CEC Continuing Education Center

DesignNews

Developing IoT Applications with Nordic nRF Modules

Day 5:

The Full Monty

Sponsored by

DigiKey

informa markets

Webinar Logistics

- Turn on your system sound to hear the streaming presentation.
- If you have technical problems, click “Help” or submit a question asking for assistance.
- Participate in ‘Attendee Chat’ by maximizing the chat widget in your dock.

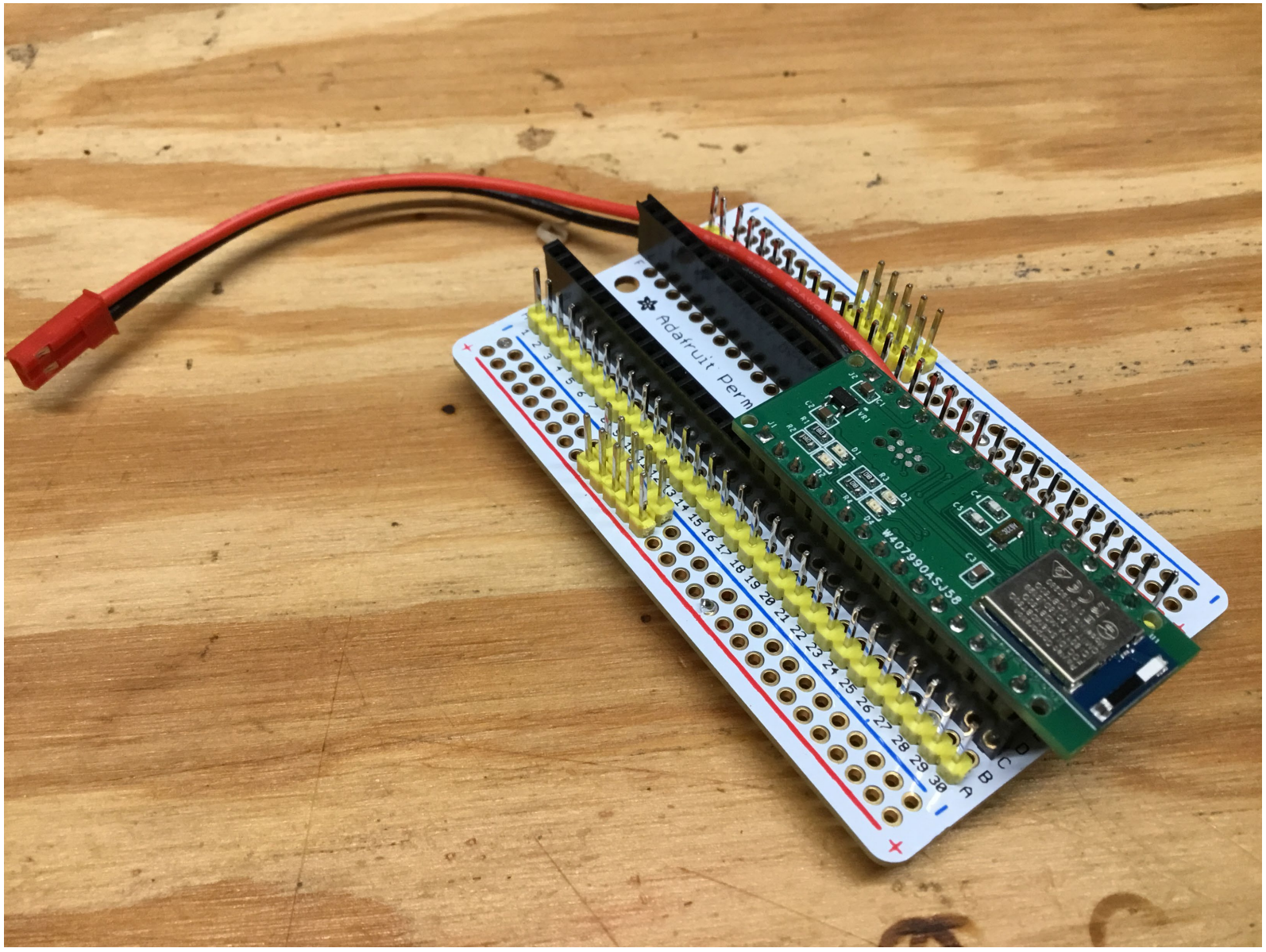
Fred Eady

Visit ‘Lecturer Profile’ in your console for more details.

