DESCRIPTION DOCUMENT FOR Wifi SINGLE RELAY BOARD

HARDWARE REVISION 0.1 AND 0.2

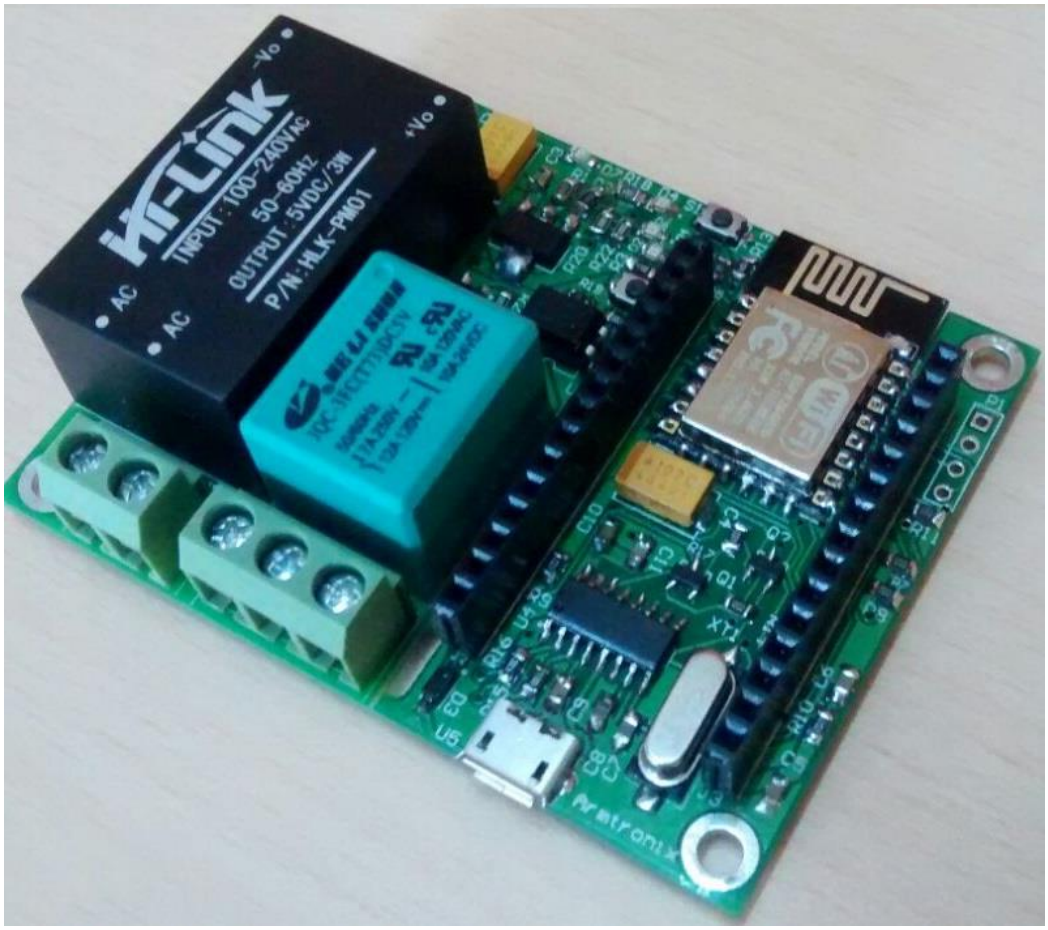
Department	Name	Signature	Date
Author			
Reviewer			
Approver			

Revision History

Rev	Description of Change	Effective Date
A	Initial Release	

ABSTRACT:

This document is a detailed product description that describes the effective features of the product. It includes a functional hardware description of the product with its internal block diagram and product images.



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1. ABBREVIATIONS

Term	Description
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
MQTT	Message Queue Telemetry Transport
HTTP	Hypertext Transfer Protocol
AC	Alternating Current
Hz	Hertz
COM	Common
NO	Normally Open
NC	Normally Closed

2. REFERENCES

Company Weblink	https://www.armtronix.in
Youtube WebLink	https://www.youtube.com/watch?v=CeX9F6baKbU
Intractable's Weblink	http://www.instructables.com/id/WIFI-SINGLE-RELAY/
Github's Weblink	https://github.com/armtronix/Wifi-Single-Relay-Board

3. PURPOSE

The purpose of this document is to outline the design description for the 1-Relay WiFi Board. It provides a high level summary of the product.

4. SCOPE

This document describes system architecture which includes Power supply, relay, WiFi Module and UART to USB converter.

