DESCRIPTION DOCUMENT FOR WIFI FOUR RELAY BOARD

HARDWARE REVISION 0.3

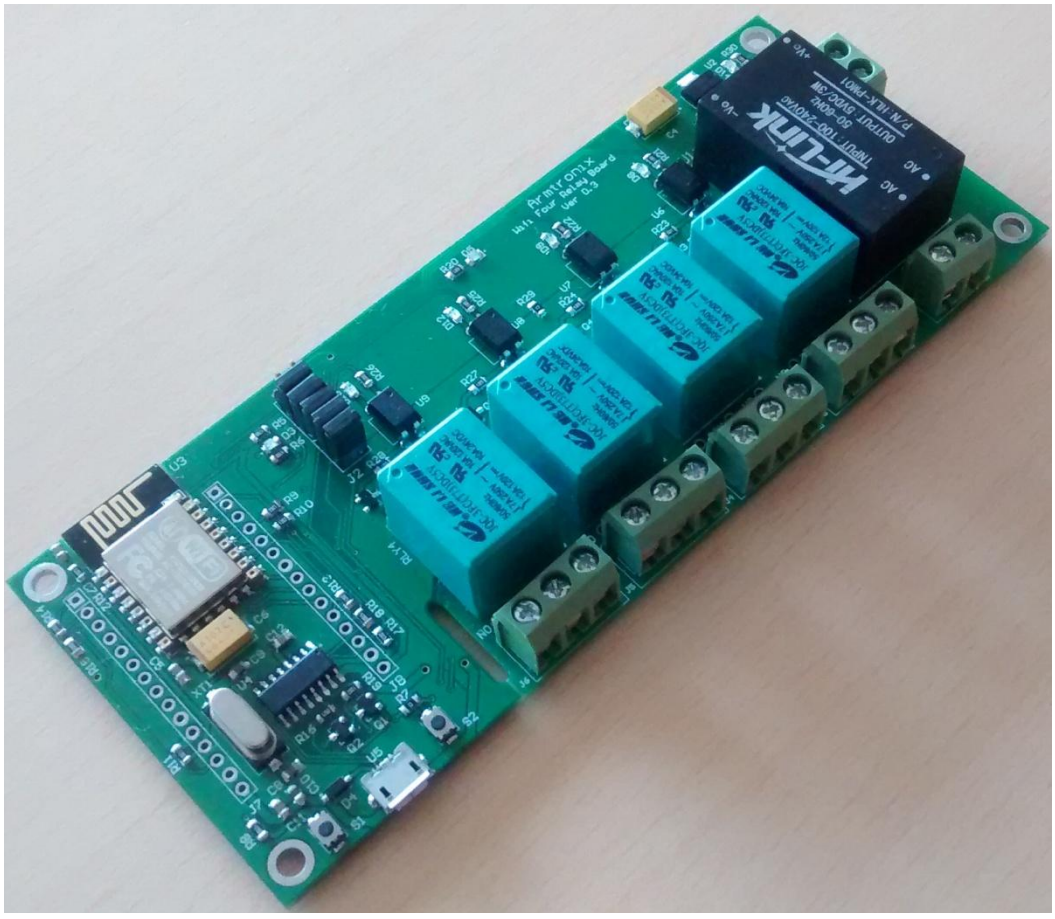
Department	Name	Signature	Date
Author			
Reviewer			
Approver			

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

2. REFERENCES

Company Website link	https://www.armtronix.net
Intractable's Weblink	http://www.instructables.com/id/NodeMCU-ESP8266-Based-Switch-Board-with-Raw-TCPIP-/#CGMPQ36JD4UOPMQ
Github's Weblink	https://github.com/armtronix/NodeMCU_four_relay_board

3. PURPOSE

The purpose of this document is to outline the design description for the Wifi Four Relay 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.
- Device firmware can be updated/reloaded/changed as per user requirement.
- Four Dry contact relay output with COM, NO and NC accessible to user.
- Board can handle up-to 4 Amps of current at relay output.
- WiFi with MQTT or HTTP protocol
- On board USB – UART converter to program WiFi Module
- 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 Factory Reset function.
- Board is compatible and configurable to Amazon Alexa.

