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WiFi WebSocket Remote Robot: 10 Steps (with Pictures)

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WIFI WEB SOCKET REMOTE ROBOT

By 陳亮 (/member/%25E9%2599%25B3%25E4%25BA%25AE/) in Technology (/technology/) > Wireless (/technology/wireless/)

757

6

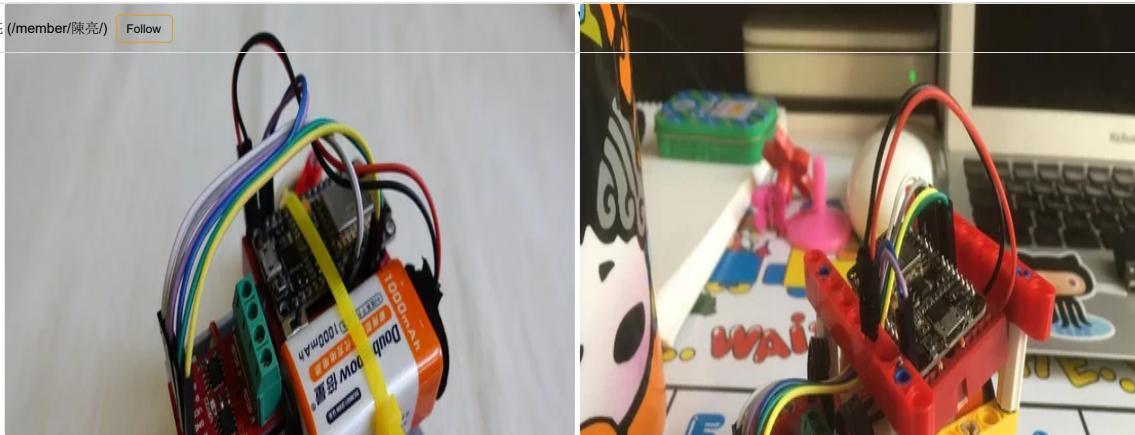
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Intro: WiFi WebSocket Remote Robot

This instructables show how to use ESP8266 module as a HTTP + Web Socket server to build a low lag time (fast response) WiFi remote robot.

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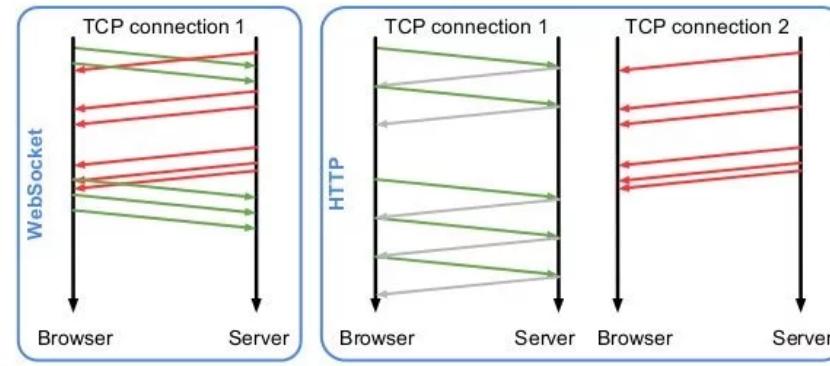
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Step 1: Why WebSocket?

WebSockets vs. HTTP

The real difference is for bidirectional scenarios:

1. HTTP requires at least 2 sockets
2. HTTP requires full round trip for each request
(by default there is no pipelining)
3. HTTP gives no control over connection reuse
(risk of a full SSL handshake for each request)
4. HTTP gives no control over message ordering



There are tons of WiFi remote robot on the web. Most of them have a simple web interface that can control the robot by a few arrow buttons. It is good enough for demonstrating the circuit works. However the response time is too slow even compare it with a few bucks RC car :(

Every remote control command can be only 1 or 2 bytes, but a single HTTP request introduce hundreds bytes overhead and require wait establish a new connection each time. WebSocket can eliminate this overhead and get over 10 times of performance gain.

You may not familiar with Web Socket, but the implementation can be very simple. This Arduino source code file only 5 KB in size, already included client side HTML + Javascript and server side HTTP + Web Socket server. It is a good starting point for learning Web Socket.

Ref.:

<https://blog.feathersjs.com/http-vs-websockets-a-performance-comparison-da2533f13a77>

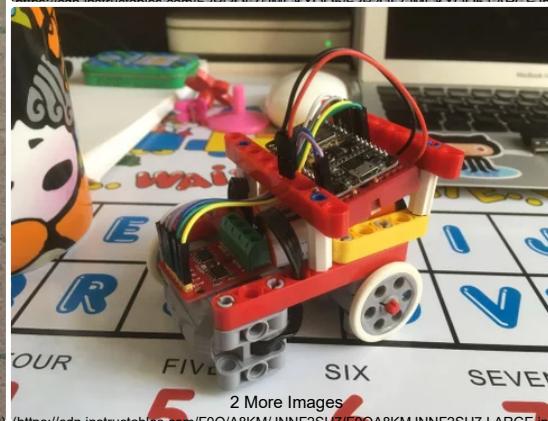
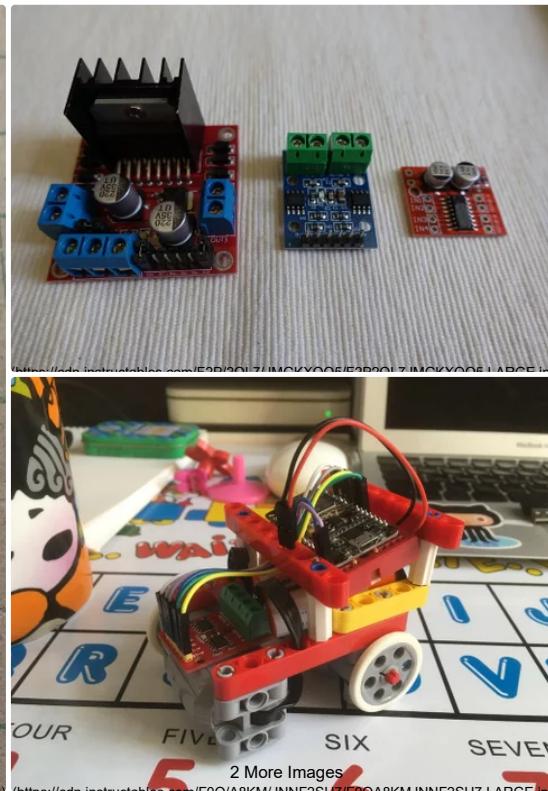
<https://medium.com/platform-engineer/web-api-design-35df8167460>

<http://blog.arungupta.me/rest-vs-websocket-comparison-benchmarks/>

<https://www.slideshare.net/alinone/from-push-technology-to-the-realtime-web>

<https://en.wikipedia.org/wiki/WebSocket> (<https://en.wikipedia.org/wiki/WebSocket>)
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Step 2: Preparation



ESP8266 Dev Board

Any ESP8266 Dev Board should be ok, this time I am using NodeMCU.

Motor Driver Board

Any 2 motors driver board should be ok, this time I am using L9110S.

2WD Robot Chassis

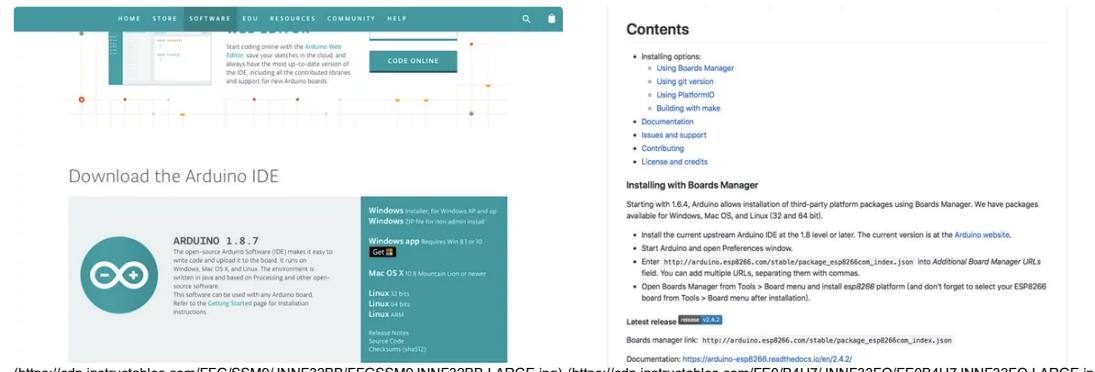
Any 2WD Robot Chassis should be ok, I have no one in hand, so I simply use some LEGO to make one.

Battery

ESP8266 operate at 3.3V, most Dev Board have a regulator to make it. In most case it can powered from the range of 5V - 12V. I am using a 8.4 V rechargeable battery with battery holder this time.

