Computer Integrated Manufacturing Unit 3: Robotics & Automation

Unit Focus

Computer-integrated manufacturing (CIM) is an introduction to the use of computer techniques to integrate manufacturing activities. These activities encompass all functions necessary to translate customer needs into a final product. CIM usually starts with the development of a product concept then product design and specification with the final step revolving around automating the manufacturing process.

The content and skills learned throughout the course will be taught in 3 separate modules (units) followed by an all encompassing PBA. For each module, students will work collaboratively, at their own pace, following a guided instructional tutorial. The first three days of the trimester will be used for review of computer aided mechanical drawing and 3D printing skills.

In this module, students will learn how to coding/programming is used to automate manufacturing processes. This will be done through a series of hands-on programming challenges in which the students will learn how to program a robotic arm to perform several tasks. A PBA will have students create and execute several autonomous programs for robots to fully automate a process in an assembly line.

Stage 1: Desired Results - Key Understandings

Standard(s)

Connecticut Goals and Standards

Computer Information Systems: 12

- Maintain and reengineer existing code *CIS.6.1.A.1*

Pre-Engineering Technology: 12

- Identify principles of a problem. *ENG.02.02*
- Brainstorm possible solutions. *ENG.02.05*
- Build a prototype from plans. *ENG.02.08*
- Test a prototype. *ENG.02.09*
- Redesign prototypes. *ENG.02.10*

CSTA: Computer Science Standards (2017-)

CSTA: 9-10

- Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. *3A-AP-17*
- Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs. *3A-AP-18*
- Evaluate and refine computational artifacts to make them more usable and accessible. *3A-AP-21*

Transfer

Students will be able to independently use their learning to...

T1 Explore and hone techniques, skills, methods, and processes to create and innovate

T2 Work together on a common goal to meet deadlines through addressing challenges and problems along the way both individually and collectively.

T3 Develop a product/solution that adheres to key parameters (e.g., cost, timeline, restrictions, available resources and audience).

Meaning

Understanding(s)

Students will understand that...

U1 Algorithms are precise sequences of instructions for processes which can be executed by a computer and are implemented using programming language.

U2 Debugging is a methodical process of finding and reducing the amount of defects in coding.

U3 Programming languages are used with various types of hardware in order to make the hardware perform the specific functions.

Essential Question(s)

Students will keep considering...

Q1 Why are robots used in industry?

Q2 How do I manually control a robot to make real time adjustments? How can I build those adjustments back into the programming?

Q3 How can the design of a robot be revised after testing to improve the robot's performance over time?

Stage 1: Desired Results - Key Understandings

- Design and develop computational artifacts working in team roles using collaborative tools. *3A-AP-22*

ITEEA - Standards for Technological Literacy

Technological Literacy: K-12

- Students will develop an understanding of engineering design. *9*
- Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. *10*
- Students will develop the abilities to apply the design process. *11*
- Students will develop an understanding of and be able to select and use manufacturing technologies. *19*

NGSS/NSTA Science & Engineering Practices

NGSS Science & Engineering Practices: 9-12

- Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations. *SE.9-12.1.8*
- Develop a complex model that allows for manipulation and testing of a proposed process or system. *SE.9-12.2.5*
- Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables. *SE.9-12.3.6*
- Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. *SE.9-12.5.2*
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. *SE.9-12.6.5*

Madison Public Schools Profile of a Graduate

- Collective Intelligence: Working respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. (POG.3.1)
- Product Creation: Effectively use a medium to communicate important information. (POG.3.2)
- Self-Awareness: Examining current performance critically to identify steps/strategies to persist. (POG.4.1)

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
Students will know... **K1** Different ways to program a robot (Learn & block mode) **K2** An autonomous program is a logical and step by step set of directions for the robot to follow after the run command has been executed. **K3** Vocabulary: Absolute Move, Relative Move, Jump, Linear, Set Joint Angle, Joint, Python, Delay time, Set R, Set L, Get Current Coordinate, and basic X, Y, Z graph coordinates	*Students will be skilled at...* **S1** Program a robot to perform a task. **S2** Create an autonomous program to solve a specific problem/task for a robot to follow. **S3** Do something repeatedly until a specific result is achieved (Iterative Process).