5. SAFETY AND WARNING

Note that, this board to be powered with AC 230V with required current. Work and handle carefully with AC power as it is harmful and danger for human beings. Touching live wire or board when it is ON is danger and not advisable, it may cause to death, please avoid it.

Even a 50 V AC supply is sufficient to kill you. Please Switch off the mains before you make or change connections, be very careful. If you are not sure of anything related to the AC supply lines, please call an electrician ask and him to help you with it. Do not attempt to interface to mains unless you have adequate training and access to appropriate safety equipment. Never work on high voltages by yourself when you are alone. Always ensure that you have a friend/partner who can see and hear you and who knows how to quickly turn off power in case of an accident. Use a 2A Fuse in series with the input to the board as a safety measure. Basic Wiring diagram is available on our instructables page and github. Please refer it.

Fire Hazard: Making wrong connections, drawing more than rated power, contact with water or other conducting material, and other types of misuse/overuse/malfunction can all cause overheating and risk starting a fire. Test your circuit and the environment in which it is deployed thoroughly before leaving it switched on and unsupervised. Always follow all fire safety precautions.

6. PRODUCT FEATURES

- Works directly with AC power 100 - 240 V AC 50-60 Hz.
- Product firmware can be updated/reloaded/changed as per user requirement.
- One Dry contact relay output with COM, NO and NC accessible to user.
- Relay output can handle up to 4 Amps
- WiFi with MQTT or HTTP protocol
- On board USB – UART converter to program WiFi Module
- 0.9 inch I2C OLED display header. The header can also be used as normal GPIO's.
- Basic Firmware to enter SSID and password to connect to the router
- Firmware has ability to control device through HTTP and MQTT mode.
- Push Button on board Provided for OTA, Restart and configuration Reset function.

7. PRODUCT DESCRIPTION

a. PHYSICAL DESCRIPTION

- AC to DC Power supply module
- Electro Magnetic Relay
- Wifi Module
- USB-UART converter

b. FUNCTIONAL DESCRIPTION

Block Diagram

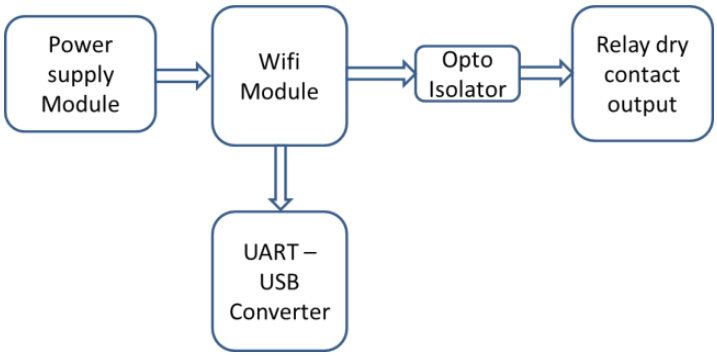

Figure 1: Block Diagram

Single relay board has on-board power supply module which takes standard AC voltage as input and provides required DC voltage as output. The DC voltage is used to power-up Wifi module used on board to establish Wifi communication with mobile phones. There is a relay mounted on board to control (ON/OFF) external electrical loads from a mobile application using MQTT/HTTP protocol. The board has Node MCU header and also the board is compatible with Arduino IDE to make the user ease of programming.

8. SYSTEM OVERVIEW

1. AC to DC Power supply module

AC to DC converter is power supply module manufactured from Hi-Link part number HLK-PM01. This power supply module rectifies and regulates voltage from 230 V AC to 5 V DC with output current capacity of 0.6A DC. The power of HLK-PM01 is at maximum of 3W.

The 5V supply is used to power on relay and USB-UATT converter. There is a DC-DC converter on board to regulate voltage from 5 V DC to 3.3 V DC to supply power to Wifi module.

2. Wifi Module

Wifi module used on the board is ESP12 with all its required GPIOs are easily accessible to user for their own application. Wifi module is powered on through 3.3 V DC. It works on both MQTT / HTTP protocol.

3. Electro Mechanical Relay

Electro Mechanical relay is powered by 5 V DC. All the three load terminals (COM, NO and NC) are given access to user to control loads. An opto isolator based driver circuit is used to drive the relay, to create isolation between relay's AC and DC part. The relay output provides the dry-contact terminals, so that user can control the load of AC or DC for their application.

4. USB-UART converter

USB-UART converter is an integrated chip used to convert serial UART data to high speed USB to program the Wifi module using Arduino IDE. This is much user friendly to customize the code and reload it. A micro USB connector given on board to make hassle free connection between computer and Wifi single relay board for programming purpose.

9. TECHNICAL SPECIFICATION

a. ELECTRICAL SPECIFICATION

Input Specifications				
Description	**Min**	**Typ**	**Max**	**Unit**
Voltage AC	100	220	230	Volts
Current AC	-	0.1	-	Amps
Power AC	-	3	-	Watts
Frequency	50	-	60	Hz

Relay Output Specifications (Maximum)				
Description	**Min**	**Typ**	**Max**	**Unit**
Voltage AC	-	-	240	Volts
Current AC	-	-	2	Amps
Power AC	-	-	980	Watts
Voltage DC			24	Volts
Current DC			10	Amps

b. MECHANICAL SPECIFICATION

- Mechanical Dimensions of PCB are 70 x 50 x 20 mm (Length x Width x Height)
- Mounting Holes (M3) at distance of 4.5mm for edges of board

10. ELECTRICAL CONNECTIONS

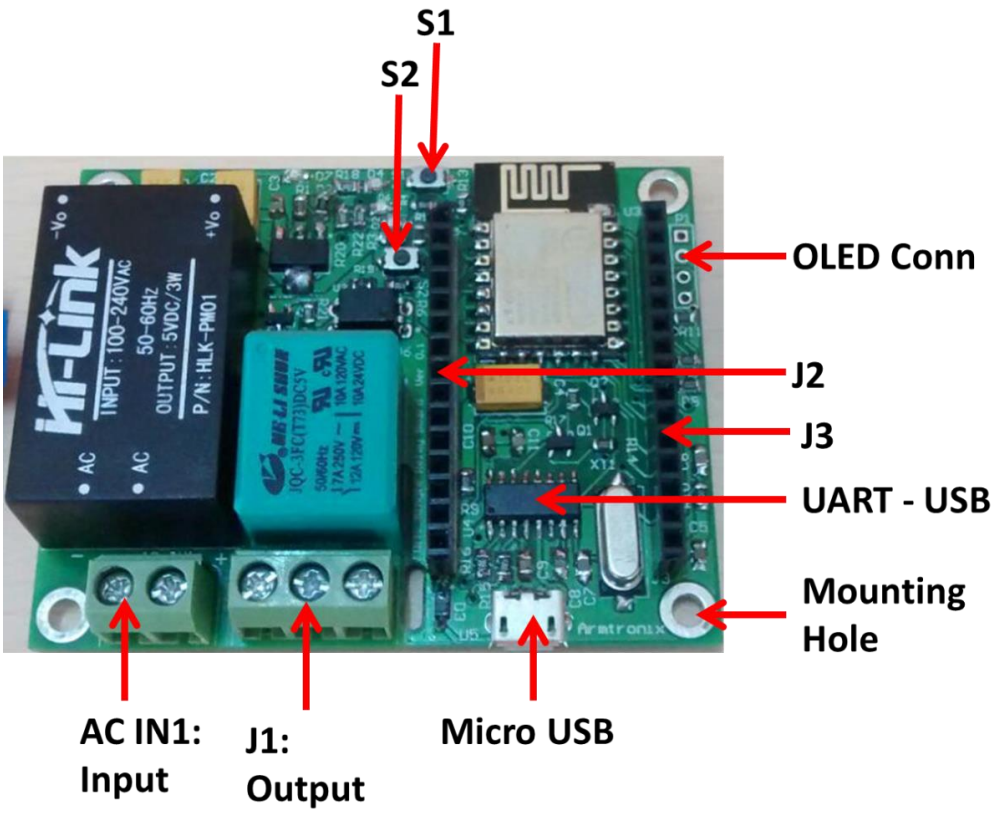

Figure 2: Header and Switch Details

Description of Header and Switches shown in Figure 1:

1. S1 Button is to reset the ESP
2. S2 Button is for Key Flash of ESP
3. P1 Header is compatible to I2C OLED
4. J2 and J3 Headers are compatible to standard NodeMCU headers

a. ESP PIN CONFIGURATION:

ESP Pin No.	ESP Port No.	Arduino Port No.	Application
2	ADC	A0	ADC
5	GPIO14	D5	GPIO
6	GPIO12	D6	LED
7	GPIO13	D7	Relay
17	GPIO2	D4	GPIO
18	GPIO0	D3	Key Flash
21	GPIO3/RXD0	D9	ESP_RXD
22	GPIO1/TXD0	D10	ESP_TXD

Table 1: ESP Pin Configuration

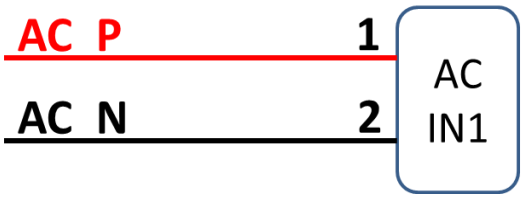

Figure 3: AC Input connection

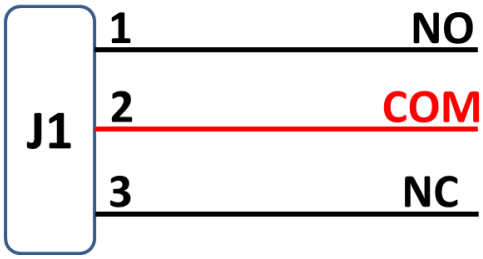

Figure 4: Relay Dry contact pin-out

Figure 2, shows pinout and connection of AC Phase and Neutral connection to AC IN1 input connector. Figure 3, shows J1 output load connector.

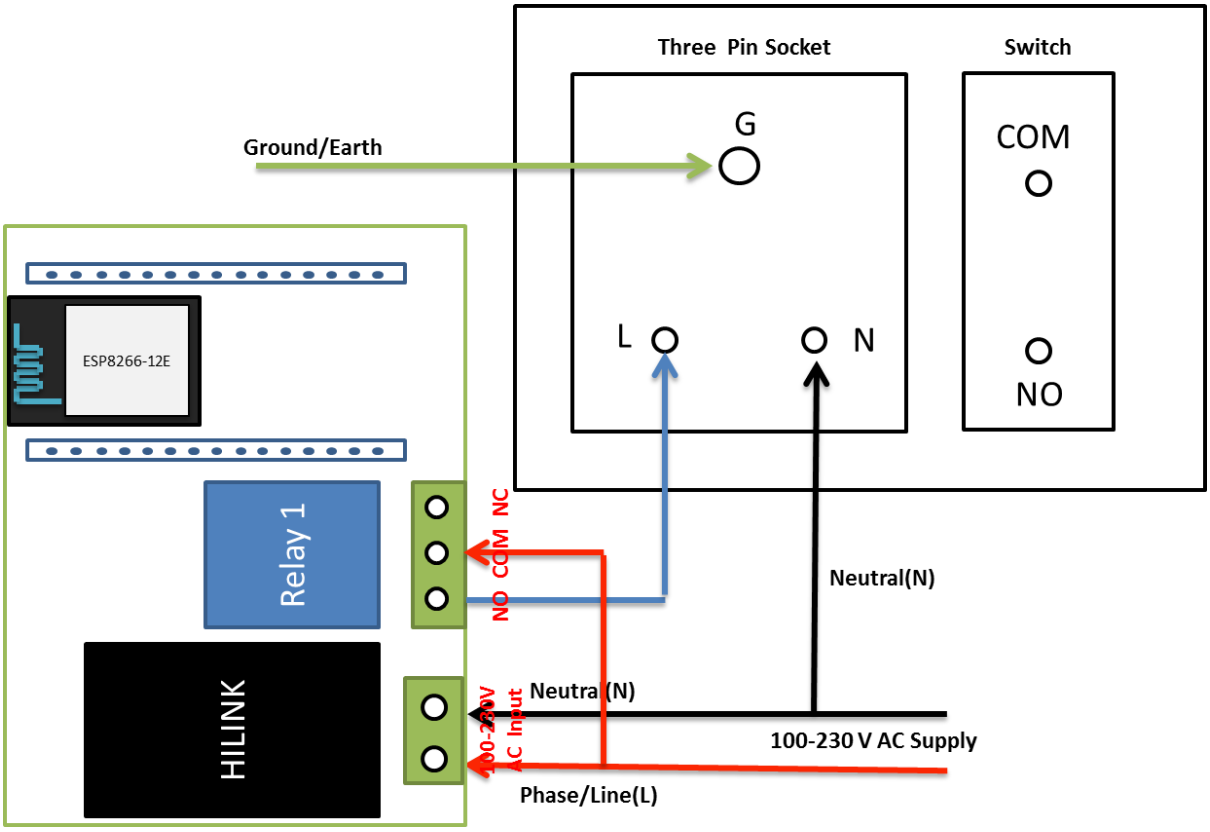

Figure 5: Load connection

Figure 4 represents about connection between load and relay output (J1) connector. Phase is given to Common terminal and load shall be connected to the NO terminal of the relay.

a. HEADER P1:

ESP Pin No.	ESP Port No.	Arduino Port No.	Application
1	VCC_3V3	-	VCC_3V3
2	GND	-	GND
3	GPIO4	D2	SCL
4	GPIO5	D1	SDA

