Measuring Different Parameters using Smart Measuring Device

Abhishek Yadav[1], Adwait Bajpai[2], Hari Om[3], Pankaj km. Kaushik[4],Vipin Sharma[5]
[1,2,3,4]Student, Dept. of ECE Engineering, ABESIT Ghaziabad (U.P), India
[5]Assistant Professor, Dept. of ECE Engineering, ABESIT Ghaziabad (U.P) India

***Abstract*-Nowadays, Multimeter for engineers is the most important and the most basic need in current dependency scenario. In this paper multimeter using Arduino is discussed, designed and implemented. Multimeter is a measuring device used to calculate the amount of energy consumed by an electrically powered device. A multimeter is an instrument that allows us to make multiple electrical measurements using the same tool. In this paper, multimeter is used to measure distance, proximity, rpm and using touch sensor.In this work a new multimeter device is introduced by using different sensors and make it reliable for common people to use a multimeter. In this an OLED is used on which different parameters are displayed. This project uses some touch sensors which make it easy for everyone to use.**

Keywords—Arduino; multimeter; touch sensors; LCD; RPM

I. INTRODUCTION

The multimeterssare oneof theimportant aspects in the smartgrid concept. There are two basic type of multimeter that is digital multimeter and analog multimeter. Digital multimeter is superior then analog multimeter because they have better accuracy in measurement, sensitive to very small changes. Digital multimeter give the output directly in a form which is easily understandable by the user. Analog multimeter give the output by using a needle on a gauze so, sometime user can make mistakes while reading the output. This is the major drawback of the analog multimeter. In this paper the multimeter display is in digital form.

The multimeter is a device use to display more then one parameter in a single device itself. Digital multimeter presents more safety then the analog ones. It is easy to use many things with a single device and not to use different devices. In this paper multimeter presented is very reliable for everyone.The most basic things we measure arevoltage andcurrent. A multimeter is also great for some basic sanity checks and troubleshooting.A multimeter is a piece of equipment used for measuring current, voltage, and resistance, as well as for troubleshooting household appliances and electrical components of vehicles.

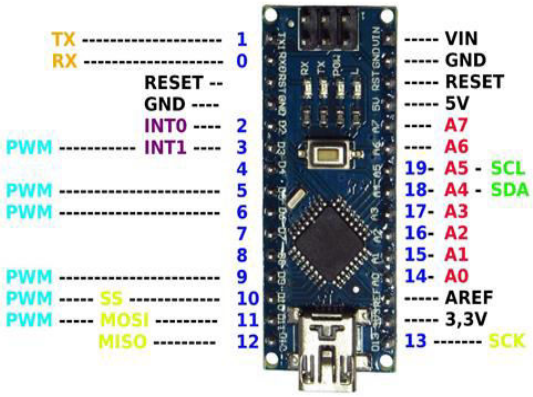

Fig. 1 Arduino NANO

Arduino NANO as shown in Fig. 1 is the basic and very important device. This is the heart of the project. It provides a software as well as a hardware for the implementation of the project. The language used in it is embedded C. It is a user-friendly language that everyone can easily understand and able to code. This make our work easier for the implementation of any project.

This paper is basically organized as follows: in first section introduction to the multimeter is mentioned. In section 2, brief literature review is mentioned. In section 3, implementation of the proposed system is mentioned. In section 4, results obtained from the setup are mentioned. And then finally in last section the paper is concluded.

II. LITERATURE REVIEW

The right now accessible meters utilize the working guideline initially actualized in meters in 1889. The point is to make an easy to use multimeter framework with least human mistakes, by executing present day innovation that is good even with the old metering units. [1] One of the points of interest utilizing the advanced based multimeter is that the read information by the gadget can be put away effectively for different applications or investigation. To measure the current, a non-intrusive current sensor was utilized for simplicity of establishment. The precision of the chose sensor was adjusted utilizing the manual ammeter, wherein the thing that matters is around ±1.79%.[2] One can't envision existence without power, as it is one's prime necessity. In this manner, there is a significant need of proficient measurement of power as well as the manner in which it is being utilized at the hour

