

DESCRIPTION DOCUMENT FOR WIFI TWELVE INPUT TWELVE OUTPUT 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.

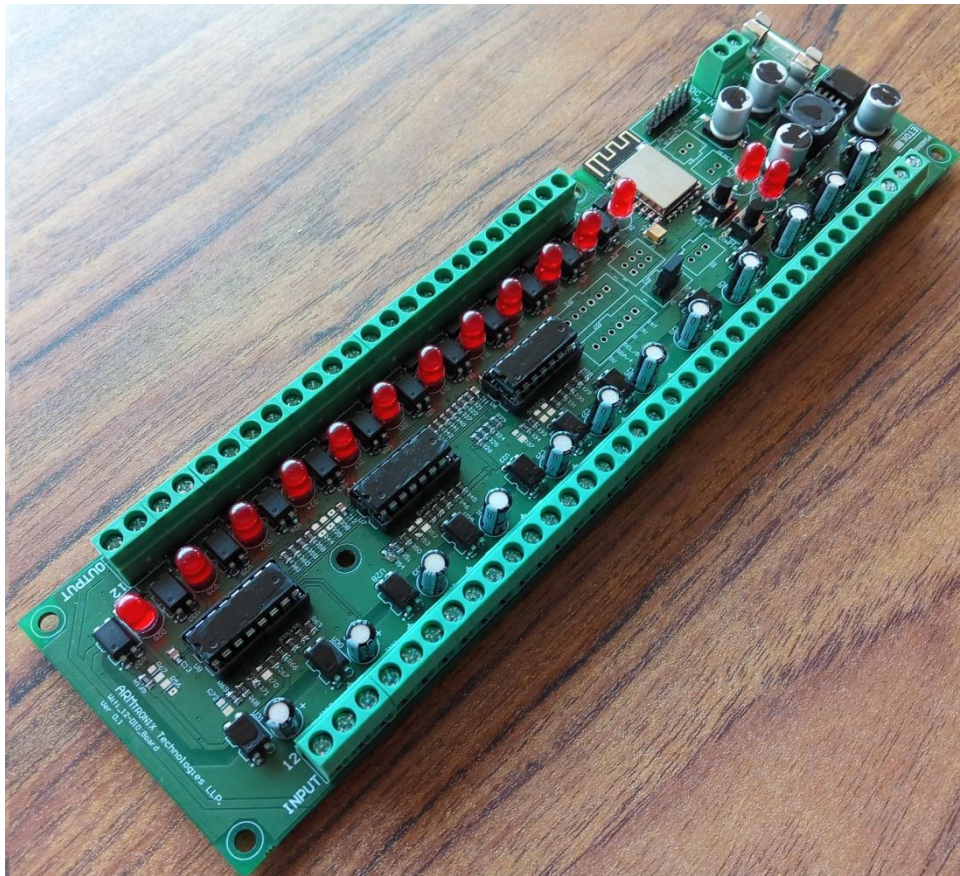


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1. ABBREVIATIONS

Term	Description
HTTP	Hypertext Transfer Protocol
MQTT	Message Queue Telemetry Transport
PLC	Programmable Logic Control
DC	Direct Current
GND	Ground (DC)

2. REFERENCES

Company Website link	https://www.armtronix.in
Instructable's Weblink	-
Github's Weblink	-

3. PURPOSE

The purpose of this document is to outline the design description for the Wifi Two GPIO Board. It provides a high level summary of the product.

4. SCOPE

This document describes system architecture which includes Isolated Inputs, Isolated Outputs, WiFi Module and Power Supply.

5. SAFETY AND WARNING

If you are working with DC power, please take necessary precautions. Do not short the positive and negative terminals of the power supply, as it may damage the Hardware and may create hazardous to your health. Do not bring AC power in contact with this board, which will damage the hardware and may create hazardous to your health. Please consider disconnecting power supply from the board if you would like to make any changes in connections. Working without safety towards hardware is not advisable. Electronic devices are static sensitive and suggest you to take necessary steps towards antistatic measures.

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 Industrial standard DC power 12-24V.
- Twelve isolated Input and Twelve isolated output are accessible to user.
- Both input and output are 12-24V voltage level compatible.
- WiFi with MQTT protocol compatible.
- The commands are provided in this document to inputs and outputs.
- Basic Firmware to enter SSID and password to connect to the router
- Configuration and Reset push button available

7. PRODUCT DESCRIPTION

a. PHYSICAL DESCRIPTION

- DC to DC Power supply module
- Isolated Inputs – 12 numbers
- Isolated outputs – 12 numbers
- Wifi Module

b. FUNCTIONAL DESCRIPTION

Block Diagram

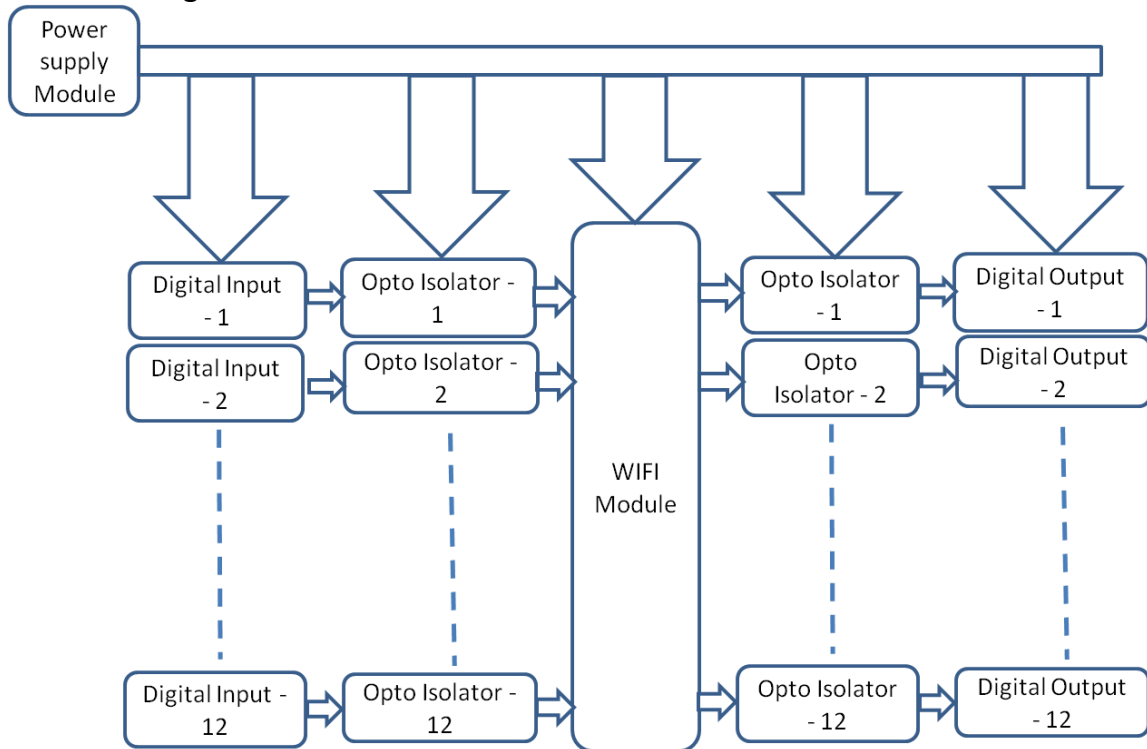


Figure 1: Block Diagram

Twelve Input and Twelve output board has on-board power supply module which takes industry standard 24V DC power as input and provides required regulated DC power. This regulated DC power is used to power-up Wifi module used on-board to establish communication with Wifi routers or access points. The board has twelve optically isolated inputs and twelve optically isolated outputs to monitor sensors and control (ON/OFF) external electrical DC loads like Lamps, relays independently from a PLC/controller using MQTT protocol.

8. SYSTEM OVERVIEW

1. DC to DC Power supply module

The DC-DC converter on board is used to regulate voltage from 24 V DC to 3.3 V DC to supply power to complete digital part including Wifi module.

The main power input 24V supply is also used to provide limited power to isolated outputs..

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. Isolated Inputs – 12 Numbers

There are twelve numbers of optically isolated inputs given accessible to user to monitor sensors or read any digital inputs with voltage level between 12V DC – 24V DC. The optical isolation is used to protect the hardware from any electrical hazardous at/from external interfaces to the board like sensor or any other respective inputs.

4. Isolated outputs – 12 Numbers

There are twelve numbers of optically isolated outputs given accessible to user to control low power consumption loads with voltage level between 12V DC – 24V DC. The optical isolation is used to protect the hardware from any electrical hazardous at/from external interfaces to the board like solenoids, relays or any other respective outputs.

9. TECHNICAL SPECIFICATION

a. ELECTRICAL SPECIFICATION

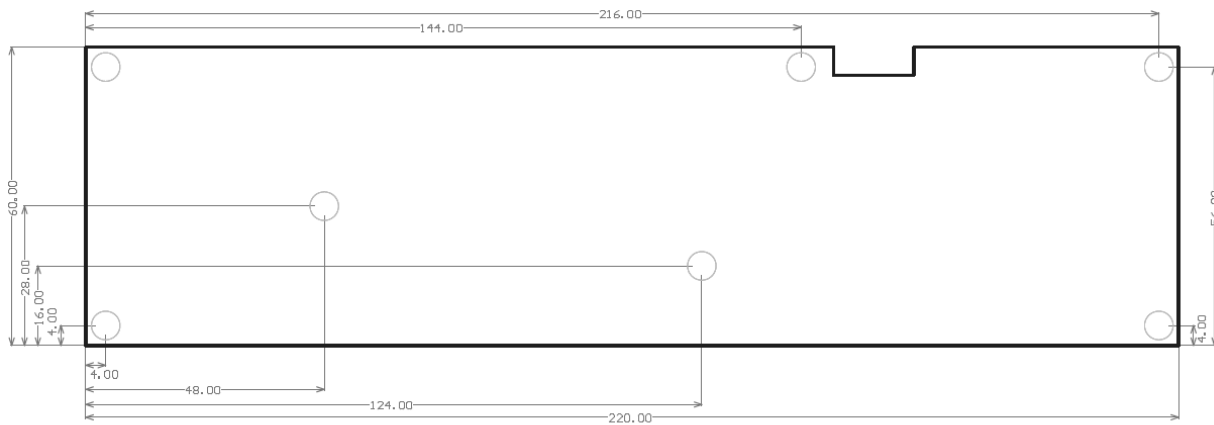
Input Specifications				
Description	Min	Typ	Max	Unit
Voltage DC	12	24	24	Volts
Current DC	-	0.1	-	Amps
Power DC	-	3	-	Watts
Frequency	50	-	60	Hz

Isolated Outputs Specifications (Maximum)				
Description	Min	Typ	Max	Unit
Voltage DC	-	-	24	Volts
Current DC	-	-	0.3	Amps
Power DC	-	-	0.72	Watts

Isolated Inputs Specifications (Maximum)				
Description	Min	Typ	Max	Unit
Voltage DC	-	-	24	Volts
Current DC	-	-	0.03	Amps

b. MECHANICAL SPECIFICATION

- Mechanical Dimensions of PCB are 220 x 60 x 25 mm (Length x Width x Height)
- For more details on dimension of the board, please refer to Figure 2.



