Hands-on Robotics with Programming

Final Project:
Development of an Automatics Train Control (ATC) System

Team Project (Max 2 members) Due Date: 06/21

Project Goal

Automatic Train Control (ATC) refers to the whole system which includes all the other automatic train control functions and, for some of these functions at least, also includes a degree of manual intervention. In this project, you and your team members will design and implement an ATC system which can be planned and implemented efficiently on Microsoft Robotics Developer Studio (MSRDS). The system is to simulate an ATC system such as Taiwan High Speed Rail (THSR).

The ATC system includes two trains (Figure 1). The train should be able to follow a line track (Figure 3) by light sensors (TCRT5000) and simultaneously send the information to a remote computer to enable a centralized control. There are four stations in the system: Taipei, Taichung, Tainan and Zuoying station. The first train only stops at Taipei and Zuoying station. The second train needs to stop at all stations. The first train has higher right of the way; therefore the second train needs to yield. The train can only go forward and backward, it cannot directly make an 180^o turn. As a result, the train needs three steps (Figure 2) to turn round at the terminal station (Taipei and Zuoying station).

You should install sonar distance sensor and LCD on the train (Figure 1). We will randomly put a box on the railway to simulate an accident. The train has to detect the accident by its sonar sensor and then stops moving until the box is removed. The LCD needs to display some information of the train. You also need to design a control panel to display the status of the ATC system.

You enhance the reality of the project, you need to use additional Lego NXT modules to create a railway signal and level crossing.

Grading

This project will be graded basically from the outcome of the project. The grading will be separated into three parts. One is live demonstration. You and your team member need to demo to the class at least 3 cycles. Another is a video demo in which you can show the best performance of your design. The other one is a written report. The report should include the program codes and detailed explanation of your design. Detailed grading items and weights are listed as follows:

1. Demonstration (60%): You need to demonstrate the robot in the class. We will run through several tests to see the performance and reliability of your work. Creativity and system design (including user interface) will also be graded.

A. Successfully demo for 3 cycles and avoid the accident – 30%

B. Control panel design – 15%

C. LCD display, railway signals and level crossing – 15%

2. Video demo (20%): You need to submit one or multiple video demos by using screen capture software or digital camera. The video demo should upload to Youtube. The link should be included in written report.

3. Report (20%): You need to develop a detailed report to describe your design. You are encouraged to include many figures, flowchart diagrams, sketches, photos and snapshots from computer screen to help you explain the designs. You have to describe the main mechanism of the robot and controlling method.

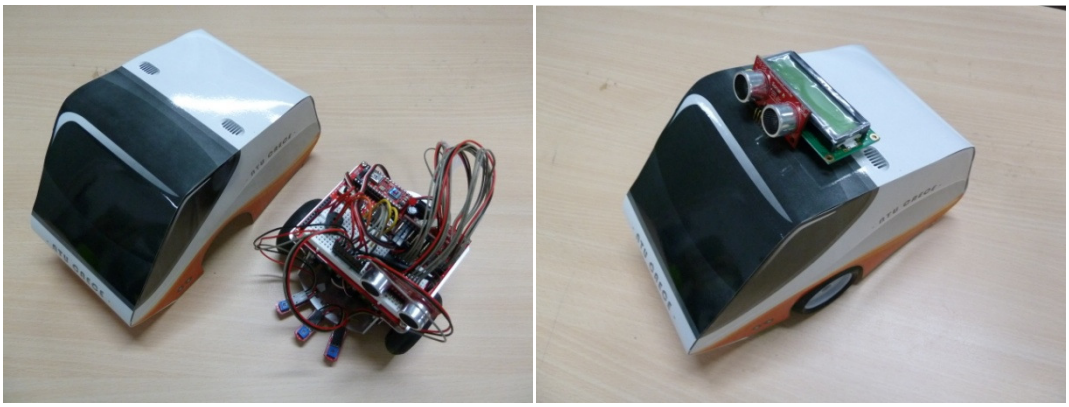

Figure 1: NTU CAECE high speed rail train

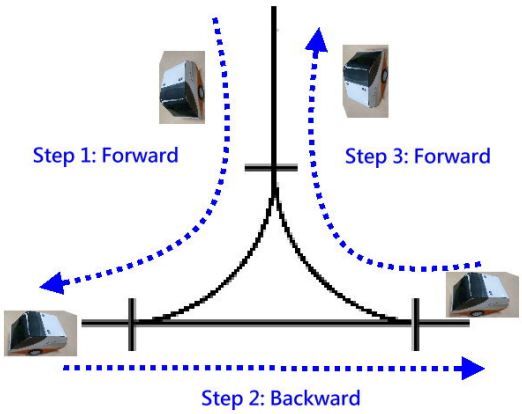

Figure 2: Three steps for the train to turn round

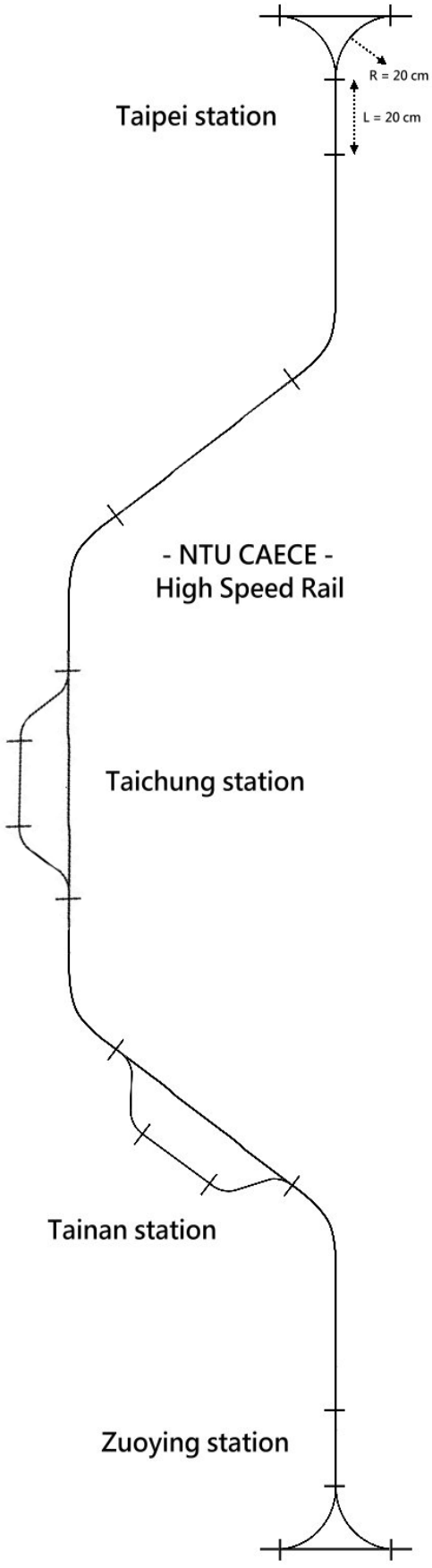

Figure 3: Robot status panel