CPE 470-670 – Autonomous Mobile Robots

Instructor: Monica Nicolescu

Lab 1 – Handout

1. General information

- Lab meeting time and place: LME 321, Monday 2:30pm-3:45pm (on Wednesday for the first week).

2. Textbook

- *Robotic Explorations: An Introduction to Engineering Through Design*, 2001, by Fred G. Martin.

Please have at least one textbook per team with you during the lab sessions, as we will refer to if for numerous design and programming topics.

3. Teammates

During the laboratory sessions you will be working in teams of two to three students. It is desired that each team contain both graduate and undergraduate students, for an equal distribution of forces ☺. Team members should equally contribute to the lab sessions, reports and final competition.

Each team will be assigned a robotic kit (described below) that will be used for the duration of the semester. Students in each team share the responsibility of maintaining and returning the kits in their original form. Any lost or destroyed pieces must be replaced before returning the kits.

4. Grading, Contests

Your laboratory grade will be composed of two parts, totaling 40% of your overall grade in the class: 20% for the Laboratory Sessions and 20% for the final Project Competition. Each of these grades will be computed based on the following:

Laboratory sessions: Final Project:

Participation	30%
Web page presentation	10%
Lab reports	25%
Lab results	35%

Result (the behavior of the robot)	65%
Project report	15%
Web page presentation	10%
Code readability	10%

Participation: Attendance to the laboratory sessions or competitions is mandatory. If you cannot attend one of these sessions you must discuss with the instructor in advance (permission to skip such sessions will only be given for extreme medical emergencies).

Cleaning: Building robots is a lot of fun, but it most always means that lots of tools and robot parts will be scattered around your working area. At the end of each lab session, your team's assigned space should be cleaned and all parts/tools should be placed in order on the desk, such that if needed other students could use the space when you are not there.

Lab reports: for some of the lab sessions each team will be required to write a report that describes the following issues:
- Your hardware and software design
- The problems that you encountered during the implementation
- Your solution to the above problems
- Any unsolved problems and reasons for why you were not able to solve them

Reports should be uploaded on your team's website and should be formatted as follows:
- a title page with the names of all the students in the team, the team number and the lab report number
- each report page should be numbered and labeled with the team number

Add to the report any additional information that you think could improve your robot evaluation. Lab reports should be uploaded by the date indicated in the lab assignments. No late reports will be accepted (to make sure that you are not spending time during the lab to finish the previous lab's reports).

Lab session code:
- for each programming lab assignment the code for that assignment has to be uploaded on the team's website

Lab results: The performance of your robot in the lab contests/assignments throughout the semester will be assessed with respect to how well it achieves the goals of the assigned task.

Final project result: Your score in the final competition will be computed based on your robot individual performance/behavior and its performance relative to that of the other teams.

Project report: This report should address the following topics:
- Introduction (description of the contest, general principles of your chosen design)
- Description of your hardware and software design
- Encountered problems and difficulties, along with your solutions
- Discussion of any unsolved problems
- Result of your robot during the contest
- Conclusions
- Appendix (this must contain the code of your program)

The project report should be submitted electronically (in PDF version) and also be made available on the team web page.

Web page presentation: Each team should design a web page that presents the effort of your team during the labs and final competition. The lab reports and the code for each lab should be made available on the group's website.

Code readability: The code of your program for the final competition **must** be submitted in the appendix of your final report. Your code should be well organized and commented.

5. The robot kit

Each kit consists of the following:

- One Lego Mindstorms Education Kit (#9797)
- Additional sensors:
    - 1 (one) HiTechnic color sensor
    - 1 (one) HiTechnic compass sensor
    - 1 (one) HiTechnic IRSeeker sensor
    - 1 (one) HiTechnic sensor multiplexer
    - 1 (one) NXT light sensor
    - 1 (one) NXT ultrasonic sensor
    - 1 (one) Codatex RFID sensor
    - 1 (one) set of connector cables

These will be presented during the first lab session.

6. Build your first robot

You can take inspiration from the Kit booklet to design your first robot. Below are some design recommendations that should help you with the following labs:
- design a wheeled robot that will be able to easily move around the lab (avoid threads and gearing that would make for a slow moving robot)
- account for appropriate placement of sensors: touch sensors, sonar sensors, light sensors should easily be mounted toward the front of the robot
- do not worry yet about the compass sensor, multiplexer, RFID and IRSeeker sensors as they will be used in later labs