Embedded Systems

Smart Home Prototype

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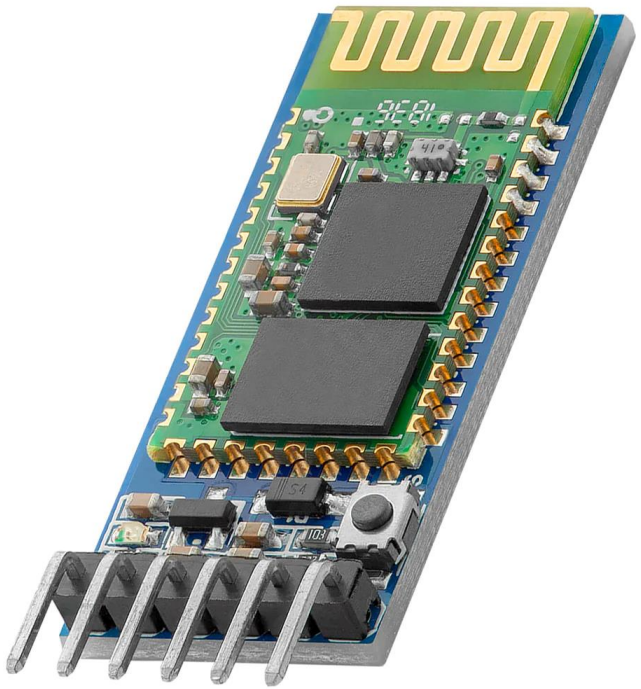
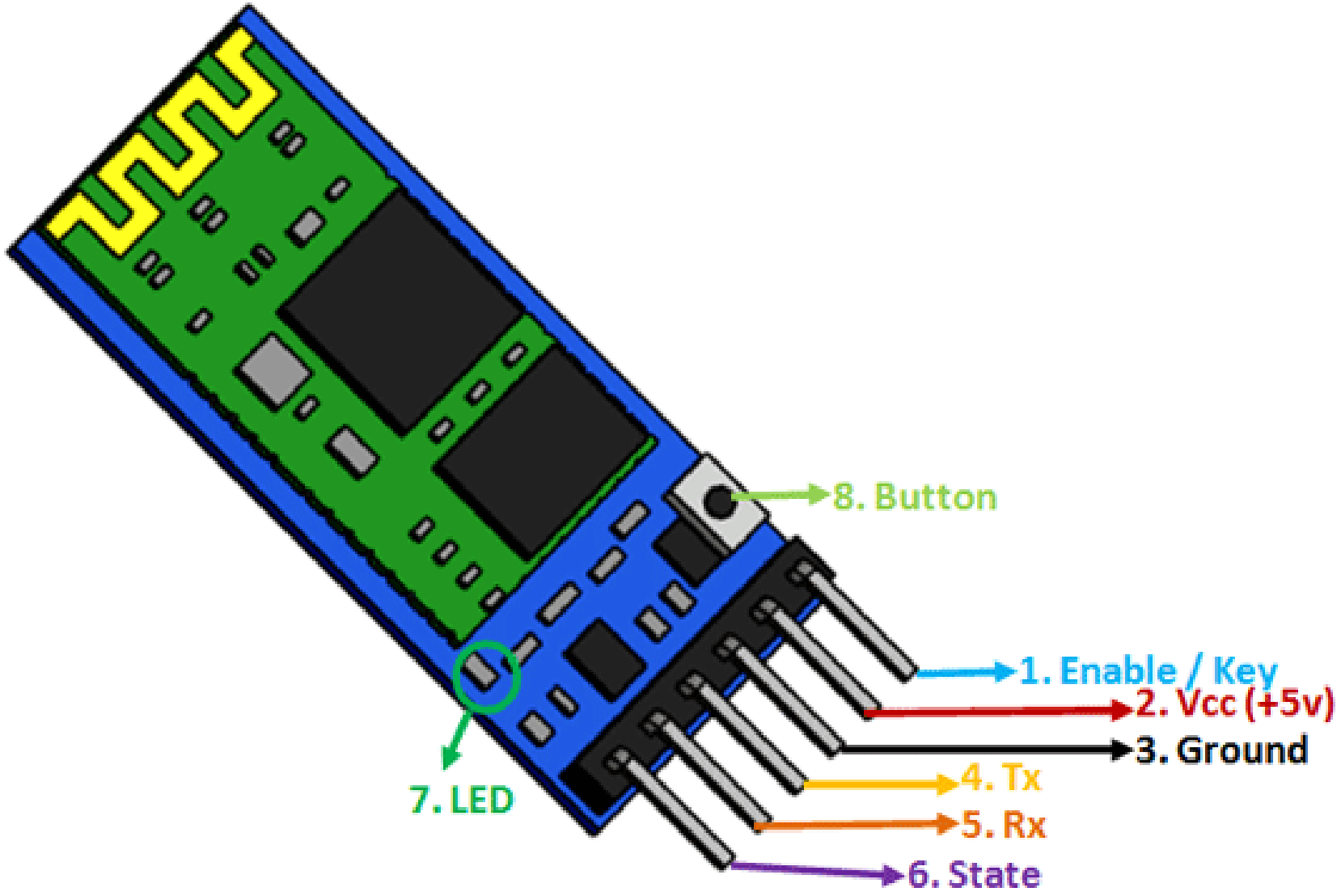
HC-05 Bluetooth Module

- HC-05 is a Bluetooth module which is designed for wireless communication.
- You can use this module to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop.

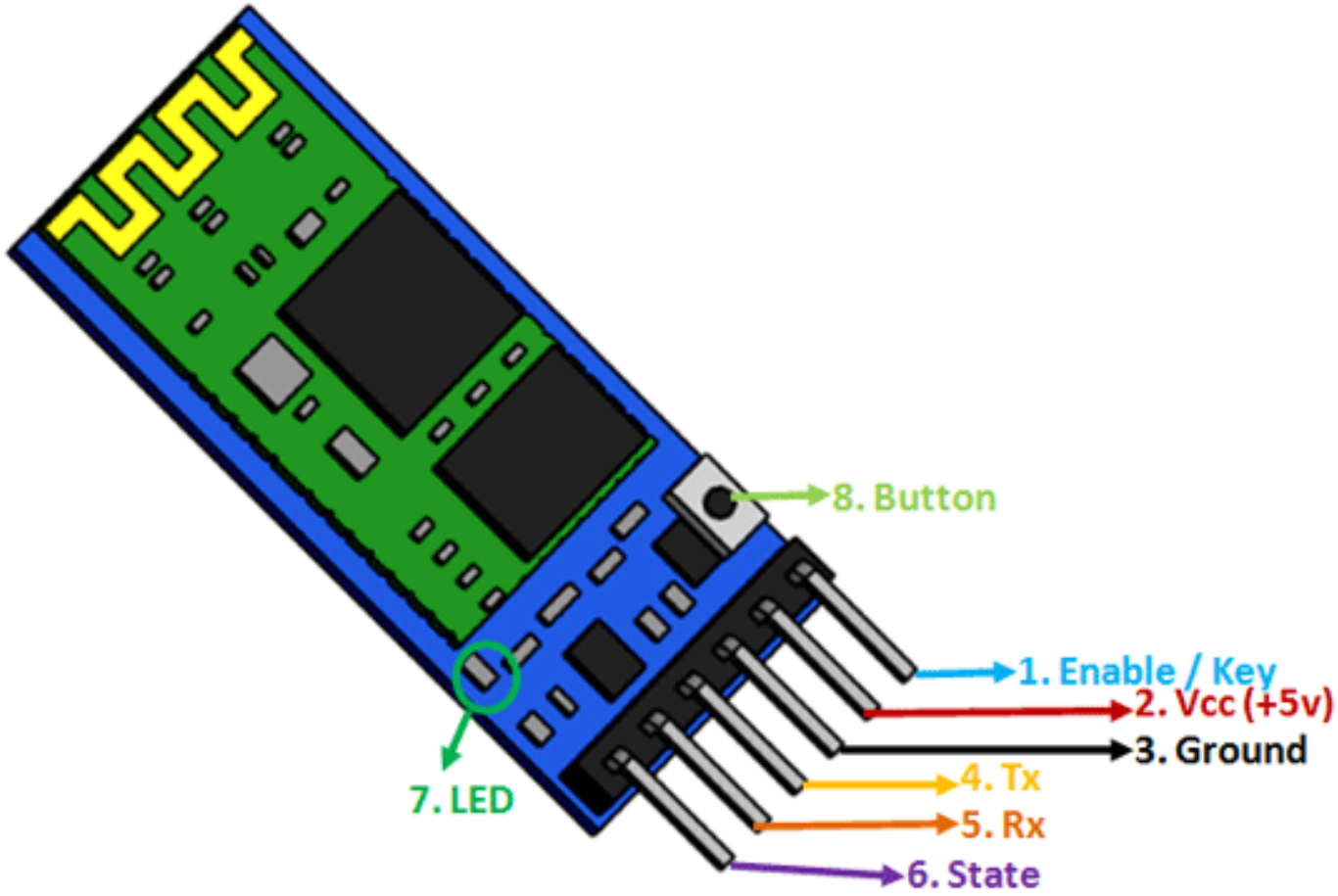


HC-05 Bluetooth Module: Pinout



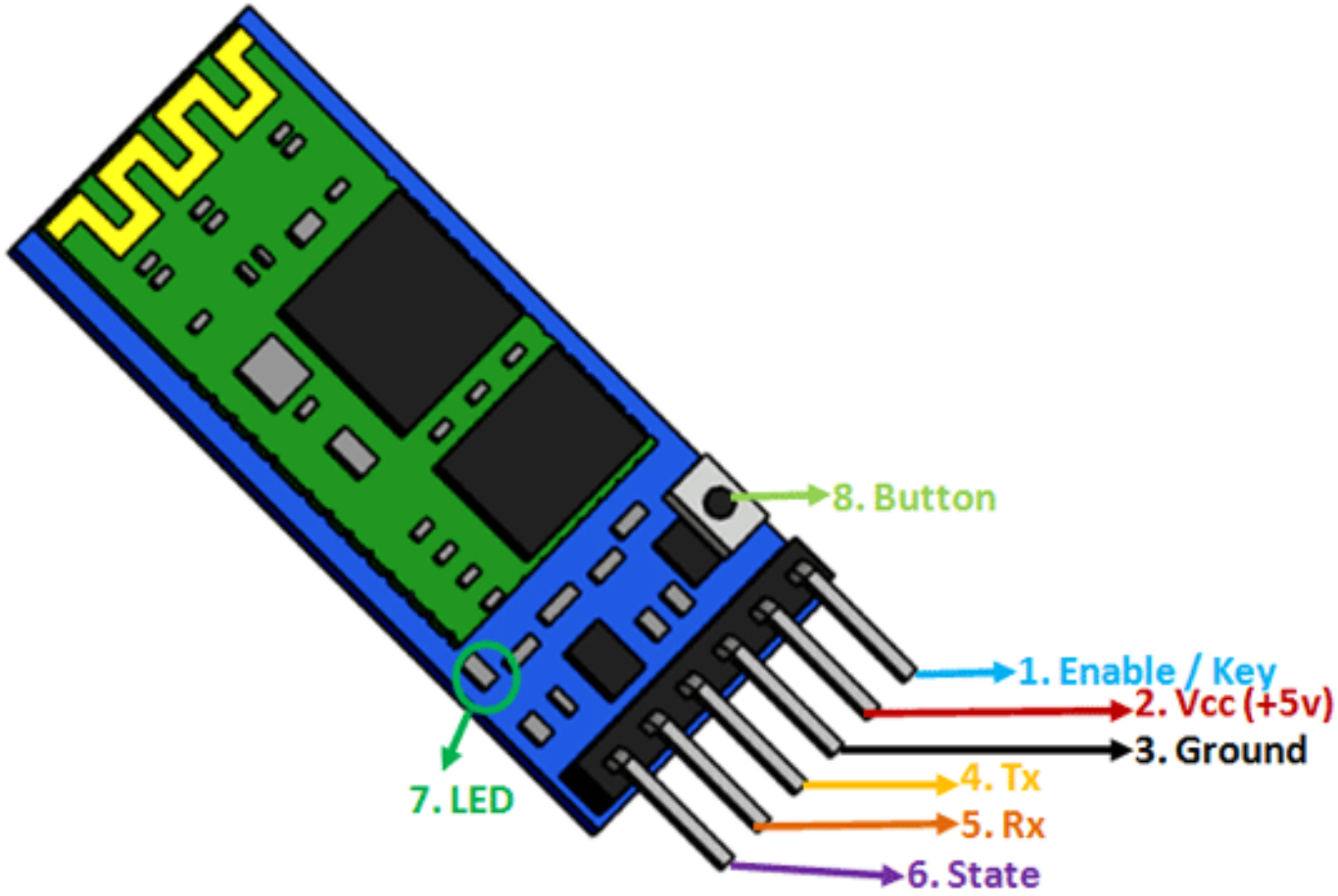
HC-05 Bluetooth Module: Pinout

- The VCC pin powers the module, connected to +5V supply voltage.



