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Embedded System for Programmable MultiFunction Waveform Generator

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Abstract: *A function generator is one of the most important equipment in electronics testing. Industries are spending lots of money on measuring devices. However, it is required to generate waves of various frequencies. It could be sine, triangular, ramp, step, rectangular, and many more types of signals. In addition to that, engineers require variable amplitude and a huge frequency range in some applications. Naturally, all are buying function generators for the same, which is costly, full of maintenance, more power consumption, and more space consumption. The method of this research is the experimental method. Any electronic measurements laboratory needs signal generators capable to generate several types of signals with different shapes, frequencies, and amplitudes. The first thing began with a literature study of the components needed and then continues with the making of a system design to generate a smaller function generator that can display 4 waves, waves that can be displayed are sine waves, squares, triangles, and sawtooth. The wave generated by the function generator is not made from Analog circuits but is made from digital data stored on the Arduino and converted to Analog with DAC pins. DAC has a function as a transformer of digital data into Analog data capable of being used to create function generators. The results of the study showed that the function generator was successfully made with smaller dimensions so that it was easier to carry everywhere.*

Keywords: Function Generator, Experimental Method, Smaller Dimensions, Different Frequencies, Electronic Measurements Laboratory.

I. INTRODUCTION

The Waveform generator plays a major role in every electronic laboratory or in industry. It can be used to test adesign or confirm that a piece of electronic equipment is working as intended. We are going to make a waveform generator using Arduino Uno (atmega328p) because this microcontroller helps us to make different waveforms. andconnect it to C.R.O. In between that, we are using many components like to connect the computer to Arduino UNO we are going to use a USB cable. And we will give one another input from a 4 x 4 keypad, in this keypad we can enter the different waveforms keys. and it connects to Arduino UNO. Also, A trimmer potentiometer also known as a trim pot, we are using it is a type of variable resistor or adjustable potentiometer that can adjust, tune, and calibratecircuits. In between Arduino Uno and C.R.O we are using D toA converter because.

The wave generated by the function generator is not made from Analog circuits but is made from digital data stored on the Arduino and converted to Analog with DAC pins. And then using an I to V convertor using an operational amplifier. And our project is used for generating different waveforms within other apparatus which can be used in communications and instrumentation circuits, and also in a. function generator instrument.

II. HISTORY

Hewlett-Packard Co. [1], which produced almost any testinstrument you could name, had a function generator, the 202A, in 1951. Designed by Robert Brunner, it was a specialized, very low-frequency instrument, aimed mainly at servo testing, vibration, and geophysical studies. It producedsine, square, and triangle waves at frequencies ranging from 0.01 to 1,000 cycles per second in five ranges. (This was before the hertz was invented.)

Bell Labs had announced the invention of the transistor many years earlier, but transistors couldn't yet provide all the functions that one could get with tubes, so transistors weren't in widespread use. The 202A used vacuum tubes, soit was a

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large box 19 inches wide x 13 inches deep x 10 1/2inches high and weighed 38 pounds. It may not have been the earliest function generator. Nobody remembers who made an earlier one, although people vaguely recall that there was a predecessor. But the 202A was the first to reach down into those low frequencies.

The 202A aimed at an important but limited market. So the instrument wasn't one you would find on every engineer's workbench. In fact, you didn't find many function generatorsaround in any frequency range. That changed in the 1960s when the function generator usually a Wavetek function generator joined the scope, DVM, and power supply as a must-have instrument

III. Proposed System

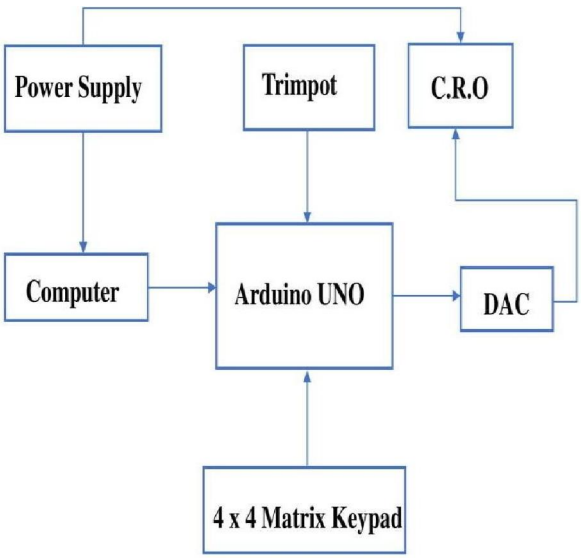

Figure 1: Block Diagram

3.1 Arduino Uno Microcontroller

Arduino is a microcontroller. It connects to your computer via a USB cable and can be programmed via your computer with a language similar to C++. One of the nice things about Arduino is the fact that the software is open-source, so it is freely available for download and can be modified by the end-user. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

