GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ENGINEERING & TECHNOLOGY

PATHWAY: Manufacturing

COURSE: Robotics and Automated Systems

UNIT: Introduction to Hardware

INTRODUCTION

Annotation:

Robotics and Automation: In this unit students will study the basic components that make up a robotic system.

Grade(s):

	9th
X	10th
X	11th
X	12th

Time:

5 hours

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Additional Author(s):

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Students with Disabilities:

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation.

FOCUS STANDARDS

GPS Focus Standards:

ENGR-RAS-1. Students will explain the history of automated systems and the benefits of those systems to manufacturing in a global society.
ENGR-RAS-2. Students will identify and explain the major engineering tasks in organizing automated manufacturing.
ENGR-RAS-3. Students will discuss the systems and applications of automation including: AGV, PLC, CNC, CIM, CAD, CAM, and robotics as essential to succeeding globally in a manufacturing market.
ENGR-STEM-1. Students will recognize the systems, components, and processes of a technological system.
ENGR-STEM-3. Students will design technological problem solutions using scientific investigation, analysis and interpretation of data, innovation, invention, and fabrication while considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.
ENGR-STEM-4. Students will apply principles of science, technology, engineering, mathematics, interpersonal communication, and teamwork to the solution of technological problems.
ENGR-STEM-5. Students will select and demonstrate techniques, skills, tools, and understanding related to energy and power, bio-related, communication, transportation, manufacturing, and construction technologies.
ENGR-STEM-6. Students will enhance reading by developing vocabulary and comprehension skills associated with text materials, problem descriptions, and laboratory activities associated with engineering and technology education.

GPS Academic Standards:

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.
SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.
SCSh3. Students will identify and investigate problems scientifically.
SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.
SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.
SCSh6. Students will communicate scientific investigations and information clearly.
SCSh7. Students will analyze how scientific knowledge is developed.
SCSh8. Students will understand important features of the process of scientific inquiry.
MM3P1. Students will solve problems (using appropriate technology)
MM3P2. Students will reason and evaluate mathematical arguments.
MM3P3. Students will communicate mathematically.
MM3P4. Students will make connections among mathematical ideas and to other disciplines.
MM3P5. Students will represent mathematics in multiple ways.
ELAALRC2. The student participates in discussions related to curricular learning in all subject areas.
ELAALRC3. The student acquires new vocabulary in each content area and uses it correctly.
ELAALRC4. The student establishes a context for information acquired by reading across subject areas.

National / Local Standards / Industry / ISTE:

ITEA - Standard 2. Students will develop an understanding of the core concepts of technology.
ITEA - Standard 8. Students will develop an understanding of the attributes of design.
ITEA - Standard 9. Students will develop an understanding of engineering design.
ITEA - Standard 16. Students will develop an understanding of and be able to select and use energy and power technologies.
ITEA - Standard 19. Students will develop an understanding of and be able to select and use manufacturing technologies.

UNDERSTANDINGS & GOALS

Enduring Understandings:

Students will understand how robotic components are put together, how joints articulate, and what devices can be attached to the end of a robotic arm to accomplish its mission.

Essential Questions:

- What components make up a robot?
- Explain how robots are classified by the type of construction and movement they can achieve.
- Name some of the end effectors used on robotic arms and discuss their capabilities.
- What safety issues should you be concerned with when working around a robot?

Knowledge from this Unit:

- Students will be able to identify various classifications of robotic hardware used in the manufacturing industry.
- Students will be able to identify multiple end effectors used on robotic arms.
- Students will be able to discuss safety issues involving robots in the work place.

Skills from this Unit:

ASSESSMENT(S)

Assessment Method Type: Select one or more of the following. Please consider the type(s) of differentiated instruction you will be using in the classroom.

____ Pre-test
X Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
_X_ Unit test
X Group project
X Individual project
X Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
_X_ Self-check rubrics
__ Self-check during writing/planning process
__ Journal reflections on concepts, personal experiences and impact on one's life
__ Reflect on evaluations of work from teachers, business partners, and competition judges
__ Academic prompts
__ Practice quizzes/tests
X Subjective assessment/Informal observations
__ Essay tests
_X_ Observe students working with partners
__ Observe students role playing
____ Peer-assessment
__ Peer editing & commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
X Dialogue and Discussion
__ Student/teacher conferences
__ Partner and small group discussions
_X_ Whole group discussions
__ Interaction with/feedback from community members/speakers and business partners
____ Constructed Responses
__ Chart good reading/writing/listening/speaking habits
__ Application of skills to real-life situations/scenarios
X Post-test

Assessment(s) Title:

Robot Hardware Exam (see Chapter 3 Hardware Exam document)

Assessment(s) Description/Directions:

Students will take a standard T/F, Multiple Choice, Short Answer exam on robot hardware, classification, safety, and end effectors.

Attachments for Assessment(s):

LEARNING EXPERIENCES

Sequence of Instruction

1. **Identify the Standards. Standards should be posted in the classroom for each lesson.**
2. **Review Essential Questions**
   - What components make up a robot?
   - Explain how robots are classified by the type of construction and movement they can achieve.
   - Name some of the end effectors used on robotic arms and discuss their capabilities.
   - What safety issues should you be concerned with when working around a robot?
3. **Identify and review the unit vocabulary**
4. **Assessment Activity**

   Step 1:
   Have students research safety in the workplace on OSHA's website. (see Robotic Safety document)

   Step 2:
   Discuss the safety issues concerning robots in the workplace. (see Safety Concerns.ppt document)

   Step 3:
   Discuss robot classifications. (see Robot Classification.ppt document)

   Step 4:
   Discuss robot end effectors. Have students complete the appropriate worksheets. (see Robotic End Effectors document)

   Step 5:
   View Davinci Surgical Assist Robot. Discuss the specialized end effectors that make distant procedures possible. (see End Effector websites document)

   Step 6:
   Create an end effector out of common materials that can be attached to a robotic arm. (see End Effector Construction document)

   Step 7:
   Prepare and give chapter 3 exam. (see Word Search Hardware & Chapter 3 Hardware Exam document)

Attachments for Learning Experiences:

http://www.appliedrobotics.com/solutions/Solutions.aspx
http://machinedesign.com/
http://davincisurgery.com/surgery/system/index.aspx
http://prime.jsc.nasa.gov/ROV/types.html
http://www.engineershandbook.com/Components/robots.htm

Notes & Reflections:

OSHA covers many safety aspects, but robots and automation provide an interesting look into the specialized safety considerations necessary when using this equipment in industry settings.

PowerPoint presentations summarize the information found on the supplement resource list and the website documents. Other sites may be found that duplicate the information or provide more in-depth coverage of a concept.

The culminating unit performance of creating an end effector might take more time than allotted. Construction can be very simplistic soda straws, rubber bands and cardboard, to using LEGO or VEX parts to attach to a working robot. The depth of this assignment is left up the instructor based on his or her resources at a given site. Project may be individual or group.

Chapter 3 Hardware Exam is available as an Exam Pro document, an RTF, and Zipped for inclusion in blackboard, angel, or CT Web (may or may not import).

CULMINATING PERFORMANCE TASK (Optional)

Culminating Unit Performance Task Title:

End Effector Construction

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Students will construct a homemade end effector that will operate with their robotic system.

Attachments for Culminating Performance Task: Please list.

(see End Effector Construction)

UNIT RESOURCES

Web Resources:

http://www.appliedrobotics.com/solutions/Solutions.aspx
http://machinedesign.com/
http://davincisurgery.com/surgery/system/index.aspx
http://prime.jsc.nasa.gov/ROV/types.html
http://www.engineershandbook.com/Components/robots.htm

Attachment(s):

Materials & Equipment:

Any materials you feel necessary for the students to create the robot end effector
(Wood, paperclips, screws, cardboard, foam core, LEGOS, VEX parts, balsa, rubber bands, string, tape, etc.)

What 21st Century Technology was used in this unit?

	Slide Show Software		Graphing Software		Audio File(s)
	Interactive Whiteboard		Calculator	X	Graphic Organizer
	Student Response System		Desktop Publishing	X	Image File(s)
	Web Design Software		Blog		Video
	Animation Software	X	Wiki		Electronic Game or Puzzle Maker
	Email	X	Website		