Module 8: RADAR and LIDAR Systems in Intelligent Transportation Systems
Modular Robotics Activity Worksheets
Grade Level: 6 - 12

Activity 1: Introduction to Autonomous Vehicle Systems

Objective:

In this activity, you will explore how autonomous vehicle systems work and how these systems can be simulated through robotics.

Directions:

- Watch the video to understand how autonomous systems work.
  https://www.youtube.com/watch?v=TsaES--OTzM

- Watch the video to understand how the MOSS Robotics system works.
  https://www.youtube.com/watch?v=47afbiKgAX0

  http://www.modrobotics.com/moss/moss-getting-started/
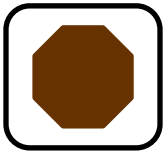
Activity 1 Completed _____

Activity 2: Introduction To MOSS Robotics

Objective:

In this activity you will identify important components and functions of the MOSS robotics system.

Directions:

Open your modular robotics kit and identify the components and their functions. Identify the purpose of the colored faces shown below.

Identify the following parts of your robotics kit:

Power & Wireless: Battery Block _____   Bluetooth Block _____

Sensors: Brightness _____   Proximity _____   Knob _____   Mic _____

Movement: Pivot _____   Motor _____

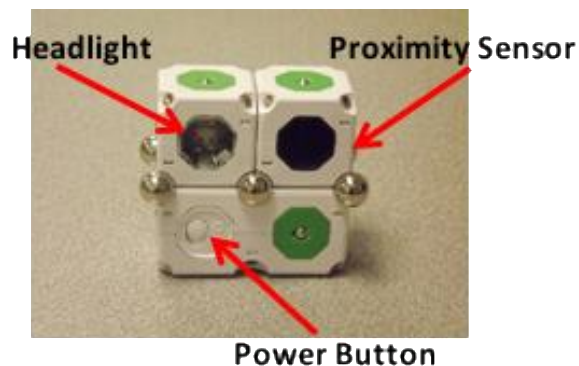**Other:**   Wheel _____   Axle _____   Flashlight _____   Corner _____

Activity 2 Completed _____

Activity 3 : Simple Sensors

Objective:

In this activity you will build a simple sensor.

Directions:

Using the battery block, connect one of the headlights. Be careful when attaching the light to ensure that the light will have power from the battery block (i.e. green faces need to be connected). Also make sure that the power switch is located so that it is easily accessible. Once the headlight is connected, connect the proximity sensor to the light. Notice that the light has a brown input face and the proximity sensor has a red output face. In order for the light to receive input from the proximity sensor, these two faces must be connected. Turn the power on and observe what happens when you move your hand closer to and away from the proximity sensor.

Sensors

Explain what happens when each sensor is connected to the headlight.

Proximity Sensor:

At what distance does the proximity sensor turn the headlight off? _____

Mic Sensor:

Brightness Sensor:

Knob:

Wrap Up Discussion:

Activity 3 Completed _____

Activity 4: Advanced Sensors

Objective:

In this activity you will create an advanced sensor system connecting power across multiple components and connecting input and output faces.

Directions:

Using a wheel, connect the battery block standing upright. Connect one of the motorized axles on top of the battery block. Be careful when connecting the axle to ensure that power can be transferred from the battery block to the axle. Turn the power on. What happens? Why? Turn off the power.

You will notice that your axle does not move. This is because the input faces are unable to receive data from an output.

Connect a blue pass through cube on top of the axle. On the side of the motorized axle, connect a blue corner block (Example 1). On the open face of the blue corner block, connect the knob sensor. When connecting the knob sensor, ensure that the red output face is connected to the brown input face of the axle using the pass through corner block (Example 2).

Example 1

Example 2

Turn the power on and observe what happens as you turn the knob sensor.

- **In the Example 1 picture, draw an arrow to show how power is flowing through the robot.**

- **In the Example 2 picture, draw and arrow to show how data is flowing through the robot.**

Once your robot is successfully working, experiment with the different sensors and explain how they affect the motorized axle.

Knob:

Proximity Sensor:

Mic Sensor:

Brightness Sensor:

Wrap Up Discussion:

Activity 4 Completed _____

Activity 5: Understanding Data and Power Flow

Objective:

When building with the Moss Robotics system, it is important to understand how power and data flow through the robot. In this activity, you will use the information you have gained in previous lessons to build a robot where power and data flow to multiple points on the robot.

Directions:

Using the MOSS Robotics System instruction manual, build the **Braitenbird Robot**.

Wrap Up Discussion:

1. What did you learn about transferring power throughout the robot?

2. What did you learn about transferring data through the robot?

3. What was the most difficult part of building the robot?

4. What considerations would you need to make to build your own robot?

Activity 5 Completed _____

Activity 6: Wireless Systems

Introduction/Objective:

Connectivity in a transportation system enables vehicles, infrastructure, and pedestrians to communicate with each other about their existing locations and intended movements. The information is sent, received and processed by technology capable of prompting responses to address three main objectives: safer driving, walking and biking; smoother traffic flow; and operating the transportation system at a lower cost to the earth's atmosphere.

Wireless networks are the means of connectivity between vehicles, infrastructure and their environment. Three types of wireless communication are currently used to help connected vehicles engage with and "see" one another:
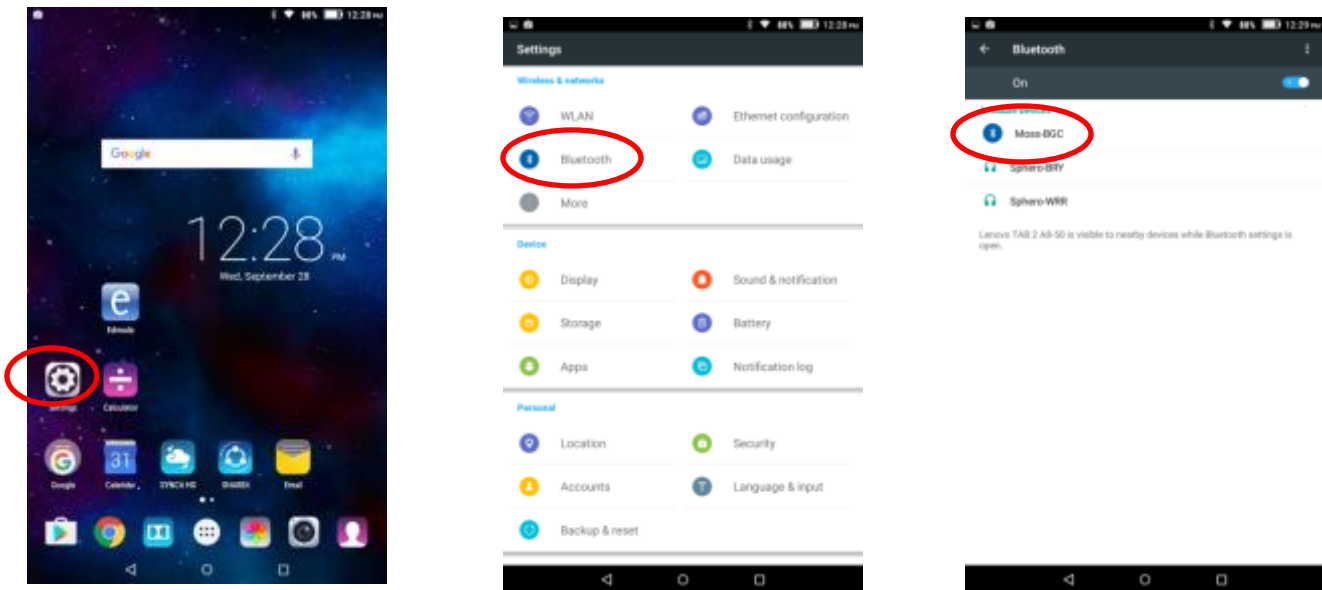
- **Bluetooth**
- **Dedicated Short Range Communication (DSRC)**
- **Cellular Communication (3G /4G/LTE**

In this activity you will explore the Bluetooth communication system.

Directions:

Using the battery block, connect the Bluetooth block. Ensure that the Bluetooth block is able to receive power from the battery block. You will now need to pair your Bluetooth block with the tablet.

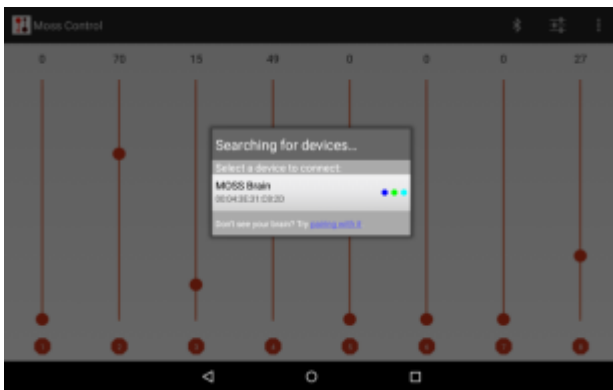To do this, open the Settings on your tablet. Make sure the Bluetooth is turned on.

Once you have turned on the Bluetooth on the tablet, power on the MOSS robotic Bluetooth block. When you turn the power on, you will notice that the Bluetooth block will flash three different colors (i.e., Blue, Yellow, Green - if the Bluetooth block is not connected correctly it will not flash). This color code is what you will use to pair the Bluetooth block with your tablet. Once you see the MOSS label under the Bluetooth, click on it to pair with the tablet.

After you have paired the Bluetooth block with the tablet, turn the power off to your robot. Use the remaining blocks to create a simple car utilizing the four axles. Notice which number Bluetooth face is connected to the motorized axles.

When your vehicle is complete, turn the power on. You will notice that the Bluetooth block will flash three colors (i.e. blue, yellow, green – BYG). This will allow you to identify your specific Bluetooth block. Open the MOSS Control app on your tablet. When the MOSS app is open, the app should automatically search for your robot. If the app does not automatically search for your robot, click on the Bluetooth icon and the program should begin searching for Bluetooth connections.   When you see your Bluetooth block appear on the screen (the colors it was flashing), click on the MOSS Brain and it will connect. Once the MOSS Brain is connected, you will be able to use the sliders to control your robot. You will need to move the sliders that are connected to the motorized axles in order for your vehicle to move.

Bluetooth Connection	**Vehicle Control**	**Bluetooth Icon**

Controlling Moss Robot

To drive your robot using the MOSS vehicle control app, move the numbered sliders that correspond to the Bluetooth faces connected to the motorized axles.

A setting of 50 on the vehicle control app means that the robot will not move – a setting lower than 50 will control the motorized axles to move in one direction and then a setting of higher than 50 will control the motorized axles to move in the opposite direction.

To drive straight forward or straight backward, move the sliders connected to the motorized axles in the same direction at the same speed. To make a turn, move one slider faster than the other.

Activity 6 Completed _____

Activity 7: Exploring Connected Vehicles

Objective:

In this activity you will design and construct a MOSS Robotic Vehicle that is able to interact with the surrounding environment in order to simulate Connected Vehicle Technology.

Directions:

Use the space below to design your Connected Vehicle.

Wrap Up:

1. **What problems did you encounter designing your vehicle?**

2. **Did your vehicle perform the way it was designed?**

3. **What positive impacts could Connected Vehicle technology have on transportation systems?**

4. **What negative impacts could Connected Vehicle technology have on transportation systems?**

Activity 7 Completed _____