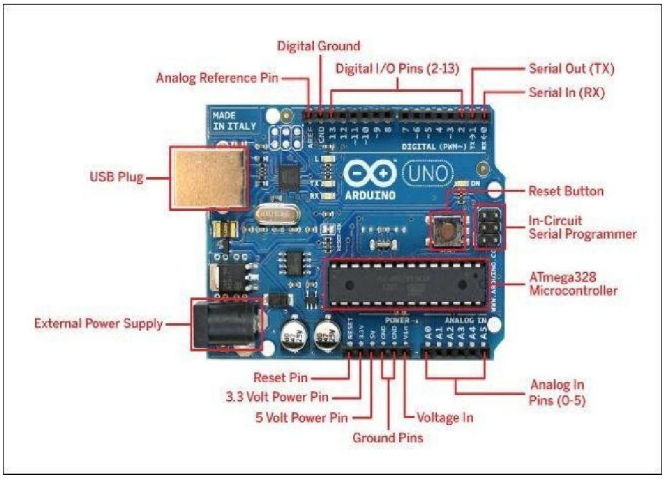

Figure: Arduino Uno

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The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards.

A. Arduino UNO Specifications

- 32 KB Flash Memory
- 1 KB EPROM
- 2 KB SRAM
- 16 MHz clock
- Inputs and outputs
- 14 Digital I/O ports
- 6 Analog Input ports

A keypad is a commonly used device to get user input. Although simple Push switches can be used to get user input, as we have done so, this would require 1 I/O line per switch. Keypads are collections of push switches however arranged in the form of a matrix. So there are rows and columns of switches. The two connections of a switch are also connected in the matrix so that the row has a common connection and the column has a common connection. Thus when a button has pressed a row and a column, where the button is pressed get connected internally. The keypads are usually available as telephone-type 4 x 4 keypads. This one has three columns and four rows, or a 4 x 4 keypad has 4 rows and 4 columns.

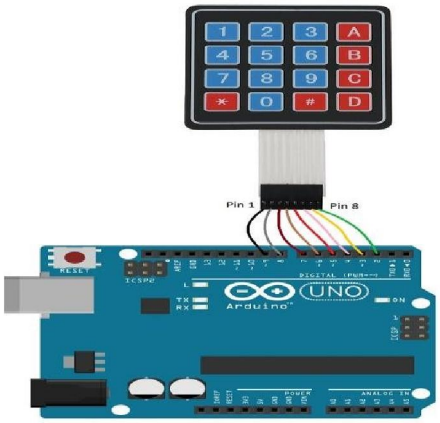

Figure 3: KEYPAD

3.2 741 IC

The UA741 is a high-performance monolithic operational amplifier constructed on a single silicon chip. It is intended for a wide range of analog applications.

- Summing amplifier
- Voltage follower
- Integrator
- Active filter
- Function generator

The high gain and wide range of operating voltages provide superior performances in integrator, summing amplifier, and general feedback applications. The internal compensation network (6dB/ octave) insures stability in closed-loop circuits.

Figure 4: UA 741 IC

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3.3 43296 Trimmer Potentiometer

Trim pots are also known as preset potentiometers used for adjustment, calibration, and tuning purposes in circuits. They are easily mountable on PCB boards and adjusted by a screwdriver. The resistive track is made up of carbon composition or cermet. When replacing with a normal potentiometer remember their life span is not so long. There are different types of trimmer pots available in the market such as through-hole, SMD, single and multi-turn variations.

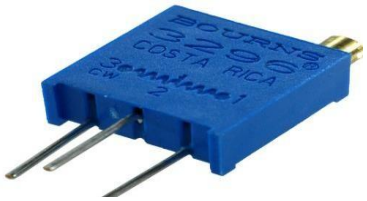

Figure 5: 3296 Trimmer Potentiometer

A. Features and Specifications

- Multi-turn / Cermet / Industrial / Sealed
- 5 terminal styles
- Tape and reel packaging available
- Chevron seal design
- Mounting hardware available (H-117P)
- RoHS compliant

IV. Conclusion

After completion of this project, we get high-frequency sine, square wave, and other low-frequency waves generated. And also you don't need to carry those heavy function generators for waveform generation you can generate a waveform with help of this project.

V. Future Scope

In the project, low MHz Frequency sine and square waves and others were successfully generated. In the future high frequency than this lower MHz and also amplitude can be changed. and also, we can make it wireless with android and MatLab.

Acknowledgement

It gives us great pleasure in presenting the paper on "Embedded System for Programmable MultiFunction Waveform Generator". Perfect and precious guidance, hard work, dedication a full encouragement is needed to complete a project successfully.

In the life of every student illumination of project work is like engraving a diamond. We would like to take this opportunity to thank our guide, prof. M. V. Kanwade, Assistant Professor, Department of Electronics and Telecommunication Engineering Department, Amrutvahini Polytechnic, Sangamner for giving us all the help and guidance we needed.

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