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Arduino and HC-05 Bluetooth Module Tutorial

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In this Arduino Tutorial we will learn how use the HC-05 Bluetooth module for controlling Arduino via Bluetooth communication. You can watch the following video or read the written tutorial below for more details.

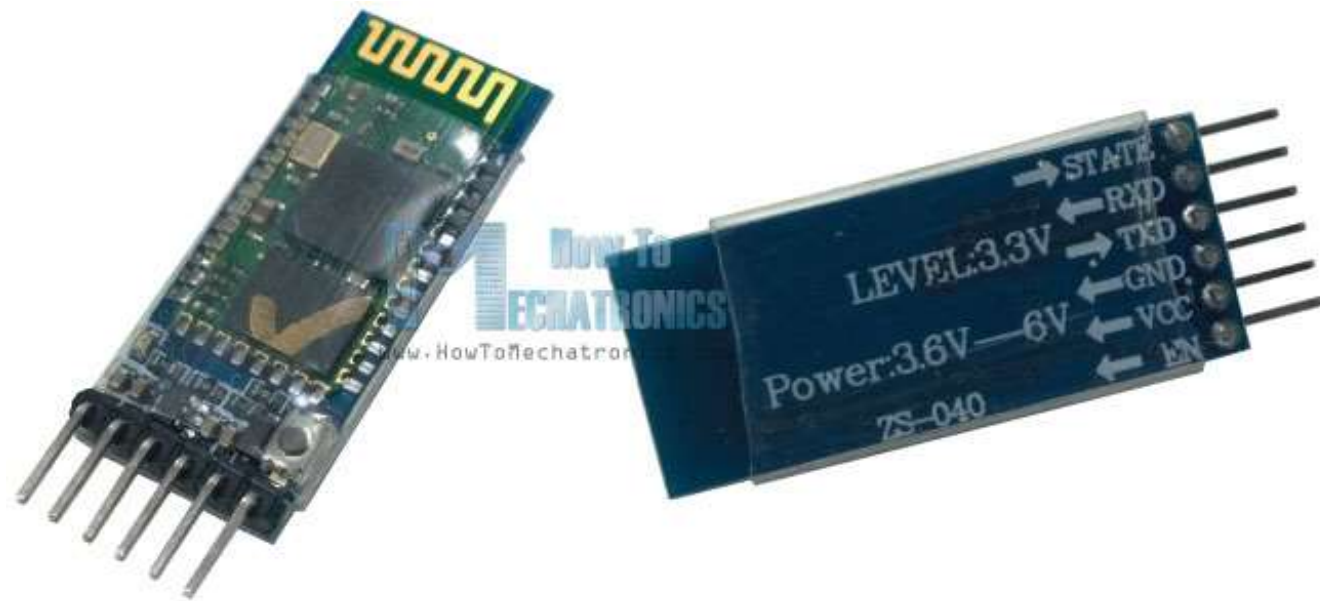
111

Arduino and HC-05 Bluetooth Module Tutorial | Android Smartphone & Lapt...



Overview

For this tutorial I made two example, controlling the Arduino using a smartphone and controlling the Arduino using a laptop or a PC. In order not to overload this tutorial, in my next tutorial we will learn how we can configure the HC-05 Bluetooth module and make a Bluetooth communication between two separate Arduino Boards as master and slave devices.



Before we start with the first example, controlling an Arduino using a smartphone, let's take a closer look at the HC-05 Bluetooth module. Comparing it to the HC-06 module, which can only be set as a Slave, the HC-05 can be set as Master as well which enables making a communication between two separate Arduino Boards. There are several different versions of this module but I recommend the one that comes on a breakout board because in that way it's much easier to be connected. The HC-05 module is a Bluetooth SPP (Serial Port Protocol) module, which means it communicates with the Arduino via the Serial Communication.

You can get the components needed for this Arduino tutorial from any of the sites below:

- HC-05 Bluetooth Module [Amazon \(http://howtomechatronics.com/recommends/hc-05-bluetooth-module-amazon/\)](http://howtomechatronics.com/recommends/hc-05-bluetooth-module-amazon/) / [Banggood \(http://howtomechatronics.com/recommends/hc-05-bluetooth-module-bg/\)](http://howtomechatronics.com/recommends/hc-05-bluetooth-module-bg/) / [GearBest \(http://howtomechatronics.com/recommends/hc-05-bluetooth-module-gearbest/\)](http://howtomechatronics.com/recommends/hc-05-bluetooth-module-gearbest/) / [DealExtreme \(http://howtomechatronics.com/recommends/hc-05-bluetooth-module-dealextreme/\)](http://howtomechatronics.com/recommends/hc-05-bluetooth-module-dealextreme/) / [ICStation \(http://howtomechatronics.com/recommends/hc-05-bluetooth-module-icstation/\)](http://howtomechatronics.com/recommends/hc-05-bluetooth-module-icstation/)
- Arduino Board [Amazon \(http://howtomechatronics.com/recommends/arduino-mega-board-amazon/\)](http://howtomechatronics.com/recommends/arduino-mega-board-amazon/) / [Banggood \(http://howtomechatronics.com/recommends/arduino-mega-board/\)](http://howtomechatronics.com/recommends/arduino-mega-board/) / [GearBest](http://howtomechatronics.com/recommends/arduino-mega-board/)

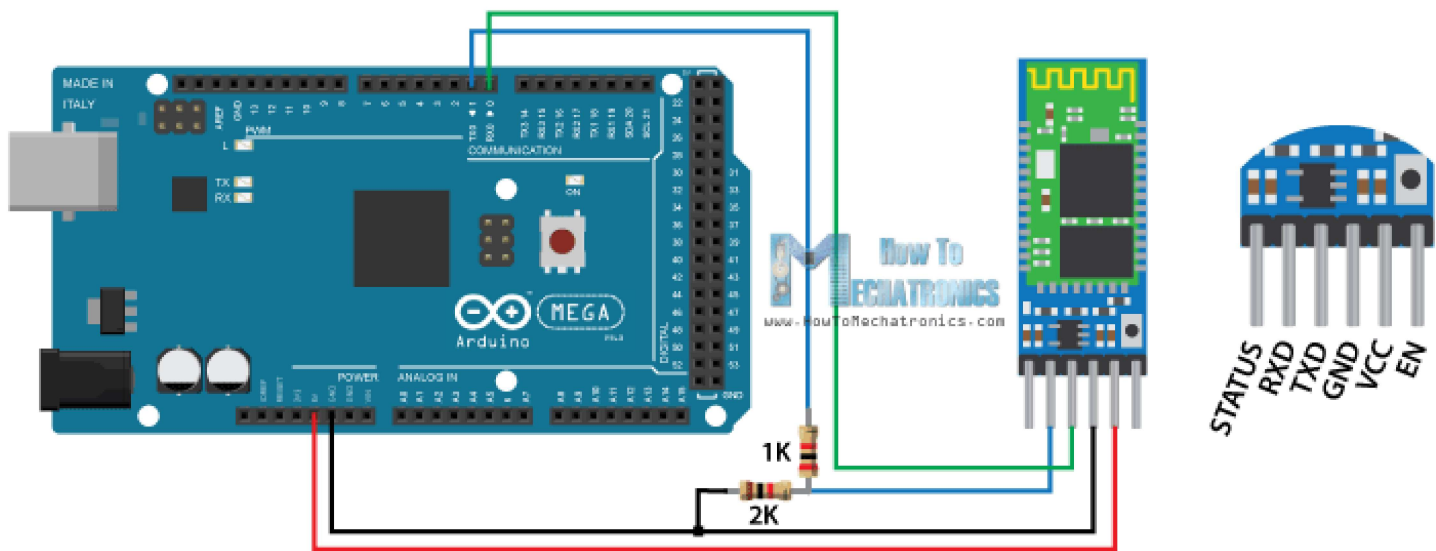
<http://howtomechatronics.com/recommends/arduino-mega-board-gearbest/>) / [DealExtreme](http://howtomechatronics.com/recommends/arduino-mega-board-dealextreme/) (<http://howtomechatronics.com/recommends/arduino-mega-board-dealextreme/>) / [ICStation](http://howtomechatronics.com/recommends/arduino-mega-2560-board-ic/) (<http://howtomechatronics.com/recommends/arduino-mega-2560-board-ic/>)

