Smart Electronic Kit

Deepak BA¹, Karthick C², Lohith A³ & Arshad Ayub⁴
¹²Department of Electronics and communication, NHCE, Bangalore. ³⁴Department of Mechanical, NHCE, Bangalore.

Abstract: Imagine the future where all the bulky electronics’ device’s which we use now in the lab’s and for personal use, to be fabricated in a small kit, which is portable and can be carried where ever necessary. Is this possible? Yes it is. The basic device’s which we use in our daily lab’s are Signal generator, CRO, Multimeter for testing, IC Tester and other’s. This kit is not only useful in labs, but can also be used by any Electronics Engineer who is not stable in one place. All the basic device’s which we use in labs are fabricated into a single piece. This can change the fate of our future in Electronics field. This is cost effective and can be afforded by any electronics’ geek.

Introduction

Had we ever wondered the size of signal generator, CRO and other testing circuits to fit in a small box? And also not all the electronic’s student or a Electronic’s Engineer are born rich to afford a private signal generator, CRO, component tester for testing purpose for their personal use. Imagine if a electronic’s engineer who works in a consumer electronics company wants to check a particular device in a customer’s home, he can’t carry all the equipment’s which is necessary for him,because they are bulky and also they are prone to get damaged as .

As we know that the things which he needs are mainly

1. A tester kit to check whether each of Components are working or not
2. A small oscilloscope to analyze a particular Circuit’s waveform
3. A signal generator during some situation’s
4. Cable Tester.

He cannot carry all these bulky devices with him all the way he travel’s ,so there is an alternative way to solve this problem, that is by using our basic electronic kit. Here we use basic available components and basic knowledge to solve the above issue.

We make use of ICL8038 for generating various signals or waveforms’, which replaces the signal generator.

1. A LCD and an Arduino board which replaces a bulky component tester kit.
2. A simple cable tester for checking the continuity of the cable or wire
3. A small oscilloscope

Here basically we are making use of all these components and fabricating it into a single Device which can be used by anyone. As a student this will be very helpful in the lab and also in home which reduces the time consumption in analysing and making the circuit.

The detailed explanation of the kit is shown in the below part

CIRCUIT AND WORKING

The block diagram of the smart Electronic Kit is shown in the Fig.1. It has a signal generator, CRO, component tester and a cable tester. It is the combination of all 4 equipments. A tester kit to check whether each of Components is working or not, A small oscilloscope to analyze a particular Circuit’s waveform, A signal generator during some situation’s and a Cable Tester. In which all the 4 equipment is being put into one and had been made into a device.

Fig.2.1. Block diagram of Smart Electronic Kit

3. Application

3.1 Signal Generator
Fig. 2 shows the signal generator circuit. The ICL8038 waveform generator is a monolithic integrated circuit capable of producing high accuracy sine, square, triangular, saw tooth and pulse waveforms with a minimum of external components.

An external capacitor C is charged and discharged by two current sources. Current source #2 is switched on and off by a flip-flop, while current source #1 is on continuously. Assuming that the flip-flop is in a state such that current source #2 is off, and the capacitor is charged with a current I, the voltage across the capacitor rises linearly with time.

When this voltage reaches the level of comparator #1 (set at 2/3 of the supply voltage), the flip-flop is triggered, changes states, and releases current source #2. This current source normally carries a current 2I, thus the capacitor is discharged with a net-current I and the voltage across it drops linearly with time. External components: segment display and RF Transmitter. The circuit operates off a 9V-12V DC bidirectional supply. You section can also use a suitable power adapter. 7805 regulator is used to convert the supply to a 5V power supply for the circuit.

When it has reached the level of comparator #2 (set at 1/3 of the supply voltage), the flip-flop is triggered into its original state and the cycle starts again.

Waveform Timing

The symmetry of all waveforms can be adjusted with the external timing resistors. Two possible ways to accomplish this are shown in Figure 3. Best results are obtained by keeping the timing resistors RA and RB separate (A). RA controls the rising portion of the triangle and sine wave and the first state of the square wave.

An external capacitor C is charged and discharged by two current sources. Current source #2 is switched on and off by a flip-flop, while current source #1 is on continuously. Assuming that the flip-flop is in a state such that current source #2 is off, and the capacitor is charged with a current I, the voltage across the capacitor rises linearly with time. When this voltage reaches the level of comparator #1 (set at 2/3 of the supply voltage), the flip-flop is triggered, changes states, and releases current source #2. This current source normally carries a current 2I, thus the capacitor is discharged with a net-current I and the voltage across it drops linearly with time. External components: segment display and RF Transmitter. The circuit operates off a 9V-12V DC bidirectional supply. You section can also use a suitable power adapter. 7805 regulator is used to convert the supply to a 5V power supply for the circuit.

When it has reached the level of comparator #2 (set at 1/3 of the supply voltage), the flip-flop is triggered into its original state and the cycle starts again.

Waveform Timing

The symmetry of all waveforms can be adjusted with the external timing resistors. Two possible ways to accomplish this are shown in Figure 3. Best results are obtained by keeping the timing resistors RA and RB separate (A). RA controls the rising portion of the triangle and sine wave and the first state of the square wave.