Table 2: Header P1 Pin Configuration

b. HEADER PIN CONFIGURATION

i. HEADER J2

J2				
Header Pin #	**ESP Pin #**	**Arduino Port #**	**Designation**	**Description**
1	-	A0	ADC_EX	External ADC input up to 3.3Vdc
2	2	-	ADC	ADC input up-to 1.1Vdc
3	-	-	RESV	Reserved by ESP
4	-	-	SD_D3	Reserved by ESP
5	-	-	SD_D2	Reserved by ESP
6	-	-	SD_D1	Reserved by ESP
7	-	-	SD_CMD	Reserved by ESP
8	-	-	SD_D0	Reserved by ESP
9	-	-	SD_CLK	Reserved by ESP
10	-	-	GND	Ground reference
11	-	-	VCC_3V3	3.3V DC Input/output
12	3	-	EN	Enable of ESP
13	1	-	nRST	Negative of Reset
14	-	-	GND	Ground reference
15	-	-	VCC_5V	5V DC Input/output

Table 3: Header J2 Pin Configuration

ii. HEADER J3

J3				
Header Pin #	**ESP Pin #**	**Arduino Port #**	**Designation**	**Description**
1	4	D0	GPIO16	GPIO16 of ESP
2	20	D1	GPIO5	GPIO5 of ESP
3	19	D2	GPIO4	GPIO4 of ESP
4	18	D3	GPIO0	GPIO0 of ESP
5	17	D4	GPIO2	GPIO2 of ESP
6	-	-	VCC_3V3	3.3V DC Input/output
7	-	-	GND	Ground reference
8	5	D5	GPIO14	GPIO14 of ESP
9	6	D6	GPIO12	GPIO12 of ESP
10	7	D7	GPIO13	GPIO13 of ESP
11	16	D8	GPIO15	GPIO15 of ESP
12	22	D9	RXD0	UART Tx ESP
13	21	D10	TXD0	UART Rx ESP
14	-	-	GND	Ground reference
15	-	-	VCC_3V3	3.3V DC Input/output

Table 4: Header J3 Pin configuration

Table 3 and 4, shows the header J2 and J3 which are in-compatible with Node MCU headers. Freely available GPIOs are also shown in connector, can be used for user application.

11. HOW TO USE THE PRODUCT

Power ON the device, so that, it will host the access point as shown in Figure 7,

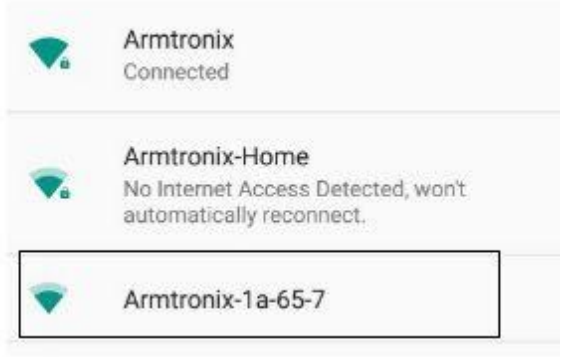

Figure 6: Device hosting Access point

Connect the mobile to access point with Armtronix-(MAC ID). EX: Armtronix-1a-65-7 as shown in Figure 8.

Figure 7: Access point name

After connecting, open browser and enter 192.168.4.1 IP address, it will open the web server as shown in the Figure 9,

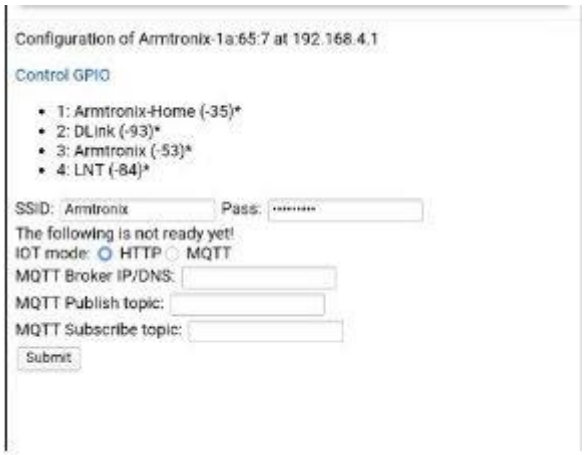

Figure 8: Web server

fill the SSID and password and select HTTP, if user wants to connect to MQTT then he has to select MQTT radio button, enter MQTT broker IP address, enter MQTT publish topic then MQTT subscribe topic and submit.

After submitting configuration, the ESP 8266 will connect to the router and router assigns IP address to the ESP. Open that IP address in the browser to control the switch (Relay).

Without configuring the SSID and Password we can control the Wifi Switch by connecting to the access point of the device and open the IP address of device i.e 192.168.4.1 the web server page will show the link with the name Control GPIO as shown in the Figure 8, by clicking this link we can control the Wifi Switch board but the response will be slow.

