# ME5751
# Robotics Motion Planning

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Project Kickoff

# Outline

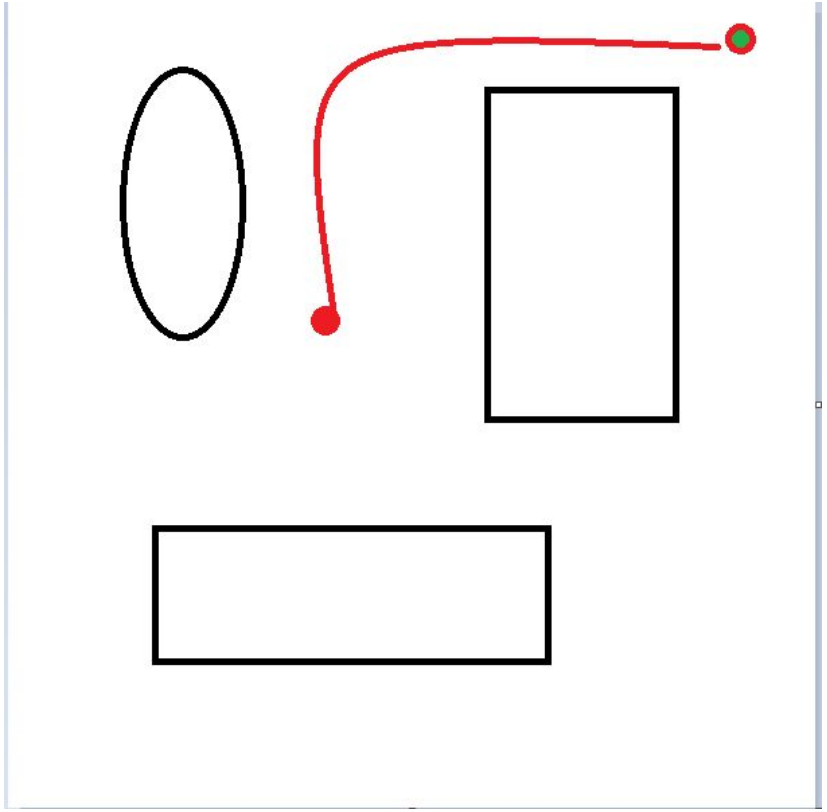
- Basic Idea
- Deliverable

# Car simulator!

- Car simulator! – No trailer

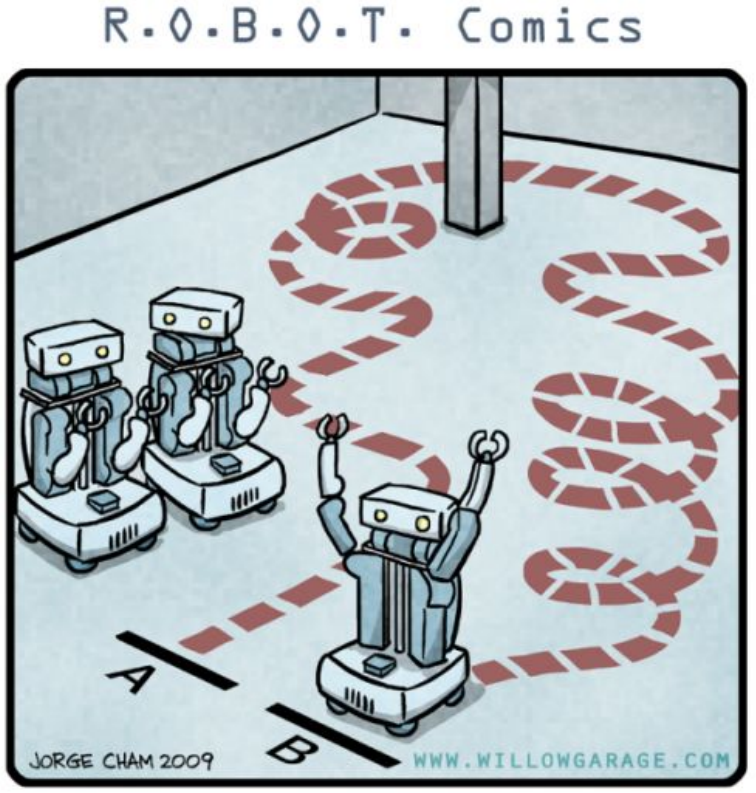
# Autonomous Navigation

- We will navigate our car autonomously in a “given” map



# Autonomous Navigation

- Your task
  - Process the given map
  - Plan a path
  - Navigate to the goal!

