

DESCRIPTION DOCUMENT FOR WIFI / BT HEAVY DUTY RELAY 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.

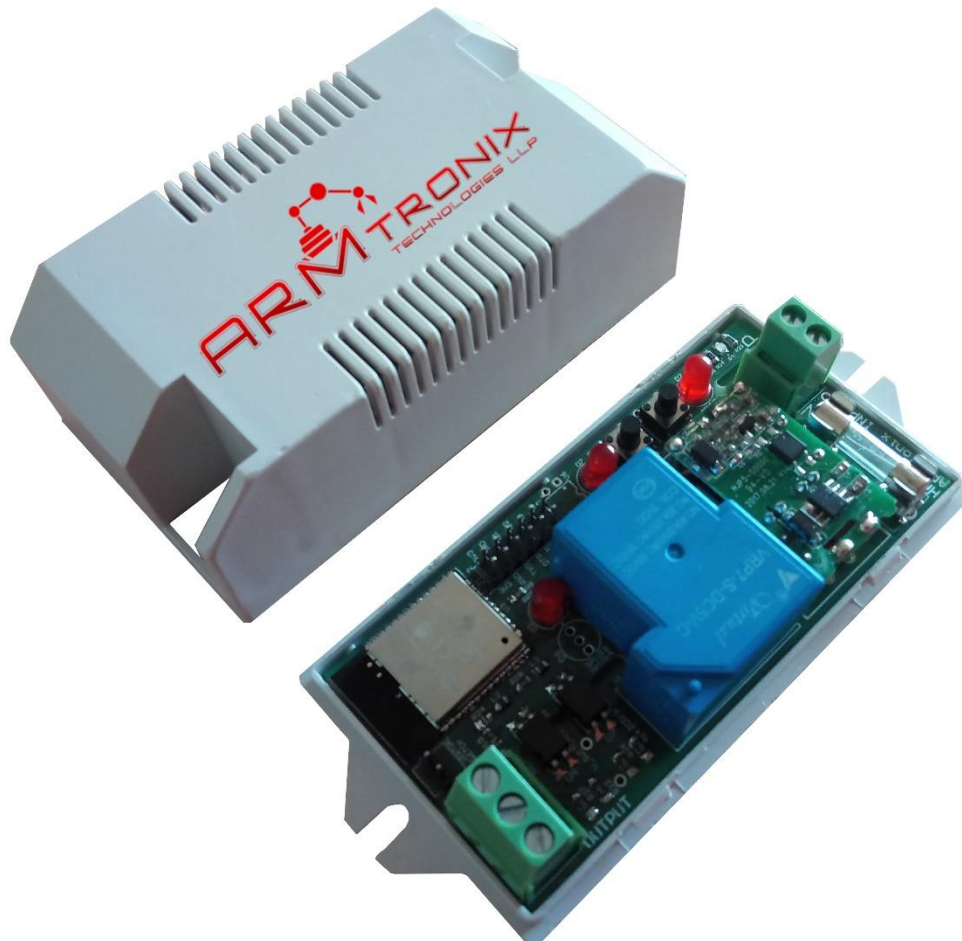


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1. ABBREVIATIONS

Term	Description
A	Ampere
AC	Alternating Current
ASIC	Application Specific Integrated Circuit
COM x	Communication Port (Where 'x' represents the port number)
COM	Common Pin of the Relay
DC	Direct Current
GPIO	General Purpose Input Output
HTTP	Hypertext Transfer Protocol
Hz	Hertz
I2C	Inter Integrated Circuit
IDE	Integrated Development Environment
IP	Internet Protocol
LED	Light Emitting Diode
MCU	Microcontroller Unit
MQTT	Message Queue Telemetry Transport
PCB	Printed Circuit Board
PWM	Pulse Width Modulation
SPI	Serial Peripheral Interface
SSID	Service Set Identifier
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
V	Volts
ZCD	Zero Crossover Detection

2. REFERENCES

Company Weblink	https://www.armtronix.in
Youtube Weblink	
Intractable's Weblink	
Github's Weblink	

3. PURPOSE

The purpose of this document is to outline the design description for the Wifi / BT Heavy Duty 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.

