Measurement of Parameters of Different Analog Circuits through Android App

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Abstract— As the title suggests, this paper presents the monitoring and controlling of the waveforms on a Smart phone or Tablet. The oscilloscope has some of the disadvantages like having no portability, no easier mobility since it is heavy in weight. It also requires more power consumption. To overcome this drawback, this paper presents how to display the waveform by using android app in mobile. The main application of this project is to observe the waveform of different analog circuits on the smart phone. We can measure the different parameters like voltage, amplitude and frequency. We can observe the output and can save the output in the form of screen shot and video clip as well.

Key words: Different Analog Circuits, Oscilloscope

I. INTRODUCTION

Cathode-Ray Oscilloscope (CRO) or Digital Storage Oscilloscope (DSO) is playing a huge role in electronics field. CRO is used in experimental laboratories, medical arena, and educational institutions and so on. CRO measures the voltage across any circuit which varies in accordance with time. The price of CRO basically ranges from$475 (22,500 Indian-Rupees) [2], In this paper we are using an Android app which depends on Android platform. Android is an open source Linux-based operating system. Android phones can run many applications. The concept in this paper is based on a Bluetooth module to supply the connectivity to a device connected to the android phone with Bluetooth, to display waveforms on smart phone. Bluetooth uses short wavelength of UHF radio waves in the LSM band from 2.4 to 2.485 GHz. We are using Atmega328. Atmega328 is high-performance, low-power CMOS Atmel AVR 8-bit micro-controller. It is based on the AVR enhanced RISC architecture. We have used Android OS since today's generation use android phones mostly.

The biggest advantage of this app is to avail us of oscilloscope at any place any time. The app becomes handy with lesser cost compared to CRO and has high mobility and low power consumption. This paper presents the measurement of various parameters of different analog circuits powered by android.

II. LITERATURE SURVEY

A. "Wireless Oscilloscope Powered By Android" Bhagyashree D. Hatwar1, Prof. Amol C.Wani2 Electronics & Tele-communicationDept., S.S.B.T's COET, Bambhori, Maharashtra, India.July,7 2014 [1]

This paper conveys the basic concept related to low-cost, portable, low-complexity Bluetooth embedded oscilloscope.

B. "Wireless Oscilloscope using Android App for Mobile" Sreenivasan.R1, Jayarani.E2 Department of ECE, Angel College of Engineering and Technology1 Department of CSE, Angel College of Engineering and Technology2 [2].

This paper presents the design and implementation of a low cost, portable, light weight, low power oscilloscope consisting of a hardware device and software application. Once this application is installed in the smart phone or tablet computers, we can use whenever we are in need of Oscilloscope. Wi-Fi technology is used in this application.

C. "Oscilloscope on android phone" Kalyani Ganvir, Hemant Waghamare. Department of Electronics & Telecommunication MIT College of Engineering, Aurangabad, Maharashtra, India [4]

The paper describes the system implemented with the help of android mobile operating system. So it concludes that oscilloscope on android phone becomes the handy oscilloscope. Android is a software stack for mobile device which means a reference to a set of system programs or a set of application programs that form a complete system. This software platform provides a foundation for application just like a real working platform.

In our paper, we have obtained the output of different analog circuits such as Astable Multivibrator, Sine wave generator, Half Wave Rectifier and Full Wave Rectifier on smart phone by using android application.

III. SYSTEM OVERVIEW

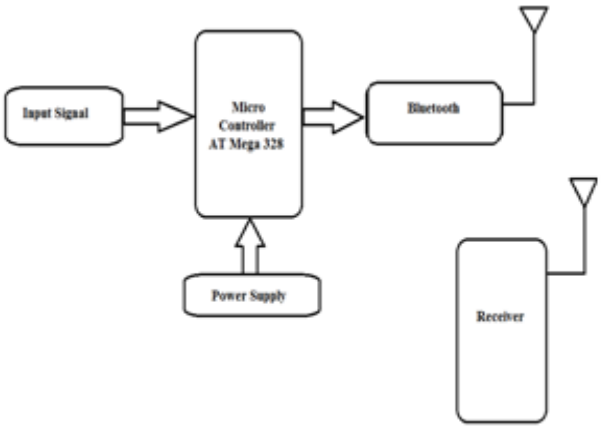

Fig. 1: Shows Block diagram of measurement of various parameters of different analog circuits

The block diagram of the measurement of various parameters of different analog circuits is as shown in fig. The Atmega328 is an 8-bit high-performance micro-controller of Atmel's Mega AVR family with low-power consumption. Atmega328 is based on enhanced RISC (Reduced Instruction Set Computing, known more as RISC

and CISC Architecture) architecture with 131 powerful instruction. Most of the instructions execute in one machine cycle. Atmega328 can work on a maximum frequency of 20MHz.

Atmega328 has 16/32K Bytes of In –System Self-Programmable Flash program memory. It has EEPROM of 512K Bytes to 1K Bytes and 512K Bytes to 2K Bytes Internal SARAM. The write/erase cycles of flash memory and EEPROM is 10,000 and 1, 00,000respectively. Atmega328 is a 28 pin micro-controller.

There are 23 programmable I/O lines and 28-pin PDIP (Plastic Dual in-line Package). The Atmega328 has various in-built peripheral like Programmable Serial USART, ADC, two 8-bit Timer/Counters, etc. It has 6-channel 10-bit ADC in PDIP package. It is used in temperature measurement. Each I/O pin has an alternative task related to in-built peripherals. The transmitter circuit is used Microchip's Atmega328 for the analog-to-digital conversion of the input signals on 6 channels. The Atmega328 has processed data that are then transmitted to the phone(for display waveform) via the Bluetooth HCI-05 Module.

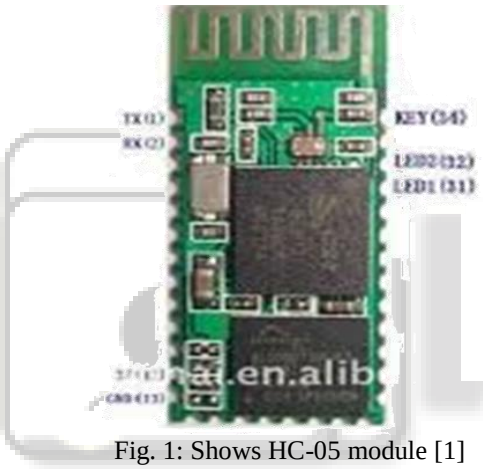

Fig. 1: Shows HC-05 module [1]

The Bluetooth trans-receiver HC-05 Breakout is the latest Bluetooth wireless serial cable. This version of the popular Bluetooth uses the HC-05/HC-06 Module. These modems work as a serial (RX/TX) pipes. The Bluetooth Technology has key features are robustness, low power, and low-cost. From the research it has been found that data rates of 2Mbps are not achievable with the existing software stacks implemented on the module's controllers [1]. The fig shows the diagram of HC-05.

The Bluetooth module has the following features:
Master and Slave cannot be switched

- Master role: In this there is no function to remember. The last paired salve device. The master can be made paired to any salve device[1].

1) Hardware feature of Master and Slave:

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation, 1.8 to 3.6 V I/O
- PI/O control

2) Software features of Master and Salve:

Default baud rate: 38400,
Data bits: 8
Use CTS and RTS to control data stream.
Given a rising pulse in PIO0, device will be disconnected.

A. Bluetooth Connectivity

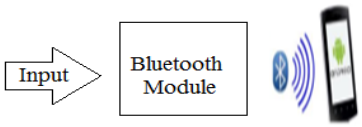

Fig. 2: Shows Block diagram of Bluetooth Module [3]

Bluetooth networks often operate as a single connection, or a Bluetooth networking may involve many devices. Bluetooth also allows for a scheme known as Bluetooth pairing where device can quickly be associated. The support of the Bluetooth device involves an Android platform, which allows exchanging the data with other Bluetooth device wireless. Fig. shows the block diagram of Bluetooth module. The application framework has functionality to access the Bluetooth though the Android Bluetooth APIs. This Bluetooth APIs has application that connects wireless to the other Bluetooth device and transmits the data point-to-point.

Bluetooth technology provides the following features:

- Less complication
- Less power consumption
- Available at cheaper rates
- Robustness

An android functionality can perform the following using Bluetooth APIs.

- Enable/disable Bluetooth.
- Make Bluetooth device discoverable by other Bluetooth devices.
- Discover other Bluetooth devices.
- List the names and MAC address of those found Bluetooth devices in a "List-View".
- Establish connection with one of the Bluetooth devices in the "List-View".

B. Android Smartphone

Android was developed by Google and the Open Handset Alliance (OHA), a consortium of hardware, software and telecommunications companies. Operating Systems have developed a lot in last 15 years. Starting from black and white phone to recent smart phone or mini computers, mobile OS in 1996 to Windows pocket PC in 2000 then to Blackberry OS and Android. One of the most widely used mobile OS these days is ANDROID. Android does a software bunch comprising not only operating system but also middleware and key applications. Android runs on both of the most widely deployed cellular standards, GSM/HSDPA and CDMA/ EV-DO. Android will also support: Bluetooth, EGGE, 3G communication protocols, Wi-Fi, MMS, SMS messaging, touch-screens, GPS.App inventor for android is an open source web application originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT). It allows newcomers to computer programming to create software applications for the Android operating system (OS). In creating App inventor, Google drew upon significant prior research in educational computing, as well as work done within Google on online development environments. The user interface of Android is based on direct manipulation, using touch input that loosely correspond to real-world action, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen object.[1]. Android is address as "the first complete, open and free mobile platform."[4]

The features & specifications of Android:

- Messaging: SMS and MMS are available forms of messaging, including threaded text messaging (C2DM).
- Web browser: The web browser available in Android is based on the open-source Blink layout engine, coupled with Chrome's V8 JavaScript engine.
- Bluetooth: Support voice dialing and sending contact between phones, sending files (OPP), accessing the phone book (PBAP), A2DP and AVRCP.
- Multitasking: Multitasking of application, with unique handling of memory allocation is available.