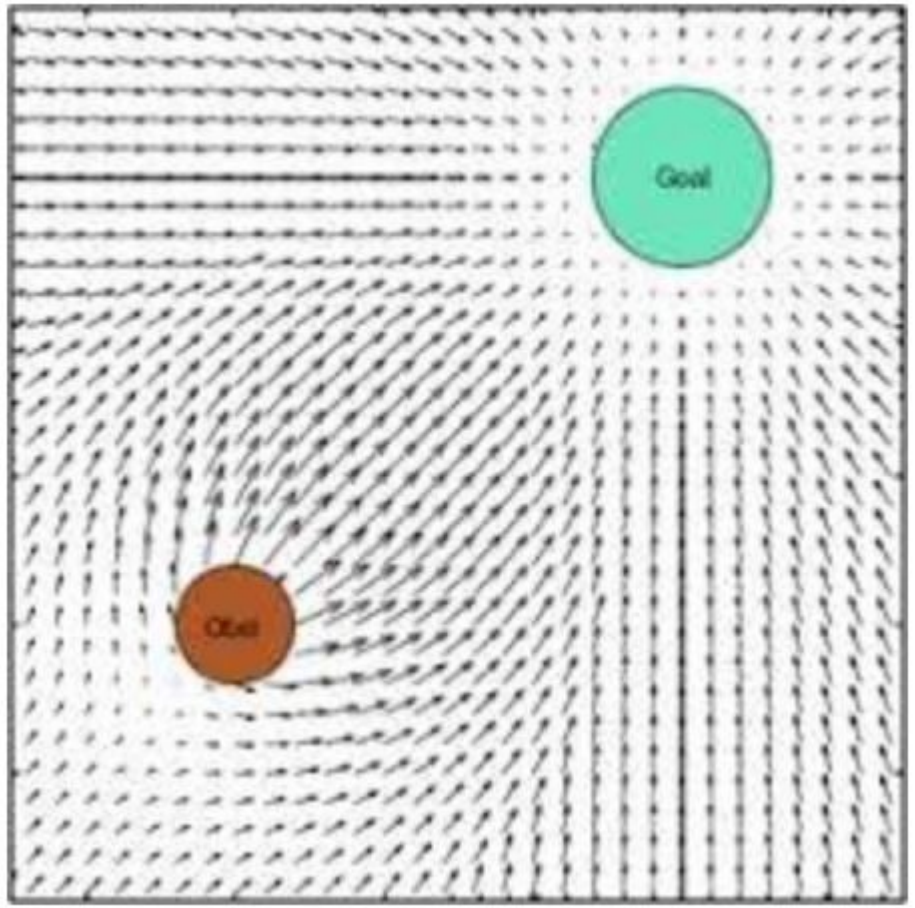


# Autonomous Navigation

- Rubric 1: Potential map generation
  - At least you should have the inflation layer done
- Rubric 2: Path planner – any path planner will work
  - Efficiency
  - Creativity – can you make your own planner?
- Rubric 3: Execution of the plan! – Frankly, P controller is bad.
  - Any other way to convert the path to motor control?
- Rubric 4: The execution fits the wheel dynamics of the car
  - We cannot turn-in-place anymore

