EIN 4601C – Automation and Robotics

Semester Project

Due (for all teams): April 16 (Wednesday), 2008, (at the beginning of the class)

As the automation engineer team, you are asked to design, build and implement an automated guided vehicle (AGV) that will be used in a manufacturing plant to transport material from one place to another. Your team will build the AGV using the LEGO Mindstorms NXT set that will be provided and will program the AGV using the LEGO Mindstorms NXT software available in ENC 1006. The AGV should achieve the following tasks:

a) The AGV moves from manufacturing cell $A$ to manufacturing cell $B$ by following a fixed black trajectory indicated on the floor (this is the fixed path of the AGV within the plant). The trajectory will be specified in the following weeks. Hint: you will need to use the light sensor to make the AGV follow the line.

b) Once the AGV reaches manufacturing cell $B$, it should stop through a voice command and wait until an object (wooden block) is placed on the AGV’s material container.

c) When an object is placed on the AGV, the AGV detects the presence of the object through a touch sensor and starts transporting the object back to the manufacturing cell $A$ by following the fixed path.

d) During the trajectory, the AGV should not leave the fixed path since this will cause damage to the AGV, manufacturing equipment and building. Also, the wooden block should not fall from the AGV.

e) If an object is obstructing the AGV’s path, the AGV should detect the object from a distance and stop until the object no longer obstructs the path. The AGV should never collide with any objects along the path.

f) Every time the AGV detects an object on its path, it should make a sound (your team can decide the type of sound) until the object is no longer on the path.

g) Once the AGV returns to manufacturing cell $A$, it should stop through a voice command and wait until the object is removed from the AGV.

The requirements for the semester project report are as follows:

1. **Cover page.** (1 page). Title of the project and names of all the team members.

2. **Project Description.** (1-2 pages)
   (a) Objective and description of project tasks.
   (b) Description of an AGV (in general) and its industrial applications.

3. **AGV Design and Description.** (1-2 pages)
   (a) Illustrations and description of the final AGV design and major components used.

4. **Control System.** (2-3 pages)
   (a) Description and sequence of operations for achieving the specified tasks including the program code.
   (b) Problems encountered in order to achieve the specified tasks in terms of design and control.

5. **Time Table for Completion of the AGV.** (1 page) Time table and task assignment (to each team member) for completion of the project.

6. **Results and Illustrations.** (1-2 pages)
   (a) Illustrations along with their description of the AGV accomplishing the specified tasks.
**Requirements for the Semester Project:**

1. The project will be graded based on the following:
   (a) Successful accomplishment of the specified tasks.
   (b) Time for the AGV to accomplish the specified tasks.
   (c) Completeness of the project report and adherence to the requirements shown under “Requirements for the Semester Project Report”.
   (d) Final presentation.
2. Each team will design and build their own AGV and develop its corresponding program code to successfully accomplish the tasks.
3. After the code has been generated, the team should test the program and ensure that all the specified tasks are accomplished by the AGV.
4. Each team will have their own container with LEGO components and a box where you can store your AGV design. Each team will be assigned a team number that will correspond to the LEGO box for your team.
5. **Absolutely no element/piece from the LEGO set should leave the lab (ENC 1006).** Each team is responsible to return all the LEGO elements/pieces to the TA at the end of the semester in the conditions that they were given to the team in order to receive a grade.
6. Please handle all LEGO elements/pieces with care in order to maintain the condition of the elements/pieces and completeness of the sets for further projects and fellow classmates.
7. No element/piece should be mixed with other teams sets.
8. If you have any questions or encounter any problems, please see the TA.
9. Always follow the safety guidelines as described in Lab I.

**Requirements for the Semester Project Report:**

1. Each team will submit a typewritten report describing the AGV design, development, and results.
2. In addition to the hard copy, your team should submit the electronic file of the project report in MS Word format and the LEGO program file to the Digital Dropbox in Blackboard. Name the files with the last names of the team members.
3. The report is to be submitted in 8.5” x 11” paper with 1” top, bottom, and side margins. The font to be used is 12-point Times New Roman or other similar-sized font throughout the report, except for headings, sub-headings, cover page, figures and tables. 1.5 line spacing with full text justification.
4. Clarity and thoroughness of the report, and good use of the English language, including grammar, spelling and punctuation, are considered in grading the project report.
5. The report must be typed and have a professional appearance. Sloppy work may cost you points.
6. Clarity of presentation of the results is an element of the grade.
7. If there is any information, data or figure obtained from other sources, you should cite the appropriate source in the References. Research ethics and responsible authorships should be followed (as an engineer) in this course. For more information about academic dishonesty, please refer to the USF Policy on Academic Dishonesty and Disruption of Academic Process at [http://www.ugs.usf.edu/catalogs/0203/adadap.htm](http://www.ugs.usf.edu/catalogs/0203/adadap.htm).
8. **No late project report** will be accepted.
9. Your team will present your AGV design and performance in a presentation at the end of the semester. More information about the presentation will be provided a few weeks prior to the presentations.