FHSU LEGO Robotics Competition March 31, 2025

Overview

Students are expected to have fully constructed devices and working programs upon arrival at FHSU.

1. Each competing robot must be constructed from parts found in a standard Lego robot kit.
2. All events require that the robots be autonomous, unless otherwise noted in the event description.
3. Calibrations of sensors are allowed and encouraged prior to the start of each event.
4. Students may use courses for practice and calibration with a judge's permission.
5. All robots must be programmed to begin an event at the pressing of the activation button.
6. No additional programming can be done once the team has been called to compete – UNLESS THE EVENT SPECIFIES OTHERWISE.
7. Teams will get up to two chances to successfully start their robot.
8. If a wrong program is started by accident, the competitor must notify the judge promptly.
9. Poor placement of robot on event mat/surface – notify the judge promptly.
10. Teams *must* use their "second chance" immediately; no additional programming is allowed.
11. Robots may begin movement immediately unless specified by an individual event rule.
12. The robot is not required to stop at the completion of an event unless specified by an individual event rule.
13. The robot can be picked up and deactivated only when prompted by the judge(s).

Teams

1. ***** For logistical reasons, a maximum of 5 teams per school may be entered. *****
2. Each team may have up to 10 students.
3. A team may choose to compete in up to five (5) possible events.
4. ** Any single robot should NOT be used for the same event for multiple teams, unless otherwise declared to the judges that it is an alternate program is running. Judges may inspect the code at their discretion. **
5. Registration fee for 1 or 2 teams is $25.
6. Registration fee for 3, 4, or 5 teams is $50.

Awards

1. Points will be given to the top five robots in each **event**.
   1st place (5 pts), 2nd place (4 pts), 3rd place (3 pts), 4th place (2 pts), 5th place (1 pt)
2. Points will be given to the top five placing **teams**.
   1st place (5 pts), 2nd place (4 pts), 3rd place (3 pts), 4th place (2 pts), 5th place (1 pt)
3. **Tie breakers** 1st - Most points with the fewest teams (average points per team)
   2nd - School with the greatest number of first place events
   3rd – School with the greatest number of second place events.
   ***The event's final arbiter will decide any eventualities that arise which are not discussed herein.
4. **Combination of event point values are used to determine team and school scores.**

   ***** The SumoBot event does not contribute to the overall team score.**

5. **Individual scores** Medals will be given for 1st, 2nd, and 3rd place robots in each event.
   A. **Team scores** Plaques will be given to 1st, 2nd, and 3rd place teams.
   B. **School scores** Plaques will be given to 1st, 2nd, and 3rd place to schools with the most points.
   C. **1st place School also receives Traveling LEGO Trophy** (to be returned next year)

Sorting Colors

NASA link – PACE (Plankton, Aerosol, Cloud, ocean Ecosystem) and Climate Change mission will investigate how climate change is affecting blooms of ocean phytoplankton. The Line Follower must follow a path of a pre-determined color. When an object is detected further along the path, it must move the object off the path.

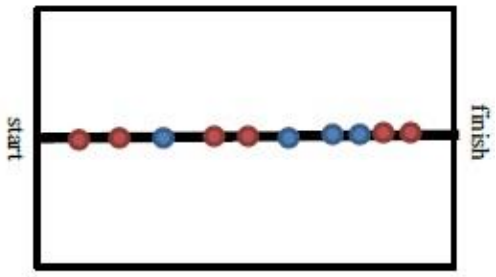
Goal - Sort a total of 10, Red and/or Blue, M&M candies from a straight line of black (matte finish) electrical tape as quickly as possible.

Event Tasks

1. _____ Follow the edge of a straight line of black electrical tape. (matte finish)
2. _____ Push **Red** M&M's completely off the black tape to the **right side** of the tape.
3. _____ Push **Blue** M&M's completely off the black line to the **left side** of the tape.
4. _____ M&M candies must remain on the white mat.

Robot Limitations

1. One (1) Color Sensor
2. Four (4) motors or less



Event limitations

1. Mat length is 5 ft long. (white typing paper)
2. Mat width is 8.5 inches (white typing paper)
3. Black line width .75-inch electrical tape (matte finish, non-glossy)
4. Black line placement is down the center of the mat length.
5. M&M's will be placed in random order.
6. Minimum distance between M&M's 5 cm.
7. Cross the finish line.

- The Color Sensor will be placed at the start line and will stop the timer upon crossing the finish line.
- Travel time will start when the button is pressed.

Scoring – (two criteria)

1. Number of accurately sorted M&M's. (primary scoring objective)
2. Quickest time to the finish line.
3. Given the same number of candies sorted, the faster robot will be deemed a higher placing robot.

1st place = 5 points
2nd place = 4 points
3rd place = 3 points
4th place = 2 points
5th place = 1 point

Line Follower

NASA link – DART (Double Asteroid Re-direction Test) was the first-ever mission dedicated to investigating and demonstrating one method of asteroid deflection by changing an asteroid's motion in space through kinetic impact. DART used a detection system to keep on a direct line path to collide with an asteroid.

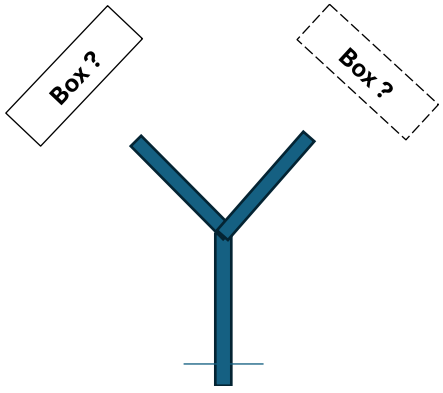
Goal – Follow a black line of electrical tape (mat finish) toward the object at the end of two possible, undetermined, paths from a fork-in-the road as quickly as possible.

Event Tasks

1. _____ Follow the edge of a straight line of black electrical tape. (mat finish)
2. _____ Navigate the 45-degree corner at the fork.
3. _____ See an object within 24 inches.
4. _____ Travel the entire line length toward the object.
5. _____ Return to start line.
6. _____ Travel only the required path toward the object for the quickest time. (optional)

Robot Limitations

1. One (1) Color Sensor
2. One (1) Ultrasonic Distance Sensor
3. One (1) Gyroscopic Sensor (optional)
4. Four (4) motors or less



Event Limitations

1. Black line width .75-inch electrical tape (matte finish, non-glossy)
2. The fork is symmetric with a left or right turn of 45-degrees.
3. Fork-to-object distance is 24 inches or less.
4. Object placement is 6 inches from either of the possible line paths.
5. No other objects, including spectators, will be present within 48 inches of the fork.
6. Object to detect is a 26.1 oz. Lucky Charms cereal box.
7. The robot may NOT touch the object.

- The Color Sensor will be placed on the black line behind the start / finish line and will stop the timer upon crossing the same start / finish line.
- Travel time will be recorded with a stopwatch from the pushing of the start button to the crossing of the finish line of the Color Sensor.