12. HOW TO CUSTOMISE FIRMWARE

You can program this board using Arduino IDE. Please follow the below steps to program the board by yourself with easy steps as mentioned below:

a. STEPS TO LOAD PROGRAM TO ESP8266:

1. Use external USB-UART converter between computer and this board.
2. Connect Micro USB cable between your computer and U5 of “Wifi Single Relay Board”.
3. Open your code in Arduino IDE as shown.
4. Click on Tools Tab, move mouse pointer on “Board: xxxxxxxxxx” and click on “NodeMCU0.9 (ESP-12 Module)” as shown in figure 10.

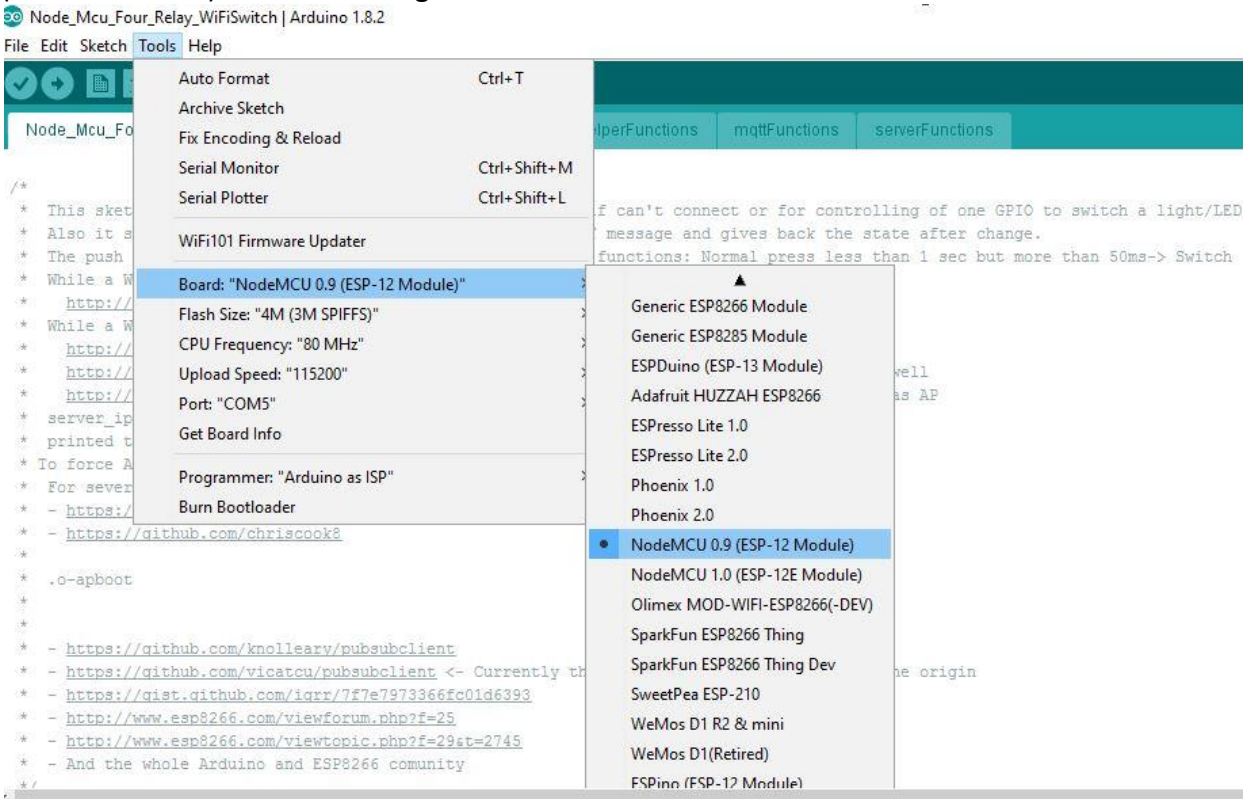

Figure 9: Board Selection

5. Click on tools tab, move mouse pointer to “Programmer: “Arduino as ISP’”, under this click on “Arduino as ISP” to select. Refer to figure 11.

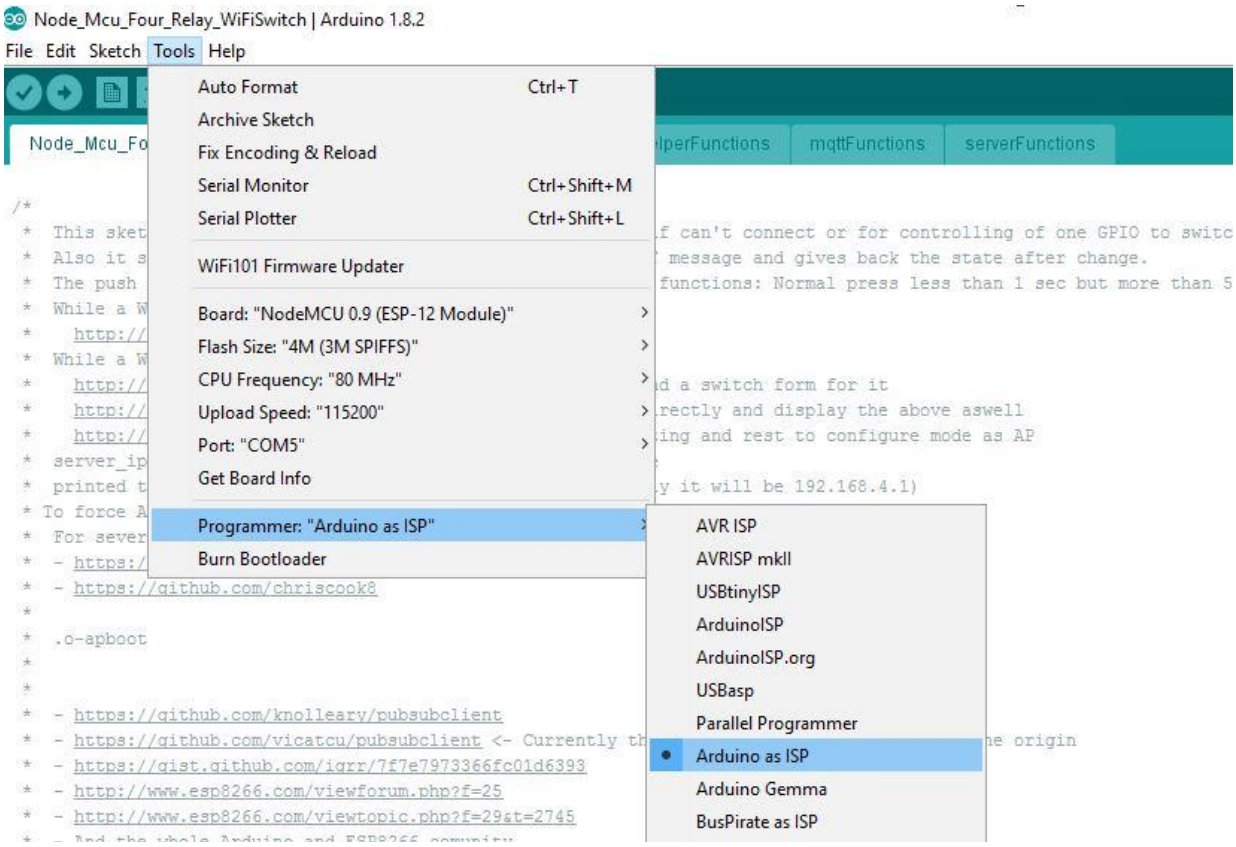

Figure 10: IDE Selection

6. Click on tools tab, move mouse pointer to “Port: “COMx”, under this click on “COMx” to select. (“x” refers to port number available in your computer) Refer to figure 12.

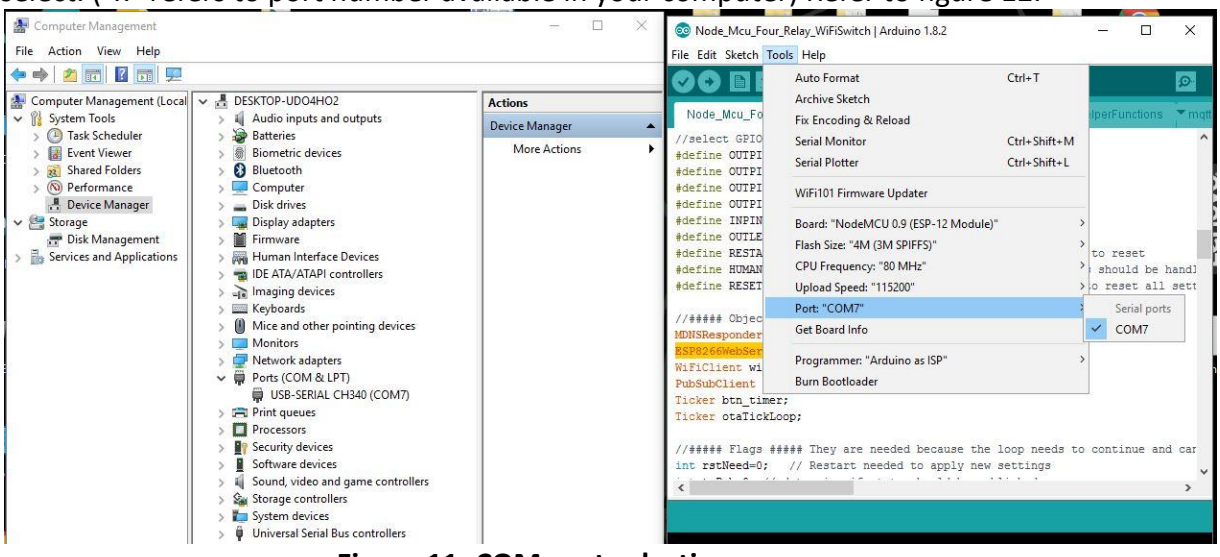

Figure 11: COM port selection.

7. Run the program. Refer to Figure 13.

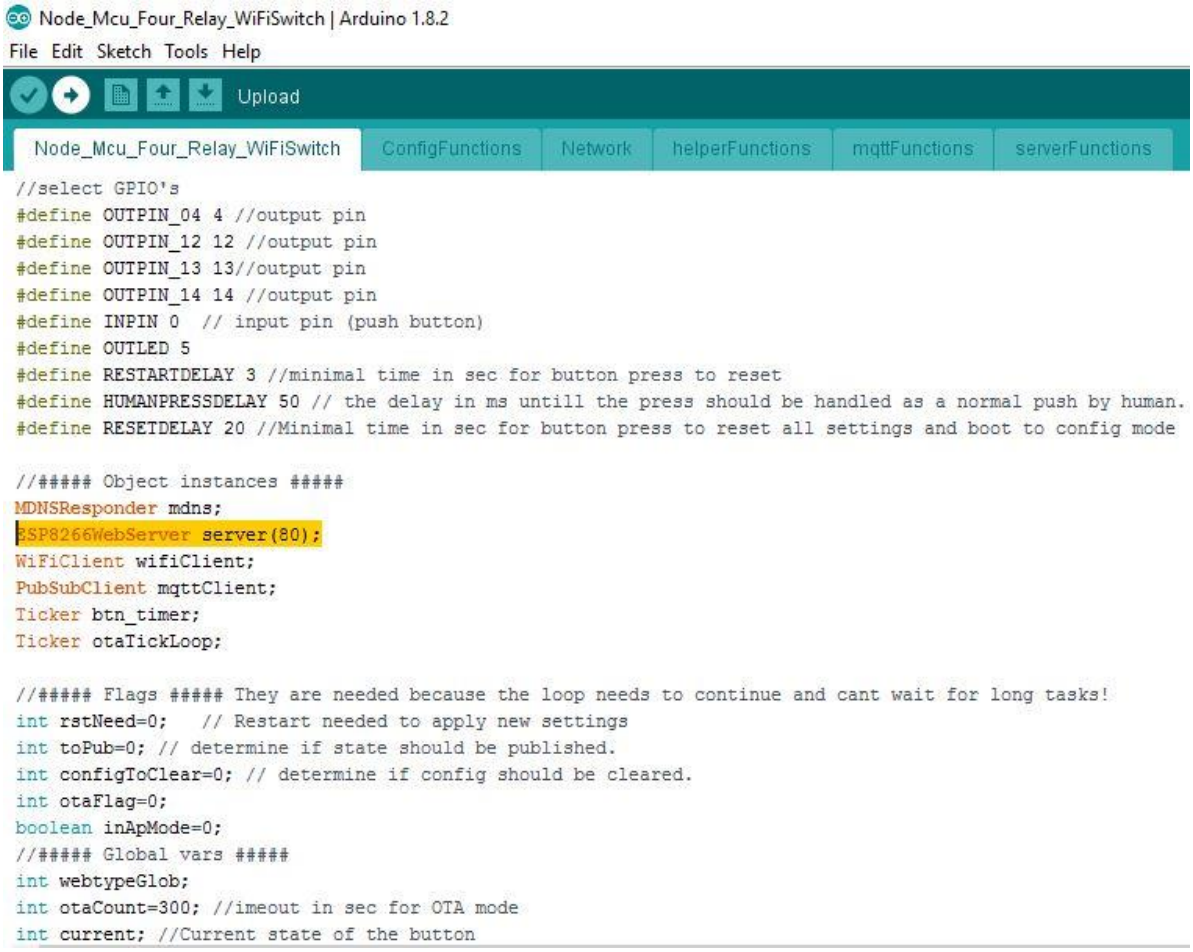

Figure 12: Executing code

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