Unit 06: The Microcontroller

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 2**
Length: **6 Weeks**
Status: **Published**

Summary

Introduction:

Students will develop skills and knowledge about microcontrollers. Students will explore inputs-i.e. sensors and switches, outputs-i.e. lights and motors, and processes-i.e. what will happen when a switch is actuated. Students will study a computer programming language structure and syntax so that they can program the microcontroller. The Arduino and the C language are used.

Revision Date: July 2022

Essential Questions/Enduring Understandings

Essential Questions:

What are microcontrollers and how are microcontrollers used?

What is a computer language?

How do you write a computer program?

Essential Understandings:

Microcontrollers are small computers that can be programmed to solve problems.

Microcontrollers primarily interface with machines.

Microcontrollers are programmed using computer languages.

Computer languages use syntax and are organized by rules based upon the language.

Computer languages often have much in common: a means to define or declare variables, define inputs and outputs, create infinite and finite loops, and work with conditions and Boolean logic.

Objectives

Students will know terms and vocabulary: EEPROM (Electrically Erasable Programmable Read-Only Memory), hardware, software, algorithm, memory, microprocessor, microcontroller, flow chart., C computer language, Arduino, servo motor, sensor.

Students will know microcontrollers are commonly used in industry.

Students will know the timeline of the development of microprocessors.

Students will know that microcontrollers are small computers.

Students will know that microcontrollers interact primarily with machines.

Students will be skilled at programming a microcontroller.

Students will be skilled at making a flowchart for a computer program,

Students will be skilled at writing code in a computer language.

Students will be skilled at compiling, uploading, and troubleshooting code.

Students will be skilled at integrating electrical inputs and outputs.

Learning Plan

Preview the essential questions and connect to learning throughout the unit.

Formative assessments will be conducted throughout the process using class discussion, student writing and practice quizzes.

Formative assessments will be conducted to determine background knowledge in atomic theory.

Lectures and lessons will be provided to develop student understanding of electrical engineering concepts: Ohm's Law, Kirchhoff's law, series, circuits, batteries, switches, parallel and series-parallel circuits.

Lecture and demonstration of solder safety and use techniques.

Summative assessment regarding soldering safely.

Summative assessments will be conducted throughout to evaluate skills acquisition.

Formative assessments will be conducted throughout the design process.

Problem based learning in mechanical/computer science engineering unit: students will design a touch sensor for use in a circuit in a robot. Students will draw a schematic drawing of the circuit and explain how it works. Students will demonstrate correct use of a breadboard.

Additional hands-on activity: program a microcontroller to turn on lights when a room gets dark. Create a light detector with a digital output.

Summative assessment will be conducted by the student and teacher using a rubric specific to the design problem.

Complete unit test

Complete unit summative assessments.

Assessment

Formative:

Participate in guided question and answer sessions, and group and individual discussions, and show an understanding of the purpose of the unit lesson(s), and their key terms and concepts.

Exit tickets

Proper use of unit vocabulary

Skills and follow safety practices when soldering

Participation in class discussions on Ohm's Law, Kirchhoff's law, series, circuits, batteries, switches, parallel and series-parallel circuits.

Quizzes

Demonstrate knowledge of computer memory capability and limits through hands-on activities.
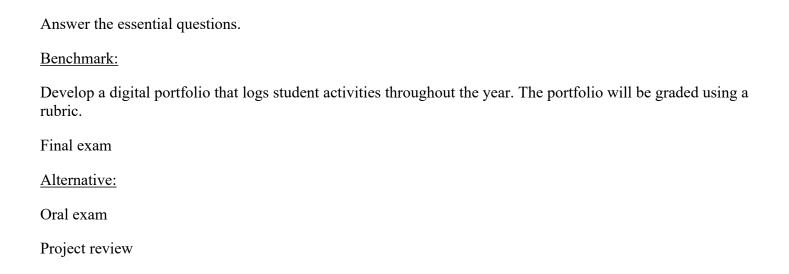
Summative:

Use flow charts to represent how microcontrollers are integrated into systems

Use the design process to develop solutions that employ microcontrollers

Assess hands-on projects using a rubric.

Complete writing prompts: The microprocessor in a microwave oven performs the following functions: The memory in an EEPROM is limited. This effects…

Answer the essential questions.

<u>Benchmark:</u>

Develop a digital portfolio that logs student activities throughout the year. The portfolio will be graded using a rubric.

Final exam

<u>Alternative:</u>

Oral exam

Project review

Materials

Textbook: Raymond B. Landis, Studying Engineering: A Road Map to a Rewarding Career (4th ed.). Discovery Press (ISBN-10: 0879348749, ISBN-13: 978-0979348747)

Robotics Lab, including: soldering irons, electric and manual drills/drill press, scroll saw, hand powered saws,

3-D printer and curing machine, safery glasses, hand operated tools like tin snips, wire cutters, electronic multi meters, power supplies, electronic components.

Computer Lab: Windows based computers with Autocad software, Arduino software, LEGO NXT software, CREO software, INTERNET connectivity.

Consumable materials: materials for 3d Printer, paper, wire, electronics components (speakers, transistors, capacitors, resistors etc).

White Board/LCD Screen

Online references from NJIT