WAMC Lab Template

Math Concept(s):

Source / Text:

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Attach the following documents:

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

Short Description (Be sure to include where in your instruction this lab takes place):

- Design, build, and program a robot to navigate a maze or obstacle course using mathematical concepts and problem-solving skills.

Lab Plan

Lab Title: Robot Project

Prerequisite skills: An understanding of Java Script, basic geometry, and basic trigonometry

Lab objective: Use a robotics kit, relevant computer programming language, and math concepts such as distance, angles, coordinates, and basic geometry/trigonometry to program a robot to effectively navigate a maze.

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*

Mathematics K–12 Learning Standards:

- CCSS.Math.Content.HSG.GMD.B.4
- CCSS.Math.Content.HSG.SRT.C.7
- CCSS.Math.Content.HSG.MG.A.1

Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them
- Attend to precision

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- CCSS.ELA.Content.RST.9-10.1
- CCSS.ELA.Content.RST.9-10.3
- CCSS.ELA.Content.SL.9-10.4
- CCSS.ELA.Content.SL.9-10.5
- CCSS.ELA.Content.SL.9-10.6

K-12 Science Standards

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Technology

- 1: Empowered Learner 1.d
- 2: Digital Citizen 2.b, 2.d
- 3: Knowlege Constructor 3.d

Engineering

- HS-ETS 1-2

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness ☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION
Creativity and Innovation
☐ X Think Creatively
☐ X Work Creatively with Others
☐ Implement Innovations
Critical Thinking and Problem Solving
☐ X Reason Effectively
☐ X Use Systems Thinking
☐ X Make Judgments and Decisions
☐ X Solve Problems
Communication and Collaboration
☐ X Communicate Clearly
☐ X Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS
Information Literacy
☐ Access and Evaluate Information
☐ Use and manage Information
Media Literacy
☐ Analyze Media
☐ X Create Media Products
Information, Communications and Technology (ICT Literacy)
☐ X Apply Technology Effectively

LIFE & CAREER SKILLS
Flexibility and Adaptability
☐ Adapt to Change
☐ Be Flexible
Initiative and Self-Direction
☐ Manage Goals and Time
☐ Work Independently
☐ Be Self-Directed Learners
Social and Cross-Cultural
☐ X Interact Effectively with Others
☐ X Work Effectively in Diverse Teams

Productivity and Accountability
☐ X Manage Projects
☐ X Produce Results
Leadership and Responsibility
☐ X Guide and Lead Others
☐ X Be Responsible to Others

Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Any programmable robot kit
- Computer with programming software compatible with the robot kit
- Measuring tapes or rulers
- Graph paper or grid paper
- Obstacles or materials to create a maze (cardboard, tape, cones, etc.)
- Whiteboard and markers
- Calculator (optional)

Set-Up Required:

- Charge robot batteries, lay out materials, print instructions

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

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Cooperative Learning:

- This lab provides students with hands-on experience in working in teams to produce a robot and program while also applying mathematical concepts to solve real-world problems.

Expectations:

- Follow your project and leadership Rubics

Timeline:

- Three class periods

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Students will gain hands-on experience in robot design, programming, and teamwork, while also applying mathematical concepts to solve real-world problems.

Career Applications

- Robotics,

Optional or Extension Activities

- Advanced programming that includes concepts such as loops, conditionals, and functions.
- Sensor integration to improve the robot's navigation capabilities

Robot Project Lab Instructions

Overview

In this project, you'll work in teams to build and program a robot capable of navigating a maze. This challenge will involve applying principles of robotics, engineering, and programming. By the end, your robot should be able to autonomously navigate through the maze from the start point to the finish.

Materials Needed

- Robot Kit
- Maze materials (construction paper and markers)
- Computer with programming software
- Batteries or power supply
- Tools (screwdrivers, pliers, etc.)

Step-by-Step Instructions

Form Your Team

- Assign roles such as Project Manager, Lead Programmer, Lead Engineer, and Documentation Specialist.

Define the Maze

- Construct a simple maze using construction paper and markers.
- Ensure the maze has a clear start and finish point.
- Measure the dimensions and note any turns or obstacles.

Build the Robot

- Follow the instructions provided with your robot kit.
- Attach sensors and ensure they are securely connected.
- Double-check connections and stability.

Program the Robot, Test, and Debug

- Test the robot in a simple section of the maze.
- Identify issues and debug the program. Common issues might include:
    - Sensors not detecting correctly
    - Robot not turning as expected
    - Robot getting stuck
- Iterate by making small adjustments and re-testing.

Optimize Performance

- Fine-tune your code to improve the robot's navigation efficiency.
- Adjust the robot's speed to balance between speed and control.

Final Challenge

- Present your robot to the class.
- Run your robot through the maze.
- Explain your design and programming choices.
- Demonstrate the robot's navigation and highlight any unique features or optimizations.

Tips for Success

- Collaborate effectively within your team, leveraging each member's strengths.
- Be patient and persistent. Debugging can be challenging but is a crucial part of the process.
- Learn from each test and make iterative improvements.
- Have fun and enjoy the process of creating and problem-solving!

By the end of this project, you'll have gained hands-on experience in robot design, programming, and teamwork, while also applying mathematical concepts to solve real-world problems. Good luck, and happy building.