

Interfacing of AT Command based HC-05 Serial Bluetooth Module with Minicom in Linux

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Abstract---In this paper I have present HC-05 serial Bluetooth module which is working on the modern wireless technology, the Bluetooth, for realization of distributed measurement and automation systems. HC-05 Bluetooth module is a serial communication module. Serial communication is the process of sending data one bit at a time, sequentially, over a communication channel. , as improved signal integrity and transmission speeds. HC-05 module operates on 3.3V. So there is USB to serial TTL module is required for voltage level conversions. Minicom is a text-based modem control and terminal emulation program for Unix-like operating systems. Minicom is a menu-driven communications program. HC-05 module can control by using minicom in a Linux operating system

Keywords: Bluetooth, HC-05, Minicom

I. INTRODUCTION

Bluetooth technology operates in the unlicensed industrial, scientific and medical (ISM) band at 2.4 to 2.485 GHz, using a spread spectrum, frequency hopping, full-duplex signal at a nominal rate of 1600 hops/sec. The 2.4 GHz ISM band is available and unlicensed in most countries. Range of Bluetooth is 5-30 meters. Latency of Bluetooth is 200ms. Bit rate of Bluetooth is 2.1Mbps.

Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has more than 19,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics.

The very fast expansion of wireless RF technologies and the low power consumption microcontrollers, which together, lead to a various types of miniature devices and communication protocols, with low-costs and low consumption, more and more replace the on-wire connections in the measurement and automation industrial systems. There are a lot of new proposal of communication technologies in the wireless sensors/actuators network field (WSAN), that all try to impose as standards.

Bluetooth is an open standard for wireless data and voice communication. As a short-range wireless communications technology standard, Bluetooth technology has been widely applied in wireless communication field as personal communications devices, wireless network communication and various transmission systems for its advantages of low cost, low power, small size and etc. The intelligent and multimedia trend integrates embedded computer system and wireless communication application has become increasingly clear, both wide-area mobile communications and short-range communication technology have played a pivotal role in information society. Embedded Bluetooth application that integrates embedded technology and Bluetooth communication is one of development directions currently and future.

HC-05 serial Bluetooth module operates on 3.3V while other devices are operates on generally 5V to 12V. So that there is required voltage level converters to connect other devices. HC-05 module transmits the data serially and so that increased in quality of signals, speed of communications etc.

Linux is one of the fastest growing operating system. Linux is an example of open source software which means its code is provided for use, modification and redistribution. The most obvious advantage of using Linux is the fact that it is free to obtain, while Microsoft products are available for a hefty and sometimes recurring fee. Microsoft licenses typically are only allowed to be installed on a single computer, whereas a Linux distribution can be installed on any number of computers, without paying a single dime. In line with the costs, the security aspect of Linux is much stronger than that of Windows. There are so many software choices when it comes to doing any specific task. Best of all, the vast majority of Linux software is free and open source. Not only are you getting the software for no charge, but you have the option to modify the source code and add more features if you understand the programming language.

Linux comes with many serial text and GUI based serial communication programs. My favorite is minicom - friendly menu driven serial communication program.

II. BLOCK DIAGRAM

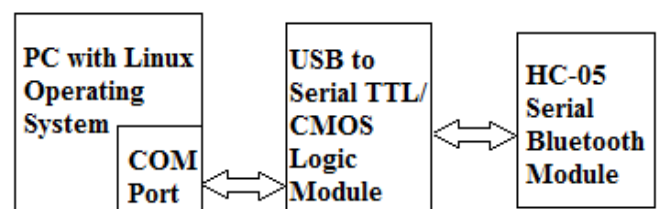


Fig. 1: Block Diagram

Fig. 1 shows the block diagram of the system implementation. Here HC-05 module operates on the 3.3V while PC operates with some high voltages. So here voltage level converter is required between PC and HC-05 module. Here I have used USB to Serial TTL/CMOS Logic Module as a voltage level converter.

III. HC-05 SERIAL BLUETOOTH MODULE

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature).

Figure 2 shows the HC-05 module. Figure 3 shows the HC-05 module and its main pins. Figure 4 shows the back side of the HC-05 Module.

HC-05 module work on 3.0V low power operation and 3.0 to 4.2V I/O controls. It has integrated antenna, edge connector and UART interface with programmable baud rate.



