DESCRIPTION DOCUMENT FOR WIFI DUAL TRIAC BOARD (BIG)

HARDWARE REVISION 0.1

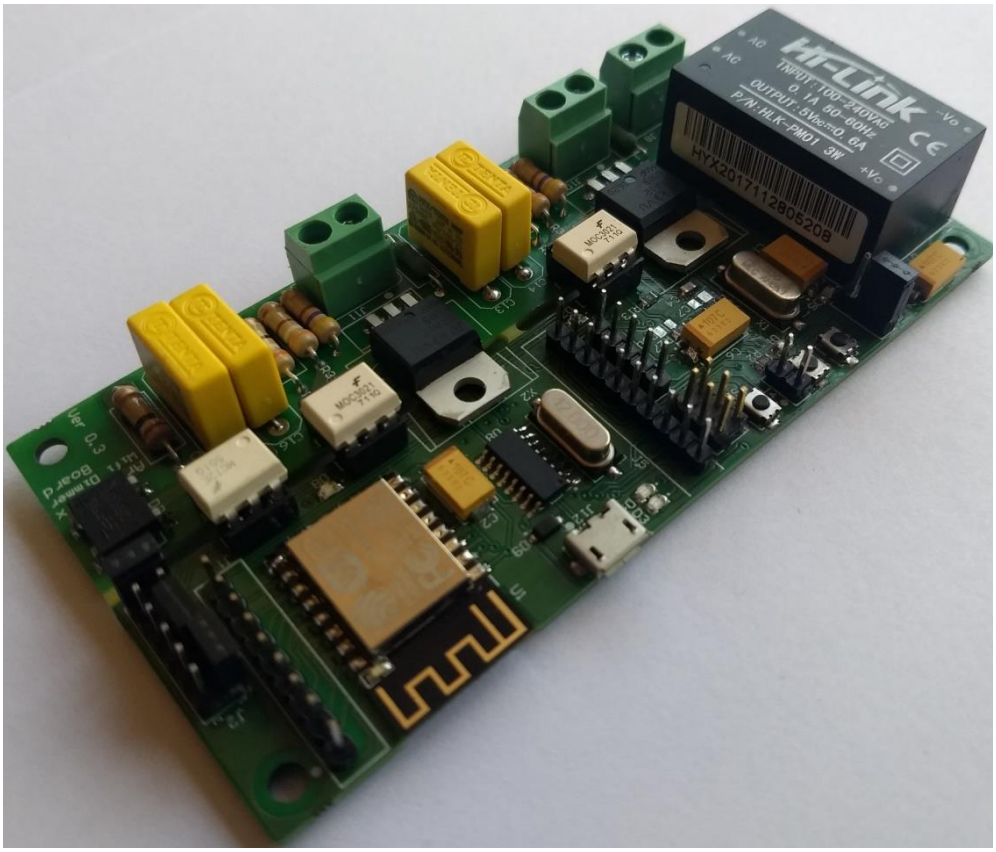
Department	Name	Signature	Date
Author			
Reviewer			
Approver			

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	Communication
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 Website link	https://www.armtronix.in
Intractable's Weblink	http://www.instructables.com/id/ARMTRONIX-WIFI-Dimmer-Board-V03/
Github's Weblink	https://github.com/armtronix/Wifi-Two-Dimmer-Big-Board

3. PURPOSE

The purpose of this document is to outline the design description for the Wifi 2-TRIAC 1A Board. It provides a high level summary of the product.

4. SCOPE

This document describes system architecture which includes Power supply, Microcontroller, WiFi Module and Triac.

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. INTRODUCTION

Dual Triac board is a Wifi based remote control switch/dimming device. Designed and developed to control lights and/or fans. Using this board the lights and fans can be controlled through smart phone which you use regularly. This board is not just to switch ON/OFF light, you can also vary the intensity of light from 0 to 100%. You can connect and control two loads at an instant. It also has feature to connect potentiometer as virtual switch to vary the intensity of light or speed of fan in two way mode with respect to mobile phone.

7. 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.
- It has onboard USB to UART converter on board for programming purpose.
- Board is Arduino compatible.
- Two Triac outputs, to control the light/Fan.
- Triac output can handle up to 2 Amperes of current.
- WiFi with MQTT or HTTP protocol.
- 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 Restart and Configuration Reset function.
- Does not require external neutral for output.

8. PRODUCT DESCRIPTION

a. PHYSICAL DESCRIPTION

- AC to DC Power supply module
- Triac 2Nos.
- Wifi Module
- Microcontroller

b. FUNCTIONAL DESCRIPTION

Block Diagram

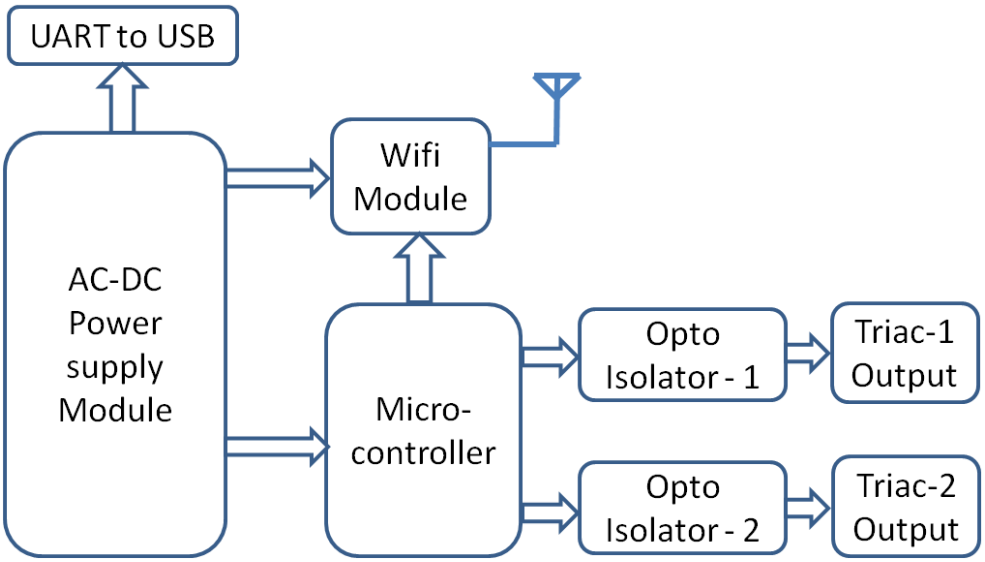

Figure 1: Block Diagram

Two Triac one Ampere board has an on-board power supply module which takes standard AC power as input and provides required DC power as output. The DC power is used to power-up microcontroller and Wifi module incorporated on board to run a dimmer algorithm and to establish Wifi communication with mobile phones respectively. There are two Triacs used to board to control ON/OFF and dimming of light intensity from a mobile application using MQTT/HTTP protocol.

9. 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 output can be accessed to connect any external sensors.

The DC-DC converter on board is used to regulate voltage from 5 V DC to 3.3 V DC to supply power to complete digital part.

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. Zero Crossover Detection

Zero cross over detection is used to detect the zero crossing of AC phase to fire the Triac synchronously to get the smooth output. Optically isolated ZCD circuit is implemented to protect device from unwanted signals due t o AC lines.

4. Triac

TRIAC is driven through optically isolated TRIAC drivers with reference to zero crossover

detection. Synchronous switching method is used to regulate the power to loads. PWM signal will drive the TRIACs and switches AC mains power from 0% to 100% of its total cycle. The PWM signal pulses shall be configured in code with respect to AC mains frequency and voltage level. BT136 triac is used in this board to act as dimmer or switch.

5. Microcontroller

The Microcontroller executes the dimmer algorithm to drive the TRIAC switch, by receiving ZCD signal. Along with this, it changes the color of Bi-colored LED to indicate the status of loads. Controller communicates with Wifi module through UART mode of communication to send and receive data to to-and-from respectively with connected Wifi network. ATmega328P microcontroller is used in the product to execute the algorithm, which is manufactured by Atmel incorporation and is compatible with Arduino.

Control processor has the capability for software up-gradation through Arduino and contains enough memory to upgrade and store the software for its own application.

6. USB to UART Converter

It has USB to UART converter on board along with micro USB connected to it for the purpose of reprogramming easily directly connecting board to computer and using Arduino IDE. You connect this board to computer USB and programming just by connecting using a micro USB cable, which does not require any external UART to USB converter.

10. TECHNICAL SPECIFICATION

a. ELECTRICAL SPECIFICATION

Input Specifications				
Description	**Min**	**Typ**	**Max**	**Unit**
Voltage AC	100	220	230	Volts
Current AC	0.6	2.6	-	Amps
Power AC	-	3	-	Watts
Frequency	50	-	60	Hz

Triac-1 Output Specifications (Maximum)				
Description	**Min**	**Typ**	**Max**	**Unit**
Voltage AC	-	-	240	Volts
Current AC	-	-	2	Amps
Power AC	-	-	480	Watts

Triac-2 Output Specifications (Maximum)				
Description	**Min**	**Typ**	**Max**	**Unit**
Voltage AC	-	-	240	Volts
Current AC	-	-	2	Amps
Power AC	-	-	480	Watts

b. MECHANICAL SPECIFICATION

- Mechanical Dimensions of PCB are 110 x 55 x 20 mm (Length x Width x Height)
- Mounting Holes M3 size.

