Arkansas Computer Science and Computing

High School Robotics - Year 2

Computational Thinking and Problem Solving

1 Students will analyze and utilize problem-solving strategies.

1. Leverage problem-solving strategies to solve problems of level-appropriate complexity CSRB.Y2.1.1
2. Analyze and utilize multiple representations of problem-solving logic used to solve problems of appropriate complexity CSRB.Y2.1.2
3. Analyze and utilize collaborative methods in problem solving of level-appropriate complexity CSRB.Y2.1.3
4. Analyze and utilize level-appropriate troubleshooting strategies for hardware and software CSRB.Y2.1.4

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.Y2.2.1
2. Classify and utilize types of information that are stored in robotics systems including, but not limited to, 2D and 3D coordinate system and sensor data CSRB.Y2.2.2
3. Continuation of this standard is not specifically included or excluded CSRB.Y2.2.3
4. Analyze and utilize concepts of abstraction as modeling and abstraction as encapsulation CSRB.Y2.2.4
5. Perform operations of level-appropriate complexity with binary, octal, decimal, and hexadecimal numbers CSRB.Y2.2.5
6. Continuation of this standard is not specifically included or excluded CSRB.Y2.2.6
7. Explain how concepts of mechanical engineering including, but not limited to, gear ratios, speed, stability, and torque relate to the implementation of robotics systems and subsystems CSRB.Y2.2.7
8. Explain how concepts of electrical engineering including, but not limited to, applying Ohm's law, using a multimeter, and understanding electric motors as they relate to the implementation of robotics systems and subsystems CSRB.Y2.2.8
9. Describe and represent basic electrical quantities including, but not limited to charge, current, energy, power, and voltage and describe the relationships among them CSRB.Y2.2.9

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 level-appropriate data (e.g., structured data, objects) CSRB.Y2.3.1
2. Define and discuss different examples of levelappropriate quantitative and qualitative data CSRB.Y2.3.2
3. Research, discuss, and create level-appropriate programs to model and simulate probabilistic and real-world scenarios CSRB.Y2.3.3
4. Analyze, utilize, and visually represent levelappropriate static and dynamic data CSRB.Y2.3.4
5. Perform level-appropriate data analysis using computing tools CSRB.Y2.3.5

4 Students will analyze and utilize concepts of cybersecurity.

1. Apply the five pillars of cybersecurity as applicable to level-appropriate computer science concepts CSRB.Y2.4.1
2. Continuation of this standard is not specifically included or excluded CSRB.Y2.4.2
3. Research and describe common attacks on software, hardware, and networks CSRB.Y2.4.3
4. Continuation of this standard is not specifically included or excluded CSRB.Y2.4.4

Algorithms and Programs

5 Students will create, evaluate, and modify algorithms.

1. Design and implement level-appropriate algorithms that use iteration, recursion, selection, and sequence CSRB.Y2.5.1
2. Continuation of this standard is not specifically included or excluded CSRB.Y2.5.2
3. Evaluate the qualities of level-appropriate studentcreated and non-student-created algorithms including classic search and sort algorithms CSRB.Y2.5.3
4. Use a systematic approach to detect and resolve errors in a given algorithm CSRB.Y2.5.4

6 Students will create programs to solve problems.

1. Create programs to solve problems of levelappropriate complexity CSRB.Y2.6.1
2. Discuss and apply best practices of program design and format (e.g., descriptive names, documentation, indentation, user experience design, whitespace) CSRB.Y2.6.2
3. Determine the scope and state of variables defined in procedures and classes CSRB.Y2.6.3
4. Create programs that read from, write to, and append to a file of level-appropriate complexity that includes structured data CSRB.Y2.6.4
5. Use a systematic approach to detect logic, runtime, and syntax errors within a program CSRB.Y2.6.5
6. Create programs that utilize various robotics system operations to solve problems CSRB.Y2.6.6

Computers and Communications

7 Students will analyze the utilization of computers within industry.

1. Utilize hardware and/or software to solve levelappropriate industry-based problems CSRB.Y2.7.1
2. Research cutting-edge robotics technology (e.g., analytics, artificial intelligence, autonomous vehicles, big data, end-of-arm tools, IoT, machine learning, vision) and its effects on the way business may be conducted in the future CSRB.Y2.7.2

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.Y2.8.1
2. Compare and contrast network connectivity options for different types of robotics platforms and communications methods within various robotics systems, including but not limited to, controller area network (CAN) busses CSRB.Y2.8.2
3. Continuation of this standard is not specifically included or excluded CSRB.Y2.8.3
4. Continuation of this standard is not specifically included or excluded CSRB.Y2.8.4

9 Students will utilize appropriate hardware and software.

1. Continuation of this standard is not specifically included or excluded CSRB.Y2.9.1
2. Use collaboration tools and version control systems in a group software project of appropriate complexity CSRB.Y2.9.2
3. Analyze the importance and effect of updating firmware and drivers within robotic systems CSRB.Y2.9.3
4. Utilize robotic hardware components to create levelappropriate robotic systems and subsystems CSRB.Y2.9.4
5. Discuss and apply autonomous and manual robotic control by coding in various robotic programming languages (e.g., C++, Karel, Python) CSRB.Y2.9.5
6. Compare and contrast different types of industryrelevant robotic systems (e.g., 3-axis, 6-axis, AMR, cobot, delta, SCARA, T-700) CSRB.Y2.9.6
7. Utilize breadboarding in the creation of a levelappropriate closed-loop robot CSRB.Y2.9.7
8. Utilize hardware diagnostic tools to design, test, and troubleshoot robotic systems and subsystems CSRB.Y2.9.8
9. Discuss hardware and software requirements and limitations of various robotics systems CSRB.Y2.9.9

Professionalism and Impacts of Computing

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

1. Continuation of this standard is not specifically included or excluded CSRB.Y2.10.1
2. Research and describe issues related to creating and enforcing cyber-related laws and regulations (e.g., ethical challenges, policy vacuum, privacy versus security, unintended consequences) CSRB.Y2.10.2
3. Continuation of this standard is not specifically included or excluded CSRB.Y2.10.3
4. Identify the ethical implications encountered in the curation, management, and monetization of data (e.g., harvesting, information overload, knowledge management repositories, sharing, summarizing) CSRB.Y2.10.4
5. Explain advantages and disadvantages of various software life cycle processes (e.g., Agile, spiral, waterfall) CSRB.Y2.10.5
6. Continuation of this standard is not specifically included or excluded CSRB.Y2.10.6
7. Demonstrate industry-relevant technical and soft skills CSRB.Y2.10.7
8. Discuss effective professional collaborative project management tools CSRB.Y2.10.8
9. Identify the components of a quality professional digital portfolio CSRB.Y2.10.9
10. Create and maintain a digital collection of selfcreated work CSRB.Y2.10.10

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.Y2.11.1`
2. Utilize level-appropriate robotic system data for storytelling `CSRB.Y2.11.2`
3. Continuation of this standard is not specifically included or excluded `CSRB.Y2.11.3`
4. Continuation of this standard is not specifically included or excluded `CSRB.Y2.11.4`
5. Continuation of this standard is not specifically included or excluded `CSRB.Y2.11.5`
6. Communicate conditions of a robotic system in terms of performance, diagnostics, troubleshooting, and repair `CSRB.Y2.11.6`