Unit 04 - System Integration and Testing

Content Area: **Science**
Course(s): **Robotics A**
Time Period: **Semester 2**
Length: **10 weeks**
Status: **Published**

Standards

9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
8.1.12.CS.2	Model interactions between application software, system software, and hardware.
8.1.12.AP.8	Evaluate and refine computational artifacts to make them more usable and accessible.
8.1.12.AP.9	Collaboratively document and present design decisions in the development of complex programs.
8.2.12.ED.5	Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
8.2.12.NT.2	Redesign an existing product to improve form or function. Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed.

Enduring Understandings

- Multiple systems developed to solve a complex problem must be designed to work together.
- One system failing in a multi-system design will normally result in a failure of the entire design.
- Modular systems are very effective for designing components that will often need replacement.
- A solution to a problem can not be deemed successful without proper testing within all potential environments/scenarios.
- The iteration process is necessary for making the most successful design possible.
- Eventually, the iteration process comes to a point where effort is greater than reward and a complete redesign is necessary to continue progressing.

Essential Questions

1. How does the process of system engineering allow for the development of a well- integrated structure?
2. How does the integration of system engineering early in the design process provide benefits to the overall design?
3. What unexpected outcomes surfaced during initial gameplay and how can you reduce the amount of uncertainties for future problems?
4. What types of robot changes are viable given specific time constraints?
5. What would you improve about the design process if you had to start over?
6. Which parts of the design process were rushed or overlooked? To what extent did your design suffer due to oversight?

7. When do we stop creating iterations of a design?

Knowledge and Skills

Knowledge:

- Improvements to one part of a design may benefit other subsystems and the product as a whole.
- Eliminating unnecessary components of a design will improve function and reliability.
- Sharing components between subsystems when possible yields more efficient designs.
- Modular designs make assembly, disassembly, repair, and replacement simpler and more time-efficient tasks.
- Efficiency is typically measured by consistency and time. Increasing speed without sacrificing consistency will result in the most effective version of your design.
- System integration should be considered throughout each iteration of a design.
- The iterative process should cease when improvements do not justify the time required to redesign. At this point, the design can be deemed sufficient for its purposes or be completely redesigned.

Skills: SWBAT

- critique the robot's ability and select critical areas for improvement.
- investigate and implement improvements between robot subsystems for their designs.
- examine potential changes to individual subsystems that will result in instant improvement for other subsystems.
- illustrate a systematic process to prioritize the improvements dictated by the data collected from their testing
- defend the role that testing plays in the design process.
- prove how the information collected in the testing process is used in the different iterations of their robot design.
- argue the need for continued iteration for each part of their design.

Transfer Goals

By the end of this unit, students will have tested and refined their designs through the iterative process and will be prepared to compete. The testing and redesign phases have enabled students to enhance their robots for competition, based on strategies they believe will lead to success. Each team has developed a vision for how gameplay will unfold, which they will now put to the test. During the competition, students will analyze the effectiveness of their strategies and make adjustments as needed over a series of matches. They will then reflect on their decisions, assessing their effectiveness in the initial stages of the engineering design process, evaluating their success, and determining a more efficient approach. This experience will enhance students'

ability to comprehend, evaluate, and develop solutions to various problems they may face, both in engineering and other aspects of life.

Resources

https://sites.google.com/whrhs-stu.org/ponzio/robotics/vex-edr/unit-04

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing