

Wireless Arduino Programming Board

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ABSTRACT: Arduino is an open-source electronics platform based on easy-to-use hardware and software. To program an Arduino controller, it is requiring to connect an USB port. Also USB port is used for debugging (in some version) and for serial communication. It is designed to provide wireless programmability and to facilitate programming on installed Arduino product over standard Radio device like Bluetooth. In addition to that wireless debugging over Bluetooth serial port is also facilitated.

KEYWORDS: Arduino, Bluetooth, Arduino wireless programming and debugging.

I. INTRODUCTION

Arduino is open source electronic platform design to ease the system designing with open source hardware and Embedded C programming language with inbuilt libraries for programming commonly used devices and sensors interfacing. It simplifies the programming by pre-designed APIs included with Arduino IDE or install externally. The programming language does not include any internal architectural component or instruction of Microcontroller [1].

Using Bluetooth SPP (Serial Port Protocol) module with higher baud rate we can setup a wireless serial port protocol to communicate with Arduino board [2]. This allow us to program Arduino board with user define software wirelessly, that is useful in the scenario of reprogramming of pre-installed hardware based on Arduino and the isolated programming method which doesn't require USB port of PC for programming and debugging.

II. PRE-REQUISITE: SETTING UP BLUETOOTH MODULE HC-05

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs). Range is approximately 10 Meters (30 feet). These modules are based on the Cambridge Silicon Radio BC417 2.4 GHz Bluetooth Radio chip [3]. You can check the datasheet for more detail on HC-05 module [4]. Front view with component specification and rear view is shown in Fig. 1 and the pin diagram is shown in Fig 2.[5].

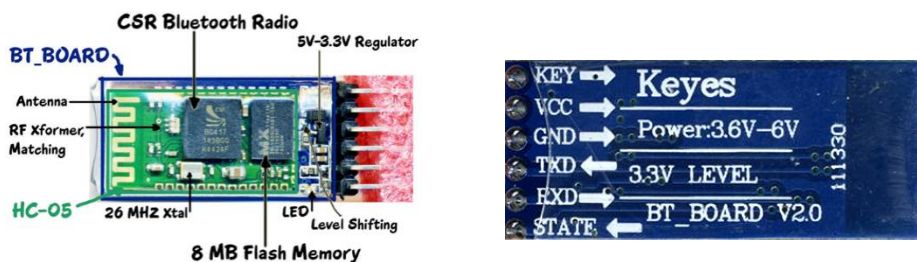


Fig 1. Front and Rear View of HC-05

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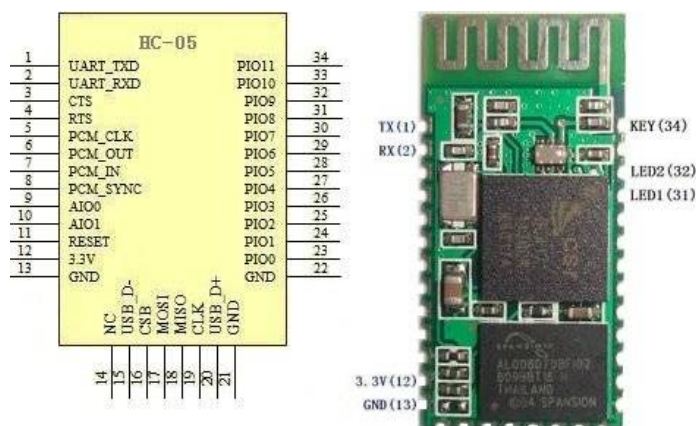


Fig. 2 Pin Diagram of HC-05 Module

The module has two modes of operation, Command Mode where we can send AT commands to it and Data Mode where it transmits and receives data to another Bluetooth module. The default mode is DATA Mode, and this is the default configuration, that may work fine for many applications:

- Baud Rate: 9600 bps,
- Data: 8 bits,
- Stop Bits: 1 bit,
- Parity: None,
- Handshake: None
- Passkey: 1234
- Device Name: HC-05

Arduino board uses higher baud rate for programming and debugging e.g. ArduinoUNO board requires 115200 baud rate. To change the baud rate, we have to enter into command mode. Follow the steps

- Connect Key pin (34) to 3.3V pin (12).
- Connect RX pin of FTD232r [6]to TX pin (1) of HC-05 module and TX pin of FTD232r to RX pin (2) of HC-05 Module (see fig.1 for TX and RX connection)
- Connect 5V supply to VCC and GND to GND between FTD232r and HC-05 module (see Fig. 1).
- Turn on the power and the HC-05 module enters into Command mode with baud rate of 38400
- Commands are sent to the module in UPPERCASE and are terminated with a CR/LF pair.

Download the Teraterm serial terminal application [7] and setup the application as follow:

- COM port: Select COM port where FTD232r module connects
- Baud Rate: 9600 bps,
- Data: 8 bits,
- Stop Bits: 1 bit,
- Parity: None,
- Handshake: None
- New line →Receive and transmit→CR+LF
- Check the Local Echo box

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After the configuration Send the following AT commands in sequence

AT commands	Reply
AT	OK
AT+ORGL	OK
AT+ROLE=0	OK
AT+POLAR=1,0	OK
AT+UART=115200,0,0	OK
AT+INIT	OK

Table 1: AT command for HC-05 Bluetooth module

Turn off the power and remove the connection between pin key (34) and 3.3V (12). HC-05 module now enters into slave mode with baud rate of 115200. You can set different baud rate for different Arduino. One last step is to solder a jumper wire on pin 32 of module which works as program reset after program is uploaded successfully onto Arduino (That is set by AT command AT+POLAR=1,0)

III. DESIGN ARDUINO BOARD

Designing guide for Arduino is provided by designer [9], which we modify to provide Wireless programmability by replacing USB port with HC-05 module. Schematic and PCB layout is shown in Fig. 3 and Fig. 4 respectively. The board schematic and PCB layout is designed using Diptrace Free edition for windows. Also note that ATMEGA 328 is preloaded with Arduino bootloader [10].

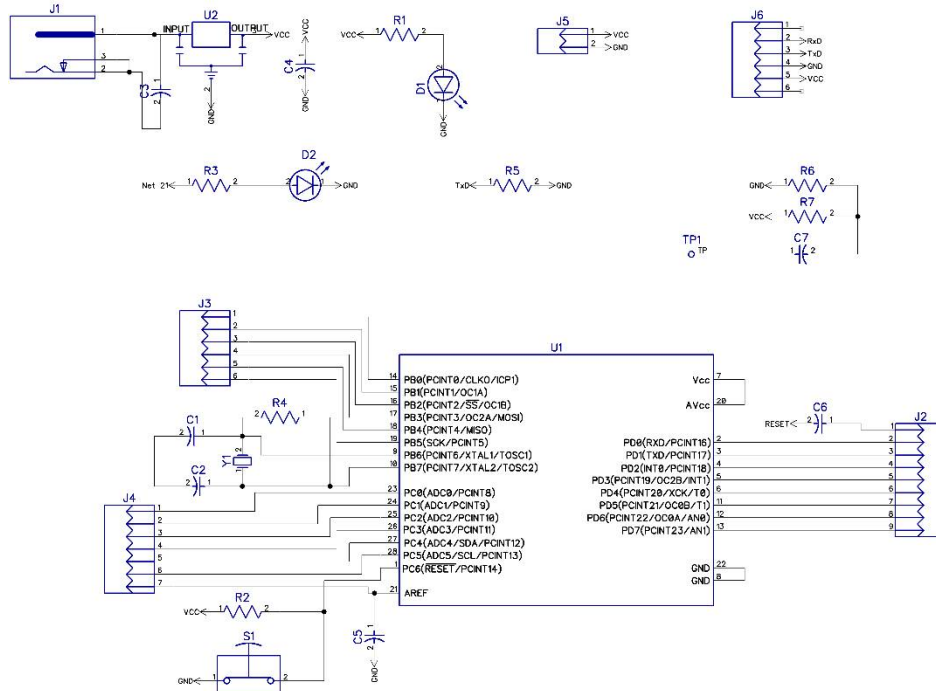


Fig. 3 Schematic of Arduino Board

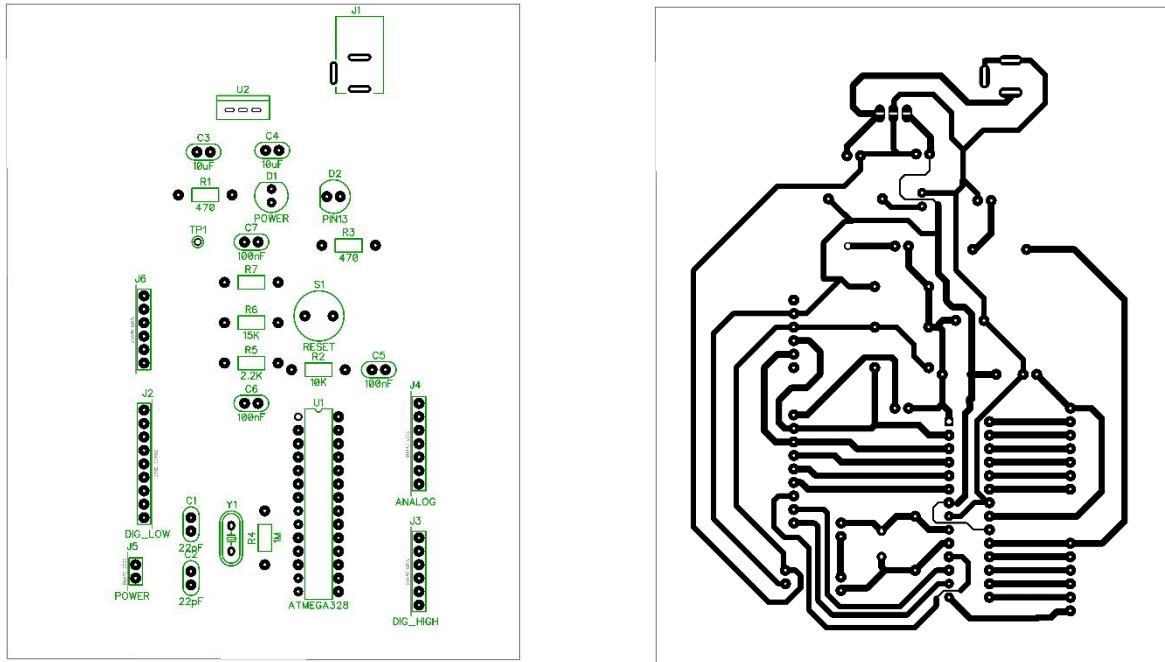


Fig 4. PCB layout of Arduino board (Top side on the left figure and bottom side on the right figure)

IV. TESTING THE BOARD

Connect The power adapter (up to 12V) and pair the HC-05 Bluetooth module with PC.Upload the following sketch named Blink to test the LED blinking in every 1 second connected on Pin 13 [11].

```
void setup()
{
    pinMode(13, OUTPUT);
}
void loop()
{
    digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)
    delay(1000);           // wait for a second
    digitalWrite(13, LOW); // turn the LED off by making the voltage LOW
    delay(1000);           // wait for a second
}
```

Upload the following sketch named DigitalReadSerial to check the working of serial communication [12].

```
int pushButton = 2;
void setup()
{
    Serial.begin(9600); // initialize serial communication at 9600 bits per second:
    pinMode(pushButton, INPUT); // make the pushbutton's pin an input:
}

// the loop routine runs over and over again forever:
void loop()
{
```



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```
int buttonState = digitalRead(pushButton); // read the input pin:
Serial.println(buttonState); // print out the state of the button:
delay(1); // delay in between reads for stability
}
```

V. CONCLUSION AND FUTURE WORK

We can design our own Arduino board with wireless programmability which is highly suitable for remote programming that require in most pre-installed hardware. This paper shows the programmability on Bluetooth, which in future we can expand with Wi-Fi and ZigBee protocol. As well as other than UNO board, we can design other high end board likes Arduino Mega or Arduino 101

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BIOGRAPHY

Mr. Ronak Mukeshbhai Vithlani obtained his M.Sc. Degree in Integrated Electronics, Computer and Instrumentation (M.Sc. (ECI-Integrated)) in 2012. He joined Saurashtra University as assistant professor in department of electronics in 2014 and currently pursuing his Ph.D. degree in Embedded system. He has published 3 papers in national and international journals.

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