Scoring

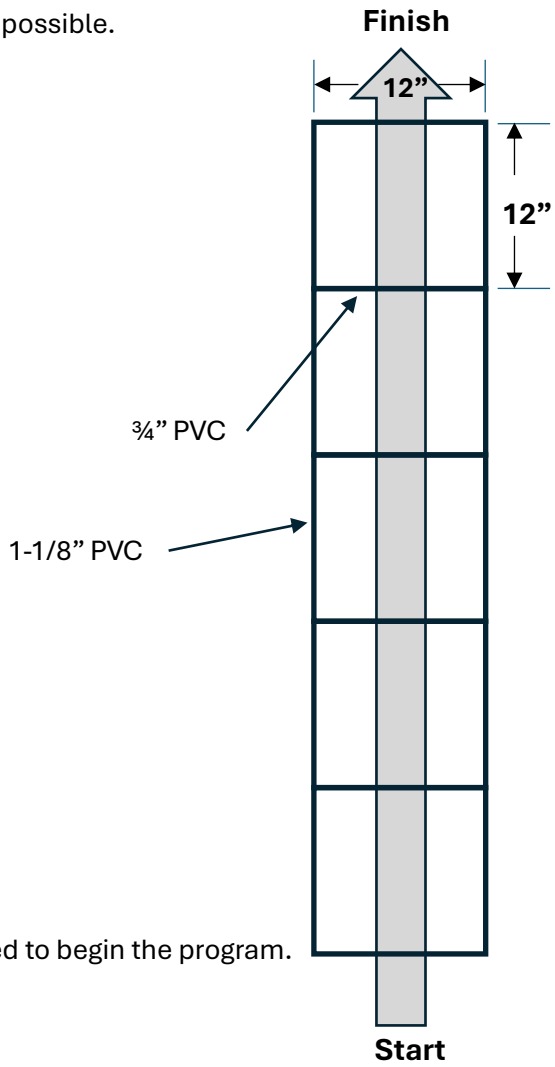
1. The robot must travel the entire length of the required path but may travel both paths.
2. Quickest time back to the finish line.

1st place = 5 points 2nd place = 4 points 3rd place = 3 points 4th place = 2 points 5th place = 1 point

Whoops

NASA link – VIPER (Volatiles Investigating Polar Exploration Rover) will explore the deepest part of selected craters in the moon's polar regions. Several challenges will need to be overcome, including autonomous detection of and compensation for low-level obstacles in its planned path. Speed is a crucial factor because VIPER will need to be able to complete its task before it seeks sunlight to recharge its batteries. The Whoops event emphasizes traversing low-level obstacles in the shortest time possible.

Goal – Traverse a series of ¾ inch PVC pipe "ladder" rungs as quickly as possible.



Event Tasks

1. _____ Robot can NOT touch the first ladder rung at start position.
2. _____ Travel over the rungs of the ladder.
3. _____ Stay on the 12-inch-wide course.
4. _____ Robot must clear the last rung completely.
5. _____ Complete course in under 90 seconds.

Robot Limitations

1. Maze robots may be built using any official LEGO robotic kit.
2. Up to 4 motors may be used.
3. No size restraints

Event Limitations

1. Ladder rungs are made of ¾ inch (nominal) PVC pipe.
2. The outer PVC rails have a dimension 1-1/8 inch.
3. Measurements are made from center-to-center of pipe sections.
4. Rungs are 1/8 inch above floor due to joint assembly.
5. All joints are touching the floor.

Scoring

1. The timer will start when the start button on the Lego block is pressed to begin the program.
2. The timer will stop when the robot clears the last rung.
3. Robots with the quickest time win.

1st place = 5 points 2nd place = 4 points 3rd place = 3 points 4th place = 2 points 5th place = 1 point

Mystery Maze

NASA link – Planetary Cave Rovers mission will explore caves to understand the planet's evolution and search for extraterrestrial life. The Mystery Maze must use a sensor to navigate through a cave to reach the other side.

Goal – Navigate a mystery maze made up of right angle turns and does not include any "T" intersections.

Event Tasks

1. _____ Begin on the open green space at the beginning of the maze.
2. _____ Sense a wall obstacle and stop or wait.
3. _____ Check either direction to the right or left of robot.
4. _____ Make a 90 degree turn toward the appropriate path, right or left as necessary.
5. _____ Identify red and stop completely on the red space at the end of the maze.

