

# Portable Multi-Purpose Instrument Using MSP430 on Android Platform

Khayal S. Chauhan<sup>1</sup>, Kirit.R.Bhatt<sup>2</sup>

<sup>1</sup>PG Student, <sup>2</sup>Professor

<sup>1</sup>Department Of Electronics & Communication, Sardar Vallabhbhai Patel Institute of Technology, Vasad, Gujarat, India

<sup>2</sup>Department Of Electronics & Communication, Sardar Vallabhbhai Patel Institute of Technology, Vasad, Gujarat, India

**Abstract** - Labs are used daily by students and researchers. Different instruments used in labs are bulky in size and costly. Nowadays, every person have smart phones, tablets and other mobile devices. Smart phones have enough screen sizes to display results in form of waveforms. Processing power of smart phones increasing day by day and it is good enough to evaluate different data and to analyse it. Mobility of user maintains due to different wireless communication options of smart phones. This paper deals with MSP430, which is low cost and low power consumptive. Due to android application, size of different instruments reduced. Different instruments build on single smart phone application.

**Keywords** - MSP430, Bluetooth module, UART, Android Smartphone

## I. INTRODUCTION

In organizations like schools, colleges and research labs etc., there are different instruments used like oscillators, signal generators and multi-meters. These instruments have disadvantages in form of their bulky size and high cost. Users can't move from one place to another while using these instruments to take critical readings. So, these instruments should have small size, low cost and user should movable. Students and researchers have smart phones, tablets and other mobile devices in their pockets is common thing nowadays. Day by day cost of these devices are reducing and processing power increasing rapidly. These devices have good enough screen sizes to display results. Smart phones have enough processing power to evaluate data and to analyse it. Smart phones have different wireless communication options like Bluetooth, Wi-Fi and NFC. MSP430 is low cost and have different low power modes. It has inbuilt DMA controller and can support many number of peripherals. Android OS is used on different smart phones mainly, which is open source and it is easy to develop any application on it. So, application build on android so that different instruments are used as a single device. Results of resistor, voltage and current display in the form of decimal. Signals of oscilloscope and signal generator display on screen. Bluetooth module is used to transmit data from microcontroller to android device.

## II. LITERATURE SURVEY

In literature<sup>[1]</sup> input signals were given from probe for resistance and oscilloscope. To increase range of the oscilloscope (in range of MHz), external ADC needed. Author had used ADC08B200. PGA113 programmable gain amplifier needed to amplify input signals. Microcontroller was used to select input signal from different input signals and to processing that signal. In literature<sup>[1]</sup> MSP430F5525 microcontroller was used, which has 16-bit RISC CPU, four 16-bit timers, 16-bit registers, inbuilt DMA and up to 63 I/O pins. In literature<sup>[10][11]</sup> AVR Atmega16, in literature<sup>[4]</sup> PIC18F25J10 was used. Author of literature<sup>[2]</sup> had used MSP430F169. Serial interface connection is used to interface wireless module and microcontroller. In literature<sup>[4][9][10]</sup> UART was used, while in literature<sup>[3]</sup> RS-232 serial interface was used. Normally RS-232 interface used nowadays to transmit data. In literature<sup>[10]</sup> HC-05 Bluetooth module was used, which has frequency range of 2.40GHz to 2.48GHz and speed of 2.1 mbps. Wireless module acquires data from microcontroller via serial cable and transmit it to android device. In literature<sup>[8]</sup> author had used BC417 Bluetooth module. In literature<sup>[10]</sup> author had used v4.0 (Ice cream Sandwich) android OS with 1GHZ Cortex-A5 processor and 768 MB of RAM. An android application was developed based on the software development kit (SDK) of android OS.