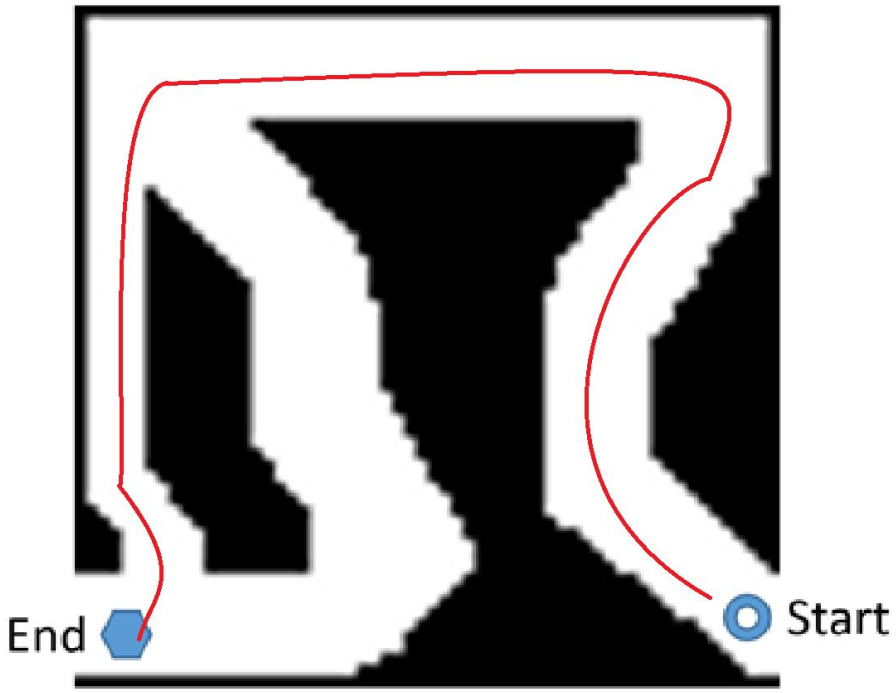
# Autonomous Navigation

- Rubric 1: Map generation
  - You must modify from a given map to a “navigation map” with at least inflation



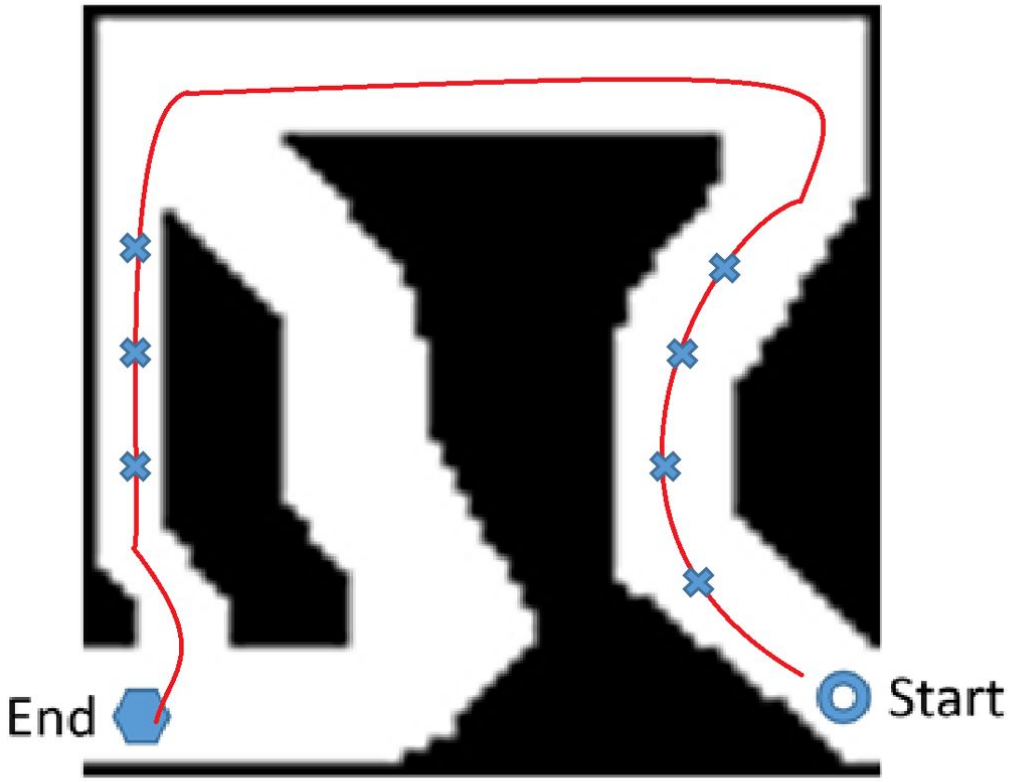
# Autonomous Navigation

- Rubric 2: Path
  - You should show your path on GUI
  - How fast you generate the path?
  - How long the path is?
  - Is there any “counter-intuitive” planning that shows the stupidity of AI?



