

Abstract:

In this lesson, we will examine how robot sensors work and see how that information is stored in a convenient, easily updatable format that accounts for errors in the robot measurements. We will use conditional probability to calculate the updated values after we get a measurement and see how to store this in an occupancy grid.

Objective:

By the end of this lesson, students will be able to:

- Examine how robots sense and remember their surroundings
- Construct and interpret frequency tables of data, total probability, and Bayes's Theorem
- Justify primary safety concerns and trade-offs of public/private data when looking at a robot's data collected of a room or area

Standards:

Computer Science Teachers Association (CSTA):

- 2-IC-23 Describe tradeoffs between allowing information to be public and keeping information private and secure.
- 3A-IC-30 Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.

Resources / Materials:

Playlist Overview: [The Robot Doctor Series](#)

Lesson Video: [Lesson 107 - Robot Sensing](#)

Student Handout: [107 Student Handout](#)

Student Handout: [107 Student Handout - Modified](#)

Student Handout: [107 Student Handout - Enrichment](#)

Teacher Handout: [107 Teacher Handout - Enrichment](#)

Teacher Handout: [107 Teacher Handout](#)

Student Survey: <https://forms.gle/vNKUqjGNyuC2X8zNA>

(Have students complete this at the end of the lesson)

Procedures:

1. Opening Question: **How do robots sense their surroundings and keep track of where they are?**
2. Review Opening Question: No, it's not magic. It's math. Make sure to support/compliment student ideas about the opening question. Introduce to the students that today's video will explain this process.
3. Explain that the video was created by **WQED** (Television Company) and **RobotWits** (Artificial Intelligence Company) who partnered to create the Robot Doctor educational video series.
4. Read the Abstract to the students or explain in your own words what the video will be about.
5. Prepare the room for the video by asking students to eliminate distractions (close laptops, lower blinds, put away folders, set down pencils, ect.).
6. **Show the video** to the students.

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7. After the video, ask the students to share **what they liked** and **what they learned** from the video with someone beside them. Facilitate discussion, then ask for volunteers to share with the rest of the class.
8. Pass out the **Student Handout** to each student.
9. Discuss the first page of the student handout with the class.
10. Have the students work on the Challenge questions. They may work individually or in small groups.
11. Provide light guidance to each student on their progress with the challenge questions, if needed. Students may also use the **Modified Student Handout** to help structure their work (the questions on this worksheet are different, but the 'fill in the blank' setup and the formulas are the same).
12. After the majority of the students have finished the student handout (or a majority are stuck), prepare to review the challenge questions one at a time.
13. Use the **Teacher Handout** to help students walk through each part of the Student Handout.
14. Review with the students the concept of storing information in an updatable format for the robot to use conditional probability to see what is in each grid space.
15. Have the students go to this link: <https://forms.gle/vNkUqjGNyuC2X8zNA> and fill out the survey.

Modification:

Students will have their lesson modified according to their IEPs and individual capabilities. The **Modified Student Handout** does not have an accompanying Teacher Handout because the problems follow the video. Use the video as a reference when working through the problem with students. The activity explanation is at **7:47** in the video.

Enrichment:

Students who are advanced will finish early and have extra time. They can work on the **Enrichment Student Handout** independently or with a partner. This handout could also be assigned for homework. If time allows, review this content with the entire class, even if they didn't have a chance to solve the enrichment activities.

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