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Final Presentation

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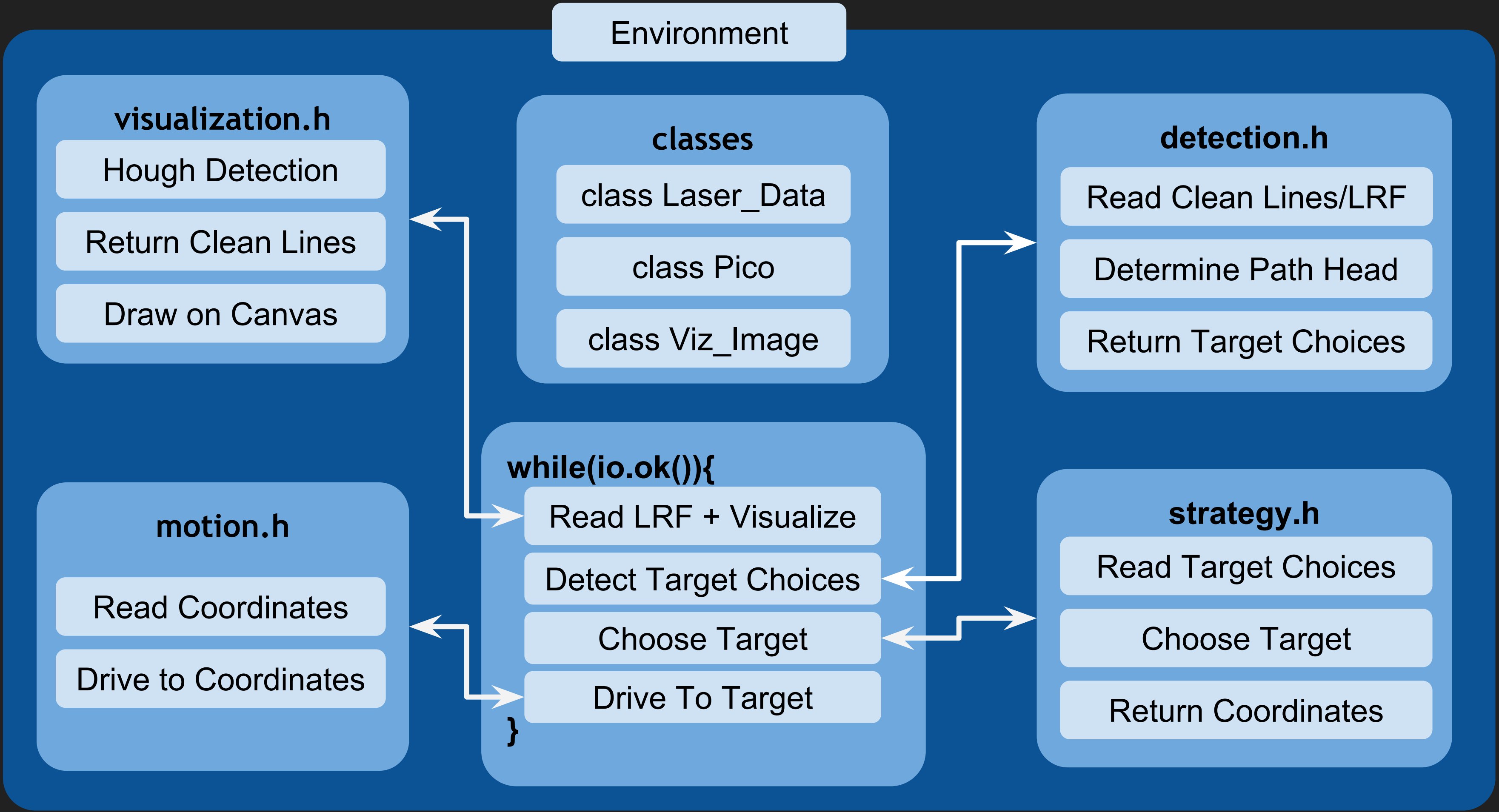
Software Design and Flow