Note:

1. All the dimensions are in mm.
2. There are 7 Mounting holes.
3. Mounting Holes are given with dia of 3.5mm for M3 screws and Pan head dia of 5.6mm.

Figure 2: Board Dimensions

10. ELECTRICAL CONNECTIONS

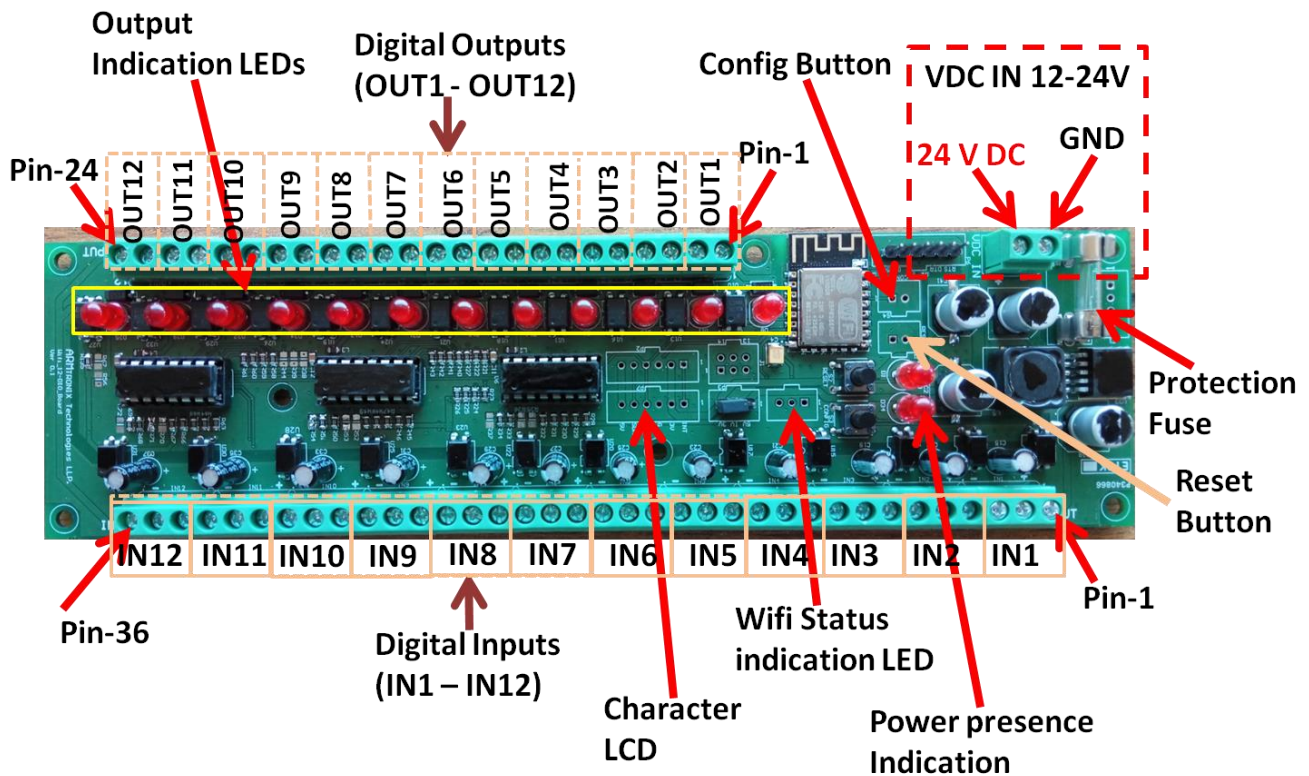


Figure 3: Header Details

Description of Header and Switches shown in Figure 3:

- | | | |
|----|--------|-------------------------------|
| 1. | VDC_IN | DC 24V power input |
| 2. | S1 | RESET Button |
| 3. | S2 | Configuration Button |
| 4. | D5 | Wifi status indication LED |
| 5. | D34 | Power Presence indication LED |
| 6. | IN1 | Digital Sensor input - 1 |

7.	IN2	Digital sensor input - 2
8.	IN3	Digital Sensor input - 3
9.	IN4	Digital sensor input - 4
10.	IN5	Digital Sensor input - 5
11.	IN6	Digital sensor input - 6
12.	IN7	Digital Sensor input - 7
13.	IN8	Digital sensor input - 8
14.	IN9	Digital Sensor input - 9
15.	IN10	Digital sensor input - 10
16.	IN11	Digital Sensor input - 11
17.	IN12	Digital sensor input - 12
18.	OUT1	Digital Output - 1
19.	OUT2	Digital Output - 2
20.	OUT3	Digital Output - 3
21.	OUT4	Digital Output - 4
22.	OUT5	Digital Output - 5
23.	OUT6	Digital Output - 6
24.	OUT7	Digital Output - 7
25.	OUT8	Digital Output - 8
26.	OUT9	Digital Output - 9
27.	OUT10	Digital Output - 10
28.	OUT11	Digital Output - 11
29.	OUT12	Digital Output - 12

Figure 4: Header Pin number references

a. HEADER PIN CONFIGURATION

i. HEADER VDC_IN

Header Pin Number	Pin Name
1	GND
2	24 V DC (IN)

Table 1: Header VDC_IN Pin Configuration

ii. DIGITAL INPUT HEADER (IN1 – IN12)

Header Pin Number	Pin Name
1	24 V DC (Out)
2	INPUT – 1
3	GND
4	24 V DC (Out)
5	INPUT – 2
6	GND
7	24 V DC (Out)
8	INPUT – 3
9	GND
10	24 V DC (Out)
11	INPUT – 4
12	GND
13	24 V DC (Out)
14	INPUT – 5
15	GND
16	24 V DC (Out)
17	INPUT – 6
18	GND
19	24 V DC (Out)
20	INPUT – 7
21	GND
22	24 V DC (Out)
23	INPUT – 8
24	GND
25	24 V DC (Out)
26	INPUT – 9
27	GND
28	24 V DC (Out)
29	INPUT – 10
30	GND
31	24 V DC (Out)
32	INPUT – 11
33	GND
34	24 V DC (Out)
35	INPUT – 12
36	GND

Table 2: Header IN1 Pin Configuration

iii. DIGITAL OUTPUT HEADER (OUT1 – OUT12)

Header Pin	Pin Name
1	24 V DC (Out)
2	OUTPUT – 1
3	24 V DC (Out)
4	OUTPUT – 2
5	24 V DC (Out)
6	OUTPUT – 3
7	24 V DC (Out)
8	OUTPUT – 4
9	24 V DC (Out)
10	OUTPUT – 5
11	24 V DC (Out)
12	OUTPUT – 6
13	24 V DC (Out)
14	OUTPUT – 7
15	24 V DC (Out)
16	OUTPUT – 8
17	24 V DC (Out)
18	OUTPUT – 9
19	24 V DC (Out)
20	OUTPUT – 10
21	24 V DC (Out)
22	OUTPUT – 11
23	24 V DC (Out)
24	OUTPUT – 12

Table 3: Header IN1 Pin Configuration

b. APPLICATION WIRING DIAGRAM

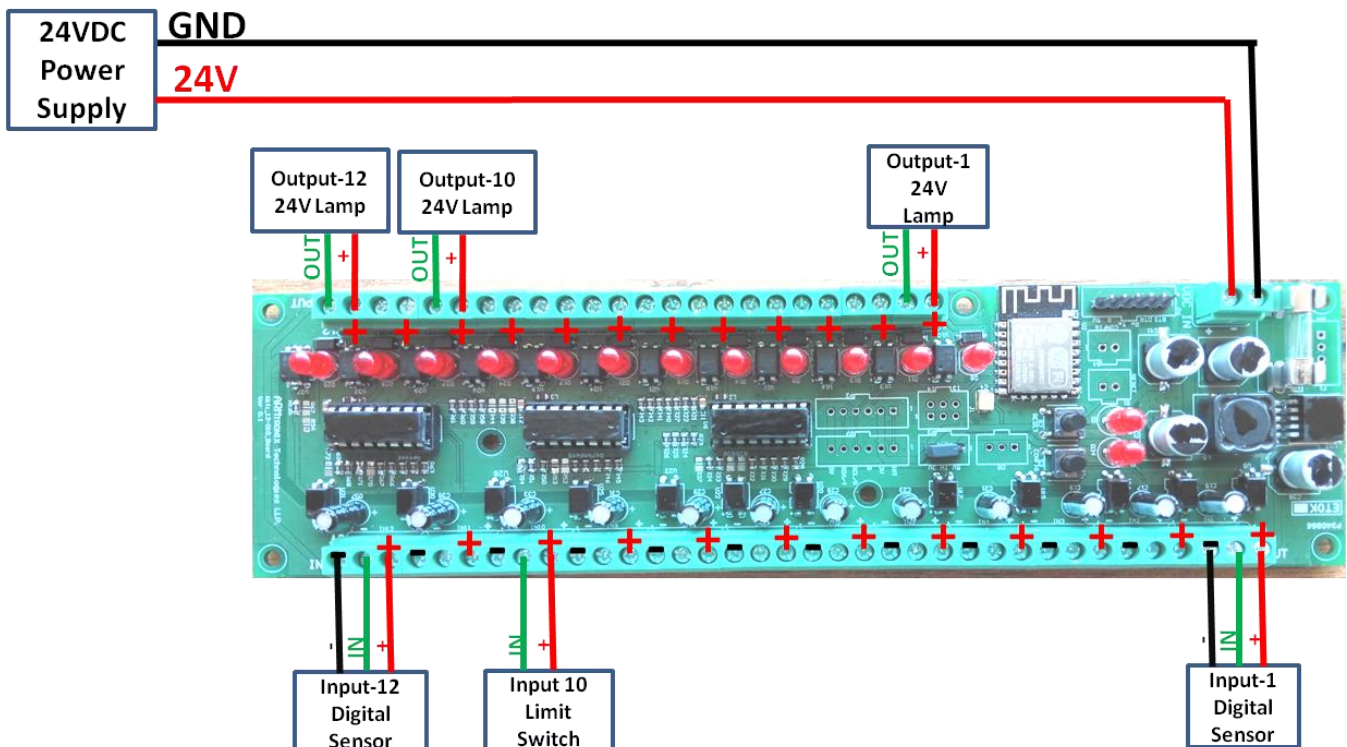


Figure 5: Application wiring example

11. COMMANDS FOR IOs

a. MQTT COMMANDS TO READ INPUTS

12. COMMANDS FOR IOs

Publishing Topic to read Inputs

Example: /I/00x

Subscription Topic to control outputs

Example: /O/00x

a. COMMANDS TO READ INPUT

- Generally on change in status of input or sensors on the topic will relevant information. This can be captured by any system which has subscribed to topic which the sensor board Publish's ON.
From the above ex. /I/00x is our boards publishing topic, so if any system subscribes to this, it will receive the information on change in status.

b. COMMANDS TO CONTROL OUTPUTS

- OUTPUT – ex. /O/00x_0000000001; Topic publish from system.
Where: x is client number

0000000001									
0	0	0	0	0	0	0	0	0	1
OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8	OUT19	OUT10

c. EXAMPLE MQTT COMMANDS TO CONTROL OUTPUTS

- OUT1 - /O/00x_1000000000; To turn ON only 1st output
- OUT2 - /O/00x_0100000000; To turn ON only 2nd output
- OUT3 - /O/00x_0010000000; To turn ON only 3rd output
- OUT4 - /O/00x_0001000000; To turn ON only 4th output
- OUT5 - /O/00x_0000100000; To turn ON only 5th output
- OUT6 - /O/00x_0000010000; To turn ON only 6th output
- OUT7 - /O/00x_0000001000; To turn ON only 7th output
- OUT8 - /O/00x_0000000100; To turn ON only 8th output
- OUT9 - /O/00x_0000000010; To turn ON only 9th output
- OUT10 - /O/00x_0000000001; To turn ON only 10th output
- OUTPUT ALL HIGH- /O/00x_1111111111; To turn ON only all 10 output
- OUTPUT ALL LOW- /O/00x_0000000000; To turn OFF only all 10 output
- OUT11 – NOT IMPLEMENTED;
- OUT12 - NOT IMPLEMENTED;

13. HOW TO USE THE DEVICE

a. STEPS TO CONFIGURE THE DEVICE TO NETWORK HOSTED BY YOU:

- i. Switch ON the device.
- ii. Make sure that Power presence indication **Red LED** is glowing.
- iii. Wait till the Wifi Status indication LED starts blinking continuously **Green/Red** in color with duration of ~1 seconds, this indicates the device is NOT configured to any network.
- iv. Press the **config** button, wait till blinking of dual color LED to turns OFF. This indicate that the device is healthy and not previously configured to any network.
- v. To configure the device, Press and hold the **Reset** button and then press and hold the **Config** Button.
- vi. Now release only the **Reset** button, wait for 30 seconds, then release the **Config** button. Now the device will host its own network (Access point/Hotspot) to allow users to configure it.
- vii. Take any Smartphone.
- viii. Switch ON Wifi in it. (make sure that, its Mobile Data connection is turned OFF).
- ix. Search for available Wifi networks in the range

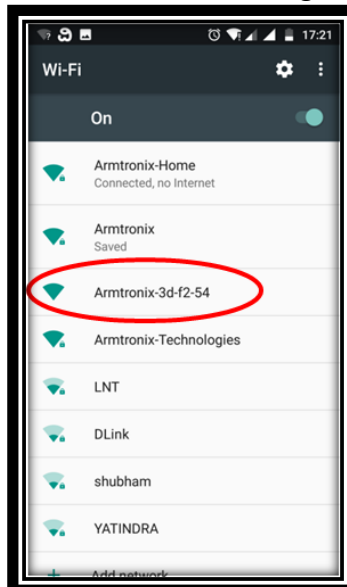


Figure 6: Available Wifi networks searched

- x. You will observe one of the available Wifi network as “Armtronix-xx-xx-xx”. Where xx: is last 6 digits of MAC address of the particular device. Click on that particular available network connect your smart phone to it. So in this scenario, the device is ‘Wifi Host’ and Smartphone is ‘Wifi Client’.

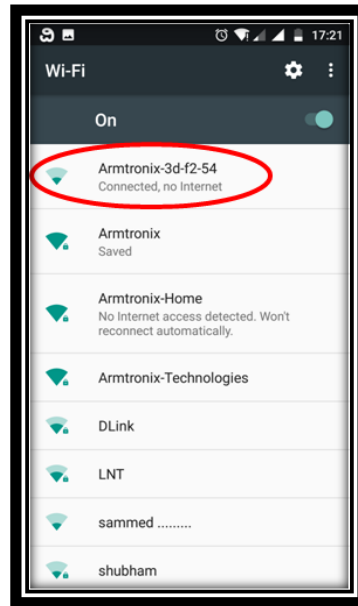


Figure 7: Smartphone Connected to Wifi hosted by DIO board

- xi. Open any web browser, enter default IP address 192.168.4.1 of the device when it is hosting its own Wifi network and click enter.

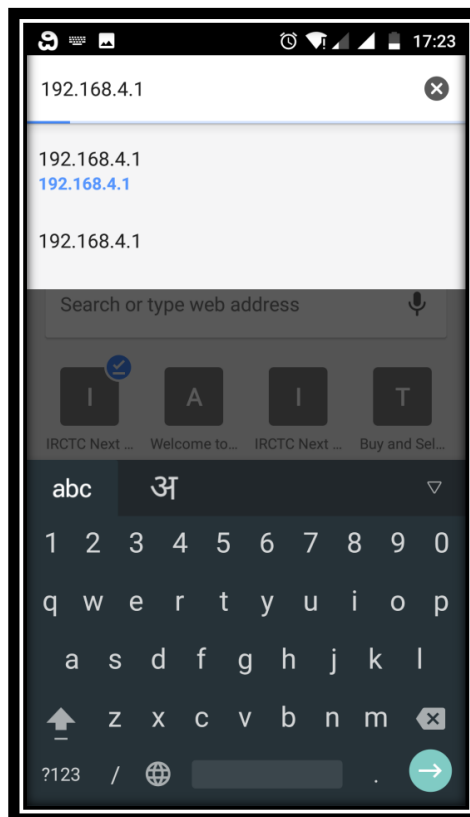


Figure 8: Default IP address entered in the Web browser

- xii. Clicking on Enter button after entering default IP address, you will be able to access its webpage as shown in Figure 9.

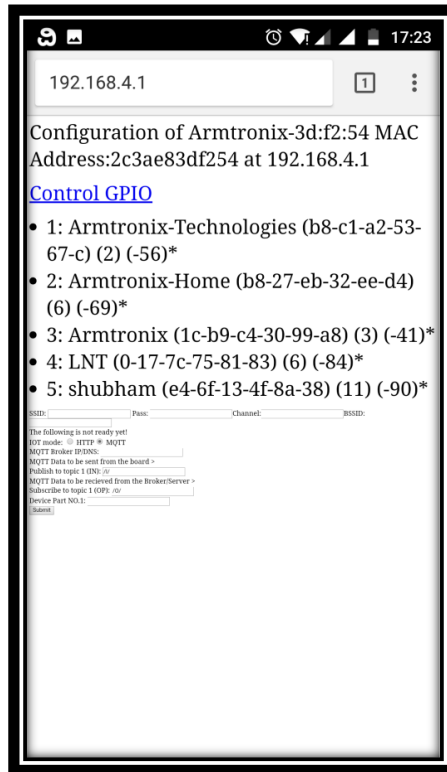


Figure 9: Accessed webpage of DIO module

- xiii. In the accessed webpage, fill-in all the required details like:
- **SSID** : SSID of Access Point
 - **Pass** : Password of Access point
 - **Channel** : Channel of Access point
 - **BSSID** : BSSID (MAC Add) of Access Point
 - **IOT Mode** : MQTT
 - **MQTT Broker IP/DNS** : xxx.xxx.xxx.xxx (Ex. 192.168.0.1)
 - **Publish to Topic 1 (IN)** : /I/xxx (Ex. /I/008)
 - **Subscribe to topic 1 (OP)** : /O/xxx(Ex. /O/008)
 - **Device Part NO.1** : xxx (Ex. 008)

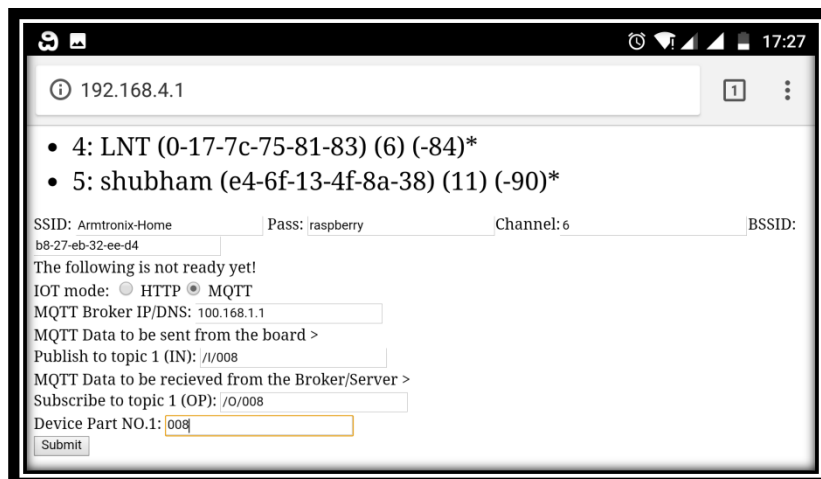


Figure 10: Entered all the required details

- xiv. After entering all the required details, click on Submit button. It will save the parameters you entered and reboot the device and acknowledge the user in the webpage. Do not turn OFF the device, it will automatically reboot.