7. PRODUCT DESCRIPTION

a. PHYSICAL DESCRIPTION

- AC to DC Power supply module
- Mechanical Relay – 4 numbers
- Wifi Module
- USB-UART converter

b. FUNCTIONAL DESCRIPTION

Block Diagram

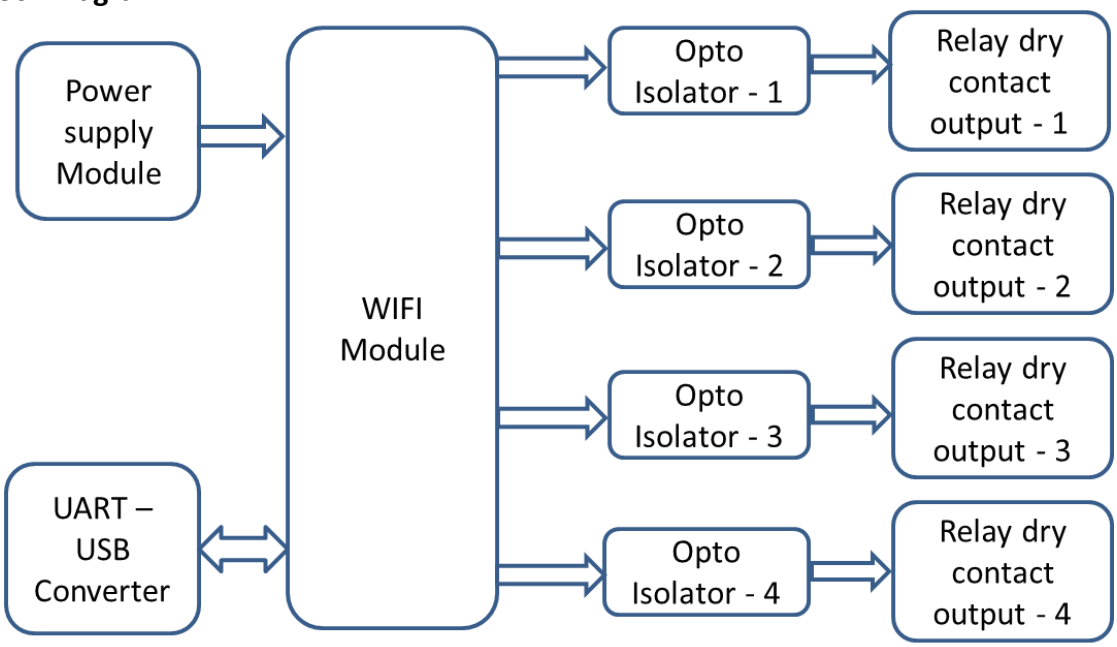

Figure 1: Block Diagram

Four 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 are four relays mounted on board to control (ON/OFF) four external electrical loads independently 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.

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. Mechanical Relay – 4 Numbers

All relays are powered by 5 V DC. The three load terminals (COM, NO and NC) of all relays are given accessible to user to control loads independently. A driver circuit with an opto-isolator is used to drive the relay.

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 Four 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

Relays Output Specifications (Maximum)				
Description	**Min**	**Typ**	**Max**	**Unit**
Voltage AC	-	-	240	Volts
Current AC	-	-	3	Amps
Power AC	-	-	980	Watts
Voltage DC	-	-	24	Volts
Current DC	-	-	3	Amps

b. MECHANICAL SPECIFICATION

- Mechanical Dimensions of PCB are 145 x 60 x 20 mm (Length x Width x Height)
- Mounting Holes (M3) at distance of 4mm for edges of board

