



1010 1010

Fully autonomous robot floats follow an indoor parade route

V3.0 – Updated Final Version for 2024 Season and World Championship

This file can be found on the **RoboParade** page on the website

International hosts may clarify/adapt/change rules for each country's qualifying competitions

Coaches are responsible for communicating rules updates to participants

www.robofest.net

robofest@ltu.edu

248-204-3568

Room J233 Taubman Complex, LTU
21000 West 10 Mile Road, Southfield, MI 48075, USA

1. RoboParade Overview

Learning Objectives:

- STEM learning with Arts and Design
- Artistic creativity
- Autonomous Line following
- Basic computer programming logic
- Object detection and autonomous stopping and restarting
- Adjusting to environmental conditions
- Problem solving
- Presentation & communication skills
- Teamwork skills

Synopsis:

- *An Open Category competition*, which will take place at the World Robofest Championship
- Local events may also host RoboParade (Teams must re-register for World Championship event)
- Fully autonomous robot floats constructed and programmed by student participants
- Programmed to follow an indoor parade route (black-line) while detecting a robot in front of it and stop. then restart when it has cleared
- A great STEAM learning opportunity for students
- An ideal event for beginners in autonomous robotics

2. RoboParade 2024 Theme

Robofest World Championship 2024 event theme:

ON THE FARM

The *On the Farm* theme refers to agriculture, animal care, machinery, soil, water, commerce or other elements of farming

Other local hosts may choose their own theme

3. Age Division and Team Size

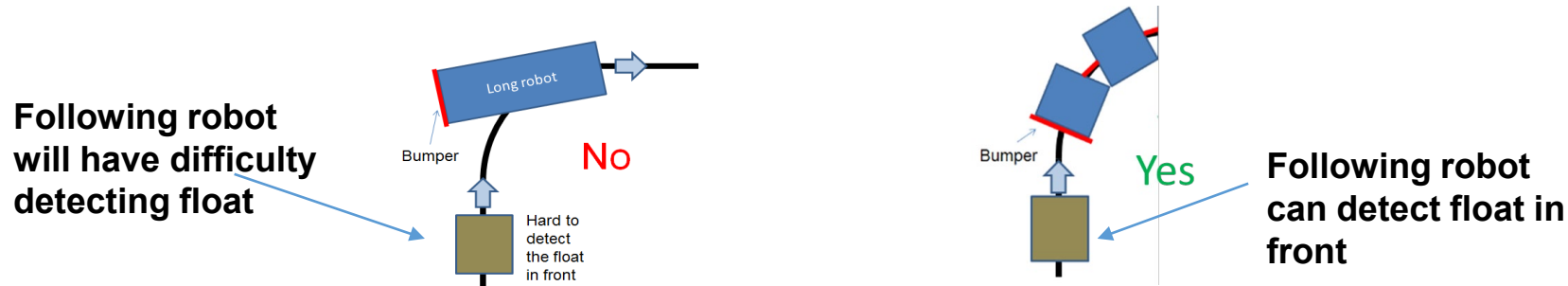
- One Age Division: Grades 4~8
- Team Size: Maximum five (5) members
- Teams of 1 allowed, but will receive a low score for the teamwork category
- A team can enter only one robot float
- Team Registration Fee: \$75 at the Robofest World Championship (Registration fee at local events may be different)
- Related important document: [Robofest 2024 General Rules](#) on the robofest.net website
- Each team member must bring the signed [Robofest Consent and Release Form](#) on the day of the event, if not completed on-line

4. Robot Requirements (1/2)

- Any robot kits are allowed. Any programming language can be used.
- Number of robot controllers, sensors (any type), or motors: unlimited
- Each robot is required to carry a small flag with a parade ID, which will be assigned once the robot completes the Test Parade Checklist
- Each robot may have its own sponsor logos
- Wireless interaction between the robot and team players using sound, ultrasonic, vision, or light sensors is encouraged
- Robot speed **must** be between **7** cm/sec and **16** cm/sec
- Robot needs to be programmed to display the current speed in cm/sec. Recommended display interval is 1 second
- No overall height or weight limitations
- Maximum width: 35 cm (13.78 in)

4. Robot Requirements (2/2)

- Maximum overall length of all sections of robot plus float(s) is 60cm (23.62"). Maximum length of any individual float section is 35cm (13.78"):



- The rear of the float must have a flat bumper at least 10cm (3.9") tall and 28 cm (11") wide and be 2.54 cm (1") off the ground so that the robot behind is able to sense reliably your robot using its distance sensors
- The rear bumper must remain over the line throughout the parade course (straight lines and curves)
- Robot must have a reliable program to consistently and efficiently follow a black line on a bright surface
- Robot must be able to follow both clockwise or counter-clockwise parade routes
- Robot must have the ability to detect a vehicle in front of it without touching it and stop. Robot then must automatically restart when the vehicle in front has cleared