- Breadboard and Jump Wires [Amazon](http://howtomechatronics.com/recommends/breadboard-jumper-wires-kit-amazon/) (<http://howtomechatronics.com/recommends/breadboard-jumper-wires-kit-amazon/>) / [Banggood](http://howtomechatronics.com/recommends/solderless-pcb-breadboard-jump-wires-bg/) (<http://howtomechatronics.com/recommends/solderless-pcb-breadboard-jump-wires-bg/>) / [GearBest](http://howtomechatronics.com/recommends/breadboard-jump-wires-gearbest/) (<http://howtomechatronics.com/recommends/breadboard-jump-wires-gearbest/>) / [DealExtreme](http://howtomechatronics.com/recommends/breadboard-kit-dealextreme/) (<http://howtomechatronics.com/recommends/breadboard-kit-dealextreme/>) / [ICStation](http://howtomechatronics.com/recommends/breadboard-jump-wires-ic/) (<http://howtomechatronics.com/recommends/breadboard-jump-wires-ic/>)

**Please note: These are affiliate links. I may make a commission if you buy the components through these links. I would appreciate your support in this way!*

Circuit Schematics

Here's how we need to connect the module to the Arduino Board.



The particular module that I have can be powered from 3.6 to 6 volts, because it comes on breakout board which contains a voltage regulator. However, the logic voltage level of the data pins is 3.3V. So, the line between the Arduino TX (Transmit Pin, which has 5V output) and the Bluetooth module RX (Receive Pin, which supports only 3.3V) needs to be connected through a voltage divider in order not to burn the module. On the other hand, the line between the Bluetooth module TX pin and the Arduino RX pin can be connected directly because the 3.3V signal from the Bluetooth module is enough to be accepted as a high logic at the Arduino Board.

Arduino Source Code

So, now we are ready to make the Arduino code for enabling the communication between the Arduino board and the smartphone. We will make a simple example, just turning on and off a LED but it will be good enough for understanding the communication.

```
1. #define ledPin 7
2. int state = 0;
3.
4. void setup() {
```

```

5.     pinMode(ledPin, OUTPUT);
6.     digitalWrite(ledPin, LOW);
7.     Serial.begin(38400); // Default communication rate of the Bluetooth module
8. }
9.
10. void loop() {
11.     if(Serial.available() > 0){ // Checks whether data is coming from the serial port
12.         state = Serial.read(); // Reads the data from the serial port
13.     }
14.
15.     if (state == '0') {
16.         digitalWrite(ledPin, LOW); // Turn LED OFF
17.         Serial.println("LED: OFF"); // Send back, to the phone, the String "LED: ON"
18.         state = 0;
19.     }
20.     else if (state == '1') {
21.         digitalWrite(ledPin, HIGH);
22.         Serial.println("LED: ON");
23.         state = 0;
24.     }
25. }

```

Description: First we need to define the pin to which our LED will be connected and a variable in which we will store the data coming from the smartphone. In the setup section we need to define the LED pin as output and set it low right away. As mention previously, we will use the serial communication so we need to begin the serial communication at 38400 baud rate, which is the default baud rate of the Bluetooth module. In the loop section with the Serial.available() function we will check whether there is available data in the serial port to be read. This means that when we will send data to the Bluetooth module this statement will be true so then using the Serial.read() function we will read that data and put it into the “state” variable. So if the Arduino receive the character ‘0’ it will turn the LED off and using the Serial.println() function it will send back to the smartphone, via the serial port, the String “LED: OFF”. Additionally we will reset the “state” variable to 0 so that the two above lines will be executed only once. Note here that the “state” variable is integer, so when we receive the character ‘0’ that comes from smartphone, the actual value of the integer “state” variable is 48, which corresponds to character ‘0’, according to the [ASCII \(https://en.wikipedia.org/wiki/ASCII\)](https://en.wikipedia.org/wiki/ASCII) table.. That’s why in the “if” statement we are comparing the “state” variable to a character ‘0’. On the other hand, if the received character is ‘1’, the LED will light up and the String “LED: ON” will be sent back.