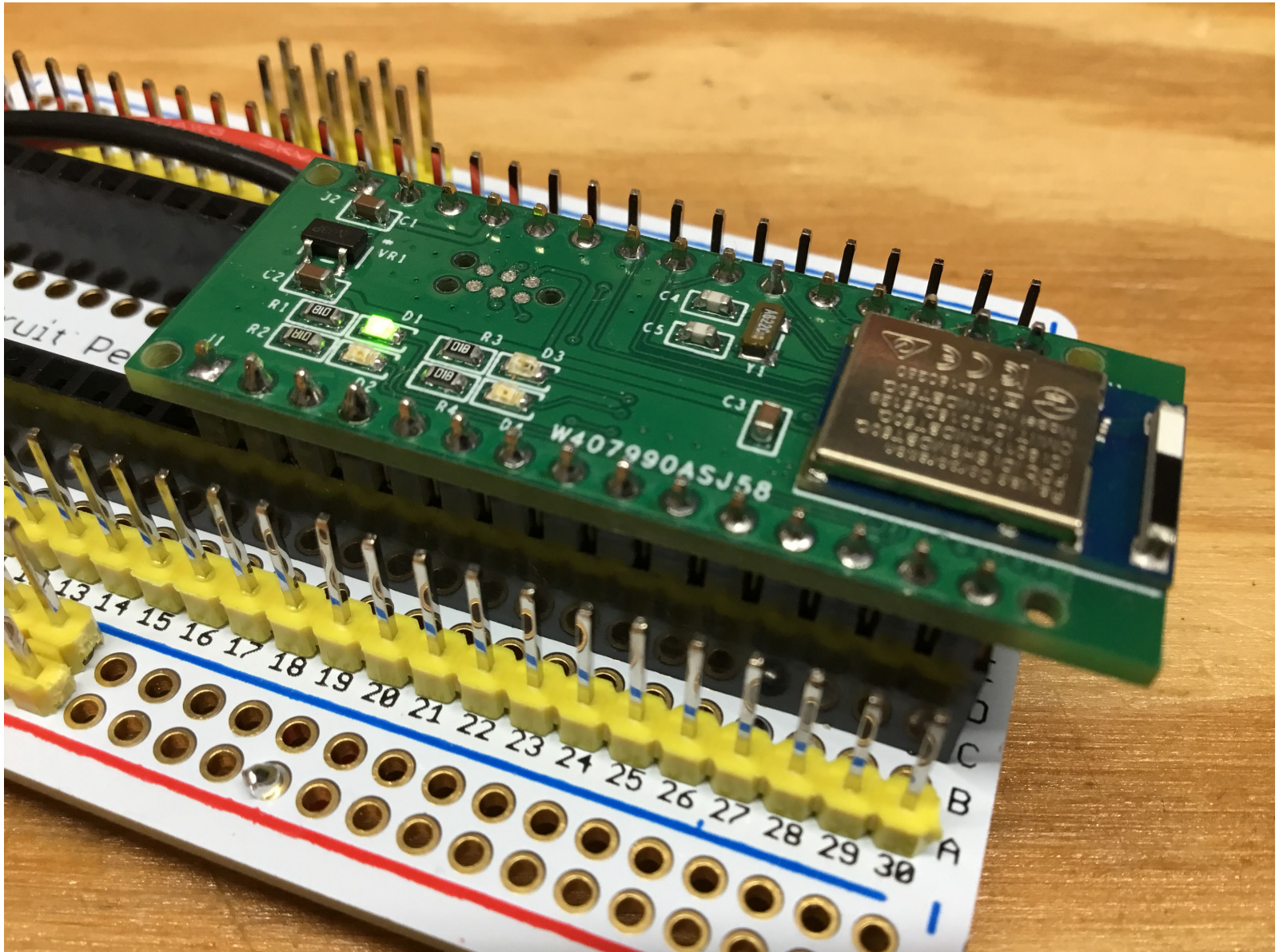
AGENDA

- **Construct an Android BLE App**

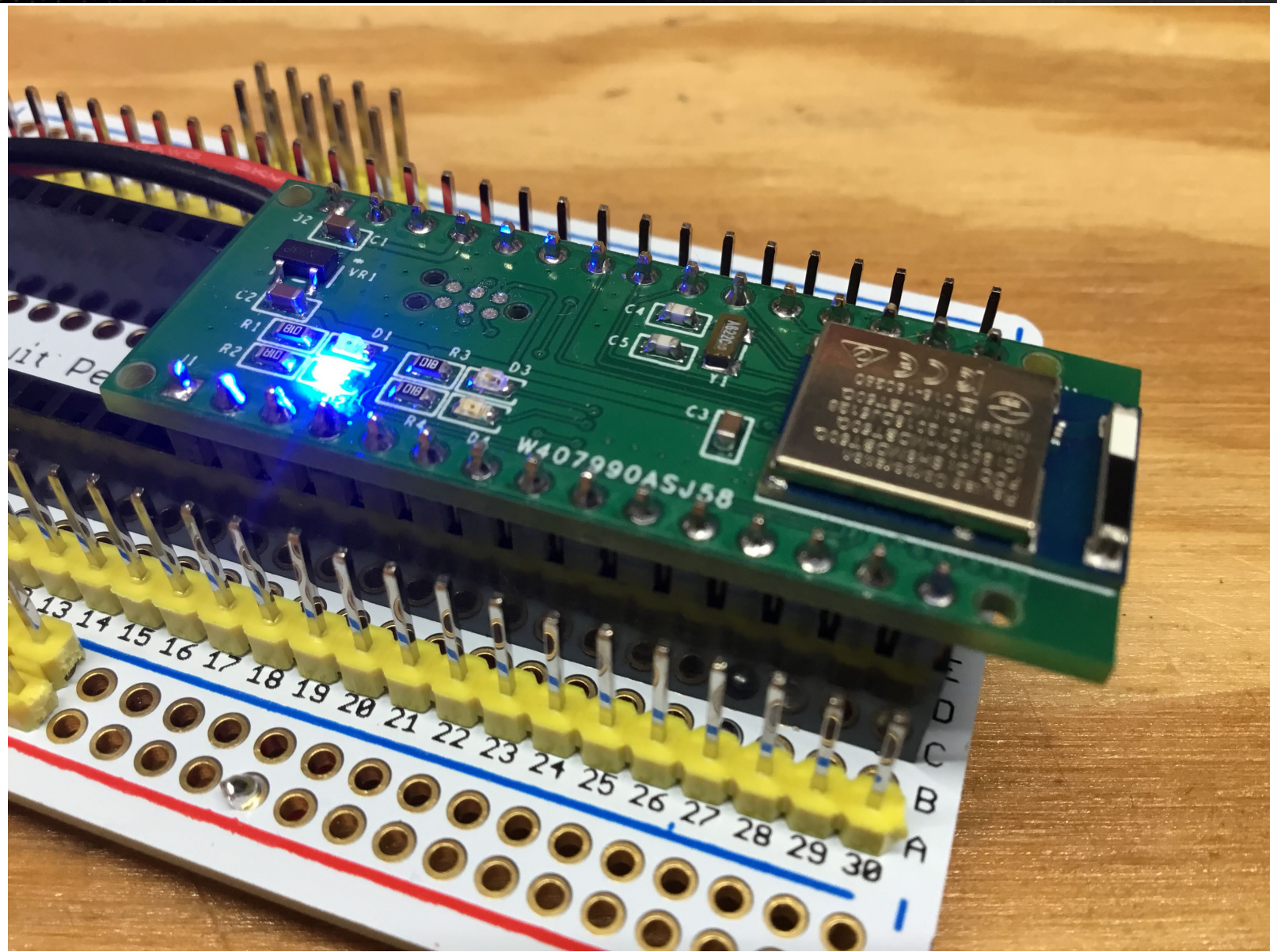
The BLE Target Hardware



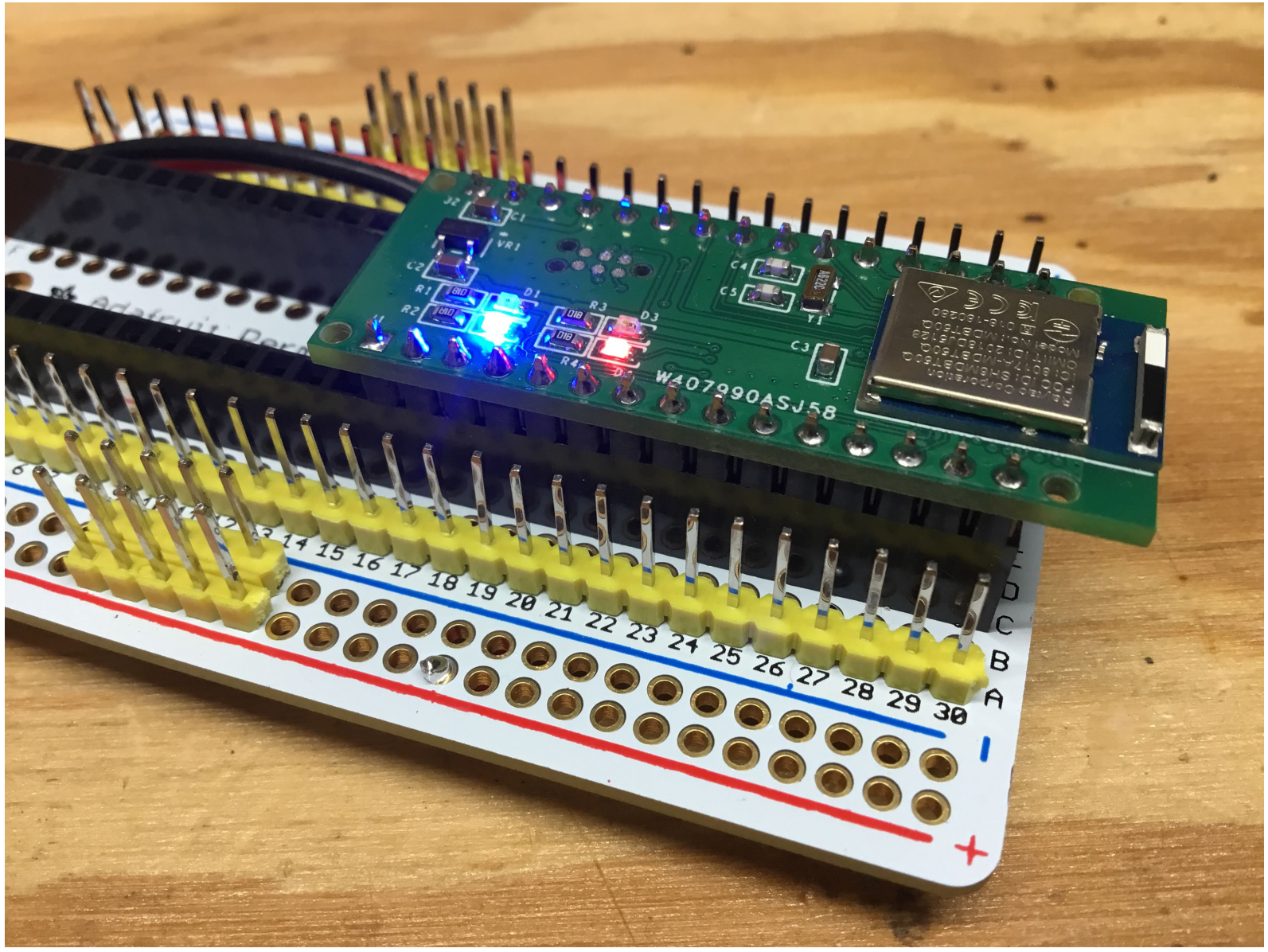
Advertising/Disconnected Mode



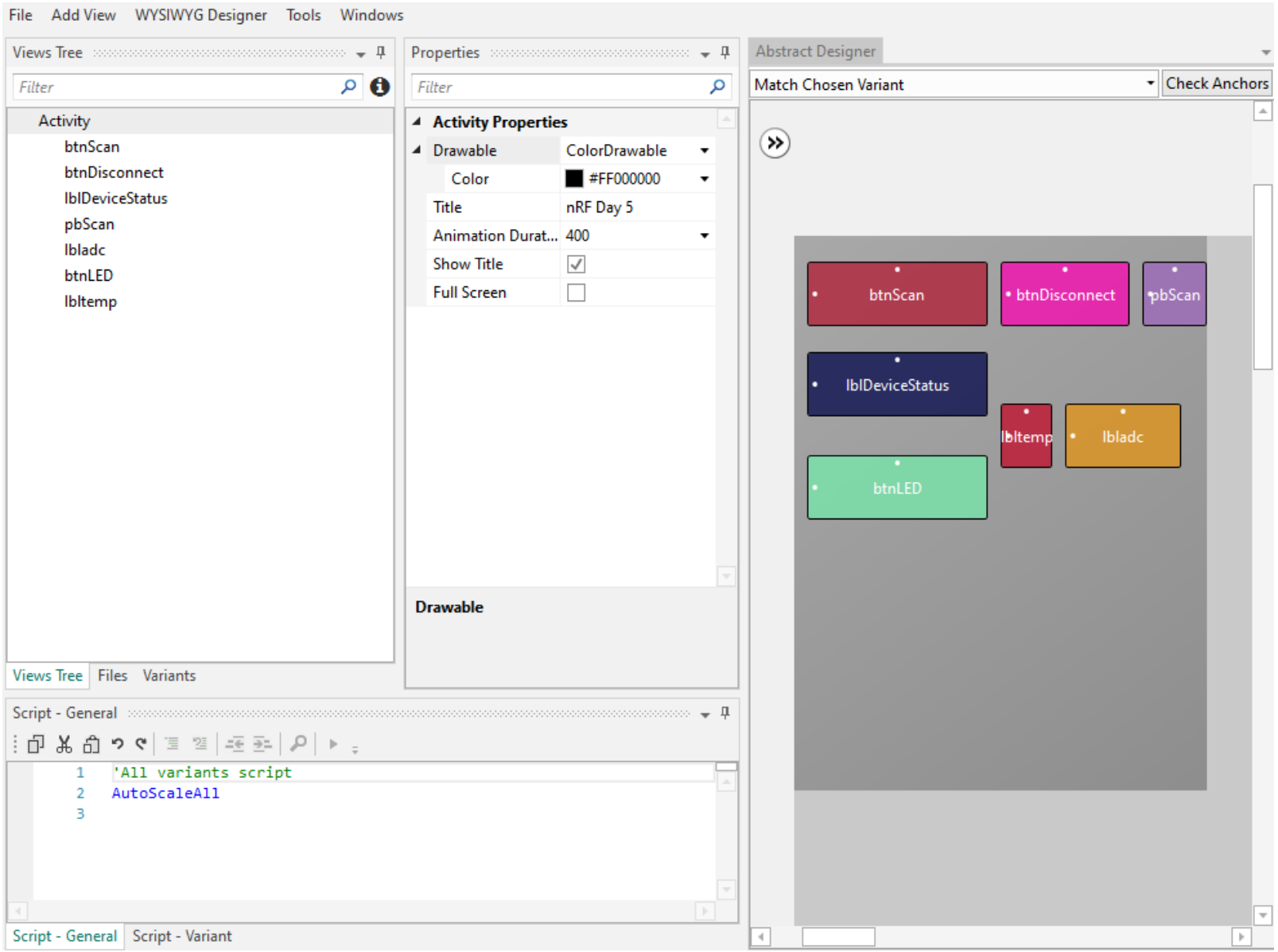
Connected

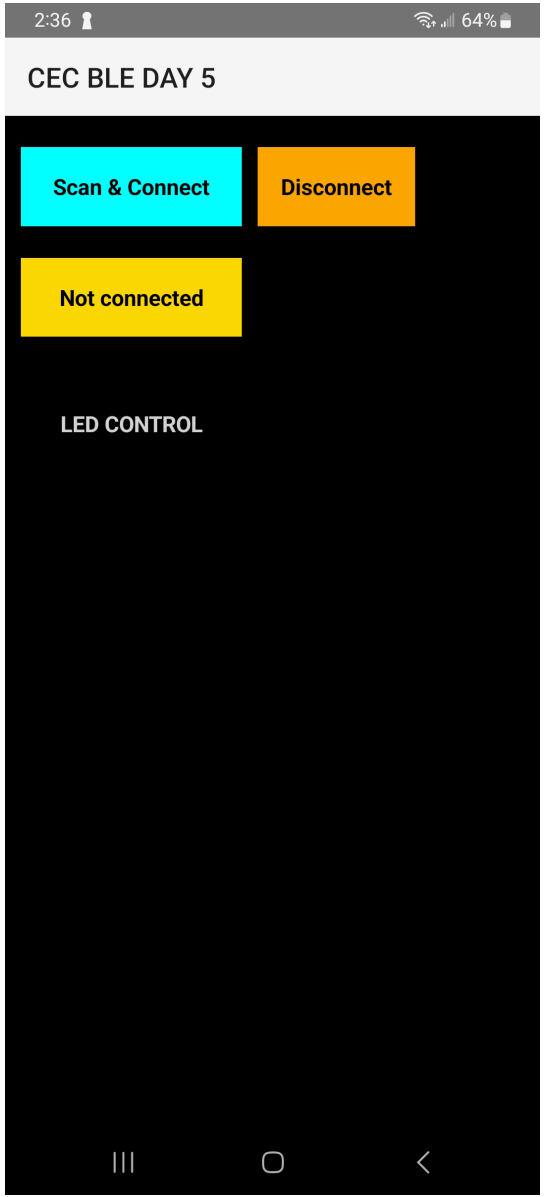


CNTL LED


W407990ASJ58
1 2 3 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
E
D
C
B
A
I
+

