DESCRIPTION DOCUMENT FOR Wifi 1-RELAY WITH POWER MONITORING BOARD
HARDWARE REVISION 0.1

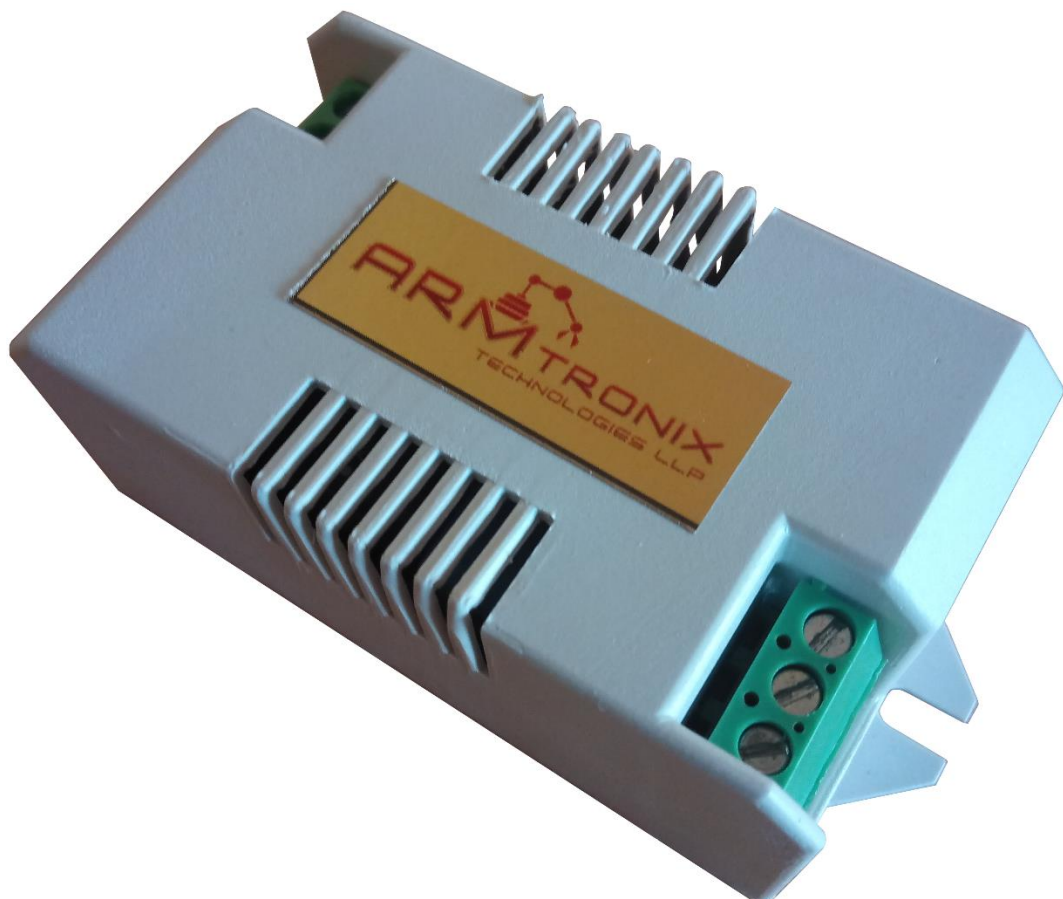| Department	Name	Signature	Date
Author			
Reviewer			
Approver			

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.

	DOCUMENT #: BA013
ARMtronix	**DOCUMENT REV:** A
DOCUMENT NAME: DESIGN DESCRIPTION, Wifi 1R PM.	

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1. ABBREVIATIONS

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

2. REFERENCES

Company Weblink	https://www.armtronix.in
Youtube WebLink	https://www.youtube.com/watch?v=g0LlqelW9FM
Intractable's Weblink	
Github's Weblink	

3. PURPOSE

The purpose of this document is to outline the design description for the Wifi One-Relay with power monitoring 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 Power monitoring.

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 living 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 a living being. 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 and ask 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 1A Fuse in series with the input to the board as a safety measure. It is suggested to follow basic safety practices for electrical connections.

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.
   - Power Monitoring (Voltage, Current and Power).
   - 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 2100 watts power.
   - Tasmota compatible.
   - WiFi with MQTT and/or HTTP protocol.
   - The header with GPIO, to use as DC virtual switch.
   - Basic Firmware to enter SSID and password to connect to the router
   - Push Button on board Provided to Reset the board.

7. **PRODUCT DESCRIPTION**

   a. PHYSICAL DESCRIPTION
   - ➢ AC to DC Power supply module
   - ➢ Electro Magnetic Relay
   - ➢ Wifi Module
   - ➢ Power Monitoring

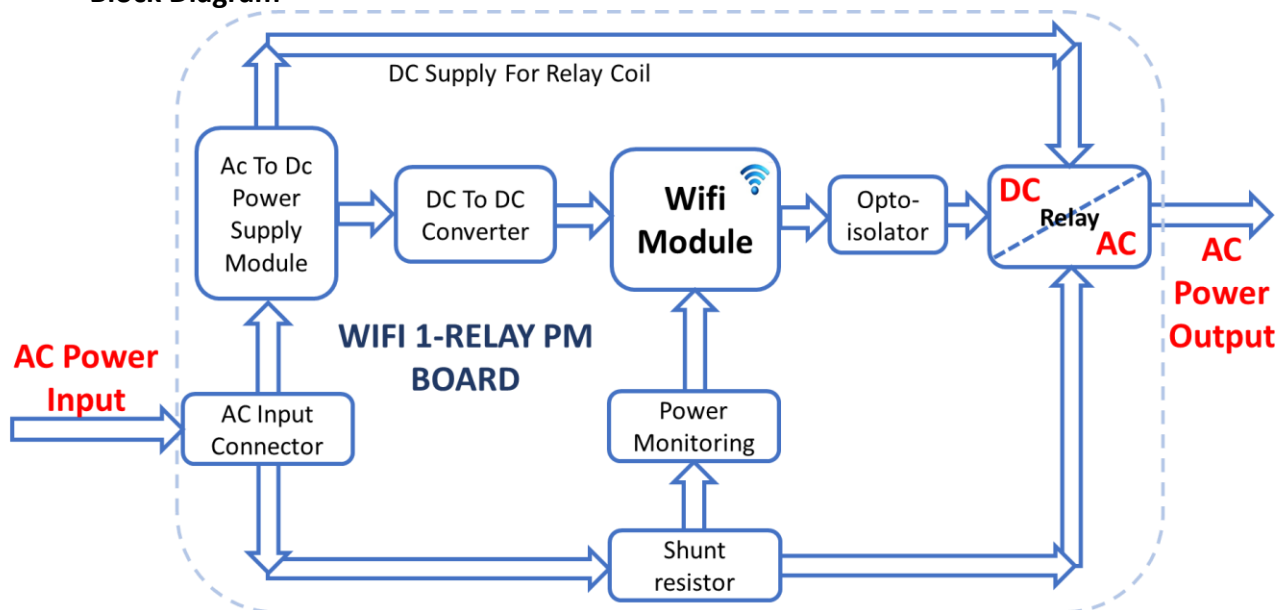   **b. FUNCTIONAL DESCRIPTION**

   Block Diagram

Figure 1: Block Diagram

One relay with power monitoring board is a Wifi based remote control switch product. Specially designed to control (ON/OFF) heavy household electrical loads like Geyser, ACs… up to 2100 watts using smartphone. The board has power monitoring section, it monitors the power consumption of the load being controlled by the device. It has provision to connect physical switch to control loads in two-way mode with respect to Smartphone. It has on-board SMPS which takes standard AC power as input. There is a relay mounted on board to control (ON/OFF) external electrical loads from a mobile application using MQTT/HTTP protocol.

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.
   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. Power Monitoring

   Power monitoring block is implemented in the hardware to monitor the consolidated power consumption by the loads. The circuit is based on single phase energy metering IC HLW8012. Which has ability to monitor voltage, current and active power and give the output in the form of pulses. User need to convert these pulse output to appropriate parameters. With these parameters, user can be able to calculate the energy consumption by the loads.

9. **TECHNICAL SPECIFICATION**

   a. **ELECTRICAL SPECIFICATION**

Input Specifications				
Description	**Min**	**Typical**	**Max**	**Unit**
Voltage AC	100	220	240	Volts
Current AC	-	0.1	-	Amps
Power AC	-	3	-	Watts
Frequency	50	-	60	Hz

Relay Output Specifications (Maximum)				
Description	**Min**	**Typical**	**Max**	**Unit**
Voltage AC	Same as input			Volts
Power AC	-	-	2100	Watts

b. MECHANICAL SPECIFICATION

- Mechanical Dimensions of PCB are 71x 39 x 20 mm (Length x Width x Height)
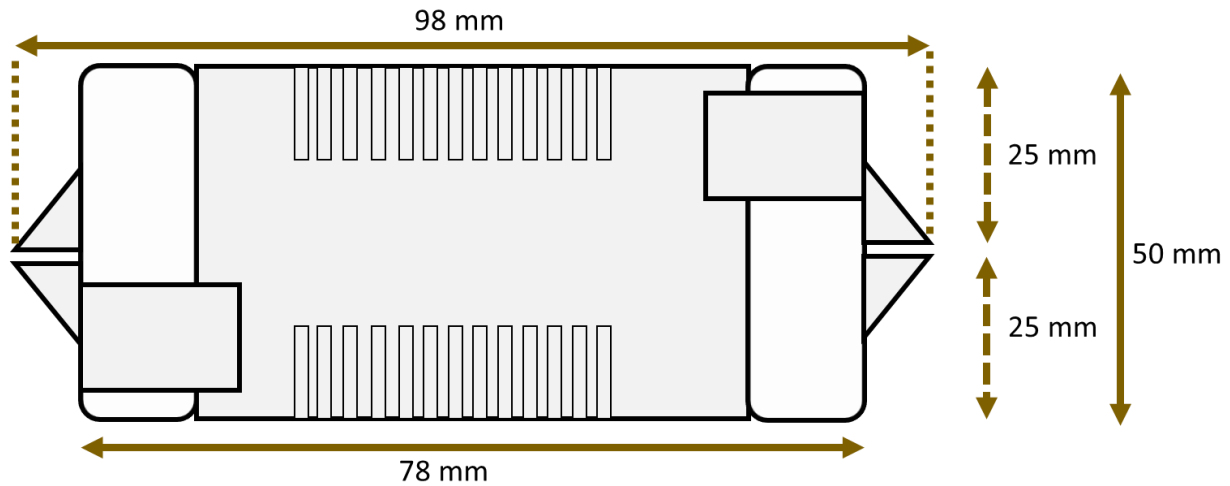- Mounting Holes (M3), board dimension is shown below.