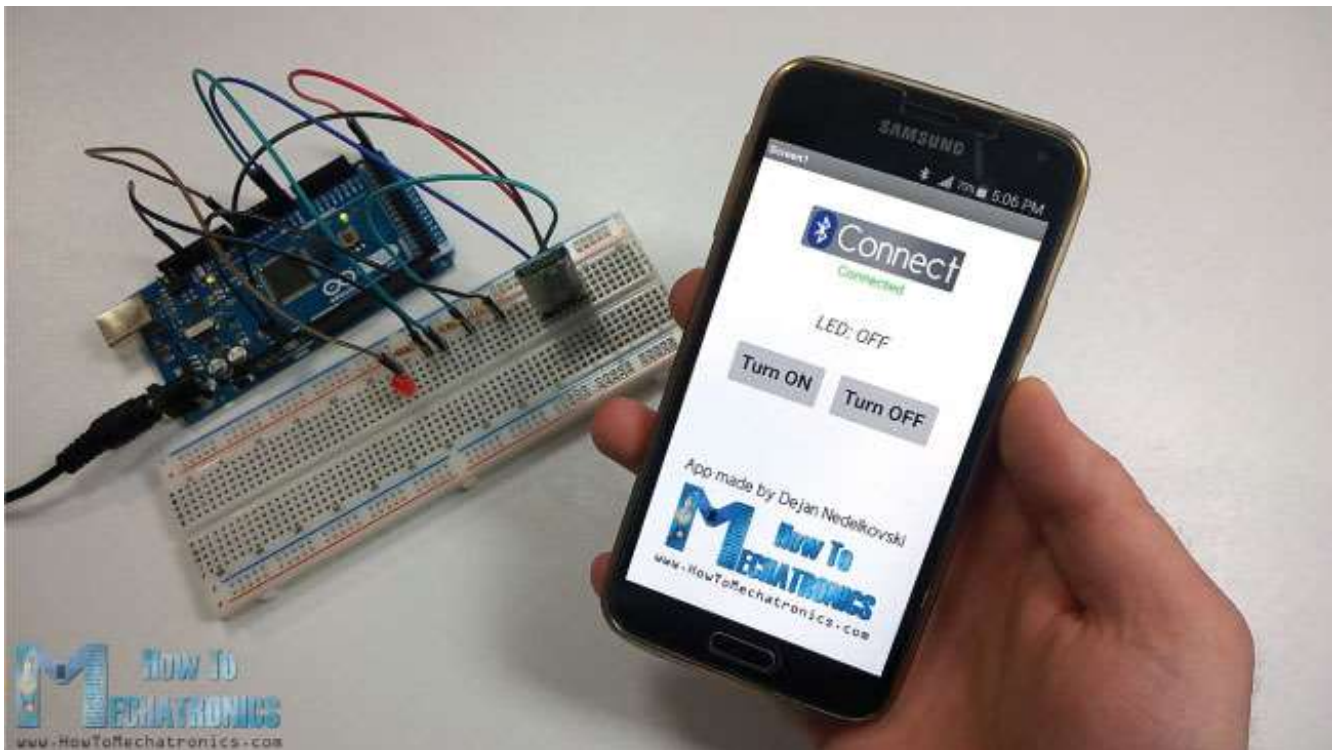
Now the code is ready to be uploaded but in order to do that we need to unplug the TX and RX lines because when uploading the Arduino uses the serial communication so the pins RX (digital pin 0) and TX (digital pin1) are busy. We can avoid this step if we use the other TX and RX pins of the Arduino Board, but in that case we will have to use the SoftwareSerial.h library for the serial communication.

Connecting the Smartphone to the HC-05 Bluetooth Module and the Arduino

Now we are ready to connect the smartphone to the Bluetooth module and the Arduino. What we need to do here is to activate the Bluetooth and the smartphone will find the HC-05 Bluetooth module.



Then we need to pair the devices and the default password of the HC-05 module is 1234. After we have paired the devices we need an application for controlling the Arduino. There are many application in the Play Store for this purpose which will work with the Arduino code that we wrote. However, I made my own custom application for this tutorial using the [MIT App Inventor](http://appinventor.mit.edu/explore/) (<http://appinventor.mit.edu/explore/>) online application. This is a great and easy to use application for building Android application and in my next tutorial you can find a detailed step by step guide how to build your own custom Android application for your Arduino Project.



