

## Abstract:

How do they transform what the cameras sense into meaningful data? In this lesson, we will discuss the pinhole camera model for cameras and see how a robot can use that to find the distance to a nearby object using a stereo camera setup.

## Objective:

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

- Paraphrase the process of using a stereo camera setup to find the distance of a nearby object
- Generate and recommend ideas about how physical security can be gained in a robot to protect images in a feasible and efficient process

## Standards:

Computer Science Teachers Association (CSTA):

- 2-NI-05 Explain how physical and digital security measures protect electronic information.
- 3A-NI-06 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.
- 3A-AP-13 Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.

## Resources / Materials:

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

Lesson Video: [Lesson 106 - Robot Vision](#)

Student Handout: [106 Student Handout](#)

Student Handout: [106 Student Handout - Enrichment](#)

Student Handout: [106 Student Handout - Modified](#)

Teacher Handout: [106 Teacher Handout - Enrichment](#)

Teacher Handout: [106 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 see?**
2. Review Opening Question: Explain that robots use cameras and software to calculate what is in the robots surroundings. Make sure to support/compliment student ideas about the opening question.
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.
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.

\*\*\*To make improvements (add suggestions) to this lesson plan, please [CLICK HERE](#) \*\*\*

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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 robot's vision by using a camera, software, and calculations.
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 problem follows the video. Use the video as a reference when working through the problem with students. The activity explanation is at **7:10** 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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