ECE 2031 Project Proposal

The A Team

Patrol Bot Overview

- Our team has been assigned with the task of patrolling a pre-defined area using a robot to detect any other robots that may intrude the area.
- The test area consists of a fixed enclosure along with a T-shaped baffle obstacle whose position can vary.
- Upon detection based on data from the built-in sensors, the robot will sound a one-second alarm.

Questions to Consider

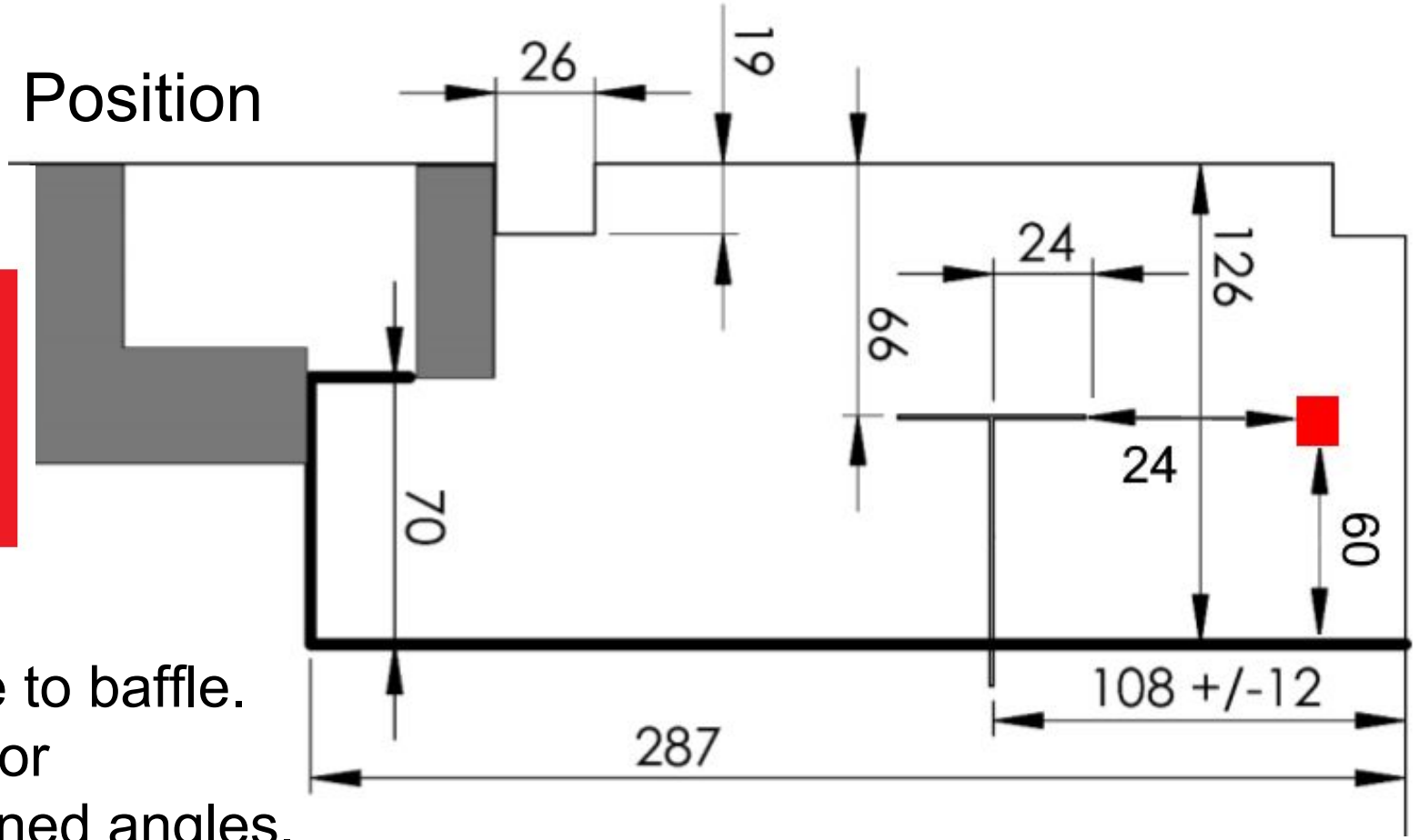
- How will the robot move?
  - Starting position, speed, direction, duration.
  - Account for baffle.
- Which sensors will be used for detection?
  - 100% coverage of area required.
- How will robot differentiate between walls or obstacles and other robots?
- What corrections, if any, need to be made to account for imprecise odometry?

Starting Position



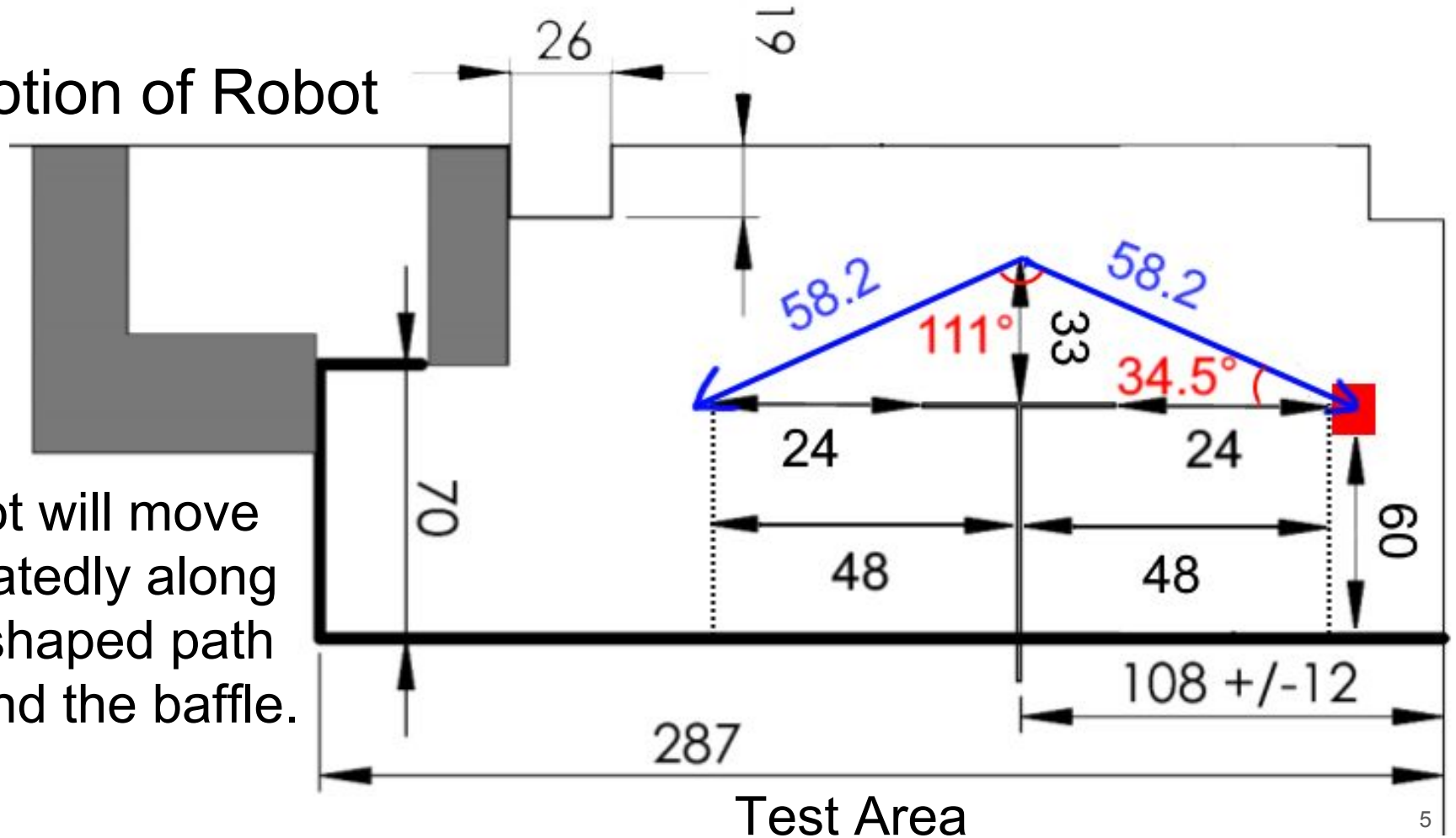
Robot

- Relative to baffle.
- Allows for pre-defined angles.
- Note: not to scale.



Test Area

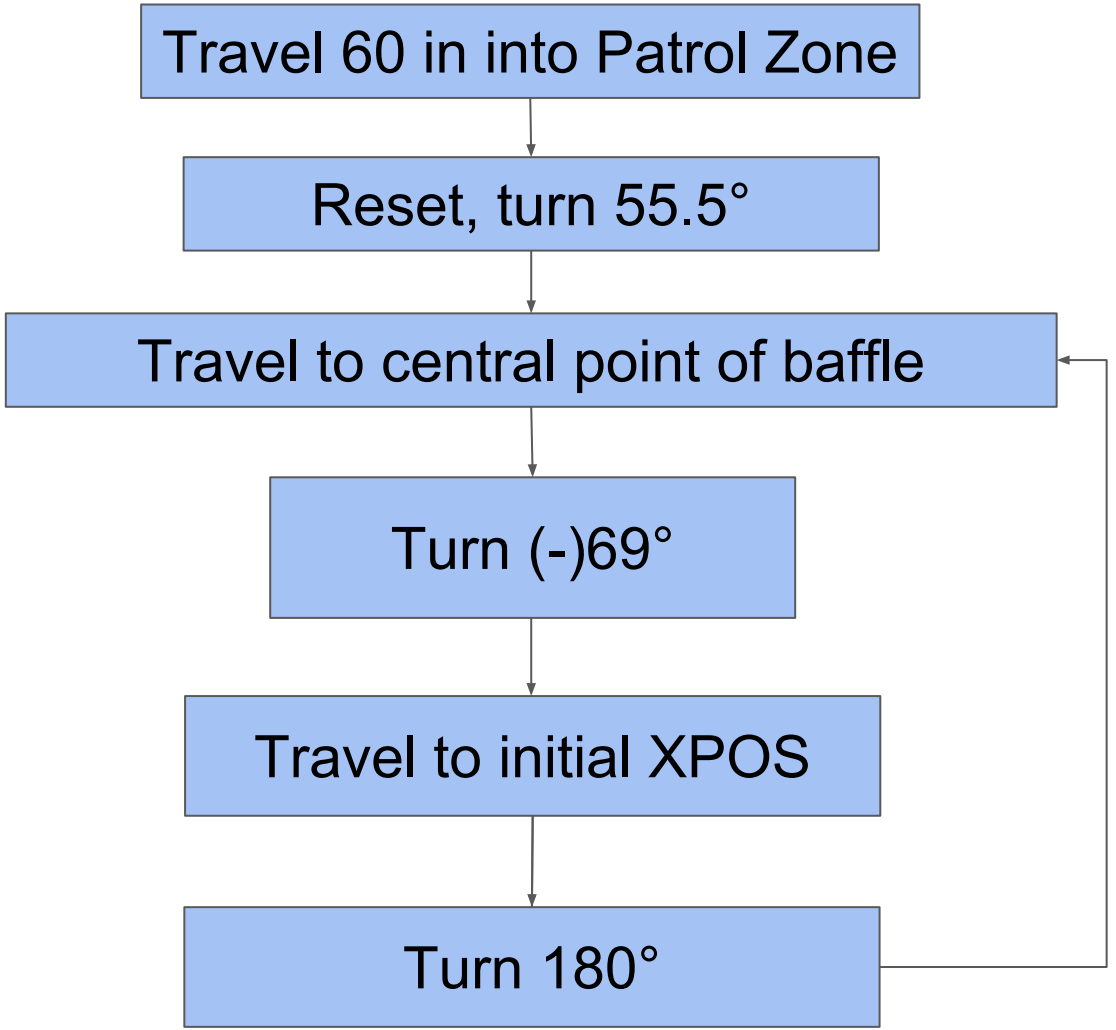
Motion of Robot



Robot will move repeatedly along a V-shaped path around the baffle.

Patrol

- Travel into the zone, then trace out a v-shaped path.
- Use pre-measured angles corrected for odometry error.

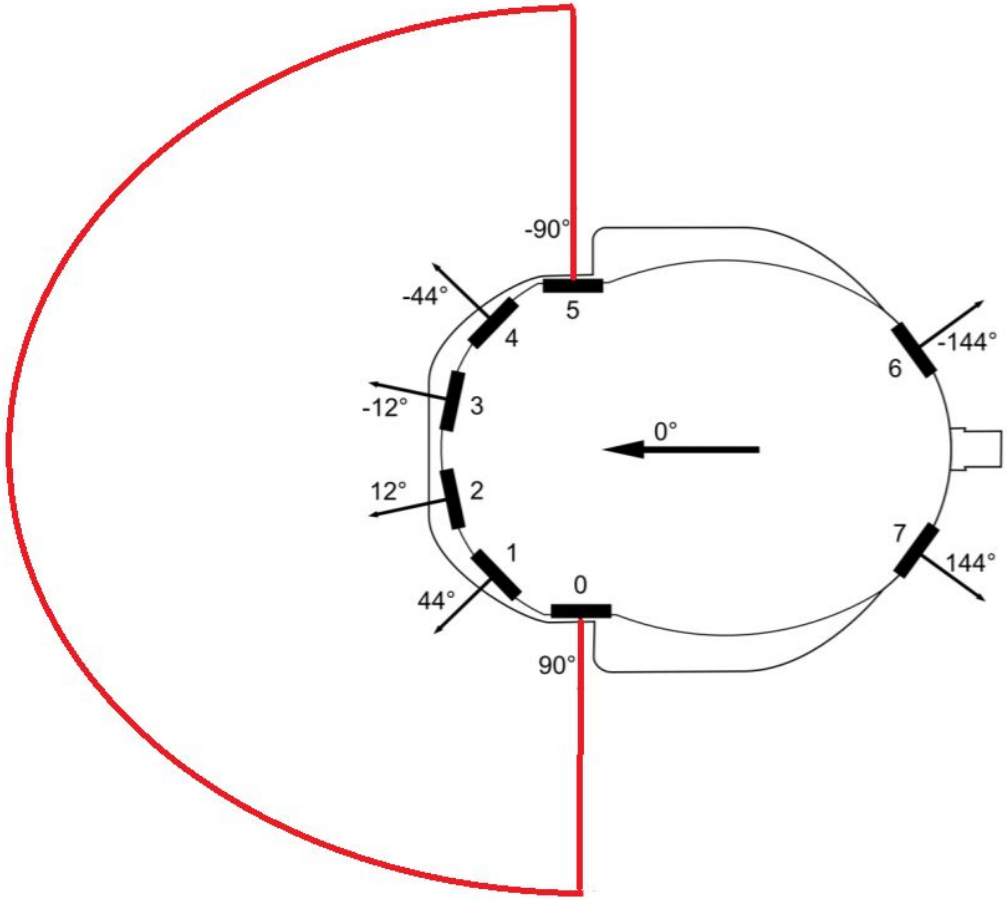


Detection: Overview

- Three locations where DE2 will stop and sense.
- Across these three locations there are seven orientations.
- We will conduct an initial sweep of the area.
- Store readings from SONAR at each orientation in memory.
- Compare readings from SONAR to the data stored in memory.
- If readings differ vastly, INTRUDER FOUND.

Sensor Details

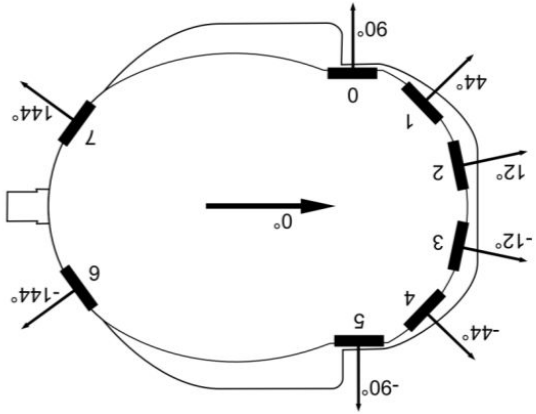
- 6 Sensors used (Sonar 0 to Sonar 5).
- 180^{o} sweep per “search”
- Some sensors have. thresholds based on current robot location.
- Only sense when stationary.



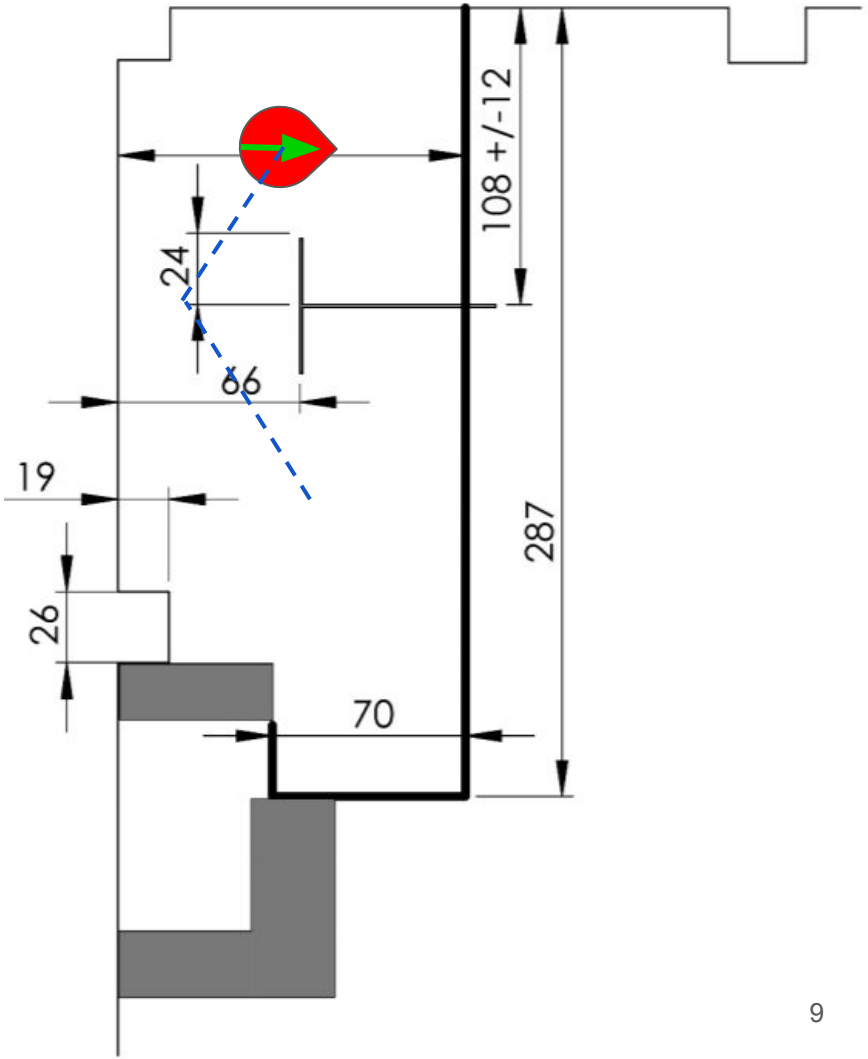
Source: DE2 User manual

Detection: Path

- Initial position is the first location where we stop to detect.
- Set threshold values for sensors 1, 2, 3 and 4.

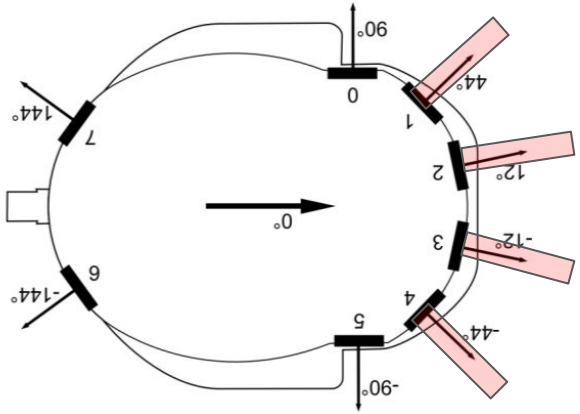


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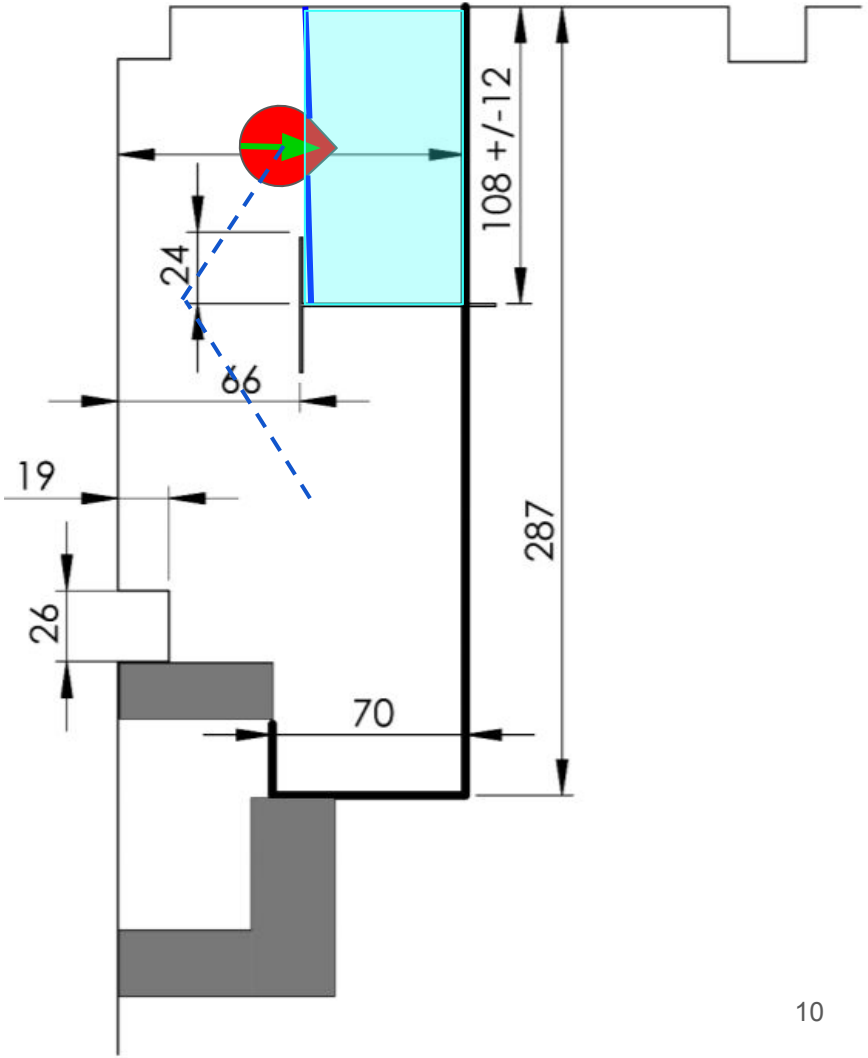


Detection: Path

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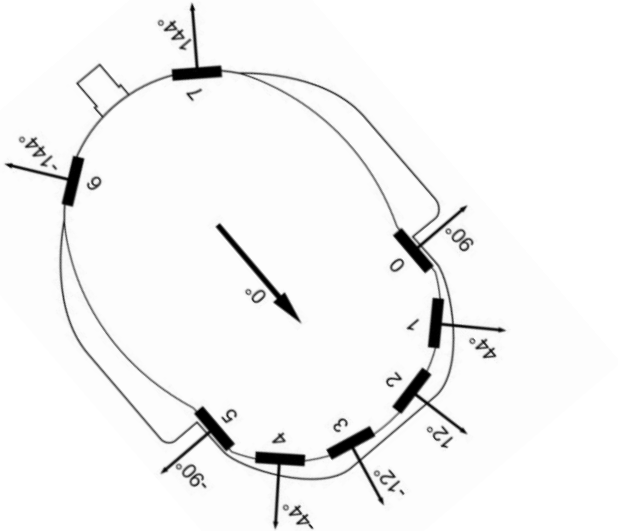


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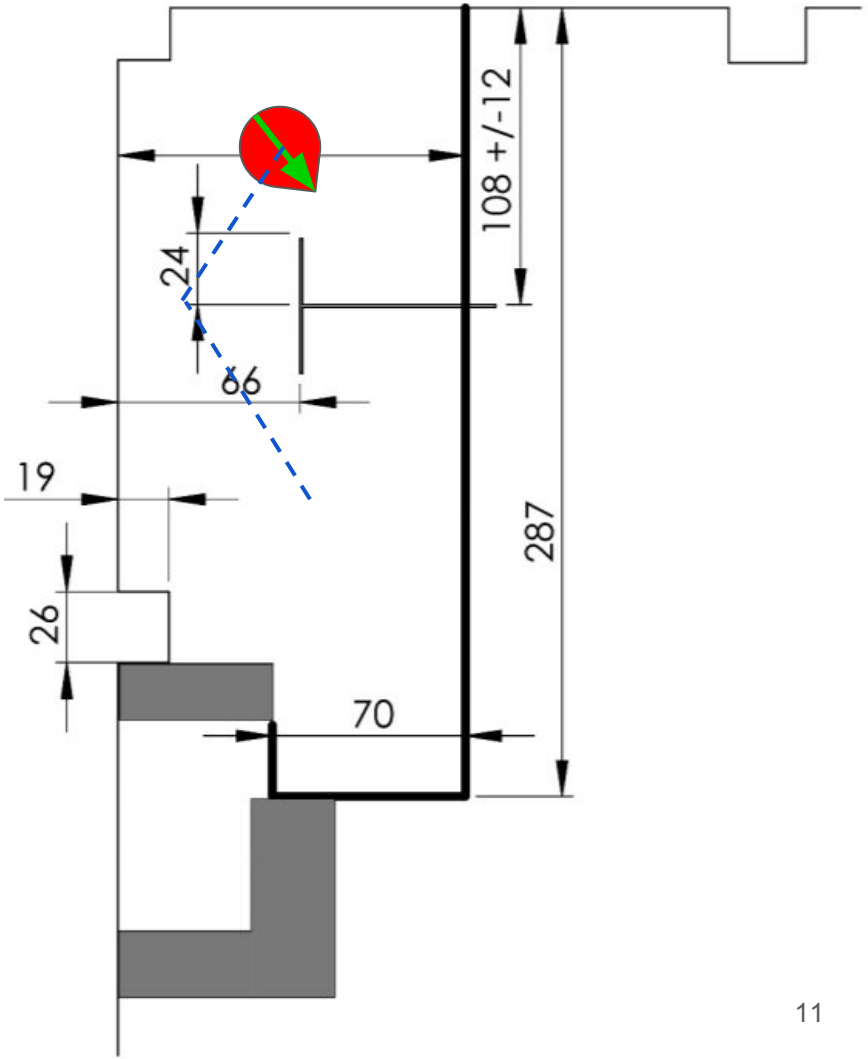


Detection: Path

- Rotates clockwise at same location.
- Set threshold values for sensors 1 and 2.