11. ELECTRICAL CONNECTIONS

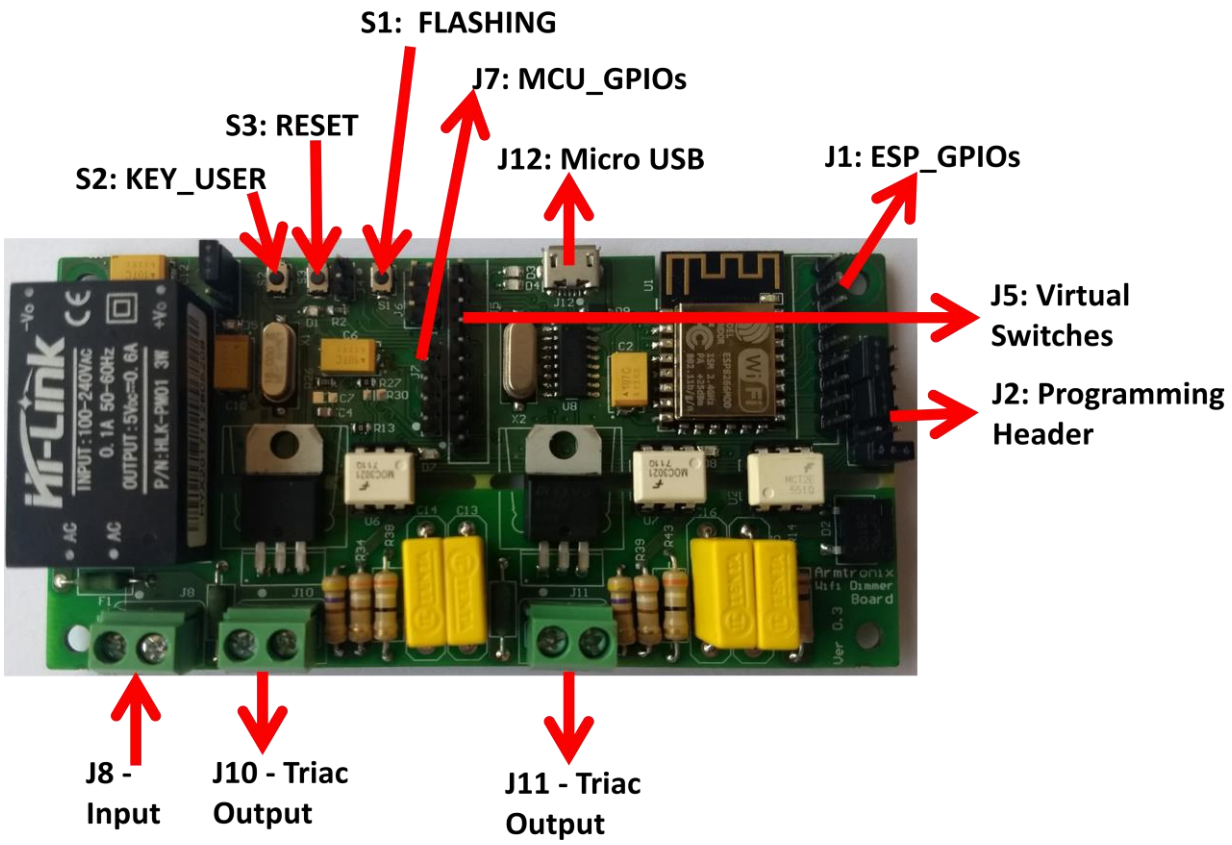

Figure 2: Header and Switch Details

Description of Header and Switches shown in Figure 2:

1. S1 Button is to reset the ESP
2. S2 Button is for Key Flash of ESP
3. S3 Button is for configuration reset
4. P1 Header is compatible to I2C OLED
5. J2 and J3 Headers are compatible to standard NodeMCU headers

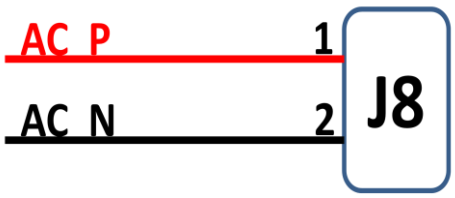

Figure 3: AC Input connection

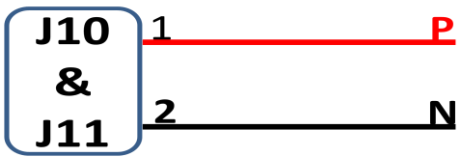

Figure 4: Triac output

Figure 3, shows pinout and connection of AC Phase and Neutral connection to J8 input connector.

Figure 4, shows output load connection of J10 and J11.

