PLANNED INSTRUCTION

A PLANNED COURSE FOR:

8th Grade Technology Education
Automation and Robotics

Curriculum writing committee:

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Grade Level: 8th Grade

Date of Board Approval: _July 14, 2022_____

Course Weighting: 8th Grade Technology Education (Automation and Robotics)

Participation	**10%**
Classwork	**35%**
Projects	**55%**
Total	**100%**

Curriculum Map

Overview: In Unit 1 What is Automation and Robotics?, students will understand what robots are used for and the effect they have on our lives. Students will experience how a robot receives information through various sources. Students will also get to write a maze algorithm for their partner to solve. In Unit 2 Mechanical Systems, students use VEX components to create various gear mechanisms and determine their real-world uses. They will then apply what they learned to create numerous VEX projects later in the course. In Unit 3 Solid Modeling, students will use Autodesk® Inventor® to create 3D models. In Unit 4 Automated Systems, students will learn RobotC programming. Using their knowledge from the previous units, they will design, build, and program real-world objects such as drag cars, spinning signs, and toll booths.

Units of study include:

What is Automation and Robotics?, Mechanical Systems, Solid Modeling, Automated Systems

Time/Credit for the Course: 45 days (1 quarter) and .25 credits

Goals:

- Students will describe the purpose of automation and robotics and its effect on society.
- Students will summarize ways that robots are used in today's world and the impact of their use on society.
- Students will describe positive and negative effects of automation and robotics on humans in terms of safety and economics.
- Students will provide examples of STEM careers and the need for these professionals in our society.
- Students will investigate and understand various mechanisms to determine their purpose and applications.
- Students will be able to apply their knowledge of mechanisms to solve a unique problem.
- Students will transfer a two-dimensional representation to a three-dimensional solid model using technology.
- Students will create a solid model using Autodesk Inventor software.
- Students will fabricate and test their design solution.

- Students will apply the design process and create all the necessary documentation in each of the steps of the design process.
- Students will create sketches for your design ideas.
- Students will create a 3D design using Autodesk Inventor.
- Students will design, build, wire, and program both open and closed loop systems.
- Students will troubleshoot a malfunctioning system using the design process.

Big Ideas:

- Recall that the goal of any engineering design process is to create solutions and opportunities for people and society.
- Analyzing the positive and negative effects robots have on humans.
- Analyzing how automation and robotics have an influence on society in the past and present and will influence society in the future.
- Investigate how engineers, designers, and engineering technologists are in high demand for the development of future technology to meet societal needs and wants.
- Knowing how to use mechanisms to transfer energy.
- Designing mechanisms to change energy by transferring direction, speed, type of movement, and force or torque.
- Creating mechanisms that can be used individually, in pairs, or in systems.
- Constructing automated systems that require minimal human interaction.
- Differentiating between an open-loop and closed-loop system.
- Revising and troubleshooting using the design process.
- Differentiate between two-dimensional and three-dimensional models.
- Interpret multi-view drawings, specifications, dimensions and annotations.
- Compare and contrast the various types of models used when designing a solution.
- Apply geometric and dimensional constraints to solid model designs.

Textbook and Supplemental Resources:

Project Lead the Way
https://my.pltw.org/

Curriculum Plan

Time/Days **7 days**

Unit 1 - What is Automation and Robotics?

- **Standards (by number):** 3.4.7.A1, 3.4.8.A1, 3.4.7.B1, 3.4.7.B3, 3.4.8.B4, 3.4.7.C1, 3.4.8.C1, 3.4.7.C2
- **Anchors:** S7.A.1, S8.A.1, S8.A.2, S8.B.3

- **Eligible Content:**
  - What is the greatest concern that should be considered before converting a factory from human workforce to robotic workforce?

Objectives:

- Students will describe the purpose of automation and robotics and its effect on society. (DOK 2)
- Students will summarize ways that robots are used in today's world and the impact of their use on society. (DOK 2)
- Students will describe the positive and negative effects of automation and robotics on humans in terms of safety and economics. (DOK 2)
- Students will provide examples of STEM careers and the need for these professionals in our society (DOK 1)

Core Activities and Corresponding Instructional Methods:

1. Maze Directions and VEX Model Build
   a. Lecture: Teacher will discuss project requirements.
   b. Demonstration: Teacher will show proper VEX building techniques
   c. Hands-on: Students will construct a VEX model and write maze directions.
2. Robot Presentation
   a. Lecture: Teacher will discuss the history of automation and robotics.
   b. Hands-on: Students will select a type of robot and create a presentation

Assessments:

Diagnostic:

1. Oral response to determine student comprehension

Formative:

1. Maze Directions and VEX Build Assignment

Summative:

1. Robot Presentation

Curriculum Plan

Time/Days **15 days**

Unit 2 - Mechanical Systems

- **Standards (by number):** 3.4.7.C1, 3.4.7.C2, 3.4.8.C1, 3.4.8.C2, 3.4.7.C3, 3.4.8.D1
- **Anchors:** S7.A.1, S8.A.2
- **Eligible Content:**
  - What mechanism would be used to increase torque or force?
  - How do you change types of motion using mechanisms?
  - Where are mechanisms used in real-life applications and what is their purpose?