MDBT50Q B4A App Layout



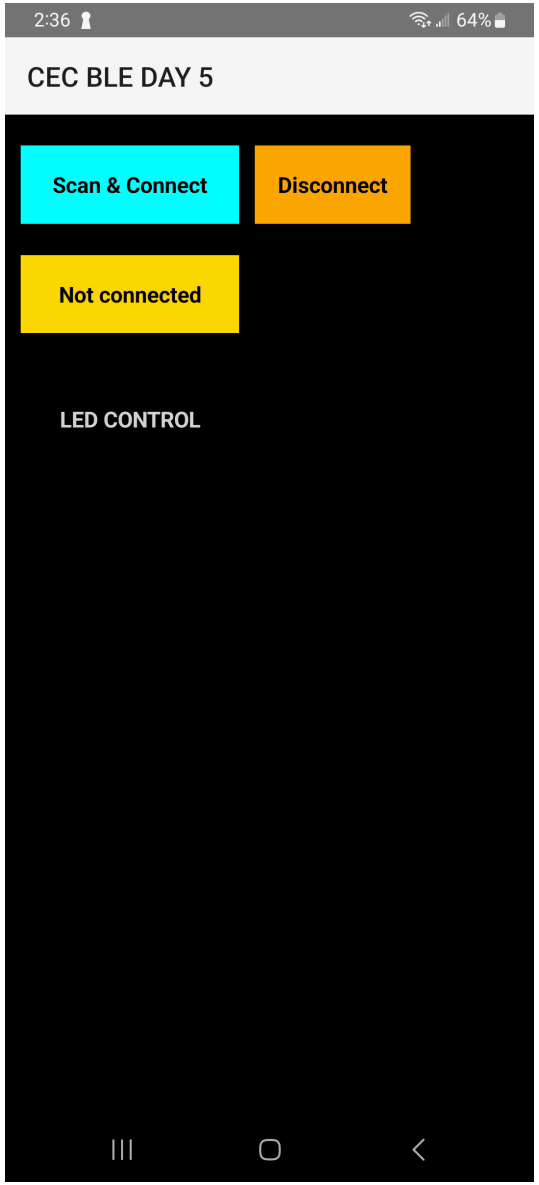


B4A Global Declarations

```
'nRF Day 5
'Last Update: 04-05-2024
'Modified by Fred Eady

Sub Class_Globals
    Private Root As B4XView
    Private xui As XUI
    Private btnDisconnect As Button
    Private btnScan As B4XView
    Private lblDeviceStatus As B4XView
    Private manager As BleManager2
    Private rp As RuntimePermissions
    Private currentState As Int
    Private connected As Boolean = False
    Private ConnectedName As String
    Private pbScan As B4XLoadingIndicator
    Public FoundDevices As Map

    Public BLEId As String = ""
    Public sensorSvc As String = ""
    Public sensorChr As String = ""
    Public ledSvc As String = ""
    Public ledChr As String = "9488b3b2-7de5-4a1c-af41-385a89931332"

    Public bc As ByteConverter
    Public adcData(8) As Short
    Public sensorData(8) As Byte
    Public rawSensorData(8) As Byte
    Public ledData(1) As Byte
    Private lbladc As Label
    Dim temptimer As Timer
    Private btnLED As Button
    Public ledTogByte As Byte = 0x00
    Private lbltemp As Label
End Sub
```

MDBT50Q Custom Android App Initialization

```
53  'This event will be called once, before the page becomes visible.
54  Private Sub B4XPage_Created (Root1 As B4XView)
55      Root = Root1
56      Root.LoadLayout("1")
57      B4XPages.SetTitle(Me, "CEC BLE DAY 5")
58      manager.Initialize("manager")
59      temptimer.Initialize("temptimer",2000)
60      lbltemp.Visible = False
61      StateChanged
62  End Sub
63
64  Private Sub temptimer_Tick
65      If connected = True Then
66          manager.ReadData(sensorSvc)
67      End If
68  End Sub
```



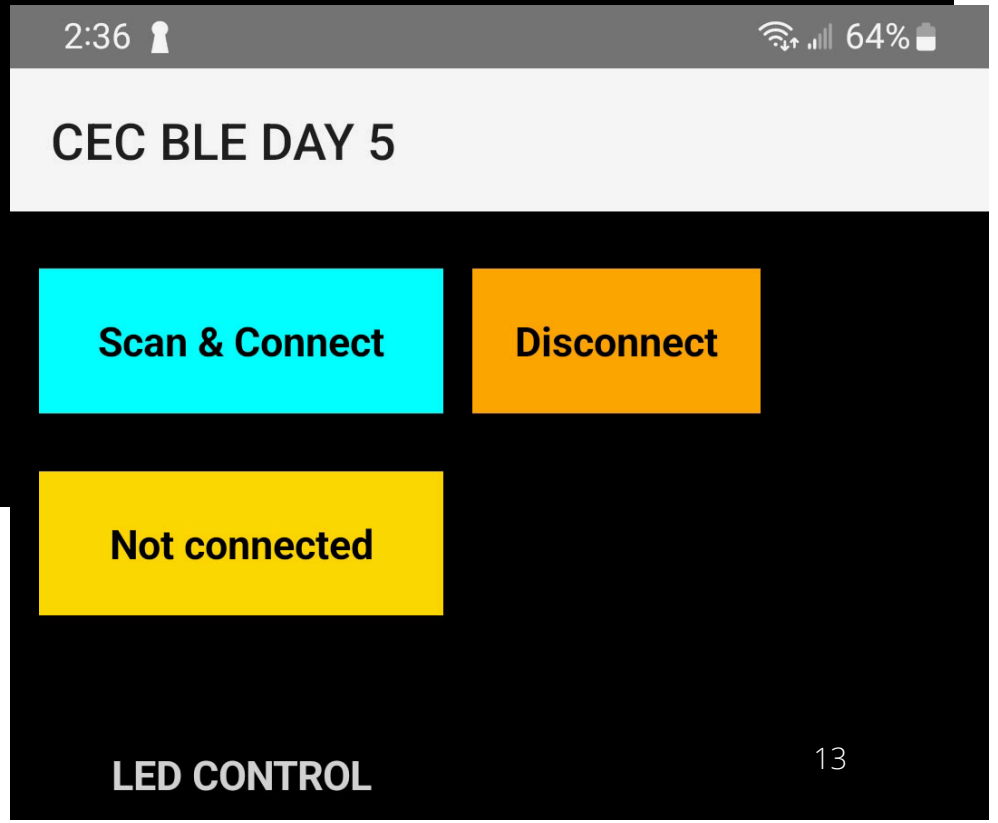
State and Devices Found Management

```
 93  Public Sub StateChanged
 94      If connected Then
 95          lblDeviceStatus.Text = "Connected: " & ConnectedName
 96      Else
 97          lblDeviceStatus.Text = "Not connected"
 98      End If
 99      btnDisconnect.Enabled = connected
100      btnScan.Enabled = Not(connected)
101      pbScan.Hide
102      btnScan.Enabled = (currentState = manager.STATE_POWERED_ON) And connected = False
103  End Sub
104
105  Sub Manager_StateChanged (State As Int)
106      currentState = State
107      StateChanged
108  End Sub
109
110  Sub Manager_DeviceFound (Name As String, Id As String, AdvertisingData As Map, RSSI As Double)
111      Log("Found: " & Name & ", " & Id & ", RSSI = " & RSSI & ", " & AdvertisingData) 'ignore
112      If Name.StartsWith("CEC_BLE_DAY4") Then
113          FoundDevices.Put(Name, Id)
114      End If
115  End Sub
```

```
Found: , 7E:57:58:BC:F4:F5, RSSI = -93, (MyMap) {1=[B@571d07, 22=[B@a59ae34, 3=[B@b7b345d, -1=[B@a57d1d2, 0=[B@3be82a3}
Found: , 00:9A:84:46:2D:7D, RSSI = -90, (MyMap) {-1=[B@fd79a0, 0=[B@8bbb959}
Found: , 28:4B:8F:B8:05:44, RSSI = -58, (MyMap) {-1=[B@e3d391e, 0=[B@2aca5ff}
Found: [TV] Samsung TU700D 43 TV, 04:B9:E3:2B:54:17, RSSI = -53, (MyMap) {1=[B@1e59215, -1=[B@27fc92a, 8=[B@2fa31b, 0=[B@9dcdcb8}
Found: , 27:52:E3:C5:71:BD, RSSI = -44, (MyMap) {-1=[B@81b55f7, 0=[B@bdf0c64}
Found: , 15:57:DC:7C:85:8B, RSSI = -57, (MyMap) {1=[B@d16eecd, -1=[B@f145382, 0=[B@5a55a93}
Found: CEC_BLE_DAY4, DE:88:83:B1:AB:15, RSSI = -51, (MyMap) {1=[B@430aac9, 9=[B@d3825ce, 7=[B@7c10cef, 0=[B@efd83fc}
Found: , 5E:49:9D:E2:54:37, RSSI = -44, (MyMap) {1=[B@297aae7, -1=[B@6505694, 0=[B@50e253d}
Found: , DA:91:A4:BC:99:9E, RSSI = -44, (MyMap) {-1=[B@8ca132, 0=[B@3aa0e83}
Found: , 4C:4B:33:AC:94:8D, RSSI = -49, (MyMap) {1=[B@c264800, 10=[B@63cd839, -1=[B@6df9e7e, 0=[B@2f50fdf}
Found: , 69:11:D2:20:9C:2C, RSSI = -90, (MyMap) {-1=[B@ec51718, 0=[B@b845571}
Found: , 5B:C3:55:5A:47:B6, RSSI = -87, (MyMap) {1=[B@fc6ff56, -1=[B@c0b1bd7, 0=[B@2808cc4}
Found: , 60:F6:29:9D:85:06, RSSI = -49, (MyMap) {1=[B@f37d7ad, 10=[B@b4bbae2, -1=[B@efb9e73, 0=[B@b5bb130}
Found: , 78:44:DF:8F:F8:A8, RSSI = -90, (MyMap) {1=[B@b2b061d, 10=[B@49ca092, -1=[B@2890a63, 0=[B@115c660}
Found: , 90:DD:5D:EE:34:E3, RSSI = -86, (MyMap) {1=[B@989d6fd, 10=[B@3dfcff2, -1=[B@ed37643, 0=[B@8e3f4c0}
```

Scan and Connect

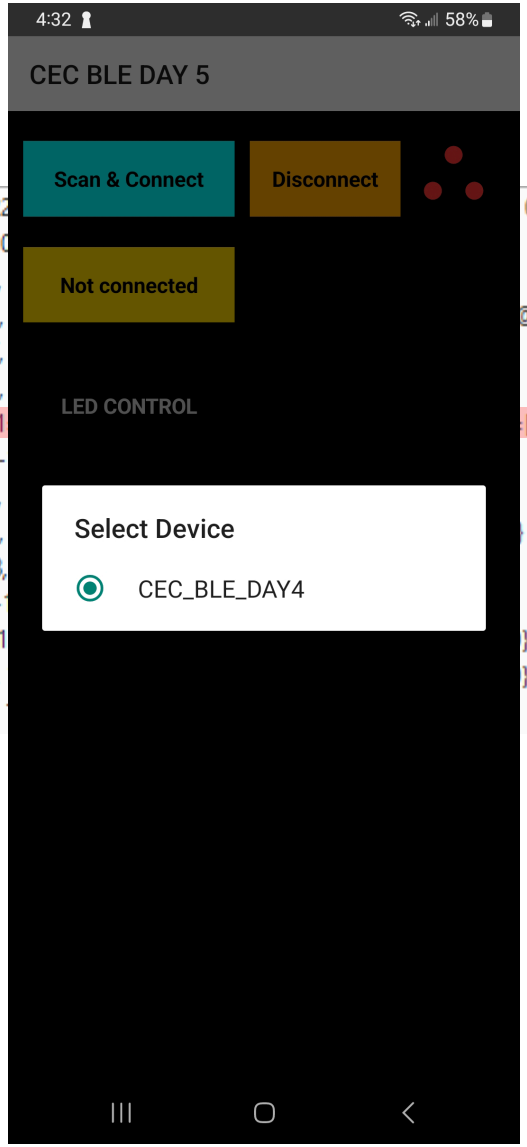
```
76  Sub btnScan_Click
77      'Don't forget to add permission to manifest
78      Dim Permissions As List
79      Dim phone As Phone
80      If phone.SdkVersion >= 31 Then
81          Permissions = Array("android.permission.BLUETOOTH_SCAN", "android.permission.BLUETOOTH_CONNECT", rp.PERMISSION_ACCESS_FINE_LOCATION)
82      Else
83          Permissions = Array(rp.PERMISSION_ACCESS_FINE_LOCATION)
84      End If
85      For Each per As String In Permissions
86          rp.CheckAndRequest(per)
87          Wait For B4XPage_PermissionResult (Permission As String, Result As Boolean)
88          If Result = False Then
89              ToastMessageShow("No permission: " & Permission, True)
90              Return
91          End If
92      Next
93      pbScan.Show
94      StartScan
95  End Sub
```



Scan and Connect

```
117   Public Sub StartScan
118       If manager.State <> manager.STATE_POWERED_ON Then
119           Log("Not powered on.")
120       Else
121           FoundDevices.Initialize 'process global Map variable
122           manager.Scan2(Null, False)
123           Sleep(5000)
124           manager.StopScan
125           AfterScan(FoundDevices)
126
127       End If
128   End Sub
129
130   Sub AfterScan(Devices As Map)
131       Dim items As List
132       items.Initialize
133       For Each name As String In Devices.Keys
134           items.Add(name)
135       Next
136       If items.Size > 0 Then
137           InputListAsync(items, "Select Device", 0, False)
138           Wait For InputList_Result (Index As Int)
139           If Index <> DialogResponse.CANCEL Then
140               Dim id As String = Devices.Get(items.Get(Index))
141               Log("Connect to: " & id)
142               manager.Connect2(id,False)
143           End If
144       Else
145           btnScan.Visible = True
146       End If
147   End Sub
```

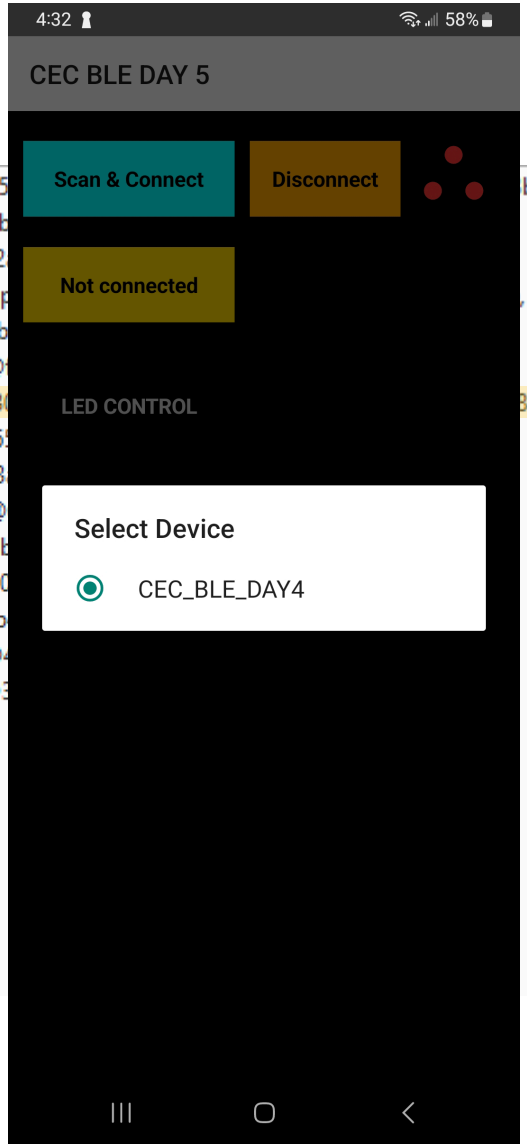
```
Found: , 7E:57:58:BC:F4:F5, RSSI = -93, (MyMap) {1=[B@571d07, 22
Found: , 00:9A:84:46:2D:7D, RSSI = -90, (MyMap) {-1=[B@fd79a0, 0
Found: , 28:4B:8F:B8:05:44, RSSI = -58, (MyMap) {-1=[B@e3d391e,
Found: [TV] Samsung TU700D 43 TV, 04:B9:E3:2B:54:17, RSSI = -53,
Found: , 27:52:E3:C5:71:BD, RSSI = -44, (MyMap) {-1=[B@81b55f7,
Found: , 15:57:DC:7C:85:8B, RSSI = -57, (MyMap) {1=[B@d16eecd,
Found: CEC_BLE_DAY4, DE:88:83:B1:AB:15, RSSI = -51, (MyMap) {1
Found: , 5E:49:9D:E2:54:37, RSSI = -44, (MyMap) {1=[B@297aae7, -
Found: , DA:91:A4:BC:99:9E, RSSI = -44, (MyMap) {-1=[B@8ca132,
Found: , 4C:4B:33:AC:94:8D, RSSI = -49, (MyMap) {1=[B@c264800,
Found: , 69:11:D2:20:9C:2C, RSSI = -90, (MyMap) {-1=[B@ec51718,
Found: , 5B:C3:55:5A:47:B6, RSSI = -87, (MyMap) {1=[B@fc6ff56, -
Found: , 60:F6:29:9D:85:06, RSSI = -49, (MyMap) {1=[B@f37d7ad, 1
Found: , 78:44:DF:8F:F8:A8, RSSI = -90, (MyMap) {1=[B@b2b061d,
Found: , 90:DD:5D:EE:34:E3, RSSI = -86, (MyMap) {1=[B@989d6fd,
```