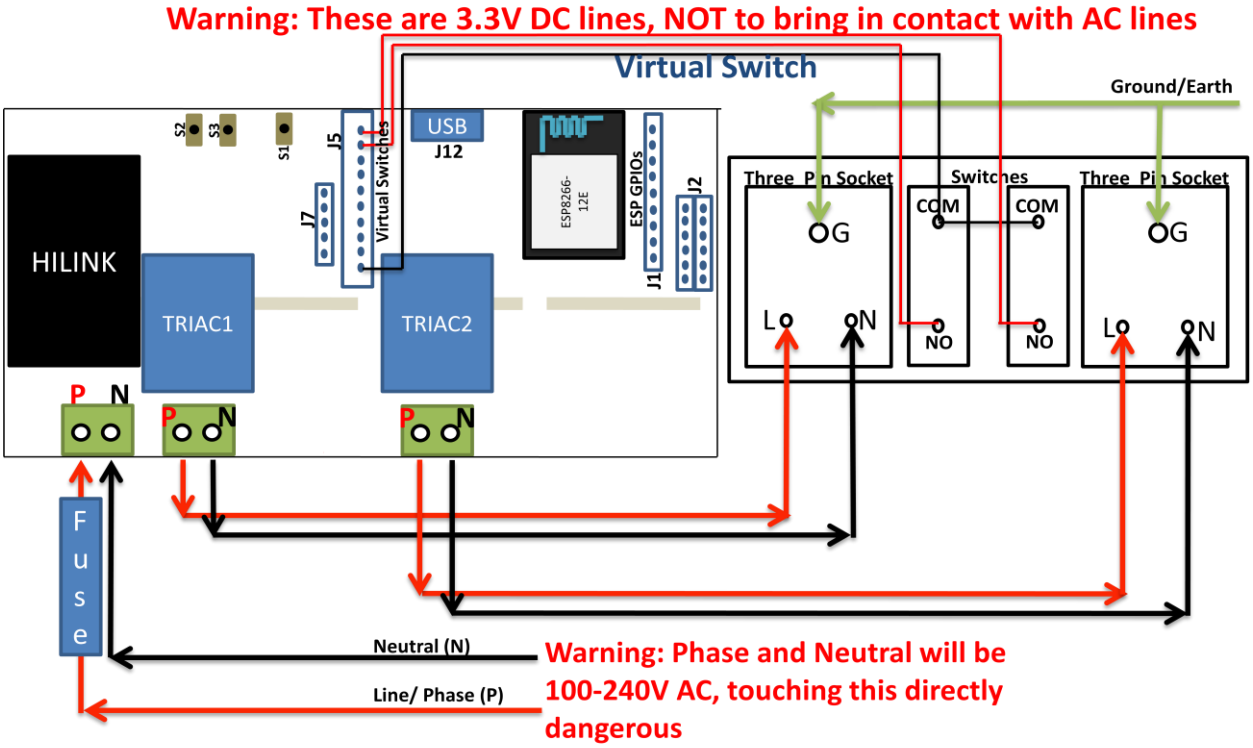

Figure 5: Load connection

Figure 5 represents about connection between load and Triac output connector, along with virtual switch connections. Triac-1 (Q3) is controlled through PB0 of MCU using PWM, and Triac-2 (Q4) is controlled through PD3 of MCU using PWM.

a. Microcontroller Pin configuration:

MCU Pin No.	MCU Port No.	Arduino Port No.	Application
2	PD4	4	Triac - 2
9	PD5	5	GPIO
10	PD6	6	GPIO
11	PD7	7	GPIO
12	PB0	8	Triac - 1
13	PB1	9	GPIO
14	PB2	10	GPIO
15	PB3	11	SPI_MOSI
16	PB4	12	SPI_MISO
17	PB5	13	SPI_SCK
19	ADC6	A6	Virtual Dimmer - 1
22	ADC7	A7	ADC
23	PC0	A0	Virtual Dimmer - 2
24	PC1	A1	GPIO/ADC
25	PC2	A2	GPIO/ADC
26	PC3	A3	GPIO/ADC
27	PC4	A4	LED1
28	PC5	A5	LED2

30	PD0/RXD	0	MCU_RXD
31	PD1/TXD	1	MCU_TXD
32	PD2/INT0	2	ZCD

Table 1: Microcontroller Pin Configuration

b. ESP Pin Configuration:

ESP Pin No.	ESP Port No.	Arduino Port No.	Application
5	GPIO14	D5	GPIO
6	GPIO12	D6	GPIO
7	GPIO13	D7	GPIO
17	GPIO2	D4	GPIO
18	GPIO0	D3	GPIO
19	GPIO4	D2	GPIO
20	GPIO5	D1	GPIO
21	GPIO3/RXD0	D9	ESP_RXD
22	GPIO1/TXD0	D10	ESP_TXD

Table 2: ESP Pin Configuration

c. Header Details

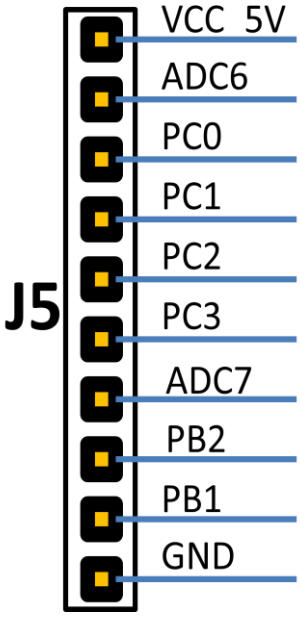

Figure 6: Virtual Switch Connector

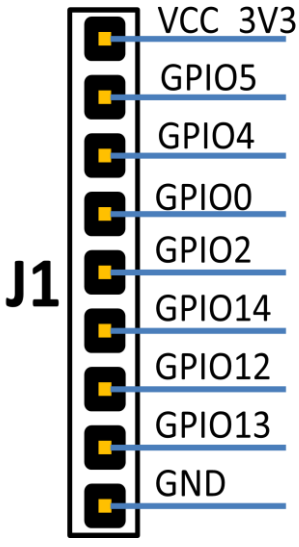

Figure 7: ESP free GPIOs

Figure 6 and Figure 7, shows the J2 and J3 headers above are Virtual switch connector and ESP freely available GPIOs respectively, can be used for user application.