Figure 11: Submitted the updates

b. STEPS TO CONNECT SMARTPHONE TO MQTT BROKER:

- i. Disconnect Smartphone from any other Wifi network if connected.
- ii. Search for available Wifi network where the MQTT broker is running.
In our case it is "Armtronix-Home" is the wifi network where our MQTT broker is running.

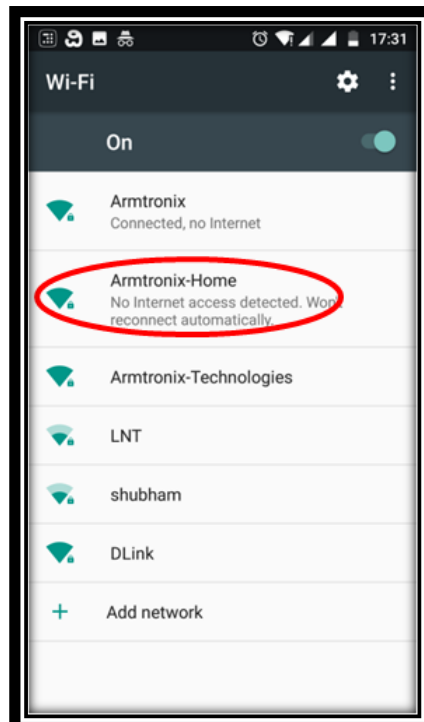


Figure 12: Smartphone searched for available Wifi networks

- iii. Click on that particular available network to connect your smart phone to it.

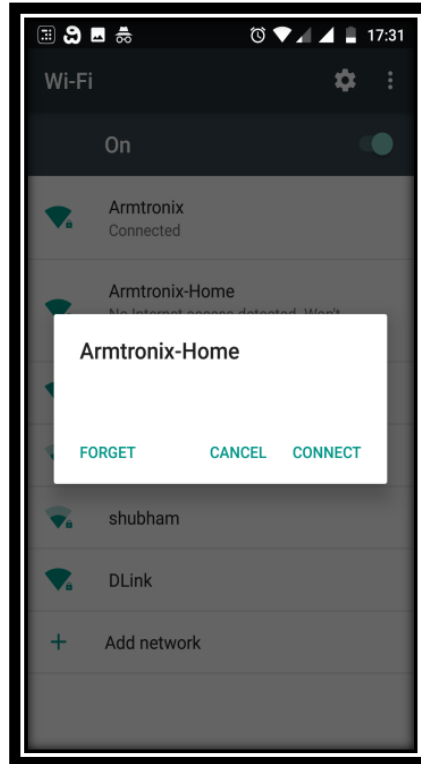


Figure 13: Trying to connect to pre-configured MQTT broker

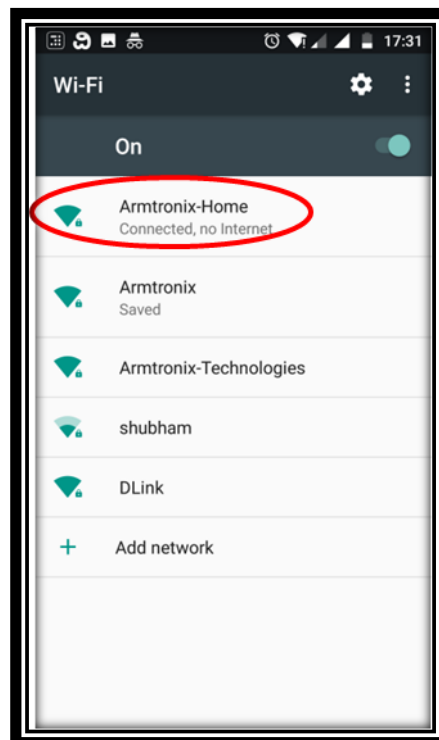


Figure 14: Smartphone connected to MQTT broker

c. STEPS TO TEST OUR WIFI 12-DIO DEVICE USING SMARTPHONE AND MQTT BROKER:

- i. Install 'MyMQTT' Android app in to a Smartphone you would use for testing.
- ii. Open an app 'MyMQTT' app Smartphone.

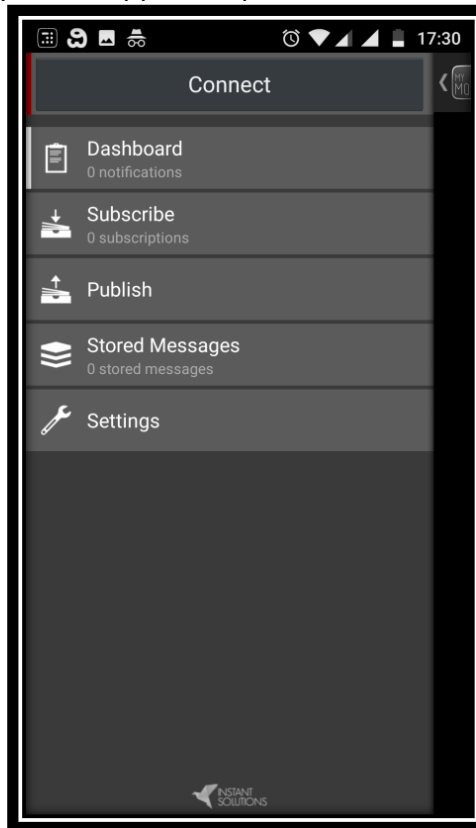


Figure 15: MyMQTT app menu page

- iii. Click on settings option.
- iv. Enter MQTT broker IP address and default Port number as 1883 (if not changed)
Our MQTT broker IP address is 192.168.0.1

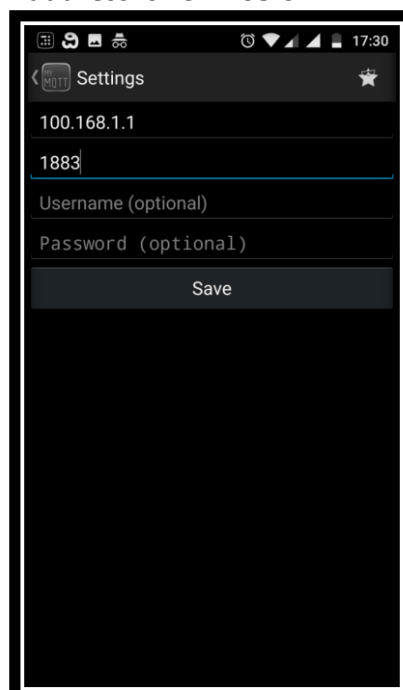


Figure 16: MQTT broker IP address and port number entered

- v. On the completion of your IP address and port number entry, Save the settings by clicking on **Save** button. Popup will indicate once the settings saved.

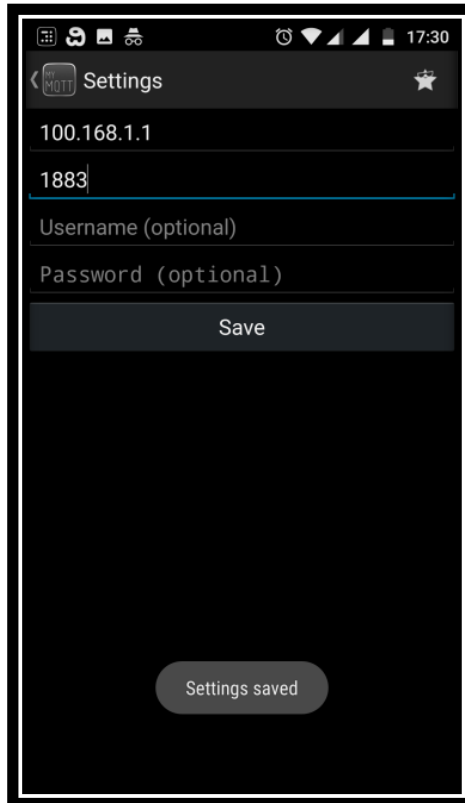


Figure 17: Saved the settings

d. CONTROL OUTPUTS VIA SMARTPHONE:

- i. Connect Smartphone to network hosted having MQTT broker as said in section 13.b.
- ii. Open MyMQTT app in Smartphone.
- iii. Tap on the screen, it will open menu window.
- iv. Click on the Publish option.
- v. Enter topic as `"/O/00x"` where x is client device number entered while configuring.
- vi. Ex. Message `"/O/00x_0000011111"` (Device will turn output 1 – output 5 as OFF and Output 6 – Output 10 outputs as ON: `'_'` indicates Outputs)

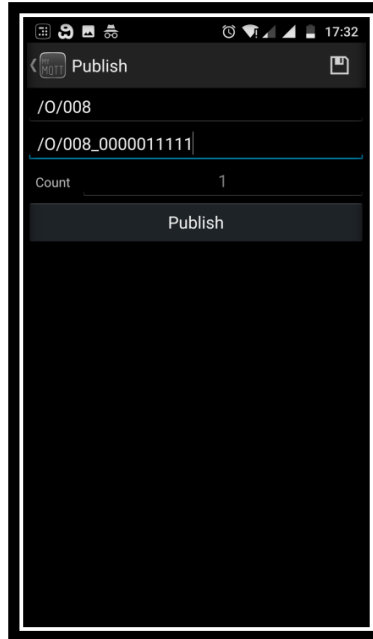


Figure 18 Entered topic and message to control outputs

- vii. Click on Publish button to publish the topic.