Here's the application that I made. With the connect button we will connect the smartphone to the Bluetooth module and the status text below the button will tell us whether we have successfully connected. Now using the "Turn ON" and "Turn OFF" buttons we can turn on and off the LED. The text above the buttons is the one that the Arduino is sending back to the smartphone when a particular button is pressed.

You can download this app from here:



Arduino Bluetooth Tutorial Example Android App 1.38 MB
Download

Controlling Arduino Using a Laptop or PC via Bluetooth Communication

Let's see how we can control the Arduino via Bluetooth using a Laptop or a PC. So, first we need to pair our laptop to the HC-05 Bluetooth module and we can do that from the Laptop Bluetooth Settings. The laptop will discover the HC-05 module and using the '1234' password we will pair the devices.



Manage Bluetooth devices

Bluetooth

On



Your PC is searching for and can be discovered by Bluetooth devices.



H-C-2010-06-01
Ready to pair

Pair

Once we will pair the devices in the Laptop Device Manager, under Ports (COM & LPT), two new entities will appear named "Standard Serial over Bluetooth link". From here we can see the COM Port number of the serial port through which the devices will communicate.

- ▷ Keyboards
- ▷ Memory technology devices
- ▷ Mice and other pointing devices
- ▷ Monitors
- ▷ Network adapters
- ▷ Ports (COM & LPT)
 - ▷ Standard Serial over Bluetooth link (COM5)
 - ▷ Standard Serial over Bluetooth link (COM6)
- ▷ Print queues
- ▷ Processors
- ▷ Sensors
- ▷ Software devices
- ▷ Sound, video and game controllers

We will stick with the same example as previously, turning on and off a LED and sending back a string to the laptop, so we will use the same Arduino code as previously described.

Processing IDE Source Code

Now using the Processing IDE we will make a program for controlling the Arduino. Here's the source code.

```
1.  import processing.serial.*;
2.  Serial myPort;
3.  String ledStatus="LED: OFF";
4.
5.  void setup(){
6.      size(450, 500);
7.      myPort = new Serial(this, "COM5", 38400); // Starts the serial communication
8.      myPort.bufferUntil('\n'); // Defines up to which character the data from the serial port will
        be read. The character '\n' or 'New Line'
9.  }
10. void serialEvent (Serial myPort){ // Checks for available data in the Serial Port
11.     ledStatus = myPort.readStringUntil('\n'); //Reads the data sent from the Arduino (the String
        "LED: OFF/ON) and it puts into the "ledStatus" variable
12. }
13.
14. void draw(){
15.     background(237, 240, 241);
16.     fill(20, 160, 133); // Green Color
17.     stroke(33);
18.     strokeWeight(1);
19.     rect(50, 100, 150, 50, 10); // Turn ON Button
20.     rect(250, 100, 150, 50, 10); // Turn OFF Button
21.     fill(255);
22.
23.     textSize(32);
24.     text("Turn ON",60, 135);
25.     text("Turn OFF", 255, 135);
26.     textSize(24);
27.     fill(33);
28.     text("Status:", 180, 200);
29.     textSize(30);
30.     textSize(16);
31.     text("Program made by Dejan Nedelkovski,\n      www.HowToMechatronics.com", 80, 320);
32.
33.     text(ledStatus, 155, 240); // Prints the string coming from the Arduino
34.
35.     // If the button "Turn ON" is pressed
36.     if(mousePressed && mouseX>50 && mouseX<200 && mouseY>100 && mouseY<150){
37.         myPort.write('1'); // Sends the character '1' and that will turn on the LED
38.         // Highlights the buttons in red color when pressed
39.         stroke(255,0,0);
40.         strokeWeight(2);
41.         noFill();
42.         rect(50, 100, 150, 50, 10);
43.     }
44.     // If the button "Turn OFF" is pressed
45.     if(mousePressed && mouseX>250 && mouseX<400 && mouseY>100 && mouseY<150){
```

```

46.     myPort.write('0'); // Sends the character '0' and that will turn on the LED
47.     stroke(255,0,0);
48.     strokeWeight(2);
49.     noFill();
50.     rect(250, 100, 150, 50, 10);
51. }
52. }