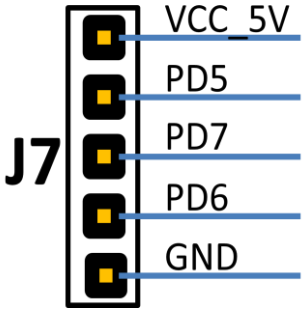

Figure 8: MCU Free GPIOs

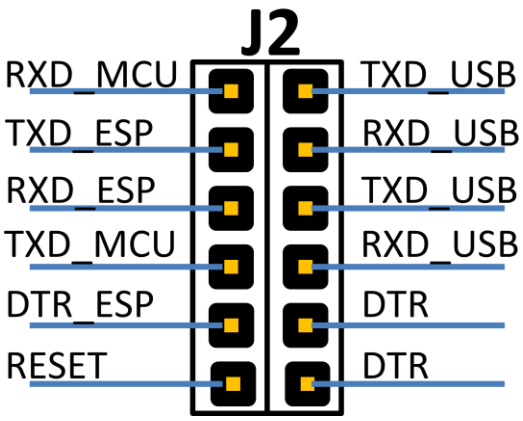

Figure 9: Programming Header

Figure 8 and Figure 9, shows the J7 and J2 headers above are MCU freely available GPIOs and programming header respectively. MCU free GPIOs can be used for your application.