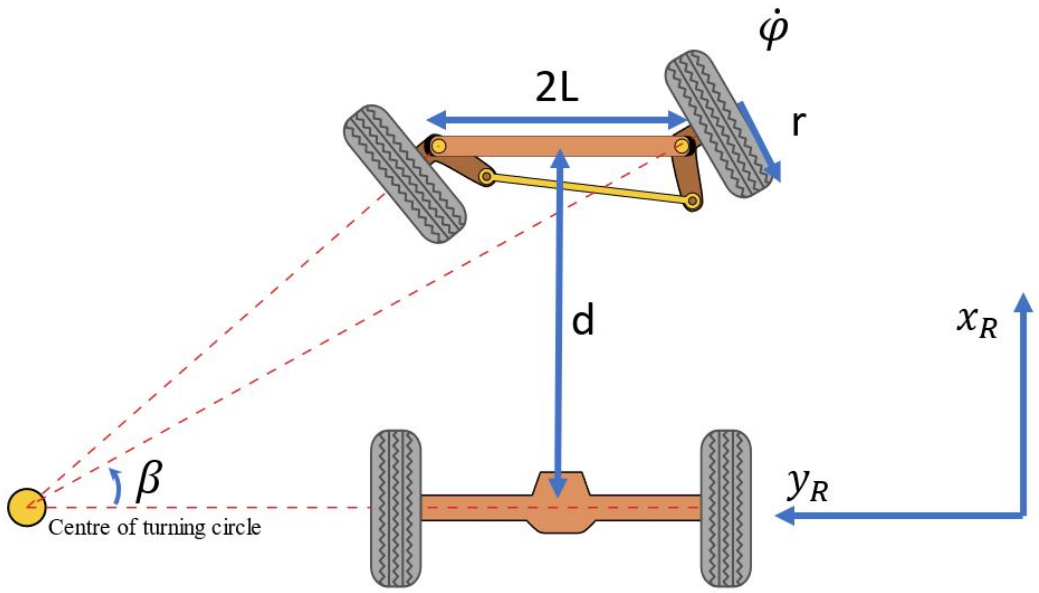
# Autonomous Navigation

- Rubric 3: Point tracking
  - We discretize the paths into a set of poses
  - Then, we track the points
  - The P - controller is not really great
- Density of Poses?



# Autonomous navigation

- Rubric 4: Dynamics of a truck!
  - Truck is different than our robot
  - Show that you have an understanding that how truck (or actual car) wheel works
  - Your simulator should reflect how does the truck move
  - Car width $2L = 16$, car axle distance $d = 20$, wheel diameter $r = 3$
  - Front-right wheel steering angle $\beta < 40°$, no wheel speed should be above 20rad/s (in your program, leave these parameters as constants)



# Outline

- Basic Idea
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# Report and presentation

- Introduction: Background, extra-curriculum research, etc.
- Detailed methods
  - Do include analysis of truck wheel dynamics
- Performance analysis (not limited to the following)
  - Map processing efficiency, path planning efficiency
  - Robot execution efficiency
  - How your parameters affect the behavior of the robot(such as heuristic function, cost function)
- Discussion
  - Anytime your car fails?
  - Does it perform better/worse than your thoughts
- Tentative time: Dec 05/07, 2022

# Competition

- The instructor will prepare 3 maps
- Crashed program will be eliminated directly
- First round: 2 maps will be used. Winners should have:
  - Minimum time (stop watch time) to reach the goal
  - Impossible frames has a penalty (let’s discuss the rule later)
  - Visual inspection on the collision
- Second round: devil map for the first 4 groups
  - Same rubrics above
- 5% global bonus for the competition