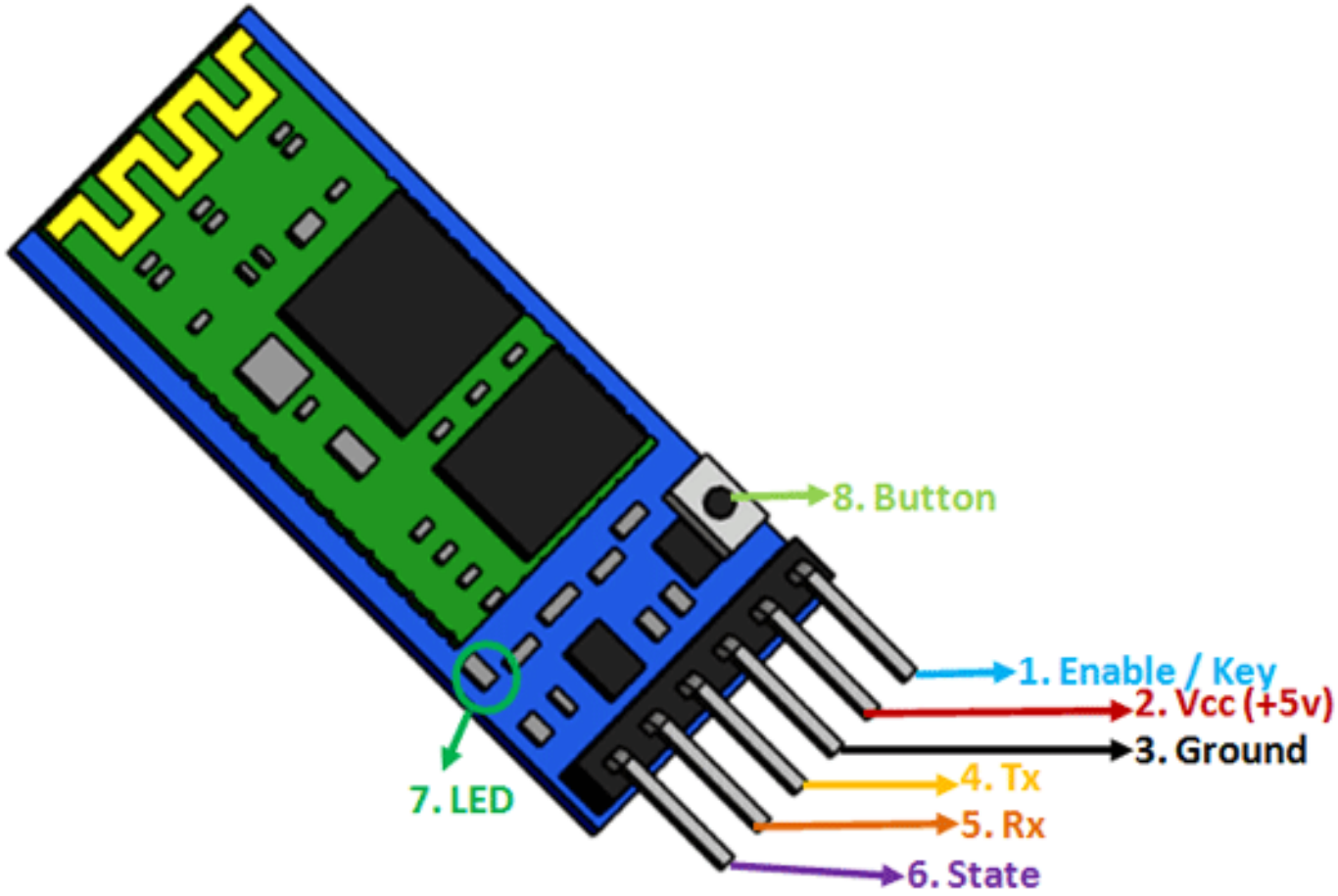
HC-05 Bluetooth Module: Pinout

- The GND pin of module, connected to the ground.



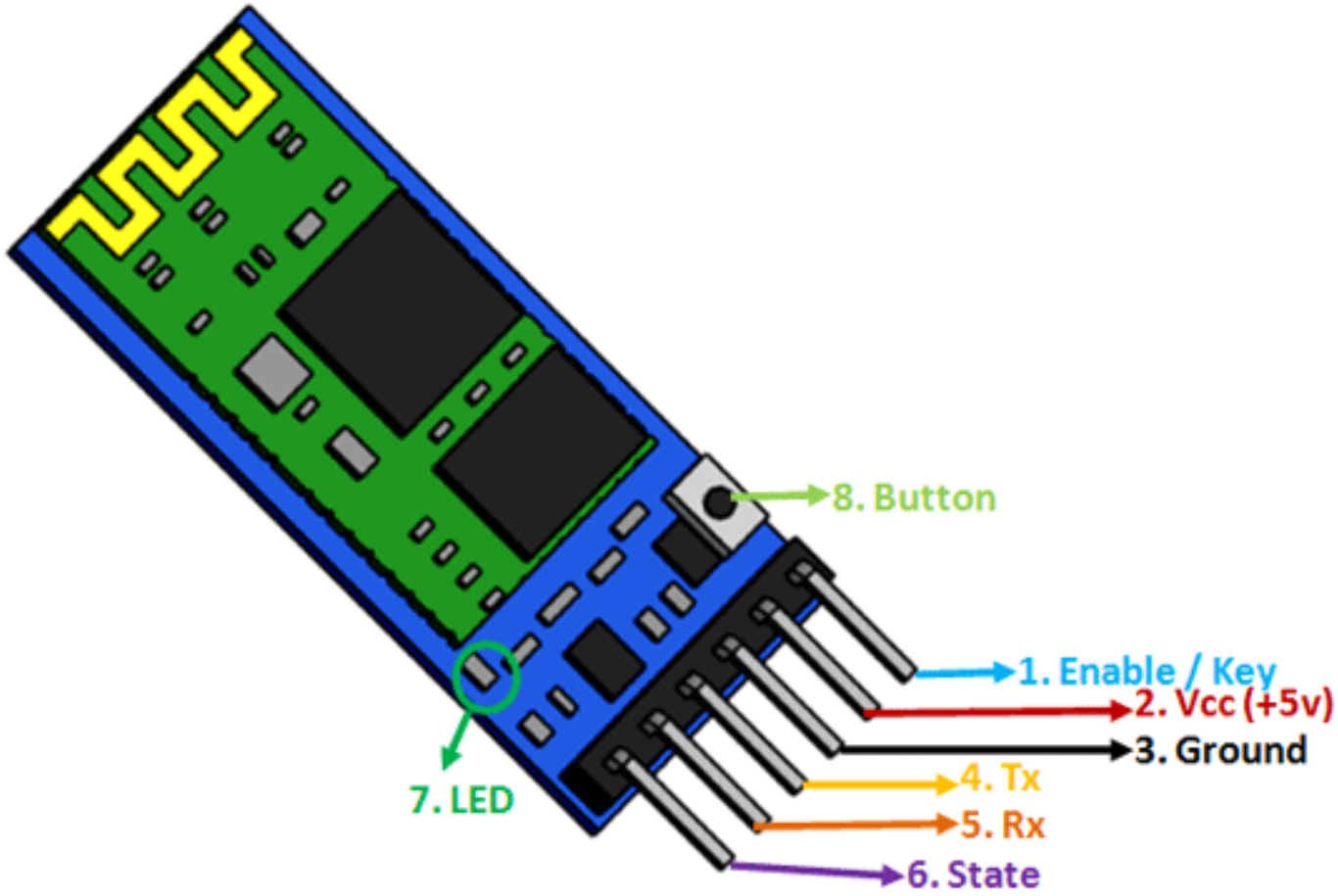
HC-05 Bluetooth Module: Pinout

- The TX pin of module transmits serial data.



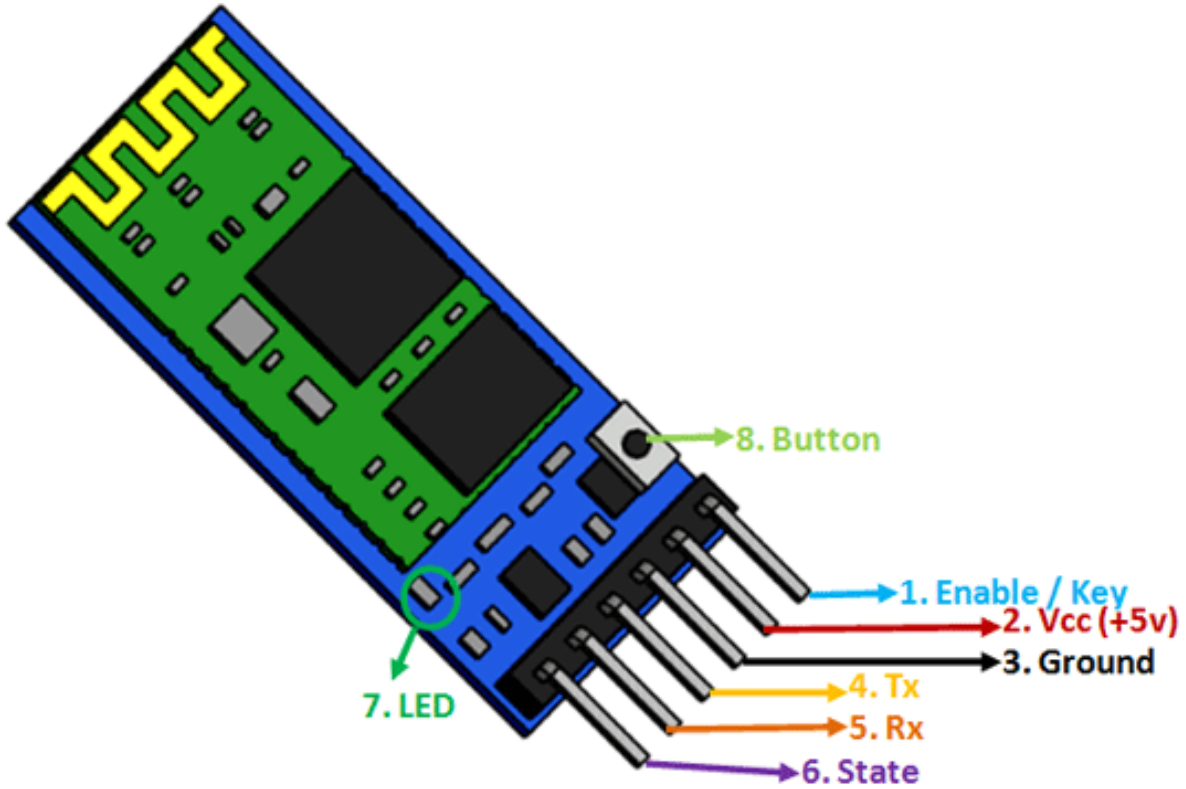
HC-05 Bluetooth Module: Pinout

- The RX pin of module receives serial data.



