

Integrated Engineering Challenges

v3.0

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Unit Overview

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.

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.

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

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.

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.

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

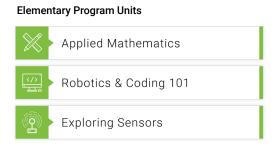
Subconcepts: Devices, Hardware & Software, Troubleshooting, Algorithms, Variables, Control, Program Development

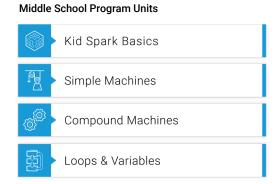
Engineering Design



Prerequisite Kid Spark Units

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





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.