Robot Limitations

1. Two (2) distance sensors or less
2. One (1) color sensor
3. Four (4) motors or less

Event Limitations

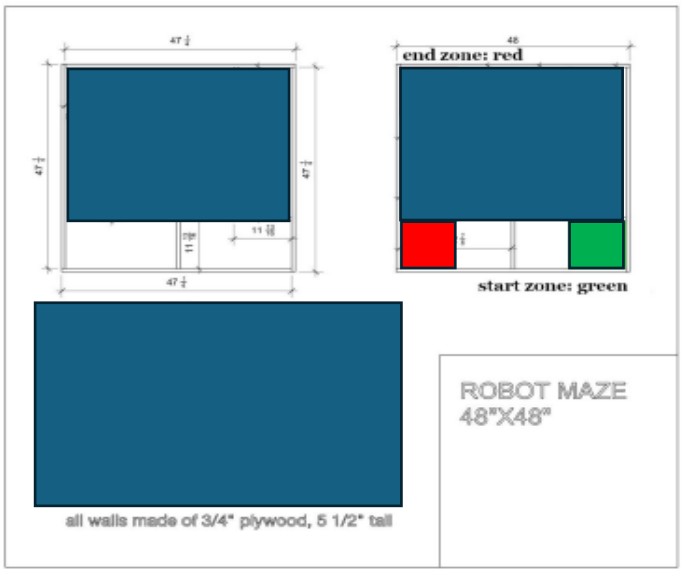
1. Base maze constructed from 0.75-inch plywood 48-inches x 48-inches.
2. Walls of maze constructed from 0.75-inch plywood 5.5-inches high.
3. Starting (green) space is an 11-1/16" (+/- 1/16") inch square space.
4. All maze lane widths are 11-1/16" (+/- 1/16") wide.
5. All corners are 90-degree angle turns.
6. Stopping (red) space is an 11-1/16" (+/- 1/16") square space.
7. The maze is obscured from aerial view except for the green and red spaces.
8. All measurements are based on the standard maze for the "Maze" challenge.

a. Ally width = 11-1/16" (+/- 1/16")

b. Ally length = unknown (Ultrasonic Sensor)

c. Ally Height = 5-1/2" (cardboard or other material resting on the maze)

- Travel time will be recorded with a stopwatch from the pushing of the start button to the robot stopping completely on the red space.



Scoring

1. Quickest time to complete the maze.
2. A robot must complete the maze within 5 minutes.

1st place = 5 points
2nd place = 4 points
3rd place = 3 points
4th place = 2 points
5th place = 1 point

Sumo Bots

NASA link – DART (Double Asteroid Re-direction Test) was the first-ever mission dedicated to investigating and demonstrating one method of asteroid deflection by changing an asteroid's motion in space through kinetic impact. This event emphasizes detecting and deflecting an opposing robot.

Goal – Push an opposing robot off a slightly elevated octagon shaped platform from a "back-to-back" starting position within a 90 second timed period.

Event Tasks

1. _____ Wait 5 seconds before moving. (Judges will start robots simultaneously)
2. _____ "Identify" the 4-inch-wide black perimeter "Danger Zone" using a Color Sensor.
3. _____ Move away from the "Danger Zone" of the black perimeter.
4. _____ "See" and attack an opposing robot using an Ultrasonic Sensor.
5. _____ Push the opposing robot off the octagonal platform.
6. _____ Stay on the Octagonal platform for 90 seconds.
7. _____ If no robots are pushed off the platform in 90 seconds, the smaller-massed robot will advance.

Robot Limitations

1. Robot may NOT exceed a mass greater than 907.2 g (2 lbs.).
2. One (1) Ultrasonic Sensor
3. Two (2) Color Sensors or fewer
4. Up to three (3) motors or fewer

Event Limitations

1. Elevated platform surface is 1 ½" above floor surface.
2. Elevated platform is 4-ft across (flat edge to flat edge)
3. Platform surface is painted white. With black painted perimeter.
4. Black perimeter "Danger Zone" is 4-inches wide. (painted - flat black)
5. A robot is deemed "out" once any part of the robot touches the floor around the platform.

Scoring - Single elimination bracket

1. Push the opposing robot off the platform to win.
2. A robot is deemed "out" once any part of the robot touches the floor around the platform.
3. If no robots are pushed off the platform in 90 seconds, the smaller-massed robot will advance.
4. The top 4 robots will compete in the "Final Four".
5. Winners' bracket will compete for 1st and 2nd place.
6. Losers' bracket will compete for 3rd and 4th place

1st place
2nd place
3rd place