins. The LCD is provided with a power supply of 5Volt dc at pin 2 through the Arduino. The figure below shows the block diagram of Ohmmeter based on Arduino Uno Rev 3.

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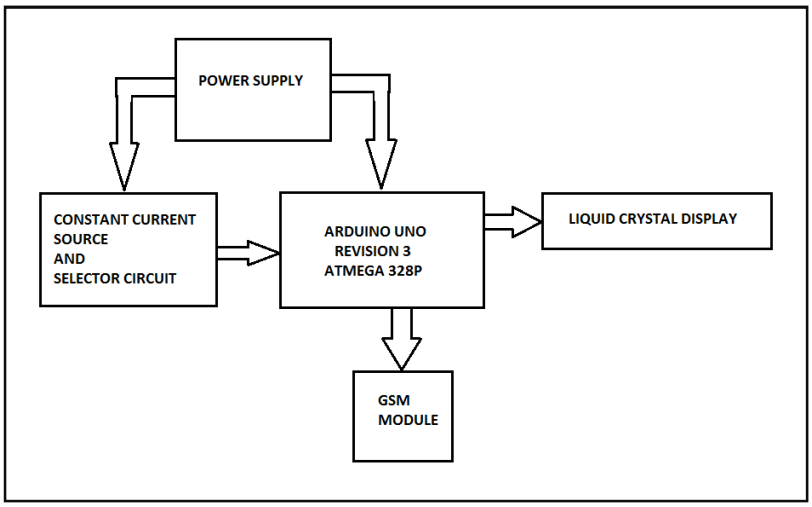

Fig. 3 Block Diagram of the system

The main power supply is an uncomplicated supply of 9 Volt dc with regulator IC LM 317. LM 317 is a 3 pin IC which includes the input, output and adjustment. The selector circuit with the constant current source is one of the foremost necessities of the ohmmeter measuring the low resistive values. The resistor under test is positioned between two terminals of selector circuit. Due the constant current being produced by the current source the voltage drop is established across this resistor. The voltage drop obtained is fed to pin A5 of Arduino. The A5 is one of the 6 analog input pins. The Arduino is employed to convert the input at pin A5 into equivalent ohmic value and display it on the LCD along with the number of resistors measured. The Arduino Uno Rev 3 functions on the programming based on C language. The software required to dump the program is Arduino compiler named Integrated Development Environment (IDE) 1.0.1. Since the measurement is based on programming the ohmmeter will provide improvised accuracy.

The low ohmic resistors are used in automobile industries for power steering and brake circuitry. Therefore, the accurate value of resistors is the main objective of the industry manufacturing these resistors on large scale. Since the ohmmeter is customized the facility of GSM communication is the reliable end of the instrument. The objectives of this ohmmeter based on Arduino for industrial purpose include:

1. Cost Effective: The cost effectiveness is one of the primary aim. As the ohmmeter available in the market for lower value measurements are costly than the ohmmeter used for the measurement of high value resistors. Due to its high cost the bulk purchasing of such ohmmeters become an expensive task. Therefore the industries manufacturing the customized resistors of low value require cost effective ohmmeters. Our system achieves this requirement effectively.

2. Improvised Accuracy: The resistors with low value in milliohms are used in advanced cars with sensitive power steering and brake circuits. Nowadays these advancements have become the major cause of the severe accidents. Therefore the components used in such circuits must have accurate and precise value for smooth working of such circuits. Ultimately this refers to the accurate testing of the resistors used. Improvised accuracy is thus the second primary aim of the ohmmeter.

3. Reduced Hardware Complexity and Automated Range Selection: Hardware complexity is one of the reasons for the high cost of ohmmeters. The use of Arduino Uno Rev 3 is to reduce the motherboard present in the conventional ohmmeter. In Arduino based ohmmeter the Arduino acts as the central board. Since Arduino are readily available in market it leads to the reduction in complexity of the design. The automated range selection is also the objective in order to speed up the testing process. This will also reduce the faults in range selection in manually operated conventional ohmmeters.

4. Use of GSM Communication: As this ohmmeter is customer oriented for industrial purpose. The GSM communication is a reliable means to provide up to date information to the customer regarding his order and its delivery.

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IV. RESULT AND DISCUSSION

The major requirement of any measuring instrument is the accuracy. In case of resistance the accuracy refers to that the value of resistor measured should lie strictly within the tolerance band of that resistor. The measurement of low ohmic value resistors (shown in figure 4) is a quite challenging, tedious and precise task. The use of inappropriate value resistors in power steering or brake circuitry of automobile or aircraft can lead to major accidents and harm to human life as well. Thus the device testing and measuring of these low value resistors have to be precisely accurate. Also it should be cost effective. As compared to other ohm meters available in market this ohm meter based on Arduino provide accuracy. In addition to this the cost of the instrument is reduced due to simpler circuit. Variety of ohm meters are available in market but they are too expensive for a manufacturer of low ohmic value resistors to buy it in ample number for fast testing purpose and complete the order on time. Also the automated part is one of the advantages which improve the speed of testing. The use of GSM module makes it more reliable for customer as well as manufacturer to stay up to date regarding the order. The figure 5 shows the implementation of Arduino based Ohm meter.

Fig. 4 ABS Resistor

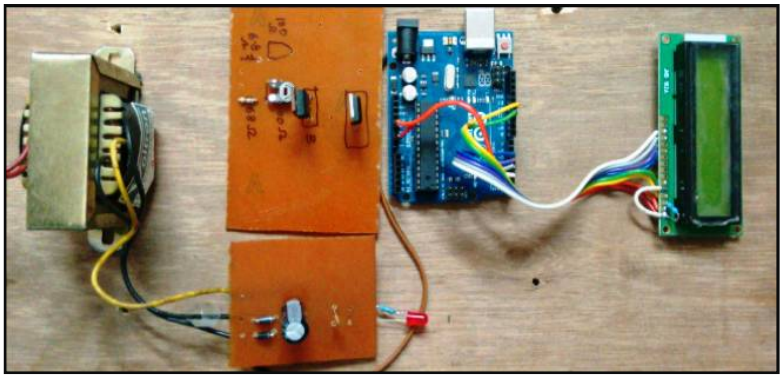

Fig. 5 Implementation of the Arduino based Ohm meter

V. CONCLUSION

The Arduino based ohm meter system effectively measures low ohmic values of resistors with greater accuracy. The system is cost effective compared to conventional ohm meters. The automated range selection makes the system free from manual errors. GSM module keeps the customer updated with the progress of the respective order of the resistor. Thus this system is a potential device for the industries manufacturing low ohmic value resistors in bulk.

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