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 them.

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 relay with live AC powered output via NO PIN of relay Neutral accessible to user.
- Board output can handle Higher load.
- WiFi with MQTT or HTTP protocol
- MQTT Authentication with Username and Password.
- 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 device Reset.

a. Special Features

- AC to DC Power supply module on board
- ESP32 Wifi Module which is more secure
- AC Virtual Switch (physical switch can be rewired directly)
- Heavy Duty Electro-Mechanical Relay for higher current loads
- Load on/off detection
- Additional GPIOs for external current sensor or secondary serial port
- Protection Fuse for the on-board power supply

7. PRODUCT DESCRIPTION

a. PHYSICAL DESCRIPTION

- AC to DC Power supply module
- Wifi Module
- AC Virtual Switch
- DC Virtual Switch
- Electro-Mechanical Relay

b. FUNCTIONAL DESCRIPTION

Block Diagram

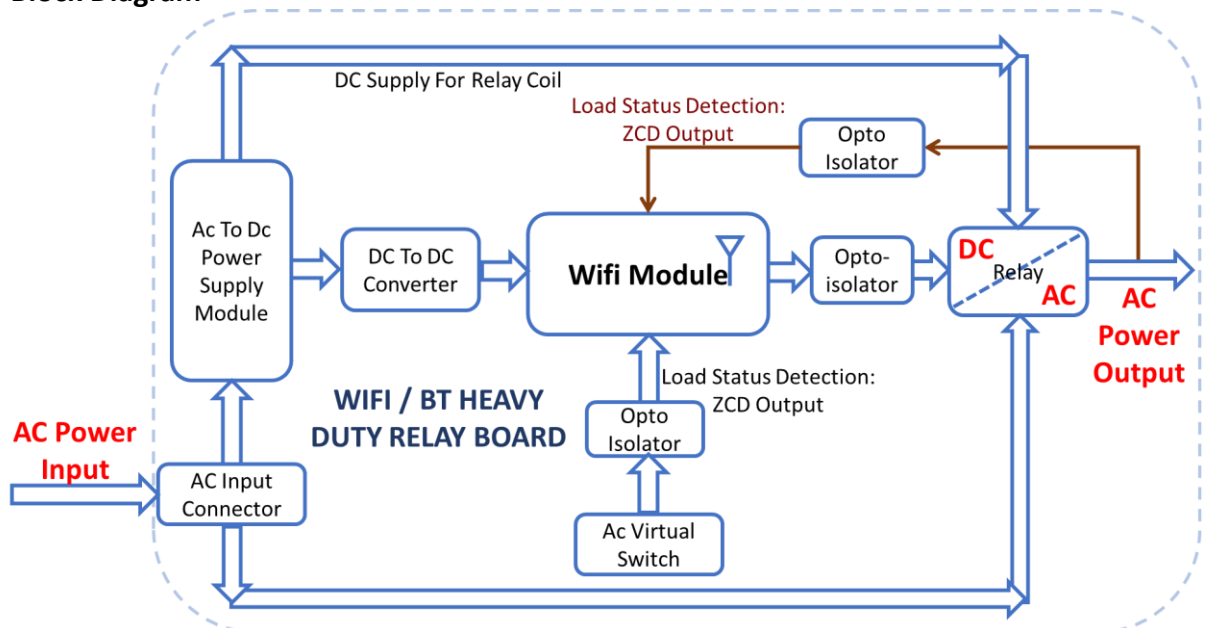


Figure 1: Block Diagram

Wifi BT HDR Switch (Heavy Duty Relay) can be used for Wifi enabled Building automation product. This can handle a load with High power consumption at 240AC. There is a relay mounted on board to control (ON/OFF) external electrical loads from a mobile application using MQTT/HTTP protocol. It also has features like, power presence detection after relay and AC virtual switch. The board has programming header (TX, RX, DTR, RTS) in compatible to NodeMCU which can be used with Arduino IDE to help the user for programming. It 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 40A relay mounted on board to control (ON/OFF) external electrical loads from a mobile application using MQTT/HTTP protocol. The board can be programmed using with Arduino IDE, makers will find it easy to programming, using an external USB-UART converter.

