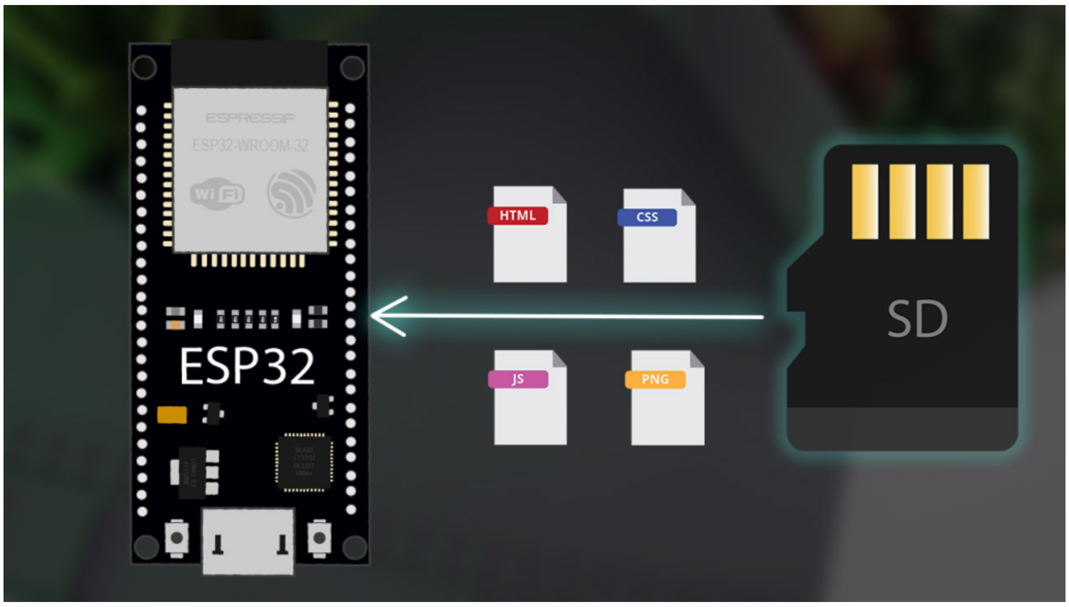
ESP32 Web Server Hosting Files from MicroSD Card

In this tutorial, you'll learn how to build an ESP32 web server to serve files from a microSD card using a microSD card module that communicates using SPI protocol. You'll learn how to serve your HTML, CSS, JavaScript files, images, and other assets saved on the microSD card. This can be especially useful if your files are too big to fit on the filesystem (SPIFFS), or it can also be more convenient depending on your project. To build the web server, we'll use the ESPAsyncWebServer library.

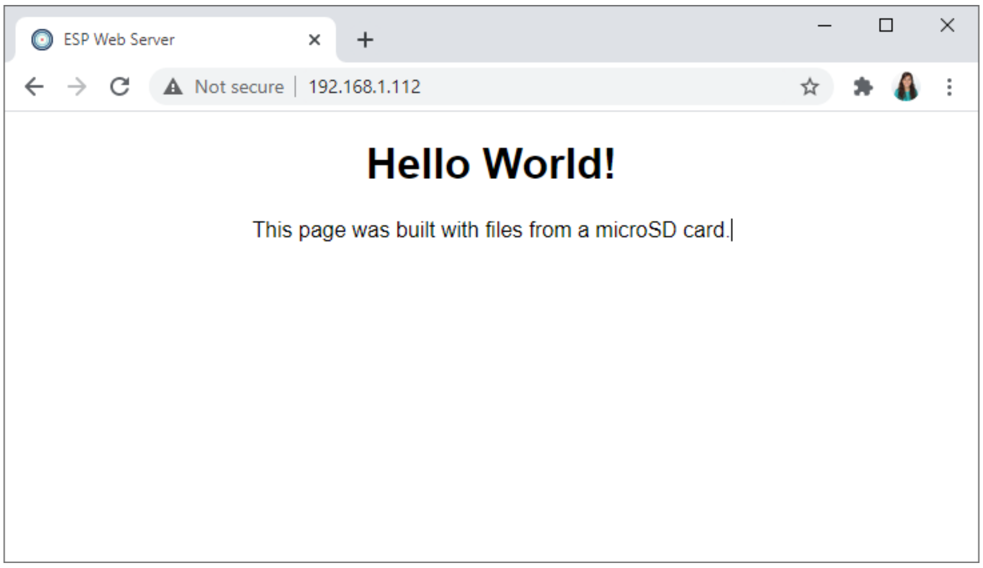


If you want to build a web server with files from SPIFFS, follow the next tutorial instead:

- ESP32 Web Server using SPIFFS (SPI Flash File System)

Project Overview

To show you how to build a web server with files from a microSD card, we'll build a simple HTML page that displays some text formatted with CSS. We'll also serve a favicon. The following image shows the web page we'll serve:

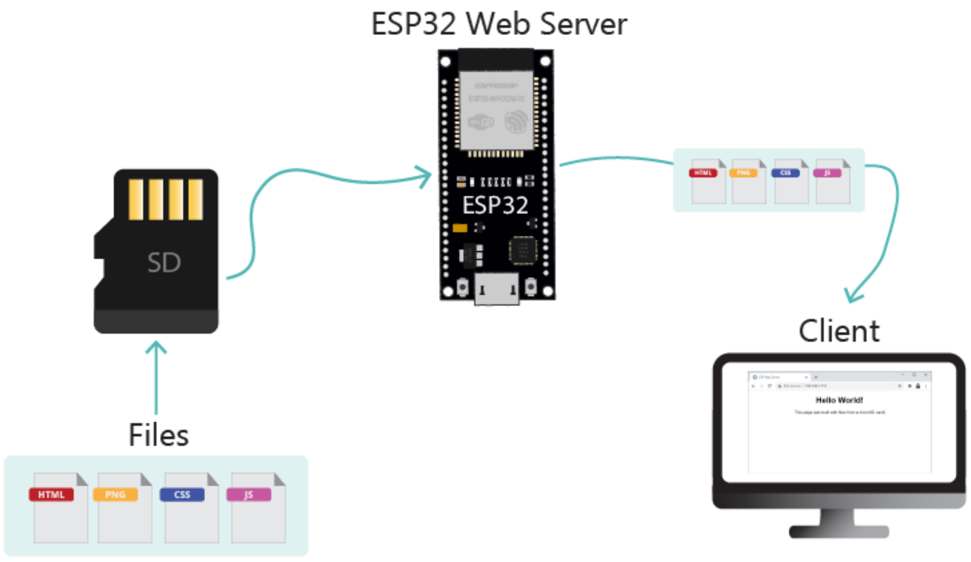


Hello World!

This page was built with files from a microSD card.

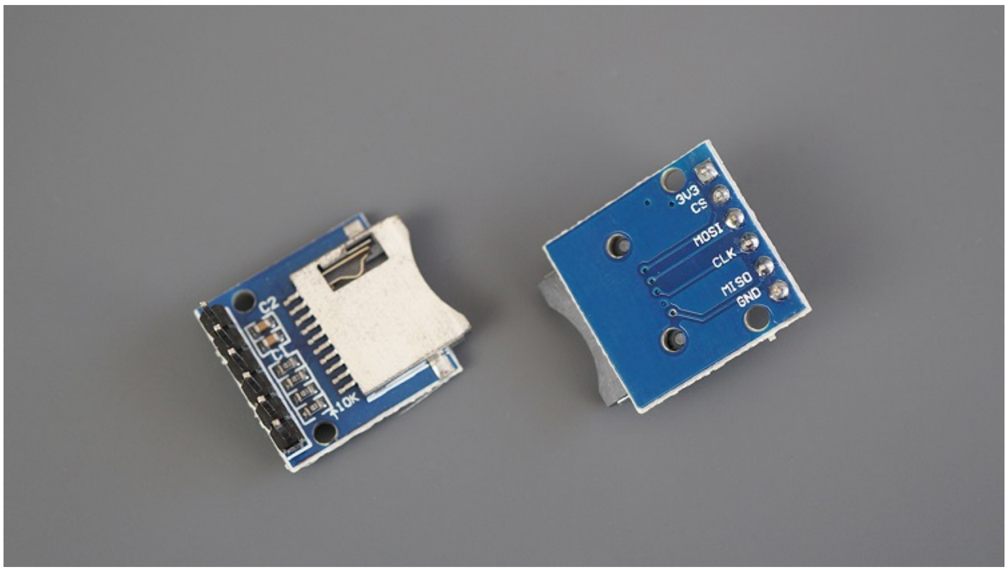
- The web server is built using the ESPAsyncWebServer library;
- The HTML, CSS, and favicon files are saved on the microSD card;

- You can apply what you'll learn here to any web server project that you are working on.