```

Description: We need to include the Serial library and create a serial object in order to enable the serial communication, as well as, define a String variable for the led status. In the setup section we need to set the window size of the program and start the serial communication. As for the COM Port Number here we need to try one of the two COM Port numbers we previously noticed in the device manager. The next line defines the buffering of the serial port and in our case that's until there is a new line and actually there is a new line each time the Arduino sends the String "LED: OFF" or "LED ON" because of the println() function. Next, using the serialEvent() function we check whether there is available data in the serial port to be read. If so, using the readStringUntil() function we will read that data from the serial port which has been sent from the Arduino and in our case that's the String "LED: OFF" or "LED: ON".

In the main draw() function, which constantly repeats, we make all the graphics and functions of the program. So first we need set the background color, the fill color, the stroke size and color and using the rect() function we draw the two buttons. Using the text() function we print all the text, including the ledStatus string that's coming from the Arduino. What's left now is to make the buttons functional. So using the first "if" statement we confine the area of the "Turn ON" button, so when the button is pressed the character '1' will be sent over the serial port to the Arduino and that will turn on the LED. The next for lines are used to highlight the button when it's pressed. The same procedure goes for the "Turn OFF" button.



Now the program is ready, so when we will click the run button, the program will automatically activate the Bluetooth communication between the laptop and the Arduino. The HC-05 Bluetooth module will start to flash every two seconds, which indicates that the module is connect and we will be able to control the LED using our

Laptop.

That's all for this tutorial, but don't forget to check my next tutorial where we will learn how we can configure the HC-05 Bluetooth module and make a Bluetooth communication between two separate Arduino Boards as master and slave devices.

We highly recommend **EasyEDA** for circuit design and **low cost PCB order**
(<https://easyeda.com/order>)

Free Circuit Simulation Software - EasyEDA (<https://easyeda.com/>)

Powerful circuit design, mixed-mode circuit simulation and PCB design (<https://easyeda.com/>)

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[Arduino Bluetooth Tutorial \(<http://howtomechatronics.com/tag/arduino-bluetooth-tutorial/>\)](http://howtomechatronics.com/tag/arduino-bluetooth-tutorial/)

[HC-05 Bluetooth \(<http://howtomechatronics.com/tag/hc-05-bluetooth/>\)](http://howtomechatronics.com/tag/hc-05-bluetooth/)

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ARDUINO TUTORIAL #02

BUTTONS & PWM

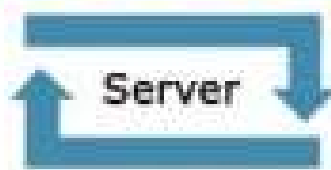
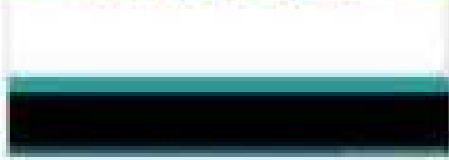
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ARDUINO TUTORIAL #07



Arduino IDE

Matlab

MATLAB

ARDUINO TUTORIAL 07: MATLAB ([HTTP://HOWTOMECHATRONICS.COM/TUTORIALS/ARDUINO/MATLAB/](http://howtomechatronics.com/tutorials/arduino/matlab/))

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Serial Communication

Android & Arduino



HOW TO BUILD CUSTOM ANDROID APP FOR YOUR ARDUINO PROJECT USING MIT APP INVENTOR
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18 (<http://howtomechatronics.com/tutorials/arduino/how-to-build-custom-android-app-for-your-arduino-project-using-mit-app-inventor/#comments>)
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13 RESPONSES

Bruce Marshall

April 8, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-781>)

Hi,

Would you please send me a link to your YouTube video on pairing two HC-05 bluetooth modules connected to Arduinos to show how you make them master and slave? Regards, Bruce Marshall

REPLY

Dejan Nedelkovski (<http://howtomechatronics.com>)

April 8, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-784>)

Hi there. Well that one isn't published yet but it will be in couple of days. 😊

REPLY

MAC

April 29, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-875>)

Hello,

I'm trying to make the same, but I'm getting this error "error: 'import' does not name a type import processing.serial.*".

how i can fix it ???

Thanx.

REPLY

Dejan Nedelkovski (<http://howtomechatronics.com>)

May 2, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-879>)

What same? It sounds like you are using a Processing IDE code into Arduino IDE.

REPLY

Rishi

May 26, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-969>)

How do I connect the LED to the Arduino for this example?

REPLY

Rishi

May 27, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-972>)

I programmed an HC-SR04 to detect any motion that occurs in front of it. I also followed your tutorial and made an app to control the Arduino using the HC-05 bluetooth module. Every time the HC-SR04 detects motion, I want a sound to play on the phone of the person with the app installed on their phone. How do I do this?

REPLY

Dharma KC

June 22, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-1017>)

Well Done tutorials – can you please share the android code for the simple app that you have made. Thank you

REPLY

Dejan Nedelkovski (<http://howtomechatronics.com>)

June 24, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-1025>)

Thanks! Well the program is available for download, you probably have missed it.

REPLY

Anggi

June 28, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-1032>)

Mr. Nedekovski, why my bluetooth HC-05 module has a 2 LEDS blinking in the same time (red & blue) ?

since I give “on” logic the led is not on.

REPLY

Anggi

June 28, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-1033>)

can i request your email address ? I want to send you a photo/video about my problem

REPLY

mohcine

July 6, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-1046>)

plz my smart phone don't detect the Bluetooth module .

REPLY

Lazar

July 9, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-1051>)

Hi, I have a problem. I have connected BT module and uploaded the code but when I press buttons nothing happens.

Is it possible that I have burned the BT module?

If yes, then how can I check that?

REPLY

Sanjeeban Maji

July 18, 2016 (<http://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/#comment-1071>)

Hi,

Thank you very much for this tutorial...i tried this and it's working.

only one issue : when the led is on, it shows LED: OFF and vice versa.Can you help how to correct this?

It will be also helpful if the app automatically switches on Bluetooth !

REPLY

LEAVE A REPLY

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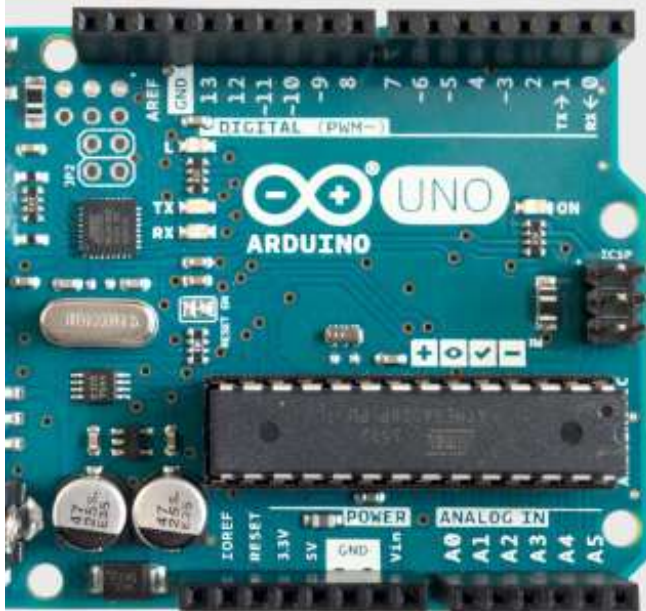
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(<https://www.facebook.com/groups/overhypedmechanics/> chat/users/DejanNedelkovsk