Environment

visualization.h

- Hough Detection
- Return Clean Lines
- Draw on Canvas

classes

- class Laser_Data
- class Pico
- class Viz_Image

detection.h

- Read Clean Lines/LRF
- Determine Path Head
- Return Target Choices

motion.h

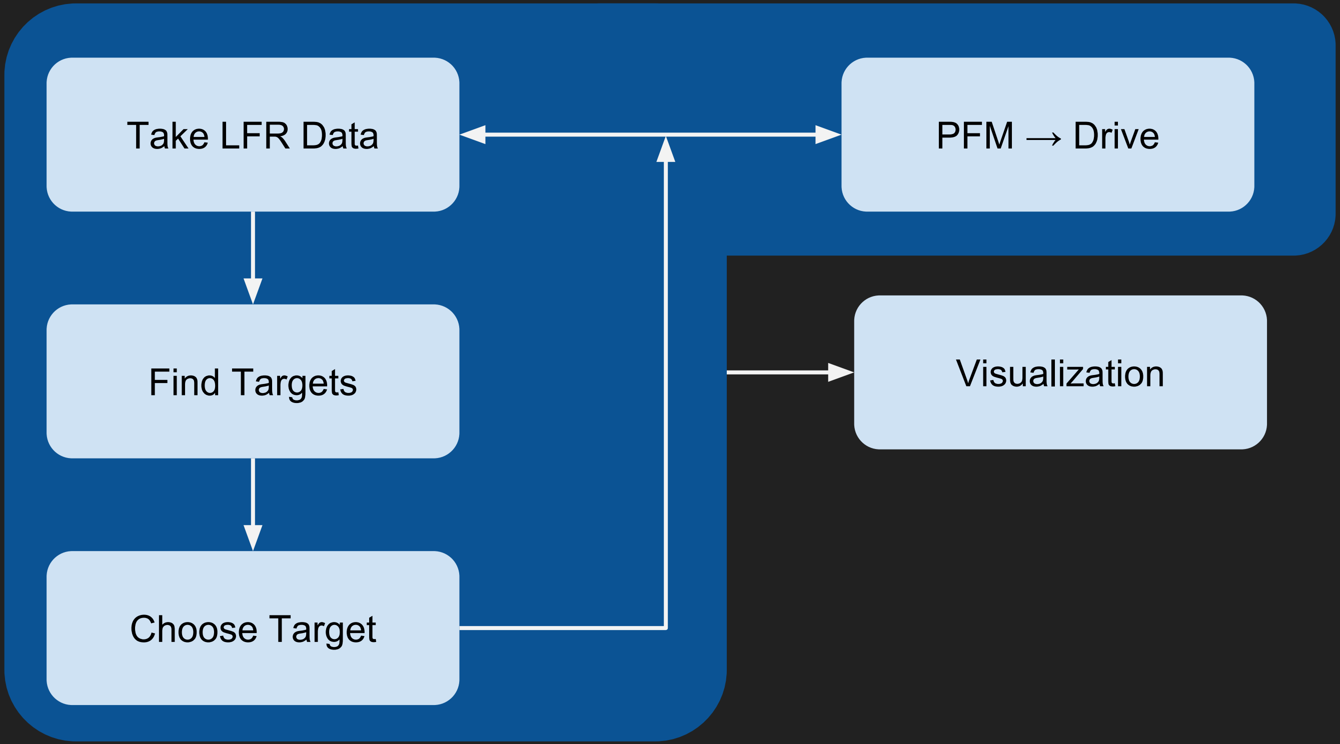
- Read Coordinates
- Drive to Coordinates

```
while(io.ok()){
    Read LRF + Visualize
    Detect Target Choices
    Choose Target
    Drive To Target
}
```

strategy.h

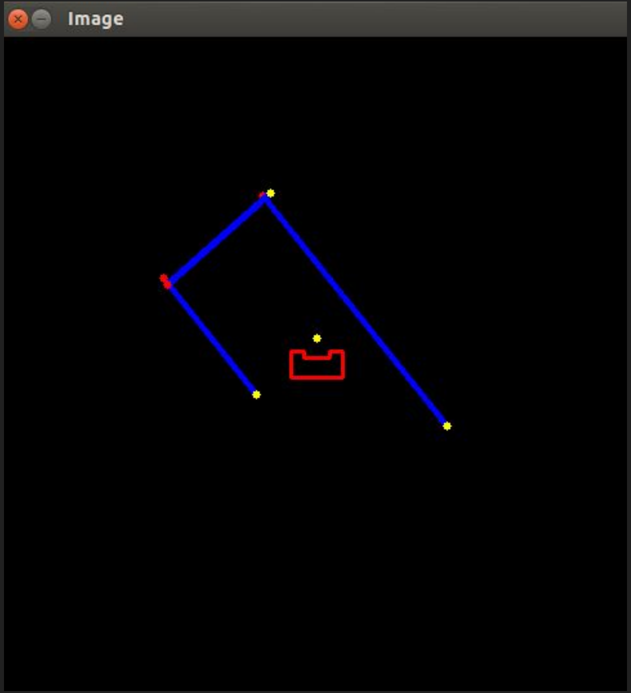
- Read Target Choices
- Choose Target
- Return Coordinates