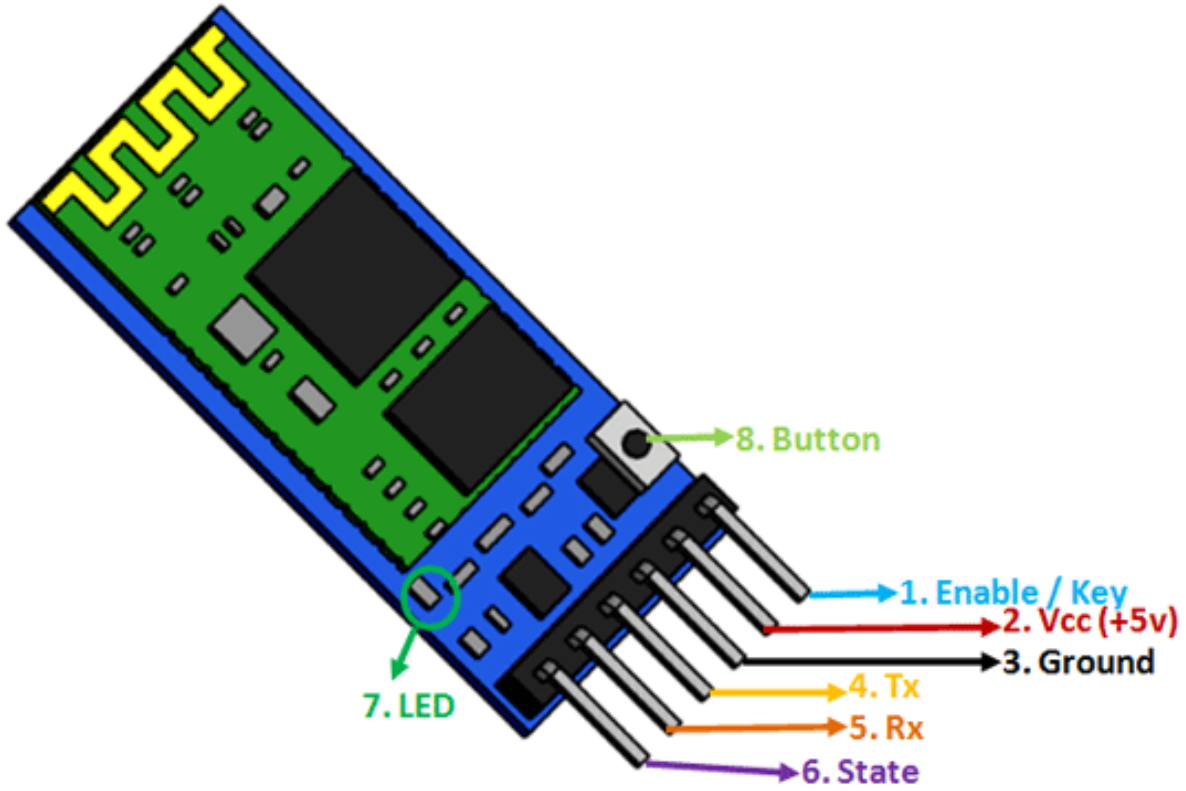
HC-05 Bluetooth Module: Pinout

- The State pin shows the current state of the Bluetooth.
- It tells whether module is connected or not.



HC-05 Bluetooth Module: Pinout

- The Enable/Key pin helps to change the device between data mode and command mode using an external signal.

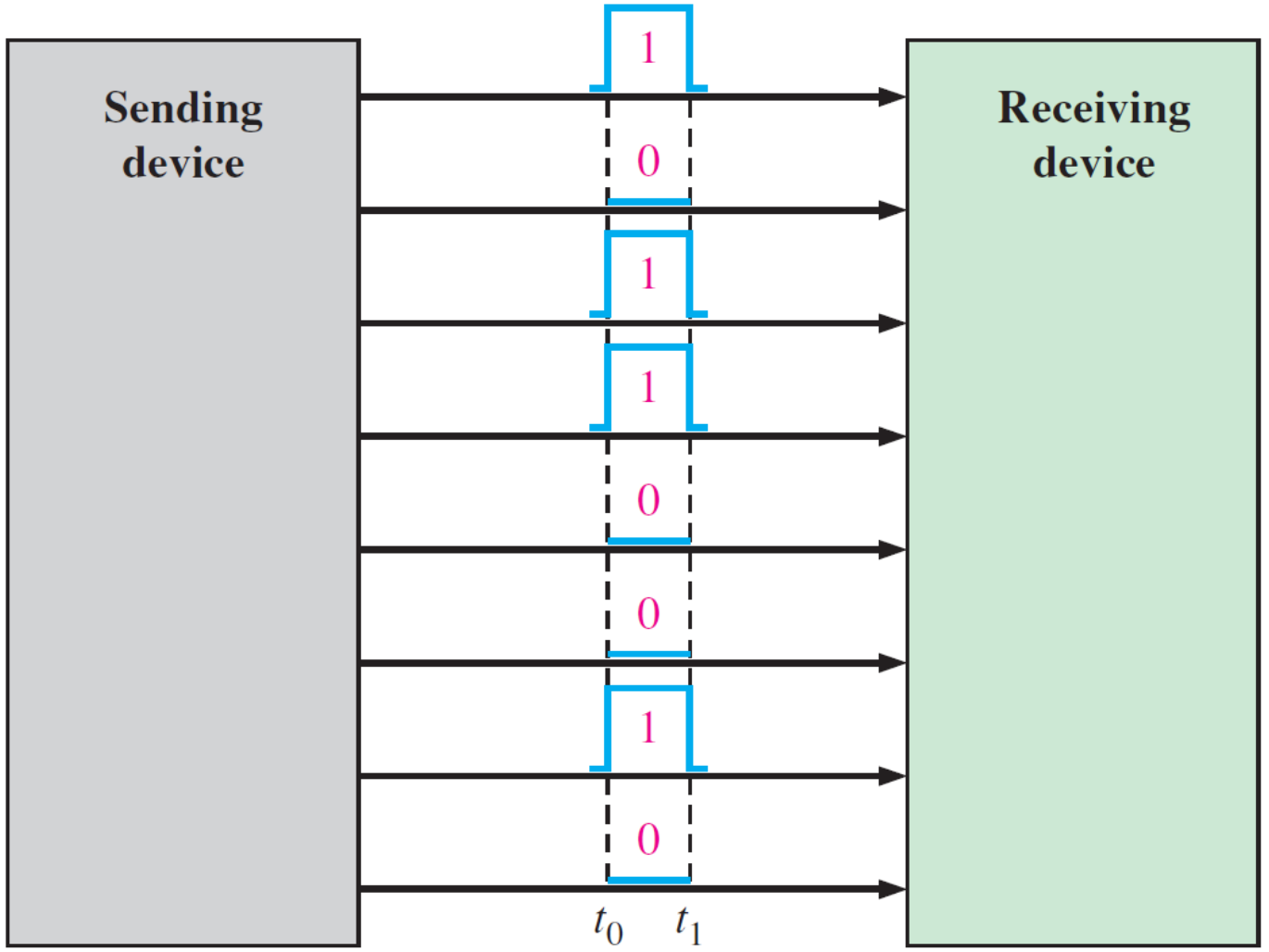


HC-05 Bluetooth Module: Specifications

Feature	Description
Model	HC-05
Frequency	2.4 GHz
Communication Method	Serial Communication
Interface	UART
Working Voltage	3.6V – 5V
Operating Current	30mA
Range	<100m
Password	1234 OR 0000
Baud Rate	9600 (default)

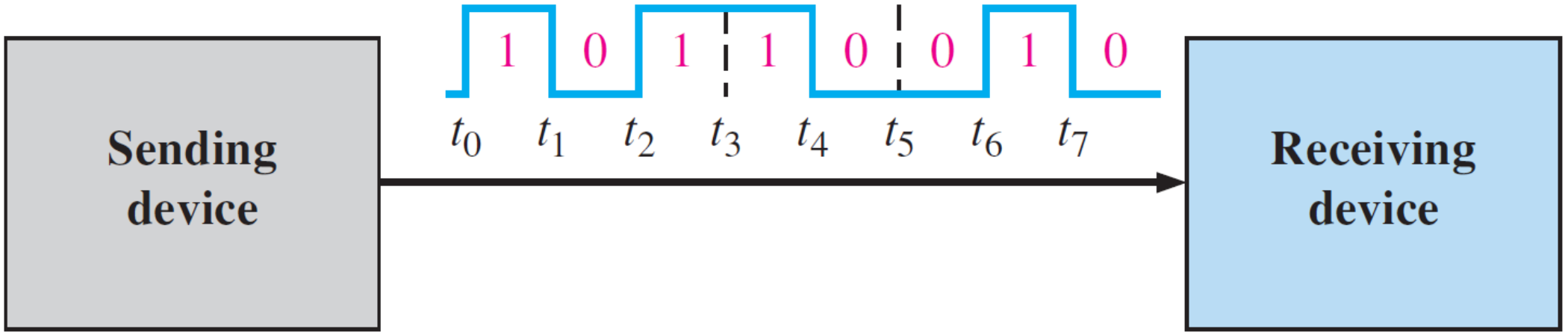
Parallel Communication

- In parallel communication, where many bits are sent at the same time.



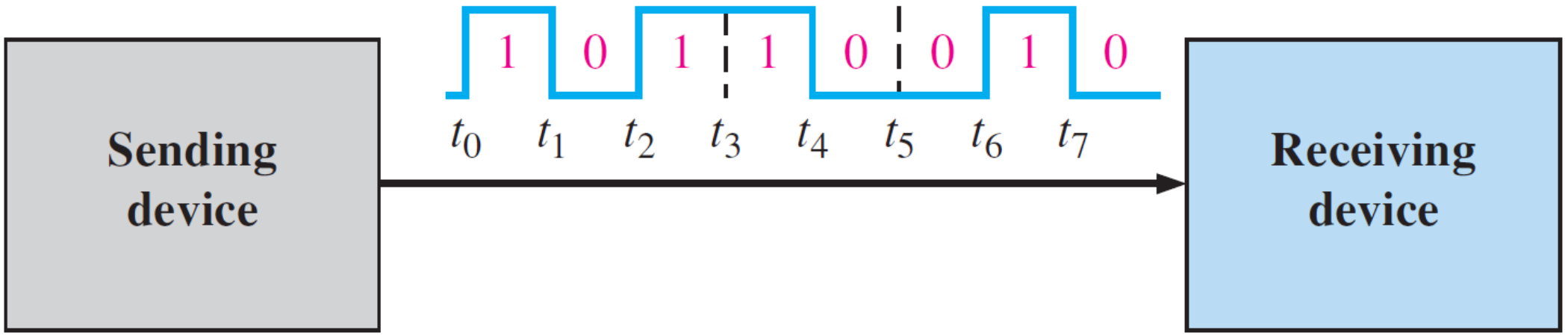
Serial Communication

- Serial communication is simply a way to transfer data.
- The data will be sent sequentially, one bit at a time.



Serial Communication: UART Protocol

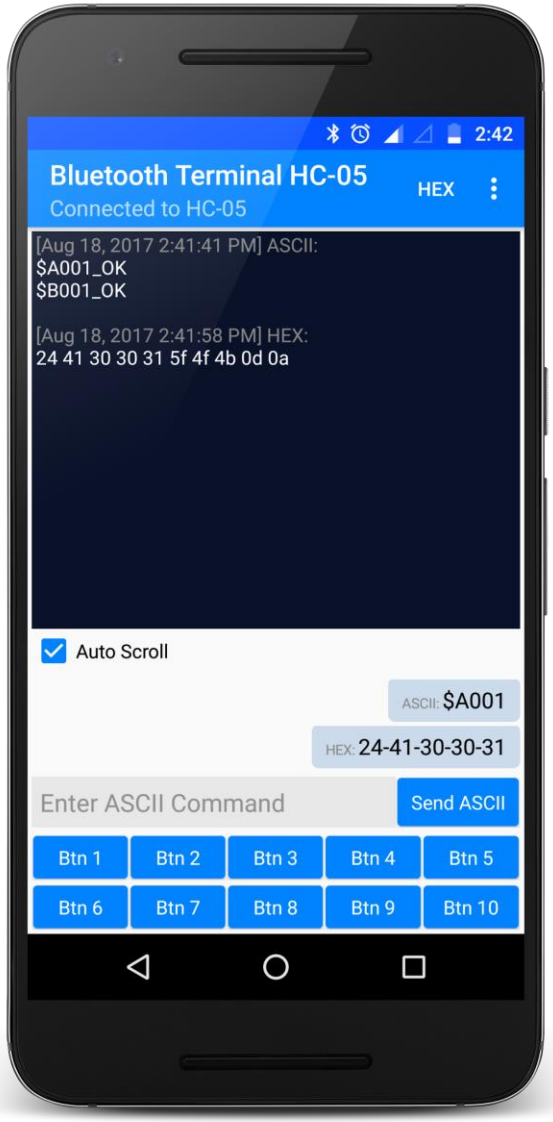
- UART means "Universal Asynchronous Receiver Transmitter".
- When you use serial communication between PC and Arduino, you're using the UART protocol.
- The UART protocol allows you to communicate between the 2 boards.