C. Application of Android:

Android application are composed of one or more application components (activities, services, content providers, and broadcast receivers)

Each component performs a different role in the overall application behavior, and each one can be activated individually.

Non-code application resources (image, string, layout files, etc.) should include alternatives for different device configurations.

The manifest file must declare all components in the application and should also declare all application requirements, such as the minimum version of Android required and any hardware configuration required.

IV. RESULTS

To test the output waveform from the different circuits, we have designed four different circuits as specimen, such as Astable multi-vibrator, Level shifter, Full wave rectifier and Half wave rectifier. We test the parameters and compare this with the cathode ray oscilloscope and digital storage oscilloscope. We observe the output on our App and CRO and it is approximately same. Bluetooth technology is used in this application, hence it works about 10m. This paper presents the design and implementation of a low cost, portable and easy in installation, low power consumption, which consists of hardware device and software application.

We have saved the output of the above mentioned circuits on mobile phone i.e. Sine wave and Square wave.

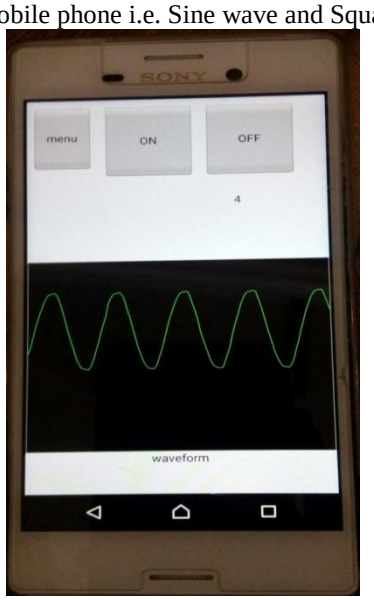

Fig. 3: Shows Output Waveform of Sine Wave Generator

Fig. 4: Shows Output Waveform of Astable Multivibrator

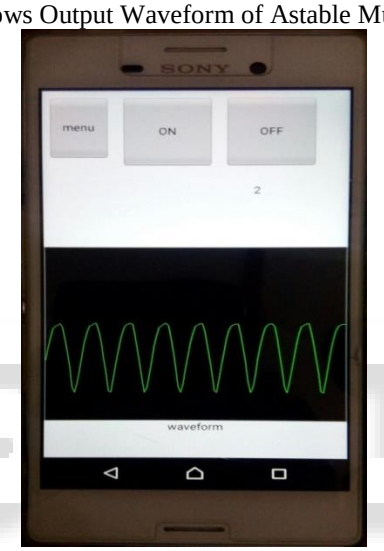

Fig. 5: Shows Output Waveform of Full Wave Rectifier

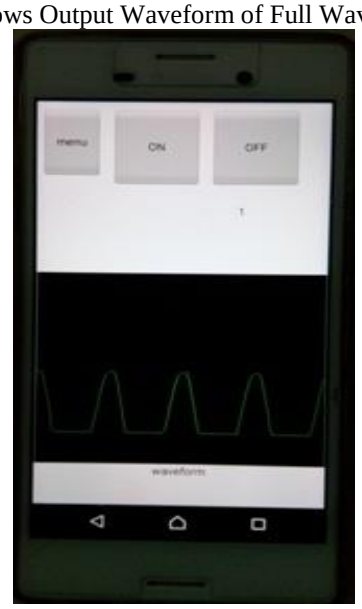

Fig. 6: Shows Output Waveform of Half Wave Rectifier

V. CONCLUSION

In this paper we have displayed output waveform of various analog circuits. Such as Half wave rectifier, Full wave rectifier, Astable Multi-vibrator and Sine wave generator.

We have also observed various parameters. We have observed the waveform as a video clip or images and save the waveform by screen shot. Our target is implementing an android app just like Oscilloscope on android mobile which is portable, low-cost, less power consuming.

We can implement this project by using Wi-Fi technology. It works above 10 -100m at a very high speed data transmission of 10-105mbps. For achieving high resolution we can use ARM7 processor instead of ATMega328. Hence, we can see the waveform of high frequency. Instead of smart phone we can use Wrist Watch to see the different waveform at the receiver.

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