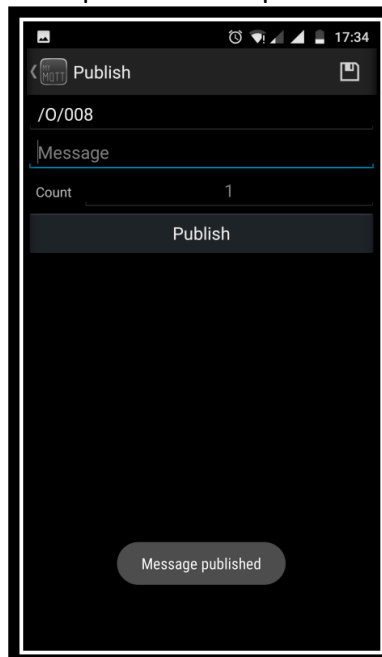


Figure 19: Message and topic published to control outputs

- viii. On publishing the topic, popup will arrive as *'Message Published'* the device will take action on the outputs.

e. CHANGE 16X2 LCD CONTENT VIA SMARTPHONE.

- i. Connect Smartphone to network hosted having MQTT Broker as said in section 13.b.
- ii. Open MyMQTT app in Smartphone.
- iii. Tap on the screen, it will open

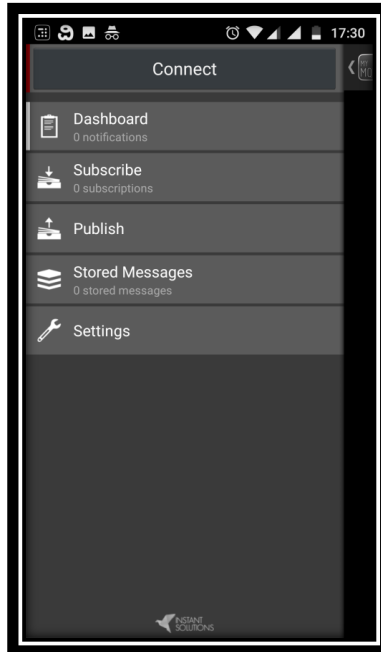


Figure 20: Taped on the default screen

- iv. Click on the Publish option.
- v. Enter topic as `"/O/00x"`; where x is client device number entered while configuring.
- vi. Ex. Message `"/O/00xLARMtronix Techno"`; (LCD will display: `"ARMtronix Techno"`: 'L' indicates LCD;)

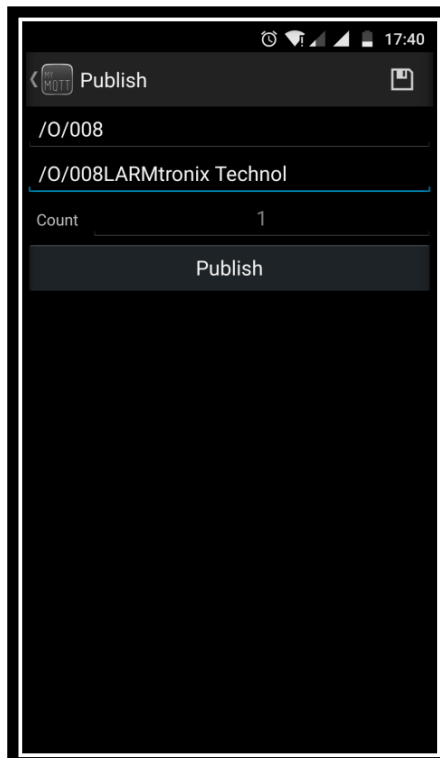


Figure 21: Clicked on the publish option and entered the message to be displayed on LCD

- vii. Click on Publish button on the screen to publish the topic.

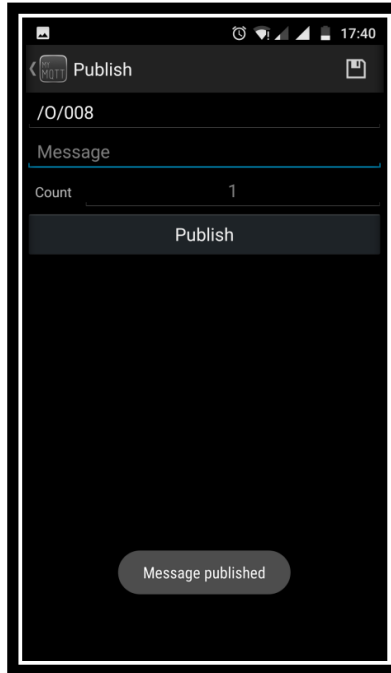


Figure 22: Published the message by clicking on Publish button

- viii. On publishing on the topic, popup will arrive as '*Message Published*' the device will take action on the outputs.

f. READ DIGITAL INPUTS VIA SMARTPHONE.

- i. Connect Smartphone to network hosted having MQTT Broker as said in section 13.b.
- ii. Open MyMQTT app in Smartphone.
- iii. Tap on the screen, it will open menu window.

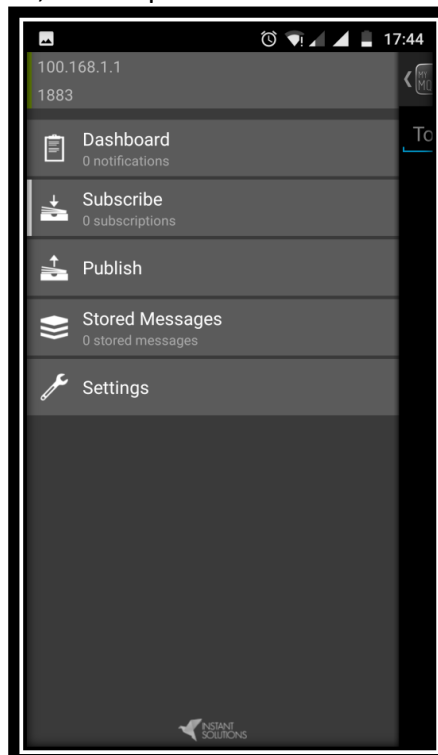


Figure 23: Tapped on the home screen

- iv. Click on the Subscribe option.

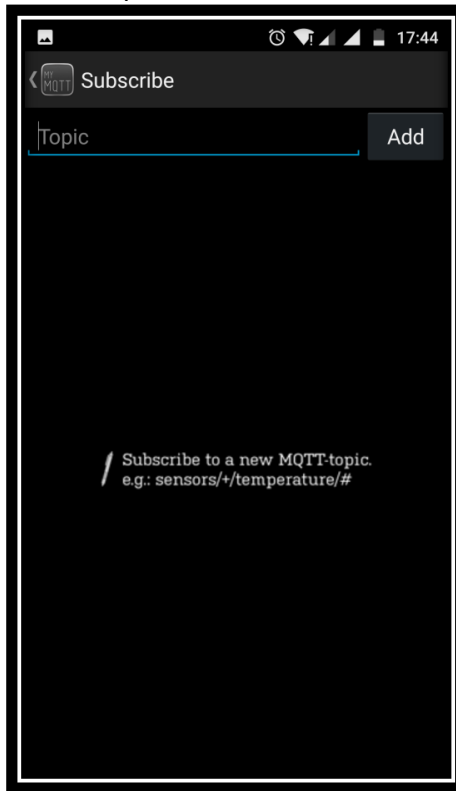


Figure 24: Clicked on the Subscribe option

- v. Enter topic as `"/l/00x"`; where x is client device number entered while configuring.
- vi. Click on Add button on the screen to subscribe to the topic. If you add '+', all the messages under `"/l/"` will be received and displayed on Dashboard screen.

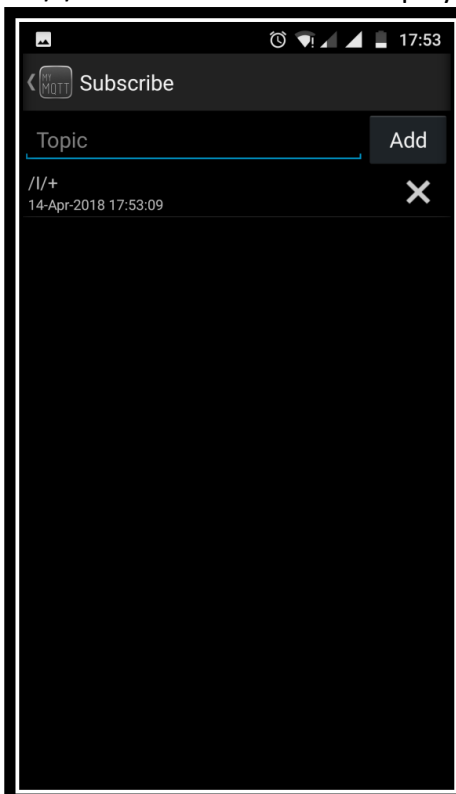


Figure 25: Entered the Subscription topic and clicked on the Add button

- vii. Click on back button located at left-top-corner of the screen.
- viii. Tap on the screen. It will open the menu.
- ix. Open the dashboard by clicking on Dashboard option in the menu.

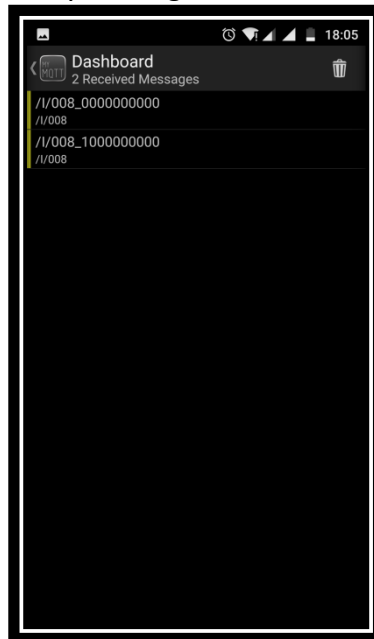


Figure 26: Dashboard window to monitor status of Digital Inputs

- x. You will receive the status of Inputs, as and when there is a change in status.

g. READ DIGITAL INPUTS RANDOMLY VIA SMARTPHONE.