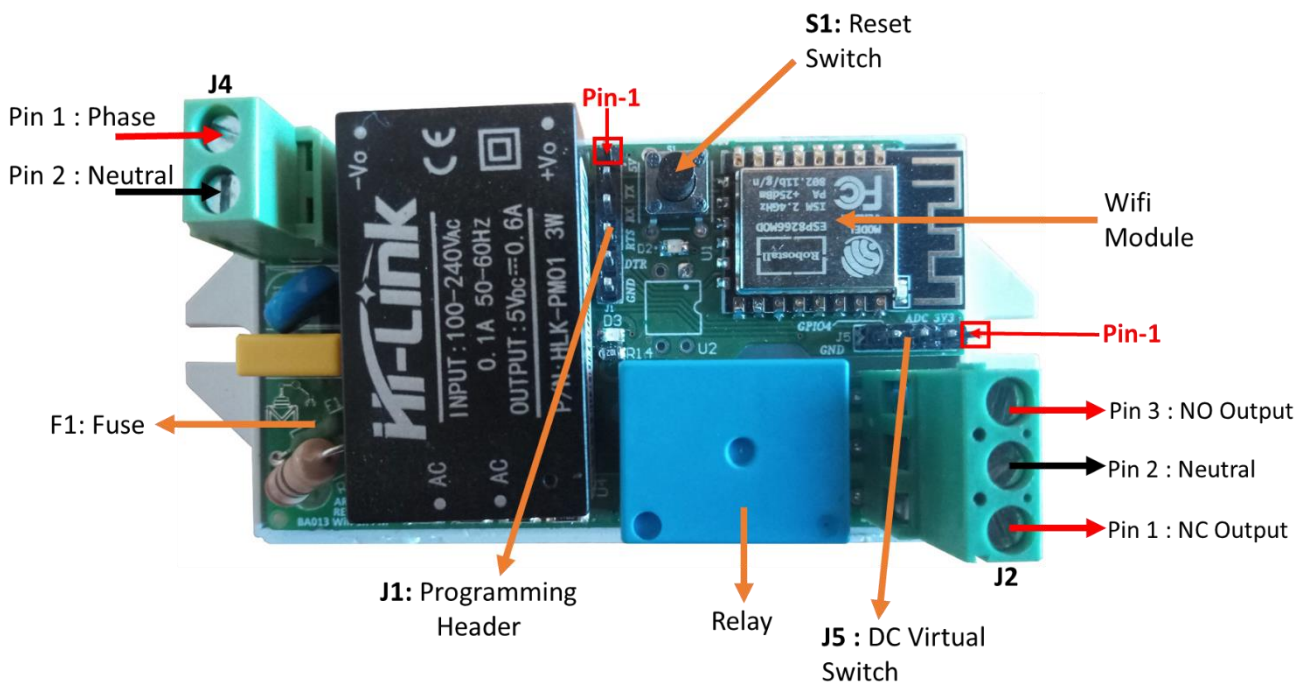**Figure 2: Mechanical dimension**

10. ELECTRICAL CONNECTIONS

Figure 3: Header and Switch Details

Description of Header and Switches shown in Figure 1:

1. S1   Button is to reset the ESP
2. J1   Header is for programming purpose.
3. J5   Headers for the connection of virtual switch.
4. J4   Input Power supply.
5. J2   Output from the board.

a. ESP PIN CONFIGURATION:

ESP Pin No.	ESP Port No.	Arduino Port No.	Application
2	ADC	A0	ADC
5	GPIO14	D5	PM – CF
6	GPIO12	D6	RELAY
7	GPIO13	D7	PM – CF1
17	GPIO4	D4	GPIO / Virtual Switch
21	GPIO3/RXD0	D9	ESP_RXD
22	GPIO1/TXD0	D10	ESP_TXD

Table 1: ESP Pin Configuration

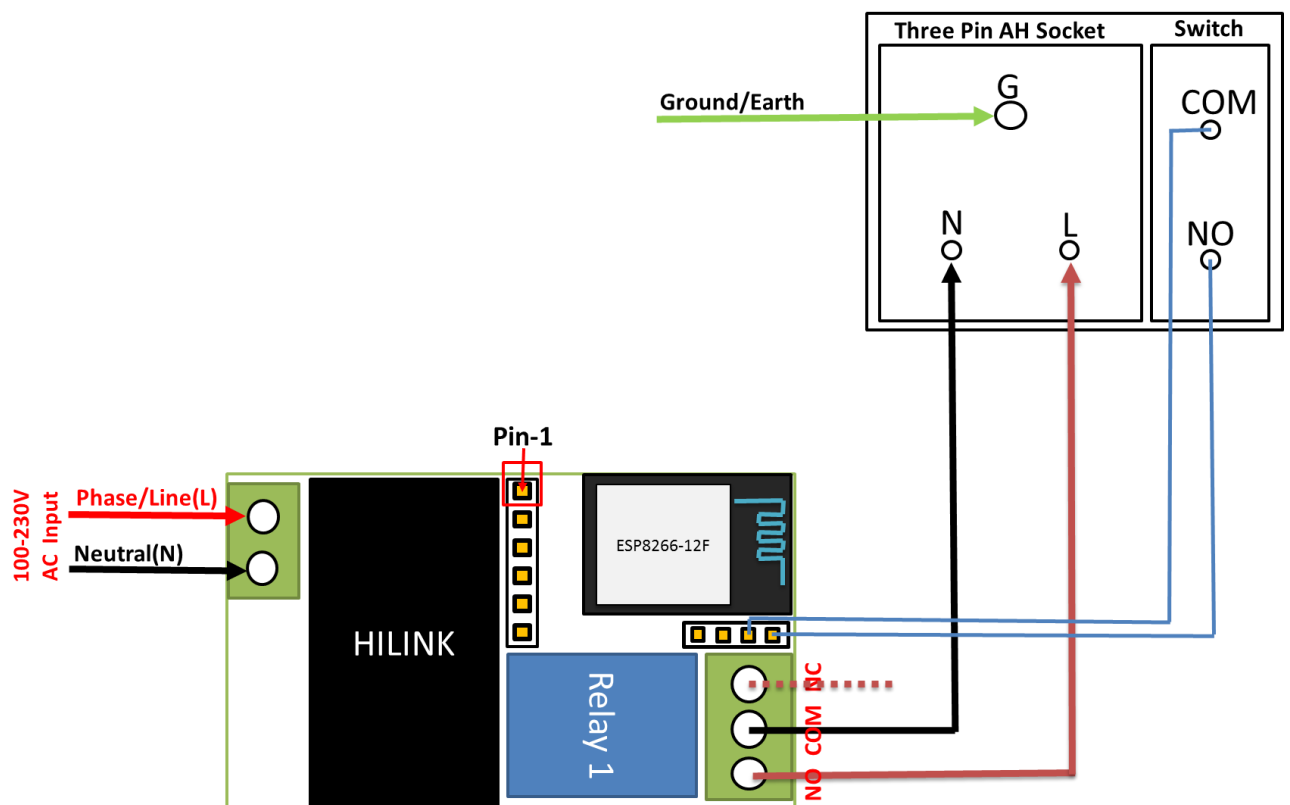### b. EXAMPLE CONNECTION DIAGRAM:

Figure 4: Example wiring diagram

Figure 4 represents example connection of load and relay output (J2) connector. Neutral is given to Common terminal and load shall be connected to the NO or NC terminal of the relay available in same terminal block.

C. HEADER PIN CONFIGURATION

i. HEADER J1:

Pin No.	Pin Description
1	VCC_5V
2	TXDE
3	RXDE
4	RTSE
5	DTRE
6	GND

Table 2: Header J1 Pin Configuration

ii. HEADER J2

Header Pin #	Description
1	Relay Out NO
2	Neutral
3	Relay Out NC

Table 3: Header J2 Pin Configuration

iii. HEADER J4

Header Pin #	Description
1	Phase
2	Neutral

Table 4: Header J4 Pin Configuration

iv. HEADER J5

Header Pin #	ESP Pin #	Arduino Port #	Designation	Description
1	-	-	VCC_3V3	3.3V DC Input/output
2	-	A0	ADC_EX	External ADC input up to 3.3Vdc
3	19	D2	GPIO4	GPIO4 of ESP
4	-	-	GND	Ground Reference

Table 5: Header J5 Pin Configuration

11. HOW TO USE THE PRODUCT

a. PROCEDURE POWER ON THE DEVICE.
1. Make an input connection AC phase and Neutral connection as shown in Figure 4.
2. Use an electrical fuse in series to input connections for the purpose of safety.
3. Check and make sure that there is no short circuit between phase and neutral.
4. Ensure that, safety precautions are taken care.
5. Power ON the device by turning ON the main input supply.
6. Then observe the LED D3 on the device is in ON condition.
7. If the device has NOT powered ON, then turn OFF the main input supply and recheck for connections by following above steps.

b. PROCEDURE TO CONFIGURE THE DEVICE
Power ON the device, so that, it will host the access point as shown in Figure 7,
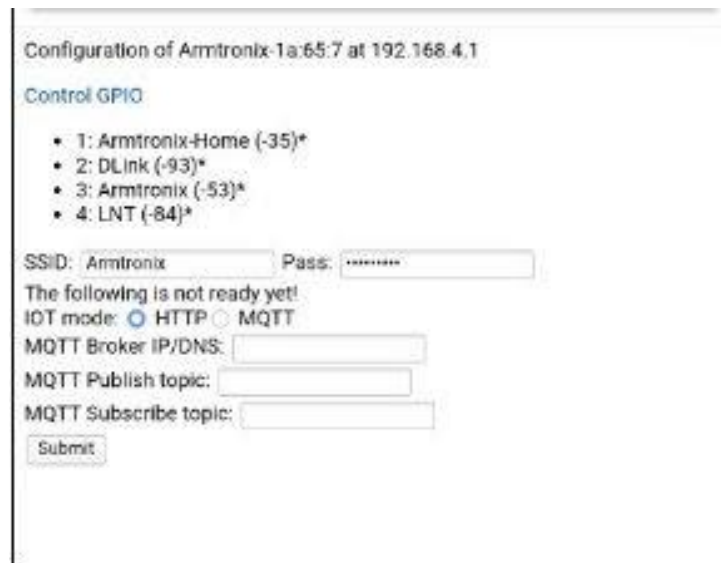

Figure 5: Device hosting Access point

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

Figure 6: 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,

Configuration of Armtronix-1a:65:7 at 192.168.4.1

Control GPIO

- 1: Armtronix-Home (-35)*
- 2: DLink (-93)*
- 3: Armtronix (-53)*
- 4: LNT (-84)*

SSID: Armtronix   Pass: ·········
The following is not ready yet!
IOT mode: ○ HTTP ○ MQTT
MQTT Broker IP/DNS: [   ]
MQTT Publish topic: [   ]
MQTT Subscribe topic: [   ]
[Submit]

Figure 7: 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 "USB-UART converter".
3. Make connections as mentioned in below table:

J1 Header		USB-UART Converter
J1 Pin No.	**Pin Description**	**Pin Description**
1	VCC_5V	VCC_5V
2	TXDE	RXD
3	RXDE	TXD
4	RTSE	RTSE
5	DTRE	DTRE
6	GND	GND

4. Open your code in Arduino IDE as shown.
5. Click on Tools Tab, move mouse pointer on "Board: xxxxxxxxxxx" and click on "NodeMCU0.9 (ESP-12 Module)" as shown in figure 9.
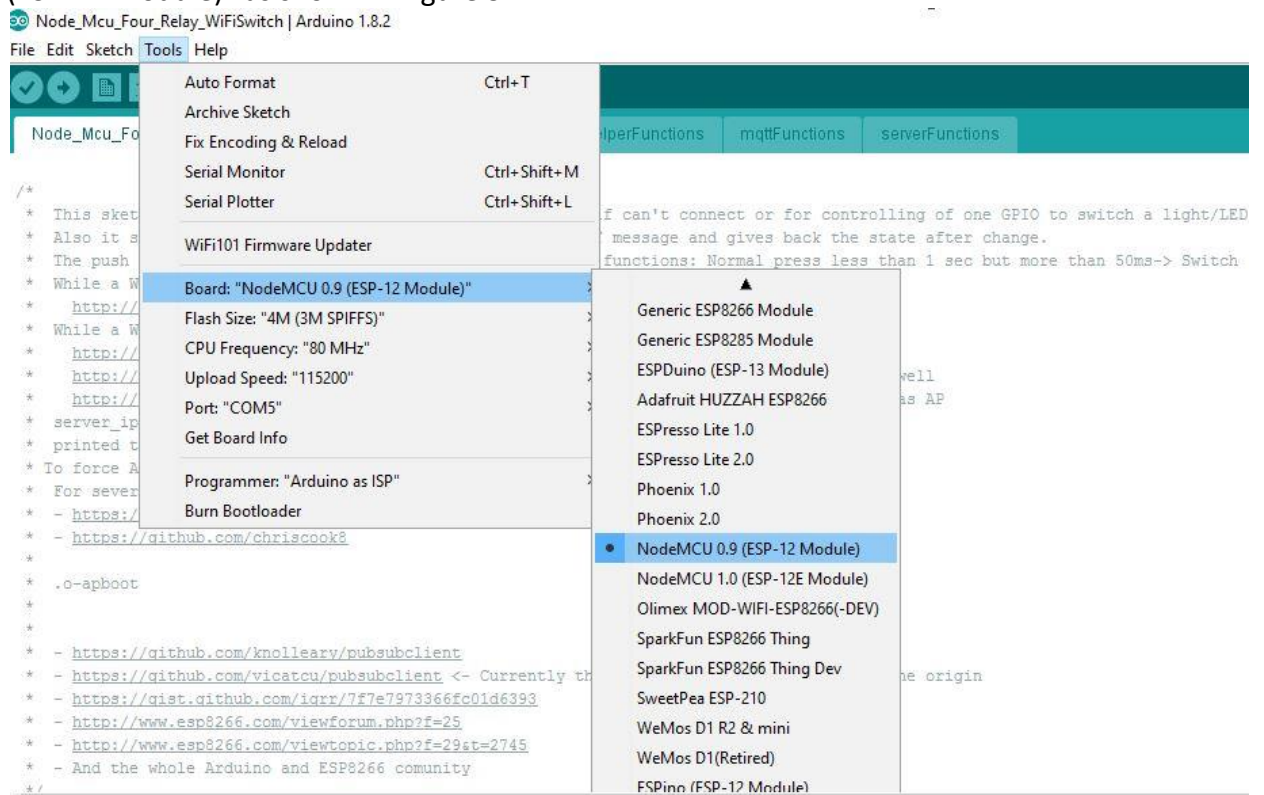
Figure 8: Board Selection

