Payload Carrier Robot Instructions (Class 9-12)

Mission: In this challenge you will build a robot that carries a payload and climbs over three steps of stairs. The payload should be unloaded when the robot reaches the final stair.. Loading and unloading should be automatic. Based on the level of complexity and innovative approaches robots will be assessed. Mission time is 120 seconds.

All robots should be controlled remotely or autonomously.

1. Step: Robot picks up payload. Payloads can be a plastic cube, wooden block, or baseball-sized safe items. Weight for payload ranges between 8 to 15 ounces.
2. Step: Starts moving towards Stairs. Cargo is located within 50 cm distance from the stairs.
3. Step: Climb three stairs.
4. Step: Removal of cargo: Unload the payload.

This type of robot can be built in various ways. You are welcome to use wheeled, tracked wheel, legs, conveyor systems and you are open to use integrated circuits such as Arduino, RaspberryPi, Microcontroller Units, VEX-Iq, Lego etc.

Robot Inspection Rule

Objective: To ensure all robots meet the safety, size, weight, and component requirements of the competition.

1. Inspection Requirement

- All robots must pass an official inspection before participating in any matches or trials.
- Robots may be inspected multiple times during the competition to ensure continued compliance with the rules.

Size and Weight Compliance

- **Maximum Dimensions**: Robots must fit within a designated box or measurement area of [Max 18x18x18 inches].
- **Maximum Weight**: The weight of the robot must not exceed [max 10.3 lb].

Component and Materials Check

- Custom or additional components not explicitly approved must be reviewed and cleared by competition officials.
- Hazardous materials, sharp edges, or flammable components are strictly prohibited.

Failure to Pass Inspection

- If a robot fails to meet any inspection criteria, the team will be given time to correct the issues.
- Any team that fails to pass inspection before the start of the competition will not be allowed to compete.
- Continuous violations of inspection rules during the competition may result in disqualification.

Power: Robots must use up to 24 V. Teams are not allowed to use external power.

*US outlets are 110V, not 220V.

Programming Language & Software : Any programming language can be used to control robots

Scoring Rubrics:

Criteria	Expert (4-5 points)	Proficient (2-3 points)	Emerging (0-1 points)
Design and Innovation	Innovative design with unique features that enhance stair-climbing and payload carrying.	Functional design with some innovative elements.	Basic design with little to no innovation.
Payload Handling & Stair-Climbing Ability	Securely carries the payload with no risk of dropping during stair climbing. Efficiently climbs all three staircases without assistance or failure.	Carries the payload with minor stability issues. Completes stair climbing with minor assistance or occasional failure.	Payload is unstable or frequently dropped.Struggles to climb stairs or frequently fails.

Structural Integrity	Robust construction with no structural failures during operation.	Generally stable with minor structural issues.	Significant structural weaknesses or failures.
Control and Navigation	Smooth and precise control with excellent navigation capabilities.	Adequate control and navigation with occasional errors.	Poor control and navigation, frequently off course.

Testing and Iteration	Extensive testing with documented iterations leading to significant improvements.	Some testing with limited iterations and improvements.	Minimal testing with no documented improvements.
Safety Features	Comprehensive safety features to prevent accidents during operation.	Basic safety features in place.	Lacks essential safety features.
Efficiency and Speed	Completes the task quickly and efficiently with optimal energy usage.	Completes the task with moderate speed and efficiency.	Slow completion with inefficient energy usage.
Team Collaboration	Excellent team collaboration with clear roles and effective communication.	Good team collaboration with some role clarity and communication.	Poor team collaboration with unclear roles and communication issues.
Documentation and Presentation	Thorough documentation and clear, engaging presentation of the design process and results.	Adequate documentation and presentation with some gaps.	Incomplete documentation and unclear presentation

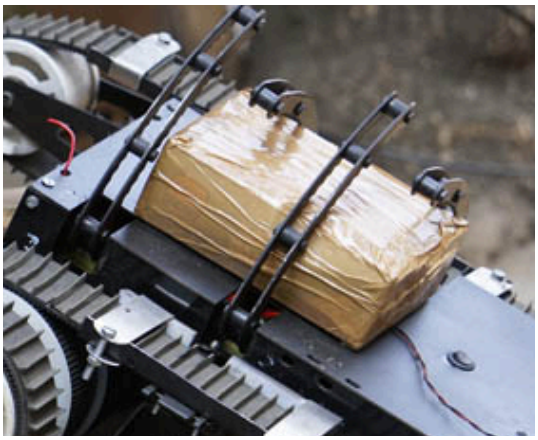
Below you will find a sample design with a tracked wheel.
Materials:
4 motors

- Wheels for mobility
- Body - wooden, plastic, 3D printed
- Rubber bands
- Soldering iron for cable connections
- Clippers
- Controller Unit
- PC for uploading Code

Using tracked wheels help robots to move both on smooth and rough driveways. Tracks are made up of either rubber or metal.

Securing two high torque motors for the front and two motors for the rear help wheels move both horizontally and vertically.
As the radius of the wheels increases, robot can overcome higher obstacles, which may be good idea to climb over stairs.

The body of the robot can be used to load and unload payloads. Attachment system or some sort of gripper or clippers can be used to achieve this objective. Gripper should be soft enough so that load is not damaged or squeezed.



Robots can be built fully automatic from start to end or Remotely controlled.
Sensors may be used to detect obstacles such as stairs or wall