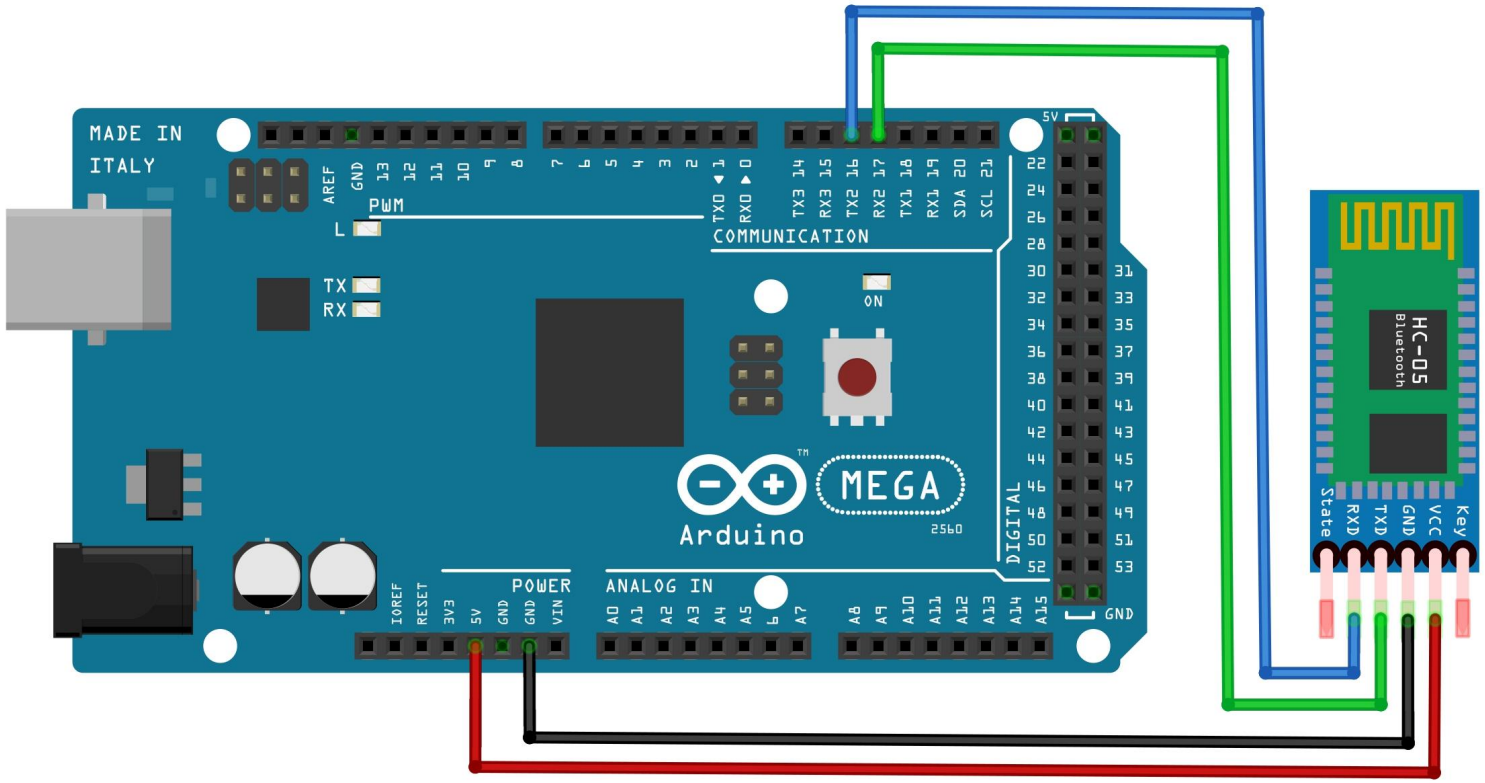


Serial Communication: Baud Rate

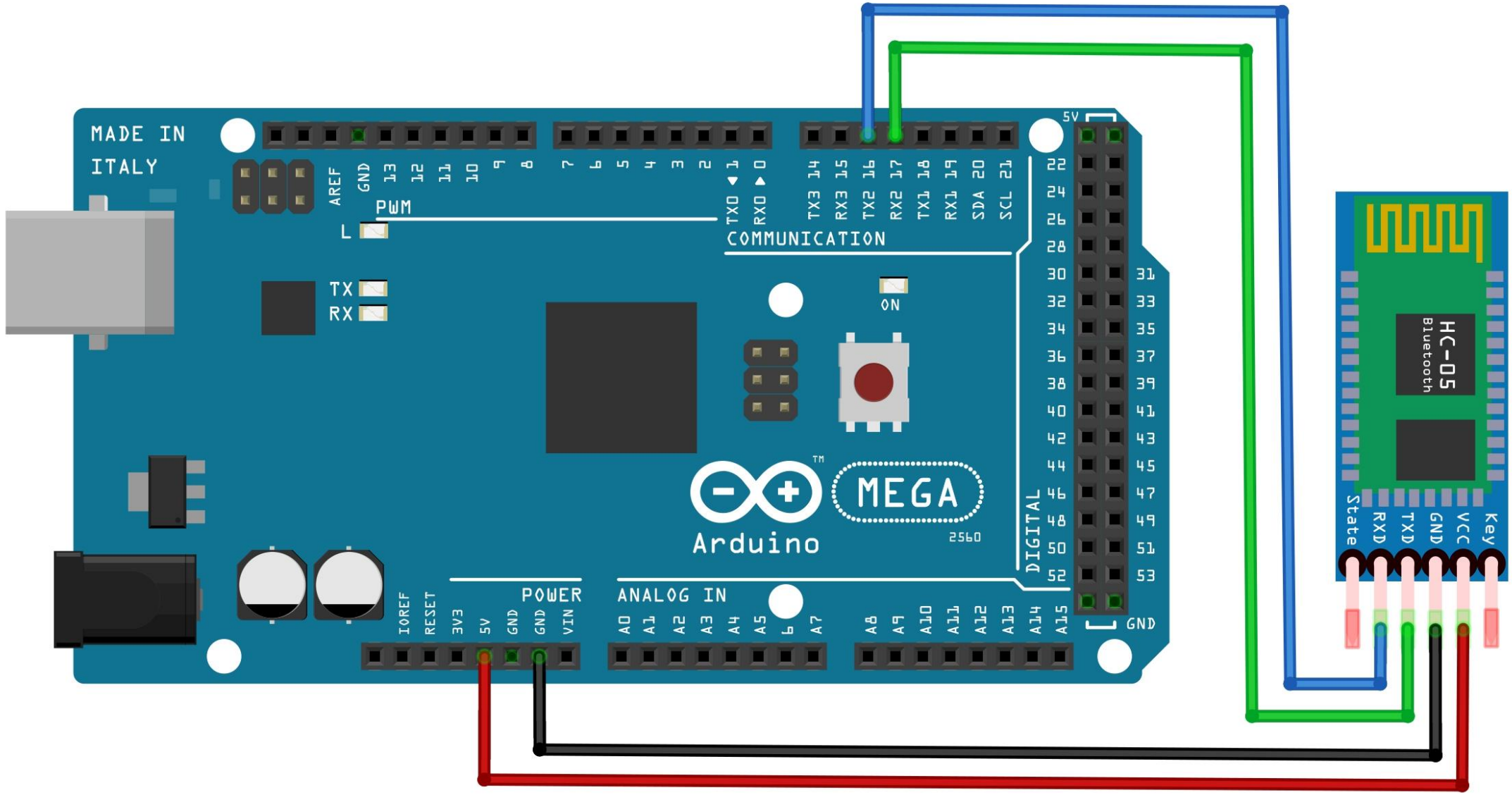
- The baud rate is the rate at which information is transferred in a communication channel.
- Baud rate is commonly used when discussing electronics that use serial communication.
- In the serial port context, “9600 baud” means that the serial port is capable of transferring a maximum of 9600 bits per second.