## III. PROPOSED SYSTEM

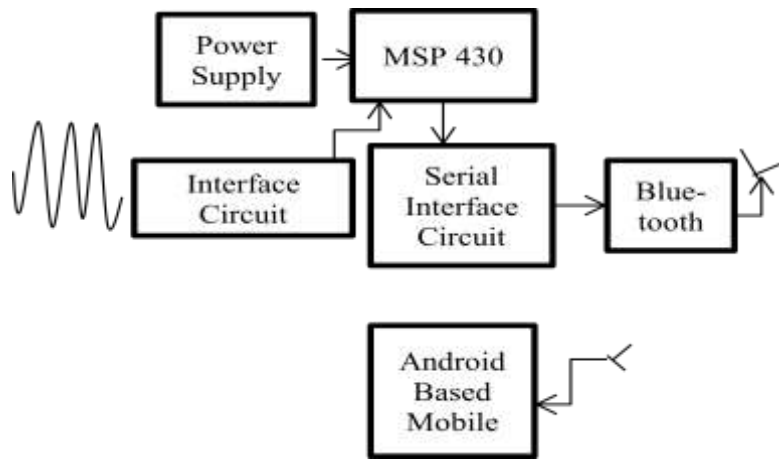


Fig.1. Block diagram of proposed system

Input signals come from different probes of multi-meter or oscilloscope. There is interface circuit placed in diagram, which will attenuate signal if the signal voltage will high or amplify signal if voltage value will low. External ADC is also included in interface circuit because if anyone want to increase frequency range of oscilloscope than internal ADC of microcontroller will not able to convert analog signal in digital. MSP430 will select signal from different input signals and analyse signal. Power supply needed for MSP430. Serial interface circuit will connect MSP430 with Bluetooth module. SPI will send data from microcontroller to Bluetooth module. Than Bluetooth module will transmit that data to android based device wirelessly. Android device has inbuilt Bluetooth module, so it is useful for our system. Application will developed on android device to complete system. Application will made so that system can be selected as multi-meter, oscilloscope or signal generator.

#### IV. SYSTEM OVERVIEW

There is MSP430F6736, Bluetooth module, UART with USB converter and android Smartphone used in system.

##### **MSP430F6736**

This device has a powerful 16-bit RISC CPU, 16-bit registers, three high-performance 24-bit sigma-delta A/D converters, a 10-bit analog-to-digital (A/D) converter, four enhanced universal serial communication interfaces, four 16-bit timers, hardware multiplier, DMA, real-time clock module with alarm capabilities, LCD driver with integrated contrast control, auxiliary supply system, and up to 72 I/O pins in 100-pin devices and 52 I/O pins in 80-pin devices.

##### **6514A-RN411 Bluetooth IC**

Supports version 2.1 + EDR

UART and USB data connection interfaces.

Frequency range: 2402MHz-2480MHz

##### **USB converter**

This device will send data to laptop and used for serial communication.

##### **Android Smartphone**

For Bluetooth pairing this device is used. And in future android application will develop on this device.

#### V. RESULTS

There is a system shown in Fig.2, which is made using MSP430F6736 microcontroller with conditioning circuit on board, UART with USB converter, Bluetooth module and Smartphone. Results are shown for Bluetooth pairing and inbuilt ADC.

