SATURDAY ENRICHMENT SPRING 2019
ADVANCED POWERS IN ROBOTICS

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Robinson Center Classroom – Guggenheim Annex

Course Description

The technology for self-driving cars is ours to experiment with! Under controlled conditions, we can simulate how a car would avoid obstacles by building models, rather than risk using this tech on the road. Within the first week, each team will build a working chassis. In the following weeks, the chassis will be programmed to navigate autonomously. This class is designed for experienced robot builders, focusing more on programming motors and sensors on our robots rather than specific mechanical builds.

Students will learn how to design and build a mechanical system that will not interfere with the proper functioning of other systems. We will have to design with robustness in mind, since the combined weight of our robots is an entirely new variable to work around. This will take experimentation and prototyping to refine pieces so they are compatible with the final robot.

Essential Questions

- What design factors contribute to robot performance on a specified task?
- Is there a simpler way to do the same thing?
- How do we respond when “things don’t quite work out as planned”?
- How can we all design and build with each other in mind?

Learning Outcomes

Students will understand the importance of iteration for improving their project designs – not only for the robot, but for the build process itself.

Students will be able to design, build, and test their robots to perform specified tasks. Mechanisms and structures will be modular, leading to a variety of combinations that still function securely.

The logic and challenge of certain design features for self-driving cars will allow students to think critically about the potential impacts of self-driving on transportation.

Instructional Strategies

The most limited resource is time! While a majority of class time is spent on designing, building, programming, and testing our robots, each class will have an agenda of topics and planned activities to frame the class goals for that week.

Storage

Students are expected to clean up their kits by placing pieces inside the kit so we can close the lid. Large assemblies can be removed from the kits as the final robot is completed, but smaller assemblies should remain in the boxes, especially for the first three class meetings.

Teamwork

The very purpose of this class is to coordinate in pairs or groups of three as well as a class to build robot parts that work by themselves and together. Students will work together with the class on tasks they design themselves. Each group of students has access to a VEX IQ Super-Kit, Brain, and Controller, and it is expected that every group member will always be able to contribute. Prototyping and experimentation is highly encouraged, even if what is built does not go on the final robot. Ultimately, we want everyone in the class to be able to point out a feature or mechanism on the robot that they helped build and design.

There are so many pieces in the kit that multiple versions of the same thing can be built, and time is best spent building new things. Students may spend time de-constructing their previous work. Sometimes this is unavoidable. However, it is extremely important they recognize situations where they have enough parts to continue without de-constructing. Loose pieces tend to get mixed together or lost. Grouping them into small assemblies is helpful for storage. If team members wish to take something apart, they should consult each other. We will respect each other's work by leaving it assembled until the group agrees it should be taken apart.

Student Assessment

Students will be given constant verbal feedback from the instructor relating to the robot build process. Students will self-reflect on their own build process and will constructively critique their peers' robot designs and ideas. With improvement in mind, students will continually iterate and share their learning with the class.

Class Design Meetings	Full class instruction on specific topics, including guided builds. Focus on technical details and overall strategies.
Group Design Meetings	The instructor meets with teams to help with specific ideas. Both targeted troubleshooting and general design advice.
Personalized Tutorials	The instructor will meet individual students for topics such as programming and advanced parts with several degrees of freedom.

Resources and Materials

VEX IQ kits and programming laptops.

All materials will be provided by the Robinson Center.

Tentative Class Schedule

Class Date	Topics	Activities
April 6	-Drive trains: gear ratios, wheel size, center of mass, traction	-Gear ratios! Spin to win! -Building symmetrically -Begin building drive trains!
April 13	-Basic controls for drive motors and adjusting power and speed	-Finish drive trains! -Robot racing!
April 20	NO SATURDAY CLASSES DUE TO HOLIDAY WEEKEND	
April 27	-Finalize chassis layout with mounting blocks for different sensors -Adding line tracking sensors to robot chassis	-Mounting a light sensor to follow a straight line -Adjusting the programming to follow a curvy line
May 4	NO ROBOTICS CLASS (A.J. travelling) Students still have their other RC classes.	
May 11	-Ultrasonic distance sensor -RGB hue sensor	-Prototype testing -Write out checklists and procedures for tasks
May 18	-Sensors and timing -Creating checklists for robot tasks and maintenance	-Group design brainstorm -Robot build and testing
May 25	NO SATURDAY CLASSES DUE TO HOLIDAY WEEKEND	
June 1	-Build Workshop and Practice	-Robot build and testing
June 8	SHOWCASE! (in the morning before RC classes) Class will still meet at the normal time.	-Presenting and celebrating work - During class, all robots will need to be deconstructed, and their parts will be sorted :(But this means other students will have opportunities to build robots!

Showcase

On the morning of the last day of class, A.J.'s robotics and programming classes will meet to display their robots and NetLogo models. This time is reserved to make up the May 4 class. Parents will be sent e-mails with event details, and students will be reminded in classes in preparation for this event.