

eYSIP2016

GREENHOUSE POWER MONITORING AND APPLIANCE CONTROL

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Duration of Internship: 10/06/2016 – 24/07/2016

2016, e-Yantra Publication

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Greenhouse Power Monitoring and appliance control

1.1 Abstract

This project aims at developing a web portal with the help of which various aspects of the greenhouse such as ON/OFF Switching,Scheduled ON/OFF ,Graphical Visualization of Real-Time Monitored data collected from "Smart Switchboard/plug" which can provide support upto 3 devices, logging and storage of past data and graphical visualizaton .

This web based GUI allows remote access and monitoring capabilities to the user .



1.2. COMPLETION STATUS

1.2 Completion status

- Tasks Accomplished
 1. Literature survey of existing Real time Web Monitoring sites.
 2. Developing a Circuit to measure Current,Voltage,Phase,Frequency.
 3. Research and finalisation on Micro-controller board and Softwares to be used.
 4. Measurement of Current,Phase,Frequency,Voltage.
 5. Establishing a connection between server and micro-controller.
 6. Logging of Real time data in database.
 7. Creating Real Time updating Charts.
 8. Graphical Visualisation of logged data.
 9. Interfaced relay with the micro-controller.
 10. Created a page to control the connected devices.
 11. Added Scheduling feature.
 12. Added 3 device Support for monitoring and controlling.
 13. Created a feedback system to compare real-device status and system's data.
 14. Created a GUI on cool term to configure the 'Smart Switchboard-Plug'.
 15. Code Documentation and Project Report.
- Incomplete Tasks
 1. Responsive web design.

Front-end can be improved and made responsive by using bootstrap.



1.3. HARDWARE PARTS

1.3 Hardware parts

1. List of hardware used:-

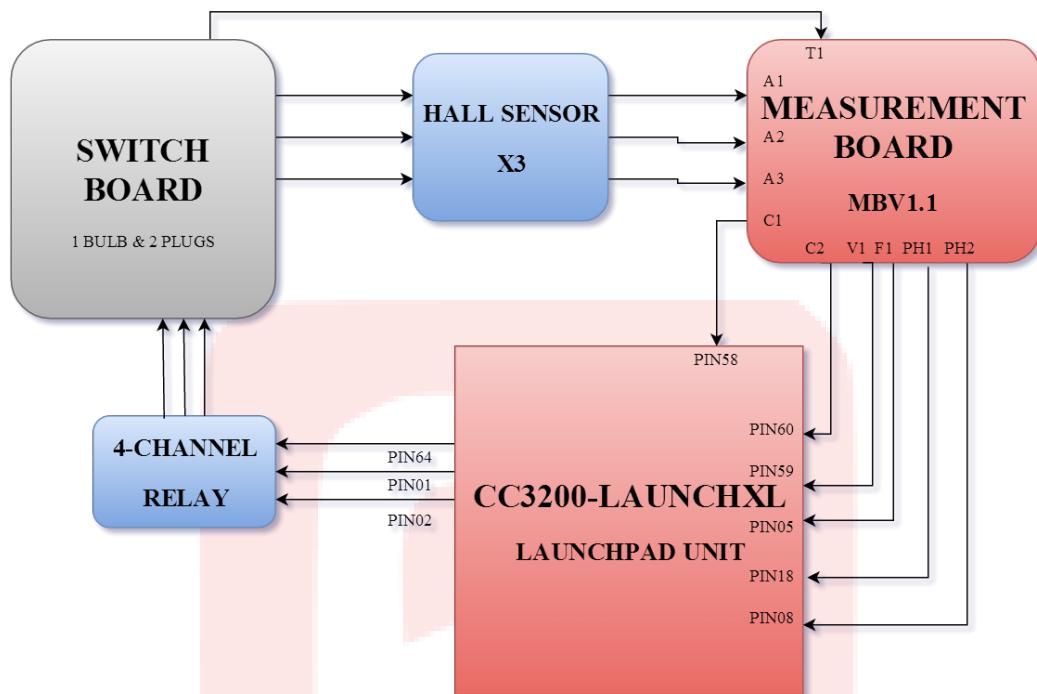
Name of hardware	Specification	Quantity
Electrical Switch Board	2-Plug and 1 Bulb Holder	1
Potential Transformer	230V-9V 100mA	1
Hall Effect Sensor Module	ACS712 (30A)	3
Bulb	100W	1
CC3200-LAUNCHPAD <i>(With CC3200-HZ on chip wifi microcontroller)</i>	TI's CC3200-LAUNCHXL	1
Soldring Iron	220V, 40W	1
Soldring Wire	50gm	1
Jumper Wires	Female to Female Male to Female	
4-Channel Relay Board	230V AC (10Amp)	1
Measurement Board <i>(Designed & Developed By Eyantra)</i>	MBV1.1	1

2. Details of hardware used:-

- Electrical Switch Board [Vendor link](#)
- Potential Transformer [Vendor link](#)
- Hall Effect Sensor Module [Datasheet, page 5](#), [Vendor link](#),
- Bulb [Vendor link](#)
- CC3200 LAUNCHPAD [Datasheet, page 5](#), [Vendor link](#)
- Jumper Wires [Vendor link](#)
- 4-Channel Relay Board [Datasheet, page 5](#), [Vendor link](#)
- Measurement Board [chapter 2](#)

1.3. HARDWARE PARTS

3. Connection diagram:-



HERE:-

- A1: current sensor input pin 1
- A2: current sensor input pin 2
- A3: current sensor input pin 3
- V1: transformer output pin
- C1: current1 signal out pin
- C2: current2 signal out pin
- V1: voltage signal out pin
- F1: frequency signal out pin
- PH1: phase 1 signal out pin
- PH2: phase 2 signal out pin

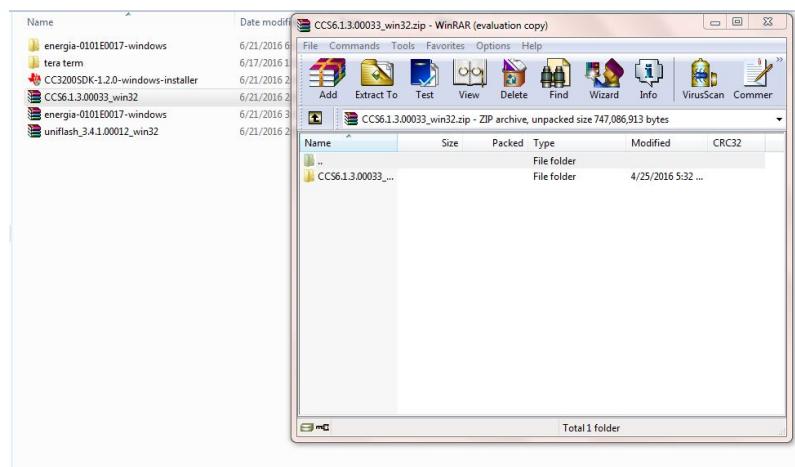


1.4. SOFTWARE USED

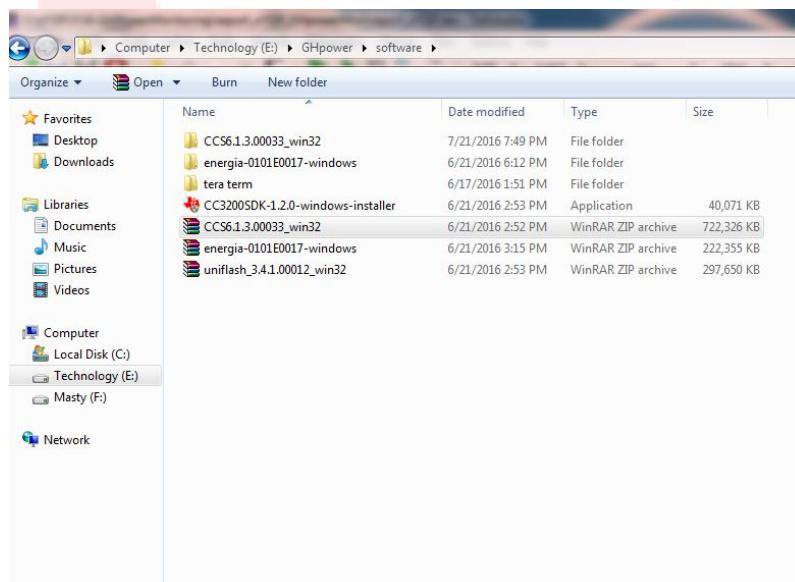
1. Code Composer Studio

- Detail of software: version 6.1.3.00033, [download link](#)
- Installation steps:

- click on the rar file named "CCS6.1.3.00033_win32"



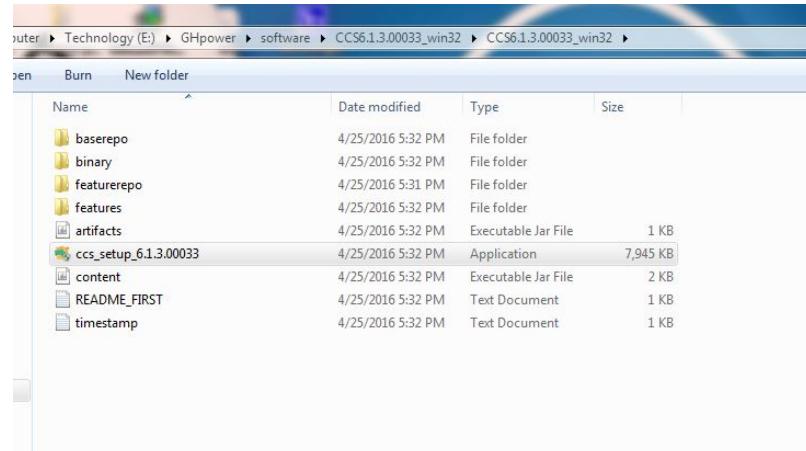
- Now click on the extracted folder



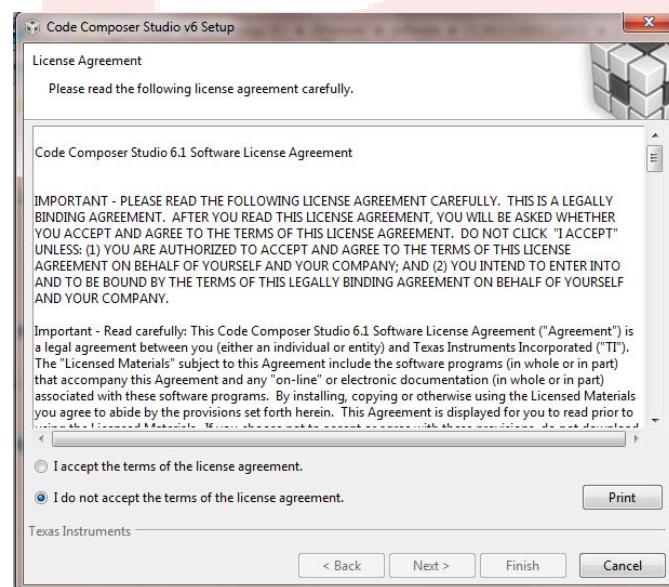


1.4. SOFTWARE USED

- click on the .exe setup file



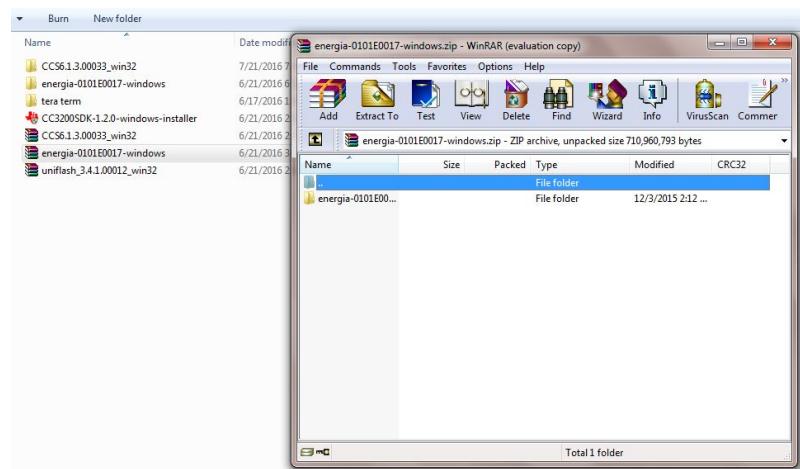
- now continue to click on next till complete installation of Code Composer studio



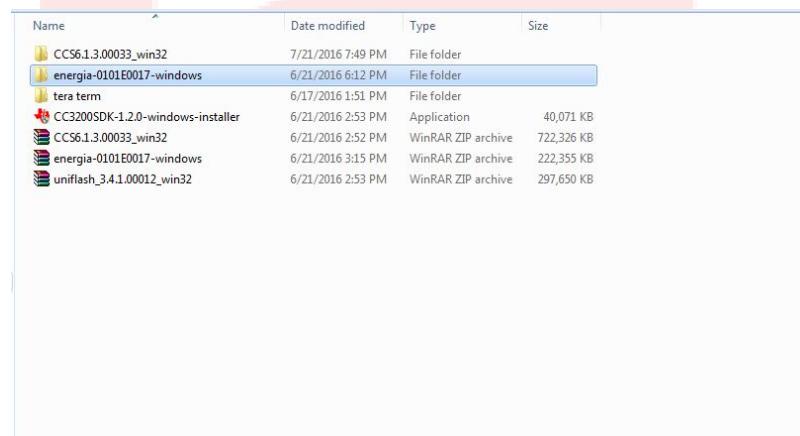


1.4. SOFTWARE USED

- **Energia** – Detail of software: version 6.1.3.00033, [download link](#)
 - Installation steps:
 - click on the rar file named ”*energia-0101E0017-windows*”



- Now click on extracted folder with same name





1.4. SOFTWARE USED

- click on energia .exe application file

A screenshot of a Windows File Explorer window showing the contents of the Energia installation directory. The folder structure includes subfolders like _MACOSX, drivers, examples, hardware, java, lib, reference, tools, and several DLL files. An 'energia - Shortcut' icon is also present.

Name	Date modified	Type	Size
_MACOSX	12/3/2015 1:36 PM	File folder	
drivers	12/3/2015 1:33 PM	File folder	
examples	12/3/2015 1:36 PM	File folder	
hardware	12/3/2015 1:36 PM	File folder	
java	12/3/2015 2:12 PM	File folder	
lib	12/3/2015 2:12 PM	File folder	
reference	12/3/2015 1:36 PM	File folder	
tools	12/3/2015 1:34 PM	File folder	
cygiconv-2.dll	12/3/2015 1:33 PM	Application extens...	947 KB
cygwin1.dll	12/3/2015 1:33 PM	Application extens...	1,829 KB
energia - Shortcut	6/21/2016 6:14 PM	Shortcut	1 KB
energia	12/3/2015 2:12 PM	Application	1,059 KB
libiconv-2.dll	12/3/2015 1:33 PM	Application extens...	1,213 KB
libusb0.dll	12/3/2015 1:33 PM	Application extens...	43 KB
revisions	12/3/2015 1:33 PM	Text Document	28 KB
rxtxSerial.dll	12/3/2015 1:33 PM	Application extens...	76 KB

- code compile upload and enjoy

A screenshot of the Energia IDE showing a sketch named 'sketch_jul21a'. The code consists of a standard 'setup' function with a comment about running once, and a 'loop' function with a comment about running repeatedly. The IDE has a red-themed interface.