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Step 3: Software



Download the Arduino IDE

ARDUINO 1.8.7
The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is suitable for beginners based on Processing and other open-source software.
This software can be used with any Arduino board. Read the Getting Started page for installation instructions.

Windows installer for Windows XP and up
Windows app Requires Win 8.1 or 10
Get it!

Mac OS X 10.8 Mountain Lion or newer
Linux 32 bit
Linux 64 bit
Linux ARM
Release Notes
Source Code
Checkins (phd32)

Latest release v1.8.7
Boards manager link: http://arduino.esp8266.com/stable/package_esp8266com_index.json
Documentation: <https://arduino-esp8266.readthedocs.io/en/2.4.2/>

<https://www.instructables.com/EC0/CSM0/INNIE20DB/EC0CSM0/INNIE20DB/> | <https://www.instructables.com/EC0/CSM0/INNIE20DB/EC0CSM0/INNIE20DB/>

Arduino IDE

Download and install Arduino IDE if not yet:

<https://www.arduino.cc/en/Main/Software> (<https://www.arduino.cc/en/Main/Software>).

ESP8266 Support

Follow the ESP8266 official steps to add ESP8266 support if not yet:

<https://github.com/esp8266/Arduino> (<https://github.com/esp8266/Arduino>).

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Step 4: HTML & Javascript



ESPwsRemote.html

```

1 <!DOCTYPE html><html><head>
2   <meta name="viewport" content="user-scalable=no,initial-scale=1,maximum-scale=1,>
3   <style>
4     body{padding: 24px; background-color: #ccc;}
5     .button{margin: 0 auto; width: auto;}
6   </style>
7   <script>
8     function nw(){return new WebSocket('ws://' + location.hostname + ':81/' + 'arduino');}
9     var ws=nw();
10    window.onload=function(){
11      document.ontouchmove=function(e){e.preventDefault();};
12      var c=document.getElementById('main');
13      var ctop=c.offsetTop;
14      var cwidth=c.getBoundingClientRect().width;
15      function z(c){
```

UNICOM HK 15:56 100% espwsremote.local

ESP TOUCH REMOTE

<https://www.instructables.com> 5/13

```
1 <div></div>
2 <div></div>
3 <div></div>
4 <div></div>
5 <div></div>
6 <div></div>
7 <div></div>
8 <div></div>
9 <div></div>
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35 <div></div>
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37 <div></div>
38 <div></div>
39 <div></div>
```

The Web Socket remote can break into 2 parts, client side and server side. Client side is a simple webpage for the mobile phone. The main area is a canvas, once you touch and swipe on it, the x and y coordinates values will pass to server side via the established Web Socket connection. Below is the complete web page source code, it has minified to a single line string value in Arduino source code:

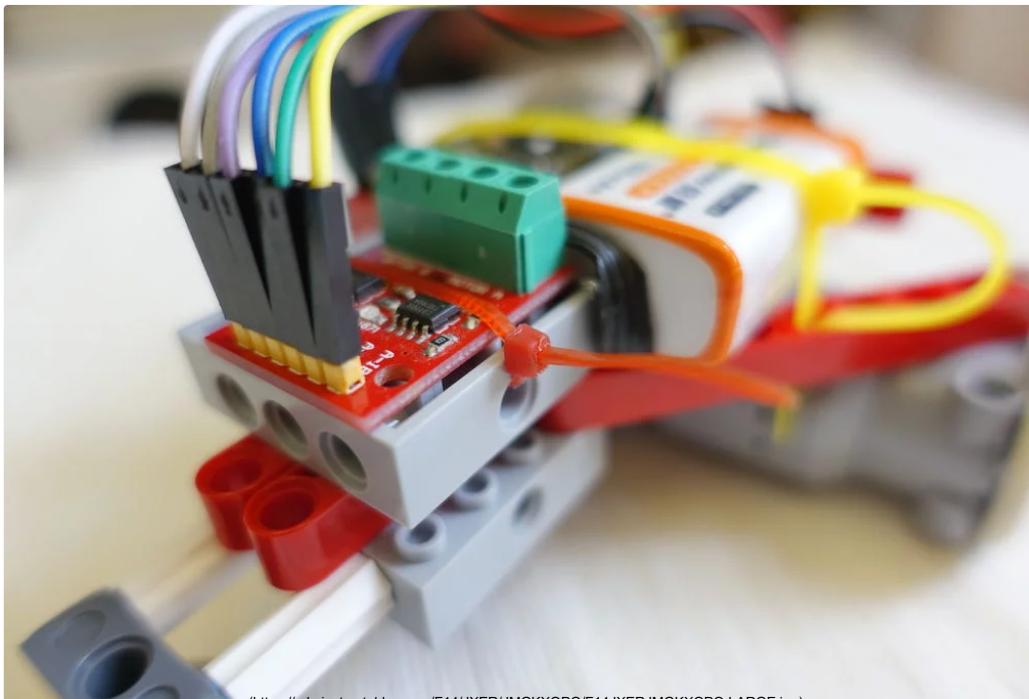
```

    if(x>=128){
        y=128;
    }
    x=x.toString(16);
    y=y.toString(16);
    if(x.length<2){x='0'+x;}
    if(y.length<2){y='0'+y;}
    if(ws.readyState==ws.CLOSED){ws=nw();}
    ws.send("# "+x+y);
}
cv.ontouchstart=function(e){
t(e);
clr();
};
cv.ontouchmove=t;
cv.ontouchend=t;
clr();
}
</script>
</head>
<body>
<h2>ESP TOUCH REMOTE</h2>
<canvas id='main' width='255' height='255'></canvas>
</body>
</html></p>

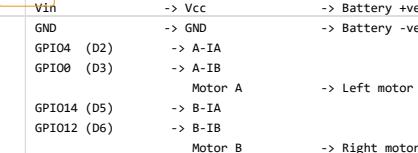
```