Objectives:

- Calculate ratios to solve mechanical advantage problems. (DOK 1)
- Calculate numerical and algebraic expressions and equations to solve real world problems, such as gear ratios. (DOK 1)
- Interpret the characteristics of a specific mechanism to evaluate its purpose and application. (DOK 2)
- Apply knowledge of mechanisms to solve a unique problem for speed, torque, force, or type of motion. (DOK 4)

Core Activities and Corresponding Instructional Methods:

1. Observing Mechanisms
   a. Lecture: Teacher will discuss and present speed, torque, and gear ratios for different mechanisms.
   b. Demonstration: Teacher will show different models to reinforce speed, torque, and gear ratios.
2. Mechanical Gear Project
   a. Lecture: Teacher will discuss project requirements.
   b. Demonstration: Teacher will give a brief overview of proper building techniques and build a VEX project.
   b. Hands-on: Students will build 8 different VEX mechanisms.
3. Pull Toy Project
   a. Lecture: Teacher will discuss project requirements.
   b. Demonstration: Teacher will give an overview of how to draw an isometric sketch with annotations.
   c. Hands-on: Students will build a working VEX pull toy.

Assessments:

Diagnostic:

1. Oral response to determine student comprehension

Formative:

1. Observing Mechanisms

Summative:

1. Mechanical Gear Project
2. Pull Toy Project

Curriculum Plan

Time/Days **7 days**

Unit 3 - Solid Modeling

- **Standards (by number):** 3.4.7.A1, 3.4.7.A2, 3.4.7.B4, 3.4.7.C1, 3.4.7.C2, 3.4.7.C3, 3.4.8.C1, 3.4.8.C3, 3.4.7.D1, 3.4.7.D2, 3.4.7.D3

- **Anchors:** S7.A.1, S7.A.2, S7.A.3, S8.A.2

- **Eligible Content:**
  - Why is it important for an engineer to be aware of the criteria and constraints when designing a project?
  - How do coordinate systems help engineers with their modeling?
  - How has the evolution of rapid prototyping tools impacted design fabrication?

Objectives:

- Students will design shapes in a coordinate system. (DOK 4)
- Students will transfer a two-dimensional representation to a three-dimensional solid model using technology. (DOK 3)
- Students will create a solid model using Autodesk Inventor software. (DOK 4)
- Students will fabricate and test their design solution. (DOK 4)
- Students will apply measurement skills while dimensioning sketches. (DOK 4)

Core Activities and Corresponding Instructional Methods:

1. Dimensioning
   a. Lecture: Teacher will discuss the proper dimensioning techniques
   b. Demonstrate: Show how to properly dimension an orthographic sketch.
   c. Hands-on: Draw and dimension various orthographic sketches.
2. Autodesk Inventor 3D Modeling
   a. Demonstrate: Show how to properly use the 3D modeling software.
   b. Hands-on: Complete various Inventor projects.

Assessments:

Diagnostic:

1. Oral response to determine student comprehension

Formative:

1. Geometric Constraints

Summative:

1. Autodesk Inventor Projects

Curriculum Plan

Time/Days **16 days**

Unit 4 - Automated Systems

- **Standards (by number):** 3.4.7.C1, 3.4.7.C2, 3.4.8.C1, 3.4.8.C2, 3.4.7.C3, 3.4.7.D1, 3.4.8.D1, 3.4.8.D2, 3.4.7.E4

- **Anchors:** S7.A.1, S8.A.2, S7.A.2

- **Eligible Content:**
  - How do you troubleshoot a malfunctioning system efficiently?
  - What is the purpose of comments in a program?
  - Why is good communication and teamwork important when solving technological problems?

Objectives:

- Students will explain the purpose of pseudocode and comments within a computer program. (DOK 3)
- Assess how to use ratio reasoning to solve mechanical advantage problems. (DOK 3)
- Design, build, wire, and program both open and closed loop systems. (DOK 4)
- Apply concepts of motors and sensors appropriately to solve robotic problems. (DOK 4)
- Analyze a malfunctioning system using the design process. (DOK 4)
- Summarize the roles and responsibilities of mechanical, electrical, and computer engineers who solve robotic problems. (DOK 2)

Core Activities and Corresponding Instructional Methods:

1. Test Bed Project
   a. Lecture: Teacher will discuss project requirements.
   b. Demonstration: Teacher will guide students on how to use the Robotc software program. Teacher will run the Test Bed code so students can see the finished project operate properly.
   c. Hands-on: Students will create the code to properly operate the Test Bed.
2. VEX Drag Car Race
   a. Lecture: Teacher will discuss project requirements and review mechanical gear project.
   b. Demonstration: Teacher will show how to properly attach motors and sensors to the project.
   b. Hands-on: Students will design and build a functioning VEX Drag Car.

3. VEX Spinning Sign
    a. Lecture: Teacher will discuss project requirements and review mechanical gear project.
    b. Demonstration: Teacher will review how to properly attach motors and sensors to the project.
    b. Hands-on: Students will design and build a functioning VEX Spinning Sign.
4. VEX Toll Booth
    a. Lecture: Teacher will discuss project requirements and review mechanical gear project.
    b. Demonstration: Teacher will review how to properly attach motors and sensors to the project.
    b. Hands-on: Students will design and build a functioning VEX Toll Booth.

Assessments:

Diagnostic:

1. Oral response to determine student comprehension

Formative:

1. Test Bed

Summative:

1. VEX Drag Car Race
2. VEX Spinning Sign
3. VEX Toll Booth