- i. Follow steps from 13.b.i to 13.b.viii
- ii. Click on the publish option.

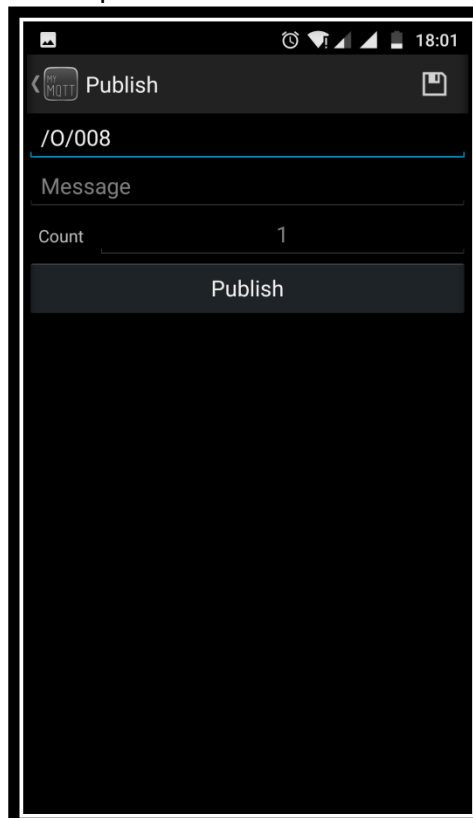


Figure 27: Opened Publish option

- iii. Enter topic as /O/00xSI? (To read inputs)

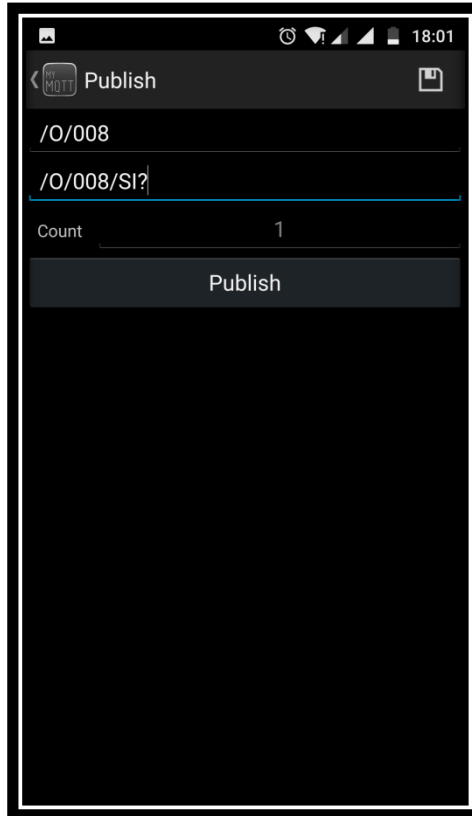


Figure 28: Entered topic an message publish to read the current status of Digital Inputs

- iv. Click on publish button to publish the topic, you will get popup as 'Message Published'

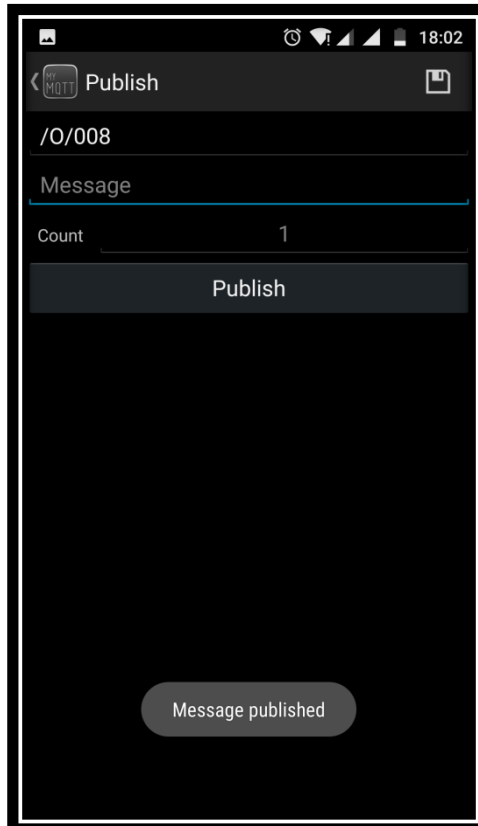


Figure 29: Published message to read Status of inputs

- v. Click on back button located at left-top-corner of the screen
- vi. Tap on the screen. It will open the menu.
- vii. Open the dashboard by clicking on Dashboard option in the menu.
- viii. You will receive the current status of Inputs.

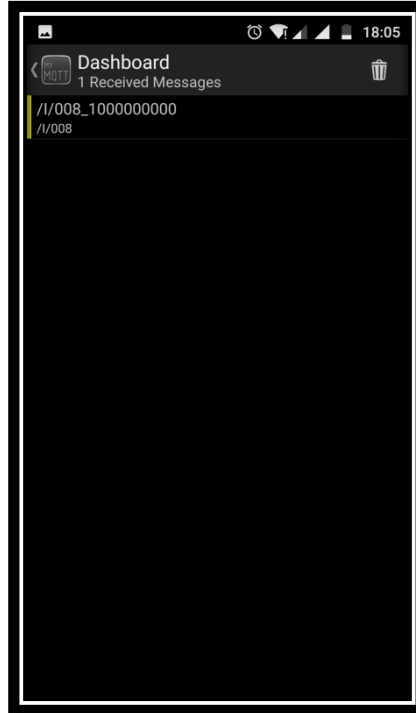


Figure 30: Reading status of Inputs on Dashboard screen

h. READ STATUS OF DIGITAL OUPUTS RANDOMLY VIA SMARTPHONE.

- ix. Follow steps from 13.b.i to 13.b.viii
- x. Click on the publish option.

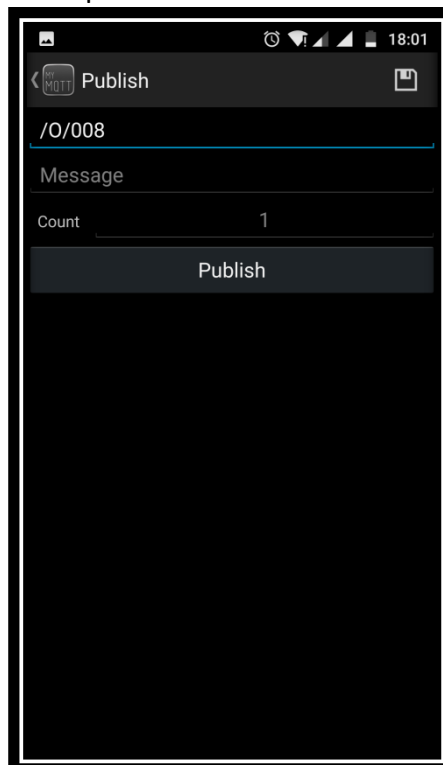


Figure 31: Opened Publish option

- xi. Enter topic as /O/00xSO? (To read status of outputs)

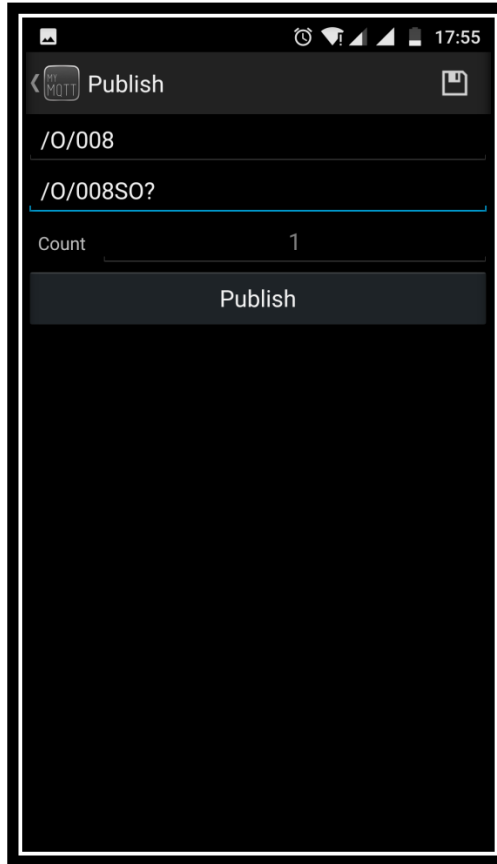


Figure 32: Entered topic and message to be published to read the current status of Digital Outputs

- xii. Click on publish button to publish the topic, you will get popup as 'Message Published'

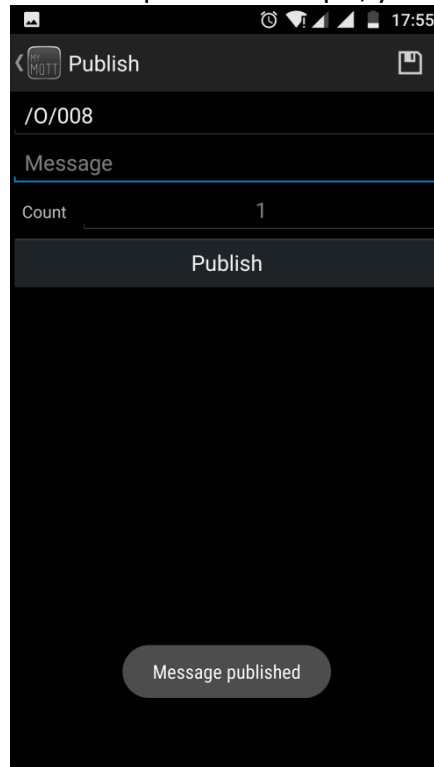


Figure 33: Message Published

- xiii. Click on back button located at left-top-corner of the screen.
- xiv. Tap on the screen. It will open the menu.
- xv. Open the dashboard by clicking on Dashboard option in the menu.
- xvi. You will receive the current status of Outputs.