12. TYPICAL APPLICATION WIRING DIAGRAM

a. 1-Light, 1-Fan, Virtual Switch and Pot Wiring

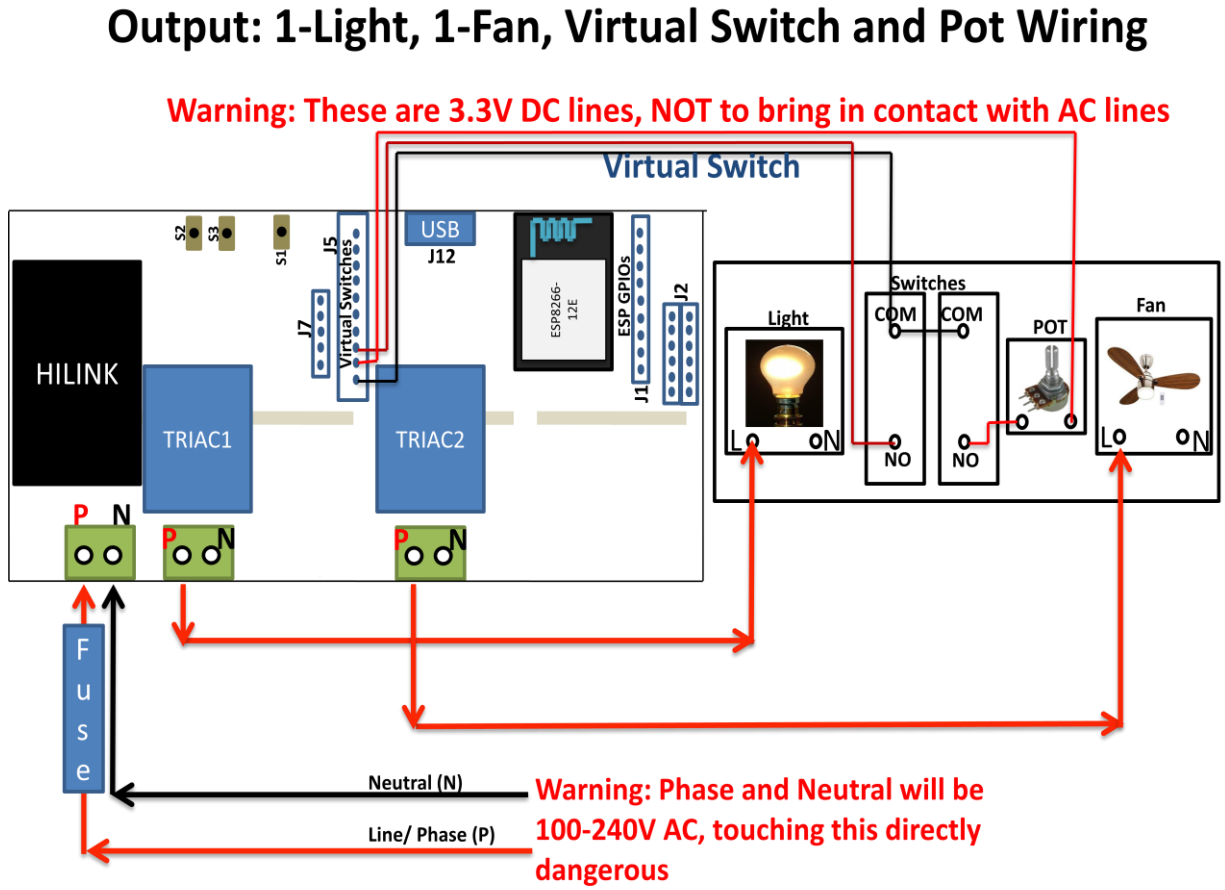

Figure 10: Typical application-1

13. HOW TO USE THE PRODUCT

Power ON the device, so that, it will host the access point as shown in Figure 11,

Figure 11: Device hosting Access point

Connect the mobile to access point with Armtronix-(MAC ID). EX: Armtronix-1a-65-7 as shown in Figure 12.

Figure 12: 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 13,

Figure 13: 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.

14. 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. Connect micro USB cable between computer and J12 of board.
2. Short Pin-3.TXD_ESP to Pin-4.RXD_USB of J2.
3. Short Pin-5.RXD_ESP to Pin-6.TXD_USB of J2.
4. Short Pin-9.DTR_ESP to Pin-10.DTR
5. Short Pin-11.RESET to Pin-12.DTR
6. Open your code in Arduino IDE as shown.
7. Click on Tools Tab, move mouse pointer on “Board: xxxxxxxxxx” and click on “NodeMCU0.9 (ESP-12 Module)” as shown in figure 14.

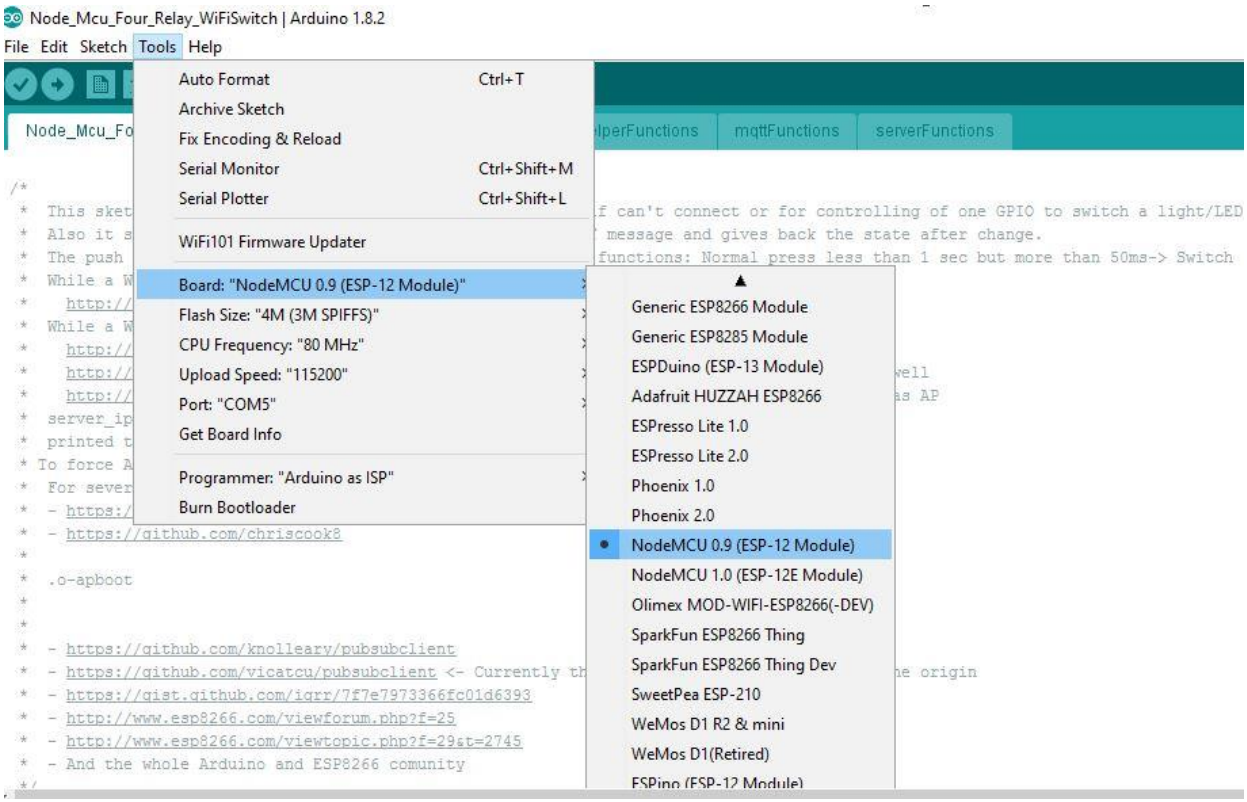

Figure 14: Board Selection

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 15.

