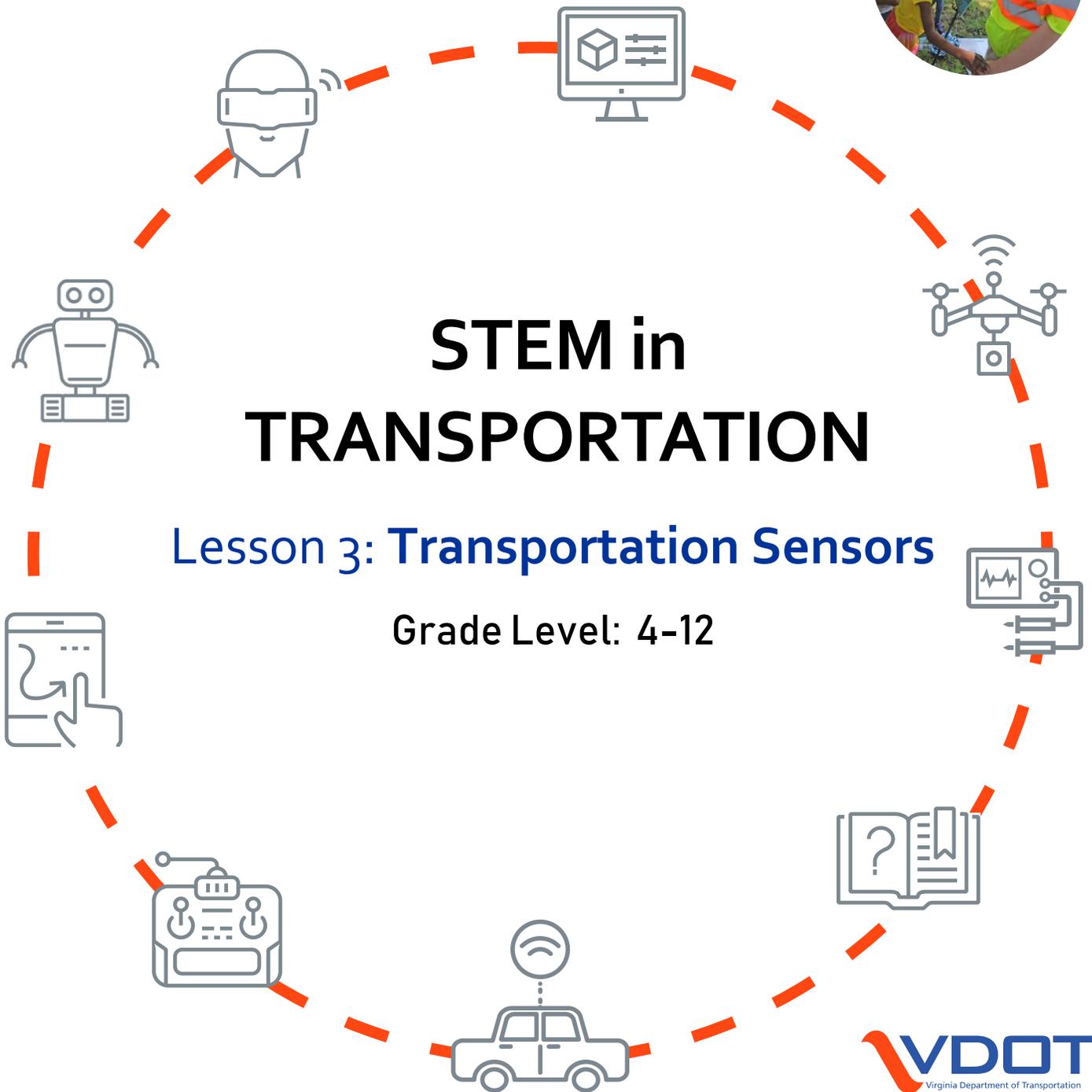




STEM FOR STUDENTS DRIVE IT HOME



Transportation Sensors

Background Knowledge

Sensors are part of most modern day technologies. They are integrated into our vehicles, appliances, buildings, and phones. Touch sensors trigger doors to open, motion sensors detect moving vehicles or pedestrians, and heat sensors supply an extra level of safety to our stoves. Sensors are integral to how we interact with technology and are becoming more common in the systems around us.

In this lesson, students will explore some of the sensors used in transportation. They will make their own touch sensor and program a sign to display a message or warning when their sensor is triggered.

Procedure

1. Begin with the PowerPoint presentation about Transportation Sensors.
2. Ask a Transportation Engineer to share their career path and what their job is like.
3. Have students work in groups of two to complete Tasks 1 – 5 of the NanoSonic, Inc. ITS Lesson-Module 9: Dynamic Message Signs found here: http://nanosonic.com/wp-content/uploads/2019/01/Module-9_Dynamic-Message-Signs_Makey-Makey-Activity-Worksheets.pdf

Some of the screen captures may look slightly different depending on the version of Scratch currently available.