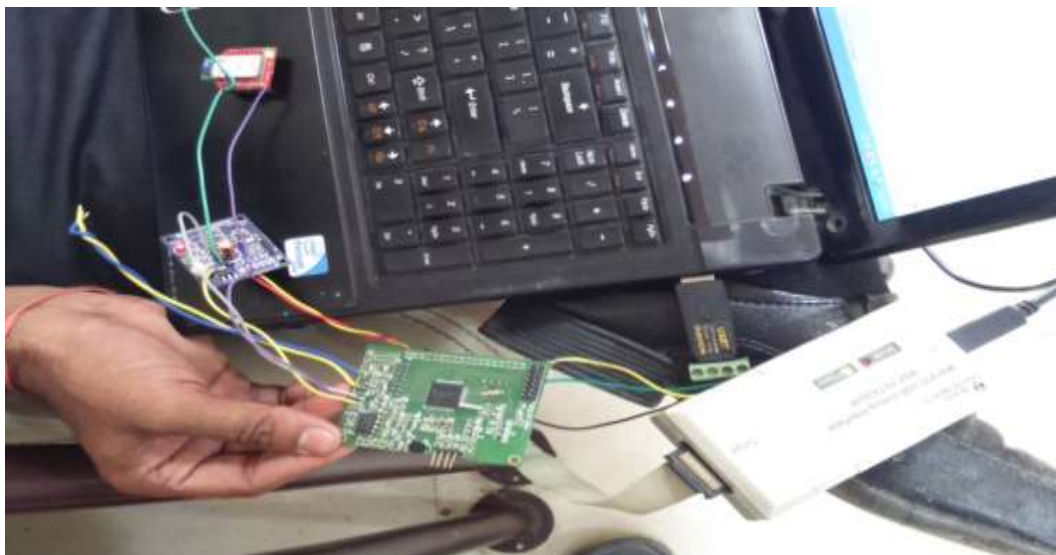


Fig.2. Total system

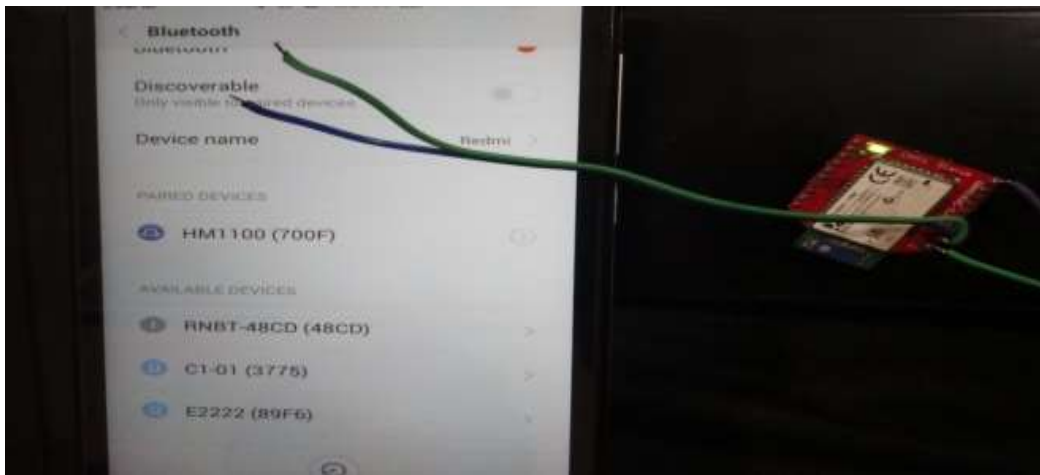


Fig.3. Bluetooth discover in android

In fig.3, there is shown that Bluetooth device RNBT-48CD is discover in Bluetooth searching of android Smartphone. Which means Bluetooth module working correctly.



Fig.4. Bluetooth pairing

In fig.4 , Bluetooth module is paired with Smartphone. Inbuilt ADC is also used in system. Result of ADC is shown in Fig.5, where Hercules software is used to see results. USB converter UART will send data to laptop and we can see results in form of HEX data.