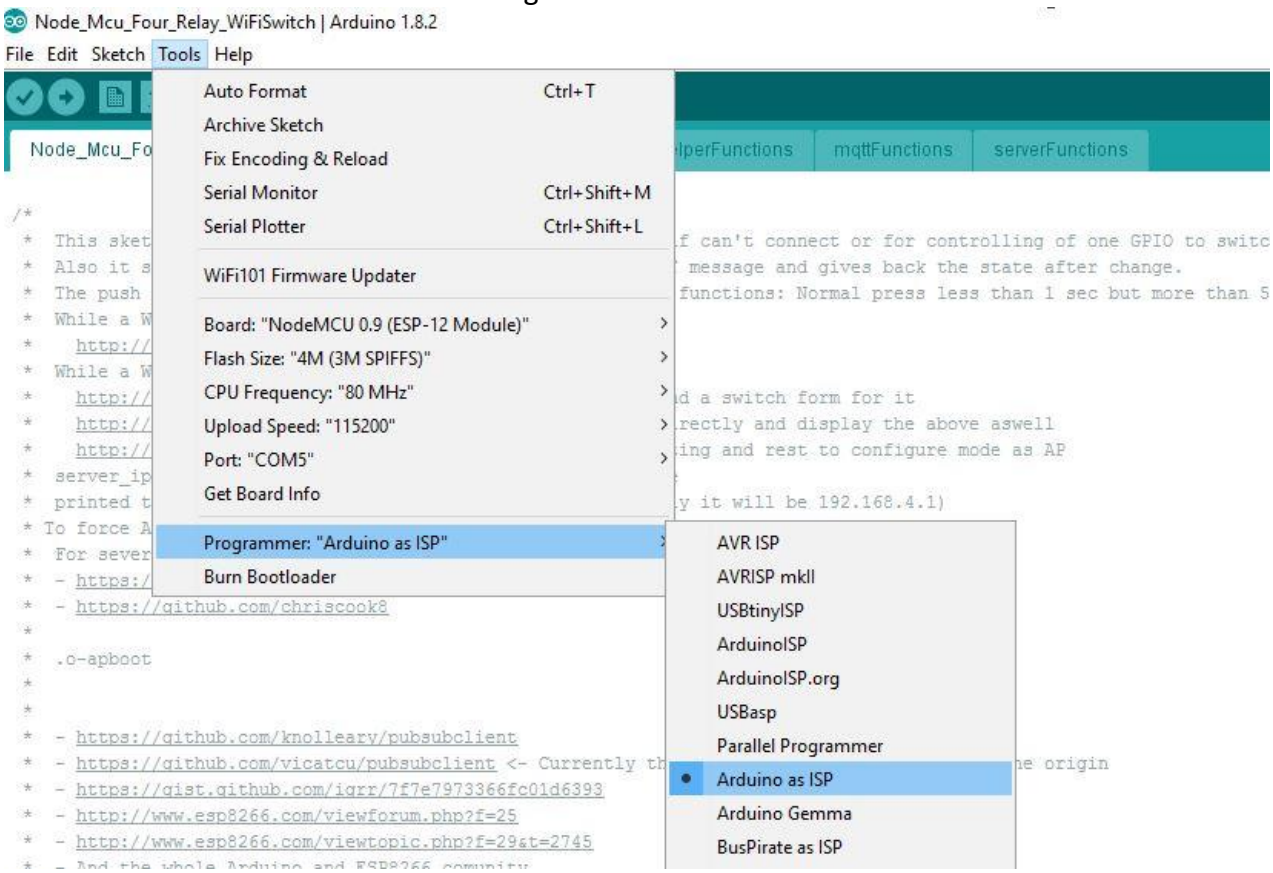

Figure 15: IDE Selection

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 16.

