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ARDUINO Based Function Generator

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Abstract: Function generator is a key component of electronics. Different sort of technologies have been developed so as to accomodate each and every aspect of signal generation. The traditional setup for function generation includes a bulky and a quite cumbersome assembly which the users find difficult to come to terms with. Thereby, it becomes evident in the world of technology to make way for a better and efficient prospect. This paper provides a clinical approach to a rapidly growing platform which can replace the age old technique of signal or function generation with a more effective means of technology using Arduino.

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I. INTRODUCTION

A frequency generator is a very handy device in electronic design, development, testing and troubleshooting. It can generate the required frequencies which can then be applied directly to the target device for testing it. True digital sources are meant to drive digital systems. Their outputs are binary pulse streams. The features of a digital source are optimized for computer bus needs and similar applications. These features might include software tools to speed pattern development as well as hardware tools such as probes designed to match various logic families.

The performance of most electronic systems under test and in operation using the function generator are basically to extract vital information based on the generated signals displayed on a scope, and in some other case be used to initiate control for systems and as such there is need to inhabit special signals for such operation. Various approaches have been adopted in the past, but with ever increasing need for flexibility and user friendliness evolve the digital synthesis approach based on the use of Arduino. Time varying signals in digital format are generated from the Arduino, and it is converted into the corresponding analog format at a high processing speed. It is worth mentioning that the system performance is enhanced by using a faster microcontroller and the digital to analog converter which is of 12 or 16 bits. Practical results show the higher performance in integrating more functions like square, ramp and the triangular wave signals in the Arduino synthesizedfunction generator.

The function generators that we currently use are costly and complicated. A typical function generator does not allow interfacing and combination with other devices. So by using PC as an interface between hardware and software we can generate different waveforms of different frequencies. They are mostly used for large scale applications. So, it is necessary to develop a portable and an affordable function generator which can fulfill the basic need of signal generation. For small scale applications, we need a function generator which is comparatively small, cheaper, easy to manoeuvre and capable enough to generate the basic waveforms like sine, square, triangular and sawtooth. In the past few years, attempts have been made to modify the design using platforms like MATLAB, microcontroller, etc. Prior to these attempts, several open sourcing platforms like Arduino, Raspberry Pi and Pinguino have been evolved.
These open sourcing platforms provide additional stimulus to the development of modern electronics. With these added benefits of Arduino, we can build a substitute function generator for small scale applications.

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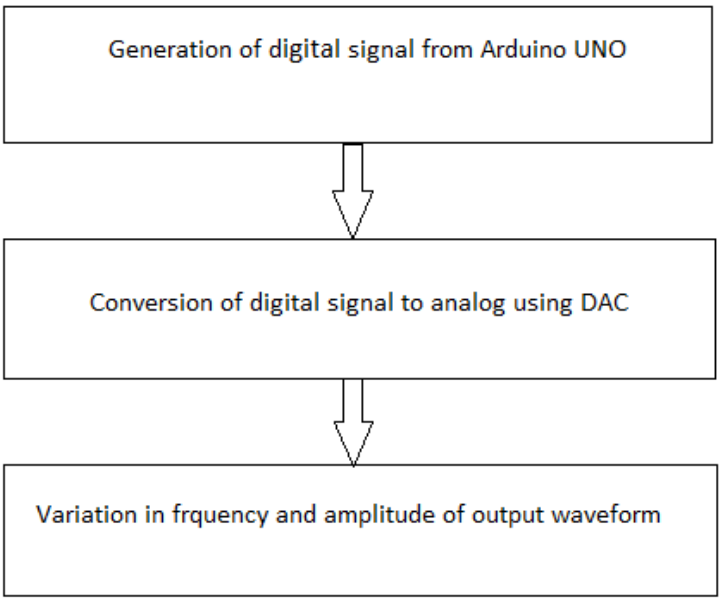
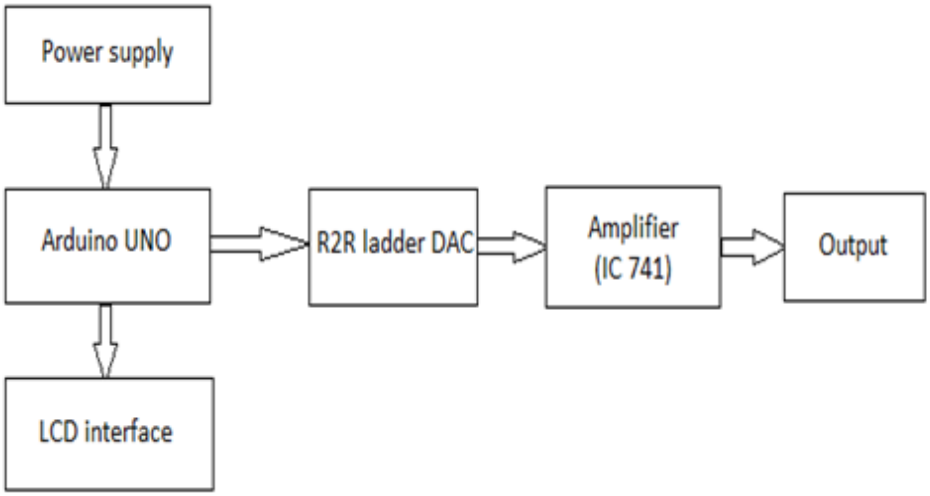