An external capacitor C is charged and discharged by two current sources. Current source #2 is switched on and off by a flip-flop, while current source #1 is on continuously. Assuming that the flip-flop is in a state such that current source #2 is off, and the capacitor is charged with a current I, the voltage across the capacitor rises linearly with time. When this voltage reaches the level of comparator #1 (set at 2/3 of the supply voltage), the flip-flop is triggered, changes states, and releases current source #2. This current source normally carries a current 2I, thus the capacitor is discharged with a net-current I and the voltage across it drops linearly with time. External components: segment display and RF Transmitter. The circuit operates off a 9V-12V DC bidirectional supply. You section can also use a suitable power adapter. 7805 regulator is used to convert the supply to a 5V power supply for the circuit.

When it has reached the level of comparator #2 (set at 1/3 of the supply voltage), the flip-flop is triggered into its original state and the cycle starts again.

Waveform Timing

The symmetry of all waveforms can be adjusted with the external timing resistors. Two possible ways to accomplish this are shown in Figure 3. Best results are obtained by keeping the timing resistors RA and RB separate (A). RA controls the rising portion of the triangle and sine wave and the first state of the square wave.

3.2 CRO

The block diagram of CRO and component tester is as shown in the figure above. It mainly consists of a Arduino board, a multi component tester circuit, a tft screen and a 16*2 LCD display. Arduino has number of analog and digital inputs, the analog inputs are used by the component tester circuit and also for the CRO probes, whereas the digital pins are used by the LCD display.
Embedded systems are components integrating software and hardware jointly and specifically designed to provide given functionalities. A combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a dedicated function. An embedded system is a special purpose computer system designed to perform one or a few dedicated functions often with real-time computing constraints. Embedded systems are designed to do some specific task rather than be a general purpose computer for multiple tasks.

An embedded system is not always a separate block—very often it is physically built-in to the device it is controlling. The software written for embedded systems is often called firmware and is stored in read only memory or flash conveter chips rather than a a disk drive. It often runs with limited computer hardware resources small or no keyboard, screen and little memory.

3.3 ATMEGA168:

There are number of popular families of microcontroller which are used in different applications as per their capability and feasibility to perform the desired task. Most common of these are 8051 AVR and PIC microcontrollers. Here we use Atmel ATMEGA168 which is a low power CMOS 8 bit microcontroller based on the AVR enhanced risk architecture by executing powerful instructions in a single clock cycle the ATMEGA168 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. The Atmel ATMEGA168 provides the following features: 16K bytes of In-System programmable flash with read-while-write capabilities, 512 bytes EEPROM, 1K bytes SRAM, 23 general purpose I/O lines, 32 general purpose registers, a serial programmable USART, a byte oriented 2-wire serial interface, an SPI serial port, a 6 channel 10 bit ADC, a programmable watchdog timer with internal oscillator.
3.4 CABLE TESTER

The above figure shows the circuit of a cable tester. The circuit is built around op-amp IC3130. IC1 is a Bi-cmos operational amplifier with MOSFET inputs and CMOS output. It has PMOS transistor’s in the input for providing very high input impedance and very good speed performance. The input readily accepts even weak signals.

IC1 is wired as a non-inverting amplifier with a feedback resistor R6 &R7 to set the closed loop voltage gain. Capacitor C1 is added to provide a progressive roll-off. Capacitor C2 is added between the offset null (pin1) and strobe (pin8) for compensation.

FIG 6- Practical Circuit

To test the circuit check 9v at the test point TP1 with respect to TP0 to verify the correct power supply to the circuit bring antenna of the circuit near some cable and check the status of LED (should see the counter).

4. Test Point

The following table shows the voltages to be obtained while connecting the circuit and can be used to debug the circuit in case of error.

<table>
<thead>
<tr>
<th>TEST POINT</th>
<th>DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP0</td>
<td>0V, GND</td>
</tr>
<tr>
<td>TP1</td>
<td>5 V</td>
</tr>
<tr>
<td>TP2</td>
<td>OUTPUT</td>
</tr>
</tbody>
</table>

5. Programming

Here we used an Arduino software (IDE) version 1.6.0 which is latest Arduino software is easily available in the Arduino website and it is of free of cost. With the help of this software we can easily upload the program to the programmer with the help of a inbuilt boot loader.

6. Conclusion and Future Work

A low cost, portable, plug-in type signal generator, CRO, Multi component tester, and a cable tester is based on the communication features. Hereby we conclude that Arduino can be used as CRO, component tester for displaying waveforms Arduino Oscilloscope. This makes analysis simpler and overcomes the drawbacks of the conventional CRO’s. We built hardware interface circuit to make the functioning of an oscilloscope much easier with few affordable electronics components so as for the conversion and processing of the analog signal into the digital form.

Acknowledgements

The authors would like to express their sincere indebtedness to the mentors Mrs. SUSHMITHA, Asst. Professor, Department of Electronics & Communication Engineering, for their valuable guidance, wholehearted co-operation and for their valuable inputs.

References

[2]. “Practical Aspects of Embedded System Design Using Microcontrollers” By JIVAN S. PARAB
[3]. https://www.Electronicsforyou.com/cabletester/
[4]. https://www.instructables.com/
[5]. https://www.electronicstoday.com/signal_generator/
[6]. https://books.google.co.in/books?id=4PC7lOX1GTAC&printsec=frontcover&dq=ATMEGA32+books&hl=en&ved=0ahUKEwiqrdHc0L3MAhXMGJQKHU6cDyUQ6AEILTAB#v=onepage&q&f=false