

## COMP4807 - Project Competition

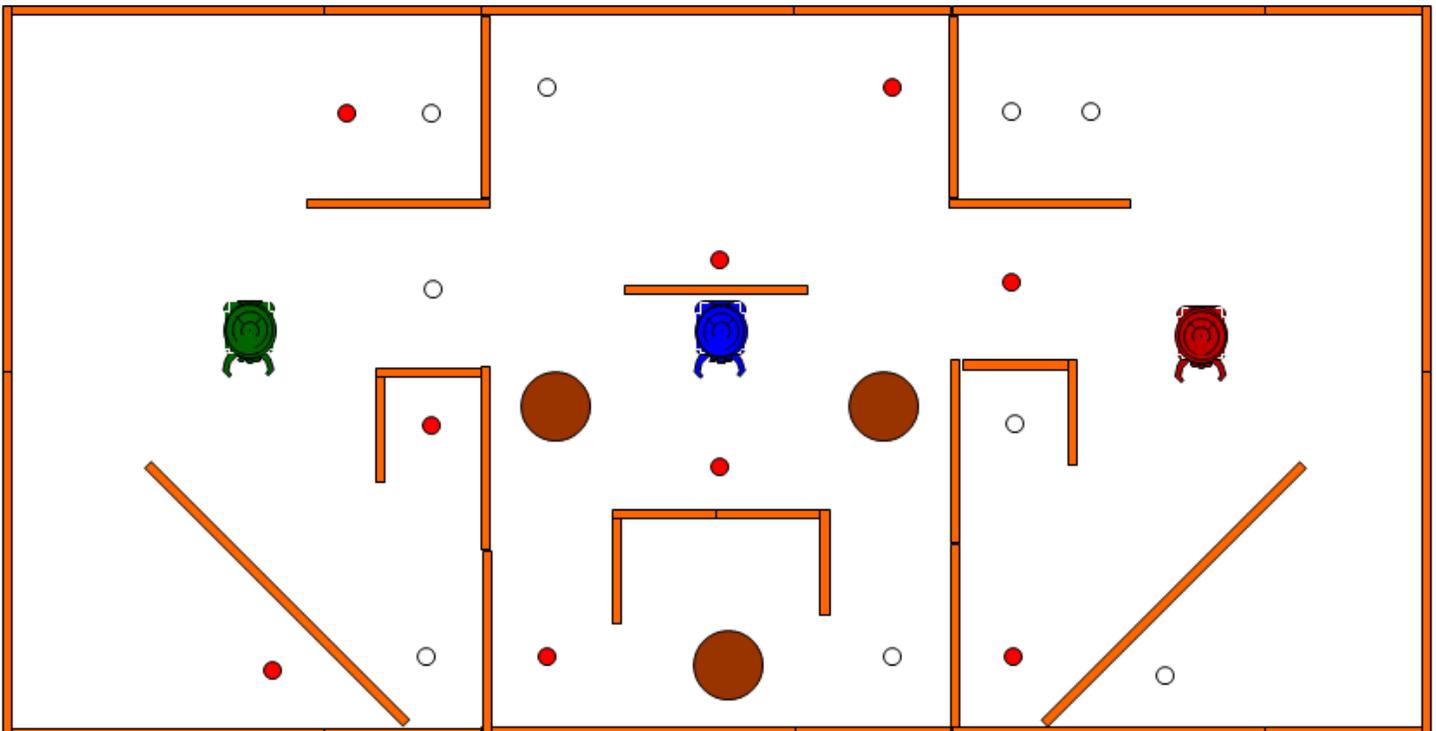
Competition Dates: April 1st, 4th and 6th  
Writeup Due: Friday, April 8<sup>th</sup> at 12pm



In this final project assignment you will work as a team to prepare accomplish a task of moving blocks and flower pots from one configuration to another. You will work on 1/3 of the team's task. Your grade will depend on how well your individual robot will perform its designated task as well as the overall level of competency of the team's robot in regards to completing the task at hand.

### Environment Setup:

For this project, some of the walls will be reconfigured from the normal roaming area setup, allowing a robot to access an adjacent robot's area. The environment will be set up as shown below. You **MUST** not change any of the obstacle positions in the environment, leave them as they are set up. The lab environment for the competition will be set up on the afternoon of Friday, March 18<sup>th</sup>, until then, you must not attempt to remove any of the walls that are fixed in place. The starting locations for the 3 robots and flower pots are shown below. There are 18 possible starting locations for the cylindrical blocks as show by small circles in the diagram below. Exactly 9 out of the 18 possible block locations for each zone will have blocks in them whereas the other 9 locations will have no block. The block locations will be chosen by the instructor immediately before the robot's will begin, so you will not be able to supply your robots with advanced knowledge of where the blocks will be.





Team score is calculated as a total of follows:

(combined total of all three individual robot points as mentioned above) +  
(10 points for successful completion of all 9 blocks) +  
(10 points for successful completion of all 3 pots)

## Marking:

The mark for your project is calculated as follows:

4 marks	TEAM RANK
3 marks	INDIVIDUAL RANK
15 marks	TASK COMPLETION
8 marks	PROJECT WRITEUP

Depending on the number of teams, you will receive a TEAM RANK according to your team's overall performance. For example, if there are 8 teams (of 3 robots each), the team with the highest points gets a rank of 4, 2<sup>nd</sup> place gets 3.5, 3<sup>rd</sup> place gets 3, ... whereas the team with the lowest points gets a rank of 0.5.

Everybody will also receive an INDIVIDUAL RANK (from 1 to 3) within their team. The robot with the most points on the team gets a rank of 3, 2<sup>nd</sup> most points gets a rank of 2 and least points gets a rank of 1. If there is a tie in the points, then both students will get the higher of the possible ranks. Therefore, when you decide which team members are responsible for moving which blocks and which pots, please consider the point system and make sure that everyone agrees on their particular task because the completion of a particular task may produce less points than the completion of a different task, potentially giving that student a lower rank.

You will also receive a TASK COMPLETION mark with depends on the percentage of task completion that you were able to achieve during the competition. If for, example, your task was to move 3 blocks and 1 pot, and you were able to move only 2 blocks, then you receive a TASK COMPLETION mark of 5. If you were supposed to move just 6 blocks but were only able to move 5, then you receive a mark of 8.3. It is vital that you describe your task clearly in your project write-up.

## Competition Rules:

1. Each robot must be programmed individually by at most 1 person on the team (just like an assignment). That is, team members at one robot workstation may not share code with those at a different workstation even though they are on the same team. To clarify, even if two robots on the same team are performing the same task, they must each be programmed differently with NO SHARING of code (this will be checked when the code is handed in).
2. Team members are NOT allowed to control the robot while it is competing. The robot must act autonomously with no user input. Upon starting the competition, you are NOT allowed to input any information to indicate which of the potential locations will have the blocks in them.

The robots must figure this out on their own. You may, however, pre-program the robots to look at any of the 18 pre-defined locations to see if there is a block there or not.

3. Each robot may be programmed using a single spin program (may contain multiple object files) and a single planner (any mode). No team is allowed to alter the RBC software, nor the Robot Tracker code (note that the Robot Tracker does not currently save tracked positions of blocks so you will not be able, nor allowed, to track the blocks). You are not allowed to alter the colors of the blocks, they must be used as they are.
4. During the competition, a team member may reset the robot and any necessary software at any time ... realizing however that this costs precious time and may affect the overall performance and success of the team. If this occurs, the team member may re-send initial data to the robot again. It is clear that this rule can conflict with rule 2 if the robot is reset multiple times. The instructor will make a decision as to whether or not rule 2 is being abused if the robot is reset at all during the competition. The instructor is also the one who makes the decision as to when and how the team member may intervene. Each time the team member intervenes and moves a robot, there is a 3 point penalty. Upon reset, the robot must stay at the same location that it stopped at ... or the original start location.
5. The blocks and pots MAY NOT be tracked by the tracker, and hence the CMUCam must be used. The robot's location is tracked at all times in any zone by the 3 networked RobotTracker programs. Be aware though that the robot's position is not available while crossing between zones.