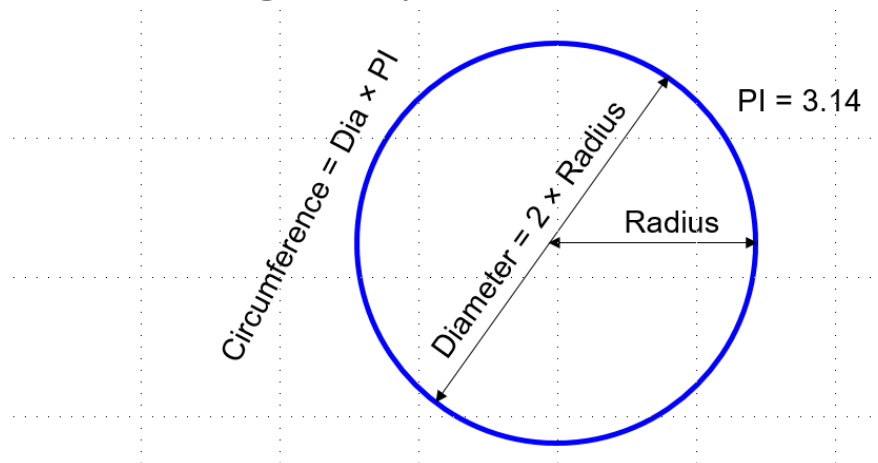
5. Displaying Accurate Speed is Judged

- Speed = Distance/Time
- For each rotation of the wheel, the robot travels

$$\text{Distance} = (\text{Wheel Diameter}) \times \pi \times (\# \text{ Rotations})$$

For more information, see RoboParade workshop material on [eAcademy](#) page

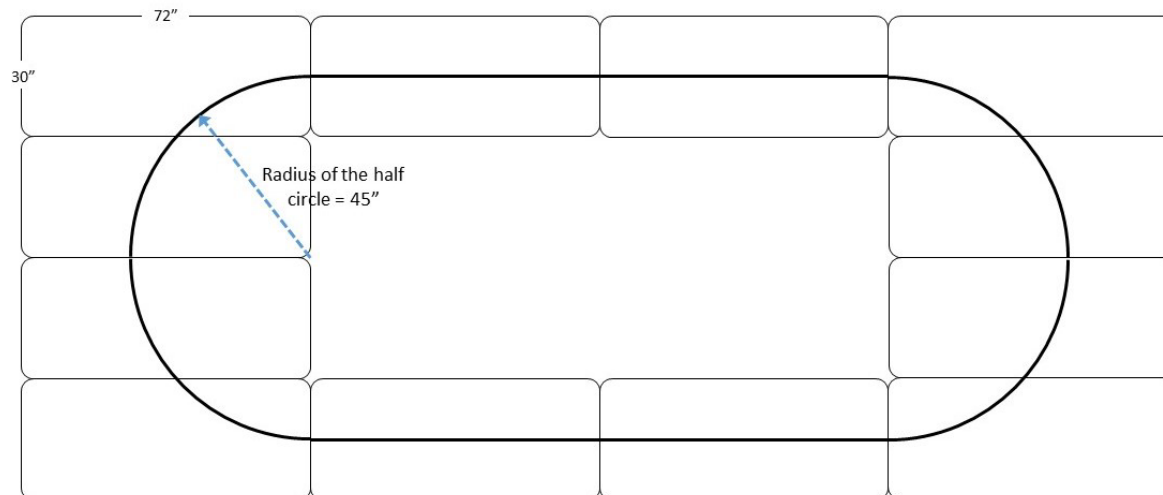
Use the wheel geometry



6. RoboParade Route Tables (1/2)

- Parade route is made from plastic folding tables 30" x 72" (75 cm x 182 cm)
- Recommended brand is "Lifetime" <https://www.lifetime.com/lifetime-2901g-6-foot-folding-table-commercial>
- Can be placed on the floor using the table legs, or on a crate with the table legs folded in. Alternatively, white paper or white vinyl can be used on a table or on the floor
- Black electrical or painters tape approximately 19mm wide can be used to make a closed rectangular shape with 4 rounded corners