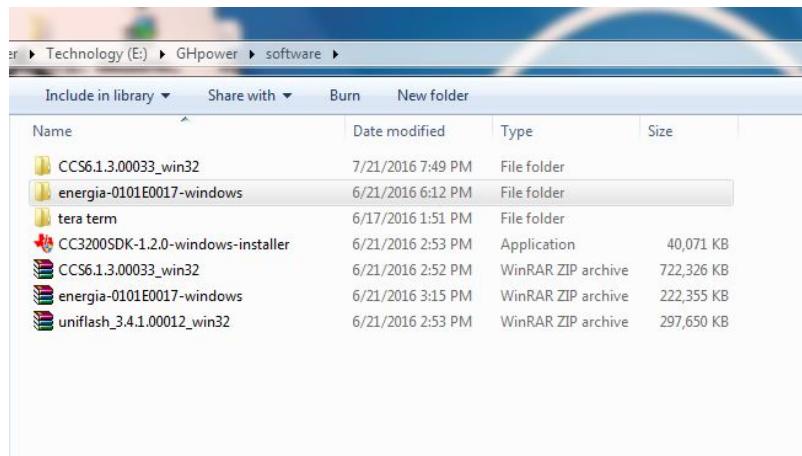
```
sketch_jul21a | Energia 0101E0017
File Edit Sketch Tools Help
sketch_jul21a
void setup()
{
  // put your setup code here, to run once:
}
void loop()
{
  // put your main code here, to run repeatedly:
}
```



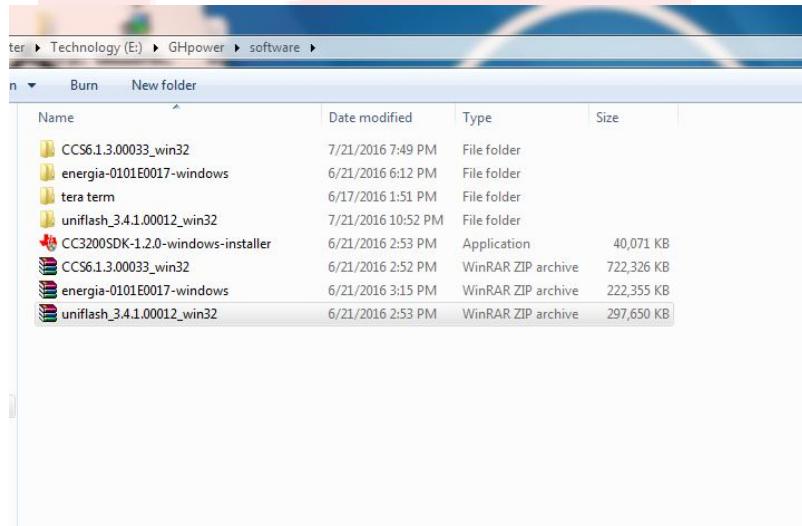
1.4. SOFTWARE USED

2. CCS Uniflash

- Detail of software: version 3.4, [download link](#)
- Installation steps:
 - click on the rar file named "uniflash_3.4.1.00012_win32"



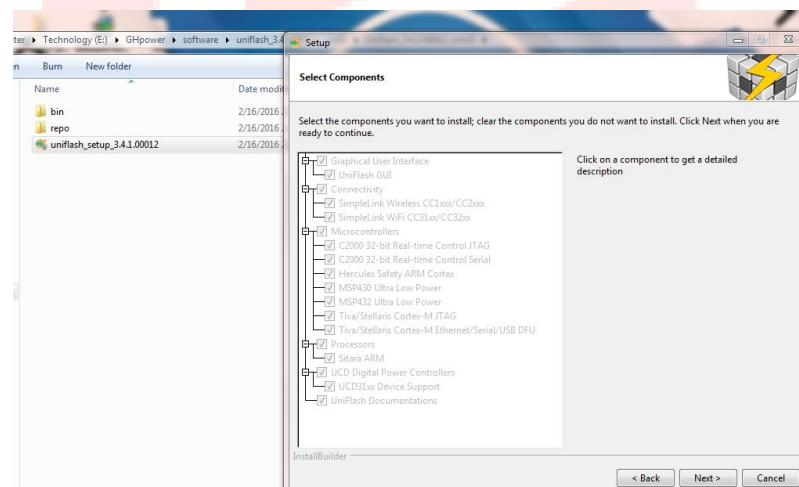
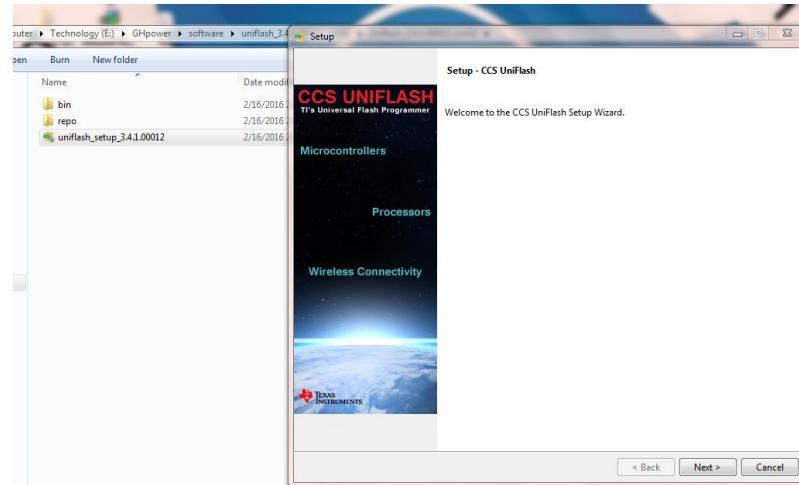
- Now click on extracted folder with same name





1.4. SOFTWARE USED

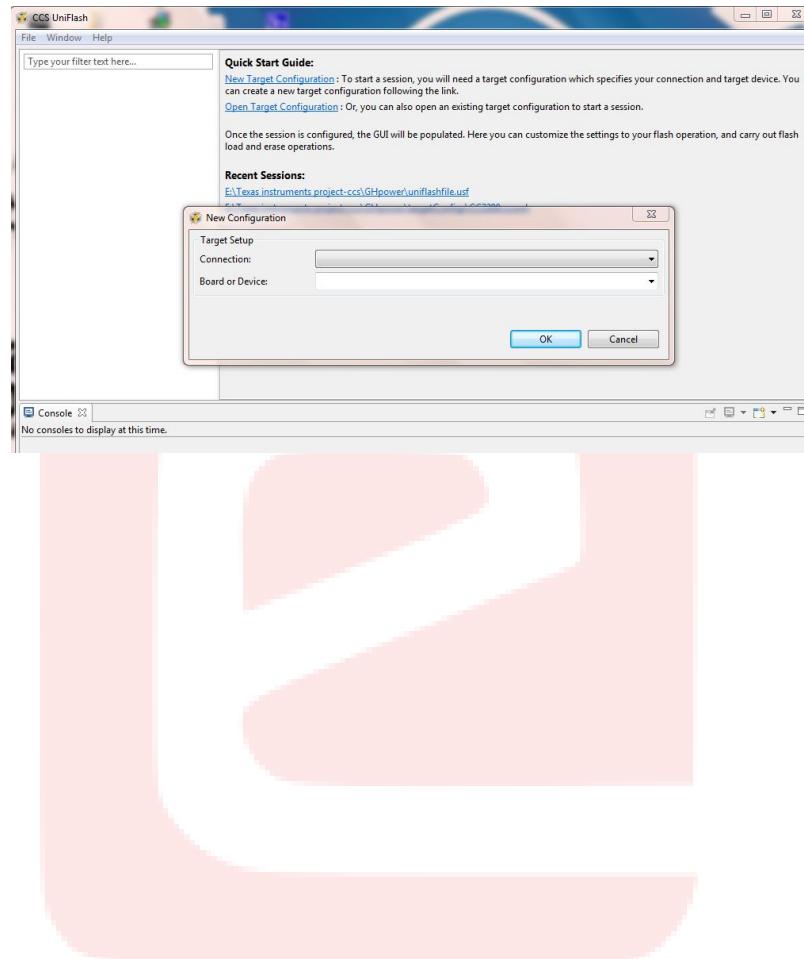
- click on *uniflashwin.exe* application file and continue to click on next till installation complete.





1.4. SOFTWARE USED

- open uniflash, select COM port and make a .ccxml file for cc3200 launchpad

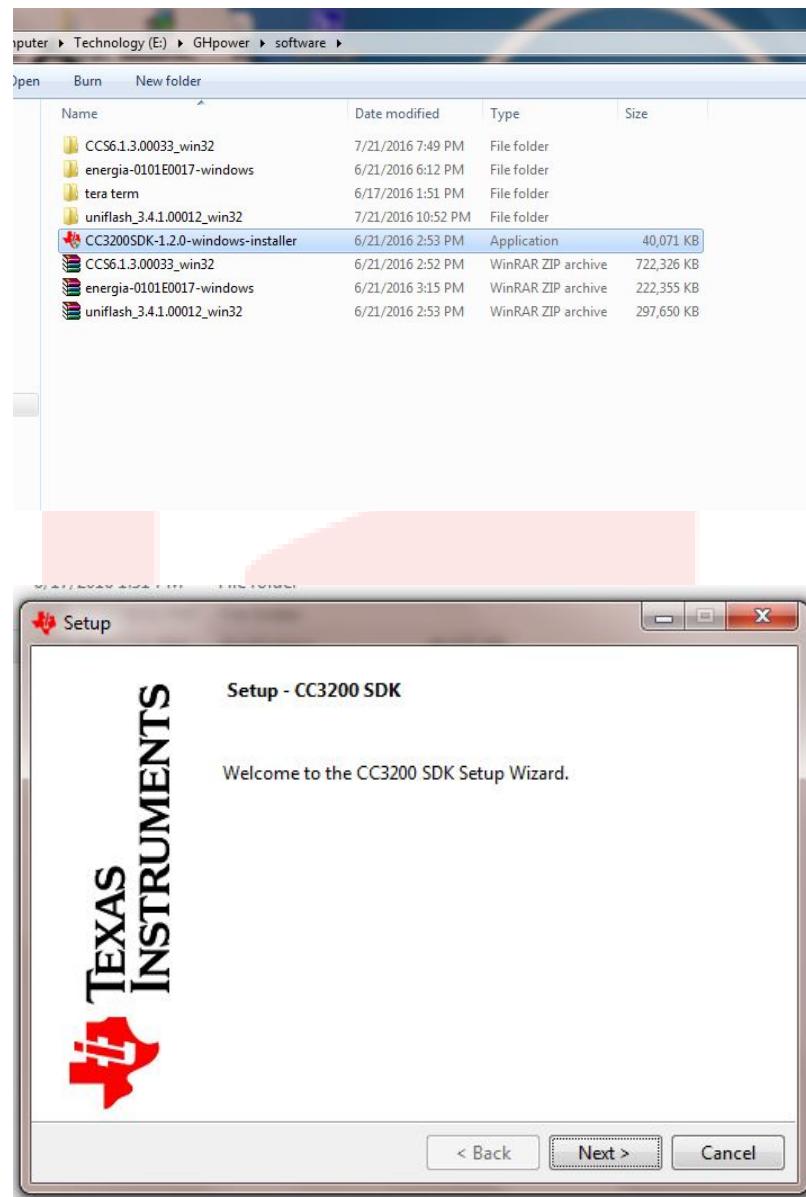




1.4. SOFTWARE USED

3. CC3200 SDK from TI

- Detail of software: version 1.2.0, [download link](#)
- Installation steps:
 - click on CC3200SDK.exe application file and install the sdk by clicking next button till installation complete





1.4. SOFTWARE USED

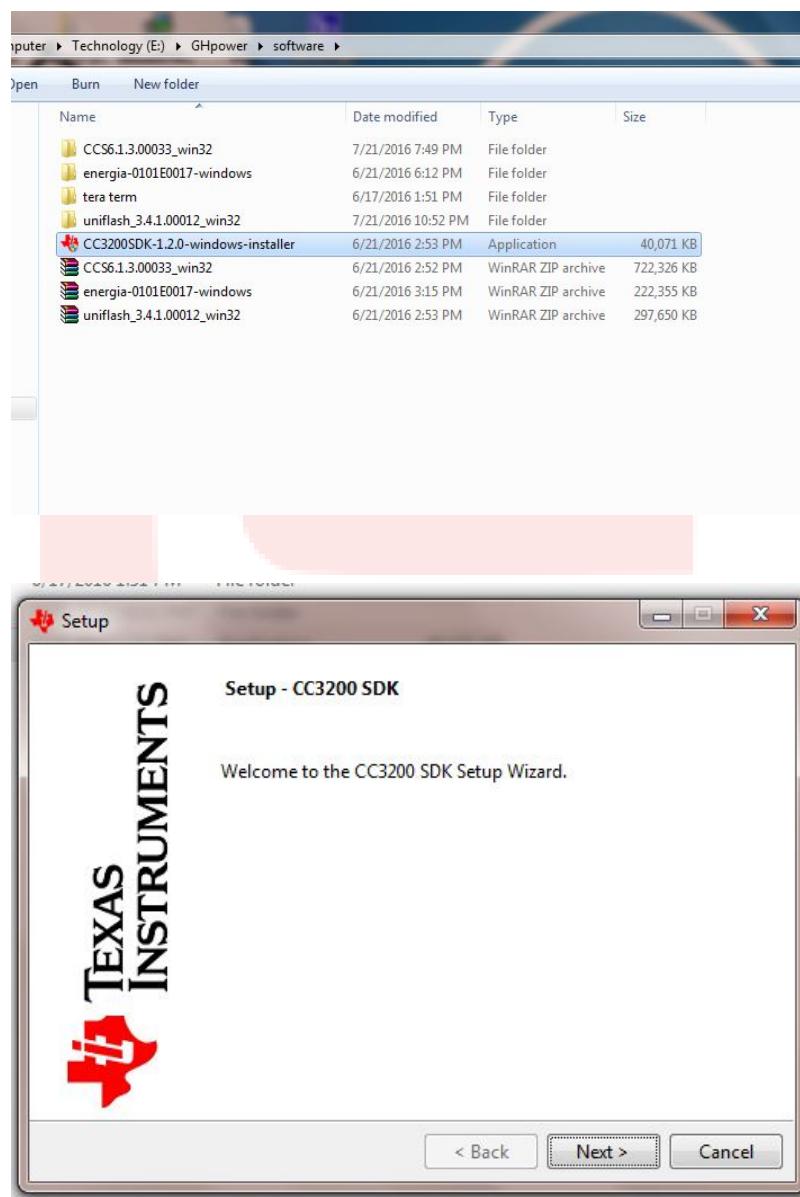
4. CC3200 service pack

- Detail of software: version 1.0.0.1.2, [download link](#)

note:- service pack should be compatible with your launchpad version

- Installation steps:

- click on CC3200SDK.exe application file and install the sdk by clicking next button till installation complete