10. ELECTRICAL CONNECTIONS

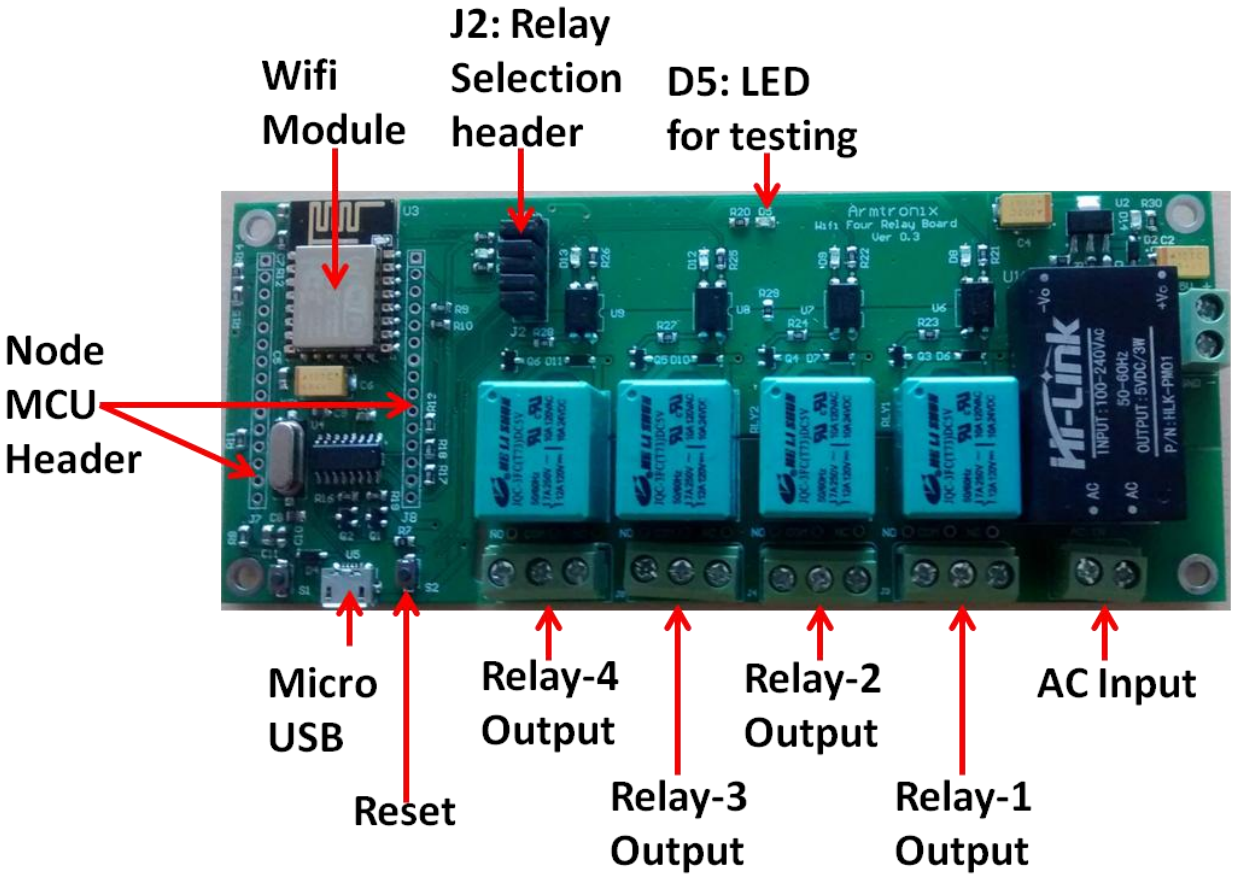

Figure 2: Header and Switch Details

Description of Header and Switches shown in Figure 1:

1. S2 Button is to reset the ESP.
2. AC_IN AC input terminal block.
3. J2 Relay Selection Header.
4. J7 and J8 Headers are compatible to standard NodeMCU headers.
5. U5 Micro USB for programming.

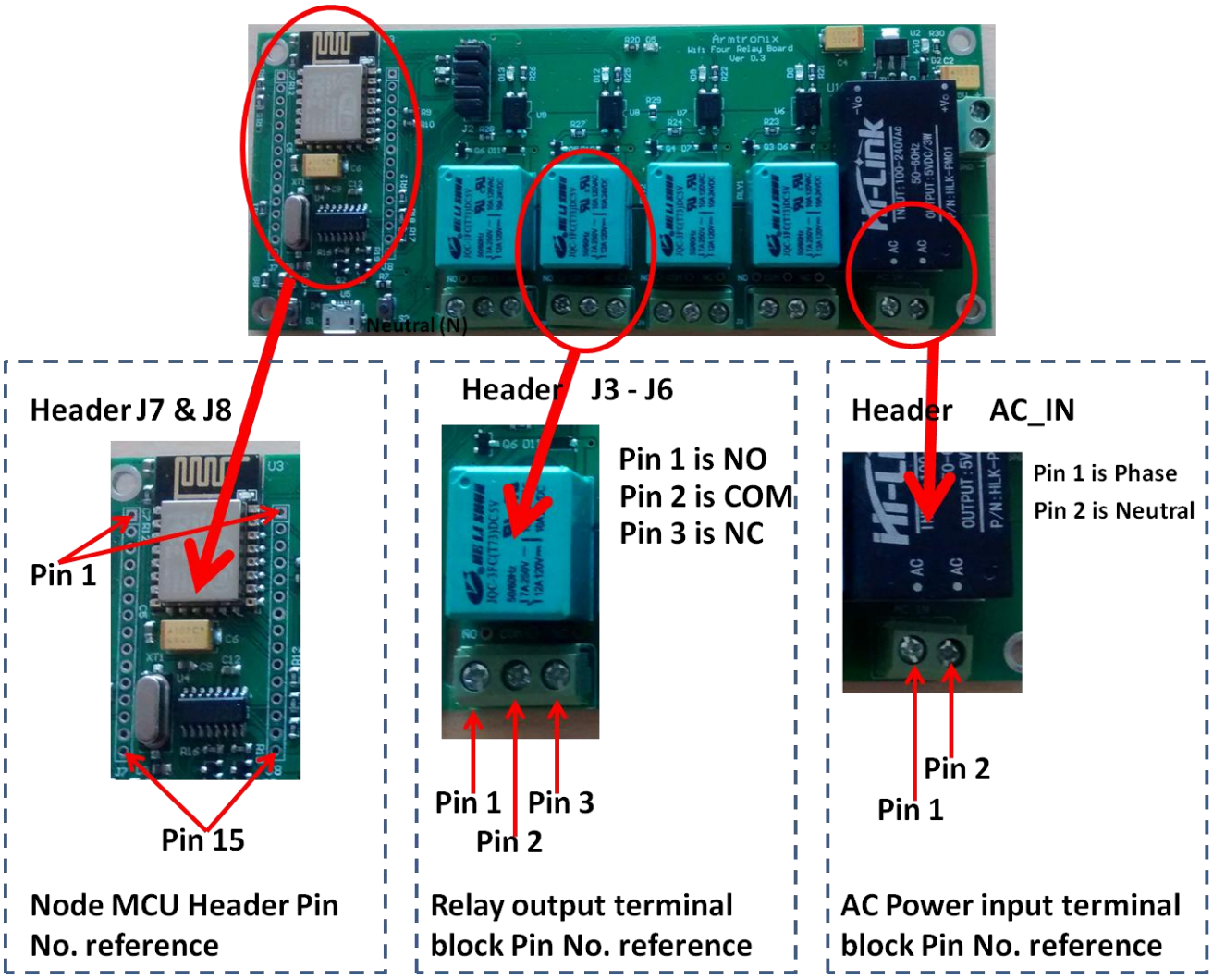

Figure 3: Header Pin number references

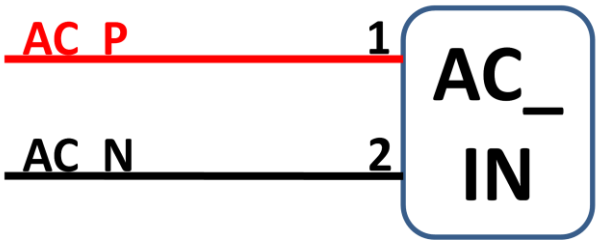

Figure 4: AC Input connection

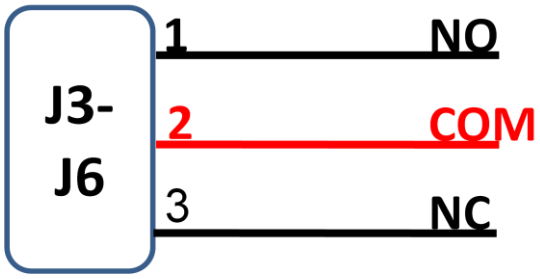

Figure 5: Relay Dry contact pin-out

Figure 3, shows pinout and connection of AC Phase and Neutral connection to AC_IN input connector. Figure 4, shows J3 - J6 are output load connector.

a. HEADER PIN CONFIGURATION

i. HEADER J7

Header Pin Number	ESP Pin Number	Pin Name	Arduino Pin Name / No
1	-	ADC_EX	A0
2	2	ADC	-
3	-	RESV	-
4	12	GPIO10	D12
5	11	GPIO9	D11
6	13	SPI_INT	-
7	9	SPI_MOSI	-
8	10	SPI_MISO	-
9	14	SPI_CLK	-
10	-	SGND	-
11	-	VCC_3V3	-
12	3	EN	-
13	1	nRST	-
14	-	SGND	-
15	-	VCC_5V	-

Table 1: Header J7 Pin Configuration

ii. HEADER J8

Header Pin Number	ESP Pin Number	Pin Name	Arduino Pin Name / No
1	4	GPIO16	D0
2	20	GPIO5	D1
3	19	GPIO4	D2
4	18	GPIO0	D3
5	17	GPIO2	D4
6	-	VCC_3V3	-
7	-	SGND	-
8	5	GPIO14	D5
9	6	GPIO12	D6
10	7	GPIO13	D7
11	16	GPIO15	D8
12	21	RXD0	D9
13	22	TXD0	D10
14	-	SGND	-
15	-	VCC_3V3	-

Table 2: Header J8 Pin configuration

Table 1 and 2, shows the header J7 and J8 which are in compatible with Node MCU headers. Freely available GPIOs are also shown in connector, can be used for user application.

iii. HEADER J2

Header Pin Number	Pin Name	Header Pin Number	Pin Name
1	GPIO15	2	Relay_01
3	GPIO4	4	Relay_01
5	GPIO12	6	Relay_02
7	GPIO13	8	Relay_03
9	GPIO14	10	Relay_04
11	GPIO5	12	Test_LED (D5)

Table 3: Header J2 Pin Configuration

GPIOs mentioned in the Table 3 are used to control relays. By default the GPIOs will be shorted (using removable jumpers) with respective relay pins as mentioned in above table. If you want to use those GPIOs for your own application instead of relays, then you have disconnect open the jumper and make use of them.

b. APPLICATION WIRING DIAGRAM

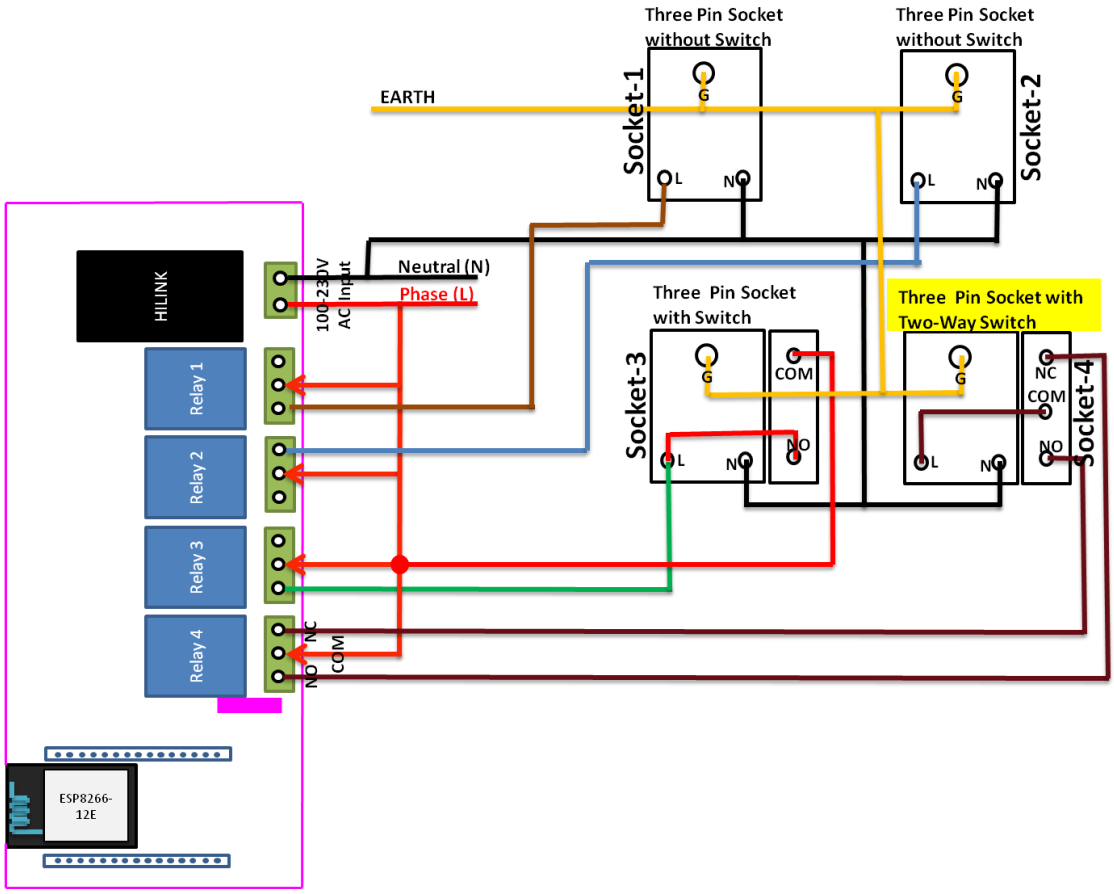

Figure 6: Application wiring example

Figure 5 represents about connection between load and relay output (J3-J6) connectors. Phase is given to Common terminal and load shall be connected to the NO/NC terminal of the relay.
Note that, in the above example connection diagram four sockets are connected in four different configurations.

Output of relay-1 is connected to Three pin socket-1 through NO and COM pin of relay. That means the socket will get power only when the relay is triggered.

Output of relay-2 is connected to Three pin socket-2 through NC and COM pin of relay. That means the socket will get power by default, and disconnects power, when the relay is triggered.

Output of relay-3 is connected to Socket-3 through NO and COM pin of relay and in parallel to physical switch. That means the socket will get power only when the relay is triggered or if the switch next to socket is in ON condition. The drawback is that, if you Turn ON the loads through physical switch then you have to Turn-Off using the same or is you Turn-On the loads through relay then you have to Turn-Off through the relay only.

Output of relay-3 is connected to Socket-4 through NO and COM pin of relay along with physical 2-way switch. That means the socket will get power if either the relay or switch is has changed its state. The major advantage of this configuration is you can Turn-On the load through physical switch and Turn it OFF through relay or vice-versa.

11. HOW TO USE THE PRODUCT

Power ON the device, so that, it will host the access point as shown in Figure 6,

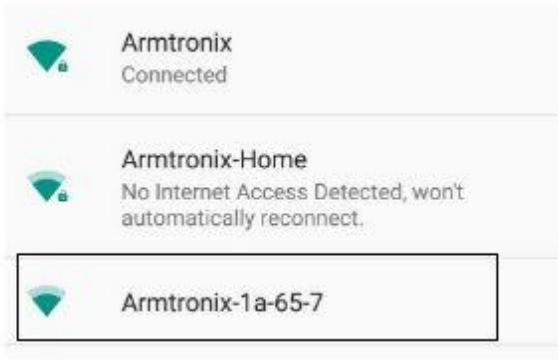

Figure 7: Device hosting Access point

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

Figure 8: 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 8,

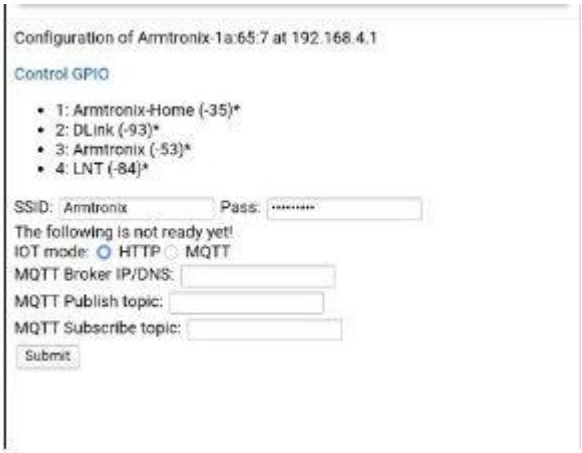

Figure 9: Web server

fill the SSID and password and select HTTP, if user wants to connect to MQTT then user 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 Four 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.

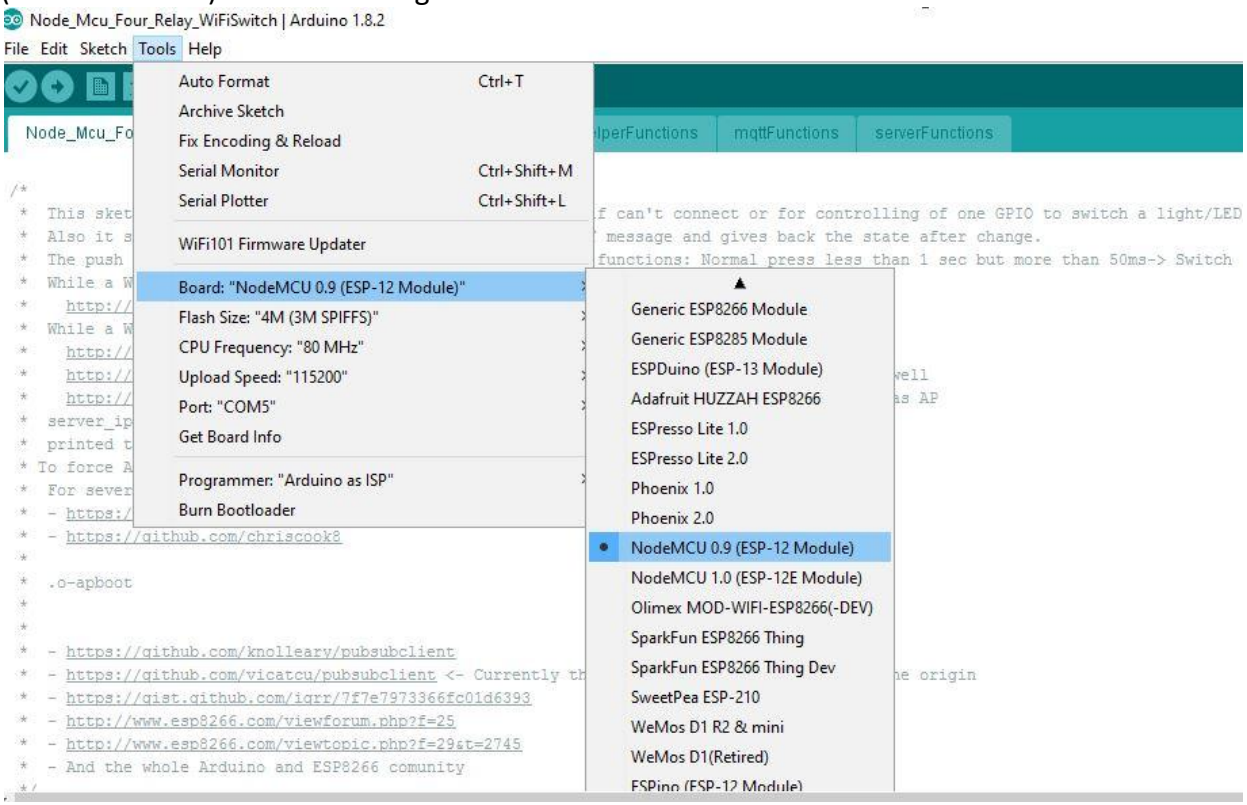

Figure 10: Board Selection

5. Select flash size as “4M (SPIFFS)”
6. Select CPU Frequency as “80Mhz”.
7. Select Upload Speed as “115200”.
8. 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.