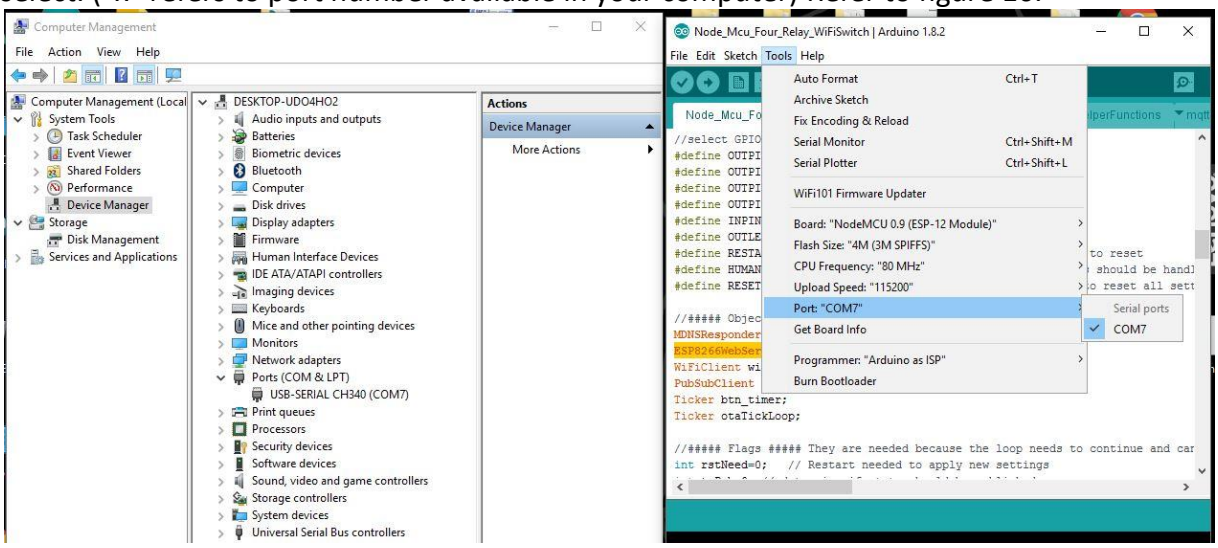

Figure 16: COM port selection.

10. Run the program. Refer to Figure 17.

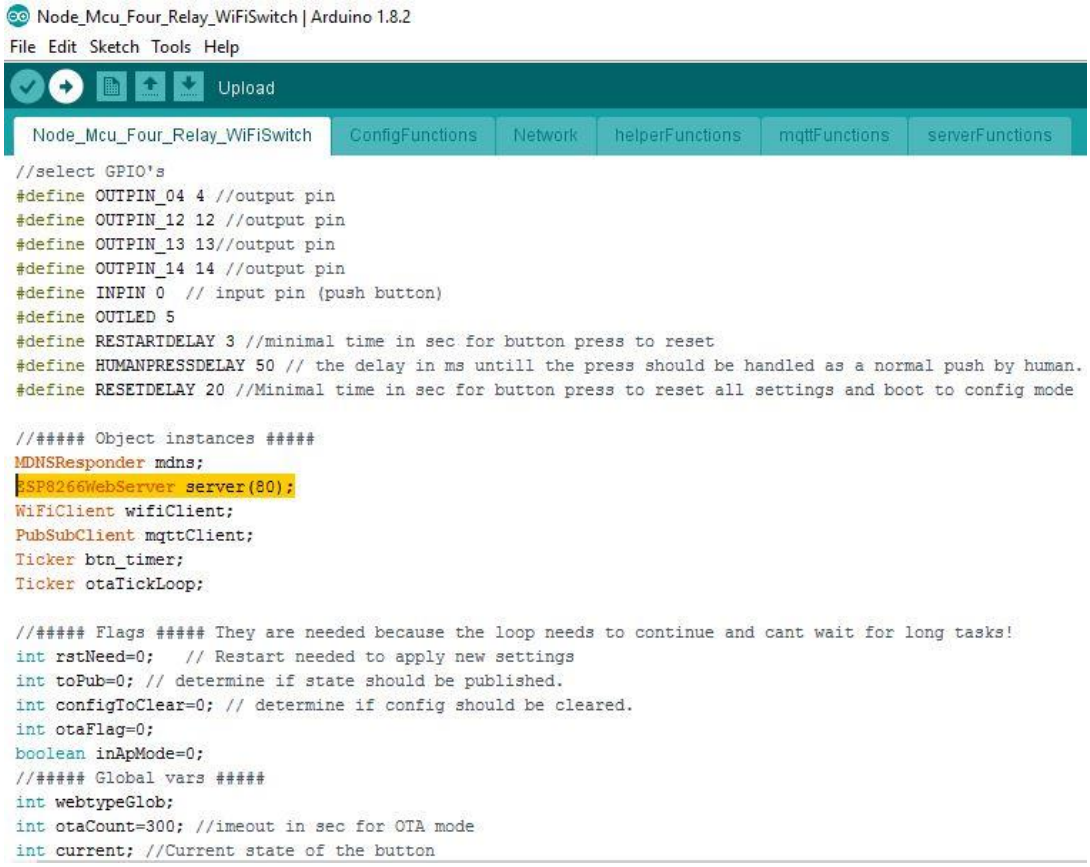

Figure 17: Executing code

b. STEPS TO LOAD PROGRAM TO ATMEGA328P:

1. Connect micro USB cable between computer and J12 of board.
2. Short Pin-1.RXD_MCU to Pin-2.TXD_USB of J2.
3. Short Pin-5.TXD_MCU to Pin-8.RXD_USB of J2.
4. Follow same steps as shown in section from “13.a Steps to Load Program to ESP8266”, except Step 10. In step 2, you need to select “Arduino Uno” instead of “NodeMCU0.9 (ESP-12 Module)”. Follow the remaining steps as they are.

Once your loading of program is completed, disconnect converter from board and short Pin-1.RXD -MCU to Pin-3.TXD_ESP, short Pin-5.TXD_MCU to Pin-6.TXDA, to check the board functionality and use. If the board is working as per your code, then you can install it for your application.

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