## Project Writeup:

You must submit a single report as a .PDF file (of MS word). There will also be some files associated with the report that must also be submitted. The report must contain the following:

- A section called "**The Team**" which indicates your robot's name (think of something good), your name, as well as the names of the other members of your team. This file should also very briefly (i.e., one sentence) explain the role that each team member played in the overall project (i.e., what they were responsible for). Be very specific ... referring to code and tests etc...
- A section called "**The Competition**" which explains how the environment was set up. It should show a single image of the environment created by joining together three snapshots from the webcams into one big 1440 x 640 pixel image. It should also explain the goal of the competition and briefly indicate all subtasks for each member of the team. Make sure that you VERY CLEARLY explain YOUR particular subtask (or goal) that you attempted to complete. For example, your goal may have been to move 3 blocks to their final location, one flower pot and return to the start position. Or, perhaps you were to move just the 3 pots and get back to the start.
- A section called "**My Approach**" which explains a detailed description of how you approached your task. Explain which sensors you used on the robot and how you planned to use them. Draw diagrams of the environment and explain how you decided to maneuver the robot to accomplish its goal. Explain (using diagrams or pictures) the areas along the robot's path that you expected problems and when you needed to change strategies. For example, you may

need to explain where/when you needed to switch between wall following and RobotTracker path planning modes. Explain your plan for transporting the blocks (i.e., which ones first, where to bring them, potential hazards from other robots etc...). Make sure to explain how you coordinated your efforts (e.g., timing, specific paths etc...) to attempt to minimize interference with your team members.

- A section called “**Implementation Details**” which provides a description of how your code works (both SPIN code and any planner code you used). Explain the challenges in the code. Have all of your code included in the text of the report (use an appendix if necessary).
- A section called “**Problems Encountered**” that explains the various problems that you encountered while you were developing your solution. Keep track of this while you are working in the lab. Do not try to “think back” after the competition. Simply take note of these problems as you encounter them. You should use snapshots and/or .avi files to explain the problems. Explain which of these problems that you were able to overcome and how you did it.
- A section called “**If I Could Turn Back Time**” which must be written AFTER the competition. This section should explain what you would have done differently if you had more time or if knew about the problems that you encountered during the competition. Please think carefully on this. Even if your portion of the project performed well, you may want to indicated where you could have helped in other areas of the project. Explain as well your feelings on the overall Team Design Approach and how you feel that the entire team could have improved its performance if you had to compete again.
- A section called “**Robot Hardware Problems**” which must be written AFTER the competition. This section should explain the particular hardware-related or code-related problems that you encountered through the course (e.g., Bluetooth, encoders, IR, etc...). Explain the problem that you were seeing, how much time you spent on trying to debug it, and finally how you fixed the problem eventually.
- A .avi file showing the successful completion of your subtask (with or without the other robots performing their task at the same time...its up to you). Do this BEFORE the competition once you get it all working. If you cannot complete the task, submit a video of what you were able to accomplish.
- Any fun/cool pictures that you may have taken of your team members, robot or lab either before or during the competition. You would need a cell phone or your own digital camera...don't mess with the cameras on the ceiling ;). This part is not marked...its just makes for nice memories from the course.

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## Submission:

This project MUST be posted online with a link submitted through the WebCT system. You may want to burn a CD or two as a “keepsake” for your team members. You may want to bring in your own digital camera and or video camera to record the competition and include all such pictures/snapshots on the CD as well...to make a souvenir of your accomplishments (or failures). If all team members agree, you may copy all of their assignments onto that CD as well so that each team member has all of their term's work on one CD...its just a thought. Your submitted code must containing ALL project-related code/files.

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