

Introduction to FRC Robotics:

Team management and Embedded Computing

This course has two parts.

The primary part is focused on embedded computing and is designed to develop the participants knowledge, skills, and abilities and lead to a sense of understanding the basic subject matter and to develop confidence in supporting software development in the high school robotics setting. The delivery of instruction has two components. There is a requirement for self-study and preparation ahead of an online teaching and laboratory session.

The secondary part of the course is a non-technical seminar that will teach the basics of team management and development.

The course will be conducted over a period of four weeks with two sessions a week. Each session is 2 hours long. The session begins with a ½ hour of online review and introduction to the assigned material. The participant will then conduct 1 ½ hours of independent work to follow-up. I will be able to additionally engage participants by appointment. The participant should expect to commit a total of 16 hours of time on this endeavor.

Each online session will be a quick review of the assigned material, and an working session to resolve and settle any issues or challenges that the participant is facing.

Reference Documents, for perusal, reference, and support:

[Control System Layout Image](#)

[Control System Setup – Software Installation](#)

[Thin Introduction to C/C++ for FRC](#)

<https://www.learn-c.org/>

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Week 1 :

June 4th

(Thursday)

Introduction to the test and development environment

Before the session: *self-guided*

You will need to have an assembled or partially assembled 'tabletop' control system.

At a minimum you will need

programmed wifi radio connected to a RoboRio computer

visual code and C++ installed, and the driver-station software installed.

This guide will get you started.

http://kellrobotics.org/files/learn_embedded_c++/A%20Quick%20Introduction%20to%20FRC%20Control%20System%20Setup.pdf.

You should review the following two videos:

[FRC Control System Component Overview](#)

[Boolean Logic](#)

Agenda

Hardware review

RoboRio

PD – Power Distribution Module

VRM – Voltage Regulator Module

PCM – Pneumatic Control Module

Motor Controllers, Talon, Victor

Radio

Wiring Connections and Communications Ports

Power

PWM control

CAN control

RSL

I2C, SPI, UART, Ethernet

Software Development Tools Installation Review

Driver Station Utilities Review

Number Bases, base 10, base 2

Boolean Logic, AND, OR, NAND, OR

Conditional evaluation

Week 1, cont'd :

June 5th (Friday)

The WPILIB Robot software framework, toward a 'Hello World' software program

Before the session: *self-guided*

You should review the following two videos:

[Timed Iterative Robot](#)

[FRC Hello World](#)

and seek to fully replicate the activity in the 2nd video – *FRC C++ Hello World++*

Agenda

- WPILIB Iterative Robot software framework

 - main()

 - ___ Init methods

 - ___ Periodic methods

- Driver-station Operation

 - Teleoperated mode

 - Autonomous mode

 - Test mode

 - Practice match setup and execution

 - Enable / Disable state transition relative to tele, auto, test modes

- VS Code / WPILIB Development familiarization, tour of key commands

- Intellisense Refreshing

- Creating projects from templates

- Building, and Deploying programs

- Operating programs

- Using the SmartDashboard, programming and operation

Week 2:

June 9th (Tuesday)

Before the session: *self-guided*

You should review the following video:

[Xbox Controllers for FRC – C++](#)

and seek to fully replicate the activity in the video.

Agenda

Instantiating the Xbox software object

Creating variables to hold Xbox controller information

Accessing the Xbox class methods

Reading the Boolean and floating point, real values from the Xbox controller

Displaying the Xbox buttons and axis value on the 'Shuffleboard'

June 11th **(Thursday)**

Before the session: *self-guided*

You should review the following videos:

[Number Bases, Digital & Analog Signals](#)

[Analog, Digital, Encoder, PWM Hardware Setup](#)

[Adding a Digital Input Limit Switch](#)

[Adding an Analog Input – Voltage Measurement](#)

[Adding an Analog Ultrasonic Sensor](#)

Seek to fully replicate the activity in the **‘Adding a(n) videos’**

Agenda

Understanding the basics of base 10 and base 2 number systems

Counting in binary

Von Neumann interpretation of memory data, information representation

The nature of quantizing or converting continuously variable into digital form

The basic difference in Analog and Digital signals, wrt computing systems.

Creating the DigitalInput and Analog Input object

Instantiating the object

Reading the data

Storing the data

Presenting the data on the Shuffleboard

Implementing an analog ultrasonic sensor

Week 3:

June 16th (Tuesday)

Control outputs: CAN speed controllers

Videos: To be announced

June 18th (Thursday)

Pneumatic controls

Videos: To be announced

Week 4:

June 23rd (Tuesday)

Putting it all together, the symphony of controls

June 25th (Thursday)

Team processes management and development: *fully live session*