

### Abstract:

In this lesson, we will explore a three-step process to find the robot's position by 1) finding at least 3 nearby landmarks with known positions 2) determine the robot's range to each landmark using onboard sensors and 3) calculate the intersection point of the 3 range circles to find the robot's position.

### Objective:

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

- Investigate to find the position of a robot
- Build a flow chart to visualize the 3-step process of calculating a robot's position

### Standards:

Computer Science Teachers Association (CSTA):

- 2-AP-10 Use flowcharts and/or pseudocode to address complex problems as algorithms.
- 2-AP-13 Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.
- 3A-AP-23 Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs.

### Resources / Materials:

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

Lesson Video: [Lesson 104 - Robot Localization](#)

Student Handout: [104 Student Handout](#)

Student Handout: [104 Student Handout - Enrichment](#)

Student Handout: [104 Student Handout - Modified](#)

Teacher Handout: [104 Teacher Handout - Enrichment](#)

Teacher Handout: [104 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 determine their location?**
2. Review Opening Question: Explain that robots go through a 3 step process that will be discussed today in the following video. 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.
8. Pass out the **Student Handout** to each student.

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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 robots looking differently because they serve different purposes and therefore each element of the robot may be different.
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 **4:40**.

#### 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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