6. Click on tools tab, move mouse pointer to "Programmer: "Arduino as ISP"", under this click on "Arduino as ISP" to select. Refer to figure 10.
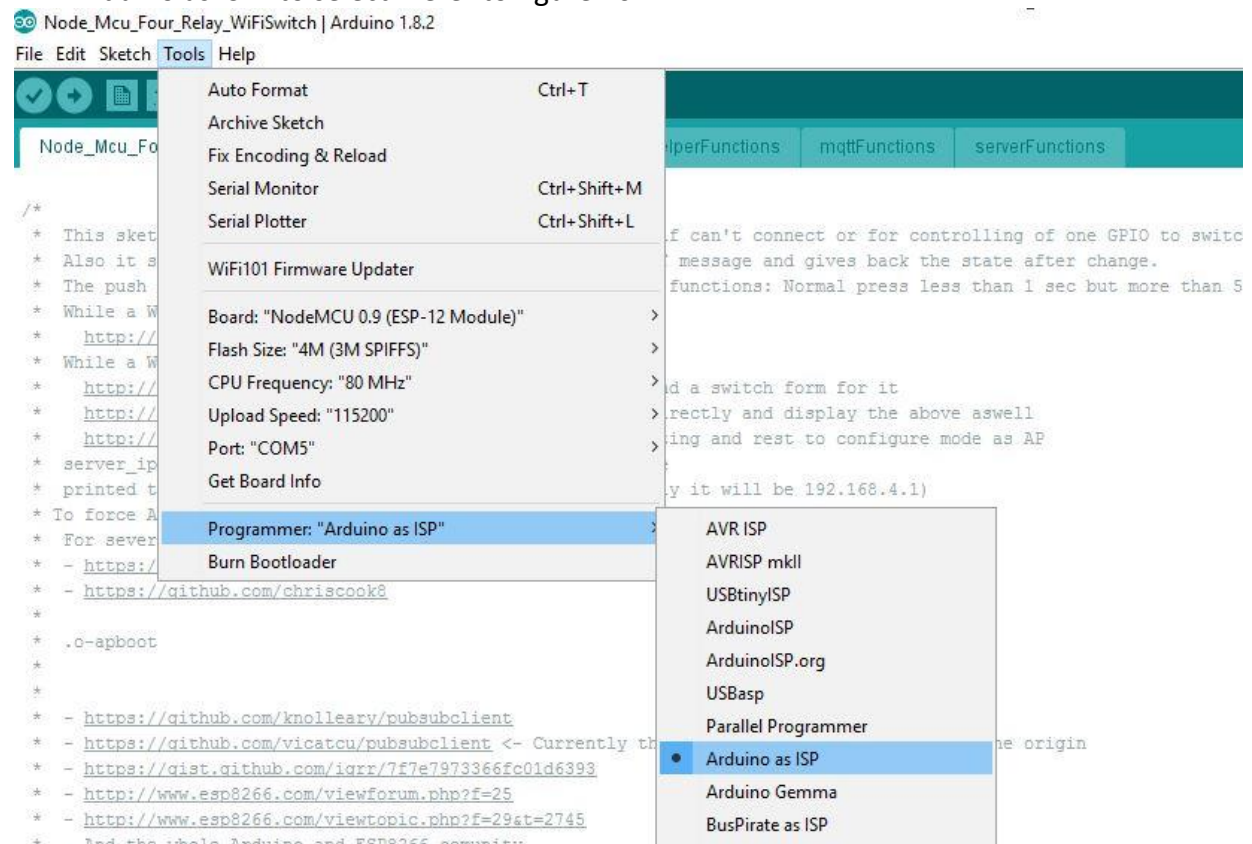
Figure 9: IDE Selection

