Integrated Engineering Challenges

v3.0

Unit Overview:

In this unit, students will apply the knowledge they have gained from previous Kid Spark learning experiences as they develop creative solutions to a series of robotics and coding challenges.

Recommended Grade Level:
6 - 8

Kid Spark STEM Lab:
STEM Pathways **or**
Engineering Pathways (w/Spark:bit)

Prerequisite Kid Spark Units:
1. Robotics & Coding 101
2. Exploring Sensors
3. Loops & Variables

Alignment to STEM Standards:

The table below highlights how this unit is aligned to the Computer Science Teachers Association (CSTA) K-12 Computer Science Standards and the Next Generation Science Standards (NGSS).

- CSTA K-12 CS standards introduce the fundamental concepts of computer science to all students, beginning at the elementary level. Click here to view the standards.
- NGSS Disciplinary Core Ideas (DCI) are standards related to content knowledge.

Lessons & Assessment	CSTA	NGSS-DCI
Challenge 1: Automated Gate Challenge (120+ Min.) In this challenge, teams will develop an automated gate that is controlled using the Spark:bit programmable robotics controller and a Bump Sensor.	**1A-CS-01** Describe how internal and external parts of computing devices function to form a system. **1B-CS-02** Model how computer hardware and software work together as a system to accomplish tasks. **1B-AP-08** Compare and refine multiple algorithms for the same task and determine which is the most appropriate. **1B-AP-10** Create programs that include sequences, events, loops, and conditionals. **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. **2-AP-11** Create clearly named variables that represent different data types and perform operations on their values. **2-AP-12** Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals. **Concepts:** Computing Systems, Algorithms & Programming **Subconcepts:** Devices, Hardware & Software, Troubleshooting, Algorithms, Variables, Control, Program Development	Engineering Design
Challenge 2: Roadway Redirect Challenge (120+ Min.) In this challenge, teams will develop a section of bridge roadway that can rotate 90° on command. Teams will utilize the Angle Sensor and serial monitor to observe real-time data that will be directly applied to the challenge.		
Challenge 3: Retractable Field Challenge (120+ Min.) In this challenge, teams will create a retractable sports field that can move inside and outside of a stadium on command. Teams will utilize Light Sensors to position the field inside or outside of the stadium.		
Challenge 4: Movable Bridge Challenge (120+ Min.) In this challenge, teams will create an automated, movable bridge. Teams will be required to utilize a pair of light gates (using transmitters and receivers) to complete the challenge.		
Challenge 5: Smart Vault Challenge (120+ Min.) In this challenge, teams will develop an automated smart vault that is used to protect valuable items on display in the city museum.		

Prerequisite Kid Spark Units

We highly recommend students complete the following Kid Spark units prior to starting this unit.

Elementary Program Units

- Applied Mathematics
- Robotics & Coding 101
- Exploring Sensors

Middle School Program Units

- Kid Spark Basics
- Simple Machines
- Compound Machines
- Loops & Variables

Note: Make sure students can access prior Kid Spark units/lessons. Students may need to re-visit past learning experiences or utilize example programs/sketches they can apply to new robotics challenges and projects.

Get Engaged!

Visit our community page at **KidSparkEducation.org/Community** for new project ideas, lesson insights, and to see how other educators are using Kid Spark materials and resources in their classrooms.