Bluetooth Communication Between Devices



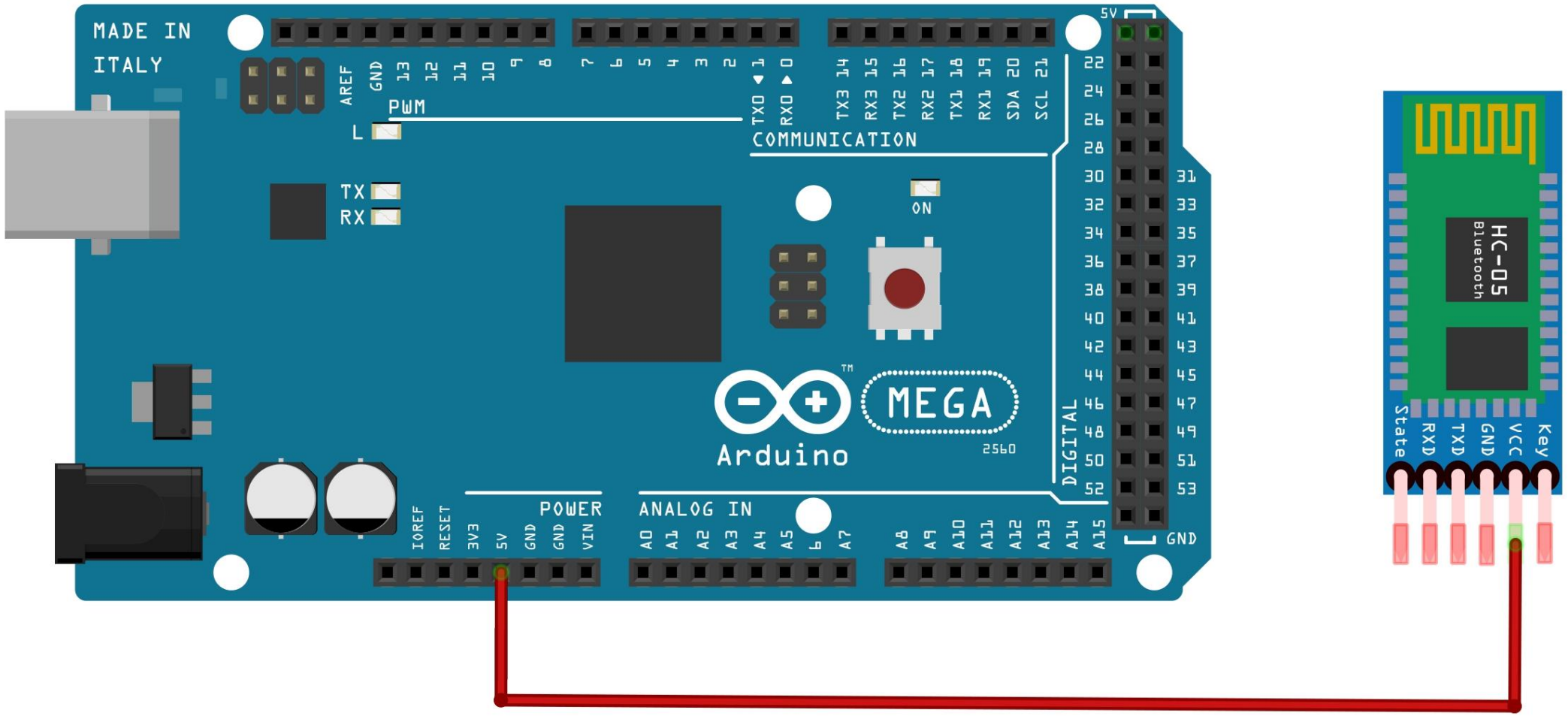


Bluetooth Messenger: Circuit



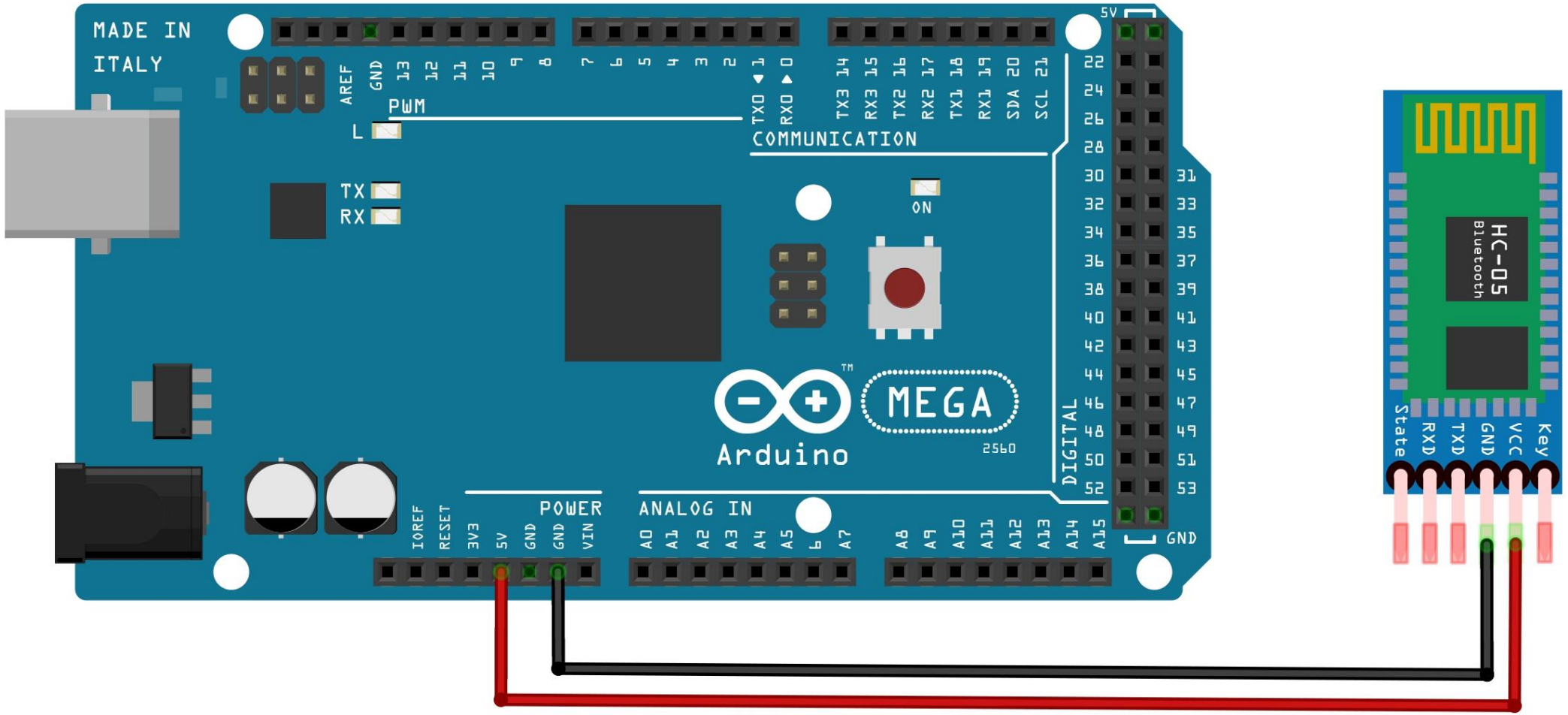
Bluetooth Messenger: Steps

1. The VCC pin of the HC-05 module connects to the 5V on Arduino.



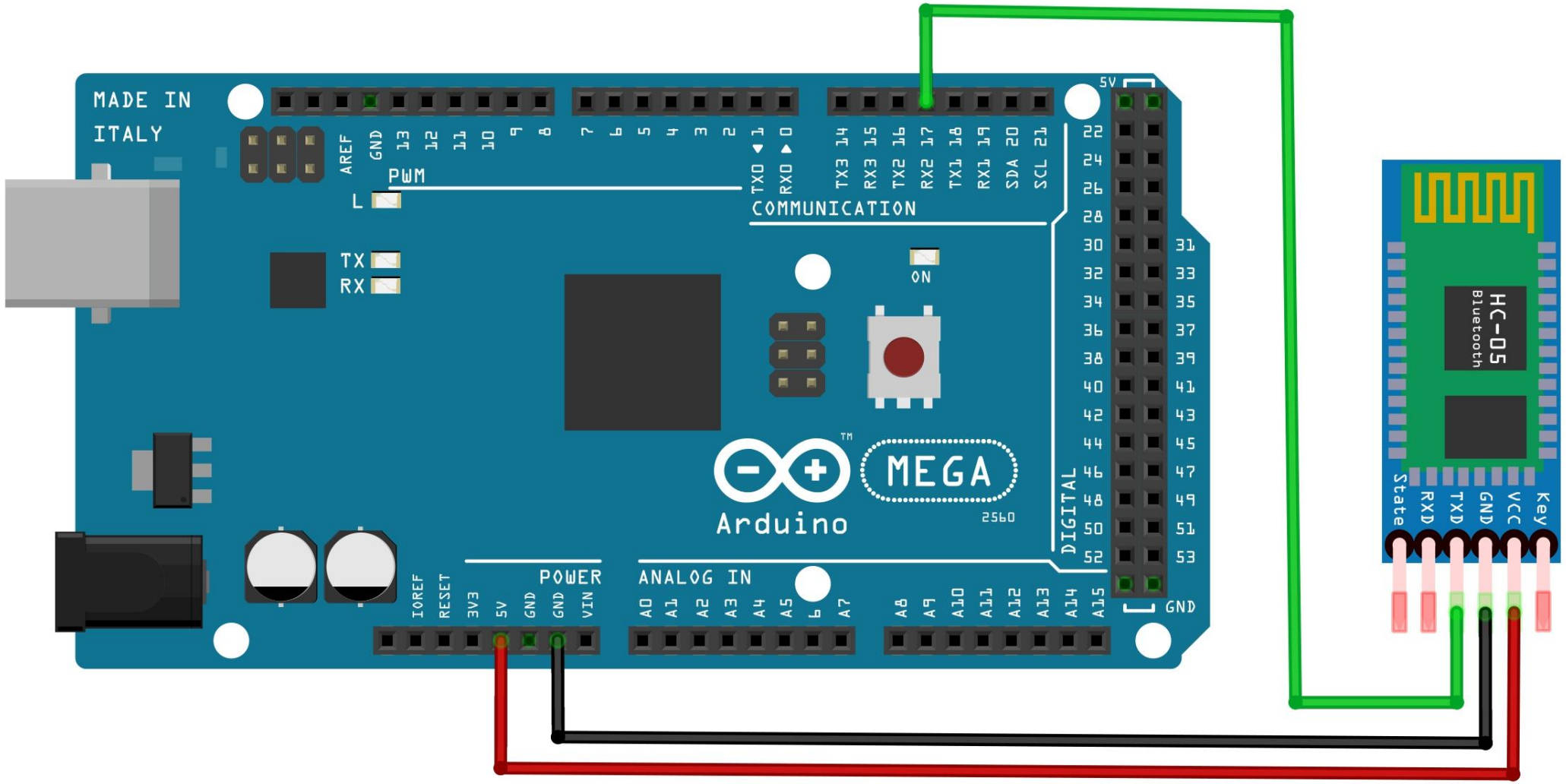
Bluetooth Messenger: Steps

2. The GND pin of the module connects to the ground on Arduino.



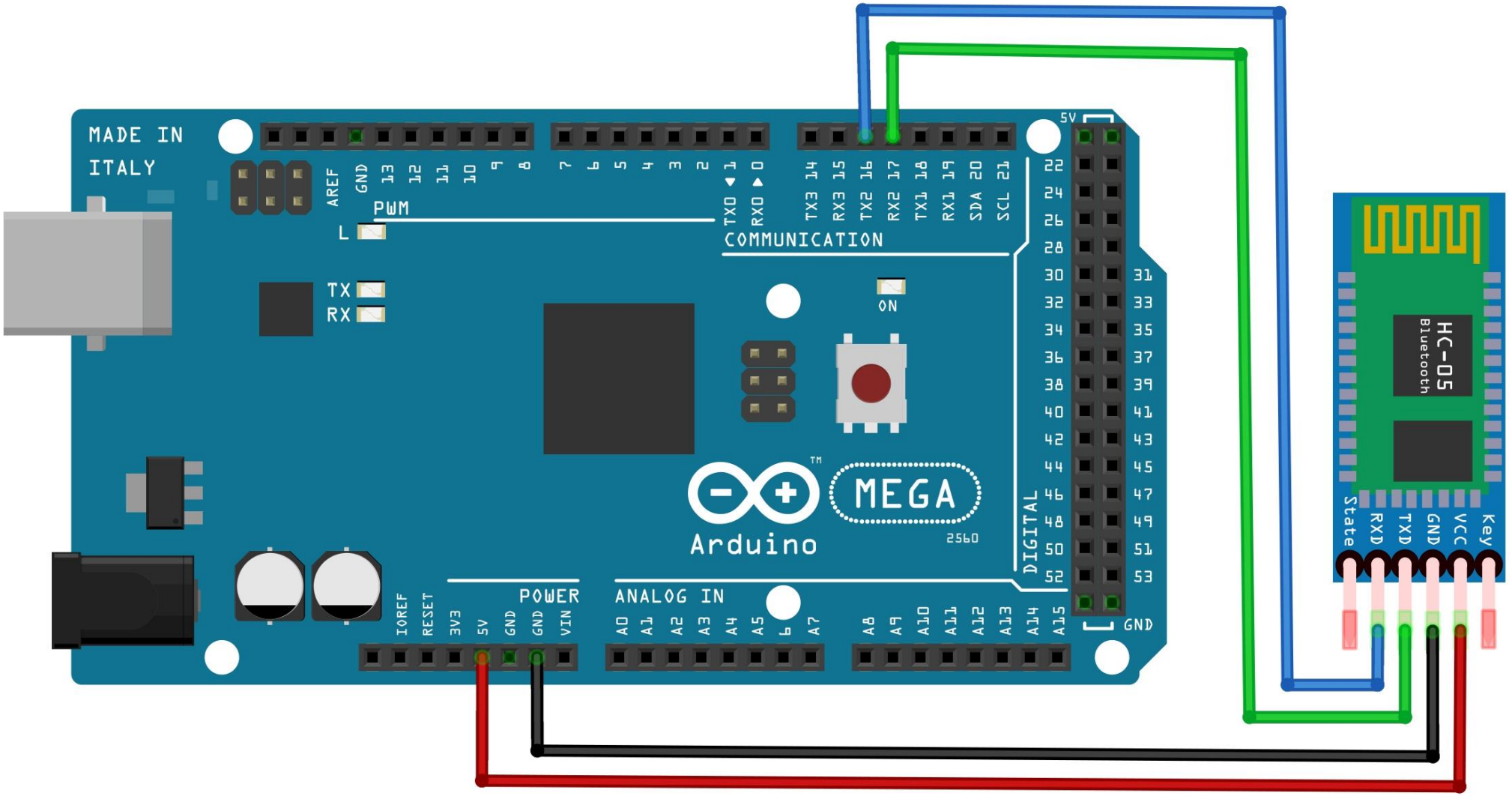
Bluetooth Messenger: Steps

3. The TX pin of the HC-05 module connects to RX2 on Arduino.



Bluetooth Messenger: Steps

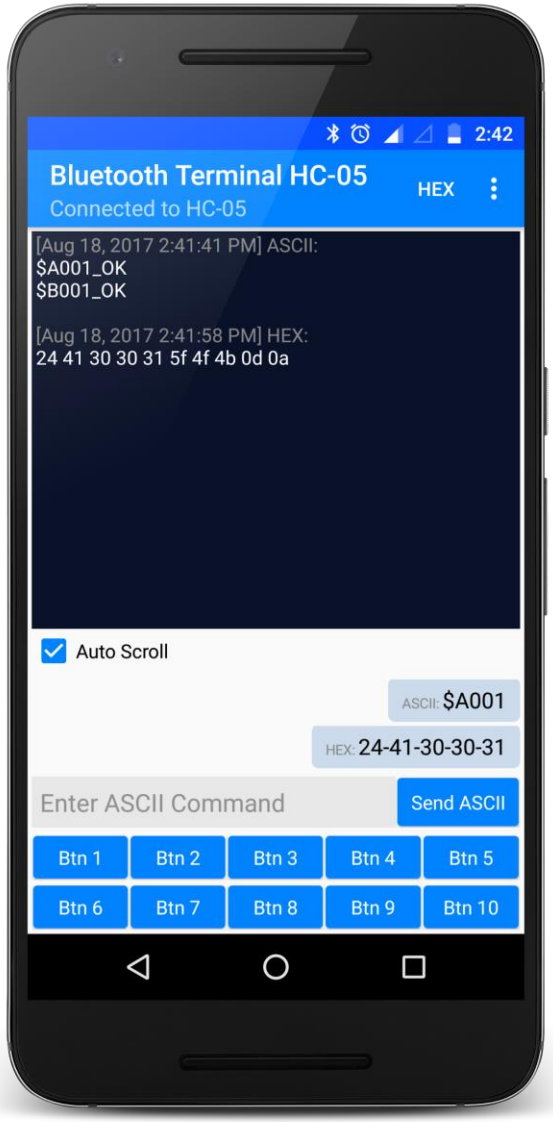
4. The RX pin of the HC-05 module connects to TX2 on Arduino.



