## User Interfaces and Industrial IoT, Hands-On

### Class 5: Advanced Human Interface Design for the IIoT

March 2, 2018

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Blue Ridge Advanced Design and Automation Asheville, North Carolina





# This Week's Agenda

- 2/26 An Overview of IIoT Applications and Interface Needs
- 2/27 Simple Interfaces that Aren't So Simple
- 2/28 Beginning Graphics Interface, Hands-on (Part 1)
- 3/1 Beginning Graphics Interface, Hands-on (Part 2)
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### HMI in the IIoT

- As we have seen, there is a large variety of application areas in the IIoT, and many have their own HMI challenges
- Some of the considerations include:
  - Robustness and reliability
  - Unique communications protocols
  - Security
  - Fail-safe
  - Timing issues

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### Automotive

- Typically uses CAN bus, but may involve BT or even WiFi
- Security and firewalls can be a major issue (Uconnect and On\*Star hacks)
- Wide range of lighting conditions
- Rugged components and construction
- Simple, uncrowded, 'corner of the eye' layout
- Lockout in motion for some features



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### Medical

- Design subject to Part 11 and HIPAA laws
- BT, WiFi, proprietary communications
- Operators often gloved

Question 1 – What other issues can you think of?



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### Industrial

- PLC, SCADA, DCS
- Programmable Logic Controllers (PLC) often provide for remote terminal access (RS-232 or RS-485). Some also provide web page access.
- Supervisory Control and Data Acquisition (SCADA) systems are more often web (HTML) or proprietary control for remote HMI
- Distributed Control Systems (DCS) have a number of interfaces







### DCS



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### Protocols

- At low levels, can include 4-20mA as well as some digital
- Digital communications can include fieldbus digital protocols, such as Foundation Fieldbus, profibus, HART, Modbus, PC Link etc., and other digital communication protocols such as modbus
- Wired Ethernet, typically integrating IEEE 1588





# Typical remote (older generation)



- MODBUS
- Membrane Switches
- 4x20 alphanumeric display
- Also available with laptop interface (RS-232)



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### **Industrial Portable Terminal**





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### And Now There is an App for That



 With the availability of durable cases for phones and tablets, there is a move to more apps to interface to industrial controls, often mimicking the original operator panel

Question 2 – Develop in android or iOS?



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### **Communications Options**

- Cellular (3G/4G)
- WiFi
- Bluetooth
- NFC
- Proprietary (via adding an external interface via USB or the above)



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### Various OS Opportunities

- Windows 10
- Android
- iOS

 Plus there is the option of using a browser in any of the above



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### An Example from Pro Audio



- Allen & Heath remote audio mixer app
- Duplicates front panel functions of a hybrid analog / digital mixer board



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# Using an App for IIoT

- Advantages
  - Essentially zero HW development cost
  - Can make field replacement quicker (and remote)
  - Depending on design, no sole source
- Disadvantages
  - Harder to lock down hardware selection than using proprietary hardware
  - Possible certification issues
  - Less control over usage



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# https://developer.android.com/ studio/index.html

### Android Studio The Official IDE for Android

Android Studio provides the fastest tools for building apps on every type of Android device.

World-class code editing, debugging, performance tooling, a flexible build system, and an instant build/deploy system all allow you to focus on building unique and high quality apps.

DOWNLOAD ANDROID STUDIO 3.0.1 FOR WINDOWS (683 MB)



> Read the docs > See the release notes

#### Question 3 – Interest in hands-on Android app training?

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### **Install Virtual Device**

🔉 Android Studio Setup						
	Choose Components Choose which features of Android Studio you want to install.					
Check the components you want to install and uncheck the components you don't want to install. Click Next to continue.						
Select components to insta	all: Android Studio	Description Position your mouse over a component to see its description,				
Space required: 2.1GB						
< <u>B</u> ack <u>N</u> ext > Cancel						



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### **Choose Standard**



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### Note Folder



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### Grab a coffee...