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Step 5: Pins Connection



Here is connection summary:

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Step 6: Upload Program

```

#include "espwsremote.h"

D2
D3
L D5
R D6

#include <Serial.h>

#include <WiFi.h>
#include <WiFiManager.h>
#include <WiFiWebServer.h>
#include <WebSocketsServer.h>
#include <Manager.h>

WiFiServer server(80);
WebSocketsServer websocket = WebSocketsServer(81);

left, int right) {
  LEFT_A, (left < 0) ? LOW : HIGH;
  LEFT_B, (left > 0) ? LOW : HIGH;
  RIGHT_A, (right < 0) ? LOW : HIGH;
  RIGHT_R, (right > 0) ? LOW : HIGH;
}
  
```

Attemped to open https://ide.instructables.com/EU7/3YMD/UNNEQWVZ/ESP8266DevBoard-MotorDriverBoard.ino?_t=1531603151&v=2 Lower Memory, Disabled, None, Only Sketch, 921600 bit /dev/cu

1. Download ESP Web Socket Remote source code at Github:

<https://github.com/moononournation/ESPWebSocketRemote...>
<https://github.com/moononournation/ESPWebSocketRemote>

2. Open ESPWebSocketRemote.ino in Arduino IDE
3. Connect your ESP8266 Dev Board
4. Select your ESP8266 Dev Board type and Port at Tools Menu
5. Press Upload

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Step 7: First Time Setup Steps

192.168.4.1
espwsremote

登入

取消

espwsremote

WiFiManager

[Configure WiFi](#)[Configure WiFi \(No Scan\)](#)[Info](#)[Reset](#)

Most WiFi robot ask you connect to it from your mobile, but I don't think it is the right method. Because it means anyone's mobile can connect to your own robot. And also every time you need to wait your robot WiFi AP start and then use your mobile search the WiFi and connect it, it is a little bit time consuming.

I think the right method should be the robot auto connect to your mobile hotspot while boot up.

But I still don't want to store my hotspot credential in source code, WiFiManager can help me solve this.

WiFiManager will auto try to connect last connected WiFi. If failed, start a AP and captive portal wait you input the WiFi details and then reboot.

So the first time setup steps are:

1. Turn on ESP8266 Robot

192.168.4.1
espwsremote

登入

取消

[Moon On AirPort](#)

100%

[LUI HOME](#)

98%

[Milk Car 2.4G](#)

68%

[ME Network](#)

50%

[defoo-home](#)

46%

[TP-LINK_FA20AC](#)

38%

[Home2](#)

34%

[CHOW](#)

32%

[PCCW-AMX](#)

30%

[Linksys01922-需謄恥](#)

30%

[Duo's Home](#)

28%

[ManUtd_T](#)

28%

[TP-LINK_0EB9](#)

28%

[lau_router](#)