Fig. 2: HC-05 Module

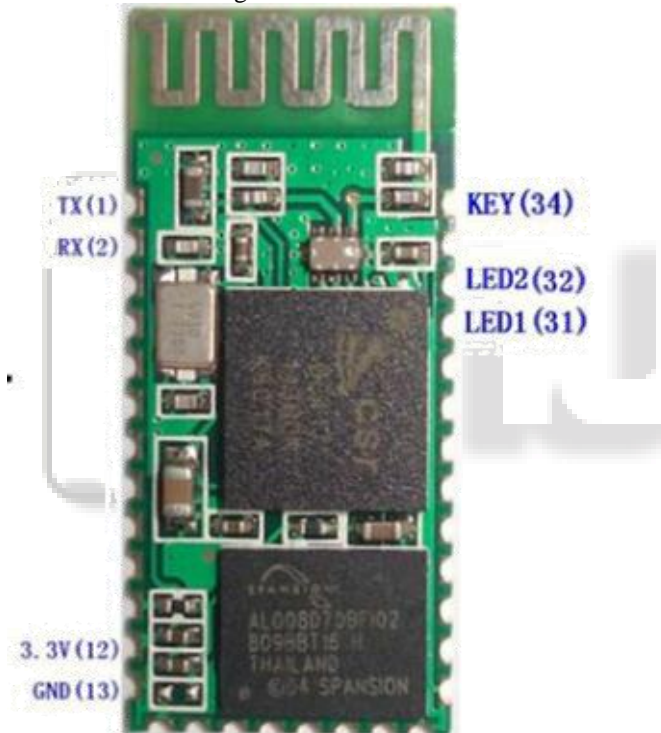


Fig. 3: HC-05 Module and its Main PINs



Fig. 4: Backside of the HC-05 Module

HC-05 module has default Baud rate: 38400, Data bits:8, Stop bit:1,Parity:No parity and supported baud rates are 9600, 19200, 38400, 57600, 115200, 230400, 460800.

Generally HC-05 module required 3.3V. USB output voltage of PC is some high. So here required voltage level converter.

IV. USB TO SERIAL TTL/CMOS LOGIC MODULE

This USB to serial converter is based on FT232 from FTDI. It gives out all 8 pins of the serial port at user selectable 3.3 or 5V logic levels. It has Transmit and Receive indicator data LEDs. It is most suitable for serial communication where data flow control is important. Since all the pins of the module are available at 5V / 3V3 and TTL / CMOS levels it can also be used for ISP (In System Programming) applications for microcontrollers such as NXP's ARM7 (LPC 2148, LPC2138...), 8051 (P89V51RD2....) etc. It has four mounting holes which makes it easy to integrate in your design. It can also provide 5V 400mA and 3.3V 30mA supply for powering external device. Board is made up of two layers PTH PCB for giving extra strength to the connectors.

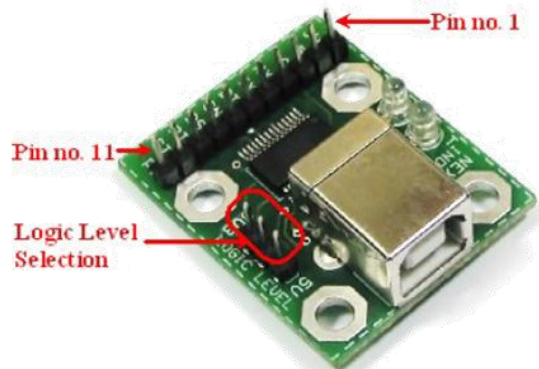


Fig. 5: Pin Configuration of the USB to Serial TTL/CMOS Logic Module.

Figure 5 shows the Pin Configuration of the USB to serial TTL/CMOS logic module.

Pin No	Pin Name	Analog Function
1	3V3	3.3V supply voltage
2	5V	5V supply voltage
3	CD	carrier detect
4	RXD	Serial data receive in
5	TXD	Serial data transmit out
6	DTR	Data terminal ready
7	GND	Supply Ground
8	DSR	Data set ready
9	RTS	Request to send
10	CTS	Clear to send
11	RI	Ring indicator

Table. 1: Pin Descriptions of the USB to serial TTL/CMOS Logic Module

Table 1 shows the pin descriptions of the USB to serial TTL/CMOS logic module.

Logic level of the USB to Serial TLL/CMOS Logic Module can be set at 3.3V or 5V by setting logic level selection jumper shown in figure 1. Set the jumper at 3.3V or 5V as per requirement.

V. CONNECTION BETWEEN HC-05 SERIAL BLUETOOTH MODULE AND USB TO SERIAL TTL/CMOS LOGIC MODULE

Figure 6 shows the connection between HC-05 serial Bluetooth module and USB to serial TTL/CMOS logic module. Here TXD of one module is connected to RXD of another module and vice-versa. Power supply pin

VCC of both module is connected to each other. Same as ground pin GND of both module is connected to each other.