Android Studio Setup Wizard		
Unzipping  Show Details		
	Previous Next	Cancel Finish

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🖉 Create New Project					
Create Android Project					
Application name					
My Application 0001					
<u>C</u> ompany domain					
charles.example.com					
Project location					
C:\Users\Charles\AndroidStudioProjects\MyApplication0001					
Package name					
com.example.charles.myapplication0001					
Include C++ support					
Include Kotlin support					
Previous <u>N</u> ext <u>C</u> ancel Finish					
	UING				
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### Critical Choice – features vs compatibility

Create New Proj	arget Android Devices
So	elect the form factors and minimum SDK ome devices require additional SDKs. Low API levels target more devices, but offer fewer API features.
2	Phone and Tablet
	API 15: Android 4.0.3 (IceCreamSandwich) By targeting API 15 and later, your app will run on approximately 100% of devices. Help me choose
C	Include Android Instant App support Wear
C	API 21: Android 5.0 (Lollipop)
	API 21:       ✓       Phone and Tablet         Android 7       API 19: Android 4.4 (KitKat)       ▼         API 24:       By targeting API 19 and later, your app will run on approximately 90.1% of devices. Help me choose       □         Include Android Instant App support       □       □
	Previous Next Cancel Finish Presented b CONTINUING

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Create New	<sup>Project</sup> Configure Activity		
		Creates a new empty activity	
	÷	Activity Name MainActivity	
		Generate Layout File	
		Layout Name activity_main	
		Backwards Compatibility (AppCompat)	
		Previous Next Cancel	<u>F</u> inish
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### If you get error 216, you need a 32-bit JRE



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### Set Pointer to JDK 8 Install



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# https://developer.android.com/ training/basics/firstapp/index.html

#### Build Your First App

The following pages teach you how to build a simple Android app. You'll learn how to create a "Hello World" project with Android Studio and run it. Then, you'll create a new interface for the app that takes some user input and opens a second screen in the app.

But before you start, there are two fundamental concepts you should understand about Android apps:

#### Apps provide multiple entry points

Android apps are built as a combination of components that can be invoked individually. For example, an *activity* is a type of app component that provides a user interface.

The "main" activity is what starts when the user taps your app icon, but you can take the user straight into a different activity from other places, such as from a notification or even from a different app.

Other components such as *broadcast receivers* and *services* also allow your app to perform background tasks without a user interface.

After you build your first app, learn more about the other components at App Fundamentals.

#### Apps adapt to different devices

Android allows you to provide different resources for different devices. For example, you can create different layouts for different screen sizes. Then the system determines which layout to use based on the current device's screen size.

If any of your app's features need specific hardware, such as a camera, you can query whether the device has that hardware at runtime and then disable the corresponding features if not. You can also set some features as required so Google Play won't allow installation on devices without them.

After you build your first app, learn more about device configurations at Device Compatibility.

With those basic concepts in mind, click below to start building your first app!

Get Started →



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### Coming to ESC Boston?

 Join me for a 4-hour HANDS ON tutorial on "Talk to Your IoT Application: Android App Programming"
 Date: Wednesday, April 18
 Time: 8:00am - 12:00pm
 Pass type: Conference (Paid)
 Get your pass now!



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### QUESTION 4: WHAT TOPICS WOULD YOU LIKE TO SEE?



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### Our Next Class!!

Tune in on March 19-23, 2018 for our next CEC class:

"Embedded System Design Techniques™ -Connecting Edge Devices to the IoT using Amazon FreeRTOS"

Instructor: Jacob Beningo



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# Please stick around as I answer your questions!

- Please give me a moment to scroll back through the chat window to find your questions
- I will stay on chat as long as it takes to answer!
- I am available to answer simple questions or to consult (or offer in-house training for your company) c.j.lord@ieee.org http://www.blueridgetechnc.com http://www.blueridgetechnc.com
   http://www.linkedin.com/in/charleslord
   Twitter: @charleslord
   https://www.github.com/bradatraining



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