MicroSD Card Module

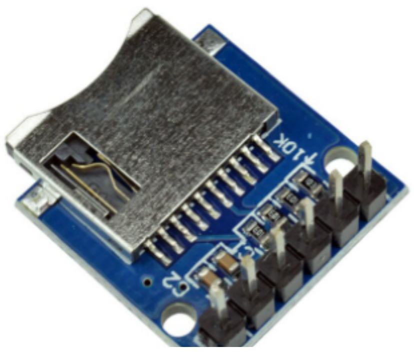
There are different microSD card modules compatible with the ESP32. We're using the microSD card module sown in the following figure – it communicates using SPI communication protocol. You can use any other microSD card module with an SPI interface.



Where to Buy?

You can click the link below to check different stores where you can get the microSD card module:

- MicroSD card module



MicroSD Card Module Pinout

The microSD card module communicates using SPI communication protocol. We'll use the default ESP32 SPI pins as shown in the following table:

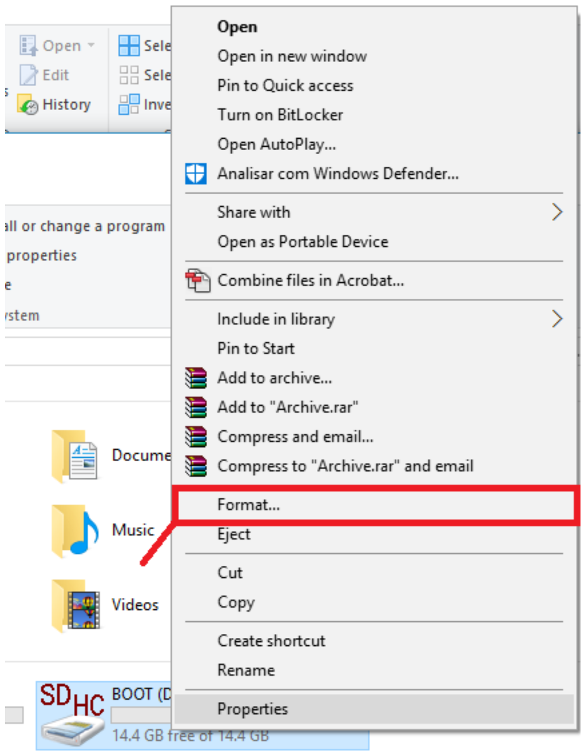
microSD card module	ESP32
3V3	3.3V
CS	GPIO 5
MOSI	GPIO 23
CLK	GPIO 18
MISO	GPIO 19
GND	GND

Recommended reading: ESP32 Pinout Reference: Which GPIO pins should you use?

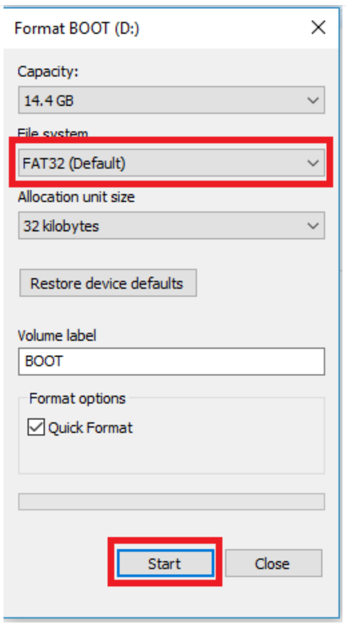
Preparing the MicroSD Card

Before proceeding with the tutorial, make sure you **format your microSD card as FAT32**. Follow the next instructions to format your microSD card or use a software tool like SD Card Formater (compatible with Windows and Mac OS).

1. Insert the microSD card in your computer. Go to **My Computer** and right click on the SD card. Select **Format** as shown in figure below.



2. A new window pops up. Select **FAT32**, press **Start** to initialize the formatting process and follow the onscreen instructions.