4. Once students have mastered the easier task of programming a message/notification with one sensor, provide students with the following challenge task. A sample solution is given, but students more familiar with Scratch may be able to program it another way.

STANDARDS OF LEARNING
COMPUTER SCIENCE:
GRADES 3-8,
MSCSE.1, MSCSE.8,
PRG.7, CSF.23

Objective

Students will:

- Explore sensor technology used in transportation systems
- Build and program a touch sensor

Materials

- Two 2" x 3" cardboard pieces
- Aluminum foil or tape
- 2 small pieces of foam
- Tape or rubber band
- Makey Makey controller or similar controller
- Laptop or computer with internet access
- Optional: art supplies & a toy vehicle

Time: 60-90 minutes

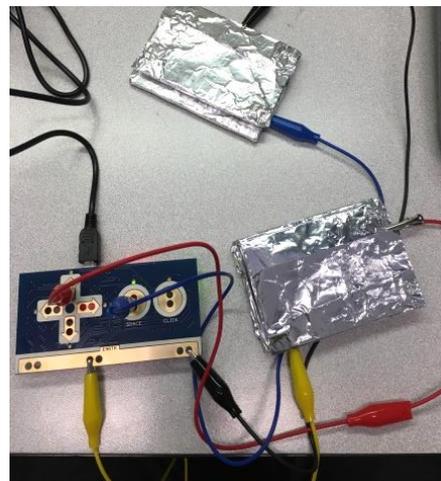
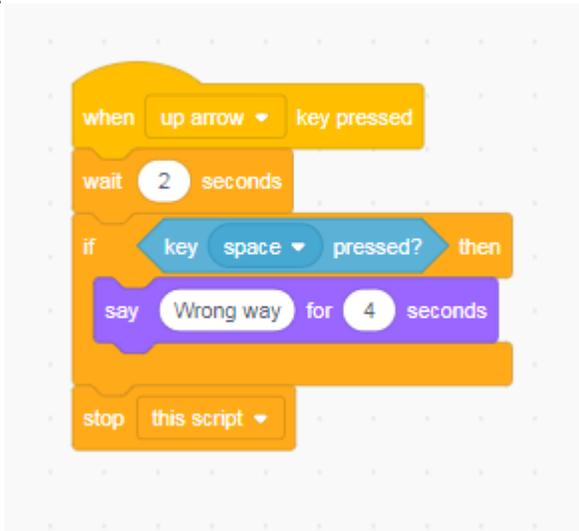
Challenge exercise:

How could you use sensors, a controller, and a message board to notify someone that they are going down a street in the wrong direction?

Possible Solution:

Use 2 sensors and write a program that would display a “Wrong Way” message if the two sensors are pushed sequentially in the opposite way that a car driving the proper direction would go over the sensors. The following Scratch program is an example of one solution.

Ex:



Given the possible solution, what are the limitations in this script?

Answer: The space bar sensor could not be pressed before the 2 second wait. If you press the two sensors too close together, no message would be displayed.

In real applications, you would need to specify a time range in which the space bar sensor can be pressed to account for a range of speeds the vehicle may be travelling.

- If you would like to have students complete Task 6 of the Module, any model cars/vehicles/robots can be used to trigger the sensors in place of the Moss Robots listed in the module.

Extension

Visit the NanoSonic, Inc. Education website for more lessons about technologies used in transportation. <https://nanosonic.com/education/>

Terminology

Sensor: a device whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor.

Circuit: a path that allows electricity to flow from one point to another. It may include various electrical components, such as transistors, resistors, and sensors.

Intelligent Transportation System (ITS): a system of integrated, advanced communication technologies used in transportation infrastructure and vehicles in a way which aims to improve transportation safety and mobility by allowing the system components to share information for better decision making. For example, a crosswalk may be fitted with LIDAR that detects pedestrians and sends a signal to a vehicle approaching the crosswalk which notifies the driver to slow down or stop for pedestrians.

Integrate: to connect pieces together so as to work toward the same purpose.

Technician: skilled workers that work with complex systems or perform highly technical, mechanical or diagnostic tasks.

Dynamic Message Boards: large signs over or near a roadway that communicate information to motorists and can be changed remotely depending on the information that needs to be displayed.

Proximity Sensor: a device that detects the presence of nearby objects without physical contact. Sound, light, infrared radiation (IR), or electromagnetic fields may be used for detection.

Autonomous Vehicle: is a vehicle that is capable of sensing its environment and moving safely with little or no human input.