Connection Management

```
162   Sub btnDisconnect_Click
163       manager.Disconnect
164       Manager_Disconnected
165   End Sub
166
167   Sub Manager_Disconnected
168       Log("Disconnected")
169       connected = False
170       lbltemp.Visible = connected
171       lbladc.Visible = connected
172       StateChanged
173   End Sub
174
175   Sub Manager_Connected (services As List)
176       Log("Connected")
177       connected = True
178       lbltemp.Visible = connected
179       lbladc.Visible = connected
180
181       Log("Manager_Connected, Services are:")
182
183       For Each S As String In services
184           Log("  [" & S & "]")
185
186           If S.Contains("-72ca-") Then
187               sensorSvc = S
188           End If
189           If S.Contains("-0c4a-") Then
190               ledSvc = S
191           End If
192       Next
193       temptimer.Enabled=True
194       StateChanged
195   End Sub
```

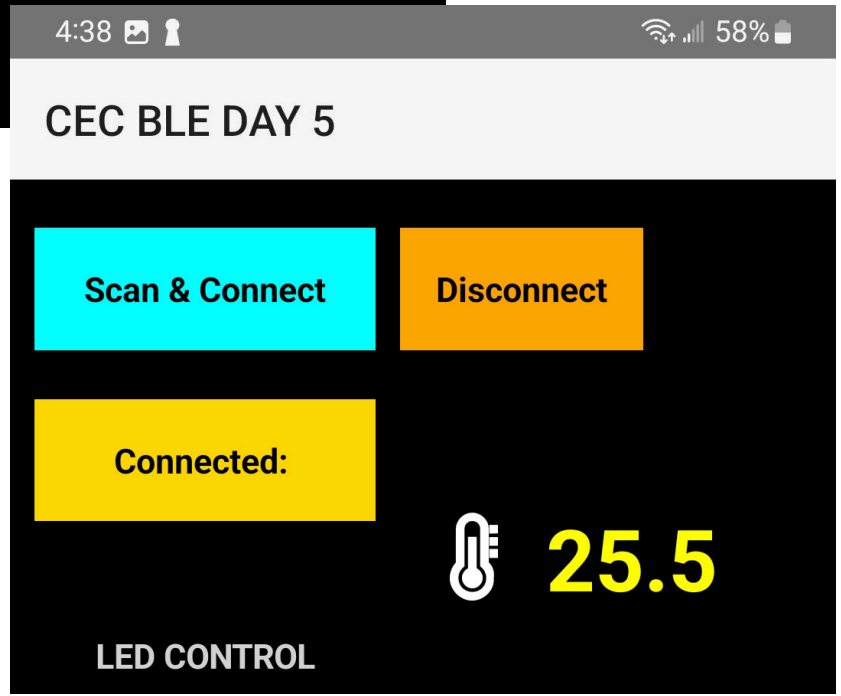
```
Found: , 7E:57:58:BC:F4:F5, RSSI = -93, (MyMap) {1=[B@571d07, 22=[B@a5
Found: , 00:9A:84:46:2D:7D, RSSI = -90, (MyMap) {-1=[B@fd79a0, 0=[B@8b
Found: , 28:4B:8F:B8:05:44, RSSI = -58, (MyMap) {-1=[B@e3d391e, 0=[B@2
Found: [TV] Samsung TU700D 43 TV, 04:B9:E3:2B:54:17, RSSI = -53, (MyMap
Found: , 27:52:E3:C5:71:BD, RSSI = -44, (MyMap) {-1=[B@81b55f7, 0=[B@b
Found: , 15:57:DC:7C:85:8B, RSSI = -57, (MyMap) {1=[B@d16eecd, -1=[B@
Found: CEC_BLE_DAY4, DE:88:83:B1:AB:15, RSSI = -51, (MyMap) {1=[B@43
Found: , 5E:49:9D:E2:54:37, RSSI = -44, (MyMap) {1=[B@297aae7, -1=[B@6
Found: , DA:91:A4:BC:99:9E, RSSI = -44, (MyMap) {-1=[B@8ca132, 0=[B@3
Found: , 4C:4B:33:AC:94:8D, RSSI = -49, (MyMap) {1=[B@c264800, 10=[B@
Found: , 69:11:D2:20:9C:2C, RSSI = -90, (MyMap) {-1=[B@ec51718, 0=[B@b
Found: , 5B:C3:55:5A:47:B6, RSSI = -87, (MyMap) {1=[B@fc6ff56, -1=[B@c0
Found: , 60:F6:29:9D:85:06, RSSI = -49, (MyMap) {1=[B@f37d7ad, 10=[B@b
Found: , 78:44:DF:8F:F8:A8, RSSI = -90, (MyMap) {1=[B@b2b061d, 10=[B@4
Found: , 90:DD:5D:EE:34:E3, RSSI = -86, (MyMap) {1=[B@989d6fd, 10=[B@3
Connect to: DE:88:83:B1:AB:15
Discovering services.
Connected
Manager_Connected, Services are:
 [00001801-0000-1000-8000-00805f9b34fb]
 [00001800-0000-1000-8000-00805f9b34fb]
 [5328b08a-0c4a-4bda-996c-41064568e694]  LED SERVICE
 [97252dff-72ca-44ea-910b-82864cae65f3]  SENSOR SERVICE
```



Incoming Data Management

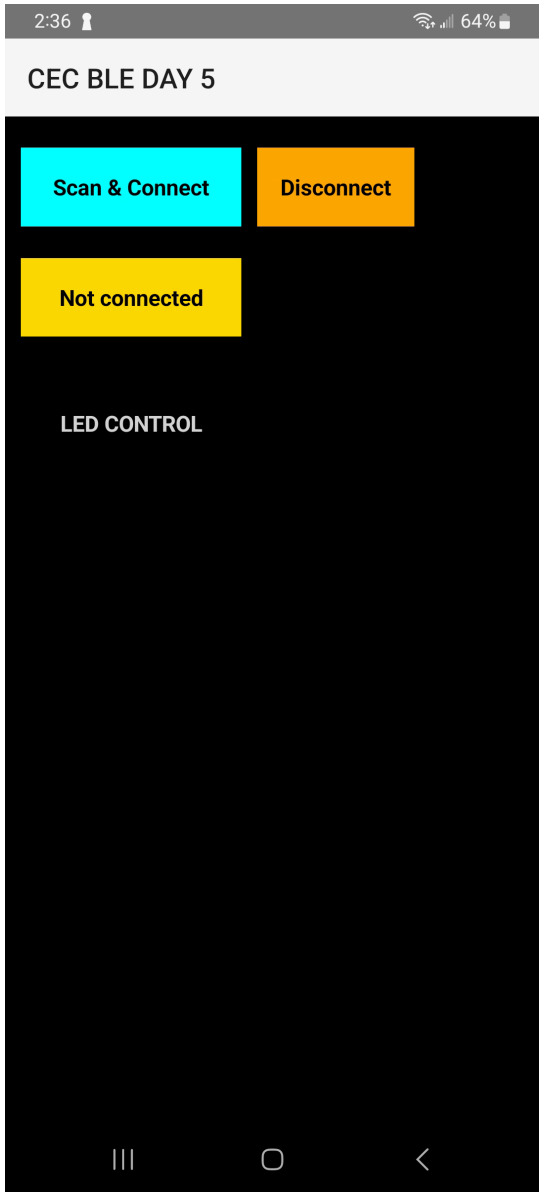
```
21  // @brief SENSOR Characteristic.
22  #define BT_UUID_SENSORCHR_VAL    \
23      BT_UUID_128_ENCODE(0xa64a76ef,0xd522,0x4783,0x9f46,0xbfdf95f4510d)
```