of estimating. Observing force utilization of electrical machines is a stage towards vitality productivity and sparing administration and is finished by multimeter. [3] The interest for power has expanded exponentially in the course of the only remaining century. One road through which the present vitality issues can be tended to is through the decrease of vitality utilization in families. This has expanded the accentuation on the requirement for exact and monetary techniques for power measurement. [4] Smart electrical vitality meter innovations have been researched and created for roughly 10 years. Different advances have been created and used to measure the electrical utilizations. A microcontroller is an incorporated circuit that contains processor centre, memory and programmable input and output peripherals. [5] The utilization of non-direct loads in modern frameworks keeps on advancing which will make new issues of consonant twisting. The utilization of non-direct loads in modern frameworks keeps on developing which will make new issues of symphonious distortion. [6] System has a great deal of information on various things while doing this task. The framework comprises of an estimating voltage circuit that is coordinated into the glass to get the voltage and current inputs to the showcase of the LCD. [7] The Electromechanical vitality meter and electronic vitality meter are the two classes of an essential vitality meter. A remote vitality meter is intended to ceaselessly watch or screen the meter perusing and to kill the force supply at whatever point the buyer doesn't cover the tab right now. [8] The range over which the Arduino can measure voltage can be expanded by utilizing two resistors to make a voltage divider. The voltage divider diminishes the voltage being measured to inside the scope of the Arduino analog inputs. [9] A voltmeter is a significant apparatus on the workbench of each gadgets specialist, creator or equipment configuration engineer. As its name recommends, permits the client to measure the voltage distinction between two points. [10]

III. IMPLEMENTATION

This section gives implementation of the proposed multimeter. The multimeter has many sub modules. These modules are Arduino nano, laser module, touch sensor, relay, distance sensor buzzer, RPM sensor, accelerometer, OLED, battery, constant current/constant voltage linear charger. The figure 1 shows the basic flowchart of the Arduino based multimeter.

Firstly, we start the project and calibrate all the sensors which are used in the project with the Arduino. The output of the project is displayed on the OLED display, the next step is to check the display of OLED. Now, we can easily measure the different parameters. At last we check the sensitivity and accuracy of the parameters measured.

The sensors which are used must be calibrated to get the better result and this is the necessary of the project. Here Arduino NANO is used which provide a user-friendly platform for the interfacing of hardware with software.

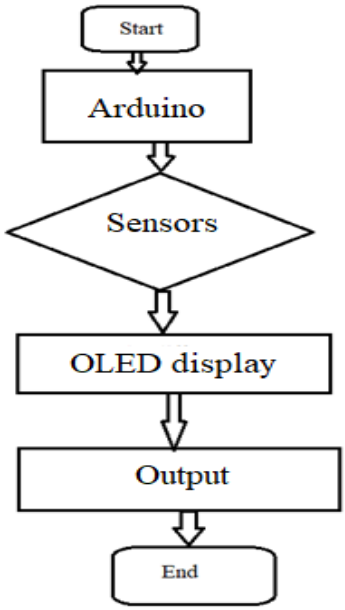

Fig. 2. Flow chart of the arduino based multimeter

The Arduino is used for the programming with the help of which one can code to perform the specific functions of a system. A distance sensor is used which gives the value of distance at which an object is placed. TP4056 is used which act as the constant current and constant voltage linear charger. MPU6050 is an accelerometer which is used to detect the axis for an object. OLED is used to display all the outputs which the proposed system is calculating. An organic light-emitting diode display work about the backlight because it emits visual light.

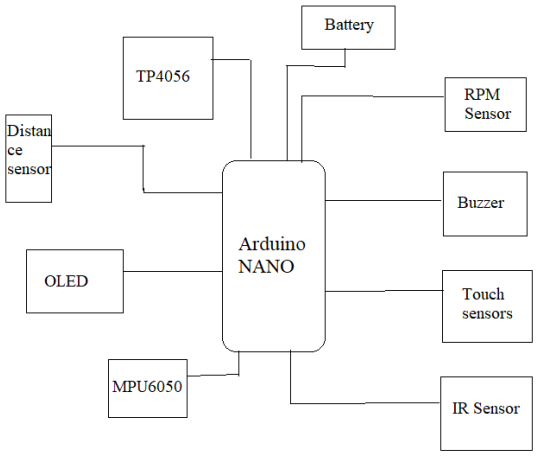

Fig. 3. Block Representation of the arduino based multimeter

The RPM sensor is an interior electronic gadget that measures a motor crankshaft's pace of cycles every moment. RPM sensors convert mechanical movement into electric heartbeats with or without direct contact when situated close to a turning rotor, apparatus, shaft or other consistently moving gadget. The resultant output signals are then taken care of to an advanced counter, totalizer, tachometer, or other observing and control gadget.

A buzzer is used in the circuit which simply indicate any type of alert or mis match in the code with the help of which we can simply get to know any error in our circuit. Contact Sensors are the electronic sensors that can recognize contact. They work as a switch when contacted. Right now four touch sensors are utilized. Contact sensors are otherwise called Tactile sensors. An infrared (IR) sensor is an electronic gadget that measures and distinguishes infrared radiation in its general condition. There are two kinds of infrared sensors: dynamic and inactive. Dynamic infrared sensors both produce and distinguish infrared radiation. An infrared sensor circuit is one of the fundamental and famous sensor module in an electronic gadget. This sensor is analogous to human's visionary detects, which can be utilized to recognize impediments and it is one of the regular applications continuously.

The basic circuit diagram of the Arduino based multimeter is shown in the figure 2. All the four sensors are shown in the circuit differently. The touch sensor1 to touch sensor 4 are connected to D7 to D4 pins of Arduino respectively. RPM Sensor that is revolution per minute is connected to the D10 pin of the Arduino nano. Buzzer is applied to the pin D3. Laser module is connected to the D5 pin of the Arduino nano. These all sensors give their outputs on the OLED display. The TP4056 that is constant current and constant voltage linear charger. Pin 5 of TP4056 is connected to the A1 pin of the Arduino nano with the help of a resistance of 1k. The distance sensor is connected to the A0 pin of the Arduino nano. It will calculate the distance on the basis of the ultrasonic waves and the sensor's name is ultrasonic sensor. The SDA and SCL of the accelerometer is connected to the A4 and A5 respectively. And these pins are also connected to the OLED display. Ground and vcc of all the sensors are common and are connected to a battery as shown in the figure 4.

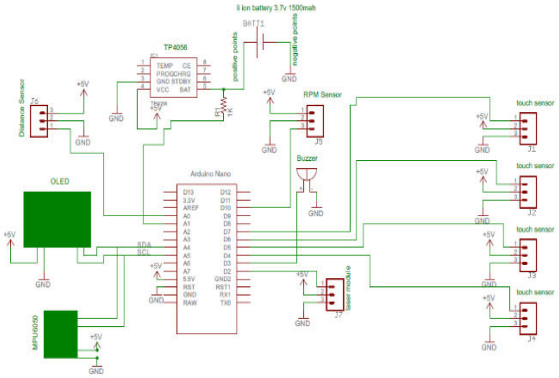

Fig. 4. Circuit diagram of the arduino based multimeter

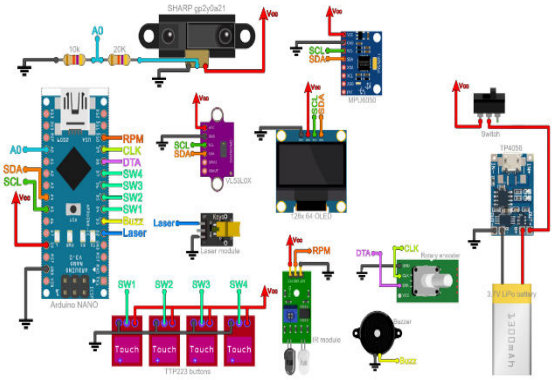

Fig. 5. Implimentation of the arduino based multimeter

After implementation of the Arduino based multi meter, the readings of different sensors are directly and easily displayed on the display which is used in the circuit. The display gives the value in the form of digital form, which are easily readable by the user**.** Arduino Nano is a little, good, adaptable and breadboard benevolent Microcontroller board, created by Arduino.cc in Italy, in view of ATmega328p (Arduino Nano V3.x)/Atmega168 (Arduino Nano V3.x). Arduino is an Integrated Development Environment dependent on Processing. It has made simple a few things specifically these are implanted framework, physical processing, apply autonomy, mechanization and different hardware based things.

IV. RESULTS

In this section, the results are discussed for the Arduino based multimeter. In Fig. 6, the image of the prototype design is shown.

Fig. 6. Project Pic

The above figure shows the implementation of the hardware used in the project. The project is implemented successfully and we get the different readings on the OLED. The IR sensor reading are accurate. Readings for TP4056 is correct and true. The reading of IR sensor is also accurate. All the values of sensors are displayed on the OLED. The coding is done with the help of Arduino nano, this is the project which decrease the cost and increase the accuracy of the measurements taken by the different sensors. The results show that all the output values are true and improved.

V. CONCLUSION

The aim is to create a user friendly multimeter using different sensors. Hence the system is successfully implemented and tested with positive outcomes. As, the employees working with electronic devices need multimeter at every stage so, its required to make a device which provide lots of measurement in a single one. In this paper the proposed method is used in a way which can detect different parameters in a single device only. By executing this work progressively one can accomplish new and better possibilities right now could set aside time and cash. Arduino has straightforward and clear programming condition and furthermore has a faster composing code. The article proposed a new method for multimeter measurement using Arduino nano. Hence, the better values of detection of different sensors is detected and an improved multimeter is implemented.

References

[1] Himanshu K. Patel, TanishMody, Anshul Goyal Arduino Based Smart Energy Meter using GSM 978-1-7281-1253-4/19/$31.00 © 2019 IEEE

[2] Teddy Surya Gunawan, Muhamad Hadzir Anuar1, Mira Kartiwi, Zuriati Janin Development of Power Factor Meter using Arduino Proc. of the 2018 IEEE 5th International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA 2018) 28-30 November 2018

[3] Osmi Jaiswal, Dilip Chaubisa, Arduino Mega and IOT based Intelligent Energy Meter (IEM) to Increase Efficiency and Accuracy in Current Billing Methodology 978-1-5386-1887-5/17/$31.00 ©2017 IEEE

[4] Nattachart Tamkittikhun, Thitinan Tantidham, Puwadech Intakot AC Power Meter Design Based on Arduino 978-1-4673-7825-3/15/$31.00 _c 2015 IEEE

[5] Srividyadevi P., Pusphalatha D.V. and Sharma P.M. Measurement of Power and Energy Using Arduino Research Journal of Engineering Sciences ISSN 2278 – 9472 Vol. 2(10), 10-15, October (2013)

[6] Win Adiyansyah Indra, Fatimah Bt Morad, Norfadzlia Binti Mohd Yusof, Siti Asma Che Aziz GSM-Based Smart Energy Meter with Arduino Uno International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 6 (2018)

[7] Birendrakumar Sahani, Tejashree Ravi, Akibjaved Tamboli, Ranjeet Pisal IoT Based Smart Energy Meter International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 04-Apr -2017

[8] Azmi rizki lubis, A Antony, Bonar horahap, Gunawan Tarigan, Jupriah sarifah Harmonic meter design using Arduino International Journal of engineering and tyechnology, 7(2.13)(2018)

[9] Suraj Khamkar, Ashish Bhosale, Vaibhav Damame Smart Glasses Multimeter International Research Journal of Engineering and Technology (IRJET) Volume: 06 Issue: 03 Mar 2019

[10] Sneha Chaudhari, Purvang Rathod, Ashfaque Shaikh Darshan Vora, Jignesha Ahir Smart Energy Meter Using Arduino and GSM International Conference on Trends in Electronics and Informatics ICEI 2017