26%

LUI HOME

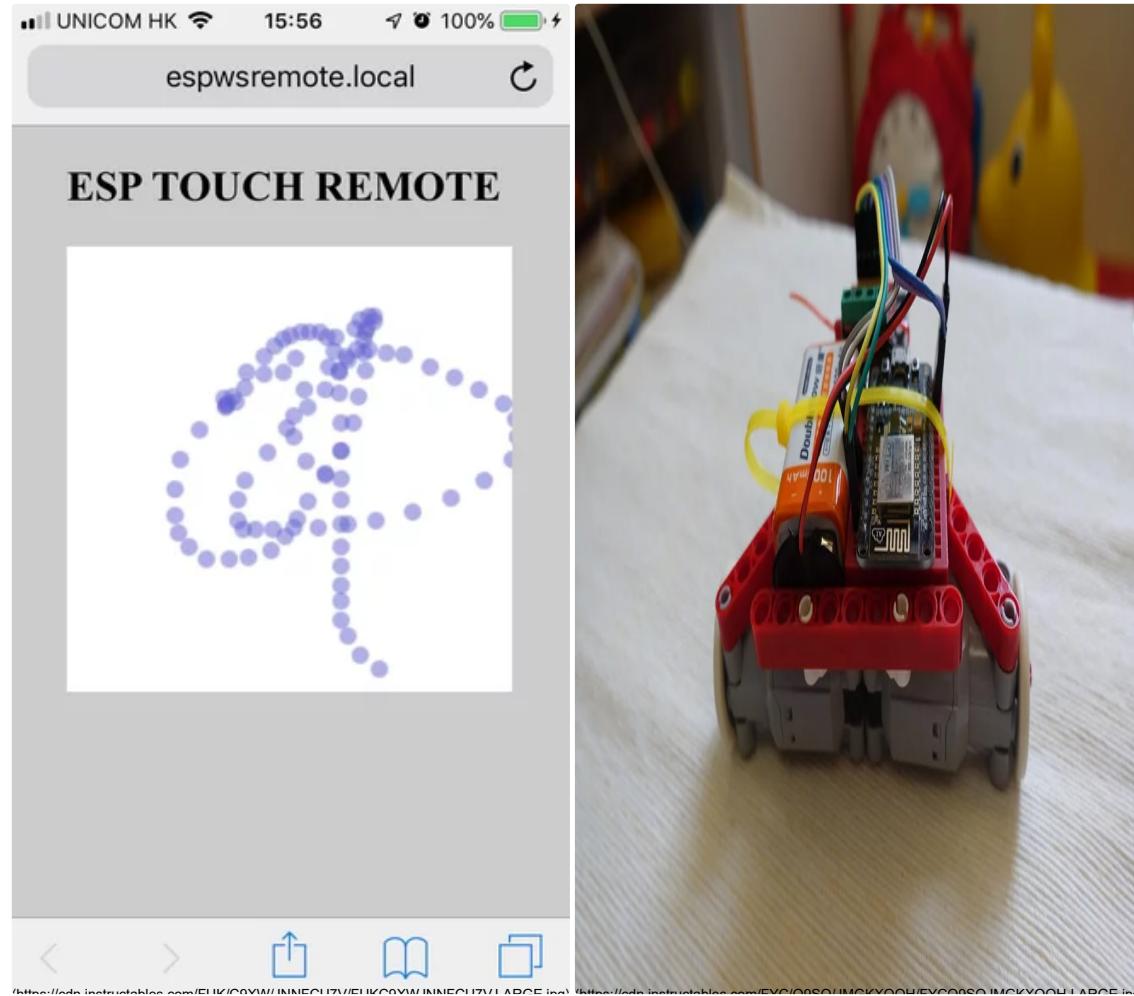
*****|

save

Scan

▲ ▼ 密碼	完成
q w e r t y u i o p	
a s d f g h j k l	
z x c v b n m ↻	
123	2 More Images
space	Go

Step 8: Connection Steps



1. Turn on mobile phone hotspot
2. Turn on ESP8266 Robot
3. Wait ESP8266 Robot connect to mobile phone hotspot
4. Open mobile web browser and browse to <http://espwsremote.local/>
(<http://espwsremote.local/>)
5. Touch and swipe on the canvas (the white square) to control the robot

Step 9: Happy Remote!



It's time to play your low lap time remote robot!

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Step 10: What's Next?



ESPWebSocketRemote is a very simple example, you can do much more on it.

E.g.:

- add more control such as robot light, arm and even launch rockets :>
- decorate the HTML layout
- build a bigger robot

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