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233
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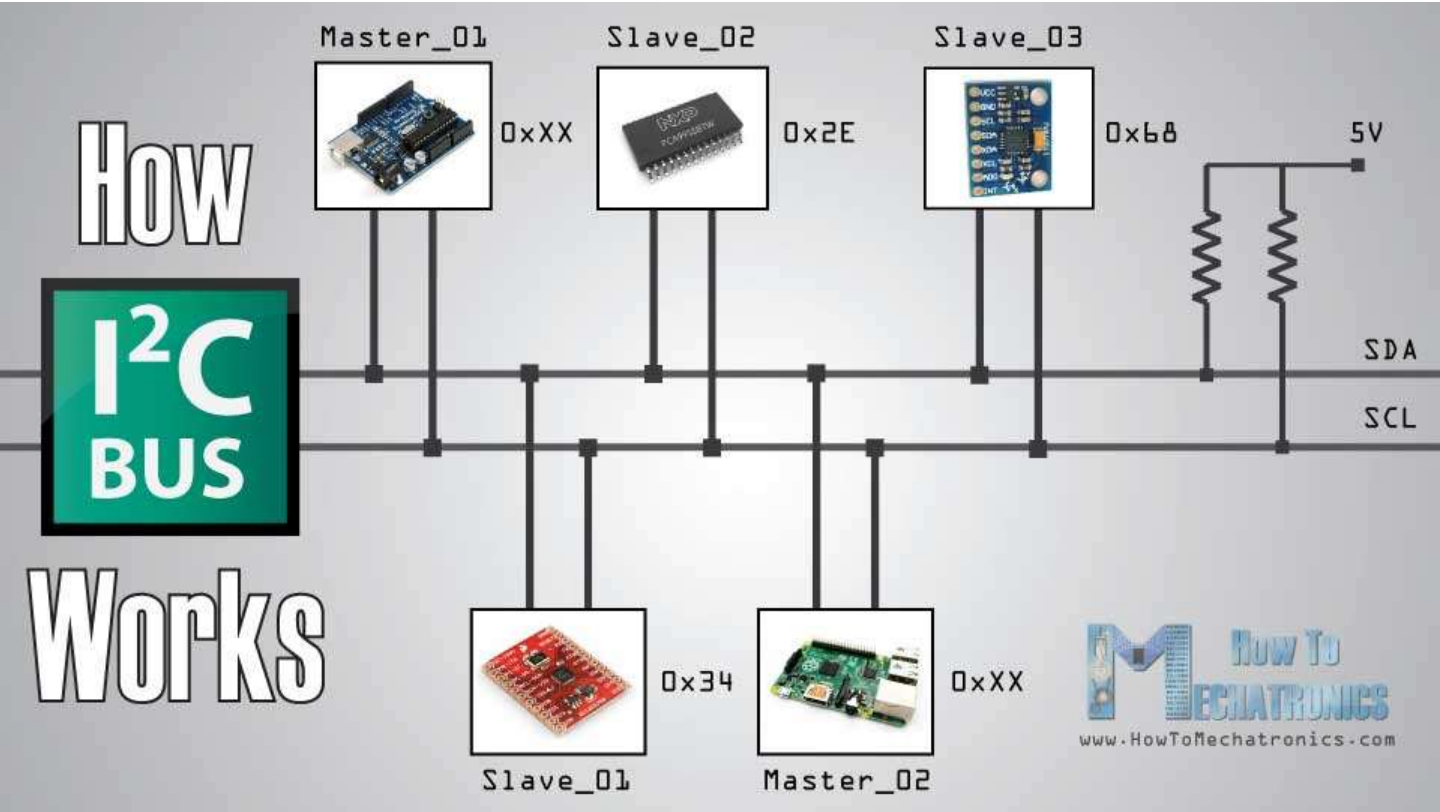
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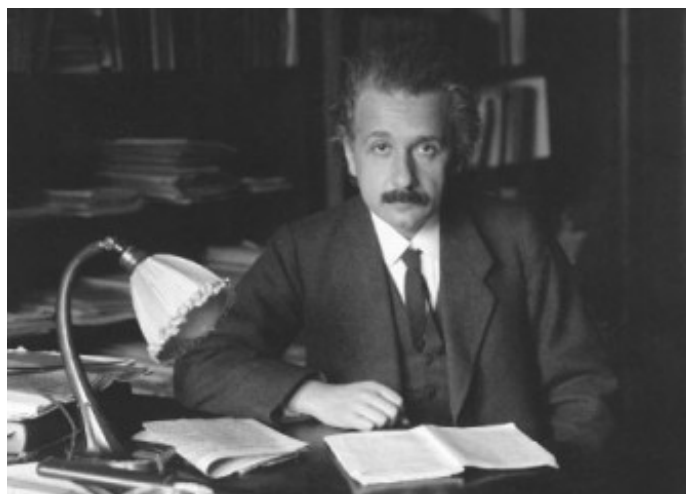
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