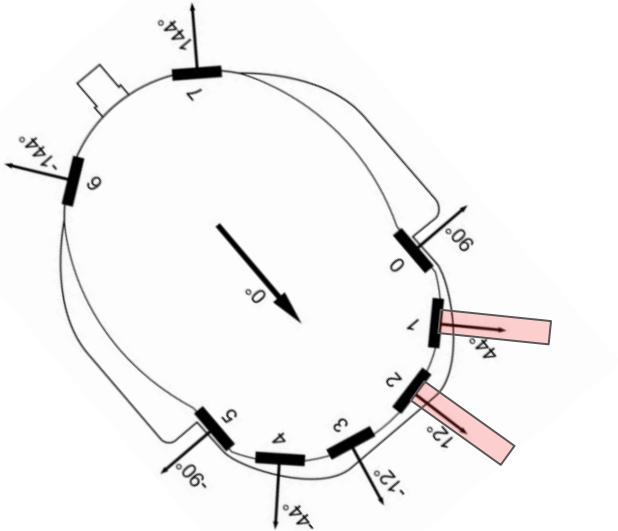


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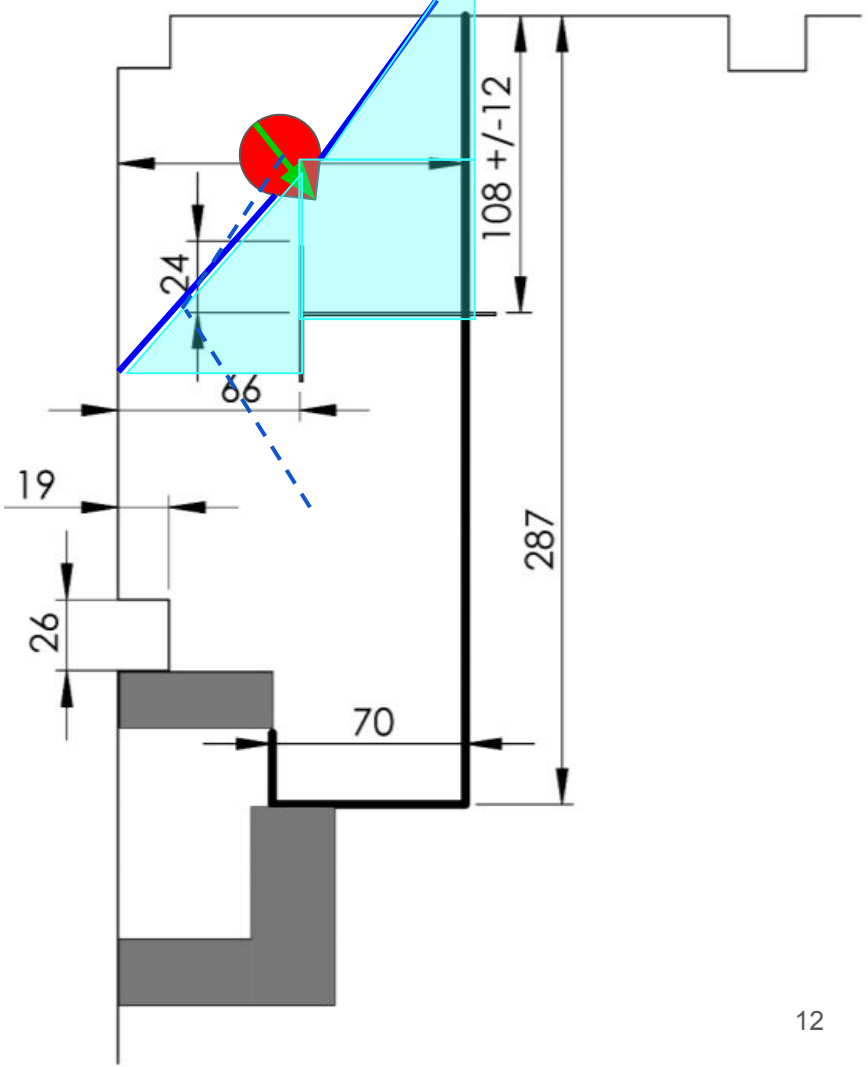


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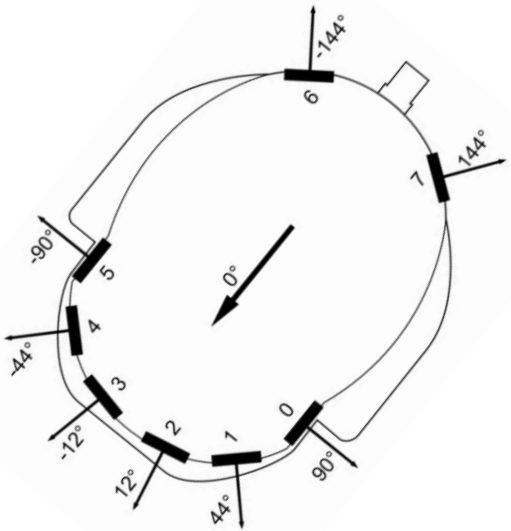


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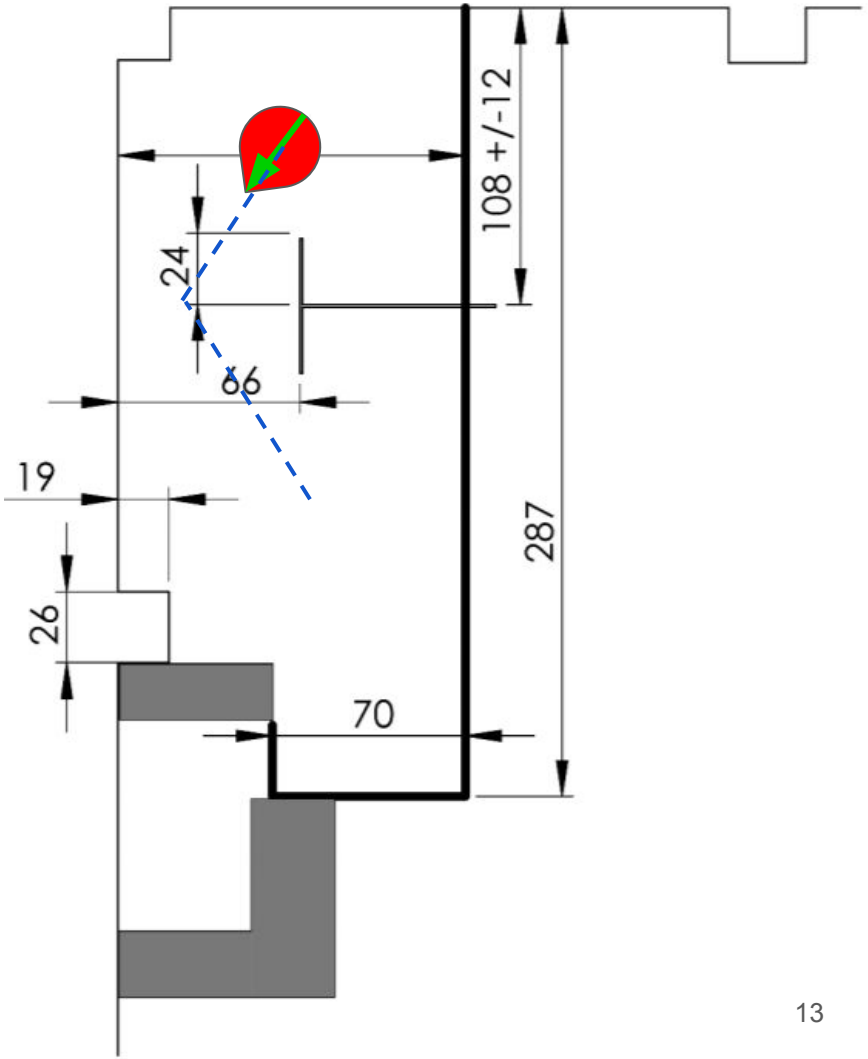


Detection: Path

- Rotates and moves to second location.

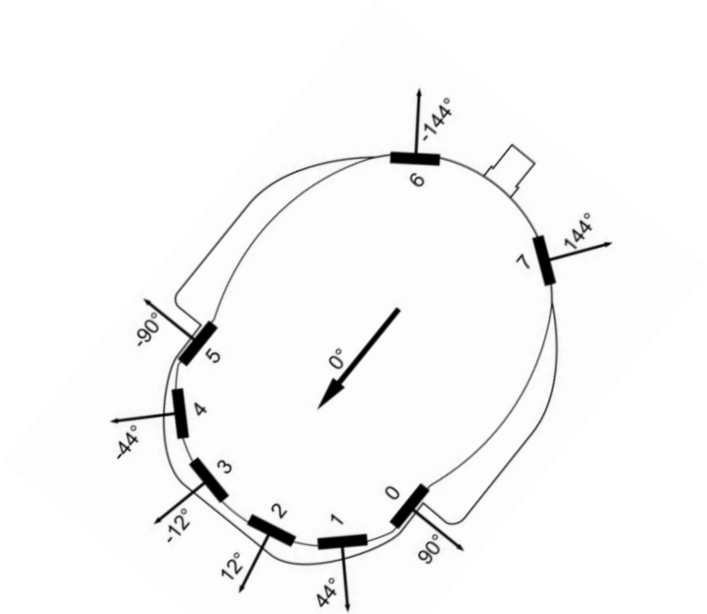


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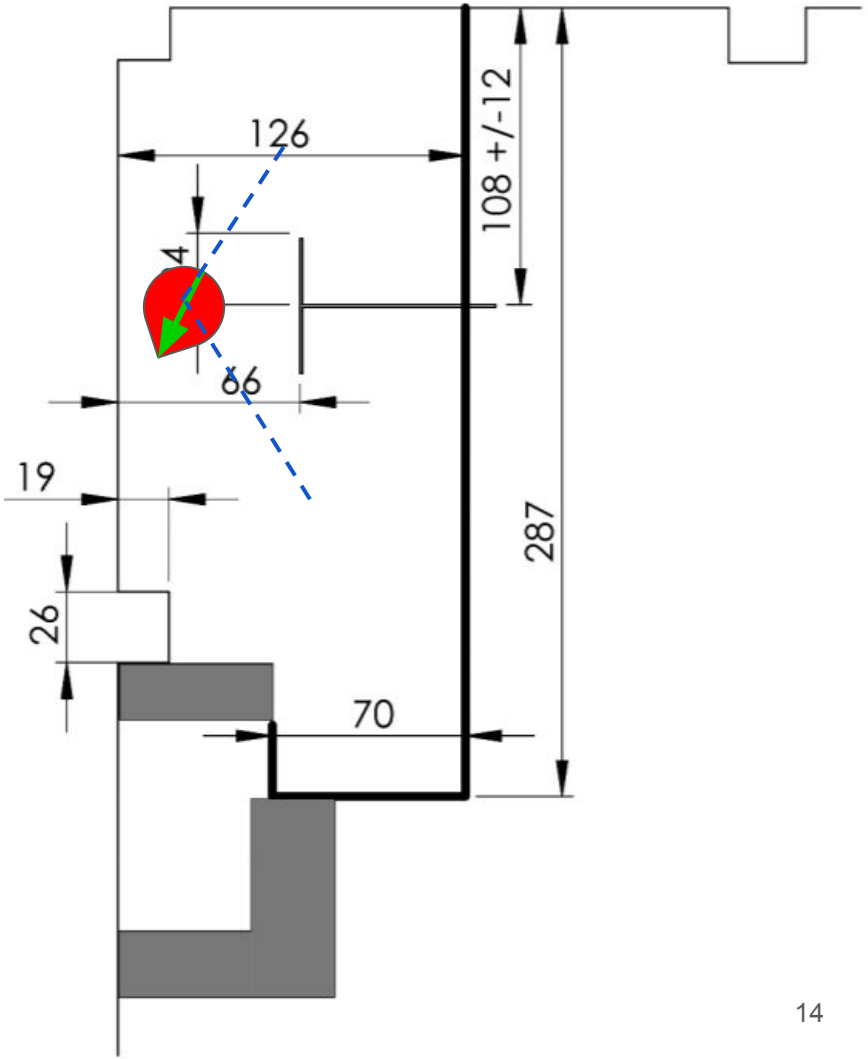


Detection: Path

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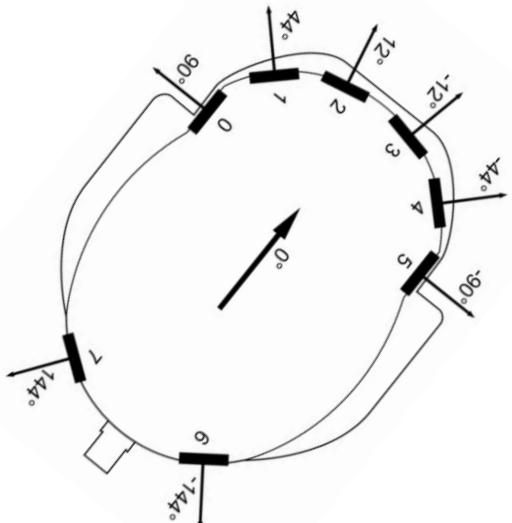


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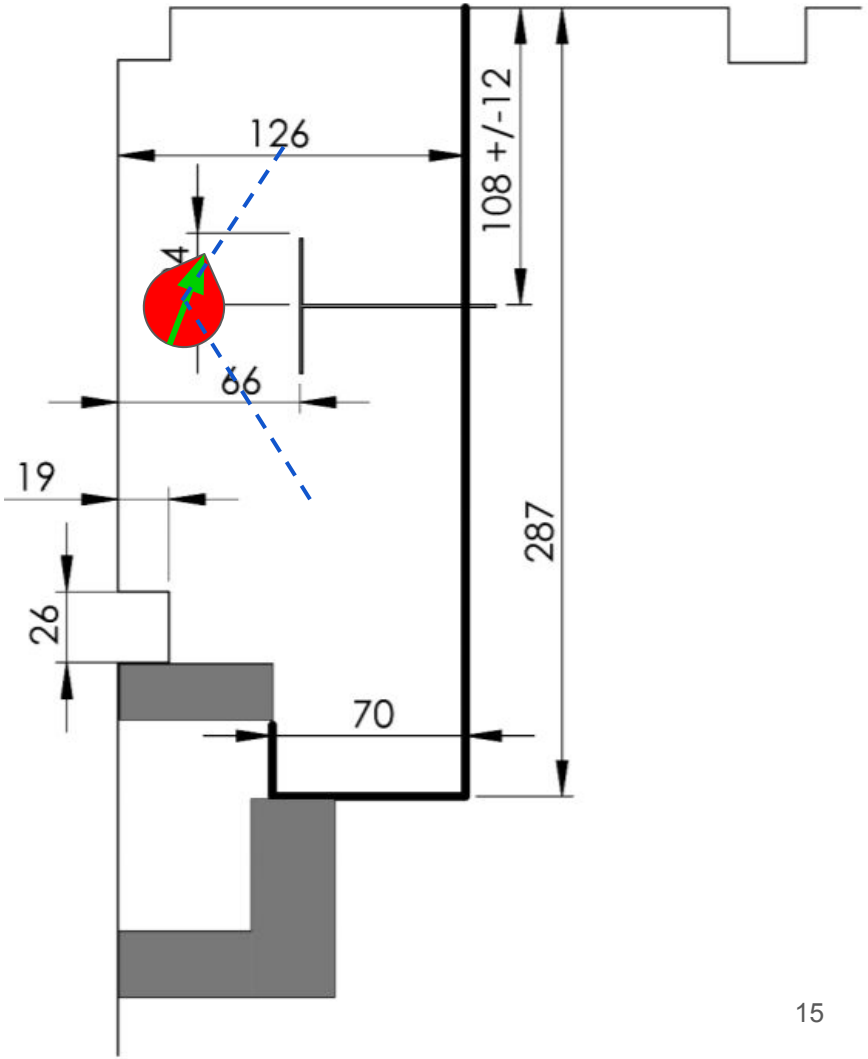


Detection: Path

- Rotates into third orientation.
- Set threshold values for sensors 3 and 4.

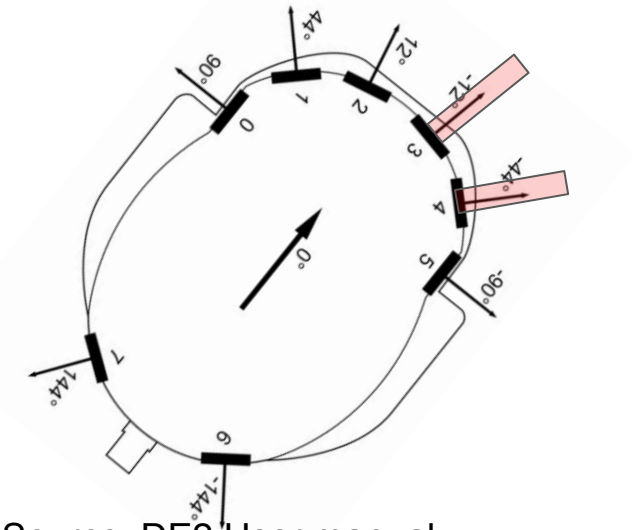


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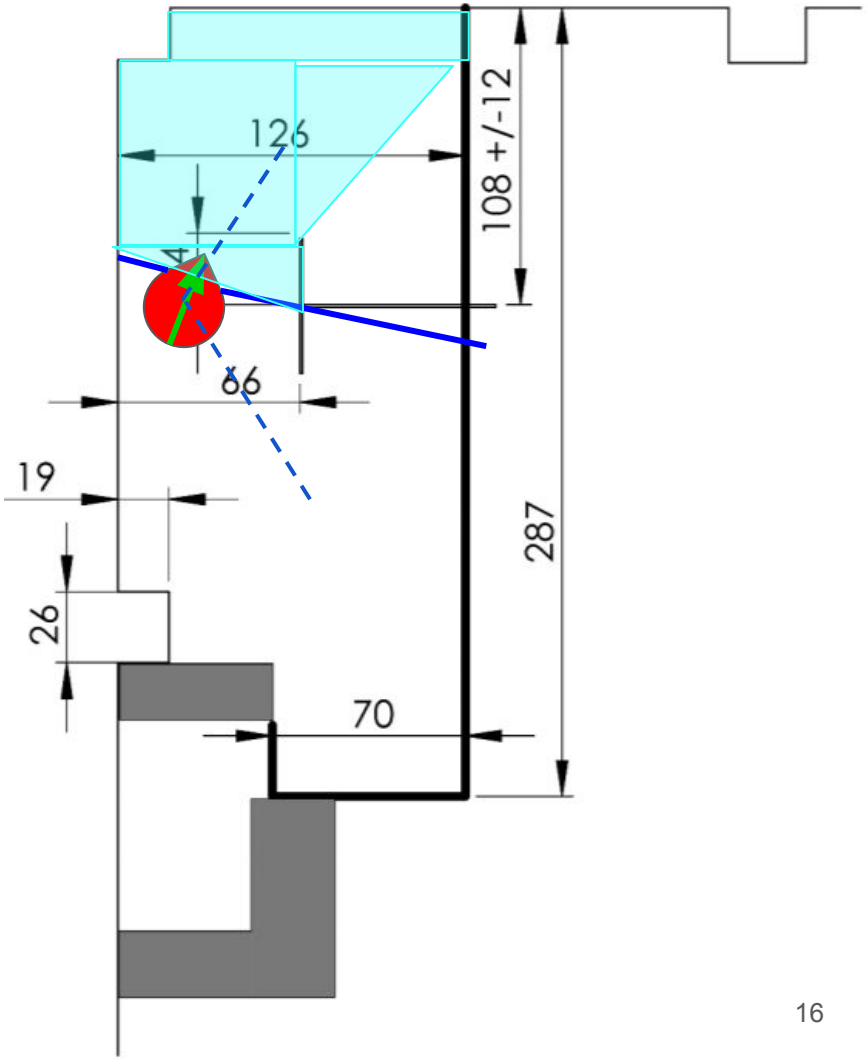


Detection: Path

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- Set threshold values for sensors 3 and 4.

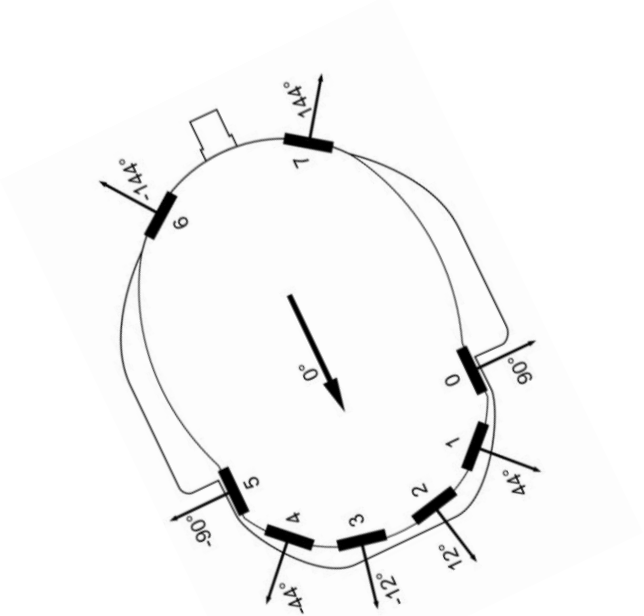


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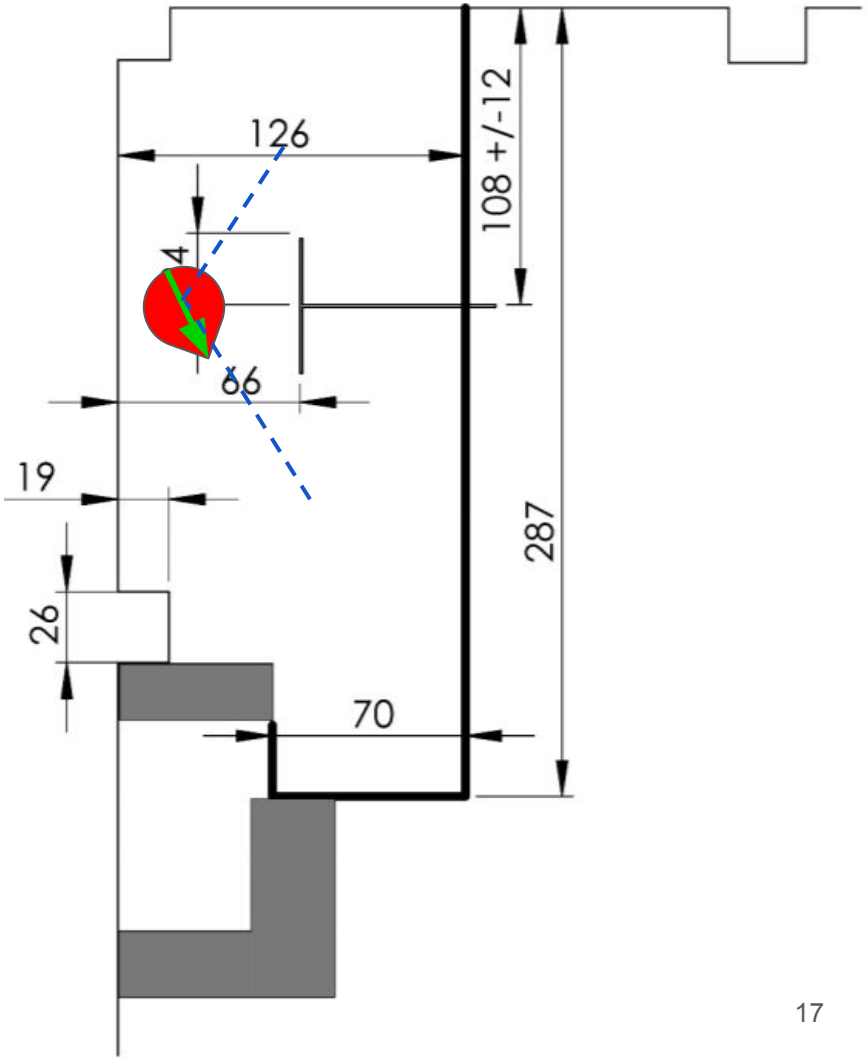


Detection: Path

- Rotates clockwise.
- Allows for detection on the other side of the baffle.

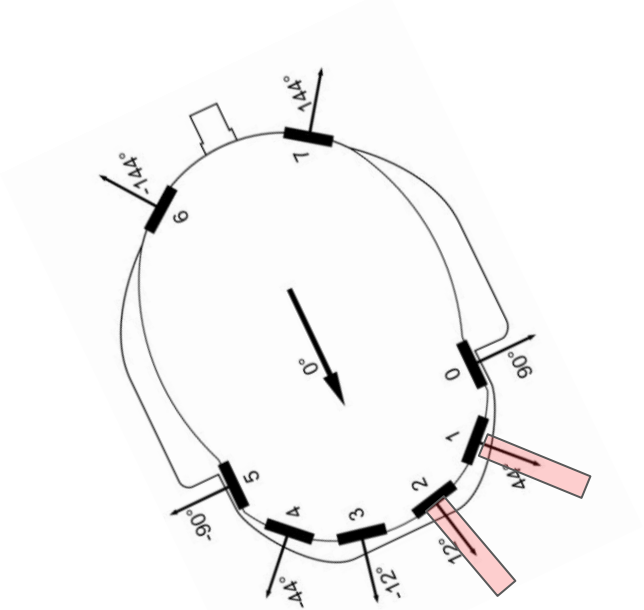


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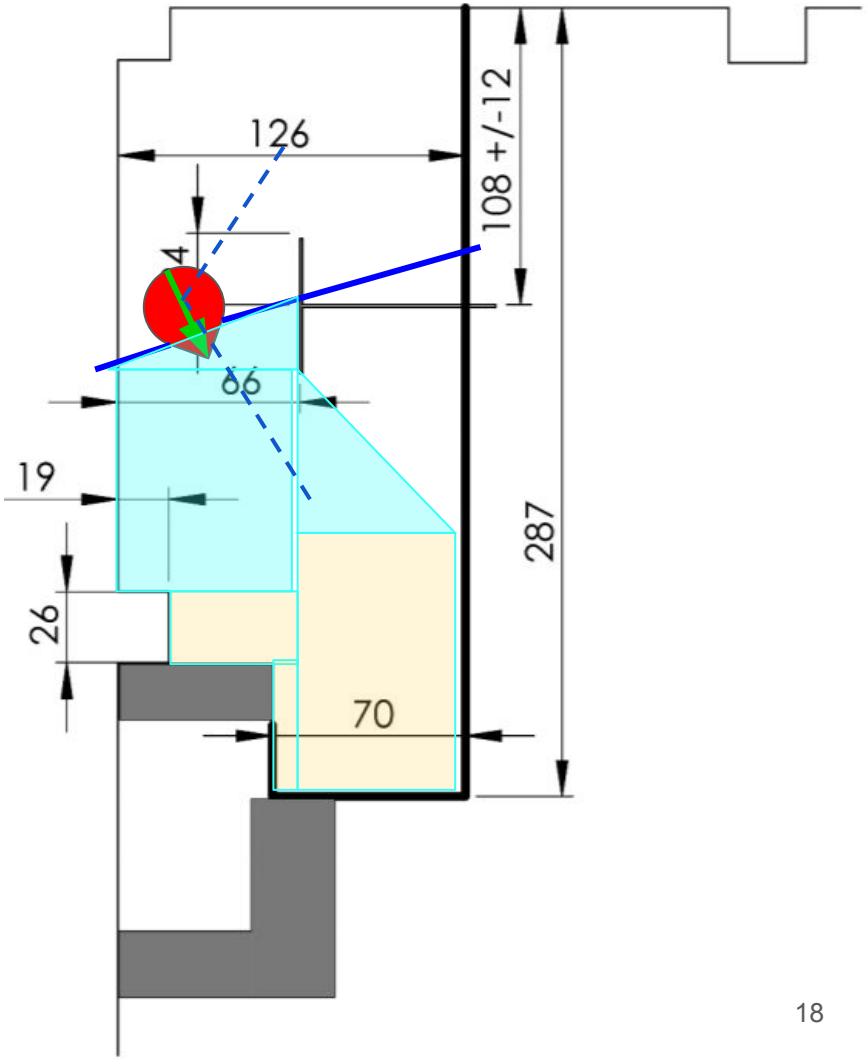


Detection: Path

- Rotates clockwise.
- Sets threshold values for sensors 1 and 2.

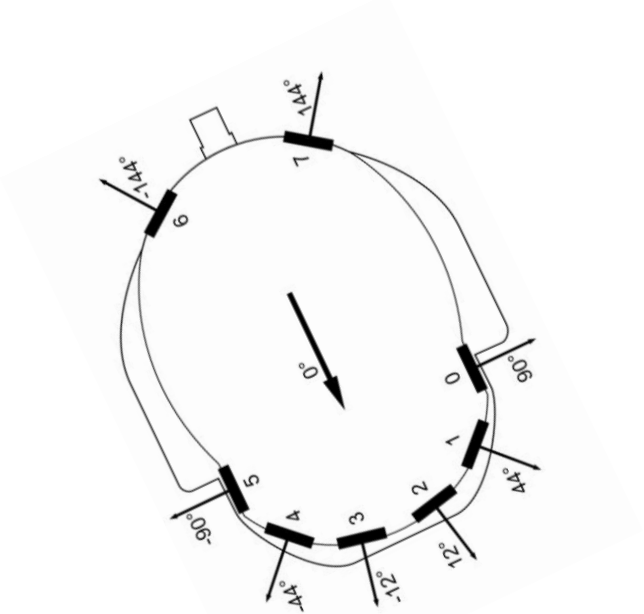


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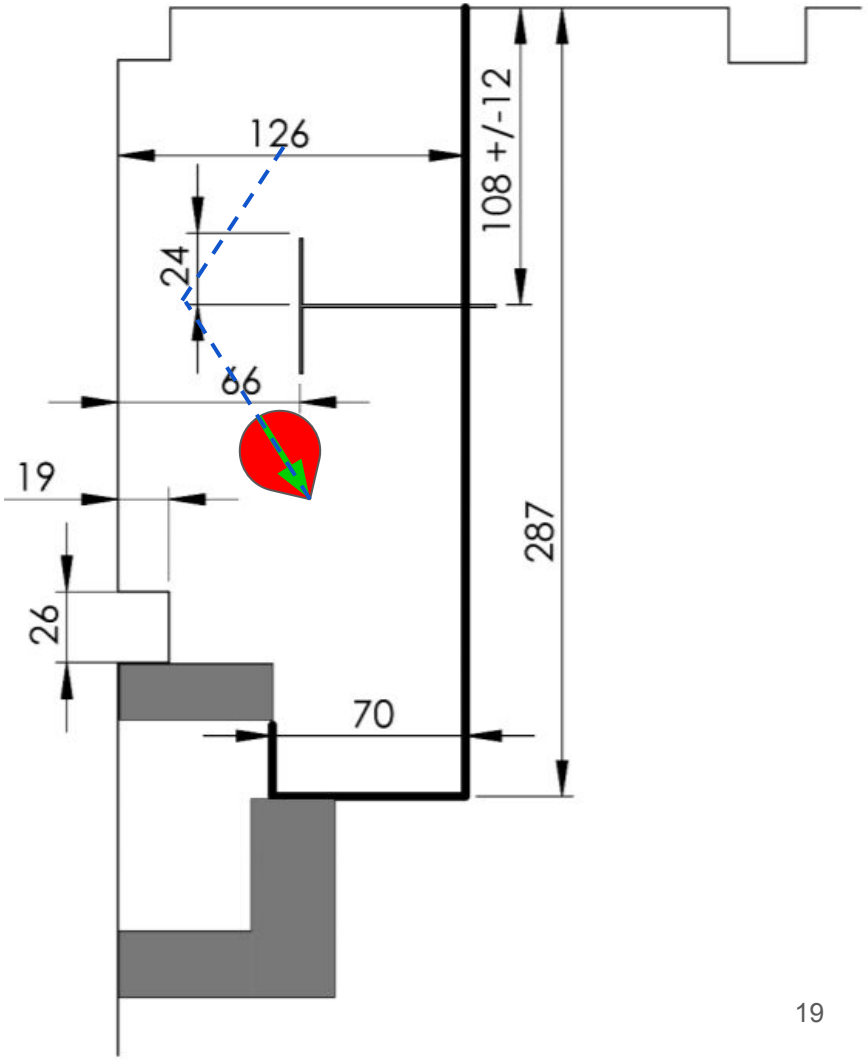


Detection: Path

- Moves forward and turns counter clockwise to account for edge case.

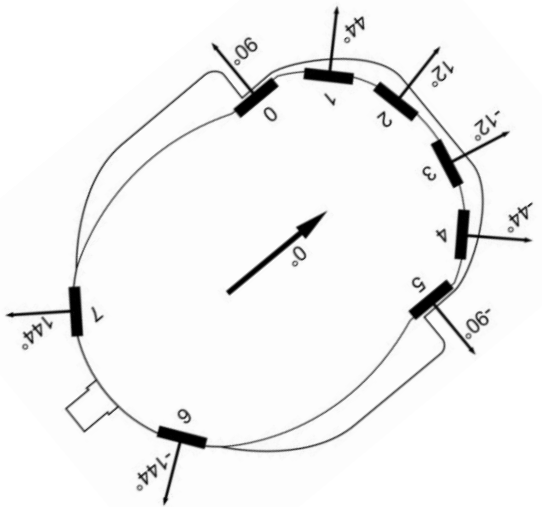


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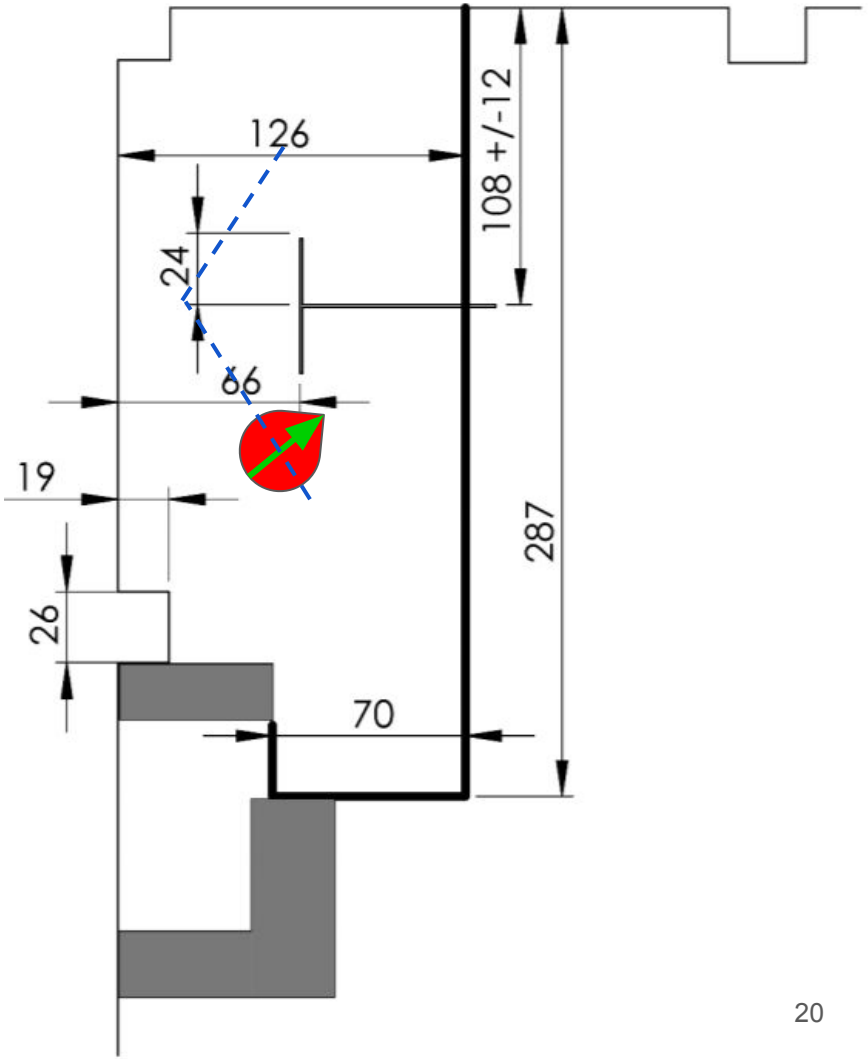


Detection: Path

- Moves forward and turns counter clockwise.

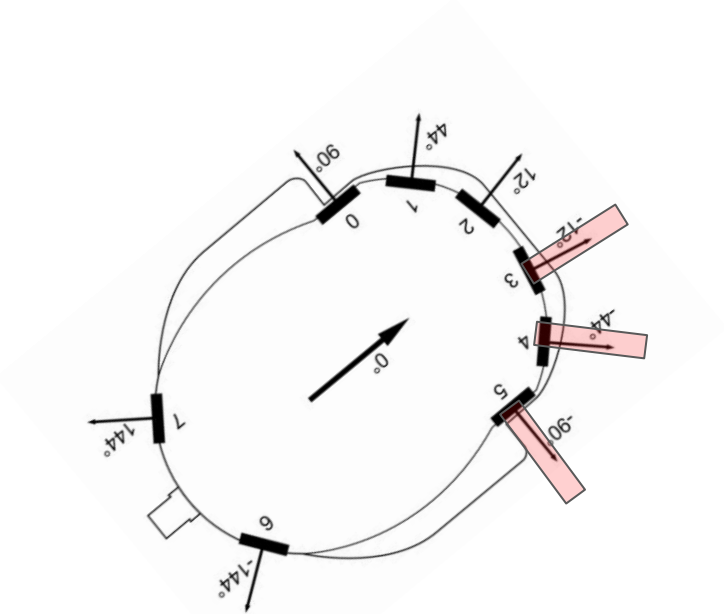


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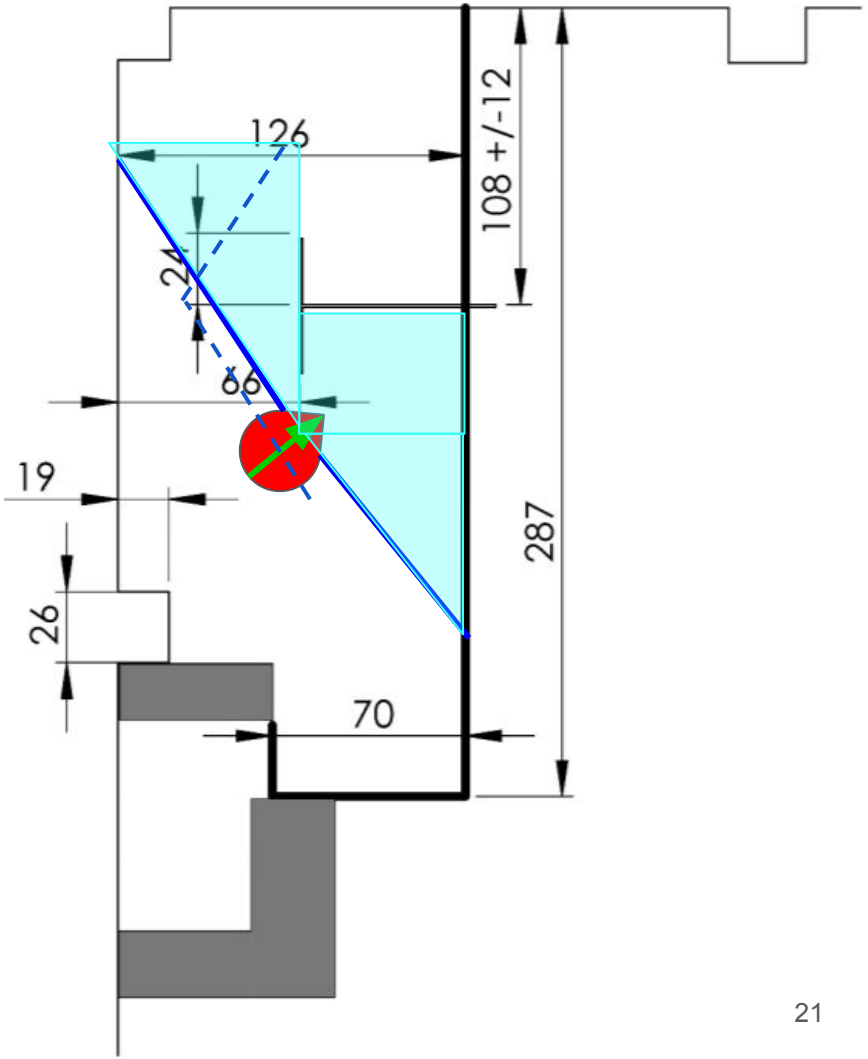


Detection: Path

- Sets threshold values for sensors 3, 4 and 5.

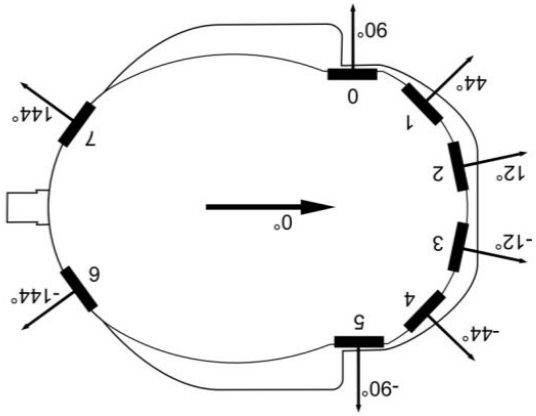


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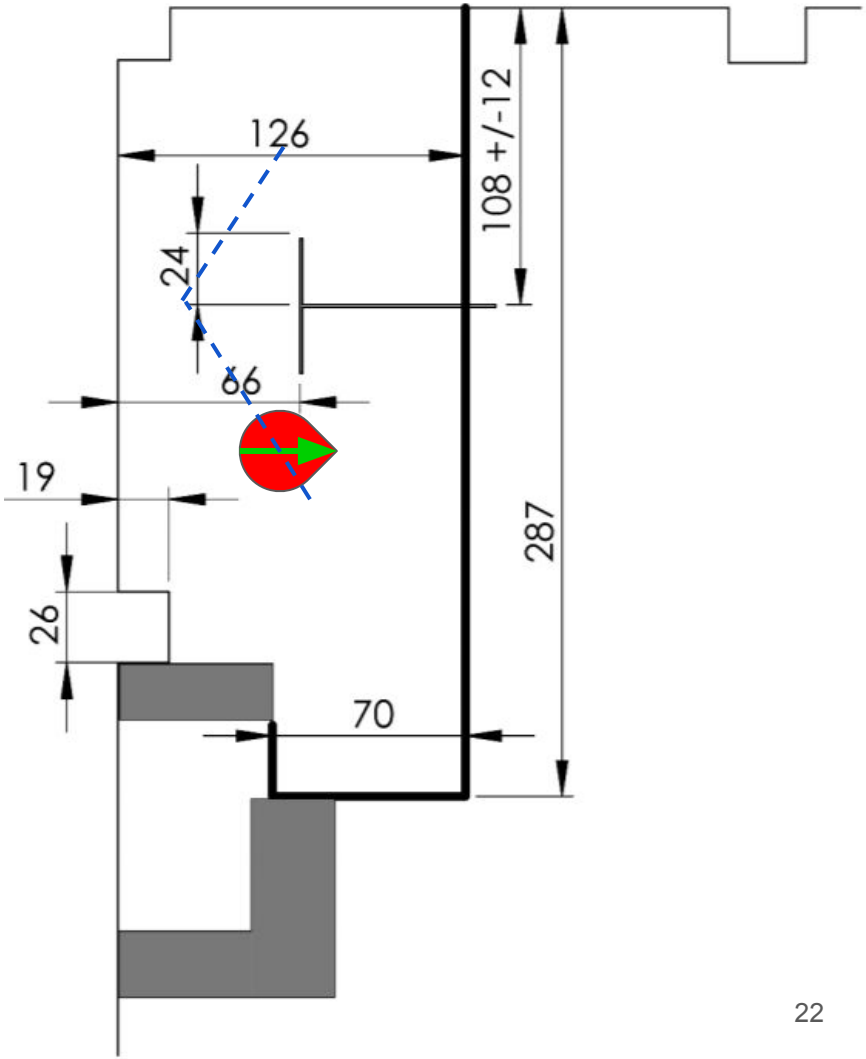


Detection: Path

- Rotates clockwise.
- Sets threshold values for sensors 2 and 3.

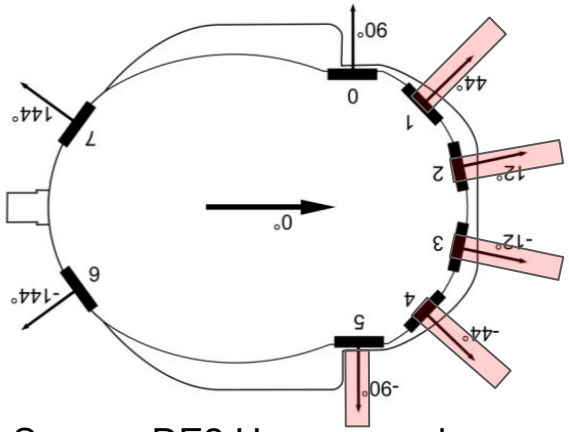


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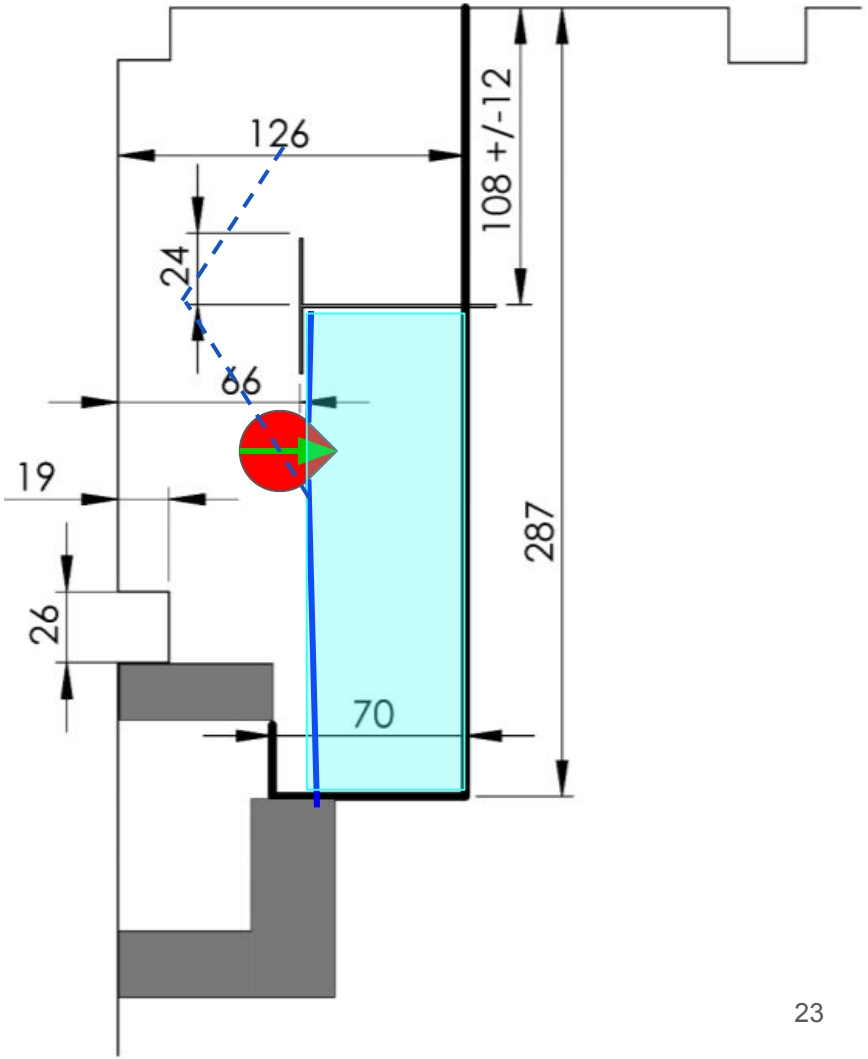


Detection: Path

- Rotates clockwise.
- Sets threshold values for sensors 1, 2, 3, 4 and 5.

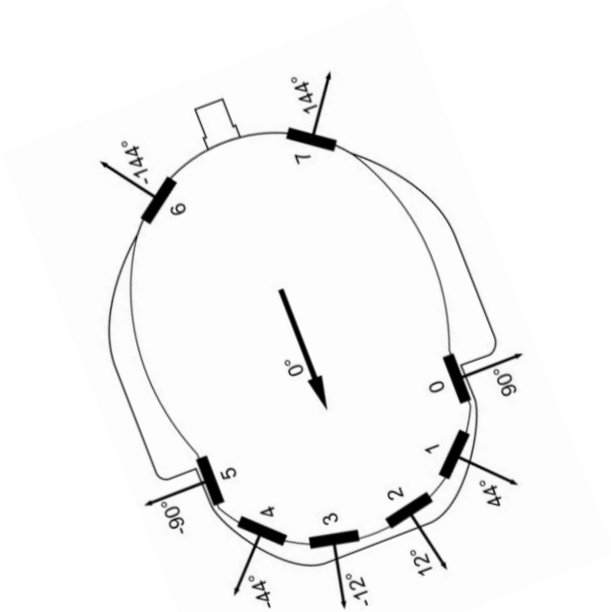


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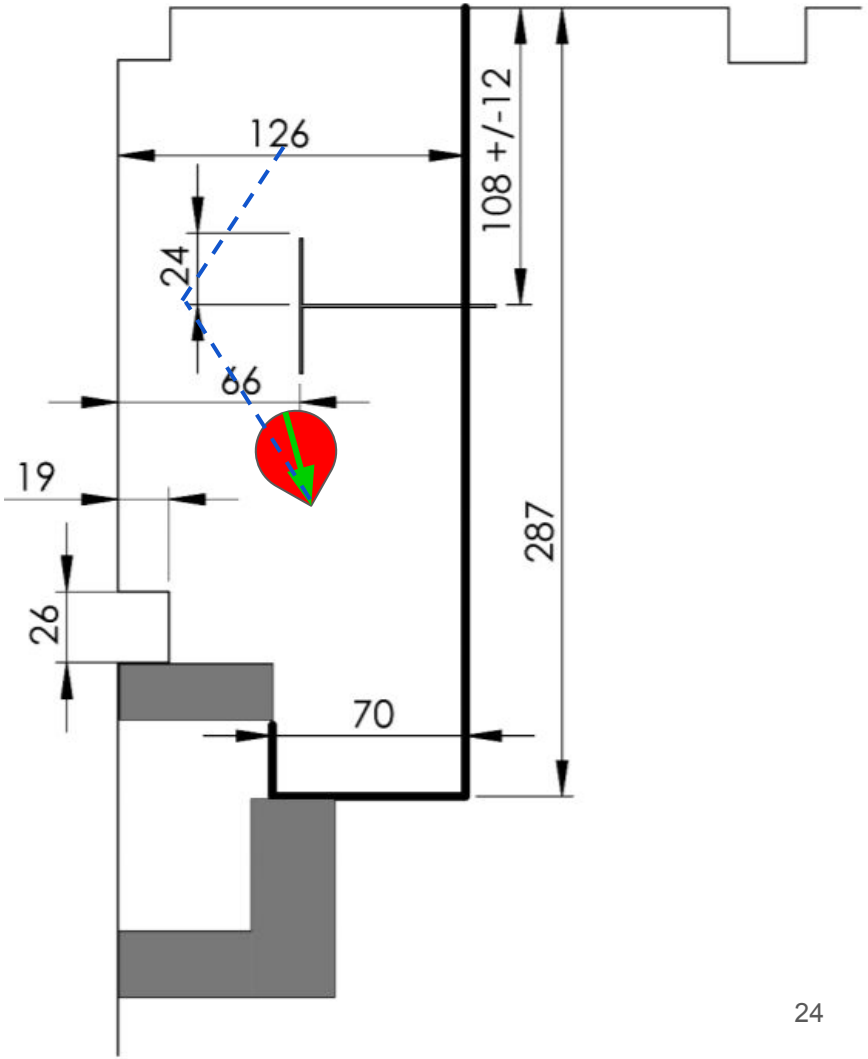


Detection: Path

- Rotates clockwise to detect previously inaccurately measure region.

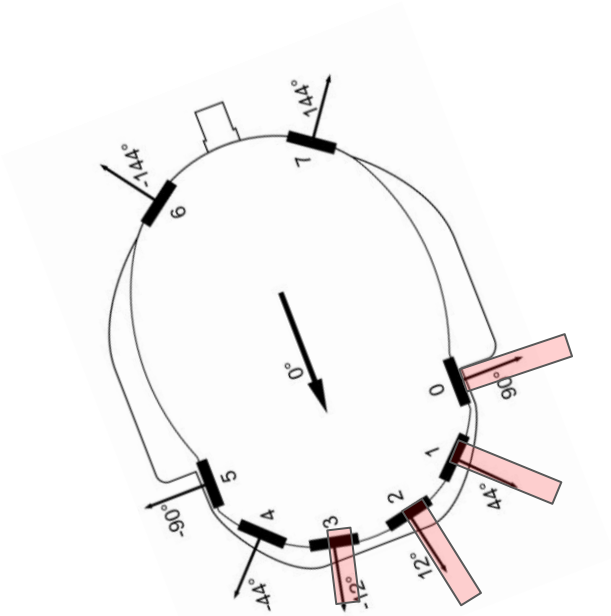


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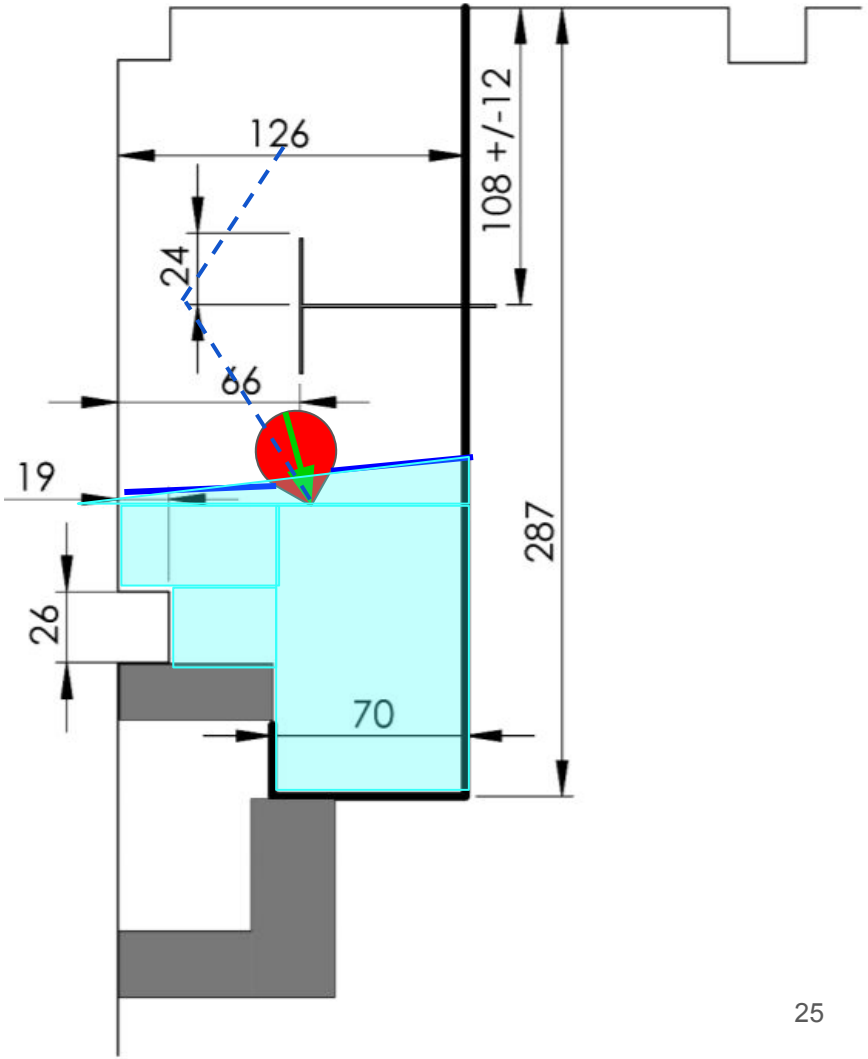


Detection: Path

- Sets threshold values for sensors 0, 1, 2 and 3.

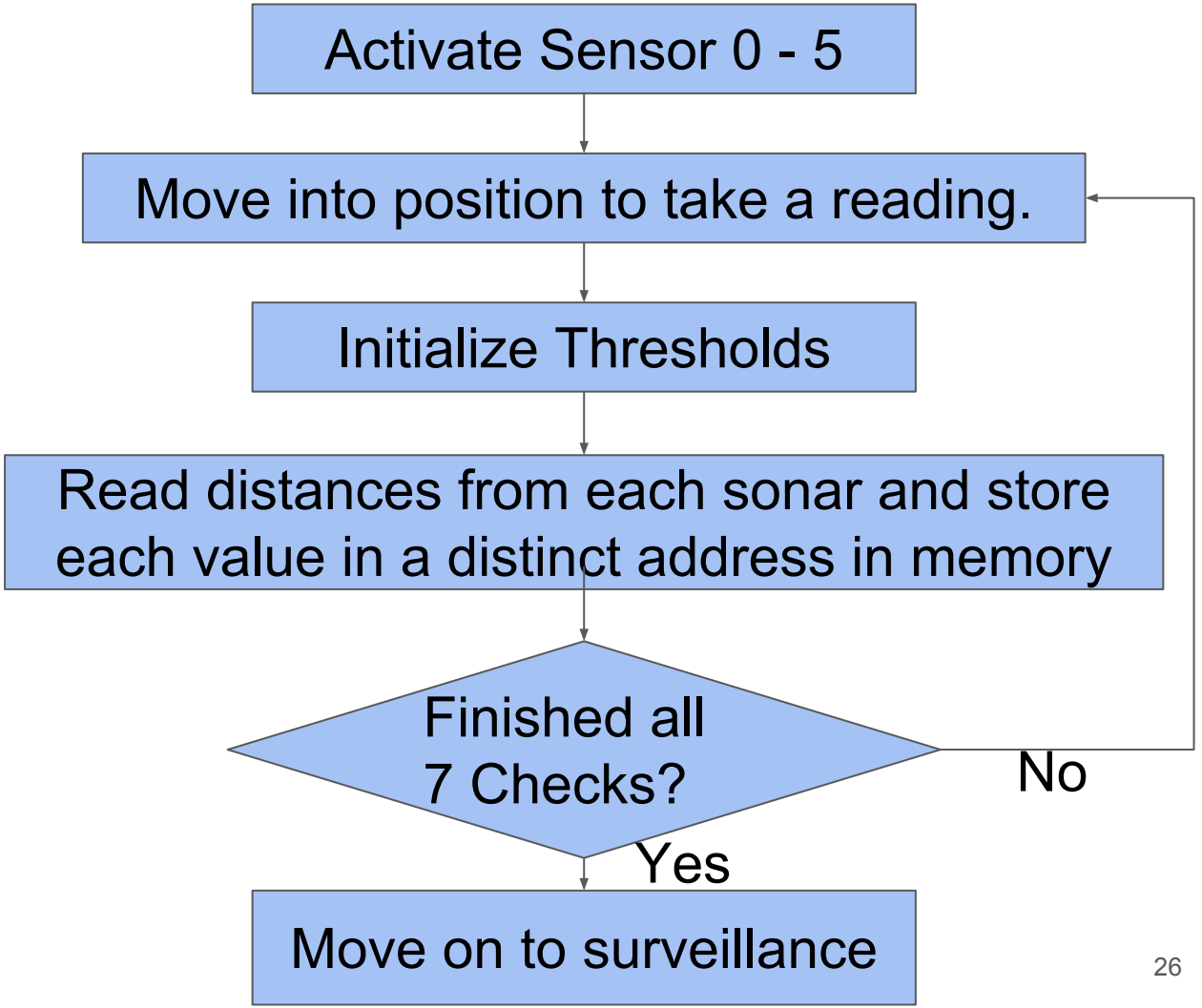


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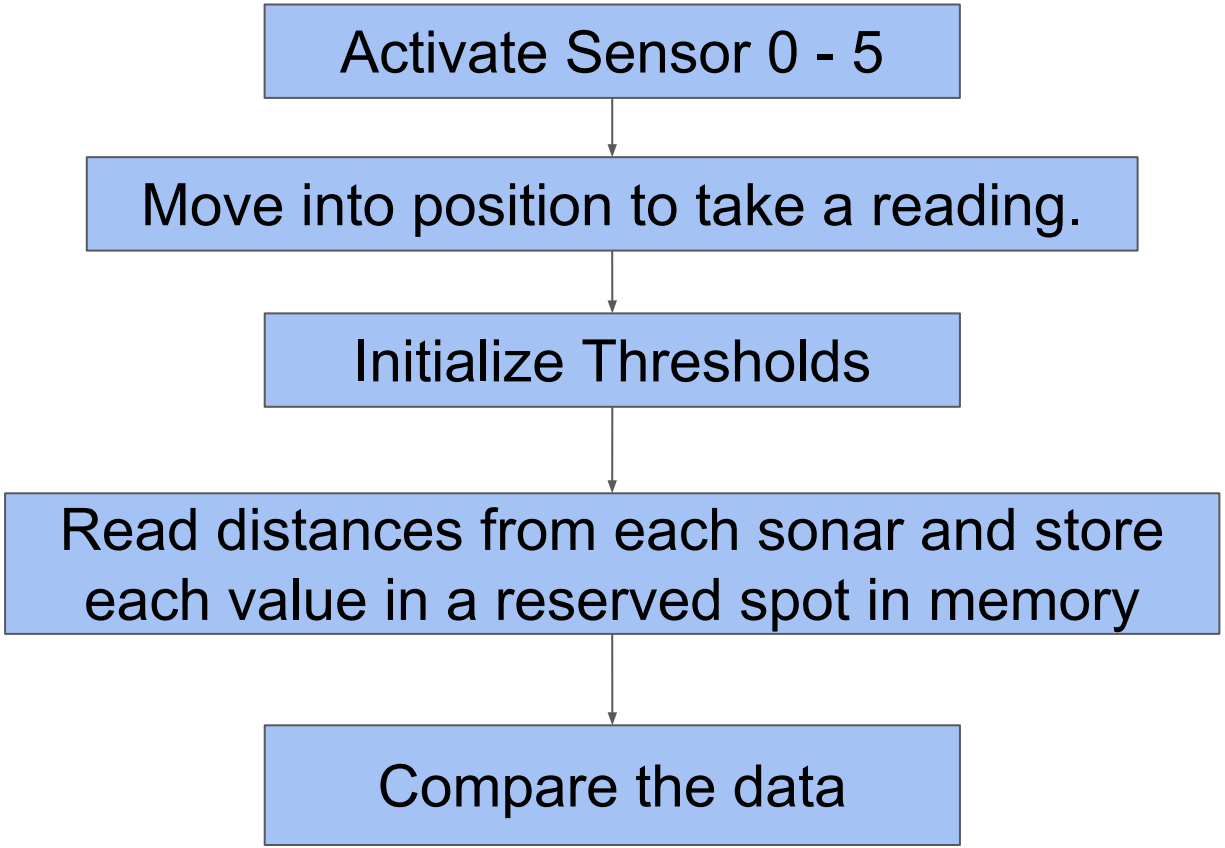
Initial Sweep

- Initial traversal of area to store how the map currently looks for future comparison.
- Once per demo.