Main Functional Loop


Take LFR Data
PFM → Drive
Find Targets
Visualization
Choose Target

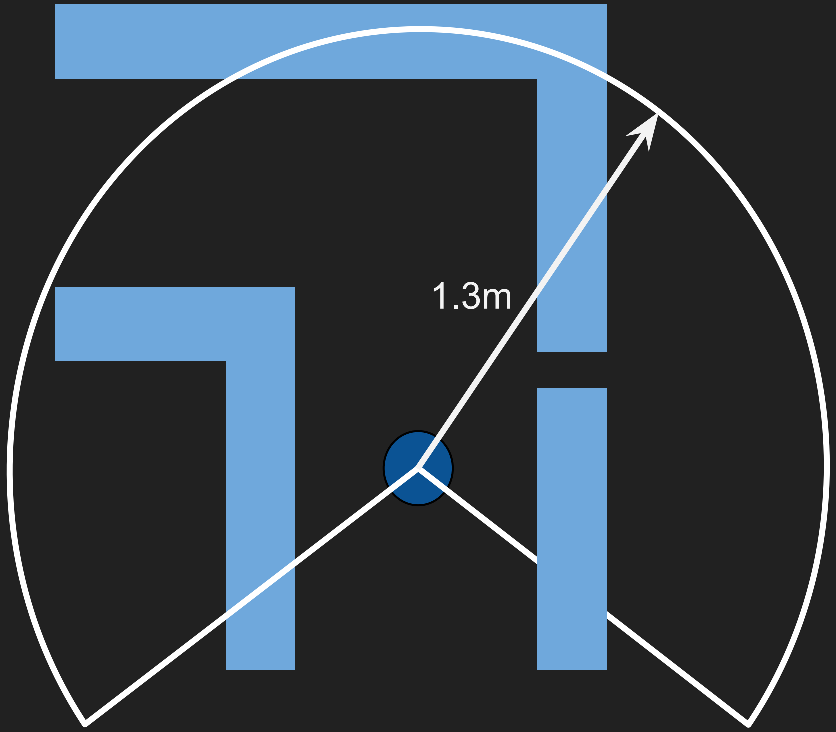
VISUALIZATION: Detecting and Drawing Lines

- Hough Transform
  - Plotting LRF data (mapping ➡ visualization)
  - Probabilistic Hough
  - Remove duplicate lines (filtering)
  - Draw
- End objective
  - Mapping primitives
  - Calculate Target
  - Navigation to desired set point