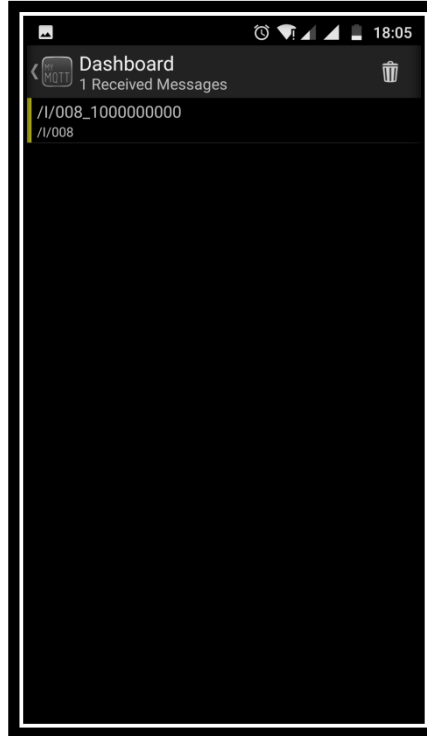


Figure 34: Reading status of Outputs on Dashboard screen

i. READ MAC ADDRESS OF CLIENT DEVICE VIA SMARTPHONE.

- i. Follow steps from 13.b.i to 13.b.viii
- ii. Click on the publish option.

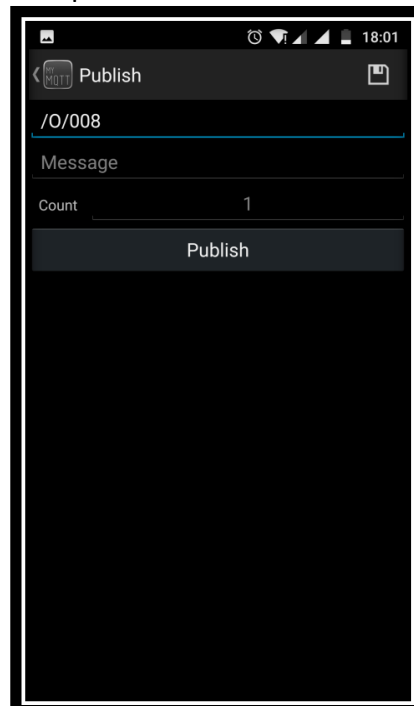


Figure 35: Opened Publish option

- iii. Enter topic as /O/00xMAC? (To read MAC address)

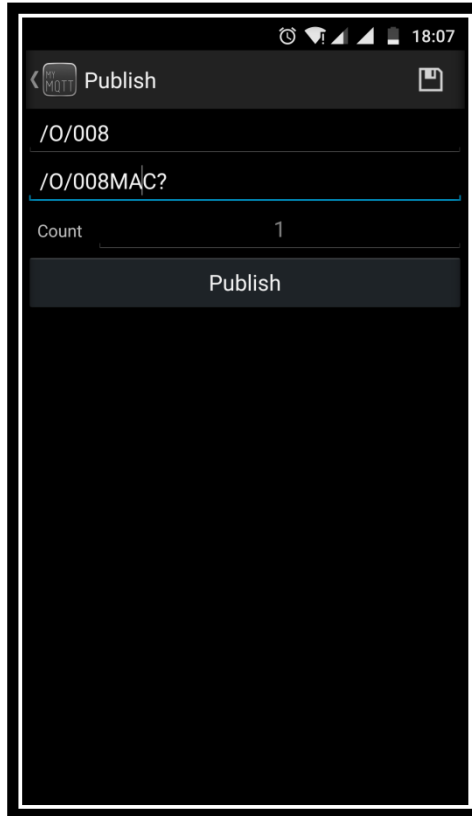


Figure 36: Entered topic and message to be Published to read the MAC address of the device

- iv. Click on publish button to publish the topic, you will get popup as 'Message Published'

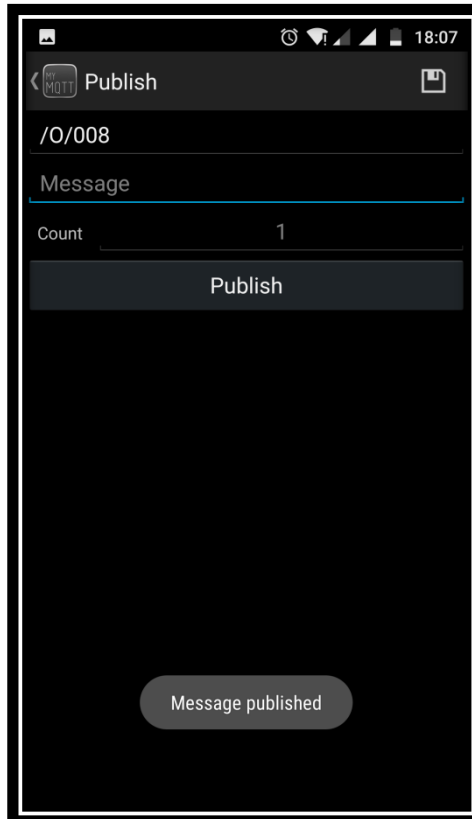


Figure 37: Message Published

- v. Click on back button located at left-top-corner of the screen.
- vi. Tap on the screen. It will open the menu.
- vii. Open the dashboard by clicking on Dashboard option in the menu.
- viii. You will receive the MAC address of the client without ":" or "-".