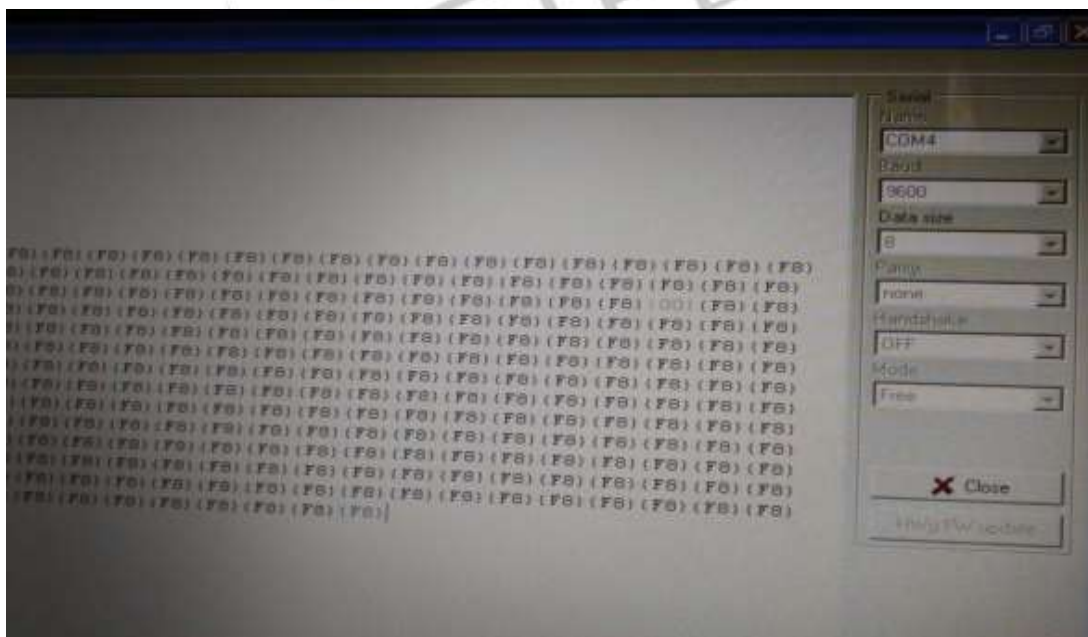


Fig.5 Result in Hercules

When input of ADC is shorted, than result is became zero, which is shown in Fig.6.



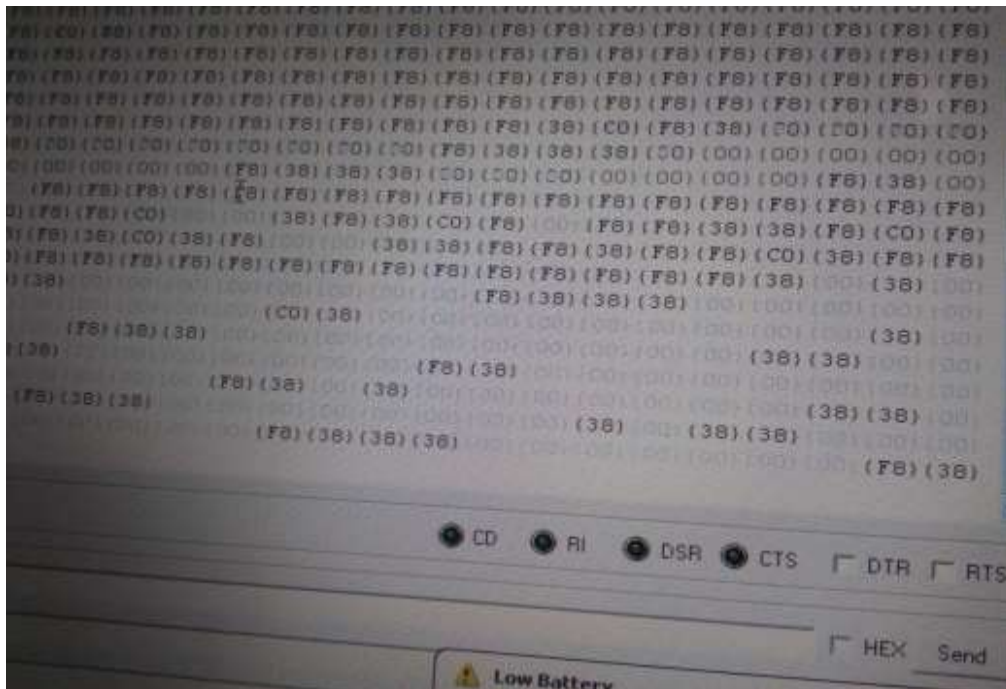


Fig.6. Result in Hercules when grounding

## VI. FUTURE EXPANSION

To make multifunctional device which will measure resistor, voltage, current and will work as signal generator or oscilloscope. So, there is need to make application on android device.

## VII. CONCLUSION

System built using msp430, Bluetooth module, USB converter and android Smartphone. Results show that Bluetooth device is pairing with android device and so Bluetooth module can communicate with android device and data can be transferred from microcontroller to the android device using UART serial communication.

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