Bluetooth Messenger: Code

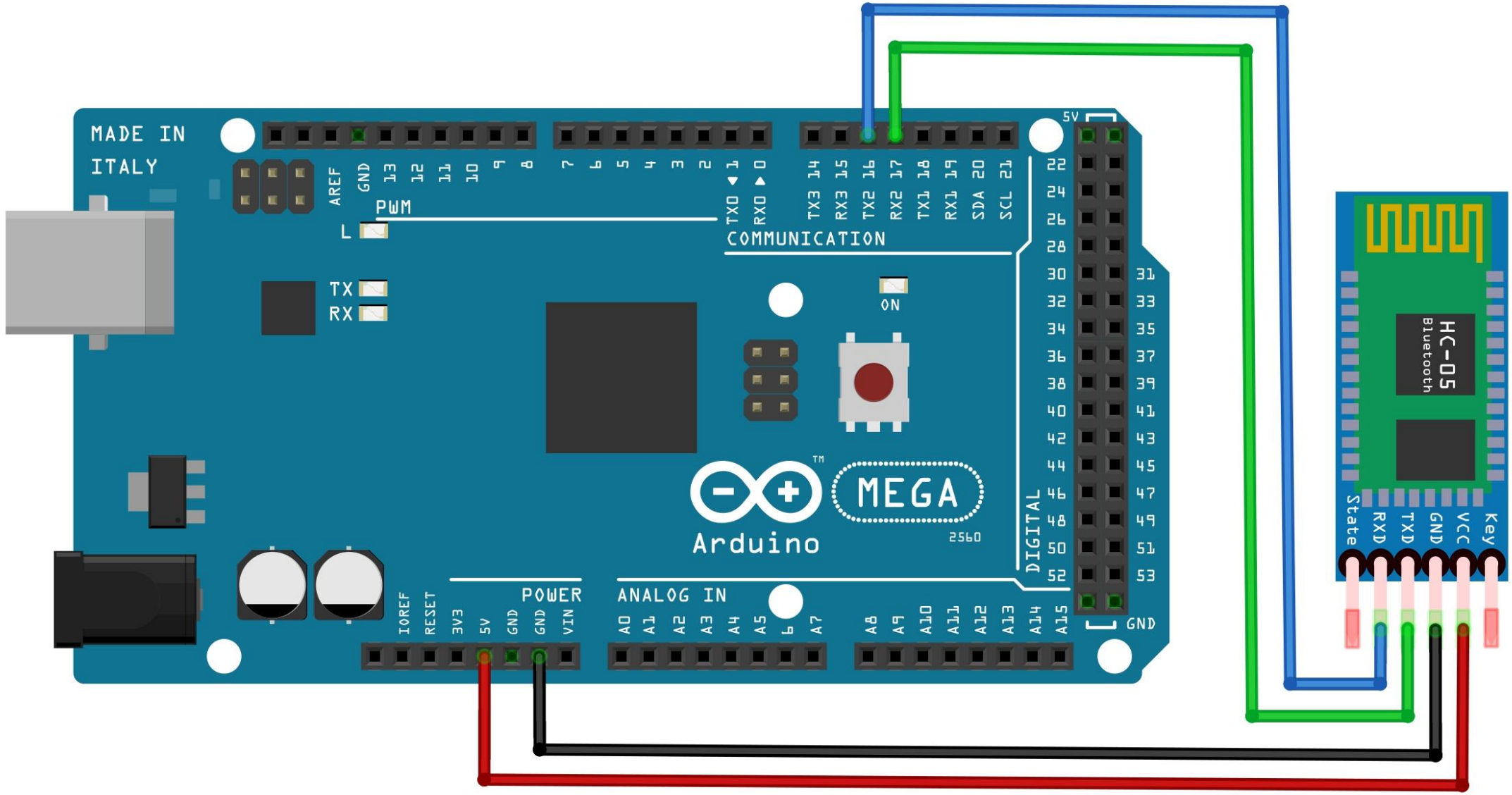
```
void setup() {
  Serial.begin(9600);                    // PC Serial
  Serial2.begin(9600);                   // Mobile Serial
}

void loop() {
  // Send a message from PC to Mobile
  if(Serial.available()){                // If there is a message,
    Serial2.write(Serial.read());        // Write it to Mobile Serial
  }

  // Send a message from Mobile to PC
  if(Serial2.available()){               // If there is a message,
    Serial.write(Serial2.read());        // Write it to PC Serial
  }
}
```

Bluetooth Terminal HC-05



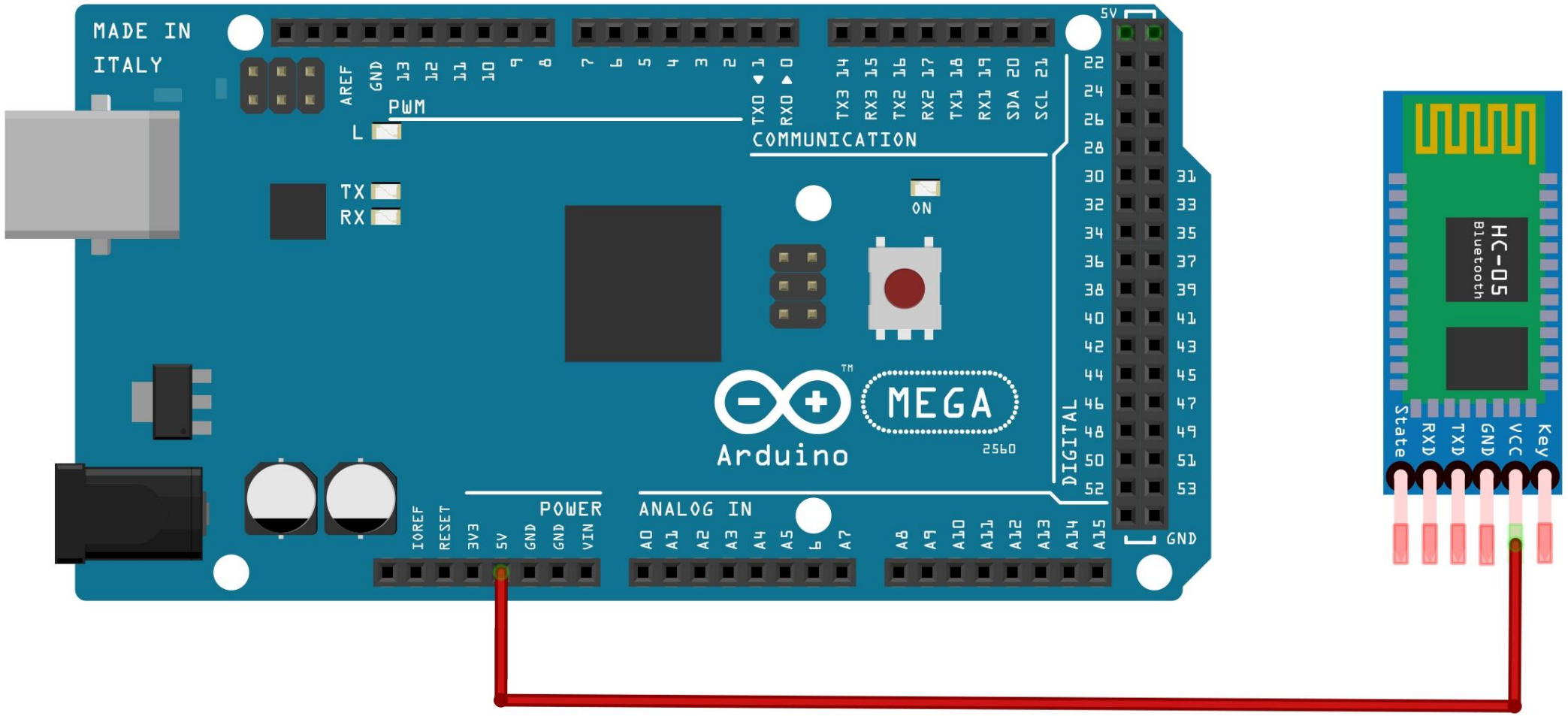
[Bluetooth Terminal HC-05 - Google Play]

Smart Home: Circuit



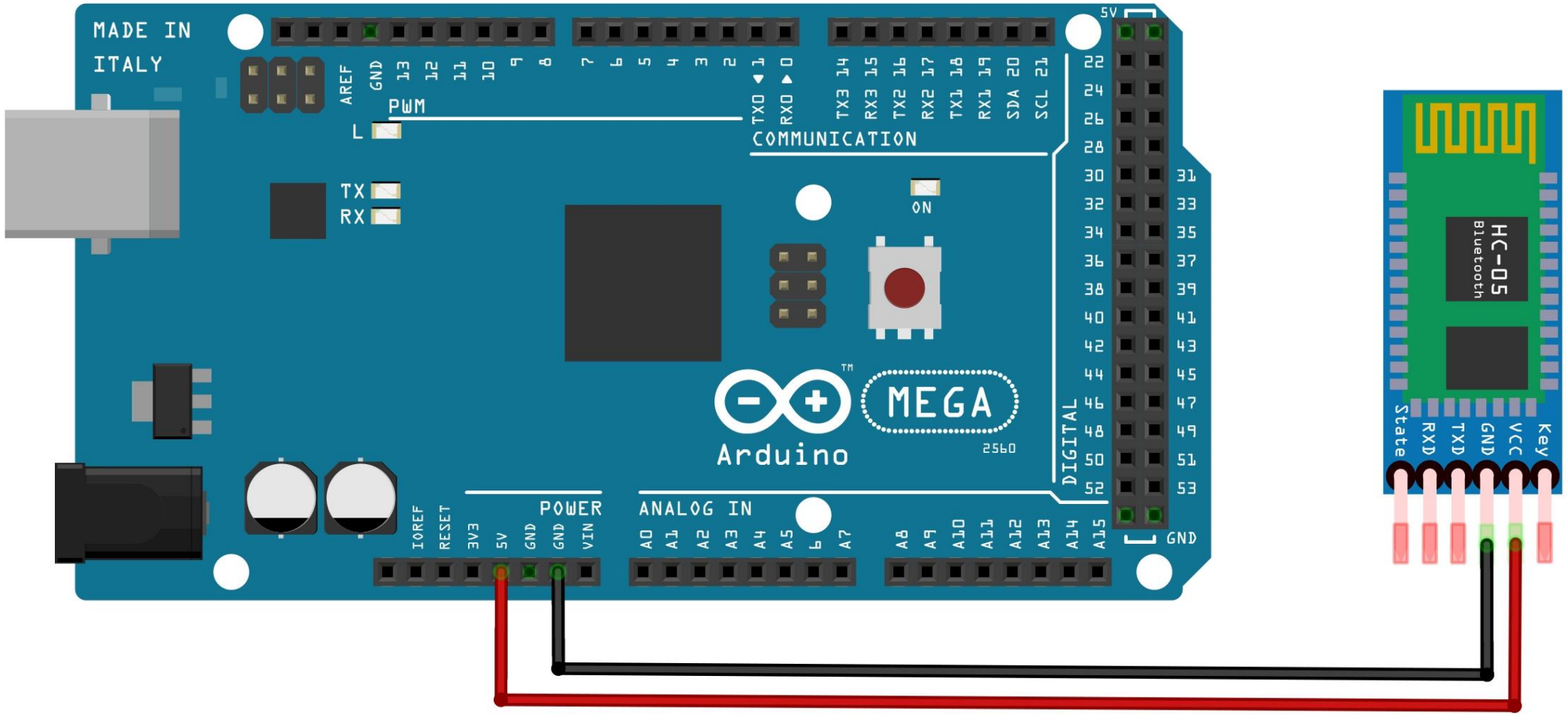
Smart Home: Steps

1. The VCC pin of the HC-05 module connects to the 5V on Arduino.



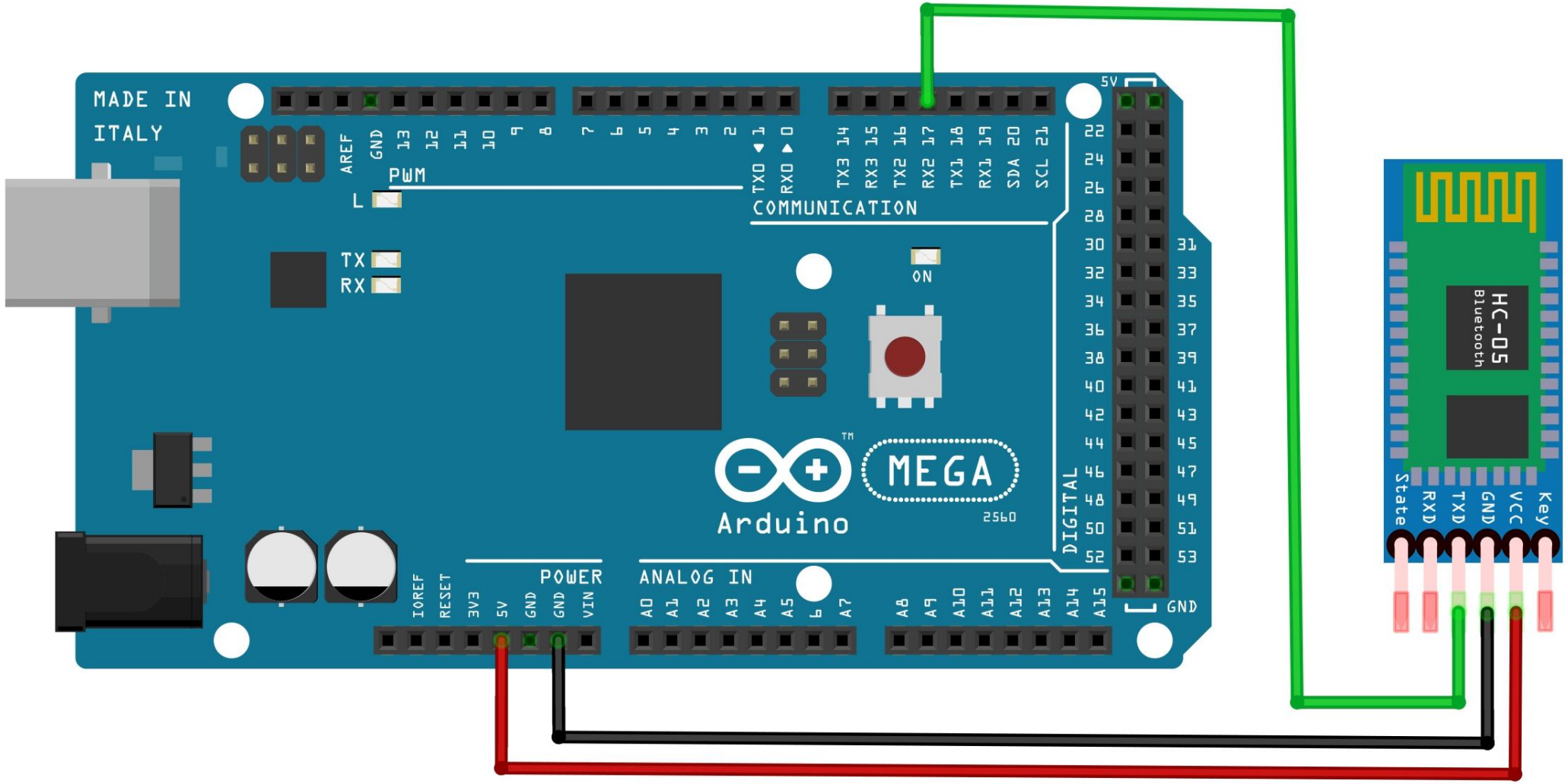
Smart Home: Steps

2. The GND pin of the module connects to the ground on Arduino.



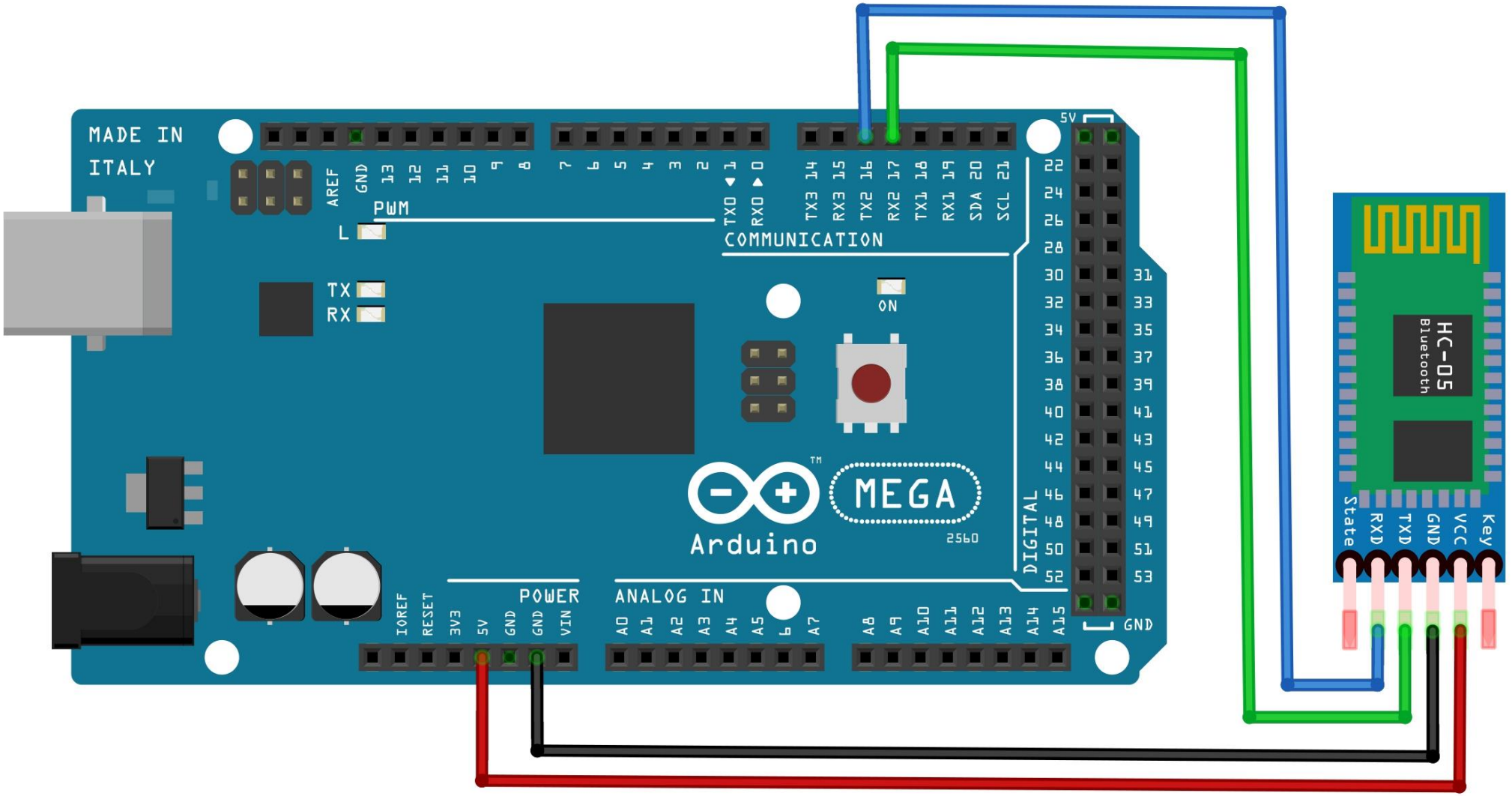
Smart Home: Steps

3. The TX pin of the HC-05 module connects to RX2 on Arduino.



Smart Home: Steps

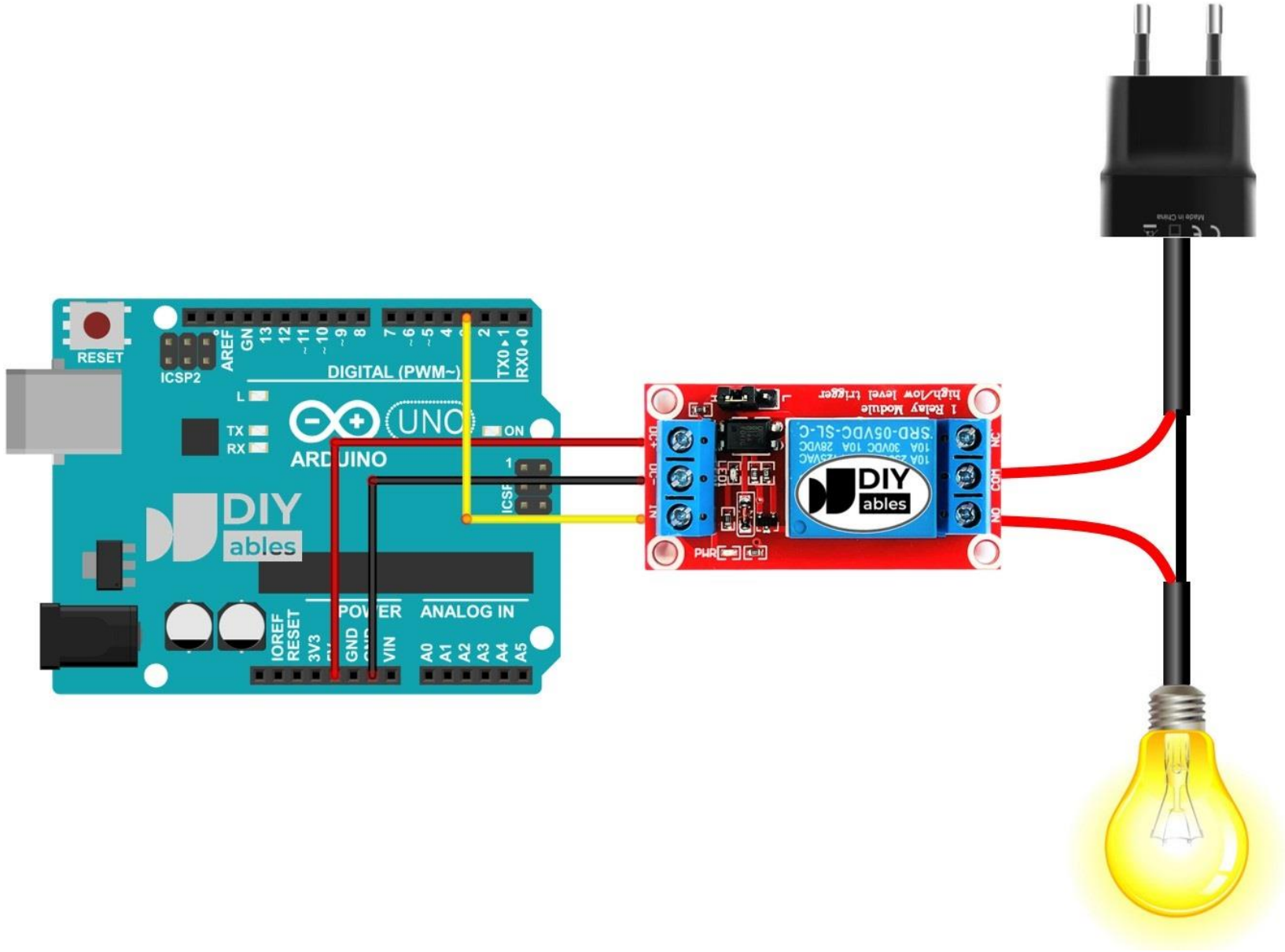
4. The RX pin of the HC-05 module connects to TX2 on Arduino.