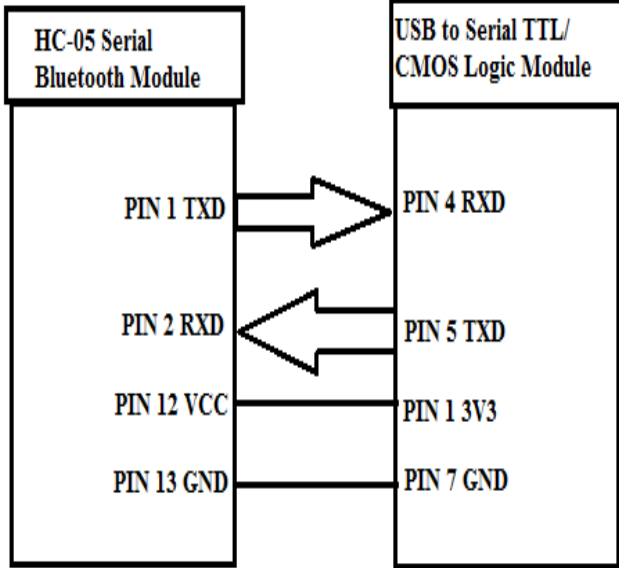


Fig. 6: Connection between HC-05 Serial Bluetooth Module and USB to Serial TTL/CMOS Logic Module.

VI. MINICOM SETUP FOR HC-05 SERIAL BLUETOOTH MODULE

A. Install Minicom:

Install minicom in your Linux PC by installing minicom RPM package like `minicom-2.3-37.2.i586.rpm`. Minicom can be install any way in your Linux PC.

After making the connection between HC-05 serial Bluetooth module and USB to serial TTL/CMOS logic module as shown in figure 6, connect this set up by using USB cable with your Linux PC.

B. Setup Minicom with `-s` Switch:

Write command `minicom -s` in your Linux terminal. After that following window will be opened.

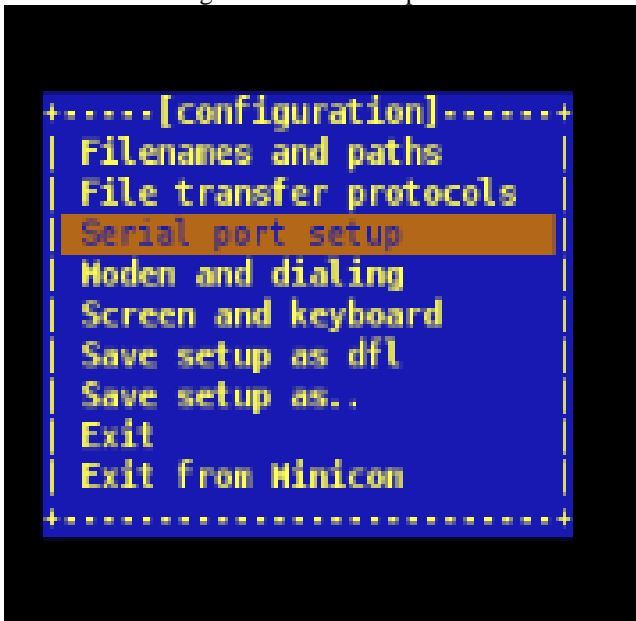


Fig. 7: Serial Port Setup

Select Serial port setup in the above figure 7. After that one window will be opened.

C. Configuration Setup for HC-05 Serial Bluetooth Module:

After select serial port setup in configuration window, press E and select following configuration.

- Speed (Baud Rate): 38400bps
- Stop Bit: 1bit
- Parity Bit: None
- Data Bit:8
- Select communication port by typing `ls /dev/tty` in terminal window

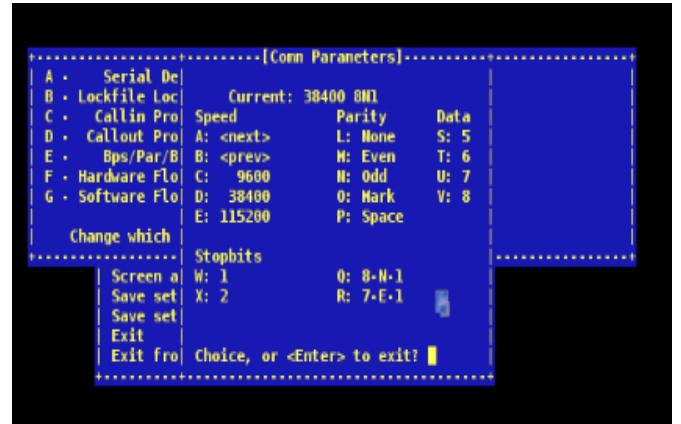


Fig. 7: Configuration Setup

D. Initializing Modem:

After writing `minicom` in terminal window, modem will be initialized as shown in figure 8 and Figure 9.

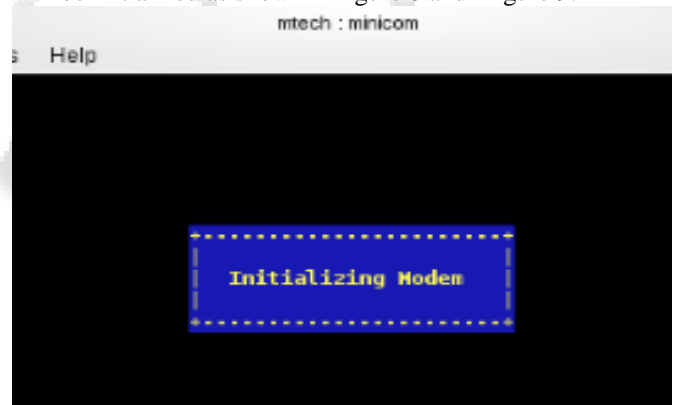


Fig. 8: Initializing Modem

E. Welcome to Minicom:

As shown in figure 9 minicom window will opened after initializing modem.

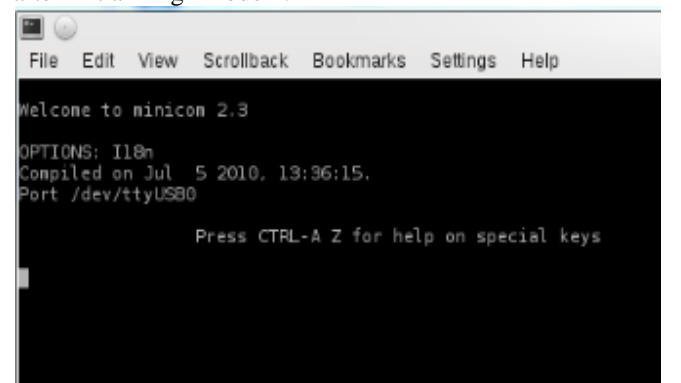


Fig. 9: Welcome to Minicom

F. Set Echo Pulse:

Press Ctrl-A E on your keyboard for enable echo pulse.



Fig. 10: Local Echo On

G. To Get AT Mode:

AT mode 1 : After power on, HC -05 can enter the AT mode by triggering PIN34 with high level. Then, the baud rate for setting AT command is equal to the baud rate in communication. For example: 9600bps

AT mode 2: First set the PIN 34 as high level or while powering the module, set the PIN34 to be at high level. The baud rate used here is 38400bps.

H. Reset the Master-Slave Mode:

AT+ROLE=0 Set the module to be slave mode. The default mode is slave.

AT+ROLE=1 ----Set the module to be master mode.

I. Write AT Commands:

AT commands can be check for HC-05 module as shown in figure 11.

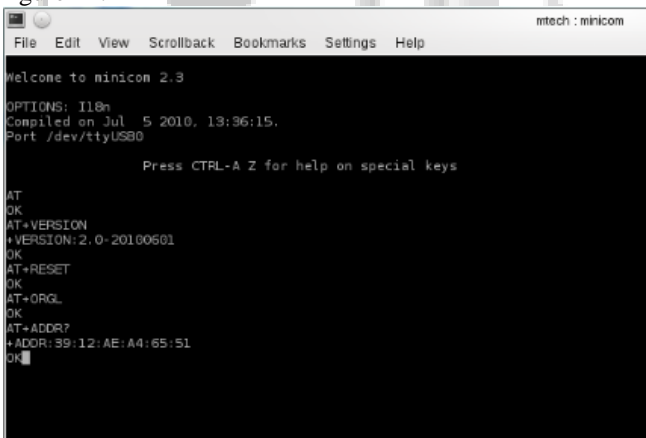


Fig. 11: AT Commands in Minicom Terminal

VII. CONCLUSIONS

This work explored a wireless communication by using HC-05 serial Bluetooth module. Now a days Bluetooth wireless communication is more developing because of their advantages like security, compatibility, low power etc. HC-05 module is communicating serially. That's why we get advantages like speed, signal integrity etc by using this module. Now a days Linux is a more developing operating system because of their advantages like open source software. Minicom is a text-based modem control and terminal emulation program for Unix-like operating

systems. Minicom is a menu-driven communications program. So minicom is easy to use.

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