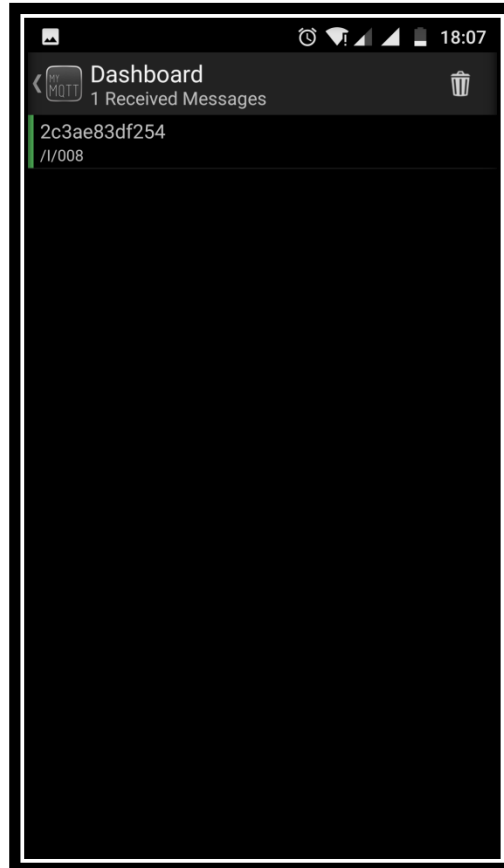


Figure 38: Reading MAC address on Dashboard screen

14. HARDWARE DETAILS

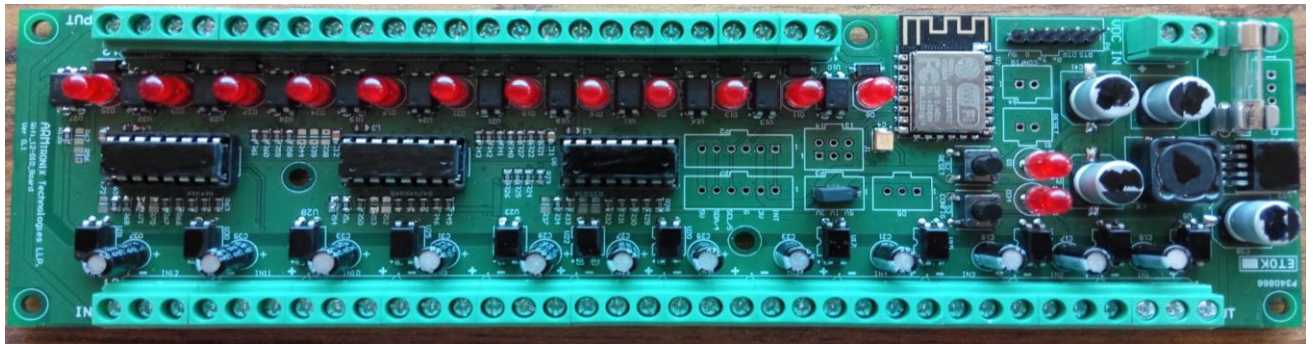


Figure 39: Embedded System Hardware

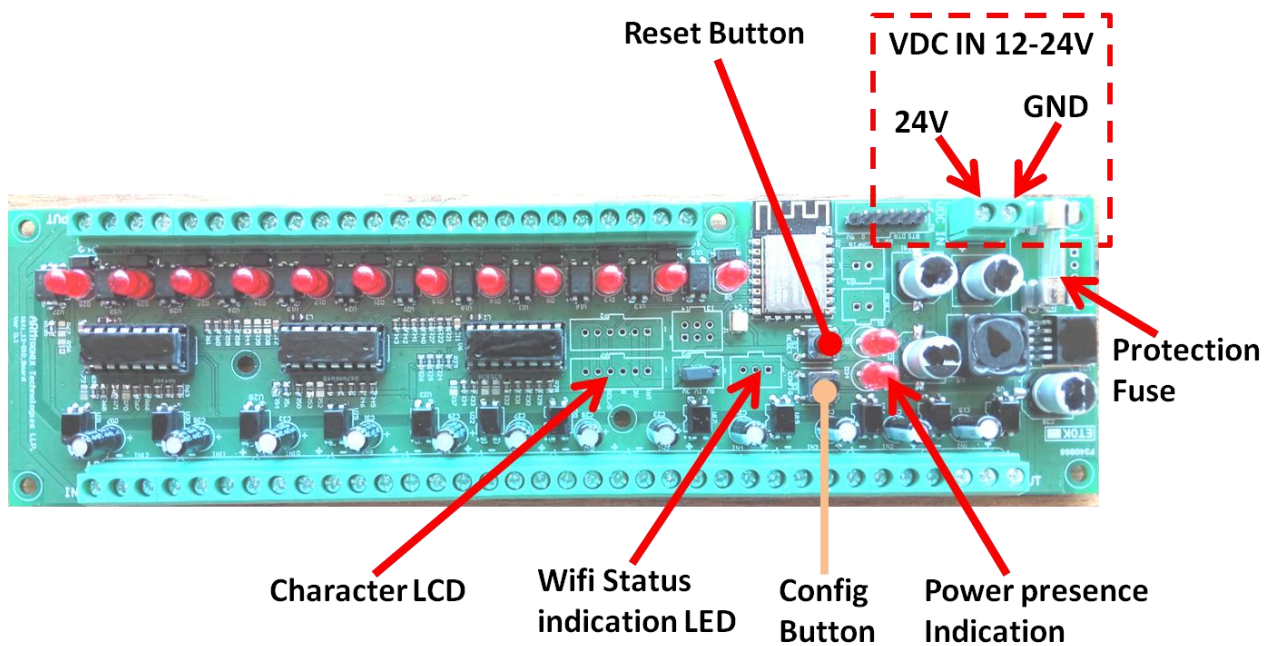


Figure 40: Button Indications

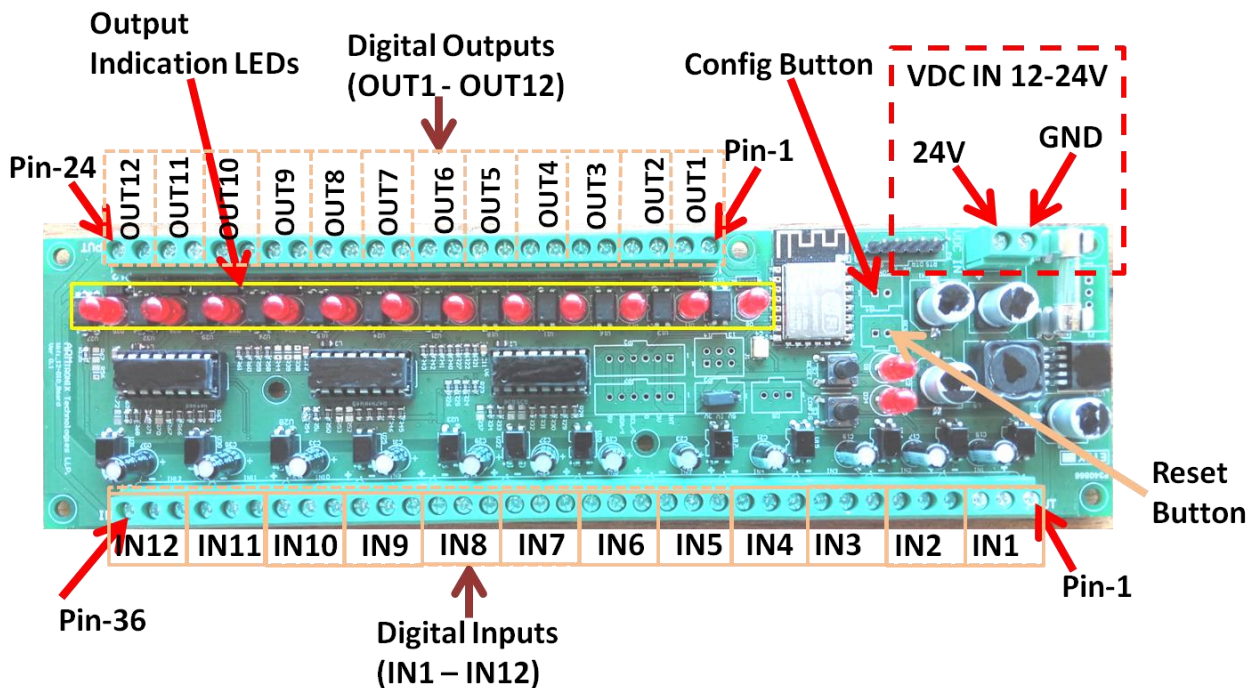


Figure 41: Input Output Connections details

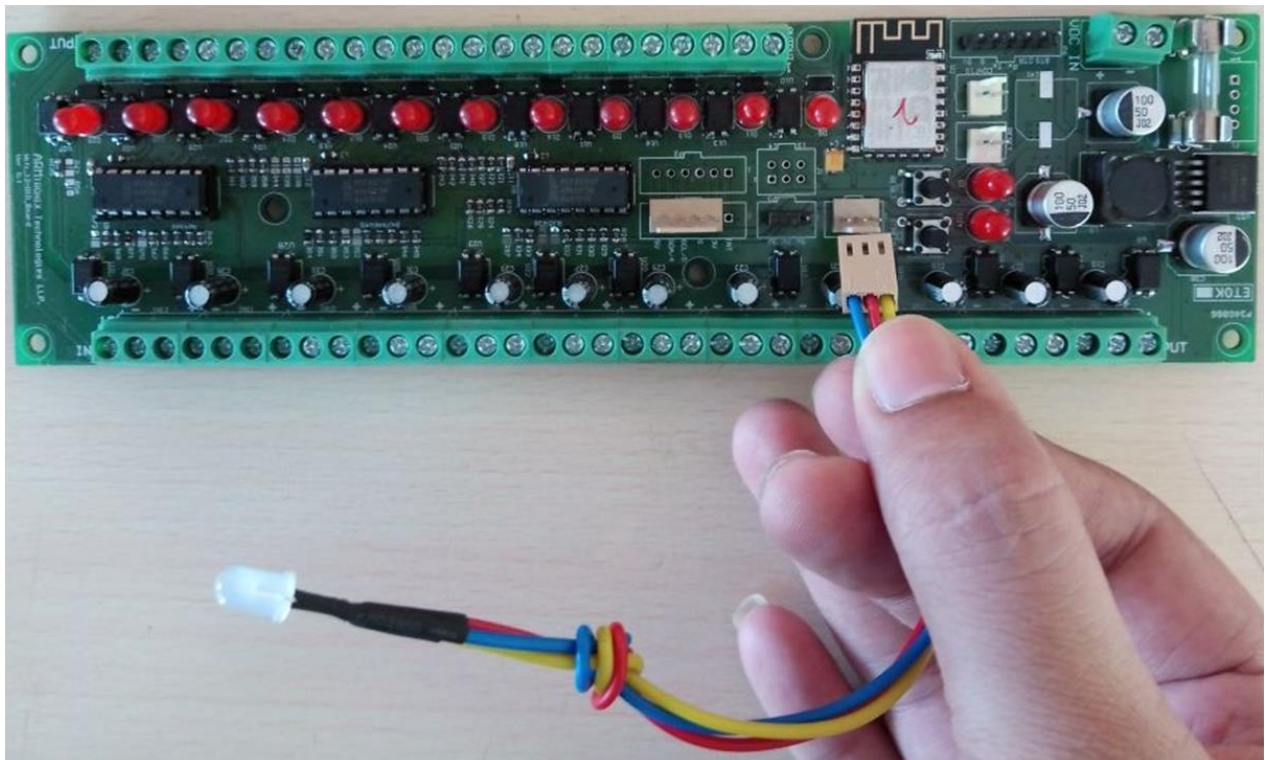


Figure 42: Wifi Status LED connection

Note: Connector is Polarised and can mate in one orientation only.

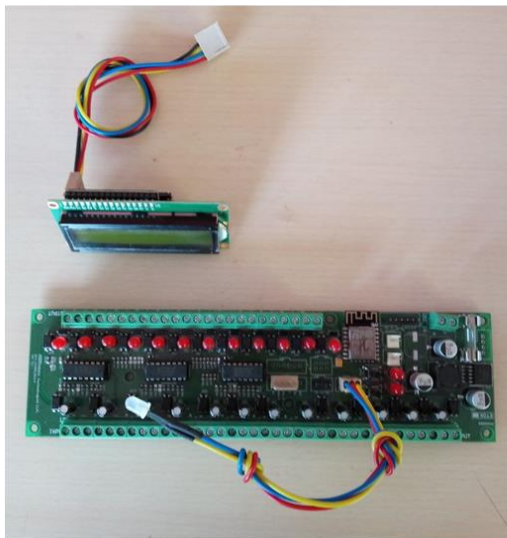


Figure 43: LCD Cable Connection

Connect the LCD cable as shown in above figure.

Note: Connector is Polarised and can mate in one orientation only.

Before Connection:



After Connection:

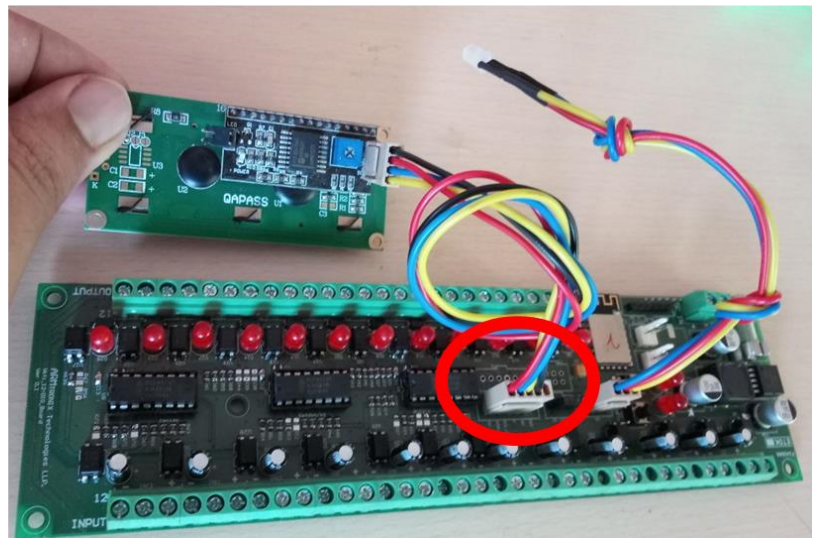


Figure 44: LCD Connection with device

Connect the LCD cable as shown in red circle in above figure.

Note: Connector is Polarised and can mate in one orientation only.



DOCUMENT #: IA009

DOCUMENT REV: A

DOCUMENT NAME: DESIGN DESCRIPTION, WIFI TWELVE INPUT TWELVE OUTPUT BOARD.

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