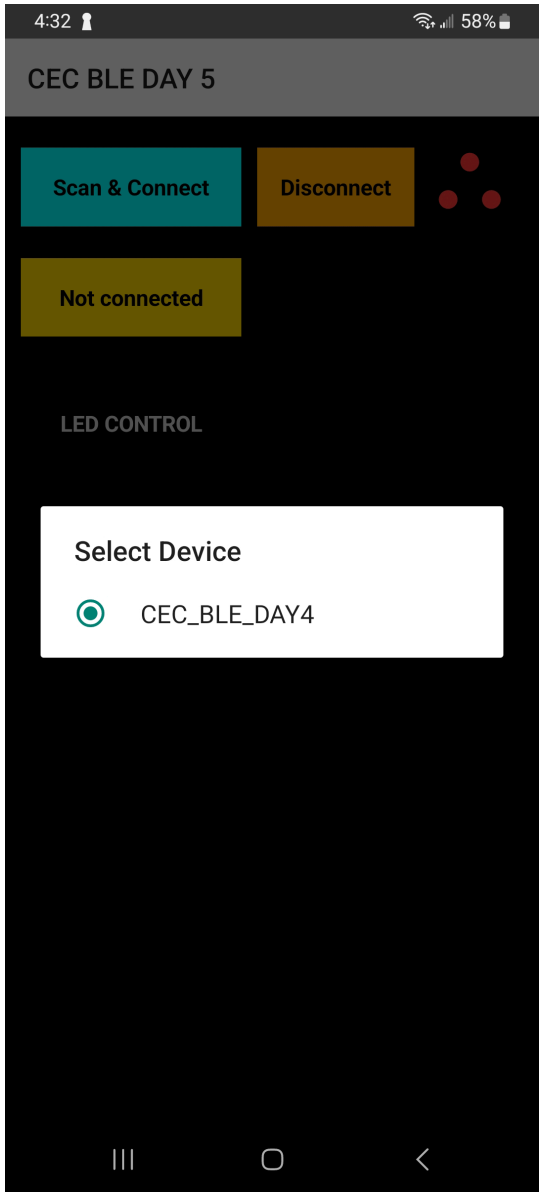
```
149 Sub Manager_DataAvailable (ServiceId As String, Characteristics As Map)
150     For Each S As String In Characteristics.Keys
151         If S.StartsWith("a64a76ef") Then
152             sensorChr = S
153             rawSensorData = Characteristics.Get(sensorChr)
154             sensorData(0) = rawSensorData(1)
155             sensorData(1) = rawSensorData(0)
156             adcData = bc.ShortsFromBytes(sensorData)
157             lbladc.Text = adcData(0) / 10
158         End If
159     Next
160 End Sub
```

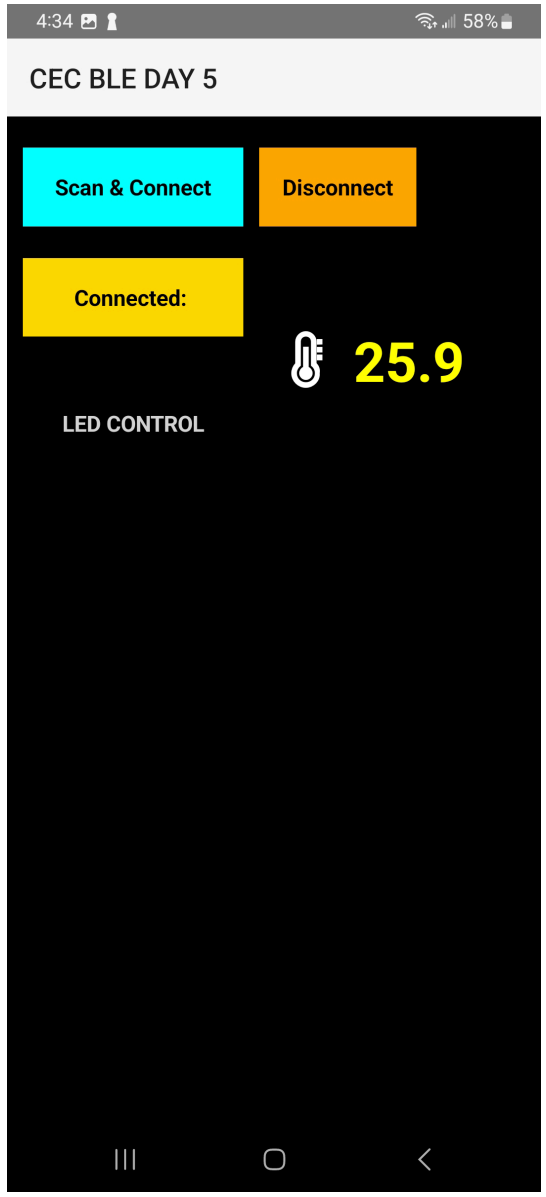



```
[00:00:30.009,185] <inf> bleday4: adc0 = 00FF
[00:00:30.009,185] <inf> bleday4: adc0 255 mV
[00:00:31.012,237] <inf> bleday4: adc0 = 0102
[00:00:31.012,268] <inf> bleday4: adc0 258 mV
[00:00:32.015,258] <inf> bleday4: adc0 = 00FF
[00:00:32.015,289] <inf> bleday4: adc0 255 mV
[00:00:33.018,280] <inf> bleday4: adc0 = 0101
[00:00:33.018,310] <inf> bleday4: adc0 257 mV
[00:00:34.021,301] <inf> bleday4: adc0 = 00FE
[00:00:34.021,331] <inf> bleday4: adc0 254 mV
[00:00:35.024,353] <inf> bleday4: adc0 = 00FE
[00:00:35.024,383] <inf> bleday4: adc0 254 mV
[00:00:36.027,374] <inf> bleday4: adc0 = 0100
[00:00:36.027,404] <inf> bleday4: adc0 256 mV
[00:00:37.030,395] <inf> bleday4: adc0 = 0102
[00:00:37.030,426] <inf> bleday4: adc0 258 mV
[00:00:38.033,416] <inf> bleday4: adc0 = 0100
[00:00:38.033,447] <inf> bleday4: adc0 256 mV
[00:00:39.036,437] <inf> bleday4: adc0 = 0101
[00:00:39.036,468] <inf> bleday4: adc0 257 mV
```