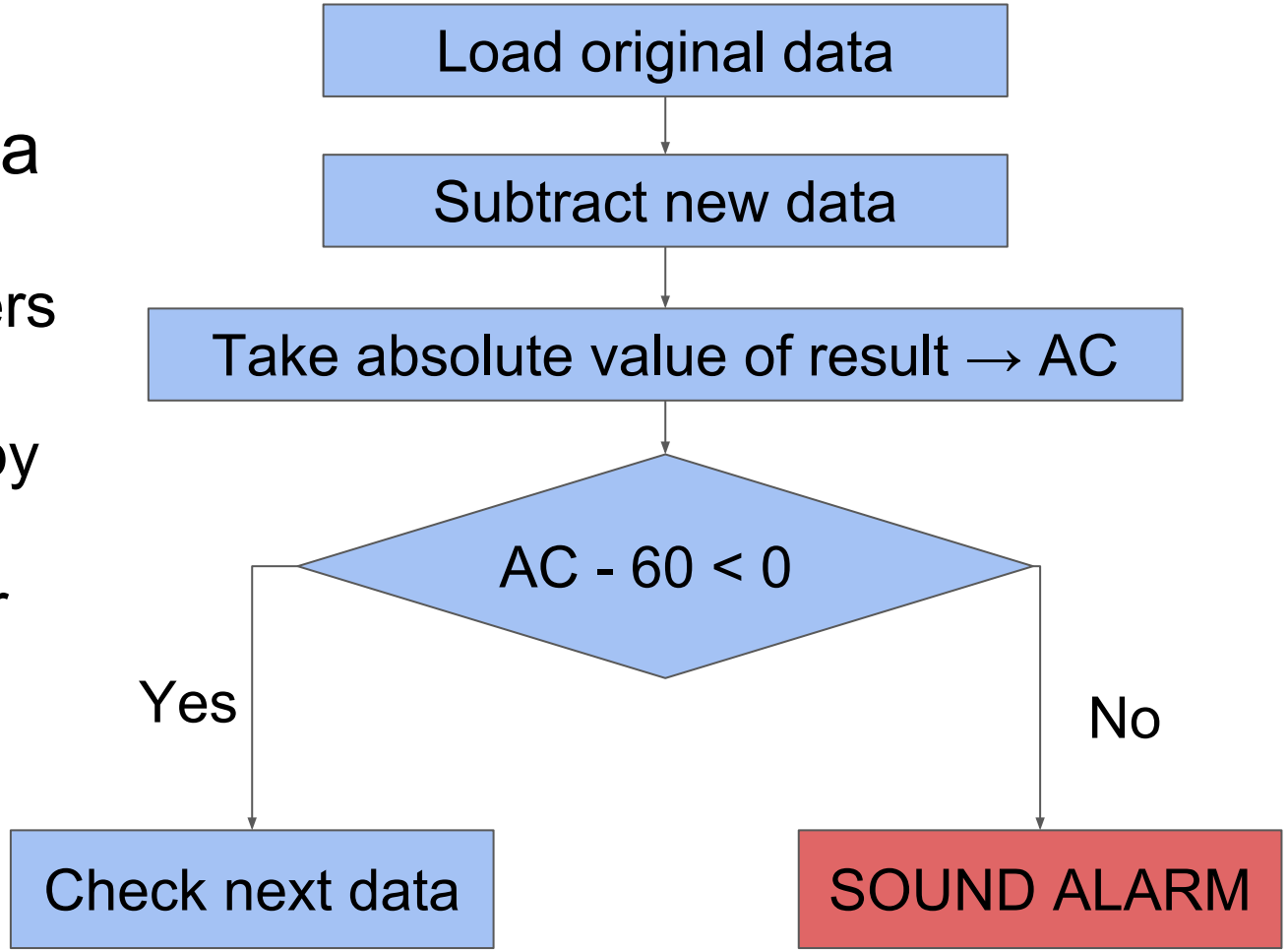
Surveillance Sweeps

- Subsequent traversals of area to check for changes.
- Run till end of the demo.



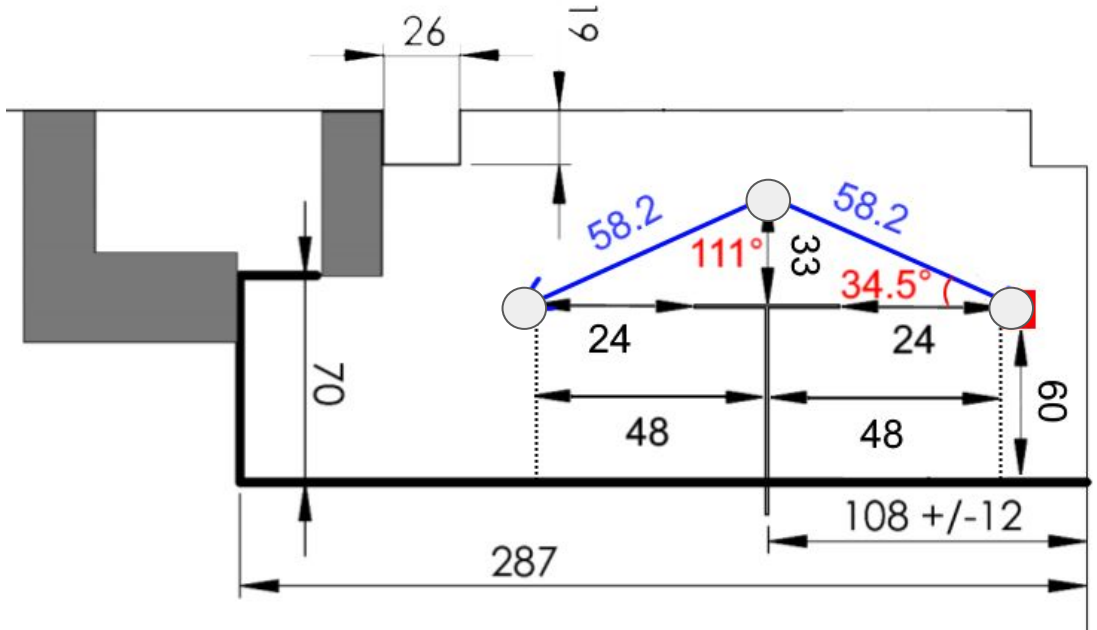
Comparing data

- Check if the new data differs from by the original data by at least 6 cm.
- Done once for each sensor every check.



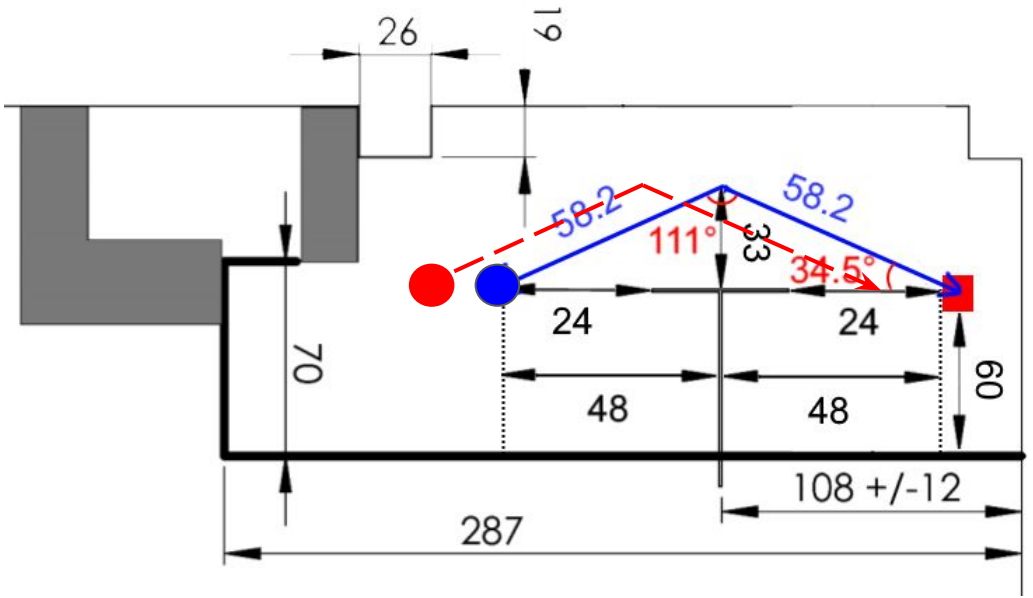
Staying on Path: Setup

- Store initial condition of the area into memory (before intruders arrive in the scene).



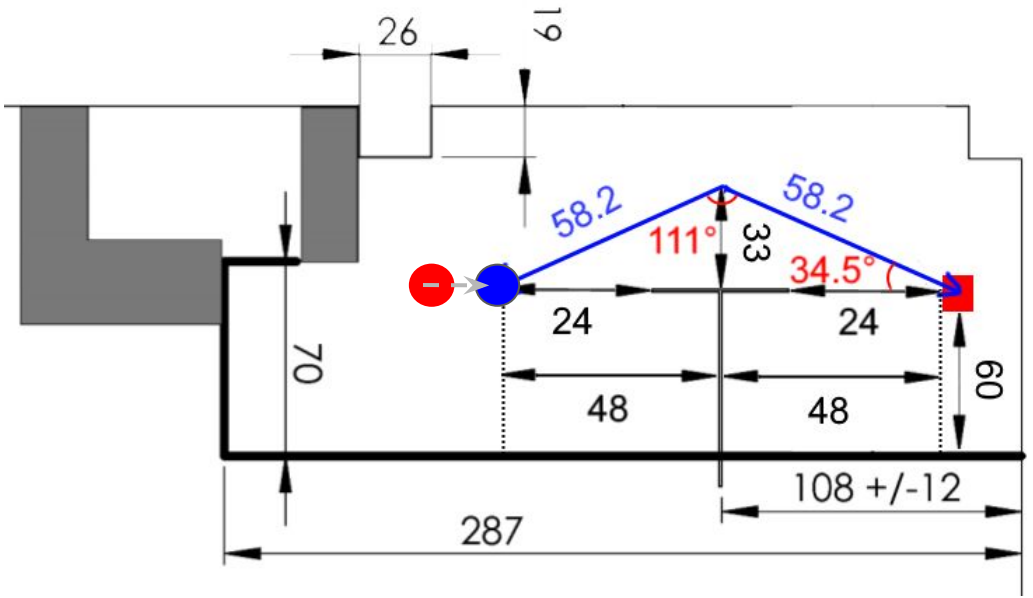
Staying on Path: Comparison

- During surveillance, compare new distances to stored data (if no intruders are detected).
- Error Margin.

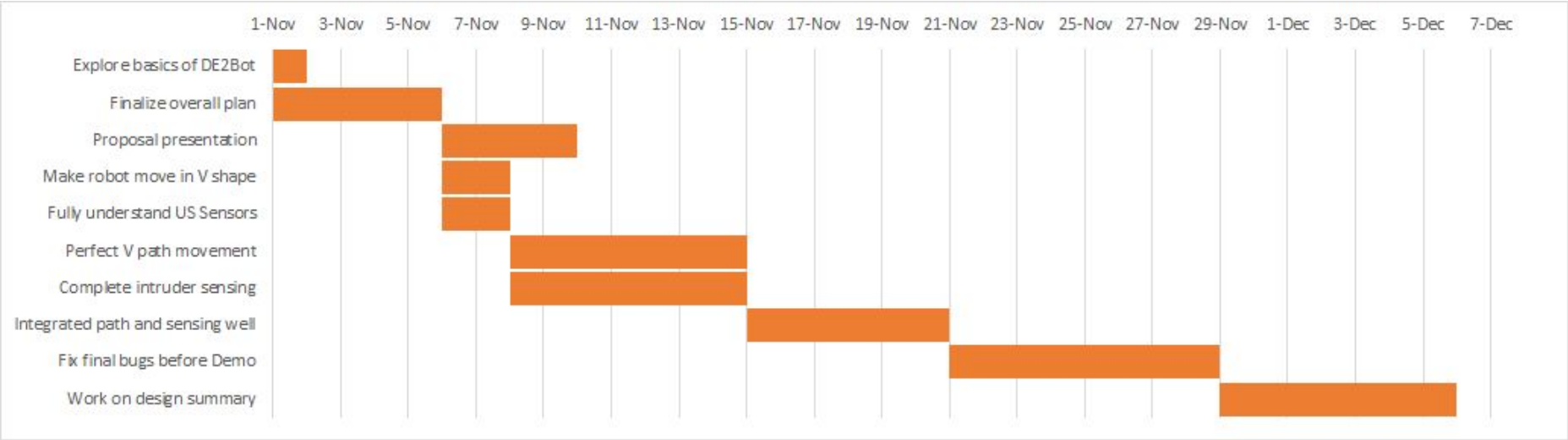


Staying on Path: Correction

- Relocate to starting position.
- Check distance to baffle and correct angle if necessary.



Timeline for the Project



Questions?