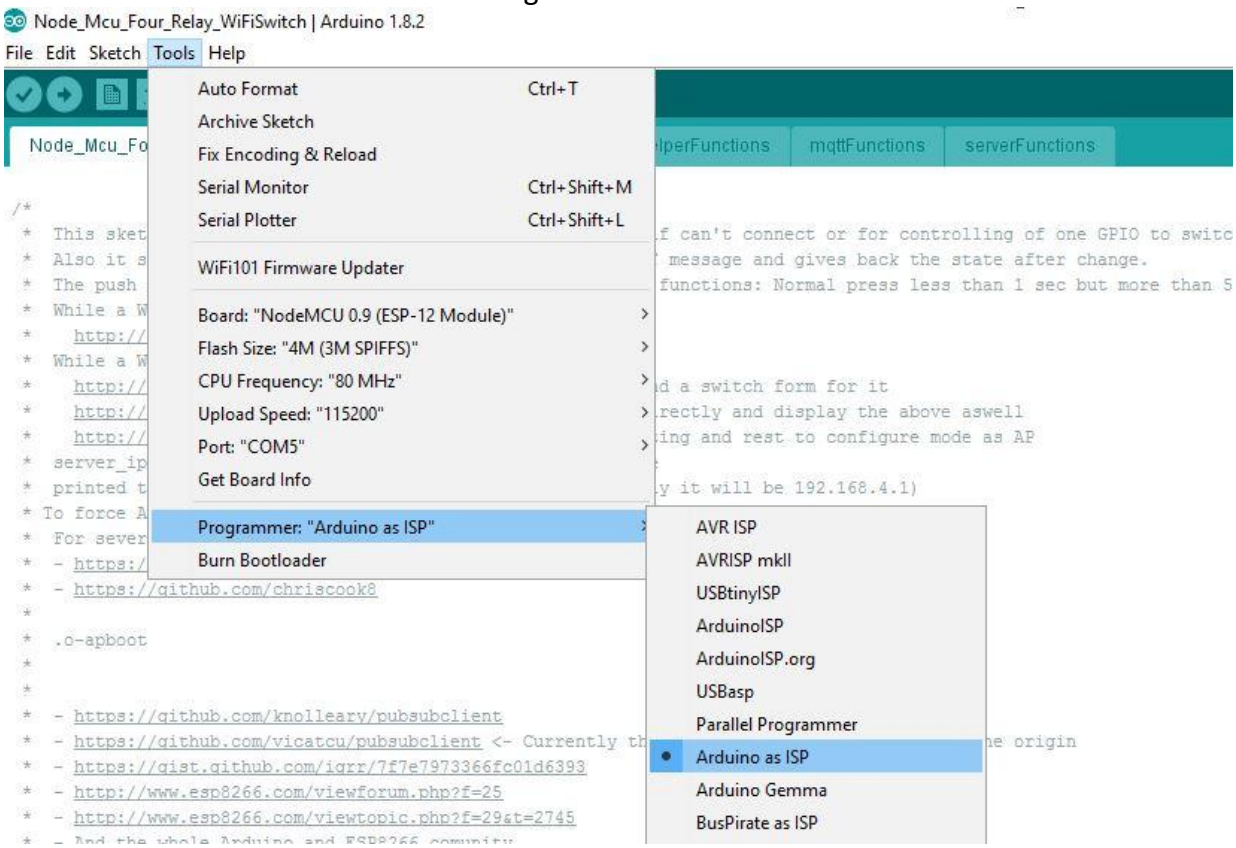

Figure 11: IDE Selection

9. 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.