Scan – Connect – Process Incoming Data

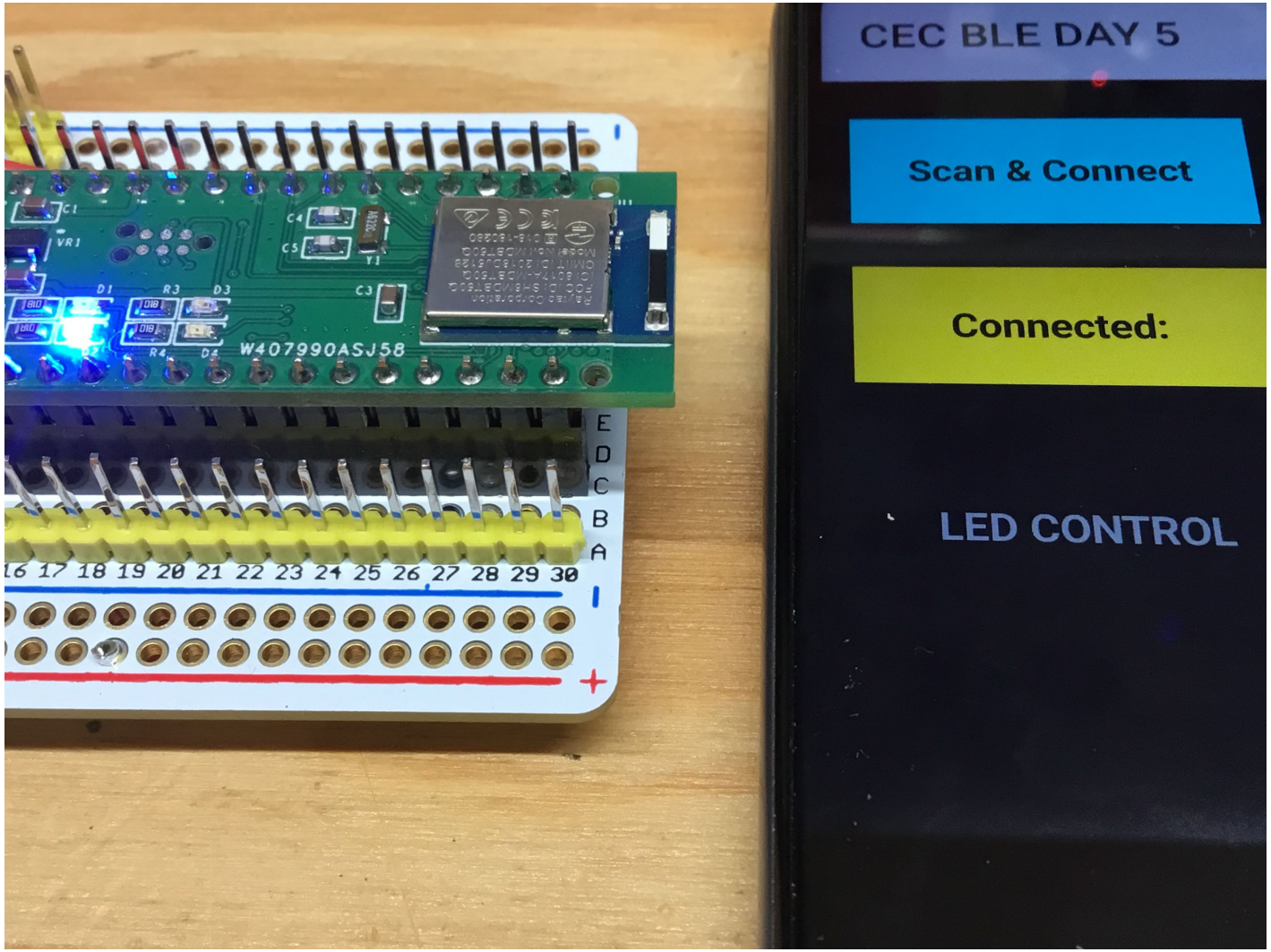






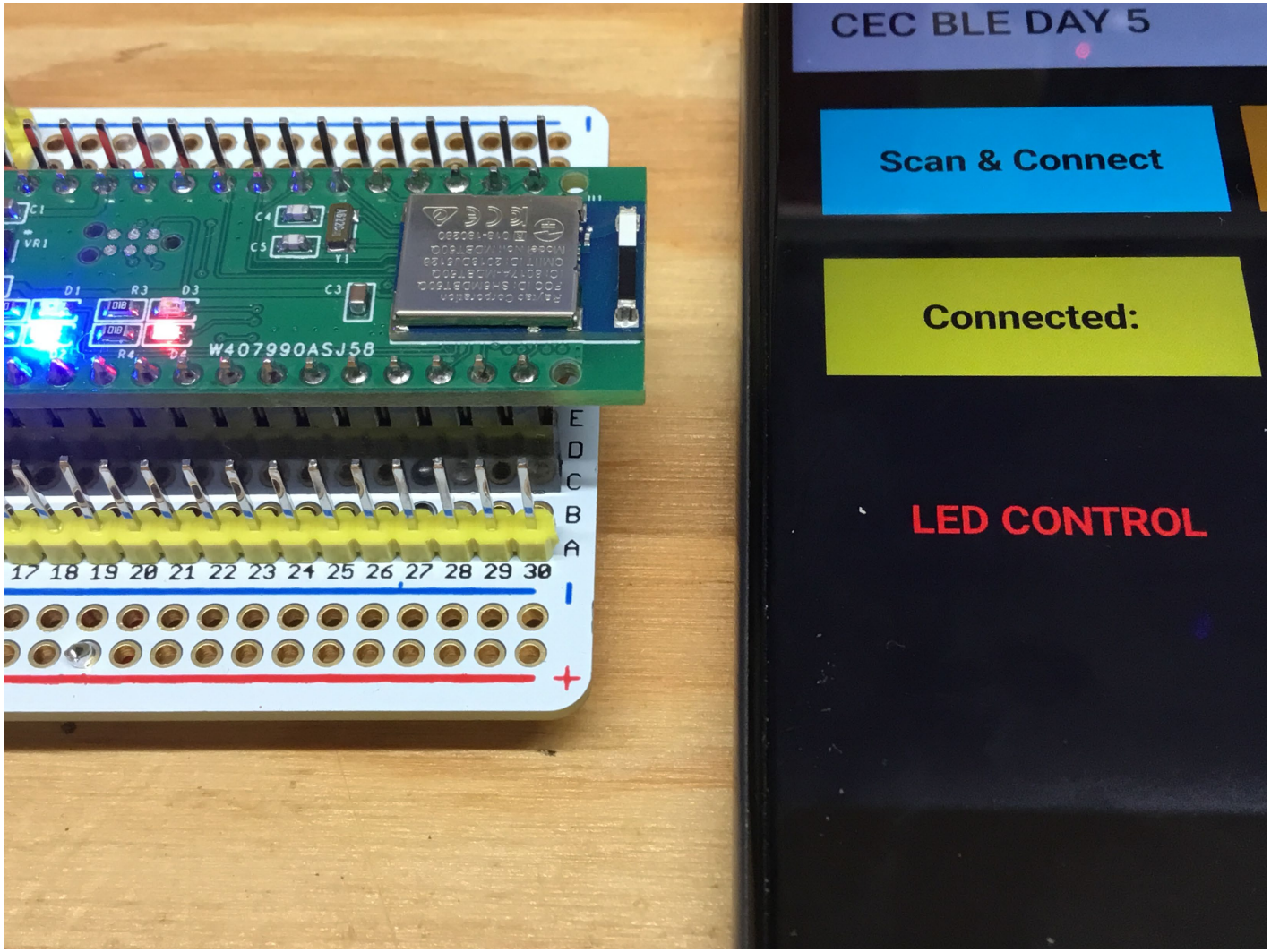
LED Control

```
197   Private Sub btnLED_Click
198       If connected = True Then
199           ledTogByte = Bit.Xor(ledTogByte, 0x01)
200           ledData(0) = ledTogByte
201           manager.WriteData(ledSvc,ledChr,ledData)
202           Select ledTogByte
203               Case 0x00
204                   btnLED.TextColor=(Colors.Gray)
205               Case 0x01
206                   btnLED.TextColor=(Colors.Red)
207           End Select
208       End If
209   End Sub
```



LED Control

```
197   Private Sub btnLED_Click
198       If connected = True Then
199           ledTogByte = Bit.Xor(ledTogByte, 0x01)
200           ledData(0) = ledTogByte
201           manager.WriteData(ledSvc,ledChr,ledData)
202           Select ledTogByte
203               Case 0x00
204                   btnLED.TextColor=(Colors.Gray)
205               Case 0x01
206                   btnLED.TextColor=(Colors.Red)
207           End Select
208       End If
209   End Sub
```



The Full Monty

Next Time…

MORE TO COME..

Thank you for attending!!!

Please consider the resources below:

- Today's Download Package
- nordicsemi.com
- nRF52840 User Guide
- raytac.com
- b4x.com

ARDUINO®

CEC Continuing Education Center

DesignNews

Thank You

Sponsored by

DigiKey

informa markets