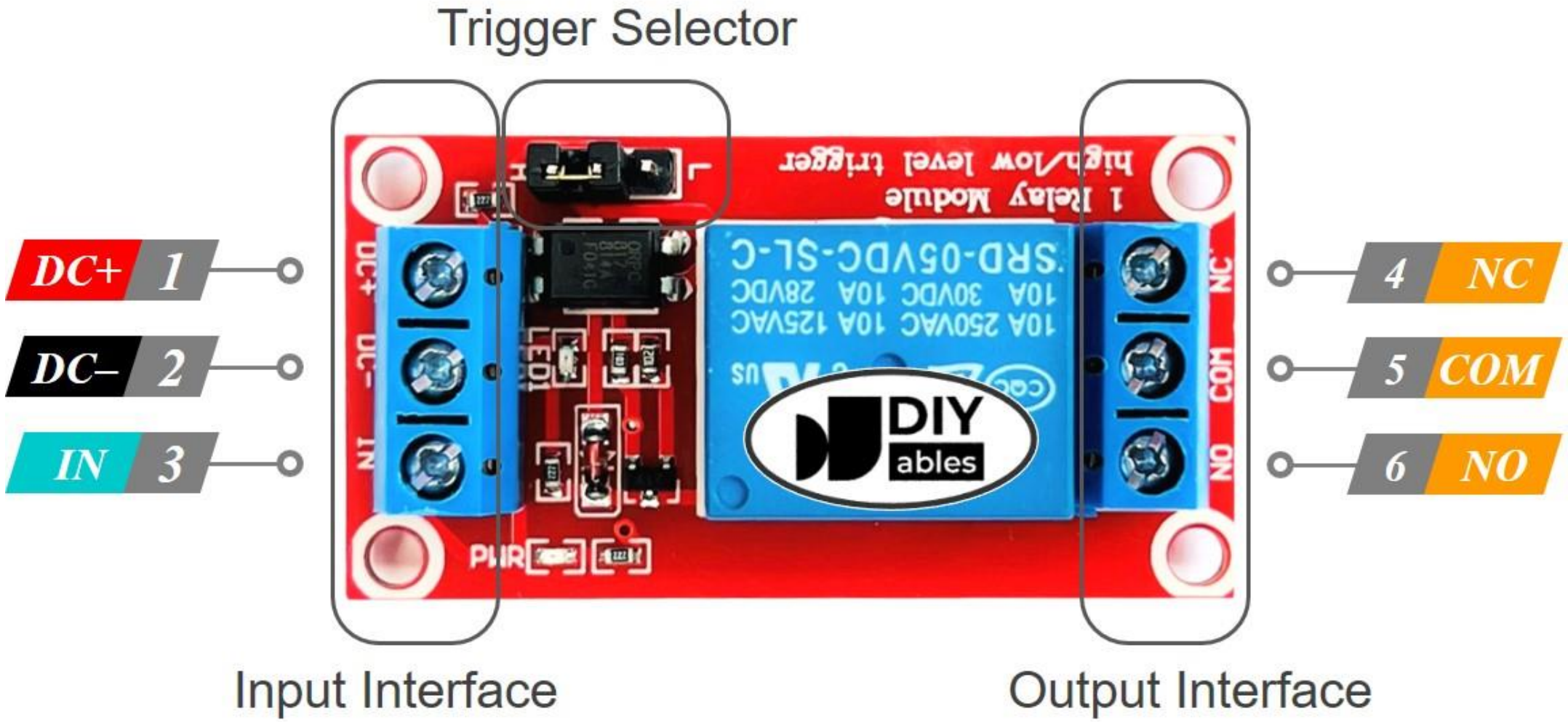
Smart Home: Code

```
char data;                                  // Variable to store the message

void setup() {
  Serial.begin(9600);                       // PC Serial
  Serial2.begin(9600);                      // Mobile Serial

  pinMode(LED_BUILTIN, OUTPUT);             // LED pin
}

void loop() {
  // Send a message from Mobile to PC
  if(Serial2.available()){                  // If there is a message,
    data = Serial2.read();                  // Read the message
    Serial.write(data);                     // Print the message

    if(data == '1')                         // If the message is '1',
      digitalWrite(LED_BUILTIN, HIGH);      // Turn on lights
    else if(data == '0')                    // If the message is '0',
      digitalWrite(LED_BUILTIN, LOW);       // Turn off lights
  }
}
```

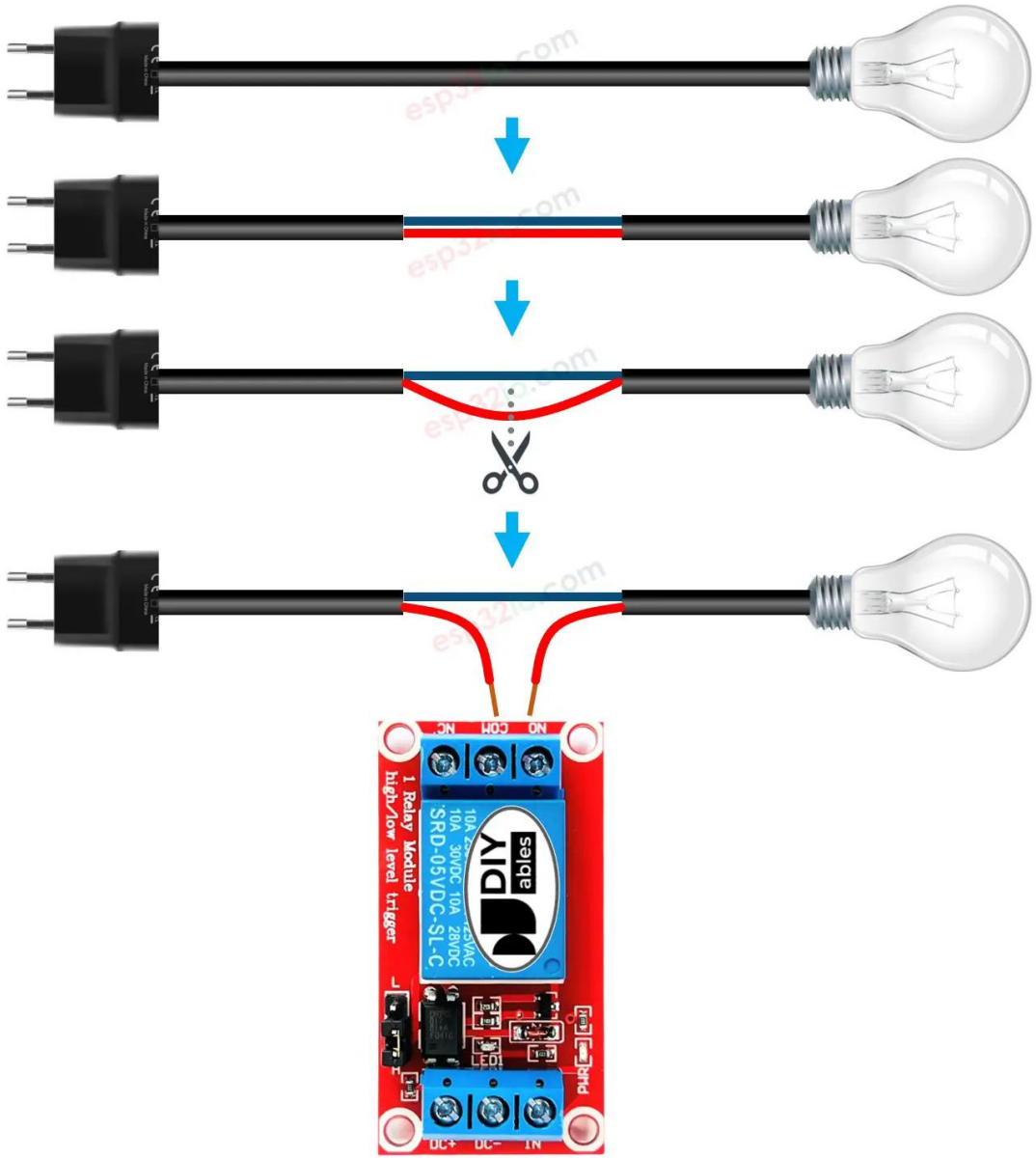
Control High Voltage Devices



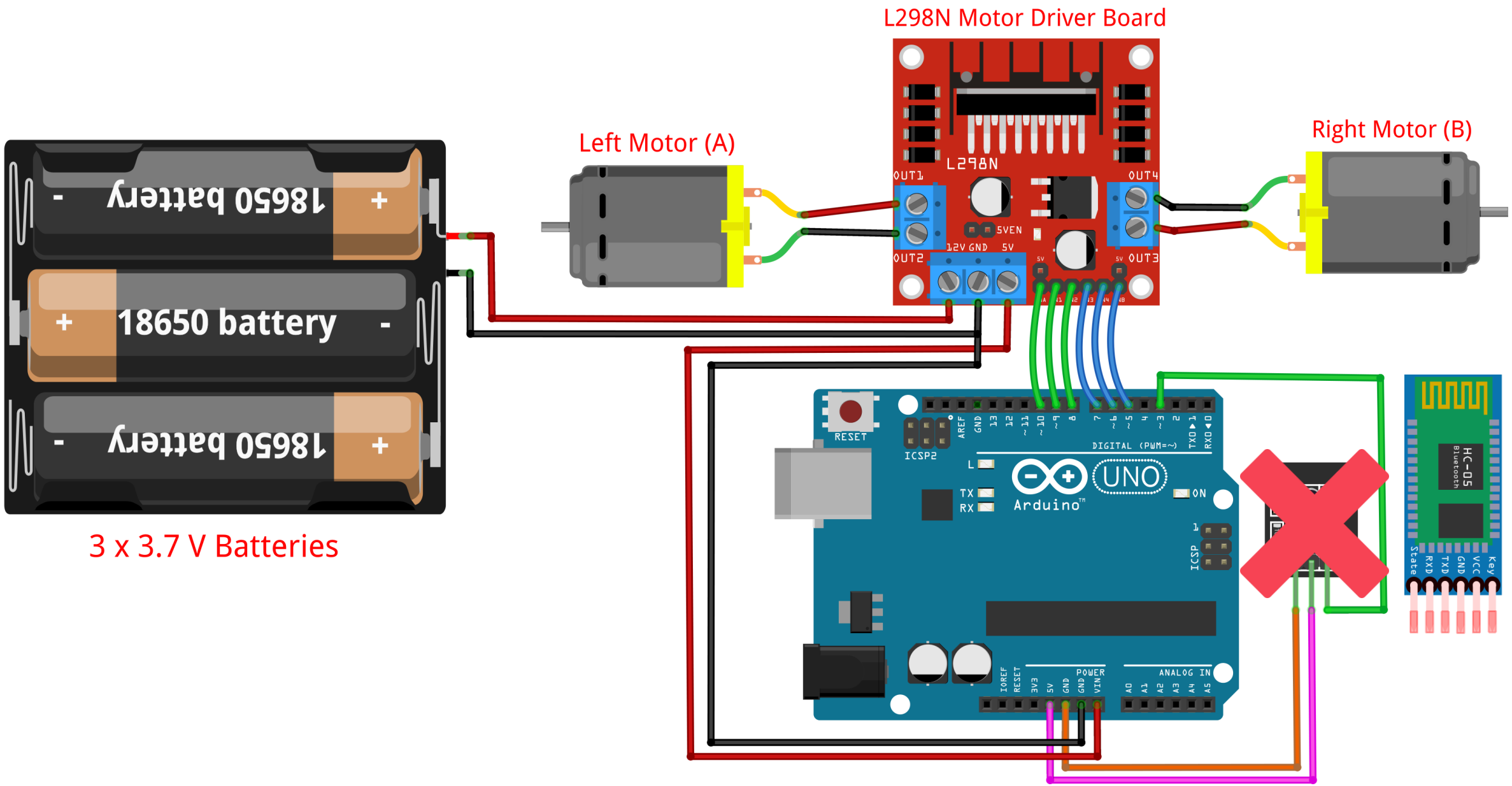
Control High Voltage Devices



Control High Voltage Devices



Assignment 06: Remote Car



References

- Bluetooth Module HC-05
- Arduino and HC-05 Bluetooth Module Complete Tutorial
- HC-05 - Bluetooth Module
- HC-05 Bluetooth Module Interfacing with Arduino UNO
- How to Control an LED Using a Smartphone and Arduino
- HC-05 Bluetooth Module – Tutorial
- Bluetooth Module HC-05 – Arabic
- HC-05 Bluetooth module with Arduino tutorial