Lesson Title	Line Trap Challenge
Length of Lesson	2 Days
Created By	Dustin Spayde
Subject	Robotics
Grade Level	11-12
State Standards	
DOK Level	DOK 4
DOK Application	Design, Create, Apply Concepts, Analyze, Critique, Connect
National Standards	9-12: A(Inquiry), E (technology)
Graduate Research Element	Developing Automated Systems

Student Learning Goal:

National Science Education Standards of Content 9-12
A (Inquiry): Identify questions and concepts that guide scientific investigations.
E (Science and Technology): Abilities of technological design: propose designs and choose between possible solutions, implement a proposed solution, evaluate the solution and its consequences, communicate the problem, process, and solution; Understanding about science and technology

Materials Needed (supplies, hand-outs, resources): A Lego Mindstoms NXT kit per 2-3 students, Access to computers (one for each group) with USB ports and the Lego Mindstorms NXT software (or other compatible language) installed on each, an extra NXT light sensor for each robot, multiple 2'x2' pieces of white foam board (with a smooth clean surface), matte black tape, and matte green tape.

Lesson Performance Task/Assessment:
Each team will have their robot navigate a randomly laid out line course.

Lesson Relevance to Performance Task and Students:
An automated vehicle such as this could easy be found in many factories and ports around the world. Developing its navigation system is an applicable task for a many engineering fields.

Anticipatory Set/Capture Interest:
Have one of the robots already prepared to run the course w/ your own program and challenge the students to place the tiles together in any order they wish. Then allow your robot to run the course the students made.

Guided Practice:
Day One: Supply students with their robot kits (with the basic education robot already constructed) so that they can modify them with dual downward facing light sensors. Explain that they should place their light sensors so that one is to the left of the black line while the other is to the right. After the brief construction period present the class with a collection of foam tiles w/ line paths on them (these tiles should be able to be placed together to create a random course). Examples of these tiles can be found online at the website for the Australian RoboCup Junior Rescue challenge (www.robocupjunior.org.au). Explain to the class that these tiles will be placed in a random order and that they must design a program so that their robot will navigate the course regardless of that order.

Day Two: Each team will run the final course until they have completed it successfully. (Some important questions to ask during this time are; "What are the limitations of your design?", "What would happen if the layout of the course changed?", "Would your robot still function properly without going off course? Why or why not?", "How could you improve your design?")

Independent Practice:
Students are split into design teams. Each team is tasked with designing programs that allows the vehicle to complete the random line course. Multiple teams can share one robot for testing purposes. Teams will then run the course in front of the instructor to be marked as completed.

Remediation and/or Enrichment:
Remediation: individual IEP; partner help throughout lesson; shorten parts of assignment; focus upon smaller elements of the process

Enrichment/Extension:
Set up a seminar in which students explain the design of their programs to the rest of the class.

Check(s) for Understanding:

Day One: Have all teams at least designed an algorithm for their program?

Day Two: Have all teams completed their designs and successfully navigated the course?

Overall: "What are the limitations of your design?", "What would happen if the layout of the course changed?", "Would your robot still function properly without going off course? Why or why not?", "How could you improve your design?"

Closure:

Day One: Allow the students to work as long as possible, while the instructor browses each group's work to clarify any misconceptions. Finish by informing the students to save their work a being prepared to finish their programming during the next class period. Encourage them to design for the next period outside of the classroom.

Day Two: Discuss with the class which team did the best and why.

Possible Alternate Subject Integrations:

*Math – can manipulate mathematical expressions to isolate needed variables

*Programming – Basic logic and algorithm models

Teacher Notes: