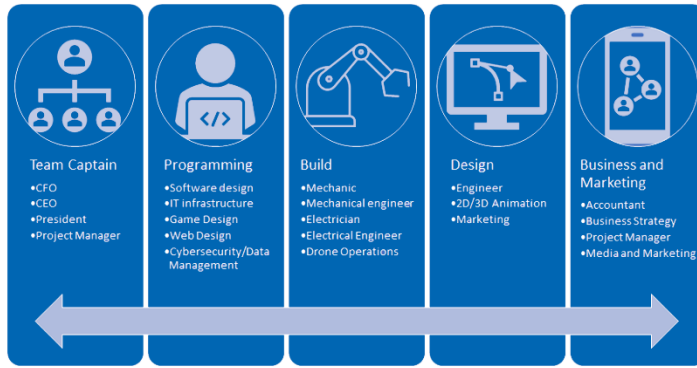


FIRST® Tech Challenge Learning Toolkit



The mission of *FIRST*® is to provide life-changing robotics programs that give young people the skills, confidence, and resilience to build a better world. With a vision to transform our culture by creating a world where science and technology are celebrated and where young people dream of becoming science and technology leaders.

Many *FIRST*® Tech Challenge team members have various roles that help the team progress and improve to achieve this mission and vision. Implementing a system where students progress in their skills while supporting their team increases engagement and helps students identify future career paths.

Using this Toolkit, *FIRST* Tech Challenge students can achieve their goals by:

- Building competencies with introductory skills through advanced skills that align with industry certifications and career pathways.
- Integrating work-based learning through job roles in a team where skill development results in increased technical skills and teamwork creating more impact for your team.
- Using industry technology and industry experts that provide experiences to students of projects they see in future industries.
- Providing pathways for students to explore their career interests by defining their own learning goals and steps to accomplish those goals.

This guide is a progression of skill learning in the different team roles you might find on a *FIRST* Tech Challenge team. Many of these roles can help students gain work-based learning credit along with pursuing industry certifications. Some skills may be replicated in multiple job roles, and students may end up completing skills in different roles. The tools for student progression of skills are a menu of options and not necessarily a prescriptive program.

In each area, you will find resources and ideas for students to apply their learning to develop skills utilizing the *FIRST* resources and some third-party resources. They can assist teachers, coaches, and mentors to guide students to continue skill development, whether they are building a robot for competition or working with a mentor to gain industry skills.

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FIRST® Core Values and Workforce Skills

FIRST Core Values emphasize friendly sportsmanship, respect for the contributions of others, teamwork, learning, and community involvement. The FIRST Community expresses the FIRST philosophies of *Gracious Professionalism*® and *Coopertition*® through our Core Values:

- **Discovery:** *We explore new skills and ideas.*
- **Innovation:** *We use creativity and persistence to solve problems.*
- **Impact:** *We apply what we learn to improve our world.*
- **Inclusion:** *We respect each other and embrace our differences.*
- **Teamwork:** *We are stronger when we work together.*
- **Fun:** *We enjoy and celebrate what we do!*

By applying these Core Values, students strengthen essential workforce competencies that align directly with the Career Ready Practices established by Advance CTE. These practices outline the knowledge, skills, and dispositions all learners need to be successful in both education and careers. Through FIRST participation, students:

- CRP-1 Demonstrate responsibility through *Gracious Professionalism*
- CRP-2 Cultivate interpersonal communication skills
- CRP-3 Promote inclusion during teamwork
- CRP-4 Demonstrate creativity and innovation
- CRP-5 Evaluate impact of decisions
- CRP-6 Exercise critical thinking and perseverance
- CRP-7 Model integrity, leadership, and time management
- CRP-8 Leverage technology to enhance productivity
- CRP-9 Prioritize personal health and well-being
- CRP-10 Integrate academic and technical skills

Students' skills and learning outcomes can be communicated to schools through standards alignments. This guide aligns with [ISTE](#), [ITEEA](#), [NIMS](#), and [NBEA](#) standards.

How to Use This Toolkit

Work-based learning through Career and Technical Education aligns classroom learning with workplace experience, helping students apply technical and employability skills in a professional setting. This guide is designed to help teams utilize their *FIRST* participation for work-based learning credit. Although credit recognition varies by school district, these tools are highly effective for building students' foundational workforce competencies.