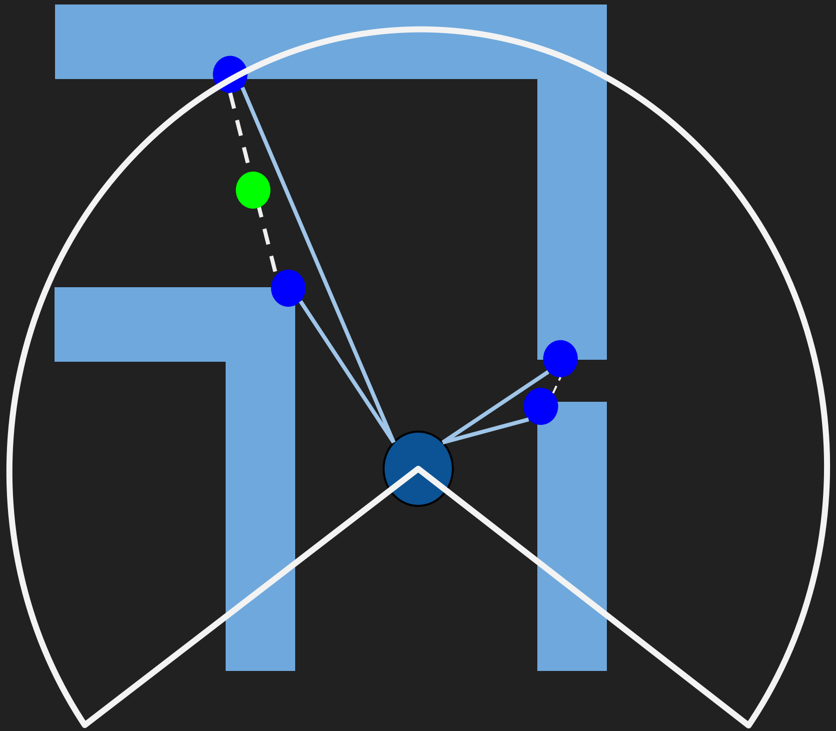
DETECTION: Finding Targets

- Consider only the measurements inside the circle



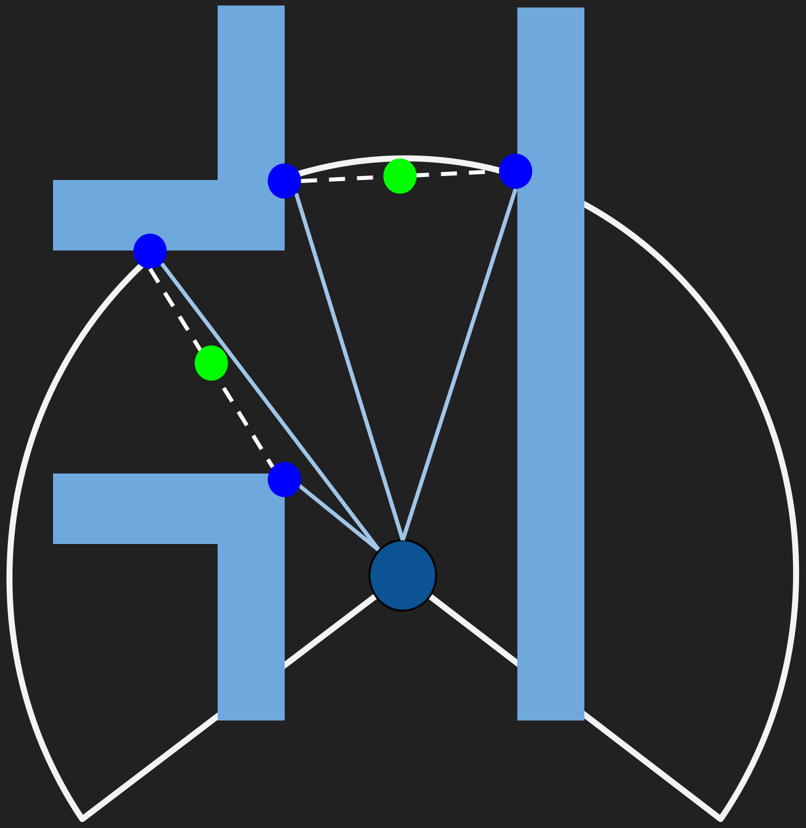
DETECTION: Finding Targets

- Search for gaps/ turns



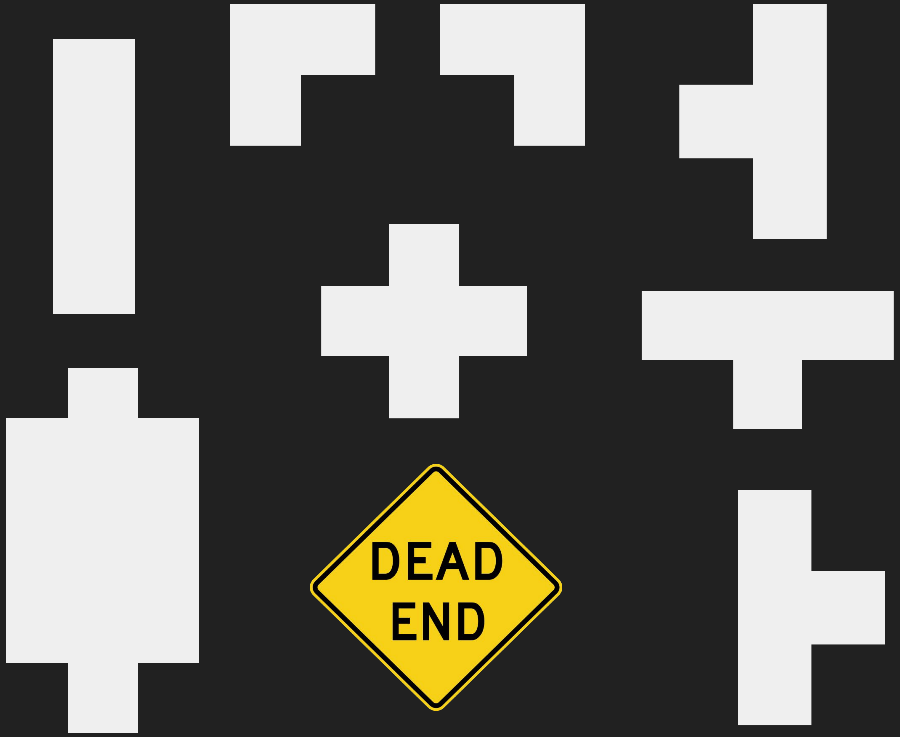
DETECTION: Finding Targets

- Search for gaps/ turns



DETECTION: Finding Targets

- Determine pattern
- Calculate target for each turn

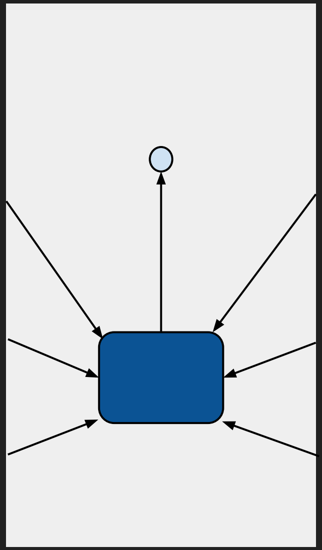


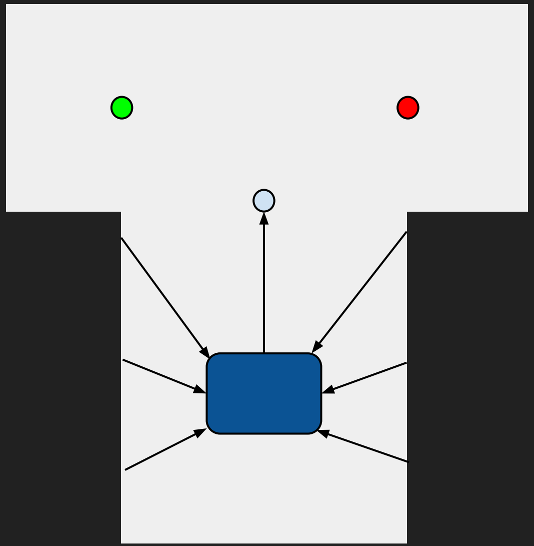
STRATEGY: Choosing a Target

- Random walk … but not totally random
- At dead-ends
  - STOP !
  - Ask for the door to be opened
  - Drive if door opens, otherwise take a 180 degree turn and drive
- To prevent getting stuck in a loop
  - Count if the robot takes 4 left (or right) turns consecutively
  - If yes, try to take the first alternate path available
- In open spaces
  - When no targets are detected, target is set as a point 10 cm in front of the robot, with the exception of a dead end
  - The potential fields drive the robot to the first opening

MOTION: Drive to Target

- Attractive and Repulsive Potential Fields
- Robot repelled by obstacles, attracted towards target
- Both forces dependent on distance of the robot to the obstacles/target
- The robot moves in direction of the resultant of the repulsive and attractive forces





Progress

- Potential field method implemented and tested
  - Target set as 10 cm in front of the robot
  - Tuned for almost all maze variations
- Hough line detection
  - Visualization tested on stationary robot
  - Hough lines generated and extra lines removed

To be done

- Test scheduled on 02/06/2016 (Thursday)
- Test option 1 of target detection
- After test, work on:
  - Strategy (Random walk)
  - A more robust algorithm to find targets using Hough lines (pattern recognition)
  - Integrate functions
  - Hope to test once again before the competition

Things we've learned

- Writing modular/structured code
  - Modules need to be tested individually
- Testing on the robot != Testing on simulator
- There is no escape from “tuning”
  - Less magic numbers = more robust functioning
- It’s not necessarily all about “control”

Thank you

Questions?

Remarks?

Suggestions?