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 ESP32 with its minimum GPIOs are easily accessible in a header 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. The AC live powered terminal (NO) is given access to user in a terminal block 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. An opto-isolator based AC-DC isolation circuit is used to drive the relay.

4. AC Virtual Switch

AC Virtual switch circuit is connected to Wifi module through an opto isolator AC-DC isolation. It gives a ZCD output to Wifi Module to detect the change in status of switch.

5. DC Virtual Switch

DC Virtual switch circuit is connected to Wifi module directly with pull-resistor at GPIO.

Note: Both AC and DC virtual switch circuits are connected to a same GPIO pin of ESP32. Hence, it is suggested to connect an only one of the virtual switch at an instant of time.

9. TECHNICAL SPECIFICATION

a. ELECTRICAL SPECIFICATION

i. Output 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

ii. Output Electrical Specification

Relay Output Specifications (Maximum)				
Description	Min	Typ	Max	Unit
Voltage AC	-	-	240	Volts
Power AC	-	-	5000	Watts
Voltage DC			30	Volts
Power DC			600	Watts

b. MECHANICAL SPECIFICATION

- Mechanical Dimensions of PCB are 100 x 50 x 30 mm (Length x Width x Height)

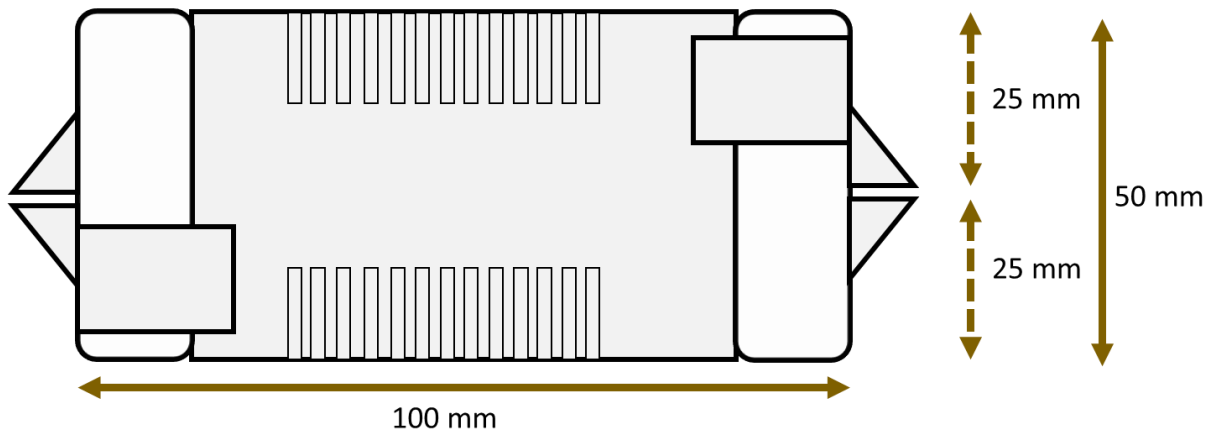


Figure 2: Mechanical Dimensions

10. ELECTRICAL CONNECTIONS

a. Header and Switch Details

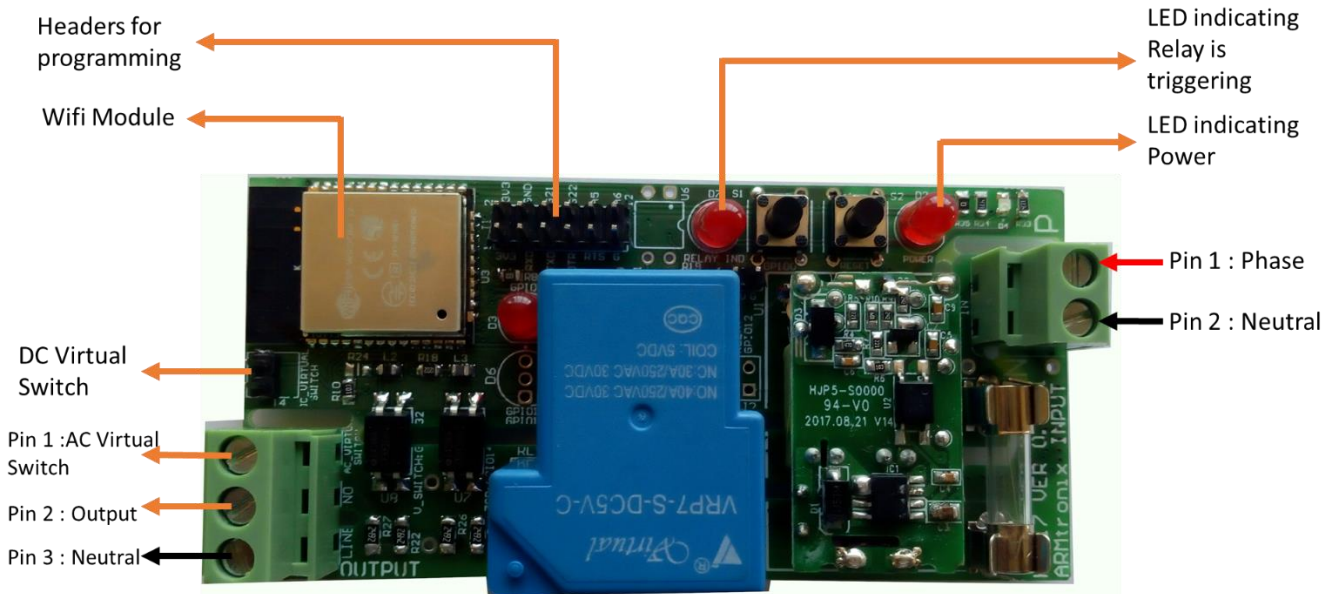


Figure 3: Header and Switch Details

Note:

- For higher loads, please do not use the on-board neutral and recommended to use external neutral.
- On-Board fuse is only for SMPS and not for loads.

b. ESP PIN CONFIGURATION:

Header Pin	ESP-32 Pin no.	Designator	Description
1	14	GPIO12	Relay
2	13	GPIO14	Load Status Detection
3	8	A4/GPIO32	Virtual Switch
4	24	GPIO2	Test LED

Table 1: ESP Pin Configuration

c. APPLICATION WIRING DIAGRAM

i. Example-1:

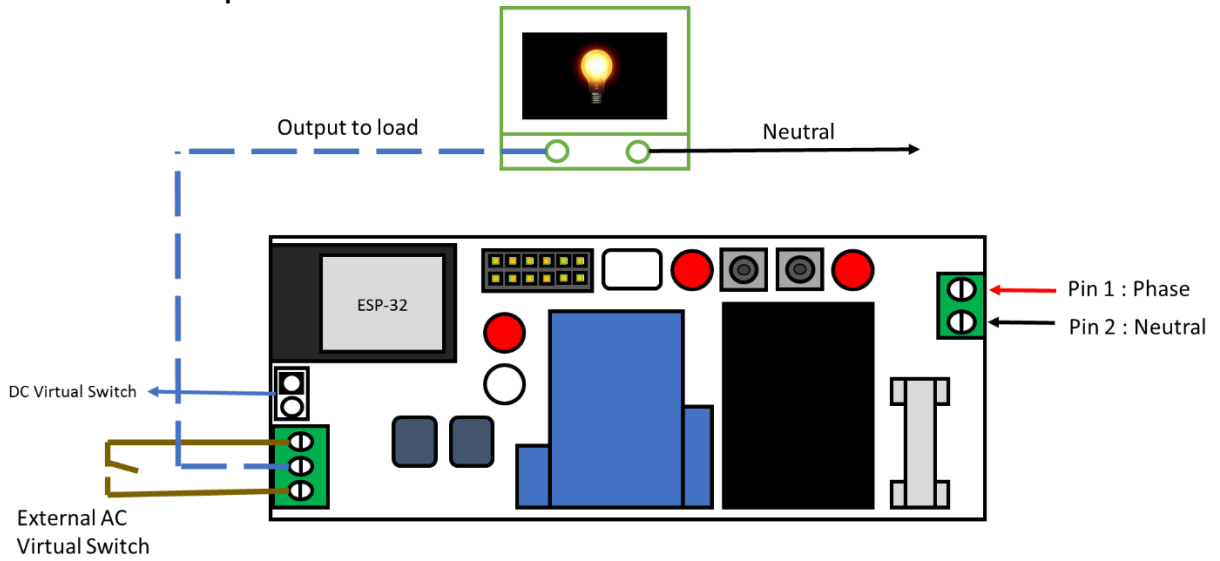


Figure 4: Load connection

Figure 3 represents about connection between electrical socket and relay output (J5) connector.

ii. Example-2:

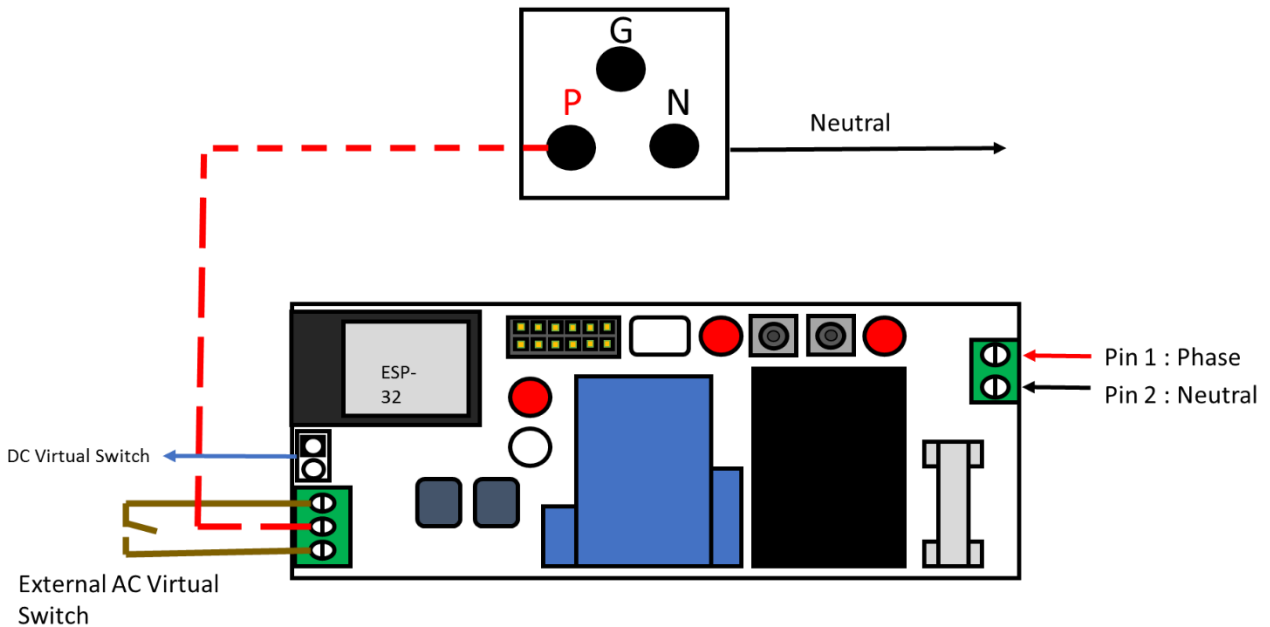


Figure 5: Socket Connection

Figure 5 represents about connection between electrical socket and relay output (J5) connector.

d. HEADER PIN CONFIGURATION

i. HEADER J1:

Header Pin	ESP-32 Pin no.	Designator	Description
1	2	3V3	3.3V DC
2	--	3V3	3.3V DC
3	34	RXD	UART Rx of ESP-32
4	--	GND	Ground Reference
5	35	TXD	UART Tx of ESP-32
6	33	G21	GPIO21
7	--	DTR	Programmer UART_DTR
8	36	G22	GPIO22
9	--	RTS	Programmer UART_RTS
10	9	A5	GPIO33
11	--	GND	Ground Reference
12	6	A6	GPIO34

Table 2: Header J1 Pin Configuration

ii. HEADER IN

Header Pin #	Description
1	Phase
2	Neutral

Table 3: Header IN Pin Configuration

iii. HEADER J5

Header Pin #	Description
1	AC Virtual Switch
2	Output
3	Neutral

Table 4: Header J5 Pin Configuration

iv. HEADER J4

Header Pin #	Description
1	DC V-Switch
2	DGND

Table 5: Header J4 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 5.
2. Use an electrical external fuse and MCB with rating 2A/250V, 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 D2 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 6,



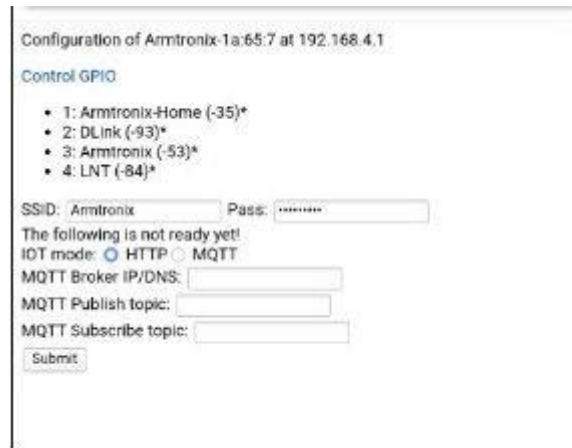
Figure 6: Device hosting Access point

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



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 8,



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:

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

User 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 ESP32S:

1. Use external USB-UART converter between computer and this board.
2. Connect VCC of converter to “Pin-1.VCC_3.3V” of J1.
3. Connect RX pin of converter to “Pin-3.RXD” of J1.
4. Connect TX pin of converter to “Pin-5.TXD” of J1.
5. Connect DTR pin of converter to “Pin-7.DTR” of J1.
6. Connect RTS pin of converter to “Pin-9.RTS” of J1.
7. Connect GND of converter to “Pin-11.GND” of J1.
8. Open your code in Arduino IDE as shown.
9. Click on Tools Tab, move mouse pointer on “Board: Arduino / Genuino Uno” and click on “NodeMCU-32S” as shown in figure 9.

