



Lab 1: Wi-Fi Scanner plus Webpage Controlled LED Matrix Display

Avnet BCM4343W IoT Starter Kit

Overview

This application introduces the user to ZentriOS command-line functions, configuring Wi-Fi network settings, servicing of a pushbutton event, plus implementation of webserver based application that is accessed from laptop (or Smartphone) for remote control of a custom scrolling LED Matrix display.

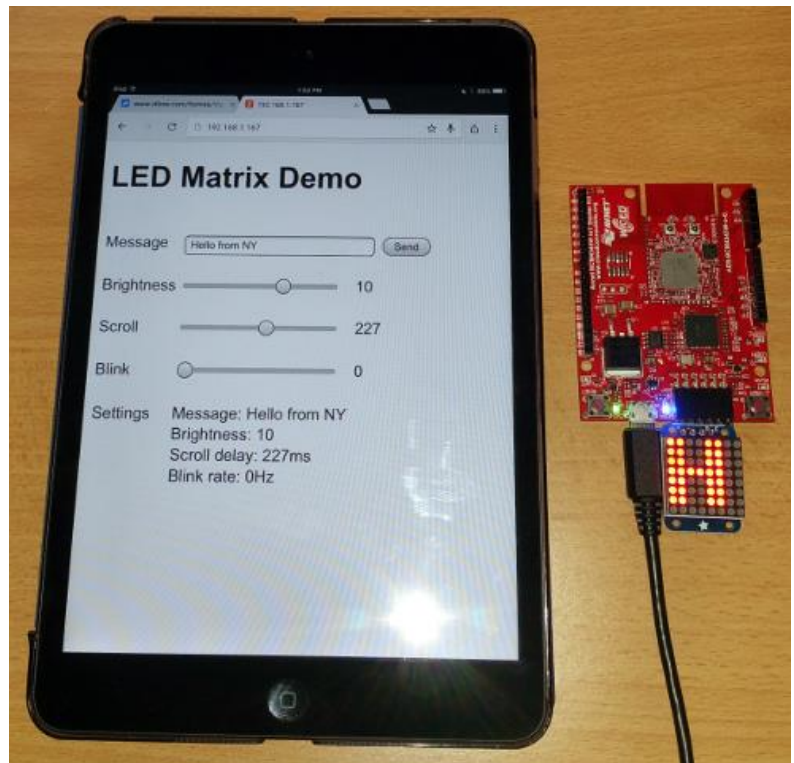
Control is by means of a dynamically updated webpage, served from an http server running on the Avnet BCM4343W module

Webserver page: Facilitates user control of:

- Message text: Sends user defined messages
- Brightness of LED Matrix (level 0 to 15)
- Scrolling Delay (10 to 400 ms)
- Blink Rate (0 to 0.5 Hz)

Pushbutton event:

- Initiates a scan for Wi-Fi networks
- Lists scan results to serial console



Requirements

- ZentriOS SDK (version 3.2.0.2 or later)
- Serial Console application (eg. TeraTerm or Putty)
- Internet Browser on Lab Computer
- Avnet BCM4343W IoT Starter Kit
- Adafruit Mini 8x8 LED Matrix Display Backpack (I2C), fitted with Pmod-compatible 6x1 right-angle connector
<https://www.adafruit.com/products/870>

Application Documentation Online

<https://docs.zentri.com/zentrios/wz/latest/sdk/examples/demo/led-matrix>

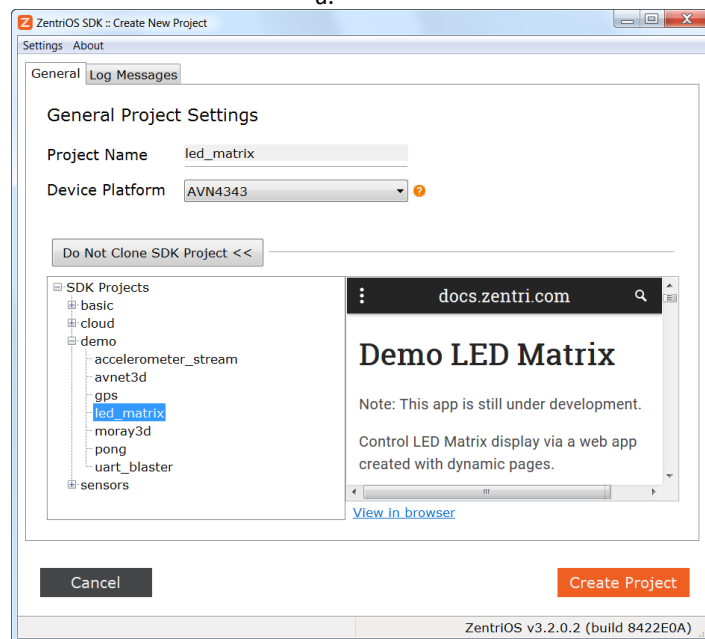


Procedure

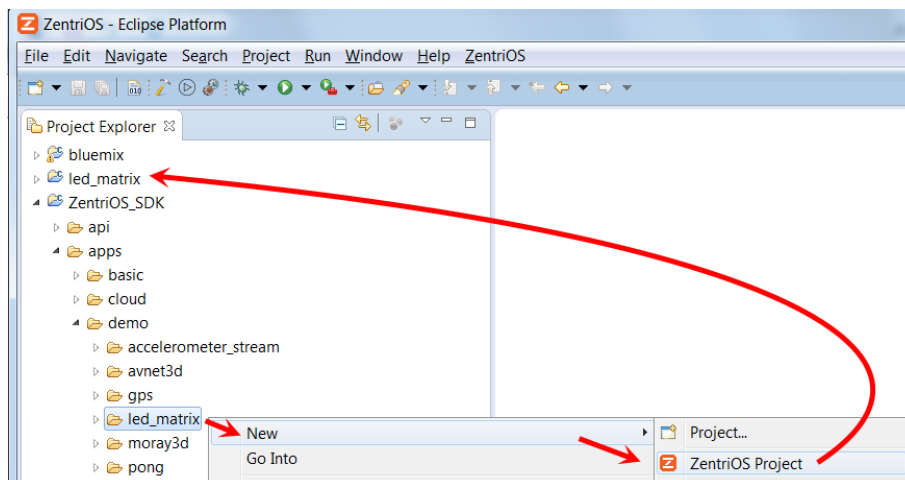
Set up the Zentri Application (ZAP)

- 1) Connect a USB cable from the Avnet BCM4343W IoT Starter Kit to your Laptop Computer.
Open the Tera Term Serial Console application. Make sure correct COM port is selected, Baud rate = **115200, 8N1N**
If ever you disconnect the board, press **Alt-N** to re-sync the Serial Port, then click the terminal window and press <Enter>
- 2) We will start by making a cloned copy of the **led_matrix** demo application. Within the Zentri IDE, click the small triangle next to **ZentriOS SDK** to open-up the view of the SDK folders, then navigate down to **\apps\demo**
- 3) Right click the '**led_matrix**' folder located there and select **New -> ZentriOS Project**. The Create New Project dialog will appear. Use the same name and select again the **led_matrix** project from which the new project is to be cloned

a.

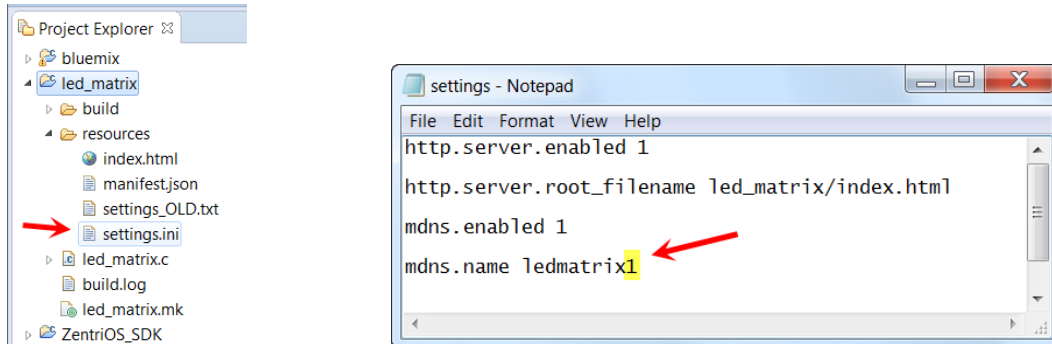


- 4) An editable version of **led_matrix** will now appear listed in the workspace area above the ZentriOS_SDK folders

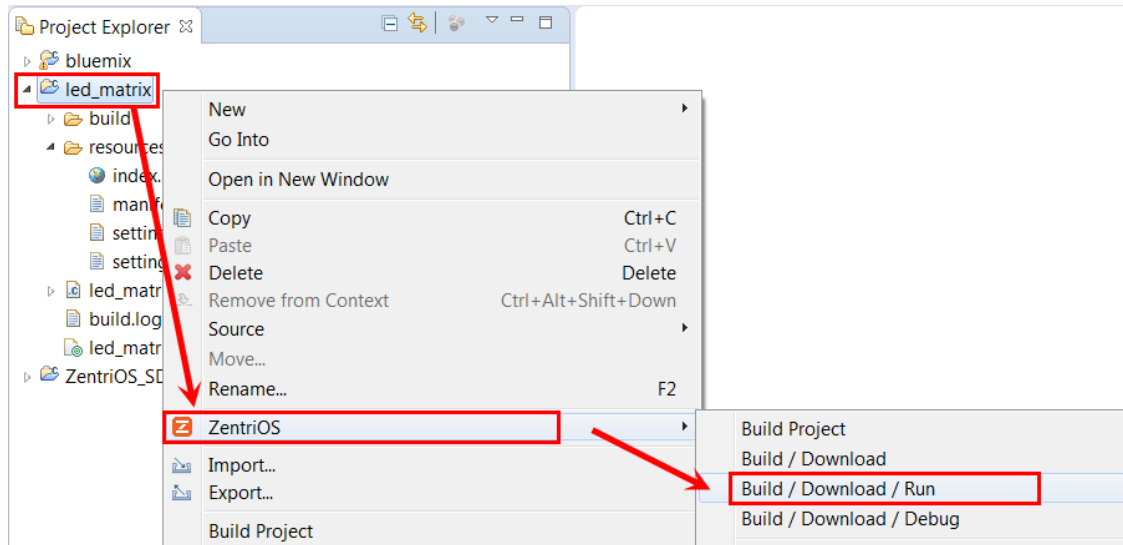




- 5) Rather than editing the source code, to save time we will overwrite **led_matrix.c** in this new workspace project folder, (ie. drag + drop the file of same name from your **USB Thumb Drive** to the newly created **led_matrix** folder)
- 6) One edit however is required: In the **resources** folder, double-click the **settings.ini** file, to open this (this will open in notepad, not the IDE's editor). Edit the **mdns.name** setting, by suffixing the number of your laptop station to the **ledmatrix** label that follows it, then **Save** and exit Notepad. This to ensure unique DNS names (eg. **ledmatrix1**) are allocated for the multiple IoT boards in use at the same time in this workshop.



- 7) Right click on the '**led_matrix**' folder in the workspace, select "**ZentriOS**", then click on "**Build / Download / Run**".



- 8) After successful build and download of this application to the hardware (takes about 1 minute), check the **serial console** application to view the initialization output messages from the hardware
- 9) You will need to provide the Wi-Fi network settings to your board from this serial console. Start with a mouse click on the console window, press the enter key once to bring-up the command prompt, then type **network_up -s** into the console. (Note: The command abbreviation **nup -s** may alternatively be used)

```
Ready
> network_up -s
Scanning for networks...
! 29 networks found
```



- 10) In the listing of network SSIDs that appears, locate the number '#' of the network that you wish to connect to. Enter this **network number** into the console followed by its **password**.
(On successful completion of network selection and password, your selection is automatically saved)

Troubleshooting Tip: If you have issues connecting your board to the local Wi-Fi, try utilizing a mobile hotspot instead.

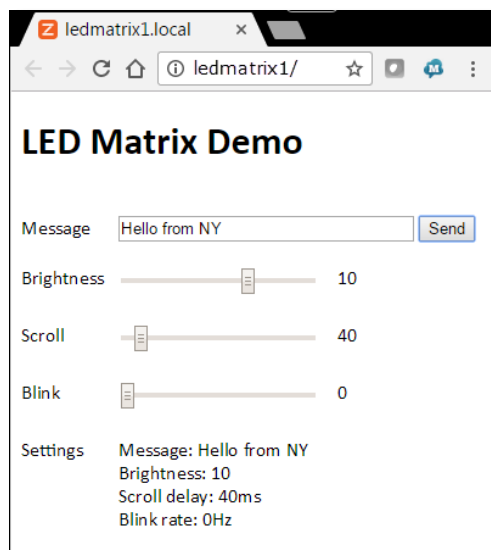
- 11) Now, press the reset button on the board to reboot the application
(or type **reboot** at the console command-line prompt)
- 12) Note! To test the Webserver functionality, either a Laptop Computer or Smartphone is used. This computer or phone however, **must** be connected to same Wi-Fi Access Point as the board!



- 13) Next, we will interact with the webserver using an Internet Browser:
In busy Wi-Fi environments (such as this workshop!) it is recommended that the unique **IPv4 address** which is reported in your terminal window (ie. **192.168.1.xxx**) be used as the browser address.
ie. **Right-click + copy** this IPV4 address from serial console window to the internet address field in your browser window...
- 14) If running this app in a less challenging Wi-Fi environment, then the mDNS feature can be used. In this case simply double click the http link provided in the serial console output, to open the webserver page on your laptop
(**Note!** The device on which browser is launched **must** be connected to the same Wi-Fi Access Point as the board!)

```
COM5 - Tera Term VT
File Edit Setup Control Window Help
[2016-09-26 | 17:24:13: Associating to AVNET_LTE]
> Obtaining IPv4 address via DHCP
IPv4 address: 192.168.1.196
Starting mDNS
mDNS domain: ledmatrix1.local
HTTP and REST API server listening on port: 80
[2016-09-26 | 17:24:18: Associated]
> From your browser, enter the URL: http://ledmatrix1/ to control the display
```

- 15) Whether using the IPV4 address or mDNS URL, the **LED Matrix Demo** webpage should now be displayed in your browser.





Testing

- 16) Enter different **custom messages** (followed by click on **Send**) to change what gets scrolled across the LED Matrix display
- 17) Experiment with **different slider settings** to vary the Brightness, Scroll Speed and Blink Rate
- 18) The display in each case should immediately update with new messages scrolled across the display and/or the display characteristics changed according to latest slider settings
- 19) Press the **User Pushbutton** on the board to manually initiate a scan for Wi-Fi networks
After a short pause, the **scan results will list on the serial console**

```
COM25 - Tera Term VT
File Edit Setup Control Window Help

USER BUTTON Pressed!
Scanning for Wi-Fi networks ...
# Type BSSID RSSI Rate Chan Security SSID
-----
0 Infra 14:22:DB:55:ED:66 -87 300.0 1 WPA2 AES Omaha
1 Infra 14:22:DB:55:ED:68 -85 300.0 1 Open <ssid hidden>
2 Infra 14:22:DB:55:ED:64 -86 300.0 1 WPA2 AES <ssid hidden>
3 Infra 14:22:DB:56:01:06 -89 300.0 1 WPA2 AES Omaha
4 Infra 14:22:DB:56:01:08 -88 300.0 1 Open <ssid hidden>
5 Infra 14:22:DB:56:01:04 -87 300.0 1 WPA2 AES <ssid hidden>
6 Infra 2C:56:DC:D6:FC:80 -67 216.7 2 WPA2 AES 2WIRE872
Scan complete in 4157 milliseconds
```

- 20) This concludes Lab1

Extra Credit! – Explore ZentriOS Commands and Variables

Try the following at the Serial Console's command-line prompt (follow each with <Enter>)

help

help commands

help variables

get all

get wlan

```
COM5 - Tera Term VT
File Edit Setup Control Window Help

BETA> help
Help options for the ZentriOS Command API ...
help all -> Print a list of all Commands and Variables
help commands -> Print a list of Commands
help variables -> Print a list of readable Variables
help <command> -> Print help for a specific Command
help <variable> -> Print help for a specific Variable

Additional help is available online at http://docs.zentri.com

BETA>
```

Try also the command abbreviations, eg.

get wl n g (ie. same as: **get wlan network gateway**)

Ping the reported Gateway IP address, ie.

ping 192.168.1.1

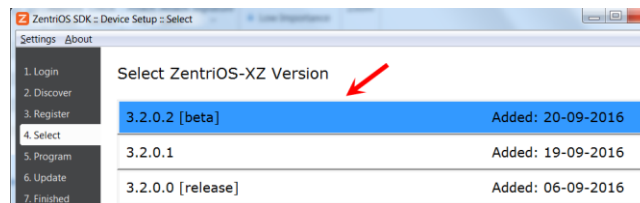
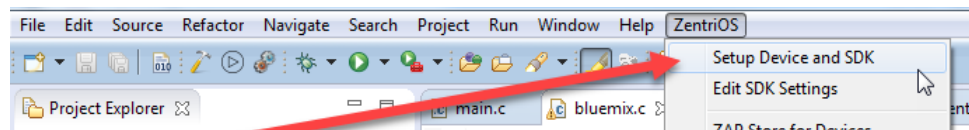
Explore other commands and variables, as well as the online Zentri documentation...

<http://docs.Zentri.com>



Appendix – ZentriOS “Setup Device and SDK”

- If you commenced this project with a new BCM4343W IoT Kit that has not previously been initialized with ZentriOS, there is an additional step required before you can interact with the board from the Zentri IDE.
- In this case, after connecting the USB cable from the BCM4343W IoT Starter Kit to your computer, select the “ZentriOS” tab from the main menu and click “Setup Device and SDK”.
Select the latest OS version when prompted, then click “Finish” once the process has completed.



- **Note!** In the workshop setting, this step should *not* be done if the board has already been provisioned as it will download and program over a megabyte to the board (internal flash and SPI flash) and if a different version OS inadvertently selected then an SDK update (over 55 MB) will also be downloaded!

Useful Links:

ZentriOS SDK Getting Started:

<https://docs.zentri.com/zentrios/wz/latest/sdk/user-guide/getting-started>

Zentri DMS account registration:

<https://dms.zentri.com/signup>

ZentriOS SDK Installer Download:

http://resources.zentri.com/zentrios_sdk/ZentriOS_SDK_Installer.exe

Avnet IoT Kit documents and reference designs:

<http://cloudconnectkits.org/product/avnet-bcm4343w-iot-starter-kit>

Avnet Technical Support Discussion Forums:

<http://cloudconnectkits.org/forum>

Zentri documentation:

<http://docs.Zentri.com>