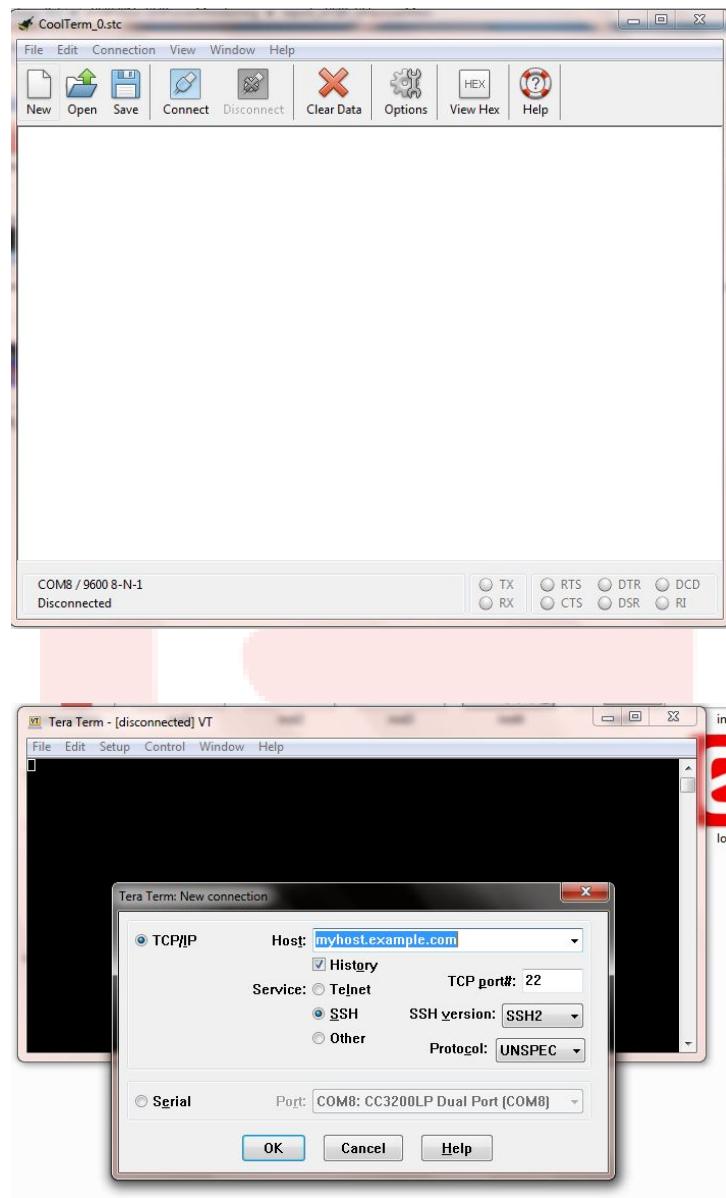




1.4. SOFTWARE USED

5. Terminal softwares: Coolterm & Teraterm

- Detail of software: version 1.4.6, [Coolterm](#)
- Detail of software: version 1.4.6, [Teraterm](#)



1.4. SOFTWARE USED

6. Setting up the environment
 - (a) Software used:Windows OS
 - (b) Version:Windows 10
7. Setting up the Server & Database
 - (a) Software used:XAMPP
 - (b) Version:XAMPP version 3.2.2
 - (c) [XAMPP Download Link](#)
 - (d) [XAMPP Installation steps.](#)

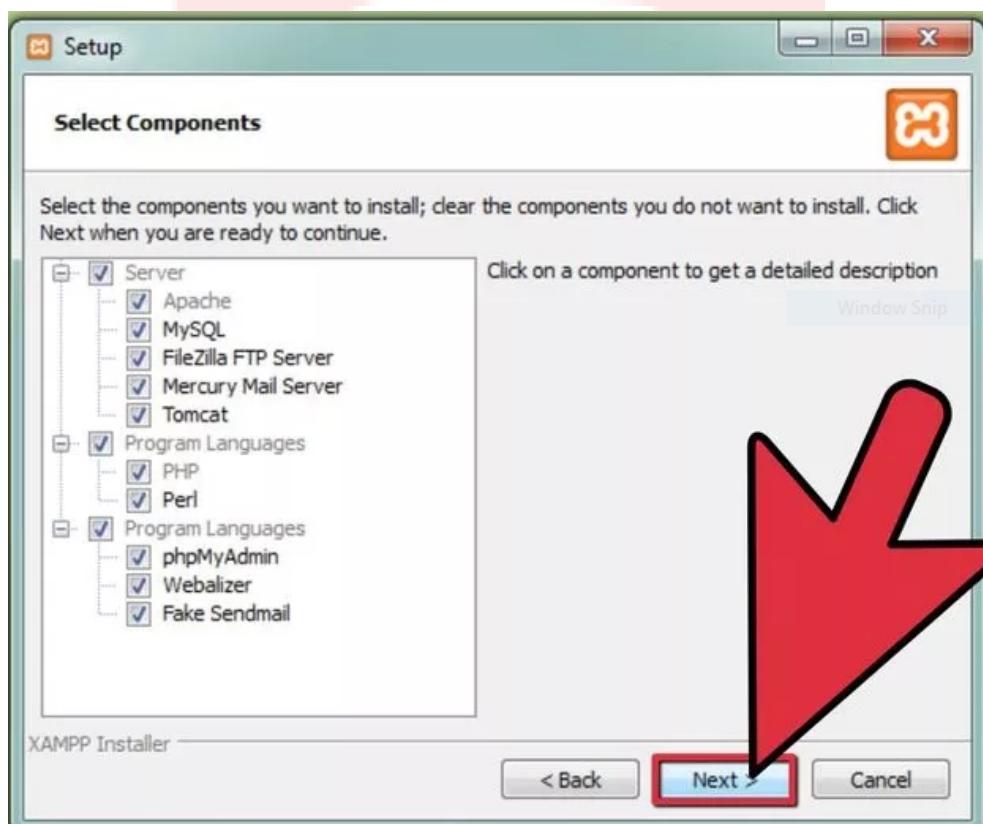


Figure 1.1: Component Selection

1.4. SOFTWARE USED

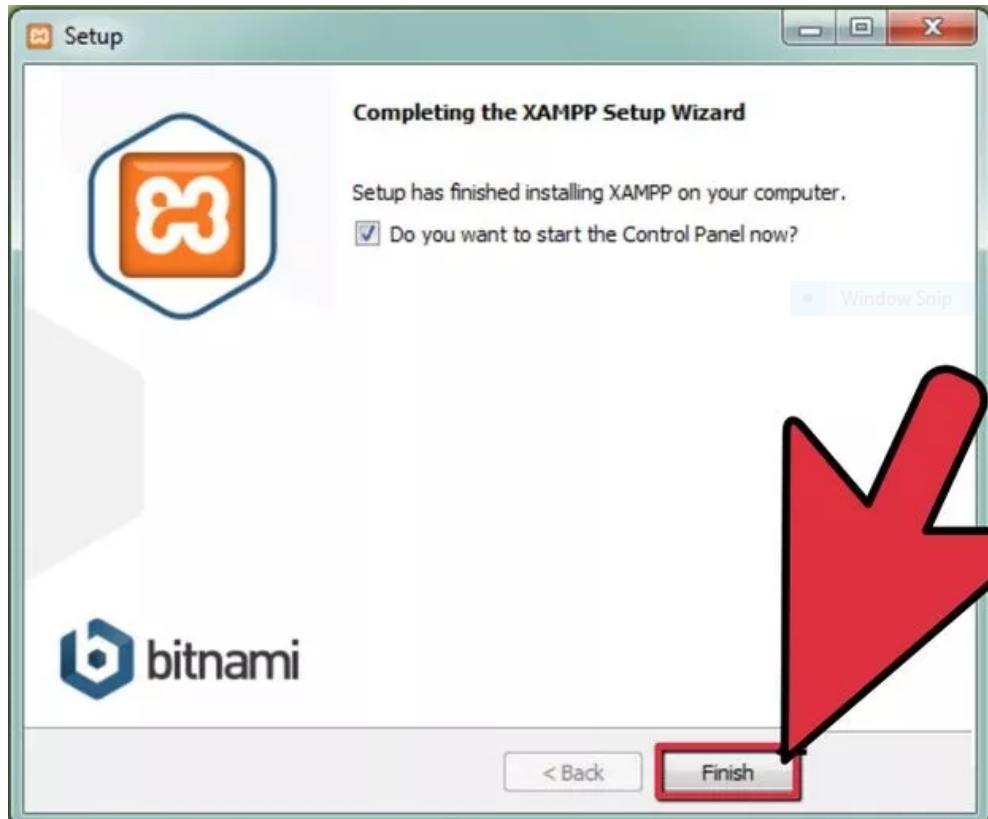


Figure 1.2: Finish Installation



1.4. SOFTWARE USED

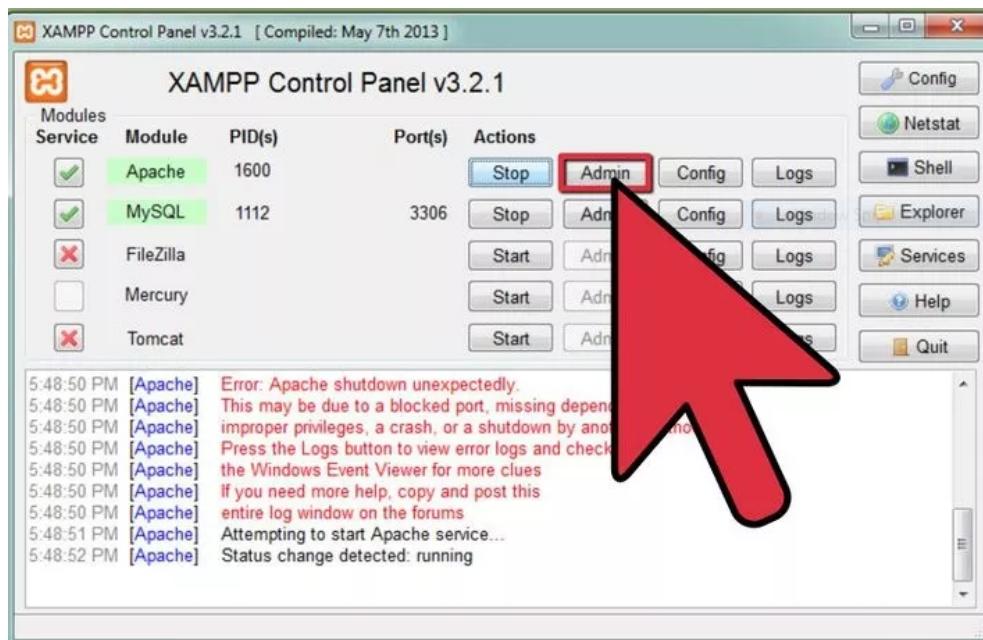


Figure 1.3: Open XAMPP Control Panel

NOTE: If Server rejects connection requests by micro-controller, follow these steps.



1.4. SOFTWARE USED

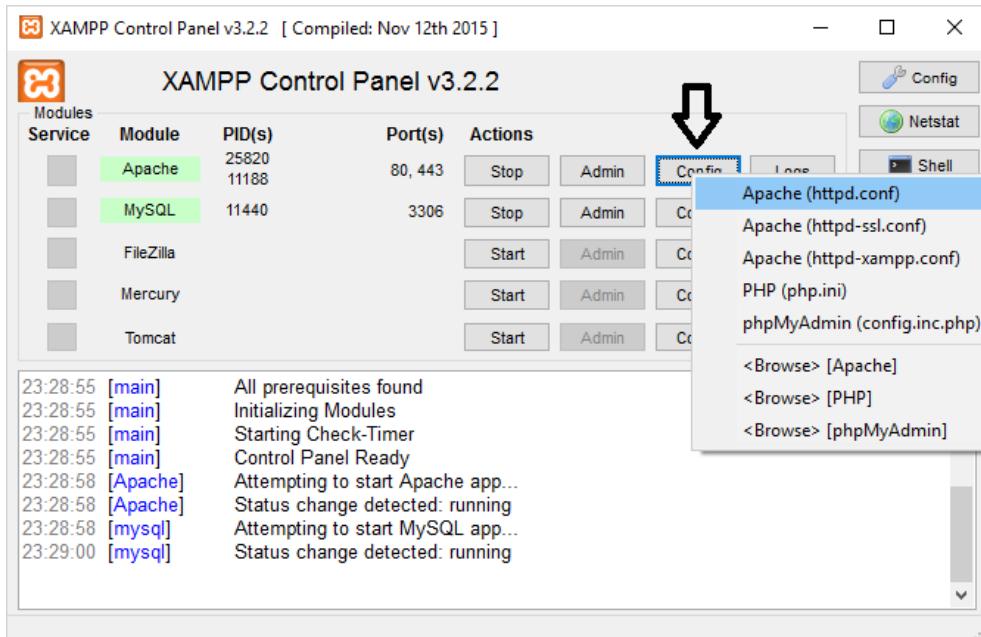


Figure 1.4: Open httpd.conf

- (e) Open httpd.conf file in configuration setting for Apache Server in XAMPP.

