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# CSE 490R Final Project

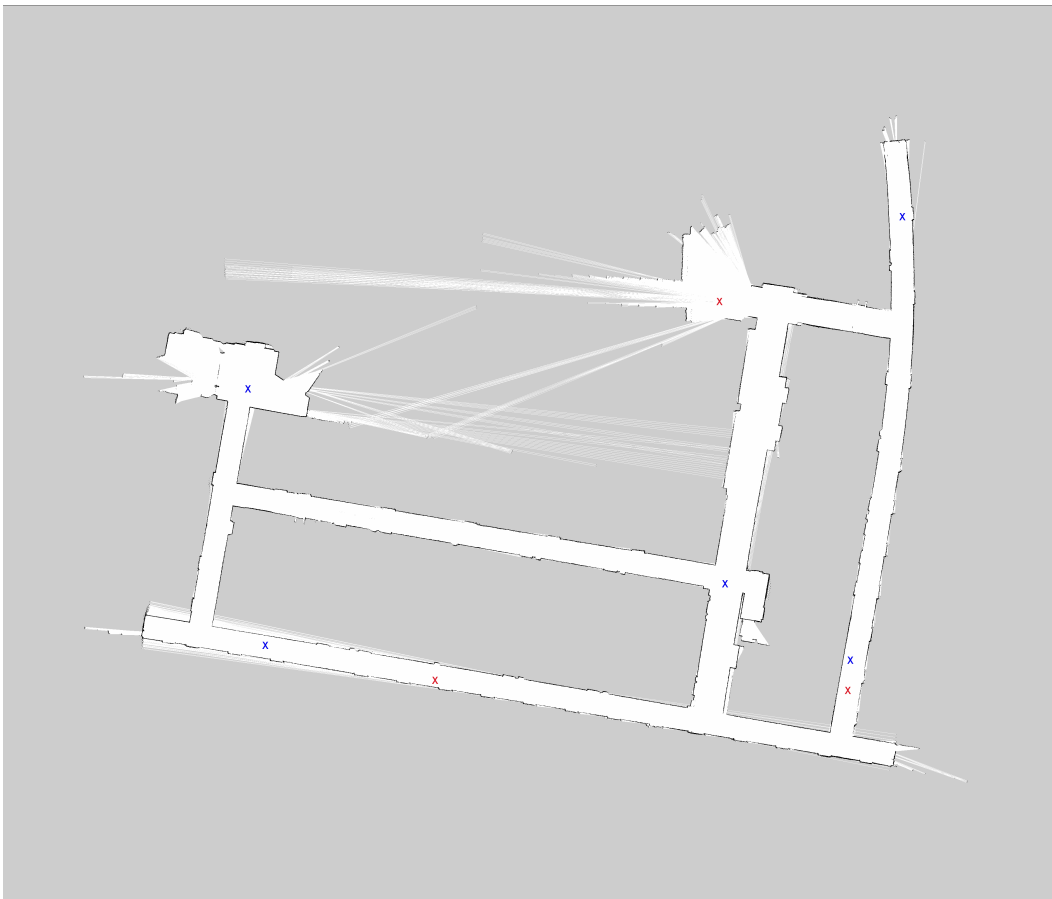
## Due date: Monday March 12

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Welcome to the final project of the course! We hope you've enjoyed it, we certainly have! You will now combine all of your past blood, sweat, tears, and knowledge from the course to autonomously navigate your robot as quickly as possible.

### 1 Task

You will be given a series of waypoints located in a map, as illustrated in Fig. 1:



**Figure 1:** Map with marked waypoints in blue and red. The car should traverse over blue waypoints, and not traverse over red waypoints

Your system needs to be capable of reading from two csv files that we will provide shortly before the demo - one containing waypoints that the robot should traverse, and the other containing waypoints that the robot should not traverse. Each line of either csv file represents a single  $(x,y)$  waypoint (in pixels). Theta will not be specified. Also, the robot does not need to visit the desired waypoints in any particular order - choosing this ordering may be part of your strategy. Each of the waypoints will also be physically marked in the world with colored tape - either with a blue 'X' that should be driven

over, or a red 'X' that should not be driven over. Note that the robot has only visited a waypoint if it actually drives over any part of the tape - just getting close does not count. Red markers will be sized such that they do not completely block passage - even in narrow passageways the robot will be able to drive around it if the robot is careful, but there may only be room for a few centimeters of error. Blue waypoints will be strategically placed such that at some point the robot will likely have to make a choice between carefully navigating around a red waypoint or taking a longer path.

## 2 Scoring

You will gain points by doing the following:

1. Driving over blue waypoints (+1 each)
2. Visiting all of the blue waypoints quicker than a given baseline amount of time (7.5 minutes) without running over any red waypoints (+3)
3. Being one of the three groups that visit all blue waypoints quickest (1st place -> +4, 2nd place -> +3, 3rd place -> +2). Note that there is no requirement that you don't run over any red waypoints here.
4. Implementing something particularly creative or awesome (Case-by-case basis)

You will lose points by doing the following:

1. Driving over red waypoints (-1 each)
2. Damaging your robot (Case-by-case basis)

There will be *approximately* 5 blue waypoints and *approximately* 5 red waypoints. The baseline time will be announced shortly. This will all take place in and around the Gates' Commons of the CSE building. You will not receive the map until shortly before the demo.

## 3 System Requirements

The only requirement is that you must integrate some form of planning into your final project. You can either adapt the skeleton code [here](#) to do planning, or implement your own code from scratch. It will be very important to robustify your system and rigorously test it.

## 4 Submission

In addition to submitting all of your code, we will ask you to record a bag file of your RGB camera's output during the demo (put it on the car's SSD at /media/JetsonSSD). You will also need to write a report describing your system and the design choices that you made in developing it. It should be written and sufficiently detailed such that any class member outside of your group could re-implement your system.

## 5 Additional Notes

- You will be given the final map, starting location, and list of waypoints thirty minutes before your demo time. **Note that all locations/waypoints will be specified in pixel space.** You are free to use this thirty minutes to generate a plan and/or tune your system
- Each team will receive a block of twenty minutes for their demo. A signup sheet will be provided soon.
- You are allowed to restart your run as many times as you would like within your allotted twenty minutes. Each time that you restart, your robot will be returned to the starting point and your score will be reverted to zero. Your final score will be the maximum score achieved across all of your runs.

- You can also intervene in the middle of a run. This involves anything that interferes with the robot's autonomous behavior, such as picking up the robot or using RVIZ to re-localize the robot. However each intervention will result in the loss of one point for the run. The clock will keep ticking during your interventions.
- Each group will nominate a team captain. Although other group members can voice their opinions, the team captain will have the final say on if/when/how interventions and restarts take place
- You are allowed to change code/settings during your demo period. This will also count as part of the demo time.
- A run ends either when you have visited all blue waypoints, or you can declare it to be over at any time. At that point, you can start another run given that you still have time remaining.
- As previously mentioned, a waypoint (good or bad) will be considered visited if any part of the robot physically touches any part of the waypoint