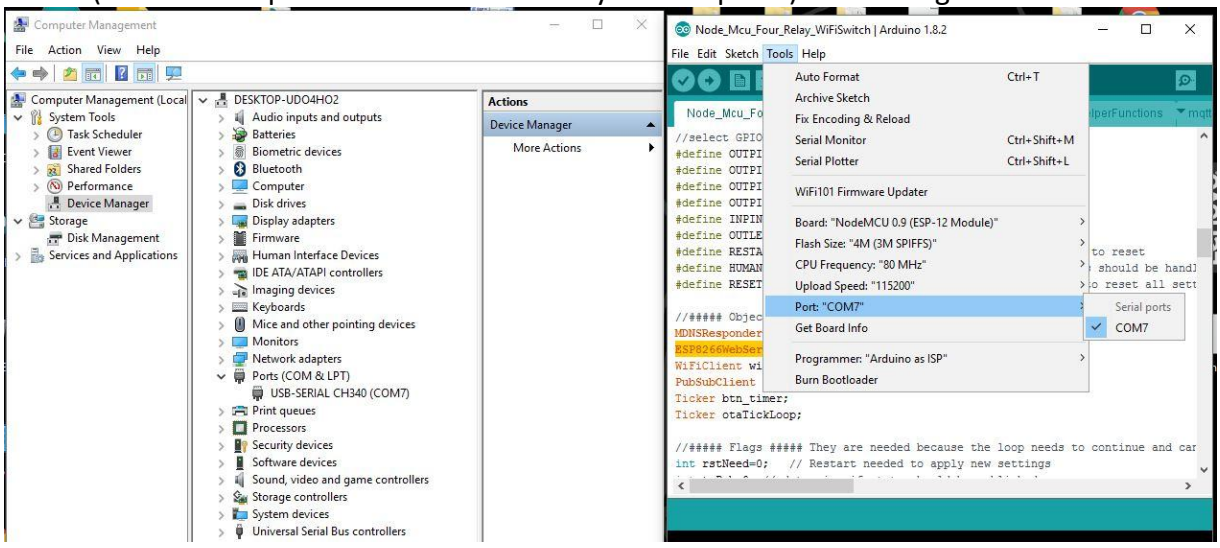

Figure 12: COM port selection.

10. Run the program. Refer to Figure 13.

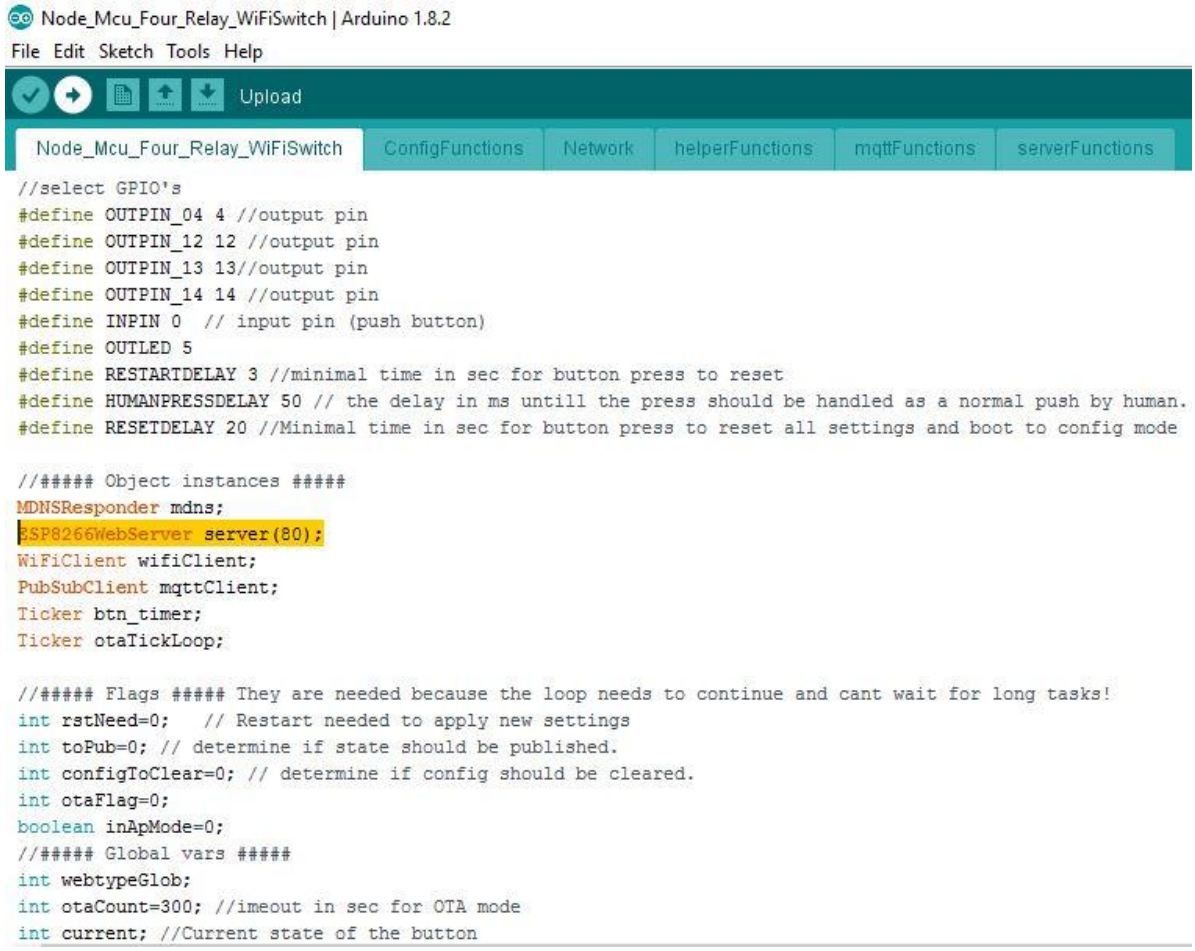

Figure 13: Executing code

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