7. 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 11.
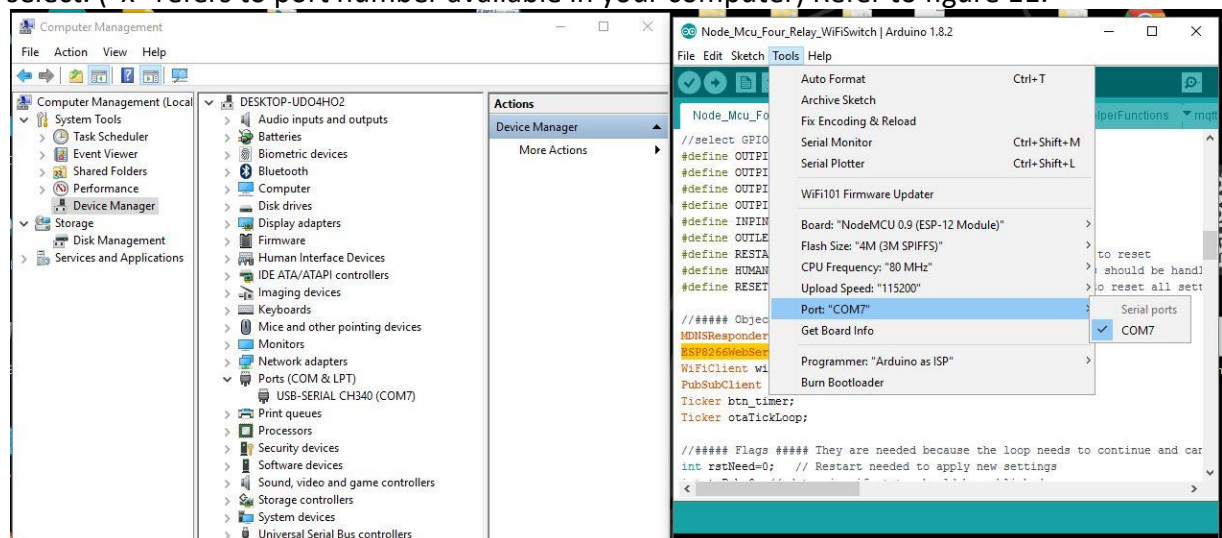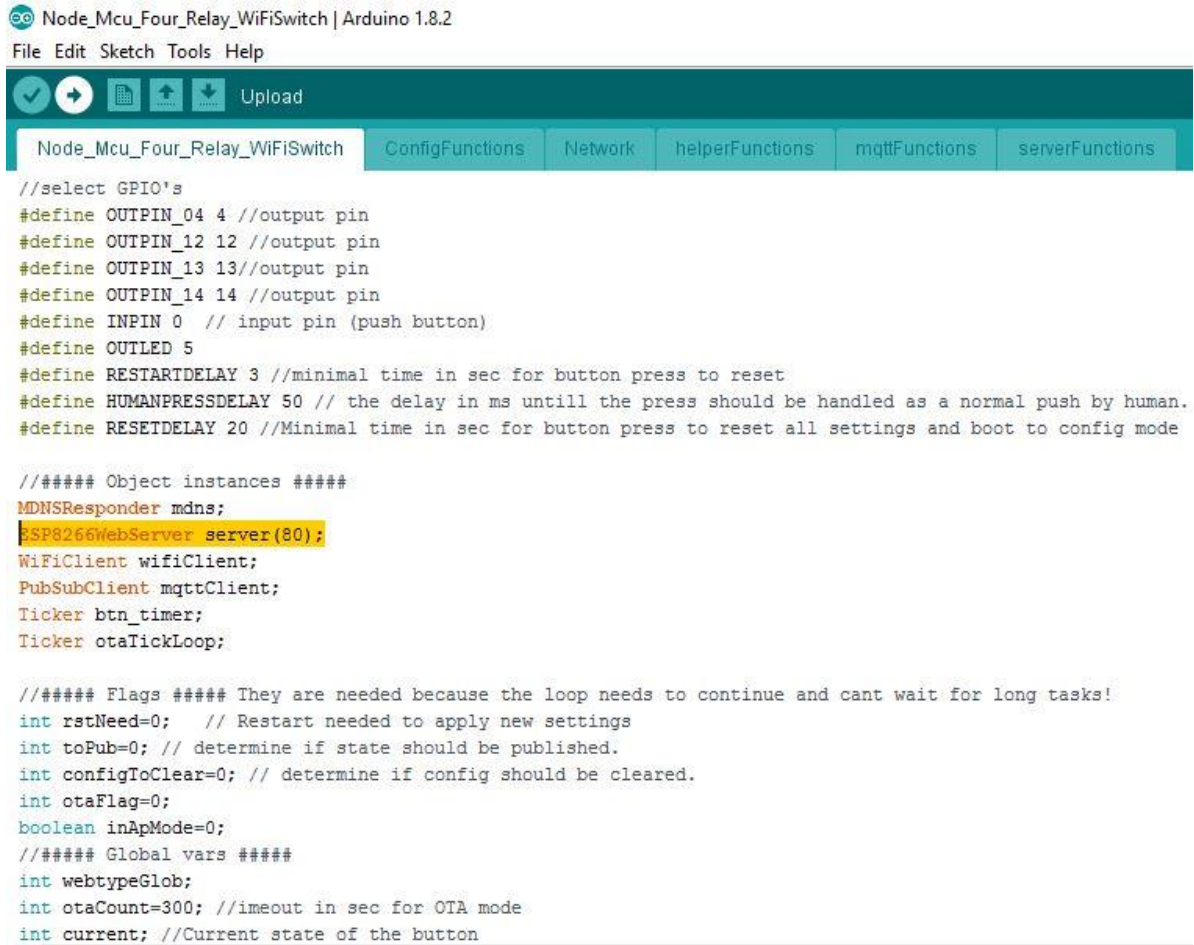

Figure 10: COM port selection.

8. Run the program. Refer to Figure 12.

Figure 11: Executing code

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