1. Have students take the [Career Planning Toolkit Course](#) to identify their career interests and learn more about job roles and how they can help them in their career.
2. Students should review the job role clusters and identify which ones they would like to focus on within their team.
3. Mentors or teachers can use the possible learning activities within this guide or provide their own.
 - Fill out the student training plan for the job role with the student's name, grade level, and the mentor that will be evaluating them throughout the season.
 - Go over the competencies for the team role with the student including the career-ready practices, so they understand competencies for the job.
4. Have them create goals for themselves at the bottom of the sheet.
5. At the end of the season, mentors evaluate student performance and meeting competencies using the following rating criteria:
 - 4 – **Highly Skilled:** Student can teach others about the task.
 - 3 – **Skilled:** Student can perform the standard independently as a team lead.
 - 2 – **Moderately Skilled:** Student can perform the competency with assistance.
 - 1 – **Introduced:** Student was taught the skill from a team lead or mentor.
 - N – **No Exposure:** Student has no experience or knowledge of this task.
6. Students and mentors should complete a reflection on what they accomplished and next steps like working toward achieving an industry certification.
7. Use the form to submit as a record of learning to your school or workforce development board.

Business and Leadership Development

Developing a comprehensive business plan and mastering project management are critical professional skills. Engaging the entire team in the planning process fosters shared ownership and ensures every member understands how their specific role contributes to the team's long-term sustainability and success.

LEARNING RESOURCES AND OBJECTIVES	
Award Summary Game and Season	Analyze award criteria to identify team strengths. Conduct brainstorming sessions to set measurable goals for improving team practices and eligibility.
Team Business Plan	Author and execute a strategic plan covering professional development, community outreach, and financial sustainability.
Fundraising Toolkit	Design a team budget and sponsorship recruitment strategy. Learn to monitor and forecast financial resources to ensure season-long stability.
Mentor Manual	Synthesize leadership best practices to cultivate an effective team culture. Apply expert strategies for conflict resolution, group communication, and professional mentorship.
Project Management	Implement industry-standard frameworks to mitigate risks, manage timelines, and streamline team decision-making.
Team Management Resources	Develop and execute a comprehensive marketing suite, including recruitment materials and brand identity assets, to build team awareness and stakeholder engagement.
Engineering Portfolio	Document the technical and business development aspects of the team. Evaluate samples from other teams to design a high-impact portfolio that emphasizes accessibility, technical rigor, and season achievements.

Standards Alignments

ISTE	ITEEA
1.1.a, 1.1.c, 3.3.c, 4.4.a, 4.4.d, 6.6.a, 6.6.b, 7.7.a, 7.7.b, 7.7.c, 7.7.d	3J, 4G, 4H, 5F, 6E, 7H, 7I, 8I
NIMS	NBEA
MMS, Planning Benchwork & Layout, Quality & Continuous Improvement, Lean Principles, Workforce Readiness, Workforce Communication, Customer & Stakeholder Awareness	Entrepreneurship I.A, Entrepreneurship III.A, Management I.C, Management II.A, Management II.B, Management III.A, Marketing I.A, Marketing III.A, Communication II.A, Communication III.A, Business Analysis I.B, Career Development I.B

Business and Leadership Development | Student Training Plan

NAME		GRADE-EXPERIENCE LEVEL		MENTOR	
Mentors evaluate students' performance using the following rating criteria (see page 4 for criteria details):					
4 – Highly Skilled		3 – Skilled	2 – Moderately skilled	1 – Introduced	N – No exposure
RATING	COMPETENCIES	RATING	CAREER READY PRACTICES		
	Contribute to the strategic development of a formal business plan, defining the team's mission, organizational hierarchy, and measurable short- and long-term goals.		Demonstrate responsibility through <i>Gracious Professionalism</i> .		
			Cultivate interpersonal communication skills		
	Facilitate team communications, including project management workflows, goal setting, and constructive conflict resolution.		Promote inclusion during teamwork		
			Demonstrate creativity and innovation		
	Execute a comprehensive SWOT analysis for the team or sub-team, utilizing the findings to drive continuous improvement and strategically market team achievements.		Evaluate impact of decisions		
			Exercise critical thinking and perseverance		
			Model integrity, leadership, and time management		
	Cultivate community partnerships and involvement by delivering sponsor presentations, promoting STEM, and producing multimedia promotional content.		Leverage technology to enhance productivity		
			Prioritize personal health and well-being		
			Integrate academic and technical skills		
GOALS		INDUSTRY CERTIFICATIONS			
<ul style="list-style-type: none"> ● ● ● ● 		<ul style="list-style-type: none"> • Certiport: Entrepreneurship & Small Business • Certiport:Communication Skills for Business • Certiport:PMI Project Management Ready 			

Marketing and Outreach

Developing materials for marketing and outreach can include elements such as creating promotional materials, connecting with community partners, presenting to sponsors, and sharing the team’s impact.

LEARNING RESOURCES AND OBJECTIVES	
Team Awards Outreach Definitions	Analyze the <i>FIRST</i> Tech Challenge Game Manual to architect a competitive strategy for the Sustain, Connect, and Reach awards.
Fundraising Toolkit	Develop a comprehensive marketing and communications plan. Apply industry standards for community analysis, stakeholder presentations, and long-term sponsor relationship management.
FIRST Branding Standards	Enforce brand consistency by applying <i>FIRST</i> branding standards across all digital and print communication assets.
Social Media Guide and Website Guidelines	Launch and manage professional communication platforms, ensuring all social media and web content aligns with official safety and branding guidelines.
Impactful Community Outreach	Implement high-impact outreach strategies to cultivate meaningful community relationships and expand the team’s local footprint.
Outreach Definitions Outreach Examples	Design and execute a community impact plan. Facilitate brainstorming sessions to improve team documentation and create compelling narratives for public presentations.
Award Summary Game and Season	Evaluate award criteria to identify growth opportunities. Establish measurable team goals to increase eligibility for technical and community-based awards.
Team Management Resources	Produce a professional recruitment package, including flyers and digital materials, to drive team growth and member engagement.

Standards Alignments

ISTE	ITEEA
1.1.a, 1.1.c, 3.3.c, 6.6.a, 6.6.b, 7.7.a, 7.7.c, 7.7.d	3J, 4G, 4H, 5F, 6E, 7H, 8I
NIMS	NBEA
Workforce Readiness, Workforce Communication, Quality & Continuous Improvement, Planning Benchwork & Layout	Entrepreneurship I.A, Entrepreneurship III.A, Management I.C, Management II.A, Management III.A, Marketing I.A, Marketing III.A, Communication II.A, Communication III.A, Business Analysis I.B, Career Development I.B

Marketing and Outreach | Student Training Plan

NAME		GRADE-EXPERIENCE LEVEL		MENTOR	
Mentors evaluate students' performance using the following rating criteria (see page 4 for criteria details):					
4- Highly Skilled	3 – Skilled	2 – Moderately skilled	1 – Introduced	N – No exposure	
RATING	COMPETENCIES		RATING	CAREER READY PRACTICES	
	Facilitate a comprehensive SWOT analysis to build a strategic communications and budget plan, specifically defining sponsor engagement and team-wide goal alignment.			Demonstrate responsibility through <i>Gracious Professionalism</i>	
				Cultivate interpersonal communication skills	
	Produce professional branding assets that articulate the team's mission, organizational hierarchy, and strategic objectives for internal and external stakeholders.			Promote inclusion during teamwork	
				Demonstrate creativity and innovation	
				Evaluate impact of decisions	
	Utilize industry-standard digital tools to design and produce high-impact multimedia assets (graphic, video, and web) tailored for technical award submissions.			Exercise critical thinking and perseverance	
				Model integrity, leadership, and time management	
	Spearhead community outreach initiatives, including sponsor presentations and STEM advocacy programs, to expand the team's local impact and brand footprint.			Leverage technology to enhance productivity	
				Prioritize personal health and well-being	
				Integrate academic and technical skills	
GOALS			INDUSTRY CERTIFICATIONS		
<ul style="list-style-type: none"> ● ● ● ● 			<ul style="list-style-type: none"> ● Certiport: IT Specialist - HTML and CSS ● Certiport: Adobe Certified Professional in Visual Design ● Certiport: Unity Certified User ● Autodesk: Certified User Maya and 3ds Max 		

Drivetrain Team

Use these learning resources for building, design, and fabrication of the drive system. Utilize the guides to help you build a drivetrain then learn how to customize the chassis for your own criteria.

LEARNING RESOURCES AND OBJECTIVES	
Safety Training Safety Manual	Execute professional workshop safety standards with a primary focus on Personal Protective Equipment (PPE) . Master the selection and proper use of eye protection, hand protection, and hearing conservation tools during the fabrication and assembly of robot hardware.
Game and Season Robot Building Resources	Analyze seasonal game constraints to architect a custom robot structure. Utilize specialized build guides to select and develop a chassis that meets specific scoring and mobility requirements.
REV DUO Andymark Chassis	Evaluate drivetrain specifications, including maneuverability and motor performance. Research diverse drivetrain designs to optimize mechanical efficiency and robot responsiveness.
GoBuilda Strafer Chassis	Deconstruct the mechanics of mecanum drive systems. Analyze motor vectors and wheel orientation to master complex multi-directional movement and precision control.
Game Manual	Audit Robot Construction Rules to ensure compliance. Strategically apply constraints regarding COTS parts, motor limits, and sizing boxes to the design and build process.
Manufacturing-FTC Docs	Engineer custom components using advanced fabrication techniques. Design and 3D print functional parts, such as connectors and guards, to enhance chassis durability and performance.
Onshape for Robotics CAD Resources	Implement Computer-Aided Design (CAD) for rapid prototyping. Execute complex assemblies, facilitate digital collaboration, and prepare files for professional-grade manufacturing.

Standards Alignments

ISTE	ITEEA
1.a, 1.1.c, 3.3.c, 4.4.a, 4.4.b, 4.4.d, 5.5.a, 5.5.b, 7.7.c	20, 3J, 4H, 6E, 7H, 7I, 8H, 8I
NIMS	NBEA
Measurement, Materials & Safety (MMS), Job Planning Benchwork & Layout, Drilling, Layout, Milling I, Turning I, Additive Manufacturing, Quality & Continuous Improvement, Safety	Career Development I.A, Career Development I.B, Management III.A, Operations I.A, Operations I.B

Drivetrain | Student Training Plan

NAME		GRADE-EXPERIENCE LEVEL		MENTOR	
Mentors evaluate students' performance using the following rating criteria (see page 4 for criteria details):					
4- Highly Skilled	3 – Skilled	2 – Moderately skilled	1 – Introduced	N – No exposure	
RATING	COMPETENCIES		RATING	CAREER READY PRACTICES	
	Execute professional workshop safety standards, prioritizing the correct use of Personal Protective Equipment (PPE) during all tool operation and fabrication tasks.			Demonstrate responsibility through <i>Gracious Professionalism</i>	
	Construct a structural chassis by following technical guides or Engineering a custom solution using industry-standard vendor components.			Cultivate interpersonal communication skills	
	Optimize mechanical efficiency by applying precision tolerances and implementing friction-reduction techniques across all drivetrain components.			Promote inclusion during teamwork	
	Iterate on chassis design to align with specific game strategies, ensuring the build supports required mobility and scoring objectives.			Demonstrate creativity and innovation	
	Fabricate custom structural components utilizing industry-standard processes, including Additive Manufacturing , precision drilling, and specialized cutting.			Evaluate impact of decisions	
	Analyze how modifications to a chassis and robot manipulators affect the drive system.			Exercise critical thinking and perseverance	
	Assess various drivetrain architectures (e.g., Tank, Mecanum, Holonomic) to determine the optimal chassis configuration for specific technical requirements.			Model integrity, leadership, and time management	
				Leverage technology to enhance productivity	
				Prioritize personal health and well-being	
				Integrate academic and technical skills	
GOALS			INDUSTRY CERTIFICATIONS		
<ul style="list-style-type: none"> ● ● ● ● 			<ul style="list-style-type: none"> ● Onshape: Certified Associate ● Autodesk: Certified Associate CAD for Mechanical Design-Fusion ● OSHA: 10 Hour Safety Training ● SME Robotics Fundamentals and Manufacturing Certification ● SME Additive Manufacturing Fundamentals Certification 		

Manipulators and Subsystems

Designing manipulators requires understanding of how to best interact with game objects and fabricating the needed items to achieve that interaction.

LEARNING RESOURCES AND OBJECTIVES	
Safety Manual Safety Training	Execute professional workshop safety standards with a focus on Personal Protective Equipment (PPE) . Maintain a professional safe environment while utilizing hand and power tools for subsystem fabrication.
Game and Season Robot Building Resources	Analyze game-specific scoring elements to identify necessary manipulator functions. Use seasonal build guides to architect subsystems that meet specific criteria and constraints.
Game Piece Intakes Presentation	Evaluate various intake architectures. Analyze mechanical advantage and grip patterns to design a system that maximizes game-piece acquisition speed and reliability.
Launchers and Placers Presentation	Research and test different mechanisms for launching and placing game objects. Apply engineering principles to optimize trajectory, precision, and release timing.
Indexers Presentation	Evaluate various indexing architectures. Analyze transition patterns to design a system that maximizes game-piece storage and organization.
Manufacturing-FTC Docs and Onshape	Engineer custom components, such as specialized connectors and guards, using 3D Printing and advanced fabrication techniques to enhance subsystem durability.
Andymark How Do I Series ; GoBuilda ; REV	Execute rapid prototyping cycles. Test multiple mechanical designs and utilize performance data to refine prototypes until they consistently achieve seasonal scoring goals.
Game Manual	Audit Robot Construction Rules to ensure all custom and COTS manipulators comply with motor limits, material constraints, and sizing requirements.
Manufacturing-FTC Docs	Design and manufacture custom structural components. Strategically integrate custom-fabricated connectors, guards, and chassis reinforcements using 3D Printing and CAD precision
Onshape for Robotics CAD Resources	Master Computer-Aided Design (CAD) for subsystem modeling. Use assemblies and digital collaboration to ensure seamless integration between the manipulator and the chassis.

Standards Alignments

ISTE	ITEEA
1.1.a, 1.1.c, 3.3.c, 4.4.a, 4.4.b, 4.4.d, 5.5.a, 5.5.b, 7.7.c	20, 3J, 4H, 6E, 7H, 7I, 8H, 8I
NIMS	NBEA
Measurement, Materials & Safety (MMS), Job Planning Benchwork & Layout, Drilling, Layout, Milling I, Turning I, Additive Manufacturing, Quality & Continuous Improvement, Safety	Career Development I.A, Career Development I.B, Management III.A, Operations I.A, Operations I.B

Designing Manipulators and Subsystems | Student Training Plan

NAME		GRADE-EXPERIENCE LEVEL		MENTOR	
Mentors evaluate students' performance using the following rating criteria (see page 4 for criteria details):					
4- Highly Skilled		3 – Skilled	2 – Moderately skilled	1 – Introduced	N – No exposure
RATING	COMPETENCIES		RATING	CAREER READY PRACTICES	
	Execute professional workshop safety standards, prioritizing the correct use of Personal Protective Equipment (PPE) during subsystem fabrication.			Demonstrate responsibility through <i>Gracious Professionalism</i>	
	Implement rapid prototyping techniques and utilize data-driven analysis to inform and justify critical design decisions.			Cultivate interpersonal communication skills	
	Optimize mechanical efficiency in subsystems by applying precision tolerances and minimizing mechanical friction.			Promote inclusion during teamwork	
	Iterate on manipulator designs to align with specific game strategies, ensuring subsystems support efficient game-piece acquisition and scoring.			Demonstrate creativity and innovation	
	Fabricate custom manipulator components using industry-standard processes, including Additive Manufacturing , precision drilling, and specialized cutting.			Evaluate impact of decisions	
				Exercise critical thinking and perseverance	
	Evaluate the systemic impact of manipulator geometry and weight distribution on overall robot stability and drive performance.			Model integrity, leadership, and time management	
	Assess various intake and delivery mechanisms to determine the optimal subsystem architecture for specific game piece requirements.			Leverage technology to enhance productivity	
	Architect and build custom mechanical subsystems that meet specific performance criteria and spatial engineering constraints.			Prioritize personal health and well-being	
				Integrate academic and technical skills	
GOALS			INDUSTRY CERTIFICATIONS		
<ul style="list-style-type: none"> ● ● ● 			<ul style="list-style-type: none"> ● Onshape: Certified Associate ● Autodesk: Certified Associate CAD for Mechanical Design-Fusion ● OSHA: 10 Hour Safety Training ● SME Robotics Fundamentals and Manufacturing Certification ● SME Additive Manufacturing Fundamentals Certification 		

Control System and Electrical

Use these resources to understand your robot control system and develop electrical skills while building your *FIRST* Tech Challenge robot. Wiring the robot includes ensuring correct transmission of the electrical current as well as reducing communication loss through good wiring techniques.

LEARNING ACTIVITIES	
Safety Manual Safety Training	Execute professional electrical safety standards, prioritizing Personal Protective Equipment (PPE) and the safe handling of lithium-polymer batteries and powered circuits.
Getting Started with Control Hub	Configure the control system elements. Master initial setup, firmware synchronization, and wireless communication protocols for critical reliability.
Electrical Theory Analog vs Digital I2C Communication Logic Levels	Apply fundamentals of electrical theory and communication protocols. Evaluate the differences between analog and digital signals to optimize sensor integration and data accuracy.
Robot Wiring Guide	Implement industry standard wiring techniques. Apply best practices for cable management, port protection, and strain relief to eliminate mechanical failure points and signal loss.
ESD Mitigation	Analyze robot architecture for Electrostatic Discharge (ESD) vulnerabilities. Implement mitigation strategies to protect sensitive electronics and prevent communication failures.
Robot Troubleshooting	Troubleshoot complex electrical systems. Use diagnostic tools and professional logic to identify and resolve wiring, connectivity, or wireless configuration bottlenecks.

Standards Alignments

ISTE	ITEEA
3.3.c, 4.4.a, 4.4.d, 5.5.a, 5.5.b, 7.7.a, 7.7.c	20, 3J, 4H, 5F, 7H, 8H, 8I
NIMS	NBEA
Measurement, Materials & Safety (MMS), Job Planning Benchwork & Layout, Electrical – Control Wiring, Electrical – Print Reading, Quality & Continuous Improvement, Safety, Industrial Technology Maintenance Awareness, Workforce Readiness	Career Development I.A, Career Development I.B, Operations I.A, Operations I.B, Management II.B, Management III.A, Business Analysis I.B

Electrical and Control System Student Training Plan

NAME		GRADE-EXPERIENCE LEVEL		MENTOR	
Mentors evaluate students' performance using the following rating criteria (see page 4 for criteria details):					
4- Highly Skilled		3 – Skilled	2 – Moderately skilled	1 – Introduced	N – No exposure
RATING	COMPETENCIES	RATING	CAREER READY PRACTICES		
	Execute professional electrical safety standards, prioritizing Personal Protective Equipment (PPE) and the safe handling of lithium-polymer batteries.		Demonstrate responsibility through <i>Gracious Professionalism</i>		
	Evaluate electronic theory and signal types to optimize sensor integration and ensure reliable data communication protocols.		Cultivate interpersonal communication skills		
	Audit electrical connections and wire terminations to ensure high-precision integrity. Evaluate crimps, solder joints, and insulation for consistent current transfer and proper polarity alignment.		Promote inclusion during teamwork		
			Demonstrate creativity and innovation		
	Engineer an electrical layout that incorporates ESD mitigation strategies to protect sensitive control components from static interference.		Evaluate impact of decisions		
	Integrate the control system using industry-standard connectors and wiring techniques to establish a robust electrical path for all motors and sensors.		Exercise critical thinking and perseverance		
			Model integrity, leadership, and time management		
	Calculate power distribution requirements for sensors, motors, and servos to prevent circuit overloads and ensure peak performance.		Leverage technology to enhance productivity		
			Prioritize personal health and well-being		
	Optimize wireless communication reliability by analyzing signal frequencies and implementing strategies to minimize network interference.		Integrate academic and technical skills		
GOALS			INDUSTRY CERTIFICATIONS		
<ul style="list-style-type: none"> ● ● ● 			<ul style="list-style-type: none"> ● AMTEC Emerging Technicians Certification ● OSHA: 10 Hour Safety Training ● SME Robotics Fundamentals and Manufacturing Certification 		

Programming and Robot Control

Programming through the control system on the robot is a fundamental part of competing successfully with your robot. It can take time and you might use different languages. The language you choose may depend on your mentor's experience and the career pathway you are considering as a student.

LEARNING ACTIVITIES	
FTC Sims	Master programming logic and flow control through virtual simulations. Develop foundational competencies in movement algorithms and sensor integration within a sandbox environment.
Blocks Programming Guide Control System Introduction	Configure and program the control system using the Integrated Development Environment (IDE). Architect a functional robot control scheme using logic-based programming tools.
Blocks Programming Guide Blocks Video Tutorials Computational Thinking Video Playlist	Utilize advanced programming blocks to interface with motors, servos, and IMUs. Apply computational thinking to resolve complex motion and feedback loop challenges.
OnBot Java Guide Android Studio Guide Android Studio Project Download and Resources	Transition to professional, text-based programming in Java . Leverage industry-standard IDEs like Android Studio to develop highly customized and efficient robot code.
GitHub	Implement version control and collaborative coding practices using GitHub . Manage code repositories, track project iterations, and ensure software integrity throughout the season.
Computer Vision Overview	Analyze computer vision frameworks, such as OpenCV , to develop advanced algorithms for object detection and real-time field navigation.
Color Processing	Engineer color-processing algorithms to automate game-element detection. Implement and test sensor-driven logic to increase robot autonomy.
Utilizing April Tags	Integrate AprilTag technology for high-precision localization. Develop algorithms that utilize visual markers to determine exact robot positioning on the competition field.
Robot Troubleshooting	Diagnose and resolve common programming errors. Apply systematic troubleshooting techniques to debug logic failures, connectivity issues, and firmware conflicts.

Standards Alignments

ISTE	ITEEA
1.1.a, 1.1.c, 3.3.c, 4.4.a, 4.4.b, 4.4.d, 5.5.a, 5.5.b, 6.6.a, 7.7.c	20, 3J, 4H, 6E, 7H, 7I, 8H, 8I
NIMS	NBEA
Industrial Technology Maintenance Awareness, Measurement Materials & Safety (MMS), Job Planning Benchwork & Layout, Quality & Continuous Improvement, Workforce Readiness	Information Technology I.A, Information Technology II.A, Information Technology III.A, Communication III.A, Career Development I.B, Management III.A

Programming and Robot Control Student Training Plan

NAME	GRADE-EXPERIENCE LEVEL	MENTOR

Mentors evaluate students' performance using the following rating criteria (see page 4 for criteria details):

4- Highly Skilled	3 – Skilled	2 – Moderately skilled	1 – Introduced	N – No exposure
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RATING	COMPETENCIES	RATING	CAREER READY PRACTICES
	Configure robust networking protocols to establish stable communication between the Driver Station and Control Hub, ensuring mission-critical connectivity.		Demonstrate responsibility through <i>Gracious Professionalism</i>
	Integrate external software libraries and open-source code to expand robot functionality and streamline the development lifecycle.		Cultivate interpersonal communication skills
	Architect sophisticated autonomous algorithms utilizing encoders, IMU feedback, and PID control to achieve precision movement and repeatability.		Promote inclusion during teamwork
		Demonstrate creativity and innovation	
	Deploy advanced computer vision frameworks to enhance field awareness, automating game-element detection and precision scoring.		Evaluate impact of decisions
	Migrate from block-based logic to text-based Java to unlock advanced object-oriented programming capabilities and custom software architecture.		Exercise critical thinking and perseverance
	Synthesize core programming principles—including data types, inheritance, and control flow—to build a comprehensive command of the language structure.		Model integrity, leadership, and time management
		Leverage technology to enhance productivity	
	Standardize team development workflows by authoring a technical training manual that defines best practices for variables, debugging, and exception handling.		Prioritize personal health and well-being
		Integrate academic and technical skills	

GOALS	INDUSTRY CERTIFICATIONS
<ul style="list-style-type: none"> ● ● ● 	<ul style="list-style-type: none"> ● Certiport: IT Specialist – Software Development / Java ● Certiport: IT Specialist – Software Development / Python ● Certiport: IT Specialist – Artificial Intelligence ● Python Institute: PCEP – Certified Entry-Level Python Programmer ● Python Institute: PCAP – Certified Associate in Python Programming ● Open CV: Fundamentals of Computer Vision