Ultrasonic Sensor: a device that measures distance by using high frequency sound waves. The sensor emits an ultrasonic wave which is reflected back from an object. Distance to the object is determined based on the time between the emission and reception of the reflected wave.

Magnetometer: an instrument used for measuring magnetic forces

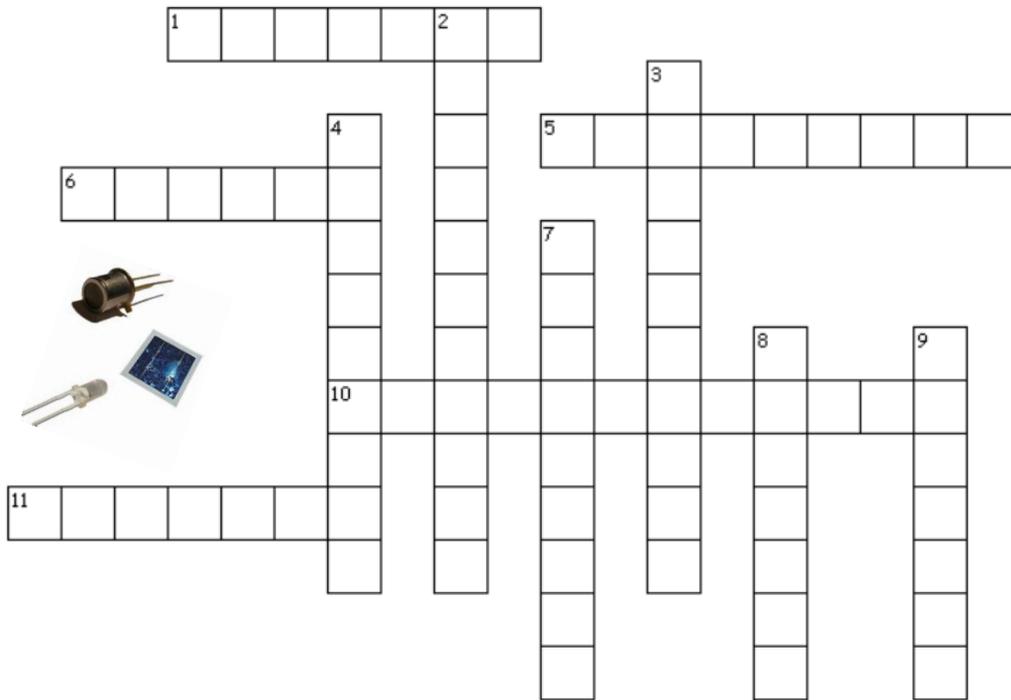
Rear Cross Traffic Alert: uses radar sensors in the back corners of a vehicle to help prevent drivers from backing into cross traffic by providing alerts when vehicles are detected. The sensors activate when a vehicle is in Reverse and can detect traffic coming from both sides of the vehicle.

Forward Collision Warning (FCW): is an advanced safety technology system that monitors a vehicle's speed, the speed of the vehicle in front of it, and the distance between the vehicles. If vehicles get too close, the FCW system will warn the driver of an impending crash.

Careers to Explore

- Electronics technician
- Traffic engineer
- Electrical engineer
- Mechanical engineer
- Equipment repair technician
- Automotive technician
- Manufacturing equipment technician
- PLC programmer

Transportation Sensors



WORD BANK	
sensor	circuit
technician	ultrasonic
traffic	integrate
collision	dynamic
intelligent	proximity
autonomous	
magnetometer	

Across

- _____ Message Boards are large signs over or near a roadway that communicate information to motorists and can be changed remotely.
- A Forward _____ Warning System is an advanced safety system that monitors a vehicle's speed, the speed of the vehicle in front of it, and the distance between the vehicles. If vehicles get too close, the system will warn the driver of an impending crash.
- a device whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor
- an instrument used for measuring magnetic forces
- a path that allows electricity to flow from one point to another; it may include various electrical components, such as transistors, resistors, and sensors
- This type of vehicle is capable of sensing its environment and moving safely with little or no human input.

Down

- An _____ Transportation System (ITS) is a system of integrated, advanced communication technologies used in transportation infrastructure and vehicles in a way which aims to improve transportation safety and mobility by allowing the system components to share information for better decision making.
- A _____ sensor is a device that measures distance by using high frequency sound waves.
- A _____ sensor is a device that detects the presence of nearby objects without physical contact. Sound, light, infrared radiation (IR), or electromagnetic fields may be used for detection.
- to connect pieces together so as to work toward the same purpose.
- skilled workers that perform highly technical, mechanical or diagnostic tasks within complex systems
- A Rear Cross _____ Alert system uses radar sensors in the back corners of a vehicle to help prevent drivers from backing into the path of vehicles that are coming from either side of them.