Fig1. Flowchart

II. SYSTEM ARCHITECTURE



Arduino is an open source physical computing platform based on a simple microcontroller board and a development environment that implements the processing language. It was originally meant for artists and designers to create electronic prototypes. They would be able to create these designs easily with a little knowledge of programming and electronics without going too deep into it. Arduino can be used to develop interactive objects, taking in inputs to control outputs. Projects done with Arduino can be stand alone or they can communicate with software running on a computer. Introducing the Arduino microcontroller to various levels of education can help improve interest of building or designing things. With an Arduino board, few other components and a little imagination, the possibilities are limitless.

The Arduino UNO is a microcontroller board based on the ATmega328, which is a high performance Atmel 8-bit AVR RISC-based microcontroller. The device operates between 1.8-5.5V. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. 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. The Arduino UNO can be powered via the USB connection or with an external power supply. Leads from a battery can be inserted in the GND and Vin pin headers of the power connector. The board can operate on an external supply of 6 to 20 volts. The power pins are:

- Vin
- GND
- IOREF

Other pins which have specialized functions are:

- Serial 0 and 1
- External interrupts 2 and 3
- PWM ouput 3,5,6,9,10 and 11
- SPI 10,11,12 and 13
- LED 13
- TWI A4 or SDA pin and A5 or SCL pin
- A0 to A5 six analog inputs
- AREF
- Reset

A resistor ladder is an electrical circuit made from repeating units of resistors. An R-2R ladder is a simple and inexpensive way to perform digital to analog conversion, using repetitive arrangements of precise resistor networks in a ladder like configuration. It is fast and has fixed output impedance R. The R-2R ladder operates as a string of current dividers, whose output accuracy is solely dependent on how well each resistor is matched to others.

IC 741 OPAMP is a voltage amplifier. It is an 8 pin dual-in-line package with following pin configuration:

- Pin1: Offset null
- Pin2: Inverting input terminal
- Pin3: Non inverting input terminal
- Pin4: -Vcc
- Pin5: Offset null
- Pin6: Output voltage
- Pin7: +Vcc
- Pin8: No connection

LCD modules form a very important part in many Arduino based embedded system designs. Here, a 16*2 LCD is interfaced with Arduino UNO. It has 16 pins:

- Pin1 Vss GND pin
- Pin2 Vcc
- Pin3 V_{EE}
- Pin4 Register select
- Pin5 R/W
- Pin6 Enable
- Pin7 DB0 to DB7 data pins
- Pin15 LED anode
- Pin16 LED cathode

III. CONCLUSION

The Arduino based function generator is a type of digital frequency generator. The waveform is generated in the form of binary stream and then it is converted into analog waveform by using digital to analog converter. On comparing with analog frequency generator which requires number of passive circuits such as integrator, differentiator and level corrector, it requires only microcontroller. It is easy to build and use. The basic components of this function generator are resistors placed in an array and Arduino UNO board, so it is very cheap compared to conventional function generator. Thus, it can hereby be concluded that for primary level applications instead of carrying the load of conventional function generators an easy, handy and reliable option like an Arduino can well be taken into consideration.

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