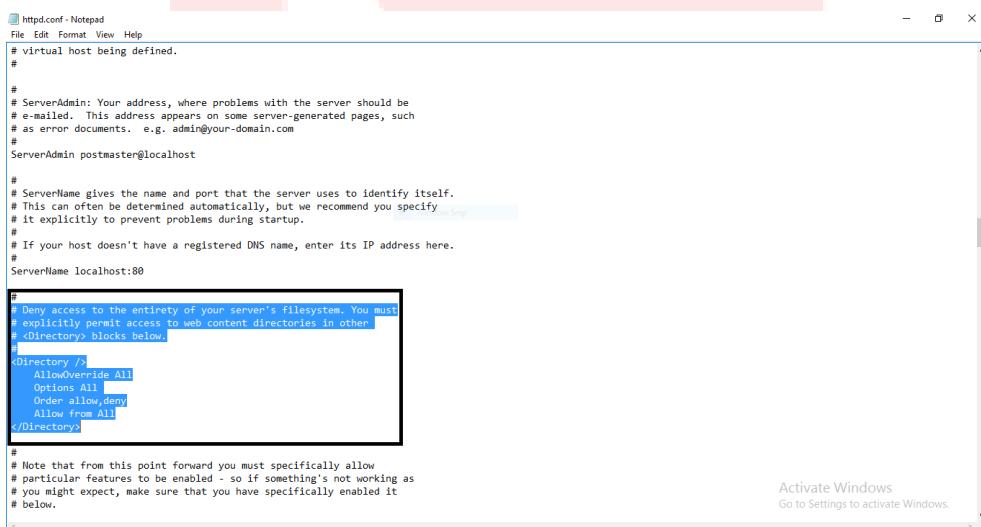


Figure 1.5: Change httpd.conf

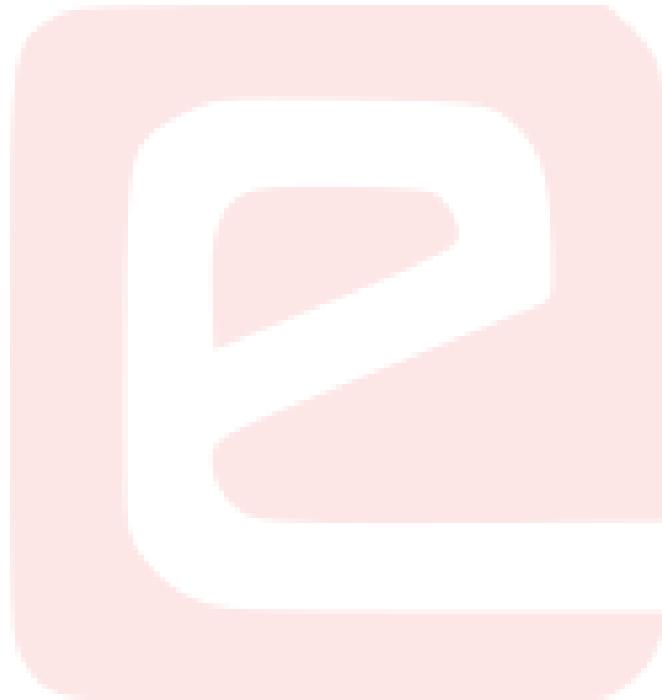
- (f) Set
AllowOverrideAll



1.4. SOFTWARE USED

*OptionsAll
Orderallow, deny
AllowfromAll*

8. Setting up the Editor
 - (a) Software used: Notepad++ v6.9.2
 - (b) [Notepad++ v6.9.2 Download Link](#)

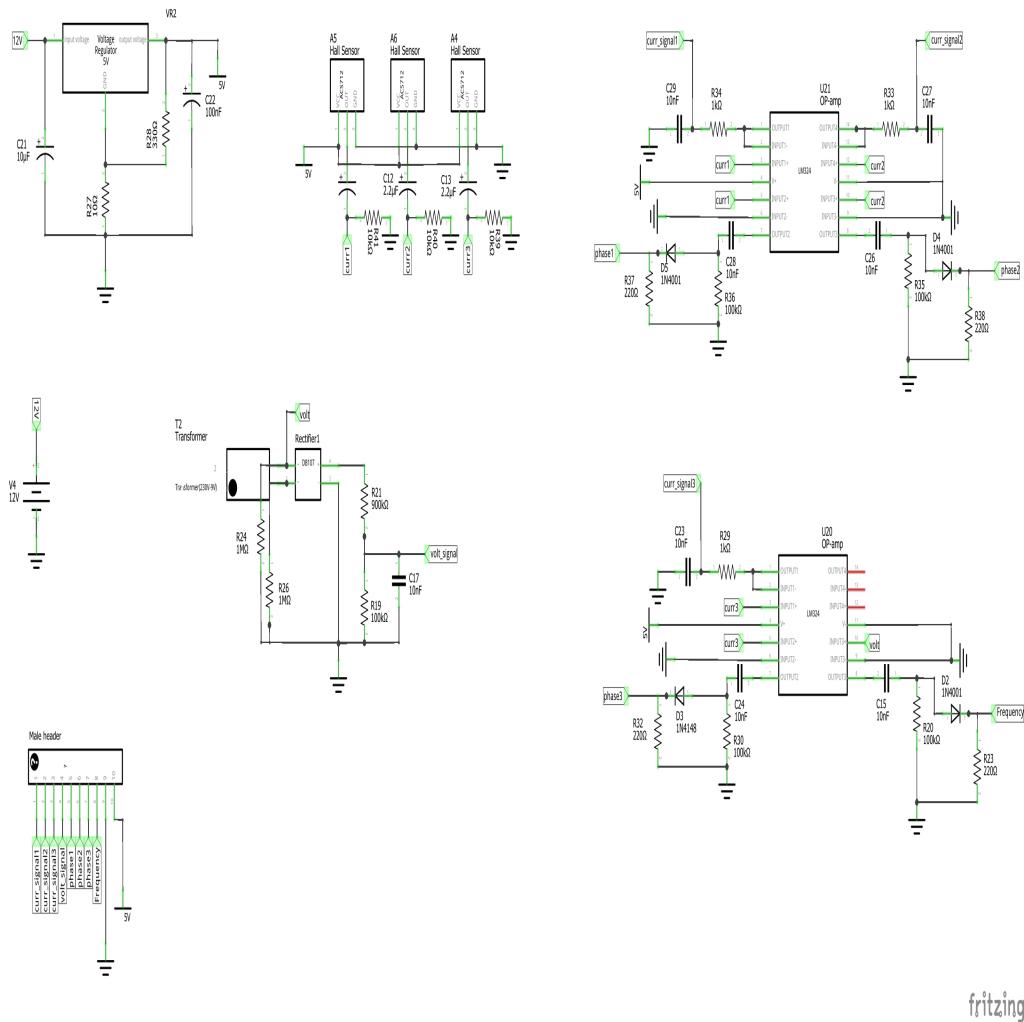


1.5. ASSEMBLY OF HARDWARE

1.5 Assembly of hardware

Circuit diagram and Steps of assembly of hardware with pictures for each step

Circuit Diagram



1.5. ASSEMBLY OF HARDWARE

Step 1

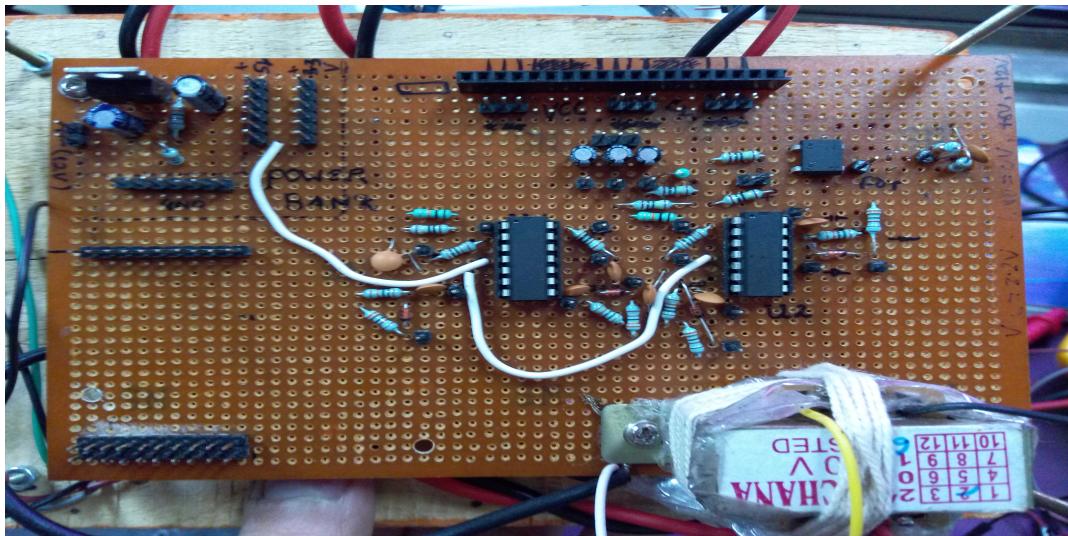
Make a basic switch board which has two plug and one bulb holder mounted on it as shown in figure below



1.5. ASSEMBLY OF HARDWARE

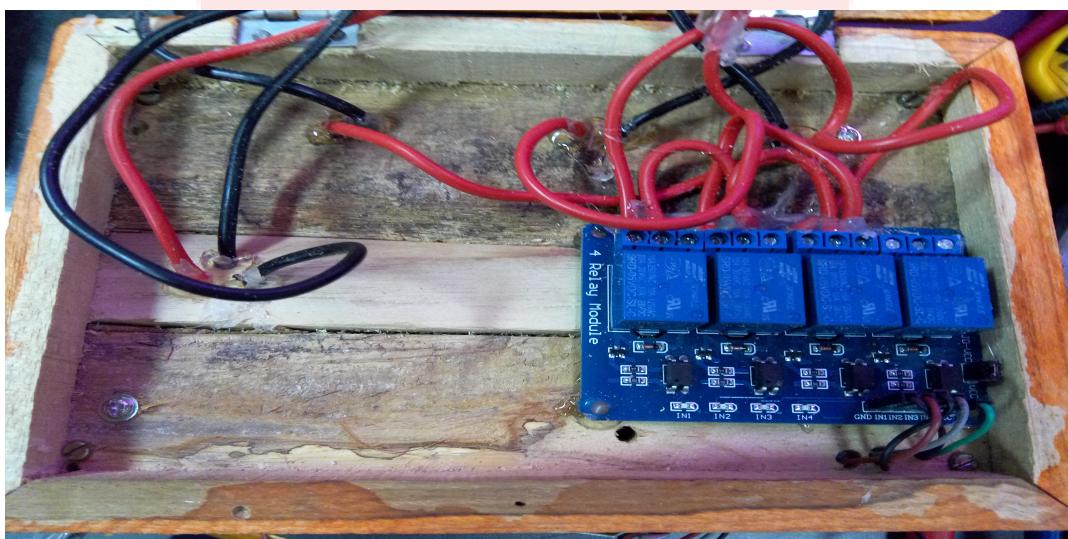
Step 2

Now assemble the "measurementboard" with the switch board at the location of your convenience. Make sure you have fixed the measurement board permanently with switch board as shown in figure below.



Step 3

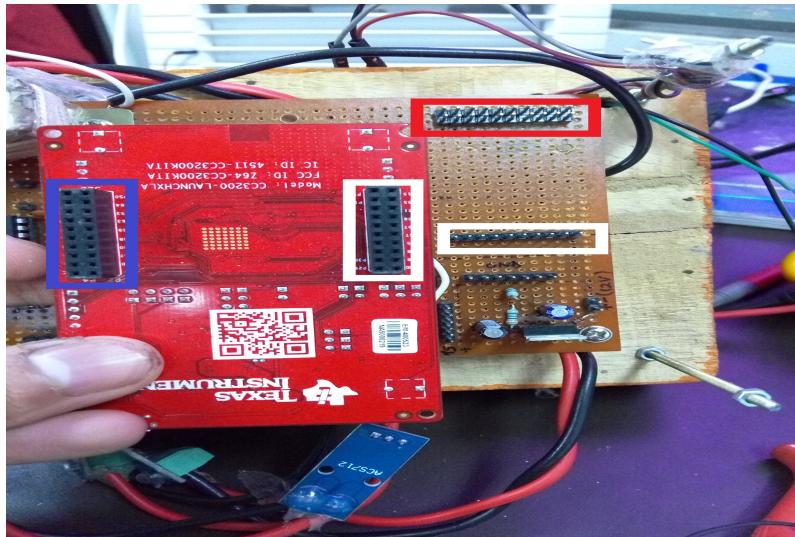
Now connect and fix relay board with switch board at the location of your convenience as show in figure below



1.5. ASSEMBLY OF HARDWARE

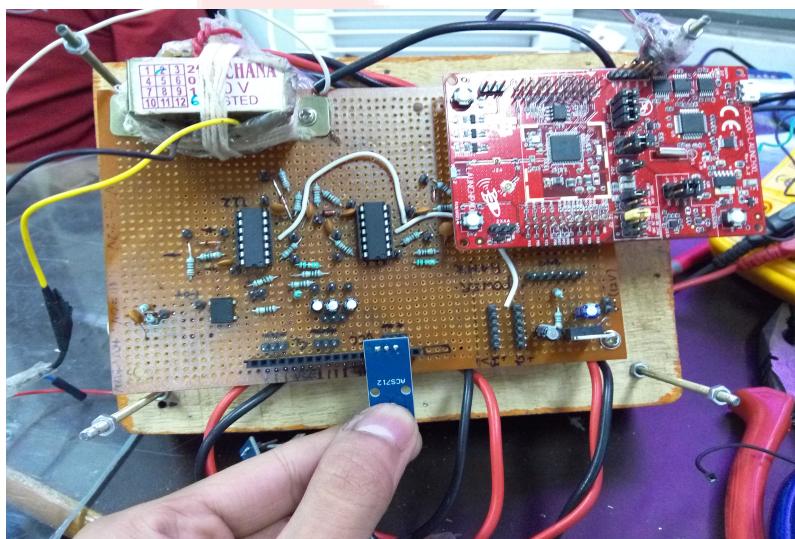
Step4

Now connect the *CC3200 – launchpad* at the male headers 21 and 22. For more detail see board manual [Figure 1.7](#)



Step5

Now connect all the three hall sensor at pin number 1,2 and 3 appropriately on measurement board. for more detail see board manual [Figure 1.7](#)





1.5. ASSEMBLY OF HARDWARE

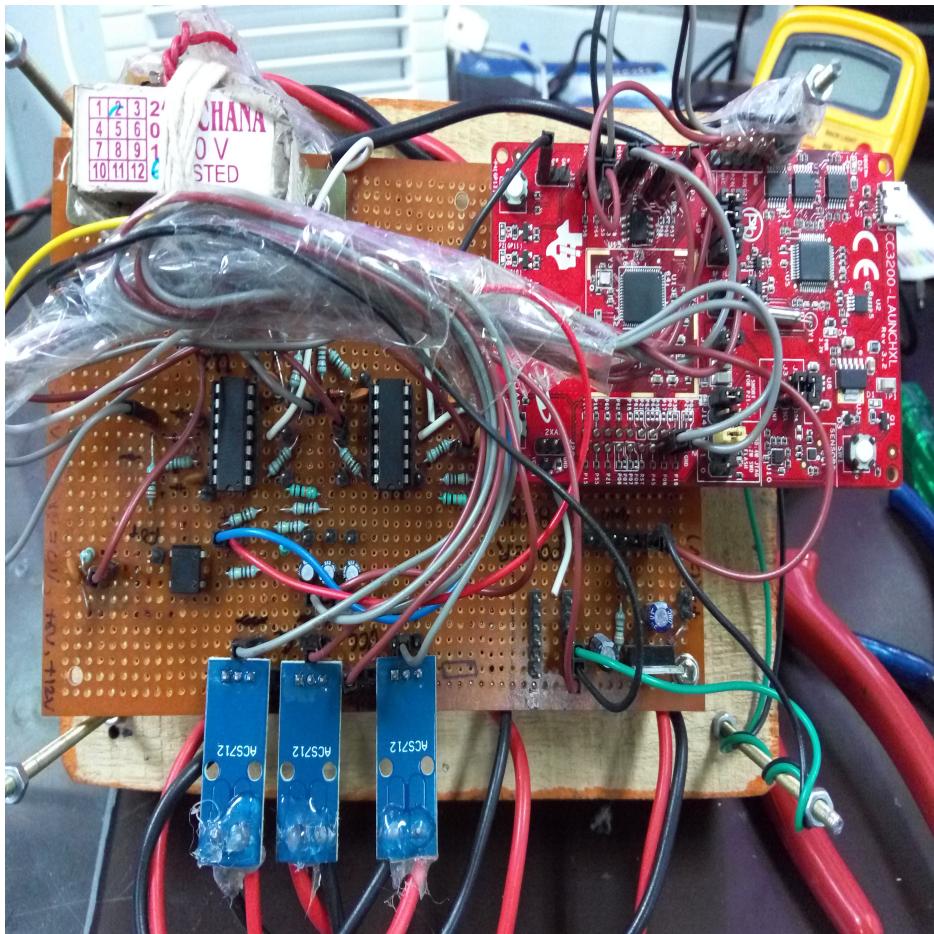
Step6

Now connect *cc3200-launchpad* and *Transformer* with measurement board using female jumper as described below:

- connect (pin1,pin4),(pin2,pin5) and (pin3,pin7) on the measurement board.
- connect pin7 and pin8 with the transformer output jumper.
- connect pin9 of measurement board to *PIN59* of cc3200 launchpad.
- connect pin17 of measurement board to *PIN05* of cc3200 launchpad.
- connect pin10 of measurement board to *PIN58* of cc3200 launchpad.
- connect pin12 of measurement board to *PIN18* of cc3200 launchpad.
- connect pin14 of measurement board to *PIN60* of cc3200 launchpad.
- connect pin15 of measurement board to *PIN08* of cc3200 launchpad.
- connect 5V and 3.3V pins of measurement board to 5V and *Vcc* pins of cc3200 launchpad.
- connect "Vcc" and "GND" of relay board with "5V" and "GND" of measurement board.
- connect the input pins of relay with *PIN64*, *PIN01* and *PIN02* of CC3200 launchpad.



1.5. ASSEMBLY OF HARDWARE



for more detail about pin connection see board manual [Figure 1.7](#)

Step7

Now connect some more accessories to improve mechanical design and your **”Smart switch board”** is ready to use.



1.6. SOFTWARE AND CODE

1.6 Software and Code

[Github link](#) for the repository of code.

- Sending measured Data to server

The screenshot shows the CoolTerm software interface. The title bar reads "CoolTerm_0.stc". The menu bar includes File, Edit, Connection, View, Window, and Help. The toolbar contains icons for New, Open, Save, Connect, Disconnect, Clear Data, Options, HEX, View Hex, and Help. The main window displays a terminal session. The user has sent the string "111" followed by "hii". The server responded with its configuration headers and then repeated the "hii" message. At the bottom, it shows the connection details: COM8 / 9600 8-N-1 and Connected 00:12:29, along with status indicators for TX, RX, RTS, CTS, DTR, DSR, DCD, and RI.

```
Date: Sat, 23 Jul 2016 07:05:42 GMT
Server: Apache/2.4.17 (Win32) OpenSSL/1.0.2d PHP/5.6.21
X-Powered-By: PHP/5.6.21
Content-Length: 3
Connection: close
Content-Type: text/html; charset=UTF-8

111
hii

Starting connection to server...
connected to server
GET /GHpowermon/action.php?cur=0.42&cur2=0.35&cur3=0.00&pha=355.8&pha2=227.2&pha3=000.0&vol=
240.54&fre=49.9176&ds1=1&ds2=1&ds3=0&c=0 HTTP/1.1
HTTP/1.1 200 OK
Date: Sat, 23 Jul 2016 07:05:46 GMT
Server: Apache/2.4.17 (Win32) OpenSSL/1.0.2d PHP/5.6.21
X-Powered-By: PHP/5.6.21
Content-Length: 3
Connection: close
Content-Type: text/html; charset=UTF-8

111

COM8 / 9600 8-N-1
Connected 00:12:29
TX RTS DTR DCD
RX CTS DSR RI
```

Figure 1.6: Cool Term - 1

- *action.php* is the page accessed by the micro-controller, which in turn updates the database according to the data acquired.
- CC3200 uses queries to POST data and updates current values for devices 1,2,3 using *cur*, *cur2*, *cur3*, updates voltage using *vol*, frequency using *fre*, phase of three devices using *pha*, *pha2*, *pha3*.



1.6. SOFTWARE AND CODE

- logging the data
 - *action.php* is also capable of logging in database, it mainly updates two tables in database.
 - * Table name - *reading*, It holds data under the columns *id*(Auto Increment), *Current1*, *Current2*, *Current3*, *Voltage*, *Frequency*, *Phase1*, *Phase2*, *Phase3*, *reg_date* (Auto time stamp)

	<input type="checkbox"/> Edit <input type="checkbox"/> Copy <input type="checkbox"/> Delete	<input type="checkbox"/> id	1	Current1	Current2	Current3	Voltage	frequency	Phase1	Phase2	Phase3	reg_date
		12476		0	0	0	232.68	49.99	0	0	0	2016-07-19 15:21:22
		12477		0	0	0	232.68	50.0751	0	0	0	2016-07-19 15:21:26
		12478		0	0	0	232.74	49.7363	0	0	0	2016-07-19 15:21:30
		12479		0	0	0	232.73	50.0075	0	0	0	2016-07-19 15:21:34
		12480		0	0	0	232.58	50	0	0	0	2016-07-19 15:21:38
		12481		0	0	0	232.6	49.97	0	0	0	2016-07-19 15:21:42
		12482		0	0	0	232.56	49.9925	0	0	0	2016-07-19 15:21:46
		12483		0	0	0	232.6	50	0	0	0	2016-07-19 15:21:50
		12484		0	0	0	232.8	50.0625	0	0	0	2016-07-19 15:21:54
		12485		0	0	0	232.63	50.02	0	0	0	2016-07-19 15:21:58
		12486		0	0	0	232.69	49.9375	0	0	0	2016-07-19 15:22:02
		12487		0	0	0	232.6	50.0225	0	0	0	2016-07-19 15:22:06
		12488		0	0	0	232.87	50.0575	0	0	0	2016-07-19 15:22:10
		12489		0	0	0	232.76	49.97	0	0	0	2016-07-19 15:22:14
		12490		0	0	0	0	0	0	0	0	2016-07-19 15:27:40
		12491		0	0	0	0	0	0	0	0	2016-07-19 15:27:43

Figure 1.7: Database table - *reading*

- * Table name - *para*, It only keeps the latest value under columns *RT*, in front of different row ids assigned to it.



1.6. SOFTWARE AND CODE

		id	parameters	reg_date	▲ 1	RT
<input type="checkbox"/>		1	Current	2016-07-19 15:27:43		0
<input type="checkbox"/>		2	Current2	2016-07-19 15:27:43		0
<input type="checkbox"/>		3	Current3	2016-07-19 15:27:43		0
<input type="checkbox"/>		4	Voltage	2016-07-19 15:27:43		0
<input type="checkbox"/>		5	Frequency	2016-07-19 15:27:43		0
<input type="checkbox"/>		6	Phase	2016-07-19 15:27:43		0
<input type="checkbox"/>		7	Phase2	2016-07-19 15:27:43		0
<input type="checkbox"/>		8	Phase3	2016-07-19 15:27:43		0

Check all With selected:

Show all | Restore column order | Number of rows: 25 Filter rows:

Figure 1.8: Database table - *para*

1.6. SOFTWARE AND CODE

- Real Time Plotting Graphs
 - *current.html* makes AJAX requests to *refresh.php* which connects to database and updates it with latest data.
 - With the latest data made available continuously, Real Time updating graphs can be plotted.
 - As the *chart.js* will need data in JSON format, it requests to *action_page.php* to fulfill this requirement.

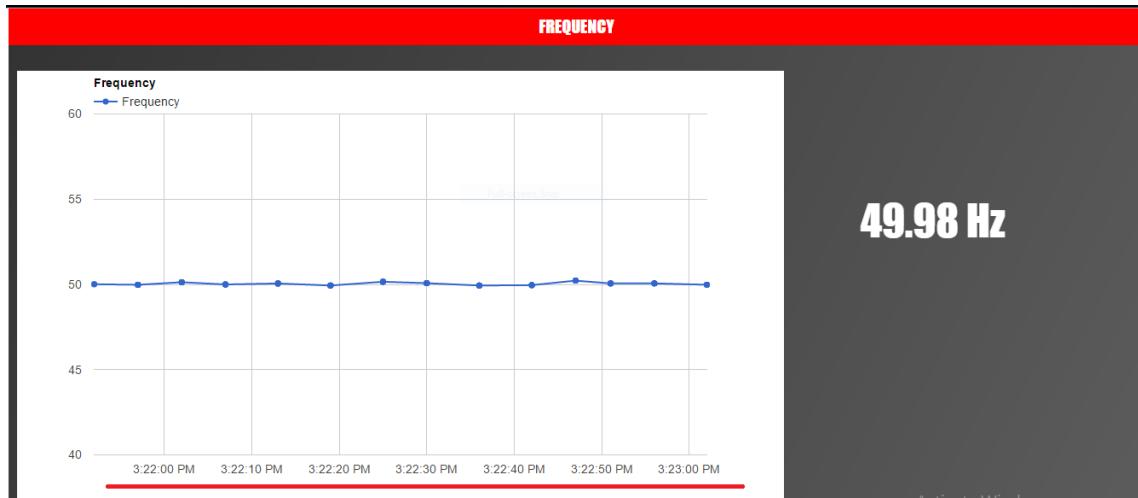


Figure 1.9: Real Time Frequency plot at 3 : 22



1.6. SOFTWARE AND CODE



Figure 1.10: Real Time Frequency plot at 4 : 02

- Plotting the logged data
 - The logged data is gathered and converted into JSON by *action_graph_week.php*



Figure 1.13: Logged Voltage Data



1.6. SOFTWARE AND CODE

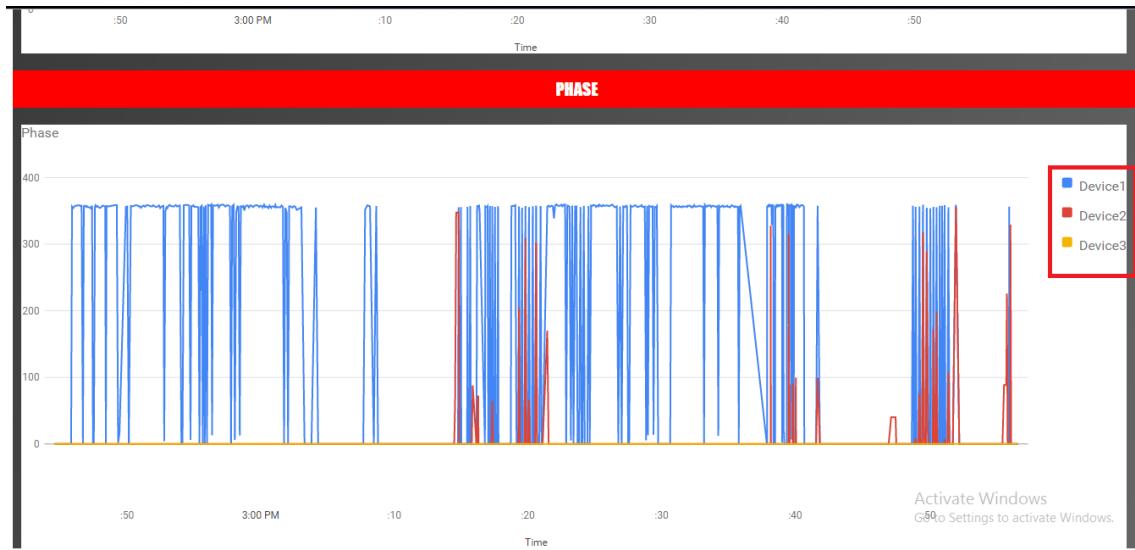


Figure 1.11: Logged Phase data



Figure 1.12: Logged Frequency Data



1.6. SOFTWARE AND CODE



Figure 1.14: Logged Current Data

- The graph is plotted by *stable_chart_loop.js* which creates a graph according to datatable generated after user selected a particular period.

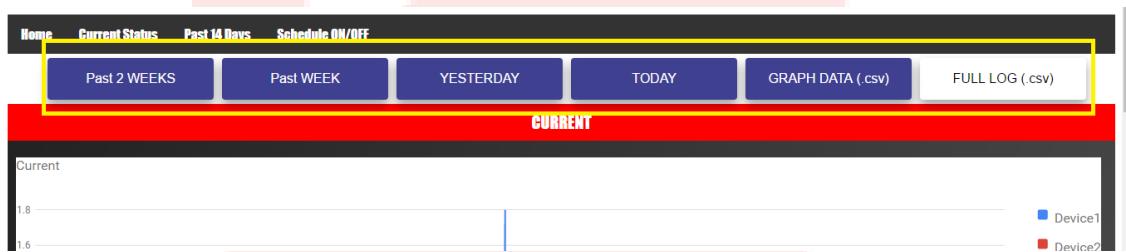


Figure 1.15: Selection Buttons

- As shown in above image, user can select the period ,which will then accordingly request and generate JSON data required for *stable_chart_loop.js*
- The graph can be selectively highlighted and observed with timestamp and value on tool-tip.

1.6. SOFTWARE AND CODE



Figure 1.16: Selective view of graphs for multiple devices.

- Feedback System.
 - In request cc3200 also provides feedback using $ds1, ds2, ds3$
 - In response server will update it with a boolean sequence for eg. 100, 110, 000... indicating switch status for each one of the 3 devices
 - Then the server waits for feedback in next request, which are provided by cc3200 in variables $ds1, ds2, ds3$

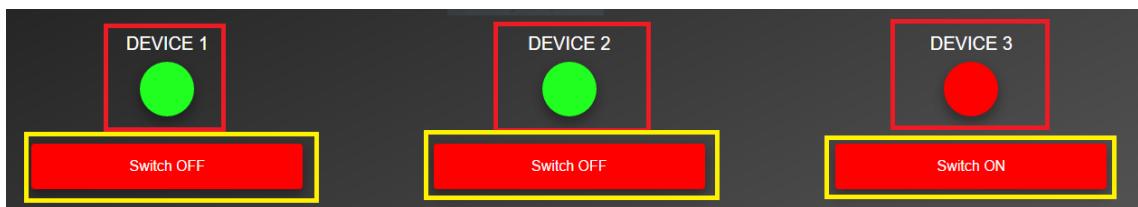


Figure 1.17: Feedback system

- The above image shows circular blocks which shows current device status according to the board, obtained in request.



1.6. SOFTWARE AND CODE

If a device is showing OFF when it should be ON or showing ON when it should be off, then fallacy can be detected. It indicates that maybe there is no device or it is not functioning properly

- Scheduling and Control
 - The scheduling page allows user to schedule ON and OFF (as Radio buttons) and selection 'FROM' time and 'TO' time using input text field and datetimepicker.

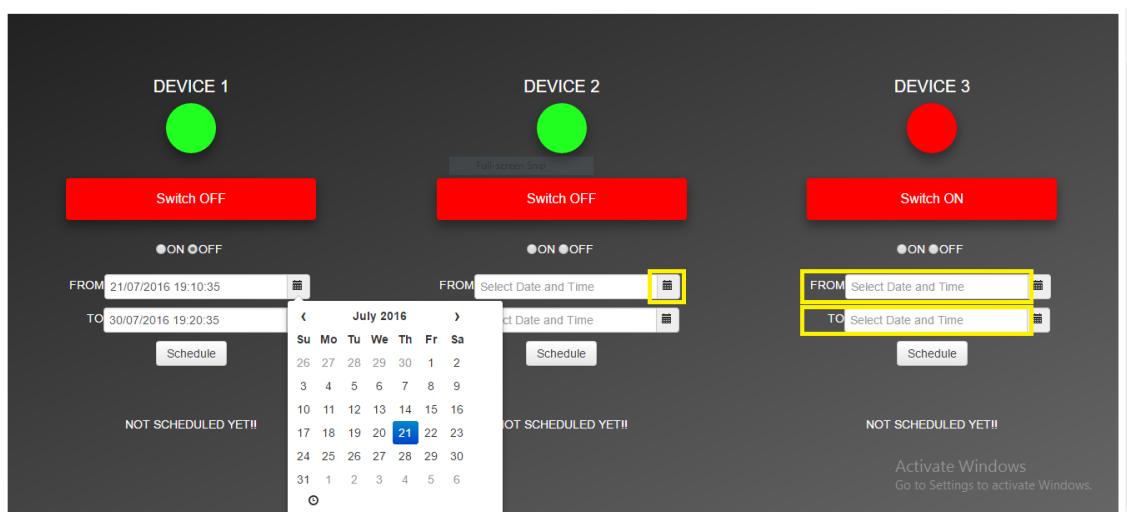


Figure 1.18: ON/OFF Scheduler

- The Scheduling datetime is submitted to *selection.php* which update values in database, which are then further compared with every timestamp and a boolean string response for connected devices



1.6. SOFTWARE AND CODE

	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	<input type="button" value="Export"/>
	<input type="checkbox"/> Check all With selected:	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	<input type="button" value="Export"/>
<input type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	1 2016-07-19 14:30:46 2016-07-19 14:29:46 2016-07-19 14:50:09		1	
<input type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	2 2016-07-11 22:19:15 2016-07-30 22:19:15 2016-07-18 22:31:52		1	
<input type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	3 2016-07-11 22:19:26 2016-07-11 22:19:26 2016-07-18 22:37:24		1	

Show all | Number of rows: 25 | Filter rows: Search this table

Query results operations

Figure 1.19: Database Table *scheduled*

- Initial status of *button_change* is 1, which means scheduling is inactive.

	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	<input type="button" value="Export"/>
	<input type="checkbox"/> Check all With selected:	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	<input type="button" value="Export"/>
<input type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	1 2016-07-21 19:10:35 2016-07-30 19:20:35 2016-07-21 19:11:00		1	
<input type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	2 2016-07-11 22:19:15 2016-07-30 22:19:15 2016-07-18 22:31:52		1	
<input type="checkbox"/>	<input type="button" value="Edit"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/>	3 2016-07-11 22:19:26 2016-07-11 22:19:26 2016-07-18 22:37:24		1	

Show all | Number of rows: 25 | Filter rows: Search this table

Query results operations

Figure 1.20: Database Table updated values in table

- Initial status of *button_change* is 0, with updated values of *Switch_on* time and *Switch_off* time(Scheduled values on left frame for reference).
- As *Switch_off* Time is smaller than *Switch_on* time, the Scheduler will automatically Switch OFF the device and wait for next Switch ON command.
- Buttons are available for all three devices, which have the capability to switch devices off/on.



1.6. SOFTWARE AND CODE

	id	button	button_2	button_3	d_status1	d_status2	d_status3	Choice
	1	1	1	1	0	0	0	4

Figure 1.21: Database table *Power*

- The button data is submitted to *button_status.php*, *button_status2.php*, *button_status.php3* with a value for variable *q*. which upadates the above shown table.



1.7. USE AND DEMO

1.7 Use and Demo

- Configure the Smart Switch-board using terminal based GUI

```

Connection: Direct
Content-Type: text/html; charset=UTF-8

111
*****
WELCOME TO EYANTRA'S SMART PLUG PORTAL
*****
Choose following options for configuration:-
1) Wifi-Configuration
2) Email-Configuration
3) Mode Configuration
4) Security Options
5) Signout from portal
Choose option>
|
```

COM8 / 9600 8-N-1
Connected 00:06:17

TX	RTS	DTR	DCD
RX	CTS	DSR	RI

Figure 1.22: Coolterm - 2

```

111
*****
WELCOME TO EYANTRA'S SMART PLUG PORTAL
*****
Choose following options for configuration:-
1) Wifi-Configuration
2) Email-Configuration
3) Mode Configuration
4) Security Options
5) Signout from portal
Choose option>
Choose following options for Wifi-Configuration:-
1) Change SSID
2) Change Password
3) Change Network Mode
4) Go to main menu
Choose option>
```

COM8 / 9600 8-N-1
Connected 00:06:51

TX	RTS	DTR	DCD
RX	CTS	DSR	RI

Figure 1.23: Coolterm - 3



1.7. USE AND DEMO

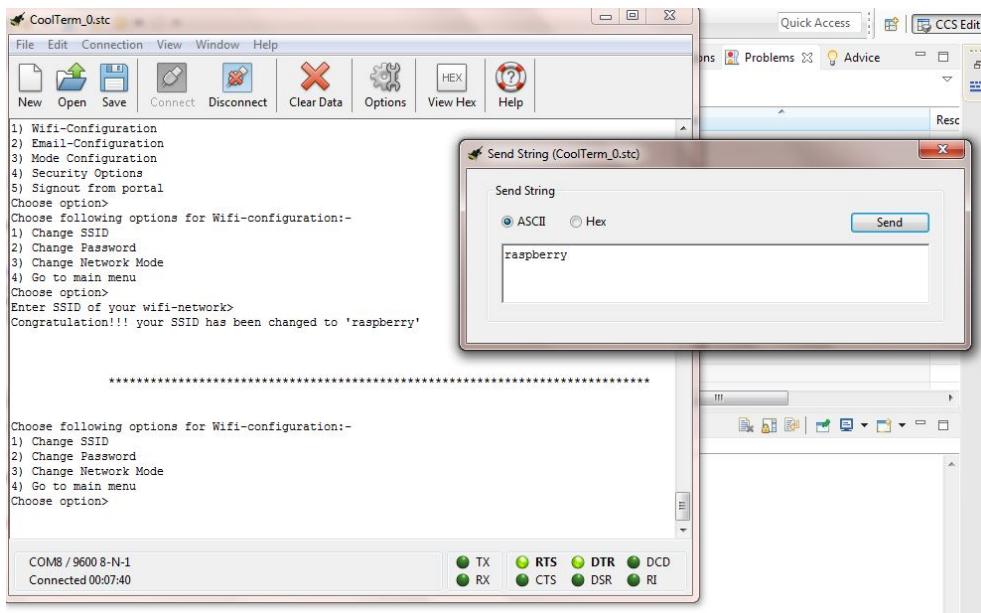


Figure 1.24: Coolterm - 4

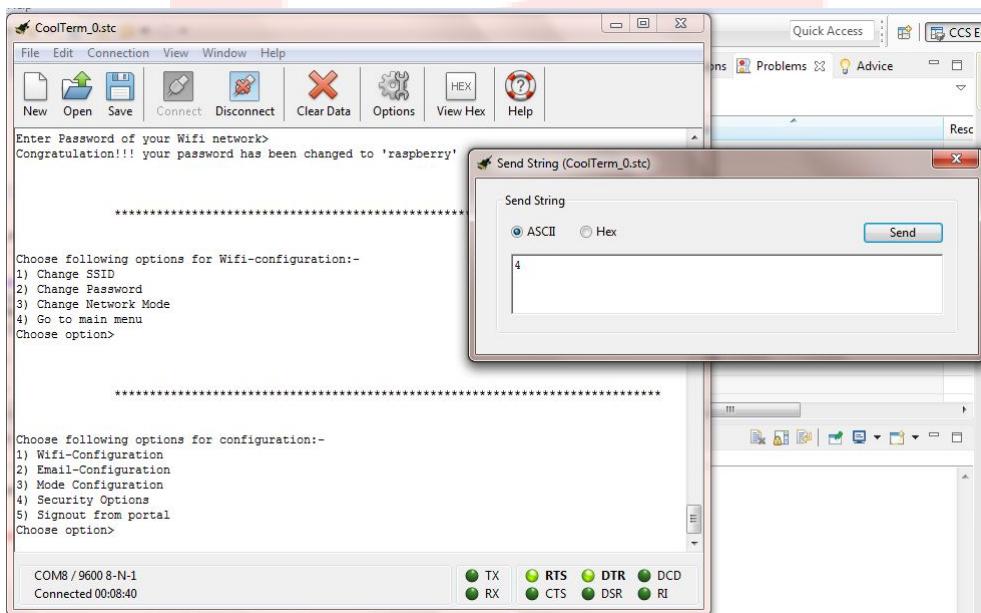


Figure 1.25: Coolterm - 5



1.7. USE AND DEMO

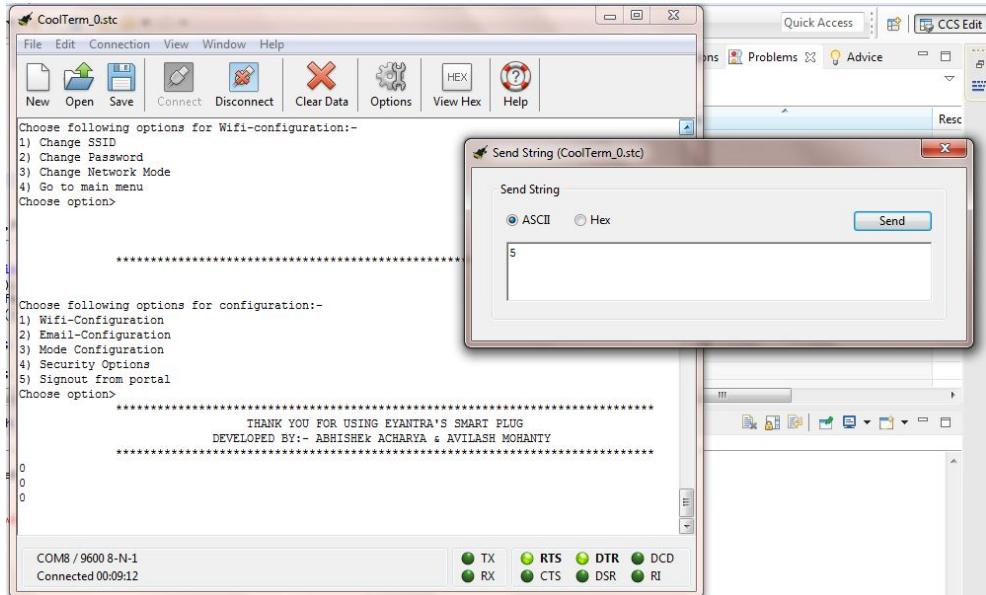


Figure 1.26: Coolterm - 6

- Open the webpage.

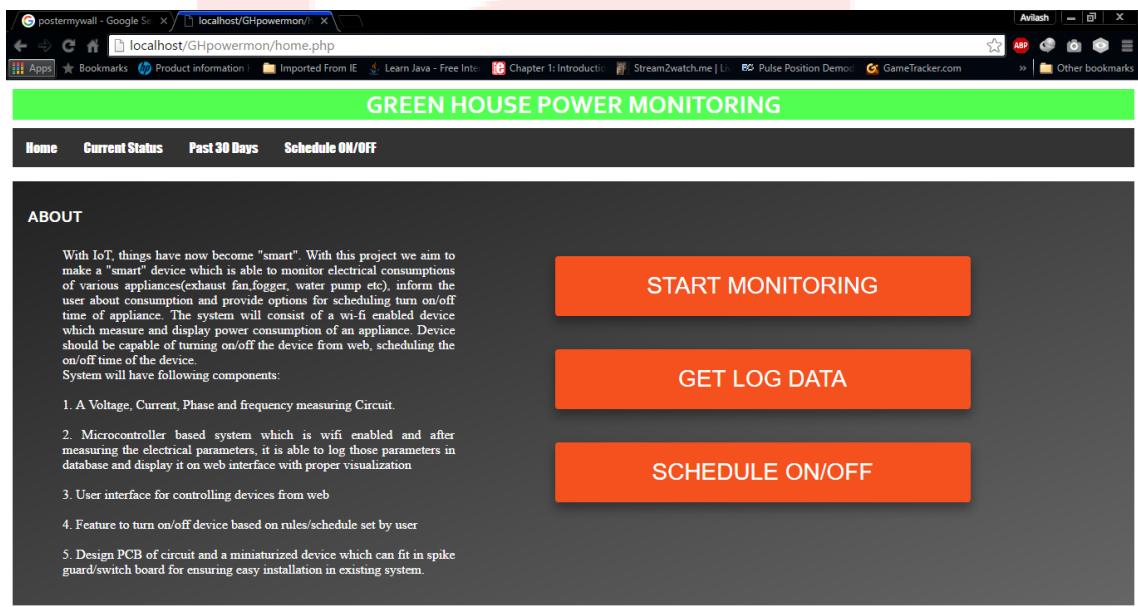


Figure 1.27: Home Page

- This is the home page of the web based GUI, with 3 buttons redirecting buttons.

1.7. USE AND DEMO

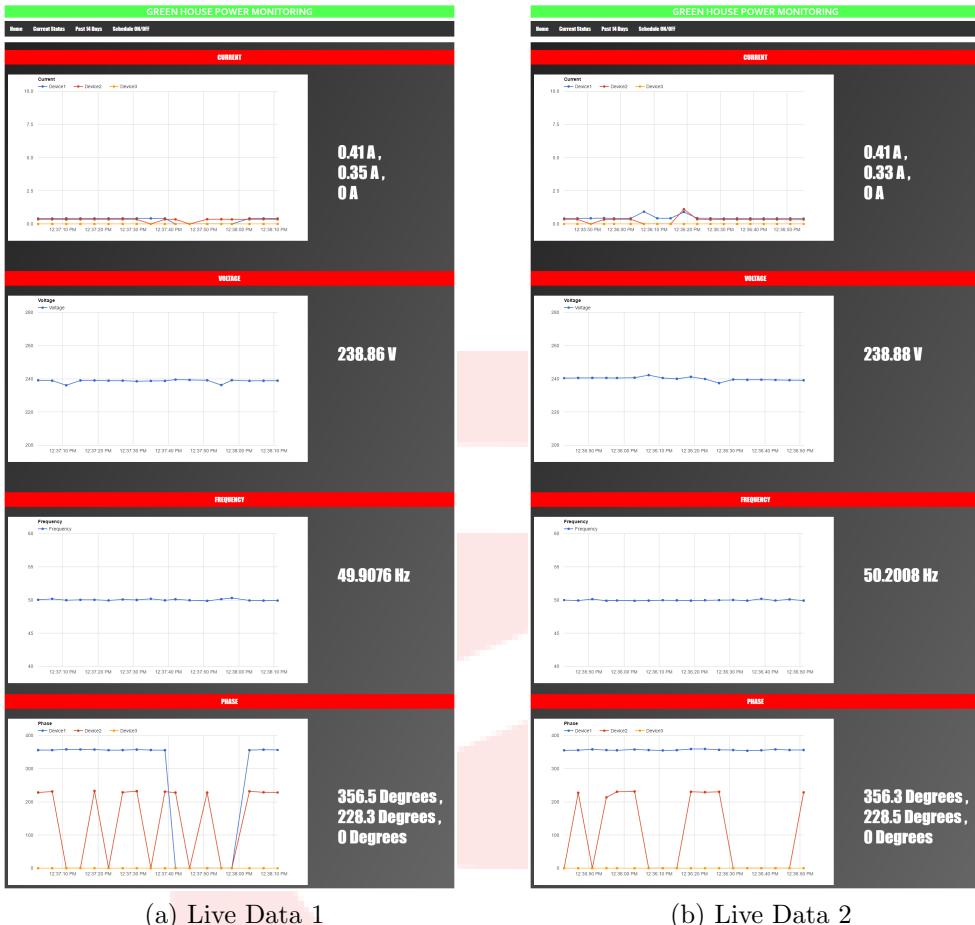


Figure 1.28: Real time updating graph

- Under the title of page, a navigation bar is present.
- Next is the current status page. See [Figure 1.28](#).
The first Division shows the current(in A) flowing in the 3 devices.
BLUE for Device 1
RED for device 2
YELLOW for device 3
- Divisions for voltage(in V)and frequency(in Hz) follow Current's division.
Only one line chart is being made for these two parameters as they are same for all three devices.
- Last division represents phase difference(in deg) of the three connected



1.7. USE AND DEMO

devices. See [Figure 1.28](#) for reference .

BLUE for device 1

RED for device 2

YELLOW for device 3

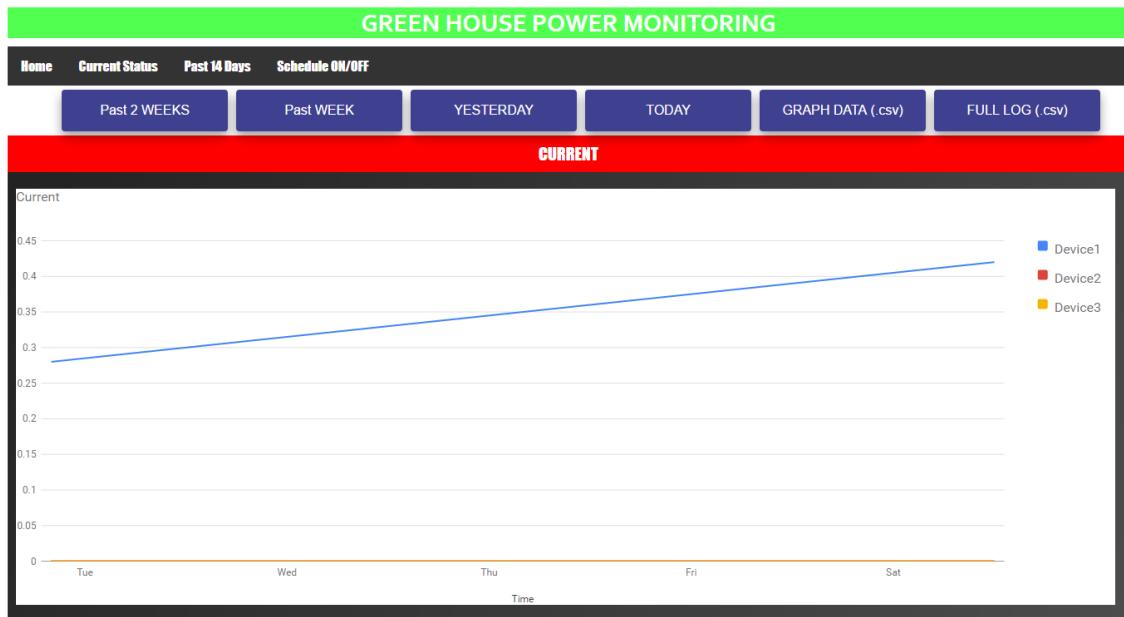


Figure 1.29: Logging page

- [Figure 1.29](#) shows the logging page.
- As shown in the [Figure 1.15](#) the first four buttons provided are for period selection, and the last two are download links for .csv format for graph data and complete log data respectively.
- By clicking any of the four buttons will plot the graph for the given period, and *GraphData* download link will generate a log for that specific period in .csv format.



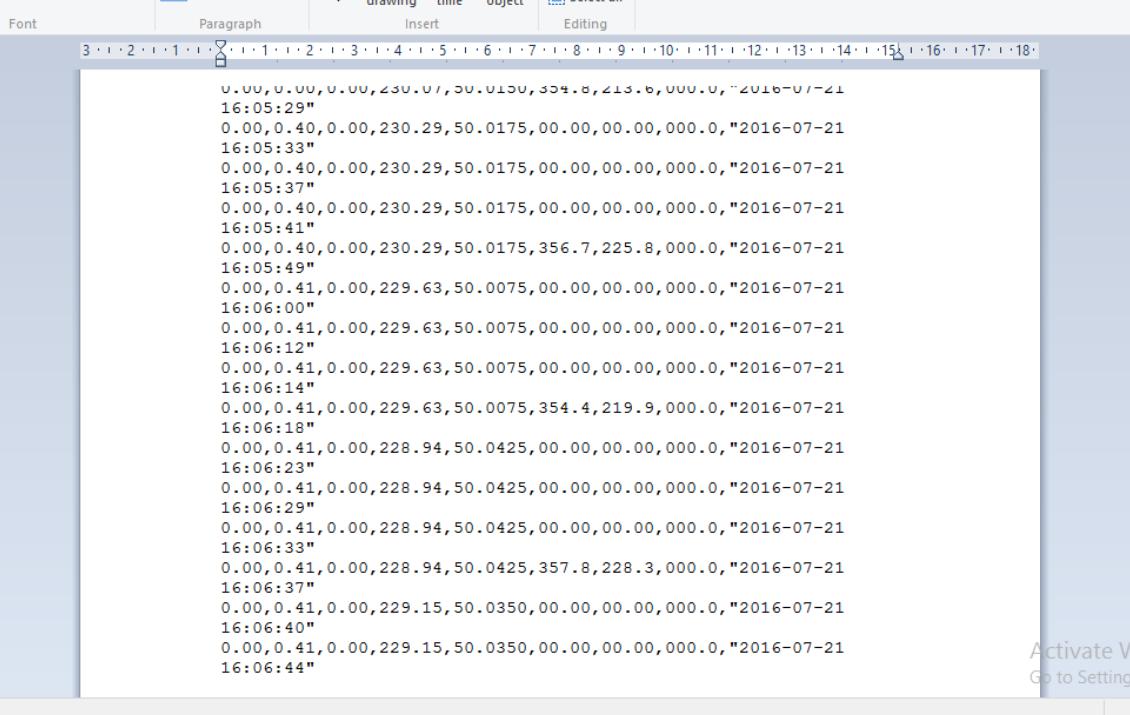
1.7. USE AND DEMO

Font	Paragraph	Insert	Editing
3 · · · 2 · · · 1 · · · 1 · · · 2 · · · 3 · · · 4 · · · 5 · · · 6 · · · 7 · · · 8 · · · 9 · · · 10 · · · 11 · · · 12 · · · 13 · · · 14 · · · 15 · · · 16 · · · 17 · · · 18 ·	· · · 1 · · · 2 · · · 3 · · · 4 · · · 5 · · · 6 · · · 7 · · · 8 · · · 9 · · · 10 · · · 11 · · · 12 · · · 13 · · · 14 · · · 15 · · · 16 · · · 17 · · · 18 ·	· · · 1 · · · 2 · · · 3 · · · 4 · · · 5 · · · 6 · · · 7 · · · 8 · · · 9 · · · 10 · · · 11 · · · 12 · · · 13 · · · 14 · · · 15 · · · 16 · · · 17 · · · 18 ·	· · · 1 · · · 2 · · · 3 · · · 4 · · · 5 · · · 6 · · · 7 · · · 8 · · · 9 · · · 10 · · · 11 · · · 12 · · · 13 · · · 14 · · · 15 · · · 16 · · · 17 · · · 18 ·
0,0,0,229.64,49.9425,0,0,0,"2016-07-21 15:50:55" 0,0,0,229.64,49.9425,0,0,0,"2016-07-21 15:50:57" 0,0,0,229.64,49.9425,357.8,0,0,"2016-07-21 15:51:00" 0,0,0,228.86,50.03,0,0,0,"2016-07-21 15:51:03" 0,0,37,0,228.86,50.03,0,0,0,"2016-07-21 15:51:05" 0,0,37,0,228.86,50.03,0,0,0,"2016-07-21 15:51:08" 0,0,37,0,228.86,50.03,358.5,6.731,0,"2016-07-21 15:51:11" 0,0,38,0,228.43,50.0425,0,0,0,"2016-07-21 15:51:15" 0,0,38,0,228.43,50.0425,0,0,0,"2016-07-21 15:51:21" 0,0,38,0,228.43,50.0425,0,0,0,"2016-07-21 15:51:24" 0,0,38,0,228.43,50.0425,355.6,108.3,0,"2016-07-21 15:51:28" 0,0,0,228.28,49.9675,0,0,0,"2016-07-21 15:51:33" 0,0,0,228.28,49.9675,0,0,0,"2016-07-21 15:51:38" 0,0,0,228.28,49.9675,0,0,0,"2016-07-21 15:51:48" 0,0,0,228.28,49.9675,359.1,355.9,0,"2016-07-21 15:52:02" 0,0,0,228.87,50.0175,0,0,0,"2016-07-21 15:52:17" 0,0,0,228.87,50.0175,0,0,0,"2016-07-21 15:52:20" 0,0,0,228.87,50.0175,0,0,0,"2016-07-21 15:52:25" 0,0,0,228.87,50.0175,0,0,0,"2016-07-21 15:52:29" 0,0,0,0,0,0,0,0,"2016-07-21 15:55:31" 0,0,0,0,0,0,88.41,0,"2016-07-21 15:55:38" 0,0,0,0,0,0,88.41,0,"2016-07-21 15:55:42" 0,0,0,0,0,0,88.41,0,"2016-07-21 15:55:45" 0,0,0,0,0,0,88.41,0,"2016-07-21 15:55:48" 0,0,0,0,0,0,226,0,"2016-07-21 15:55:51" 0,0,38,0,228.65,49.9725,0,0,0,"2016-07-21 15:55:54" 0,0,38,0,228.65,49.9725,0,0,0,"2016-07-21 15:55:58" 0,0,38,0,228.65,49.9725,356.4,0,0,"2016-07-21 15:56:01" 0,0,0,228.99,49.8603,0,0,0,"2016-07-21 15:56:03" 0,0,0,228.99,49.8603,0,0,0,"2016-07-21 15:56:04"			

Figure 1.30: Graph Data Log

- *Today* button will generate graph with Only That day's data.
Yesterday button will generate graph for previous data only.
Past week will generate filtered hourly data in the past week.
Past 2 Weeks will generate filtered hourly data in the past 2 weeks.
These are defined in *action_graph_week.php*.
- Full log in .csv format is always available for the user to download .

1.7. USE AND DEMO

The screenshot shows a Microsoft Word document window. The title bar includes 'Font', 'Paragraph', 'Insert', 'Editing', and a red 'e' icon. The main content area contains a large block of text representing a log or data dump. The text is organized into several columns, likely representing timestamp, device ID, and various parameters. The log entries start with '16:05:29' and continue through '16:06:44'. The right side of the window shows standard Word interface elements like 'Activate View' and 'Go to Setting'.

```

3 2 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
0.00,0.00,0.00,230.07,50.0150,354.8,213.6,000.0,"2016-07-21
16:05:29"
0.00,0.40,0.00,230.29,50.0175,00.00,00.00,000.0,"2016-07-21
16:05:33"
0.00,0.40,0.00,230.29,50.0175,00.00,00.00,000.0,"2016-07-21
16:05:37"
0.00,0.40,0.00,230.29,50.0175,00.00,00.00,000.0,"2016-07-21
16:05:41"
0.00,0.40,0.00,230.29,50.0175,356.7,225.8,000.0,"2016-07-21
16:05:49"
0.00,0.41,0.00,229.63,50.0075,00.00,00.00,000.0,"2016-07-21
16:06:00"
0.00,0.41,0.00,229.63,50.0075,00.00,00.00,000.0,"2016-07-21
16:06:12"
0.00,0.41,0.00,229.63,50.0075,00.00,00.00,000.0,"2016-07-21
16:06:14"
0.00,0.41,0.00,229.63,50.0075,354.4,219.9,000.0,"2016-07-21
16:06:18"
0.00,0.41,0.00,228.94,50.0425,00.00,00.00,000.0,"2016-07-21
16:06:23"
0.00,0.41,0.00,228.94,50.0425,00.00,00.00,000.0,"2016-07-21
16:06:29"
0.00,0.41,0.00,228.94,50.0425,00.00,00.00,000.0,"2016-07-21
16:06:33"
0.00,0.41,0.00,228.94,50.0425,357.8,228.3,000.0,"2016-07-21
16:06:37"
0.00,0.41,0.00,229.15,50.0350,00.00,00.00,000.0,"2016-07-21
16:06:40"
0.00,0.41,0.00,229.15,50.0350,00.00,00.00,000.0,"2016-07-21
16:06:44"

```

Figure 1.31: Full Log

- The last page is *Schedule ON/OFF*. See [Figure 1.18](#) . This is the controlling page with features like scheduling and switching ON/OFF. The button highlighted in the image is the switch. It can be noted that the text on it changes according to current button status.
Above switch, there is a circular block which indicates the actual device status.
GREEN represents ON status.
RED represents OFF status. As depicted in figure 1.17.
- Just below every switch button there is a scheduler which can schedule ON/OFF.
The user first have to make a choice between ON/OFF radio buttons. If no selection is made it will be automatically counted as OFF .
- Then the user have to fill the two input fields namely *FROM* and *TO* as per requirement. See [Figure 1.18](#)
- Scheduled Time-interval and Type will be notified as text. See [Figure 1.19](#)



1.8. FUTURE WORK

1.8 Future Work

- Current Web GUI is not responsive and will not work properly on mobile phones. Using Bootstrap (HTML,CSS framework) it can be done.
- Zoom Function can be added in charts for better user experience.
- Frequency feature can be added scheduling.
- Support for more devices can be added even when monitoring is available for few devices due to limited ADCs.
- Circuit can be miniaturized by using Redbear Wifi-mini aur cc3200 micro, which can increase portability
- Phase measurement accuracy can be improved.



1.9 Bug report and Challenges

Bug report

- For accurate measurement of phase please calculate the phase difference created by coupling capacitor applied to current wave for removing offset voltage.
- Use **TI-RTOS & Free-RTOS** for fast processing and transient analysis of the electrical parameters.
- SQL Injection
- HTTP communication protocol has been used. More secured protocols can be used.

Challenges

- To add header files to the code composer studio project right click on project ,go to properties than select linked resources and than add *CC3200_skd*. After adding sdk to linked resources than again right click on project, go to GNU compiler and include directories to it.
- The debug mode of CCS load the program into RAM of CC3200 launchpad so to load program into ROM use **Uniflash**.
- Before loading the program into flash please follow the below procedure
 - Format the whole CC3200 launchpad's ROM using **format** tab.
 - Load **service pack**, which is compatible with your launchpad's version.
 - Now load the .bin file of project.
- For loading program into ROM select **mcu.bin** tab in Uniflash and than add the .bin file of the project. After adding the .bin file program MCU using program tab.
- To write program for CC3200-launchpad please take help from **Driver-lib API's, Simplelink API's** and all the API module files present inside CC3200sdk folder.

Bibliography

- [1] Stack Overflow www.stackoverflow.com
- [2] TutorialsPoint www.tutorialspoint.com/
- [3] GitHub www.github.com
- [4] W3Schools www.w3schools.com/
- [5] TI E2E Community <https://e2e.ti.com/>
- [6] Instructables [www.instructables .com](http://www.instructables.com)

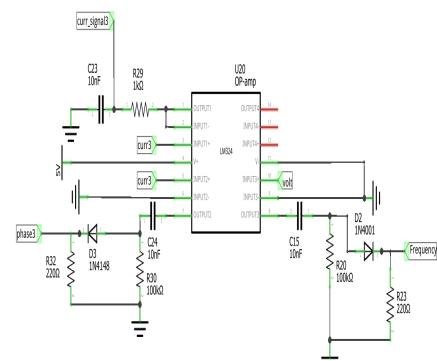
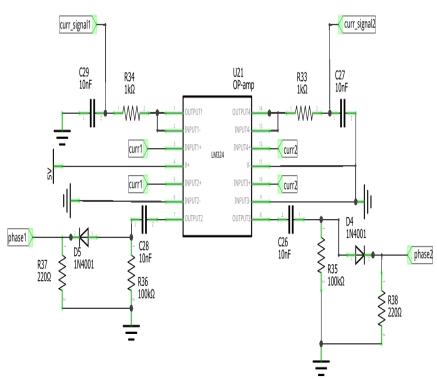
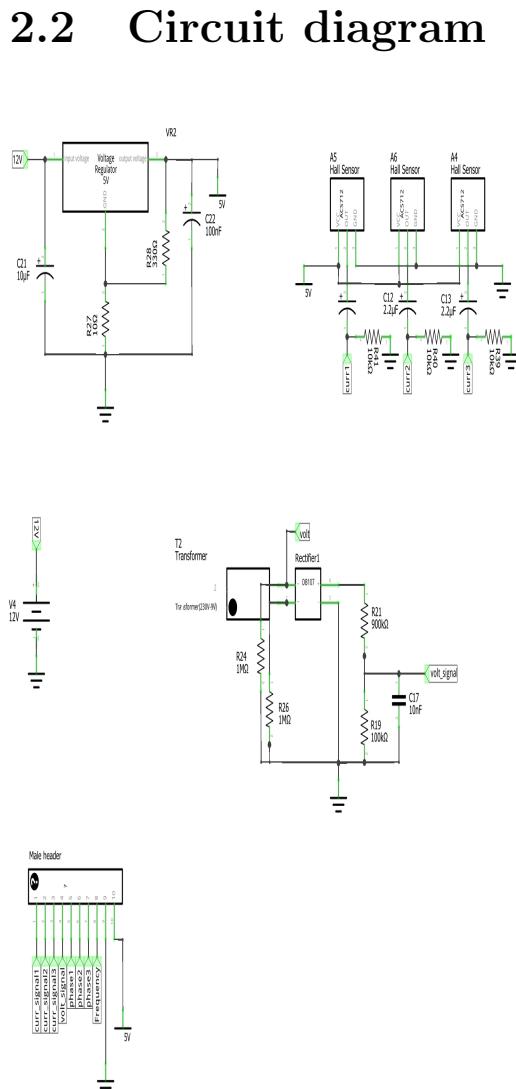
Measurement board manual

2.1 Abstract

The measurement board can process the input electrical signal and measure the basic electrical parameter from that. This is able to upload measured parameters to online Web servers.



2.2. CIRCUIT DIAGRAM



fritzing



2.3. DIY

Here we are including a special feature in the manual. By reading the manual now you can make this board by your self. To make it your self please follow the following instruction:

List of components

Name of component	Specification	Quantity
Resister	10 ohm (1/4W)	1
	330 ohm (1/4 W)	1
	1K ohm (1/4W)	3
	10K ohm (1/4W)	3
	33K ohm (1/4W)	4
	100K ohm (1/4W)	5
	900K ohm (1/4W)	1
	1M ohm (1/4W)	2
Electrostatic Capacitor	0.1uF (50V)	1
	0.22uF (10V)	3
	10uF (50V)	1
Ceramic capacitor	0.01uF (103)	8
Diode	IN4148 (high speed diode)	4
Operational Amplifier	LM324 <i>Quard opamp IC</i>	2
Rectifier	DB-107	1
Bug strip	Male(40x1)	2
	Female(40x1)	1
Breadboard & Wires	-	1
Soldering iron and wire	40W	1
General purpose PCB	15cmx15cm	1

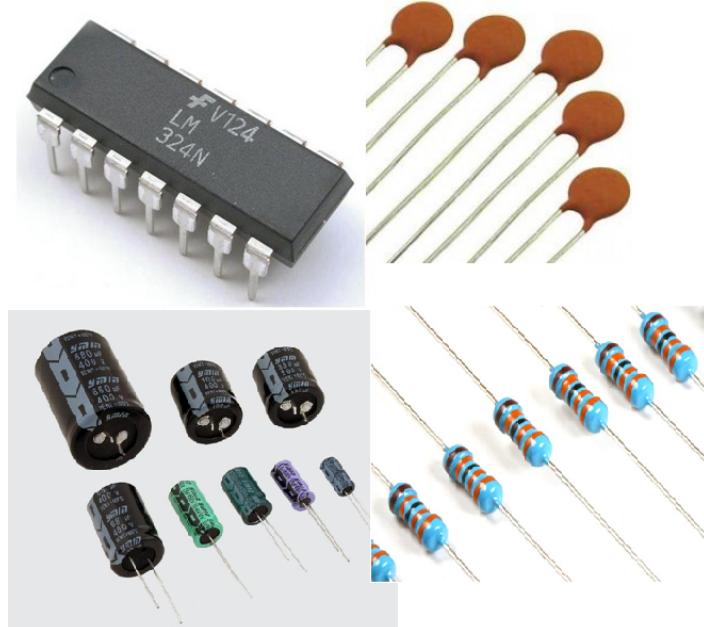
Procedure

- Before starting to building the circuit make sure you have gone through the circuit description. Because making circuit according to provided circuit doesn't make any sense.



2.3. DIY

- Buy all the component listed above it hardly cost you 500 rupees.



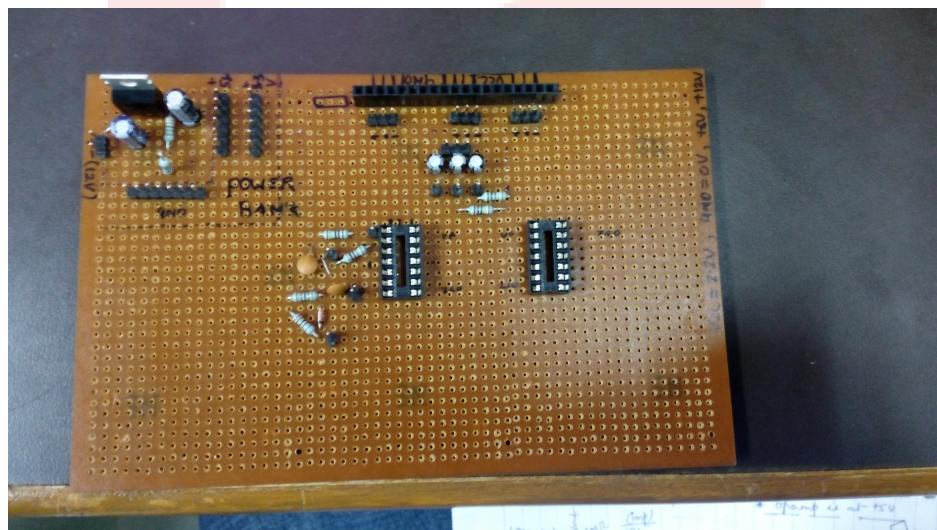
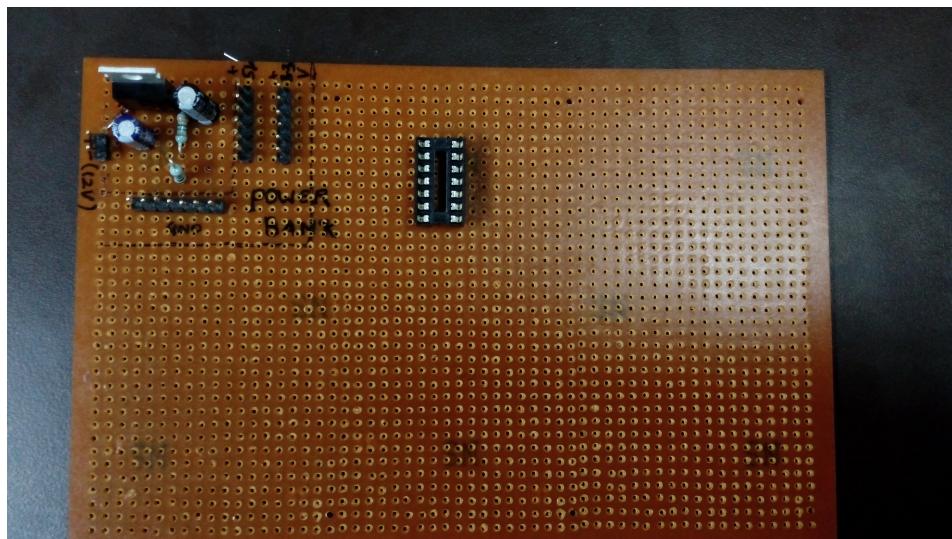
- First of check the circuit on the breadboard whether it is working or not, after checking the circuit on breadboard please connect your soldering Iron to plug and put up your PCB board on table.





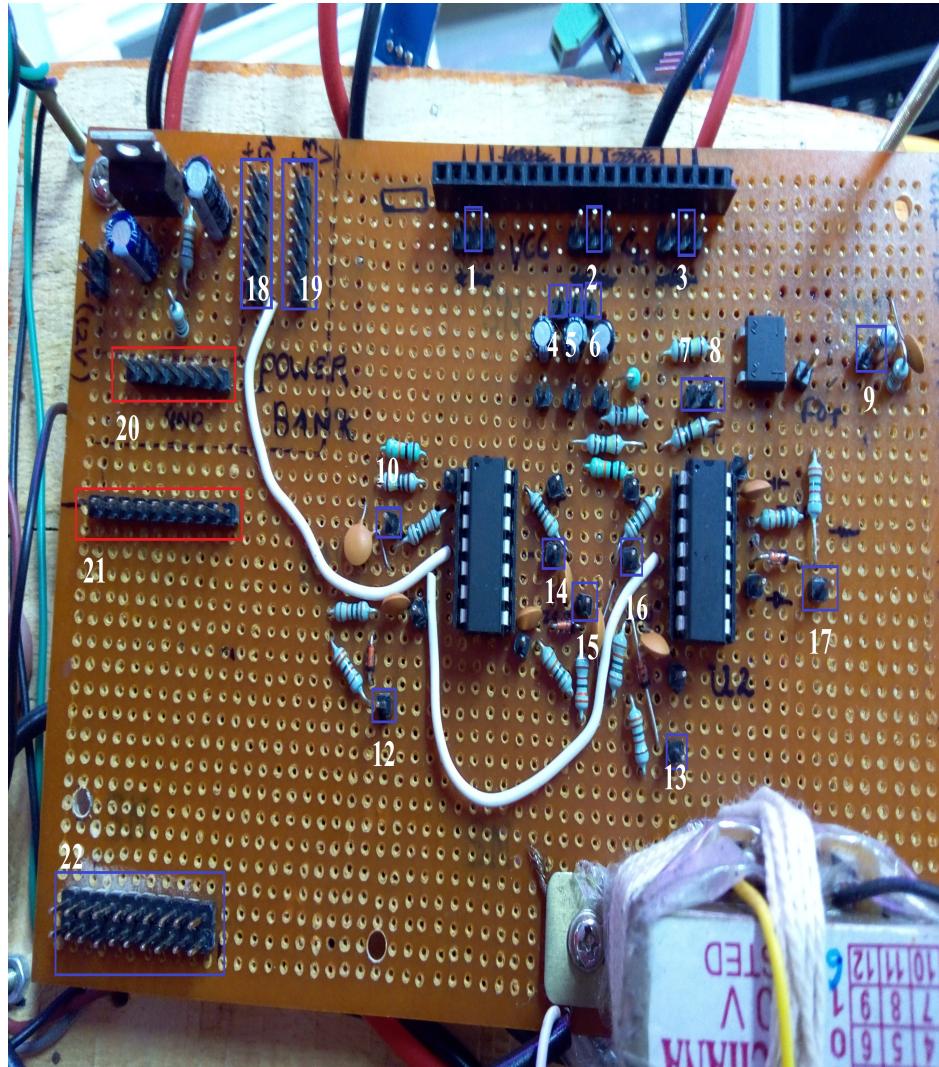
2.3. DIY

- Start making small circuit on different the part of PCB step by step as the circuit diagram is explained.



- When small section of circuit schematic got completed on PCB than start connecting those small section according to label provided in schematic.
- Cheers!!! your measurement board is ready to use, now you can connect CC3200 launchpad to it and start software part.

Pin Description



- **PIN 1:** Hall sensor 1 input pin
- **PIN 2:** Hall sensor 2 input pin
- **PIN 3:** Hall sensor 3 input pin
- **PIN 4:** DC blocked current signal 1
- **PIN 5:** DC blocked current signal 2
- **PIN 6:** DC blocked current signal 3



2.3. DIY

- **PIN 7 & PIN 8:** Transformer(230V/9V) output pins
- **PIN 9:** processed voltage signal that will going into ADC pin
- **PIN 10:** processed current signal that will going into ADC pin
- **PIN 12:** Phase 1 signal
- **PIN 14:** processed current signal that will going into ADC pin
- **PIN 15:** Phase 2 signal
- **PIN 16:** processed current signal that will going into ADC pin
- **PIN 13:** Phase 3 signal
- **PIN 17:** Frequency signal
- **PIN 18:** 5V header pins
- **PIN 19:** Vcc header pins
- **PIN 20:** Gnd header pins
- **PIN 21 & PIN22:** Headers for mounting of CC3200 launchpad



2.4. CIRCUIT OUTPUT THE EACH PIN

2.4 Circuit output the each pin

At Pin number 1,2 & 3

At these pins a current wave with 2.5V offset will appear.

$$\text{OUT} = 2.5 + a\sin(wt)$$

Where:

a = amplitude of *sin* wave in V.

w = angular frequency of current signal in (rad/sec).

t = time in sec.

At Pin number 4,5 & 6

At these pins a current wave without offset will appear.

$$\text{OUT} = a\sin(wt)$$

Where:

a = amplitude of *sin* wave in V.

w = angular frequency of current signal in (rad/sec).

t = time in sec.

At Pin number 12,15,13 & 17

At these pins output of zero crossing circuit will appear.

$$\text{OUT} = 5e^{-(t/\tau)}$$

Where:

τ = time constant of zero crossing detector circuit.

t = time in sec.

At Pin number 9,10,14 & 16

Voltage and current signal manipulated according to reference voltage of CC3200 launchpad

2.4. CIRCUIT OUTPUT THE EACH PIN

At Pin number 18,19 & 20

5V, Vcc and ground pins on the measurement board.

At Pin number 21 & 22

Headers for connecting CC3200-launchpad.

