

Self-Driving Cars

Vocabulary

LiDAR - A technology that uses lasers to measure distances and create 3D maps of objects. Stands for Light Detection And Ranging.

Time-of-Flight Sensor - A sensor that emits a signal and calculates the distance to an object based on how long it takes for the signal to return.

Point Cloud - A set of data containing points, each of which represents a position in 3-dimensional space. The points together create a visual representation of an object.

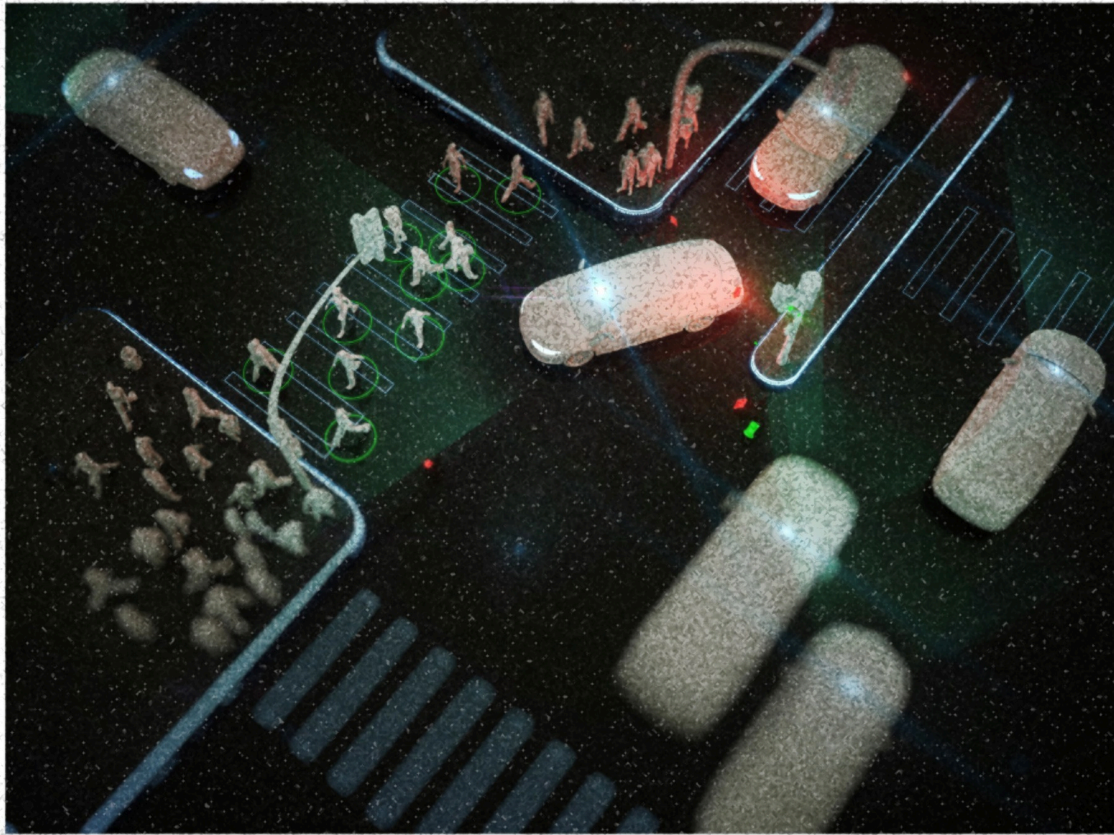
Direct Instruction

Introduction

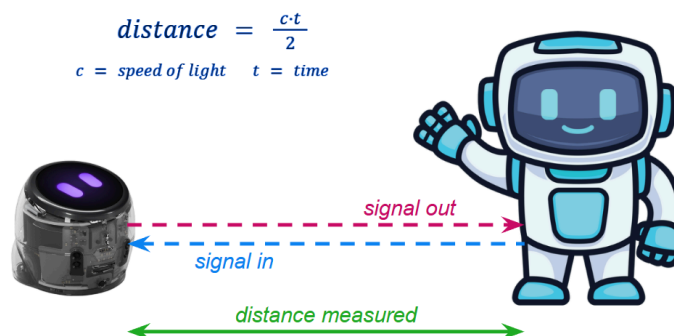
1. Unlike your phone's GPS system, the mapping technology in self-driving cars must be much more accurate in order to avoid accidents. These cars use a variety of mapping tools, including LiDAR, to create a visual representation of their surroundings.
2. Self-driving cars typically have a large, rotating sensor on top, which is used to help map their environment.
3. The sensor on top of a self-driving car is a LiDAR sensor, a time-of-flight sensor that emits light and waits for the light to return. These sensors calculate distance based on how long it takes for the light to return.
4. The sensor rotates around on top of the car, shooting out anywhere from 16 to 128 lasers at a time, over and over again, creating a point cloud of the local environment.



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5. A point cloud is a collection of points, each of which is a small part of the outer surface of an object. Taken together, these points create a visual map of a car's surroundings.
6. This LiDAR technology, in addition to others, is what allows self-driving cars to see the world around them.
7. Similar to LiDAR in cars, Ari uses a LiDAR sensor to determine the distance between it and objects in front of it.

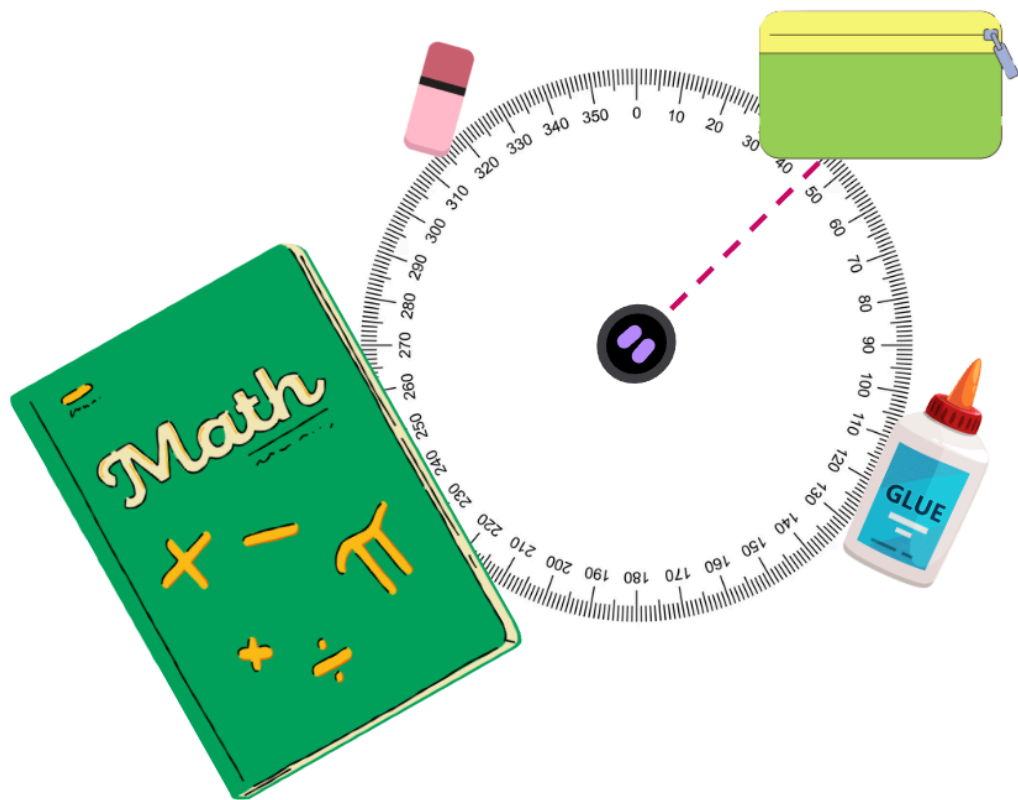


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Activity 1 - Obtaining LiDAR Readings

1. Place students into groups and provide each group with an Ari and a 360-degree protractor. Students should also have a small collection of objects that can be placed around Ari.
2. Split each group into two halves: the builders and the mappers. The builders will place objects around Ari while the mappers look away.
3. The builders will then use Ari's distance app to provide distance readings every 5 degrees (starting with 0 degrees) for a total of 72 data points. The mappers will record the readings on their Student Activity Sheet.

Alternatively, you can have students take readings every 10 points for a total of 36 data points, but this may not give as accurate of an image of Ari's environment.

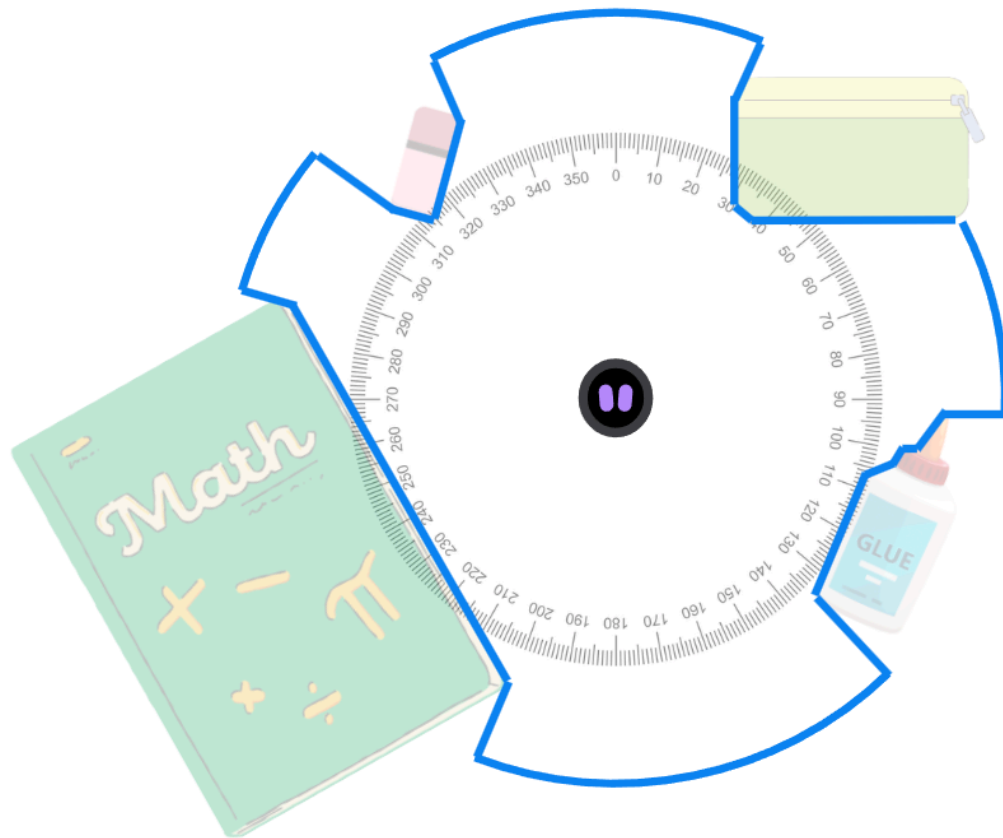


4. Repeat steps 2-3, with students switching roles.

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Activity 2 - Mapping Ari's Environment

1. For the second activity, students will use their distance readings to create a spatial map of Ari's surroundings. Provide each group with a piece of chart paper.
2. Students should use Ari (or a ruler) and a 360-degree protractor to map out the points from their data collection in Activity 1.
3. Once all points are plotted, the mappers should have an image similar to the one below.



Evaluate: Exit Ticket

Students will fill out and submit their Exit Tickets (The last page of the Student Activity Sheet).