Arkansas Computer Science and Computing

High School Robotics - Year 3

Computational Thinking and Problem Solving

1 **Students will analyze and utilize problem-solving strategies.**

1 Utilize the engineering design process to solve problems of level-appropriate complexity CSRB.Y3.1.1

2 Analyze and utilize multiple representations of problem-solving logic used to solve problems of level-appropriate complexity, such as schematics and 3D modeling CSRB.Y3.1.2

3 Analyze and utilize collaborative methods in problem solving of level-appropriate complexity CSRB.Y3.1.3

4 Analyze and utilize level-appropriate troubleshooting strategies for hardware and software CSRB.Y3.1.4

2 **Students will analyze and utilize connections between concepts of mathematics and computer science.**

1 Continuation of this standard is not specifically included or excluded CSRB.Y3.2.1

2 Utilize types of information that are stored in robotics systems including, but not limited to, 2D and 3D coordinate system and sensor data CSRB.Y3.2.2

3 Continuation of this standard is not specifically included or excluded CSRB.Y3.2.3

4 Continuation of this standard is not specifically included or excluded CSRB.Y3.2.4

5 Continuation of this standard is not specifically included or excluded CSRB.Y3.2.5

6 Continuation of this standard is not specifically included or excluded CSRB.Y3.2.6

7 Apply concepts of mechanical engineering including, but not limited to, gear ratios, speed, stability, and torque CSRB.Y3.2.7

8 Apply concepts of electrical engineering including, but not limited to, applying fundamental laws of electricity (e.g., Kirchhoff's Law, Ohm's Law), using a multimeter, and understanding electric motors as they relate to the implementation of robotics systems and subsystems CSRB.Y3.2.8

9 Continuation of this standard is not specifically included or excluded CSRB.Y3.2.9

Data, Information, and Security

3 Students will analyze and utilize data through the use of computing devices.

1. Create programs to store, access, and manipulate, with a high level of efficiency, level-appropriate robotics system data CSRB.Y3.3.1
2. Analyze how quantitative and qualitative data are utilized in robotic systems CSRB.Y3.3.2
3. Create and evaluate models and simulations to answer student-identified scenarios CSRB.Y3.3.3
4. Analyze, utilize, and visually represent levelappropriate static and dynamic data, including, but not limited to, data collected through robotic sensors CSRB.Y3.3.4
5. Perform level-appropriate data analysis using computing tools CSRB.Y3.3.5

4 Students will analyze and utilize concepts of cybersecurity.

1. Continuation of this standard is not specifically included or excluded CSRB.Y3.4.1
3. Continuation of this standard is not specifically included or excluded CSRB.Y3.4.3
2. Continuation of this standard is not specifically included or excluded CSRB.Y3.4.2
4. Continuation of this standard is not specifically included or excluded CSRB.Y3.4.4

Algorithms and Programs

5 Students will create, evaluate, and modify algorithms.

1. Design and implement algorithms that solve student-identified problems CSRB.Y3.5.1
2. Continuation of this standard is not specifically included or excluded CSRB.Y3.5.2
3. Continuation of this standard is not specifically included or excluded CSRB.Y3.5.3
4. Use a systematic approach to detect and resolve errors in a given algorithm CSRB.Y3.5.

6 Students will create programs to solve problems.

1. Create programs that utilize robotic systems to solve problems of level-appropriate complexity CSRB.Y3.6.1
2. Discuss and apply best practices of program design, user experience design, and format (e.g., descriptive names, documentation, indentation, whitespace) CSRB.Y3.6.2
3. Continuation of this standard is not specifically included or excluded CSRB.Y3.6.3
4. Create programs of level-appropriate complexity that leverage real-time sensory input to make decisions for completing physical tasks CSRB.Y3.6.4
5. Use a systematic approach to detect logic, runtime, and syntax errors within a program CSRB.Y3.6.5
6. Create programs that utilize various robotics system operations to solve real-world problems CSRB.Y3.6.6

Computers and Communications

7 Students will analyze the utilization of computers within industry.

1 Utilize multiple hardware and software tools simultaneously to solve level-appropriate industrybased problems CSRB.Y3.7.1

2 Research integration of multiple technologies (e.g., analytics, artificial intelligence, big data, end-of-arm tools, IoT machine learning, vision) to solve levelappropriate industry-based problems CSRB.Y3.7.2

8 Students will analyze communication methods and systems used to transmit information among computing devices.

1 Continuation of this standard is not specifically included or excluded CSRB.Y3.8.1

2 Utilize a network-connected robot CSRB.Y3.8.2

3 Continuation of this standard is not specifically included or excluded CSRB.Y3.8.3

4 Continuation of this standard is not specifically included or excluded CSRB.Y3.8.4

9 Students will utilize appropriate hardware and software.

1 Continuation of this standard is not specifically included or excluded CSRB.Y3.9.1

2 Use collaborative tools and processes to configure level-appropriate robotic hardware components CSRB.Y3.9.2

3 Continuation of this standard is not specifically included or excluded CSRB.Y3.9.3

4 Utilize robotic hardware components to create levelappropriate robotic systems and subsystems CSRB.Y3.9.4

5 Apply autonomous and manual robotic control by coding in various robotic programming languages (e.g., C++, Karel, Python) CSRB.Y3.9.5

6 Analyze different industry-relevant robotic systems and their various applications (e.g., 3-axis, 6-axis, AMR, cobot, delta, SCARA, T-700) CSRB.Y3.9.6

7 Utilize breadboarding and prototyping in the creation of a level-appropriate closed-loop robot CSRB.Y3.9.7

8 Utilize hardware diagnostic tools to design, test, and troubleshoot robotic systems and subsystems CSRB.Y3.9.8

9 Analyze hardware and software requirements and limitations of various robotics systems CSRB.Y3.9.9

Professionalism and Impacts of Computing

10 Students will analyze the impacts of technology and professionalism within the computing community.

1. Discuss etiquette and professionalism as related to communication in industry `CSRB.Y3.10.1`
2. Continuation of this standard is not specifically included or excluded `CSRB.Y3.10.2`
3. Continuation of this standard is not specifically included or excluded `CSRB.Y3.10.3`
4. Discuss ethical implications encountered in the robotics industry that relate to intellectual property, non-compete clauses, and non-disclosure agreements `CSRB.Y3.10.4`
5. Continuation of this standard is not specifically included or excluded `CSRB.Y3.10.5`
6. Continuation of this standard is not specifically included or excluded `CSRB.Y3.10.6`
7. Demonstrate industry-relevant technical and soft skills `CSRB.Y3.10.7`
8. Utilize and model effective professional project management `CSRB.Y3.10.8`
9. Evaluate the quality and impact of a professional digital portfolio `CSRB.Y3.10.9`
10. Create and maintain a professional digital portfolio comprised of self-created work `CSRB.Y3.10.10`

---

11 Students will demonstrate understanding of storytelling with data and appropriately communicate about technical information.

1. Communicate robotics concepts to diverse audiences including, but not limited to, non-technical audience members `CSRB.Y3.11.1`
2. Utilize level-appropriate robotic system data for storytelling `CSRB.Y3.11.2`
3. Continuation of this standard is not specifically included or excluded `CSRB.Y3.11.3`
4. Continuation of this standard is not specifically included or excluded `CSRB.Y3.11.4`
5. Continuation of this standard is not specifically included or excluded `CSRB.Y3.11.5`
6. Communicate conditions of a robotic system in terms of performance, diagnostics, troubleshooting, and repair `CSRB.Y3.11.6`