Format BOOT (D:)

Capacity:
14.4 GB

File system
FAT32 (Default)

Allocation unit size
32 kilobytes

Volume label
BOOT

Format options
[✓] Quick Format

After formatting the microSD card, you can paste the files used to build the web server there. We'll move the `index.html`, `style.css`, and `favicon.png` files into there. Follow the next section to get your files.

HTML File

Create a file called `index.html` with the following content:

```
<!DOCTYPE HTML><html>
<head>
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <link rel="stylesheet" type="text/css" href="style.css">
  <link rel="icon"  type="image/png" href="favicon.png">
  <title>ESP Web Server</title>
</head>
<body>
  <h1>Hello World!</h1>
  <p>This page was built with files from a microSD card.</p>
</body>
</html>
```

View raw code

CSS File

Create a file called `style.css` with the following content:

```
html {
    font-family: Arial;
    text-align: center;
}
body {
    max-width: 400px;
    margin:0px auto;
}
```

View raw code

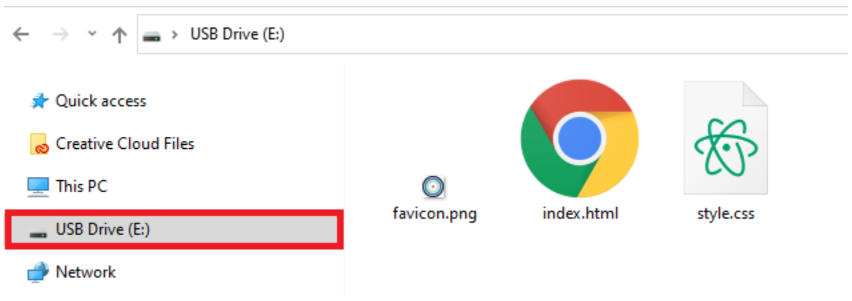
We'll also serve a favicon. It is a png image with 15×15 pixels. You can use the same favicon as ours, or your own icon, or none favicon at all.

You can click on the following link to download the favicon:

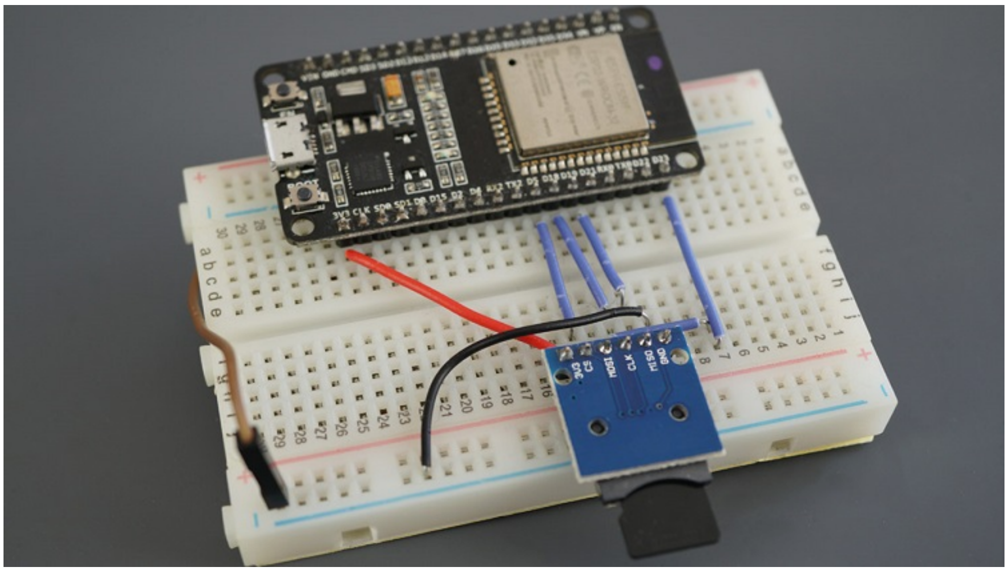
- Download favicon.png file

Copy Files to MicroSD Card

After having all files prepared, open the microSD card directory and paste the files.



Parts Required



For this tutorial you need the following parts:

- ESP32 (read Best ESP32 development boards)
- MicroSD card module
- MicroSD card
- Breadboard
- Jumper wires

You can use the preceding links or go directly to MakerAdvisor.com/tools to find all the parts for your projects at the best price!

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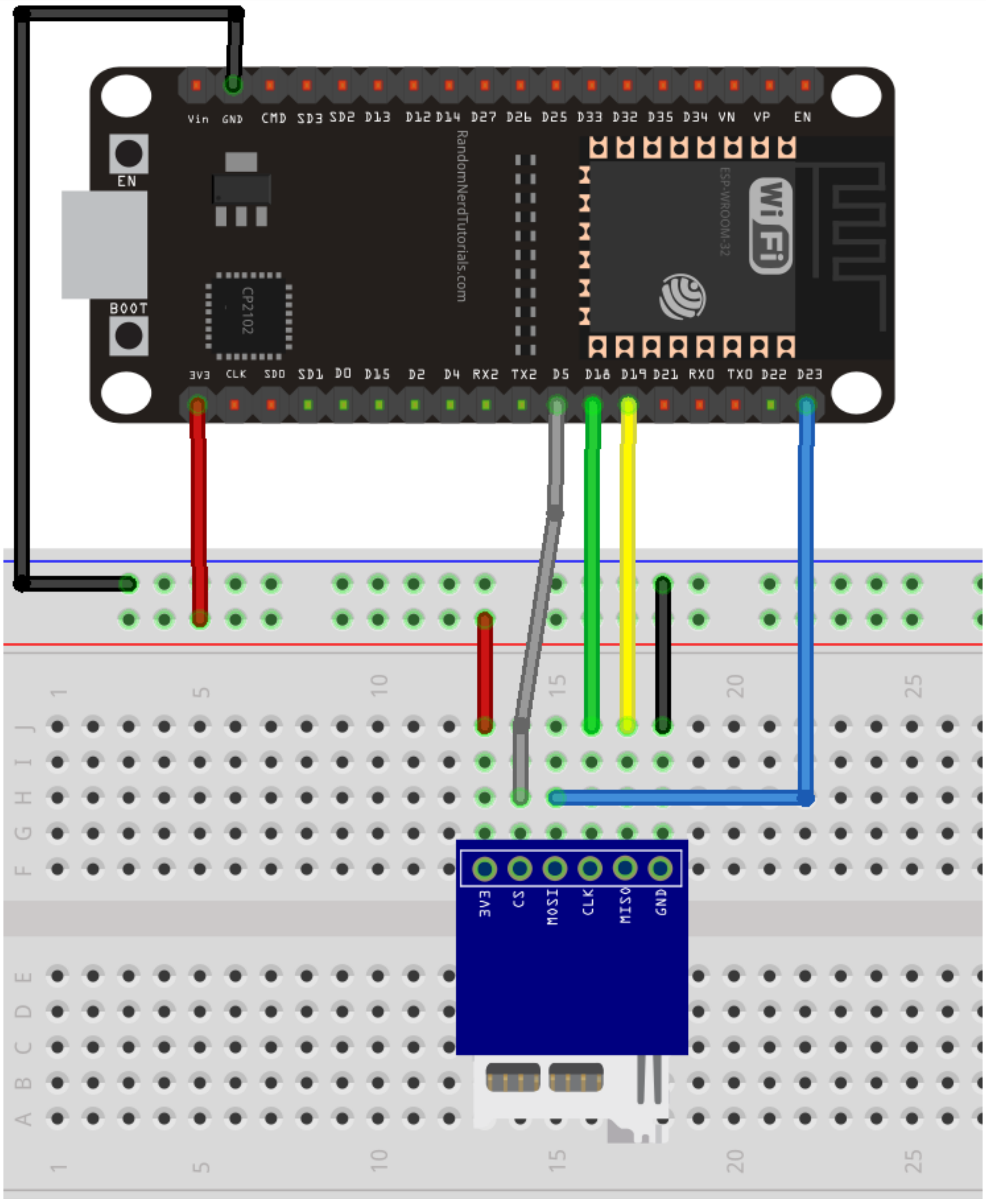
Schematic Diagram

Wire the microSD card module to the ESP32 as shown in the following schematic diagram. We're using the default ESP32 SPI



Code

Copy the following code to your Arduino IDE.

```
/*
  Rui Santos
  Complete project details at https://RandomNerdTutorials.com/esp32-web-server-microsd-card

  Permission is hereby granted, free of charge, to any person obtaining a copy
  of this software and associated documentation files.

  The above copyright notice and this permission notice shall be included in all
  copies or substantial portions of the Software.
*/

#include <Arduino.h>
#include <WiFi.h>
#include <AsyncTCP.h>
#include <ESPAsyncWebServer.h>
#include "FS.h"
#include "SD.h"
```

```
// Replace with your network credentials
const char* ssid = "REPLACE_WITH_YOUR_SSID";
const char* password = "REPLACE_WITH_YOUR_PASSWORD";

// Create AsyncWebServer object on port 80
AsyncWebServer server(80);
```

View raw code

Insert your network credentials in the following variables and the code should work straight away:

```
// Replace with your network credentials
const char* ssid = "REPLACE_WITH_YOUR_SSID";
const char* password = "REPLACE_WITH_YOUR_PASSWORD";
```

How the Code Works

We've covered how to build a web server with the ESP32 in previous tutorials. So, we'll just take a look at the relevant parts for this tutorial.

Libraries

First, make sure you include the `FS.h`, `SD.h` and `SPI.h` libraries to be able to communicate with the microSD card and handle files.

```
#include "FS.h"
#include "SD.h"
#include "SPI.h"
```

Initialize MicroSD Card

The `initSDCard()` function initializes the microSD card on the default SPI pins.

```
void initSDCard(){
  if(!SD.begin()){
    Serial.println("Card Mount Failed");
    return;
  }
  uint8_t cardType = SD.cardType();

  if(cardType == CARD_NONE){
    Serial.println("No SD card attached");
    return;
  }
  Serial.print("SD Card Type: ");
  if(cardType == CARD_MMC){
    Serial.println("MMC");
  } else if(cardType == CARD_SD){
    Serial.println("SDSC");
  } else if(cardType == CARD_SDHC){
    Serial.println("SDHC");
  } else {
    uint64_t cardSize = SD.cardSize() / (1024 * 1024);
    Serial.printf("SD Card Size: %lluMB\n", cardSize);
  }
```

Then, you need to call this function in the `setup()`:

```
  initSDCard();
```

Serve Files From microSD Card

When you access the ESP32 IP address on the root (`/`) URL, send the HTML file saved on the microSD card.

```
  server.on("/", HTTP_GET, [](AsyncWebServerRequest *request){
    request->send(SD, "/index.html", "text/html");
  });
```

The first argument of the `send()` function is the filesystem where the files are saved. In this case, it is saved in the SD card (`SD`). The second argument is the path where the file is located `/index.html`). The third argument refers to the content type (`text/html`).

When the HTML file loads on your browser, it will request the CSS and the favicon files. These are static files saved on the same directory (`SD`). We can add the following line to serve static files in a directory when requested by the root URL. It serves the CSS and favicon files automatically.

```
  server.serveStatic("/", SD, "/");
```

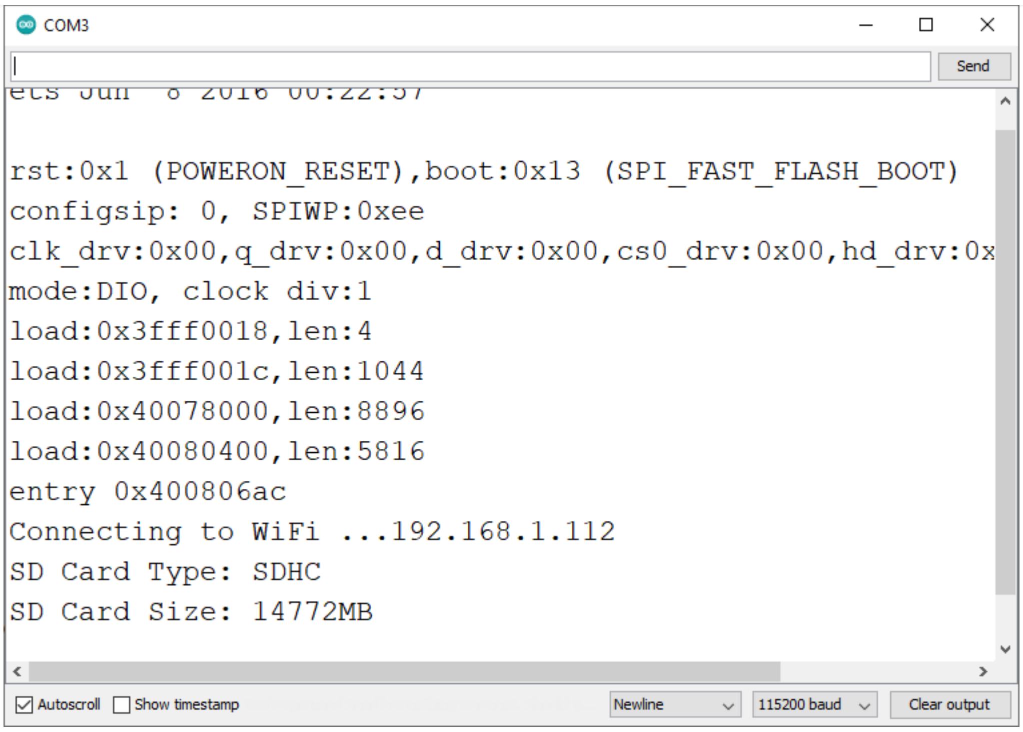
If your web server needs to handle more routes, you can add them to the `setup()`. Don't forget to set `SD` as the first argument to the `send()` function. This way, it will look for the files in the microSD card.

