FRC Programming Practices Workshop

Hosted by: Bechtel

Date: November 15th – 9 am to 1 pm

Location: Bechtel’s Reston Facility  12011 Sunset Hills Road  Reston, VA 20190

**The presenters:**

1. Josh Long: [jalong@bechtel.com](mailto:jalong@bechtel.com) [(240)480-2798](tel:%28240%29480-2798)

2. Jeffery Crockett: did not get his contact info.

3. Mike Anderson: [robot-maker12@verizon.net](mailto:robot-maker12@verizon.net)

Mike Anderson volunteered to come to our school with their robot prototype and guide us, we are also welcome to go to Herndon HS on Tue evenings to see their demos and talk to them.

**Attendees from 2186:**

Sabrina, Colman, Gautam

Agenda:

1. Break the room into teams of 4, grouped by the school the students attend for hands on workshops.
2. Safety procedure overview. Discuss safety procedures and do a worksheet, each team come up with what they consider as good safety practices, John presented the fishbone diagram method of laying out safety practices. Will detail this further. Teams were judged based on their output.
3. Documentation: Present alternatives for documenting the code and design of the program. Will detail this further with examples.
4. Programming style guideline: Presentation by Jeffery Crockett. Will detail this further.
5. RobotDrive demo by Mike Anderson. Creation of a program from scratch and export to netbeans and Eclipse. Touched upon WPI API.
6. <https://www.facebook.com/FRC2015ControlsBeta> is a Facebook group we need to look at in detail about what the Herndon HS team is working on with the new beta 2015 control system.
7. Demo of Robot presented by Mike with the beta 2015 control system. New features detailed and presented.
8. Asked the students to do a programming challenge, i.e., do a flowchart to solve a problem. Will detail this further.

Safety procedures

Teams collaborated to come up with a list of safety procedures and organize them and present to the hosts as a fishbone diagram. Below is an example of a fishbone diagram in progress outlining safety procedures:

Equipment and materials safety Transportation safety Tournament

Carry robot with extreme caution

Caution around chemicals

Train team members

Write safety manual

Safety tasks pre build time Safety tasks during build time

Documentation

1. Flowchart your program before implementing to document the design
2. Standard IE61131. Part 3 of *IEC 61131* deals with [programming languages](http://en.wikipedia.org/wiki/Programming_languages) and defines two graphical and two textual [PLC](http://en.wikipedia.org/wiki/Programmable_logic_controller) programming language standards:

* [Ladder diagram](http://en.wikipedia.org/wiki/Ladder_logic) (LD), graphical
* [Function block diagram](http://en.wikipedia.org/wiki/Function_block_diagram) (FBD), graphical
* [Structured text](http://en.wikipedia.org/wiki/Structured_text) (ST), textual
* [Instruction list](http://en.wikipedia.org/wiki/Instruction_list) (IL), textual
* [Sequential function chart](http://en.wikipedia.org/wiki/Sequential_function_chart) (SFC), has elements to organize programs for sequential and [parallel control processing](http://en.wikipedia.org/wiki/Parallel_computing).

Here is an example SFC below:

Limit switch . arm is deployed

Limit switch . counter >= 2 feet . a gate

Deploy arm

Move bot forward 2 feet

Programming Style

1. Introductory comment block1
2. Introductory comment block 2
3. Introductory comment block 3
4. Comment and whitespace conventions
5. Choose meaningful variable names
6. Whitespace to make code readable
7. Pretty printer for formatting code
8. Variable scope and variable data type are important
9. Avoid globals and use local variables
10. Use namespaces
11. Proper use of static variables
12. Use appropriate variable type
13. Use floats judiciously
14. Use only integers for counters

Follow the below advice/guidelines

1. Use API WPI as a reference
2. Reach out to more experienced teams for help
3. Start the drive train well before the build season
4. Refer to the Herndon HS team Facebook page for help: <https://www.facebook.com/FRC2015ControlsBeta>
5. Make a diagram of wiring and connections and correlate to code and hand out to wiring team
6. WPI Robot builder
7. Use your programming language reference as needed
8. Specify the problem definition
9. Keep the IDE reference, Eclipse or netbeans
10. Cheap Delphi(?)
11. WPI Robotics library users guide.
12. CAN tutorial (Controller Area Network), become familiar
13. Jaguar CAN documentation, read it
14. RoboBio website, become familiar
15. Wireshark, become familiar with it

Version control

Github or svn to archive and reuse code and maintain history and logs