GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ENGINEERING & TECHNOLOGY

PATHWAY: Manufacturing

COURSE: Robotics and Automated Systems

UNIT: 6.2. PLC

INTRODUCTION

Annotation:

In this unit students will explore PLC program concepts and apply them to a manufacturing setting.

Grade(s):

	9th
X	10th
X	11th
X	12th

Time:

5 hours

Author:

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Additional Author(s):

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-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-RAS-4. Students will outline the utilization of programmable control devices and data transfer.
ENGR-RAS-5. Students will apply the principles of PLC, CIM, CAD, CAM, and robotics in the manufacturing of a product.
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:

SCSh7. Students will analyze how scientific knowledge is developed.
SCSh3. Students will identify and investigate problems scientifically.
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.
MM3P3. Students will communicate mathematically.
MM3P4. Students will make connections among mathematical ideas and to other disciplines.

National / Local Standards / Industry / ISTE:

UNDERSTANDINGS & GOALS

Enduring Understandings:

- Students will understand how automation of manufacturing systems has developed, with particular emphasis on the role of PLCs in the process.

Essential Questions:

- What is PLC?
- What jobs might a PLC programmer have to perform in a real world setting?
- How is Boolean Math utilized in PLCs?
- How are truth tables used with logic gates to control outputs?

Knowledge from this Unit:

- Students will be able to identify primary concepts of PLCs.
- Students will be able to apply truth tables to logic circuits
- Students will be able to explain the purpose of a Microprocessor, RAM, and ROM, Logic gates, and Ladders in PLC programming.

Skills from this Unit:

- Students will be able to apply Ladder logic in a PLC setting.
- Students will be able to create a simple program for PLC components

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.

X Pre-test
X Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
_x_ Unit test
X Group project
X Individual project
____ Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
__ 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:

PLCs and Manufacturing Exam

Assessment(s) Description/Directions:

Students are tested on PLCs manufacturing, with emphasis on ladder logic, logic gates, truth tables, and basic PLC concepts.

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.**
3. **Identify and review the unit vocabulary.**
4. **Assessment Activity.**

Step 1:
Discuss the concepts behind PLC's. Show Intro to PLC Powerpoint. *(see Intro to PLCs.ppt)*

Step 2:
Explain the concepts of digital circuitry, Boolean math, and logic circuits. Show Boolean Math Powerpoint. Use the Boolean Worksheet to reinforce logic circuit paths and signals. *(see Boolean Math.ppt & Boolean worksheet.doc)*

Step 3:
Draw simple circuits using single and multiple logic gates. Have students create physical models that mimic logic circuits. *(See Logic Circuits.doc)*

Step 4:
Discuss Ladder logic and how it is used in PLCs. Show Ladder Logic Powerpoint. *(see Ladder Logic.ppt)*

Step 5:
Use PLC program you purchased with your trainer, download a free program or use an online trainer to create and demonstrate knowledge of PLCs. *(See PLC sites.doc. & PLC Demonstration.doc)*

Step 6:
Have students take the PLCs and Manufacturing Exam. *(See PLC Exam.rtf.)*

Attachments for Learning Experiences:

Notes & Reflections

Animation sequences in some PowerPoints do not work properly if viewed under Open Office or other presentation programs. Download the PowerPoint Viewer if your district does not possess PowerPoint.

Systems with PLC trainers will have the resources to teach commands and logic flow utilizing the resources on hand. If your system does not have a PLC trainer, and cannot afford one, you can still teach the fundamentals and concepts involved using the free downloads and resources off the Internet.

This Unit provides basic background concepts, terms, and sequencing that should be common to all versions of PLC programming.

Logic circuits.doc provides an exercise in understanding basic logic chips using electrical circuits and switches. While any switch will work for the gates, the old fashioned knife switches (available from many science & technology suppliers) create a very "visual" connection on logic signals TRUE / FALSE : OPEN / CLOSED : 1 / 0, both on the board and in student brains. Low voltage batteries, wires, bulbs, and switches can create multiple logic chips, and allows for students to show their creativity in creating the components. If the individual modules are created in a similar size and systematic order, they can be used together to create more complex circuits. Constructed properly, almost all of the components can be salvaged for future classroom use.

CULMINATING PERFORMANCE TASK (Optional)

Culminating Unit Performance Task Title:

PLC Demonstration

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

PLC demonstration allows students to utilize either a free downloadable PLC simulator from a website such as http://www.tri-plc.com/trilogi.htm or http://www.plcsimulator.net/ ; or a PLC system that is currently available in their laboratory, based on current district equipment.

Attachments for Culminating Performance Task:

See *PLC Demonstration.doc*

UNIT RESOURCES

Web Resources:

http://www.tri-plc.com/trilogi.htm
http://sites.google.com/site/automatedmanufacturingsystems/
http://www.howstuffworks.com/boolean.htm

http://www.learn-c.com/index.html

http://www.allaboutcircuits.com/vol_4/chpt_7/2.html

Attachment(s):

Materials & Equipment:

What 21st Century Technology was used in this unit:

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