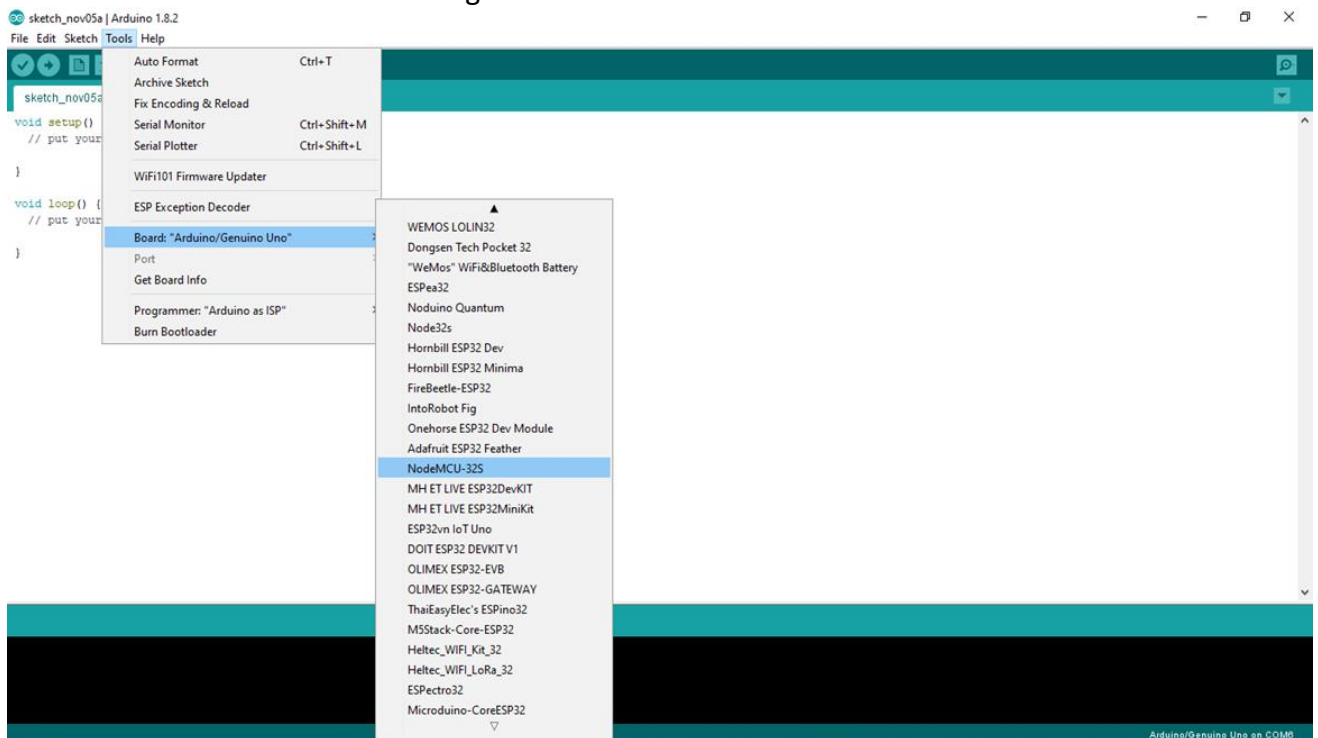


Figure 9: Board Selection

10. 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.

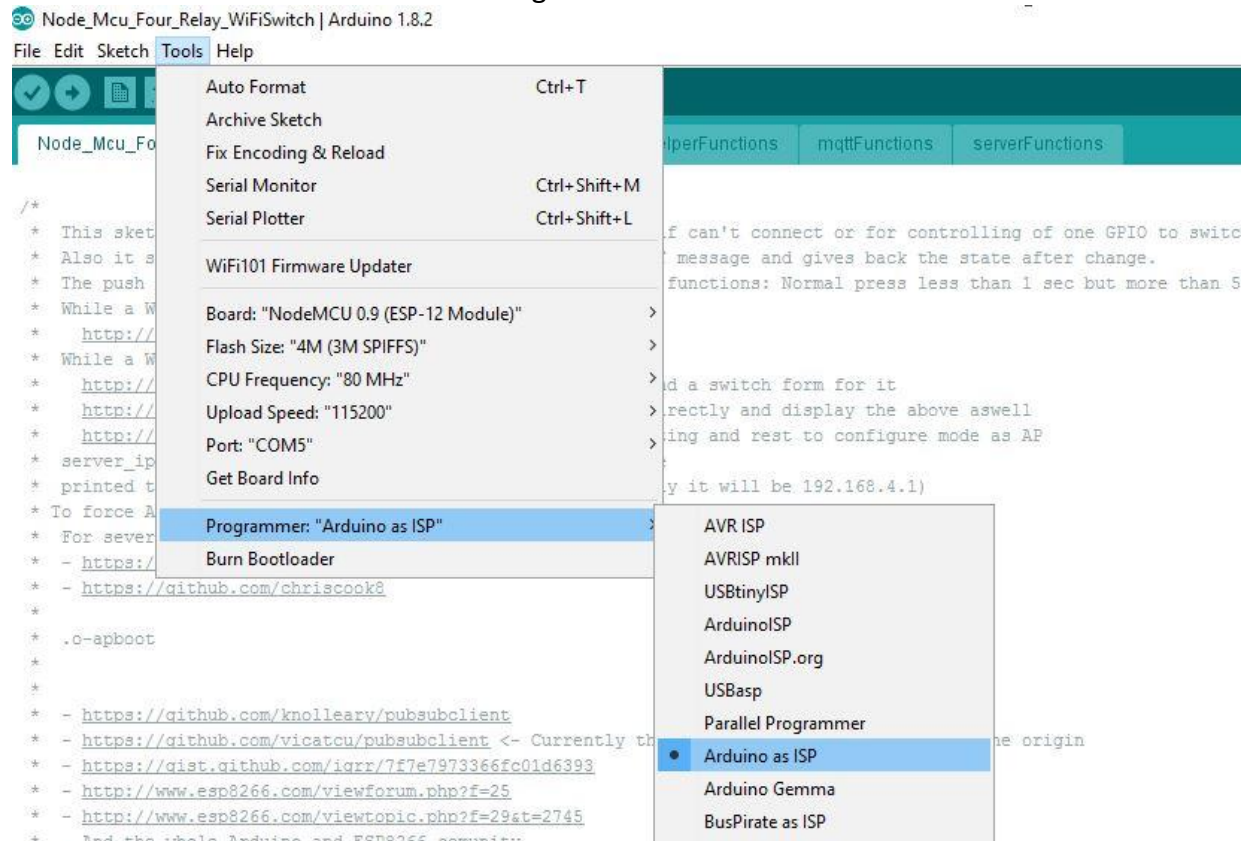


Figure 10: IDE Selection

11. 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.

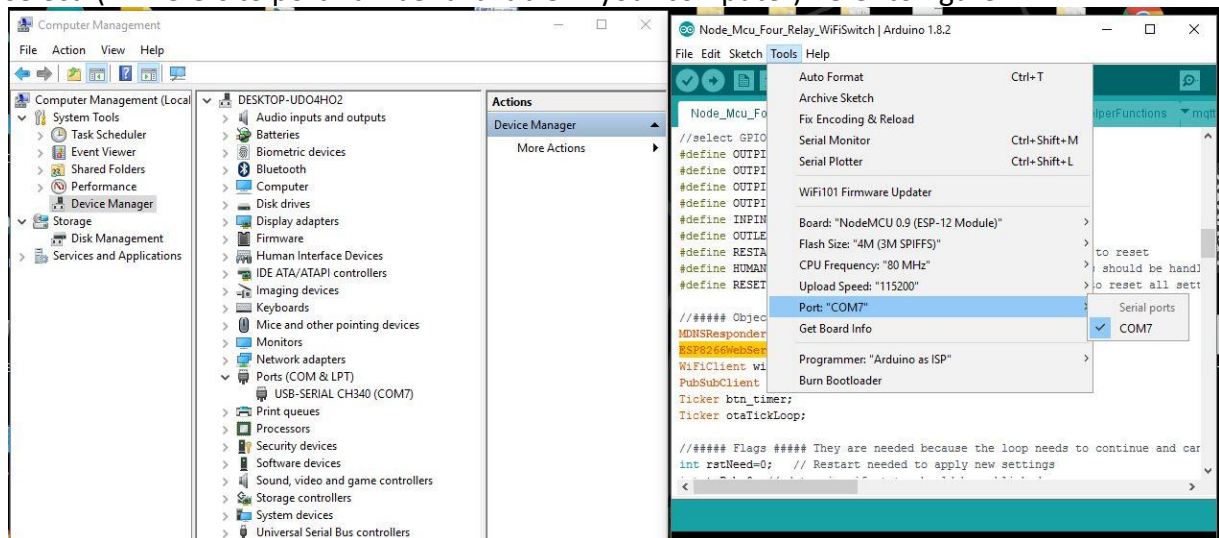


Figure 11: COM port selection.

12. Run the program. Refer to Figure 12.



Indicates how to Upload the Program from PC to the Board

Figure 12: Executing code



DOCUMENT #: BA020

DOCUMENT REV: A

DOCUMENT NAME: DESIGN DESCRIPTION, WIFI / BT HEAVY DUTY RELAY BOARD.

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