It's as simple as this. This can be applied to any other web server project.

Demonstration

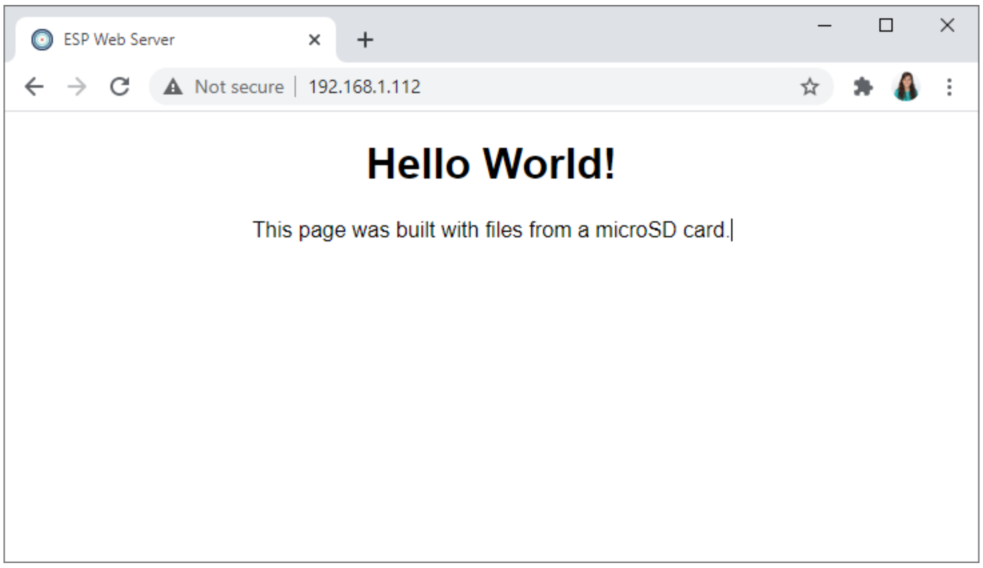
After uploading the code, open the Serial Monitor at a baud rate of 115200. Press the on-board RST button.

You should get something similar on the Serial Monitor: the ESP32 IP address and information about the microSD card.



```
rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x
mode:DIO, clock div:1
load:0x3fff0018,len:4
load:0x3fff001c,len:1044
load:0x40078000,len:8896
load:0x40080400,len:5816
entry 0x400806ac
Connecting to WiFi ...192.168.1.112
SD Card Type: SDHC
SD Card Size: 14772MB
```

Open a browser on your local network and paste the ESP32 IP address. It will load the following web page with the files saved on the microSD card. Notice the favicon on the web browser title bar.



Hello World!

This page was built with files from a microSD card.

Wrapping Up

In this tutorial, you've learned how to build a web server with the ESP32 with files saved on the microSD card. Instead of writing the HTML, CSS, and JavaScript text directly on the Arduino sketch, you can save them on separate files on a microSD card. This can also be useful to store other data that you might want to display on your web server.

If you don't have a microSD card module, you can save the files on the ESP32 filesystem (SPIFFS) if they fit. You might also like:

- ESP32 Data Logging Temperature to MicroSD Card

We hope you've found this tutorial useful.

Learn more about the ESP32 with our resources:

- Learn ESP32 with Arduino IDE