Example of a possible official parade route configuration



6. RoboParade Route Tables (2/2)

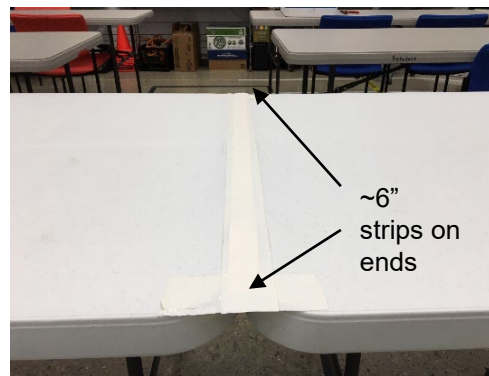
- A thin strip of poster paper can be used to cover the joints formed by the table edges
- 2" wide (5.08 cm) colored duct tape, masking tape, or similar can be used to connect and hold tables together. Color should closely match the tables
- 19mm black electrical tape is then applied to the tables and over the joints



a) table joint with gap



b) with poster paper filler (~1" wide)



c) with 2" tape



d) Finished connections with 2" tape and black line from electrical tape

7.1 RoboParade Competition Procedure

- Each team must complete **Test Parade** Checklist items 1-6 to ensure that all robot vehicles meet the specifications and functional requirements. Maximum 5 attempts are permitted
- Upon passing the items 1-6 on Test Parade Checklist, a numbered flag will be given
- Teams that do not fully meet parade requirements of the Test Parade Checklist item 1-6 will be given a lettered flag and allowed to compete, though ability to meet requirements will be considered in the judges' evaluations
- Teams will introduce themselves and their robot for up to 1-minute right after the opening. Each team member must explain his/her role clearly
- Judges will interview team members throughout the competition
- There will be two (10+2 = 12 minutes) parade rounds

7.2 Two RoboParade Rounds

- **Round 1: Clockwise**

- **Official Parade** (10 minutes): Any robots that violate parade rules (line following, rear bumper over the line, object detection and stop/restart, etc.) will be removed by Judges from the parade route. Team may fix the robot & change the code. One team member can restart the robot with Judge's assistance.
- **Judging Parade** (2 minutes for Rubric 4.2): All the robots will be placed on the parade route and started simultaneously. A judge will say 3-2-1-go and 2 minute timer will be displayed. All participants must move away from the route after starting the robot. Any violated robots will be placed aside and teams cannot access them. Judges shall record this Judging parade data for Rubric judging category item 4.2.

- Teams will have time between rounds to make adjustment to the robot

- **Round 2: Counter-clockwise**

- **Official Parade** (10 minutes): see above
- **Judging Parade** (2 minutes): See above

7.3 RoboParade Judging

- A panel of Judges will score each Judging category defined in the RoboParade Judging Rubric
- To complete the Judging Rubric, Judges shall
 - Use data on Test Parade Checklist
 - Visit team tables for informal interviews and code inspection, throughout the competition
 - Observe & record info & data for Judging during:
 - One minute Team Introduction
 - Two 12 minute parade rounds (Official Parade and Judging Parade)
- Winner trophies will be awarded based on the total score in the rubric
- Special award trophies may be given to recognize an extraordinary aspect of a parade float

8.1 Test Parade Checklist

Teams must pass this Test Parade Checklist to ensure that all robot vehicles meet the specifications and functional requirements. Maximum 5 attempts are permitted.

- A **numbered** flag will be given when test items 1 – 6 below are passed. Note that items 7 & 8 do not affect other robots during the parade.
- Teams that do not fully meet test items 1 – 6, will be given a **lettered** flag, though final judging score will be evaluated by individual Judges.

Test Item	Details	Tally of attempts	Pass or No-pass	Notes
1. Robot Length	Maximum width: 35cm (13.78"); Max. overall length: 60cm (23.62")			
	No robot or float section greater than 35cm (13.78")			
2. Rear Bumper	At least 10cm (3.9") tall and 28cm (11") wide; 2.54cm (1") off the ground			
	Remains over the line throughout the course. <i>(Must be tested during the Autonomous Performance Tests 3 & 4)</i>			
3. Autonomous Performance (Clockwise)	Negotiates the official parade route without human touch at least a half circle with 2 curves			<i>Robots that require human touch during official rounds will be removed from the parade</i>
4. Autonomous Performance (Counter-clockwise)	Negotiates the official parade route without human touch at least a half circle with 2 curves			

5. Object (Rear Bumper) Detection <i>(Must be tested during Autonomous Performance tests 3 & 4, above)</i>	Waits and restarts on straight line			
	Waits and restarts on clockwise curve			
	Waits and restarts on counter-clockwise curve			
6. Speed limit	7cm/sec - 16cm/sec			Measured Speed:
7. Speed Display	Accurate to ± 1.5 cm/sec			Displayed Speed:
8. Speed Math	Team members understand perfectly the math behind speed calculation			Score if paper exam used

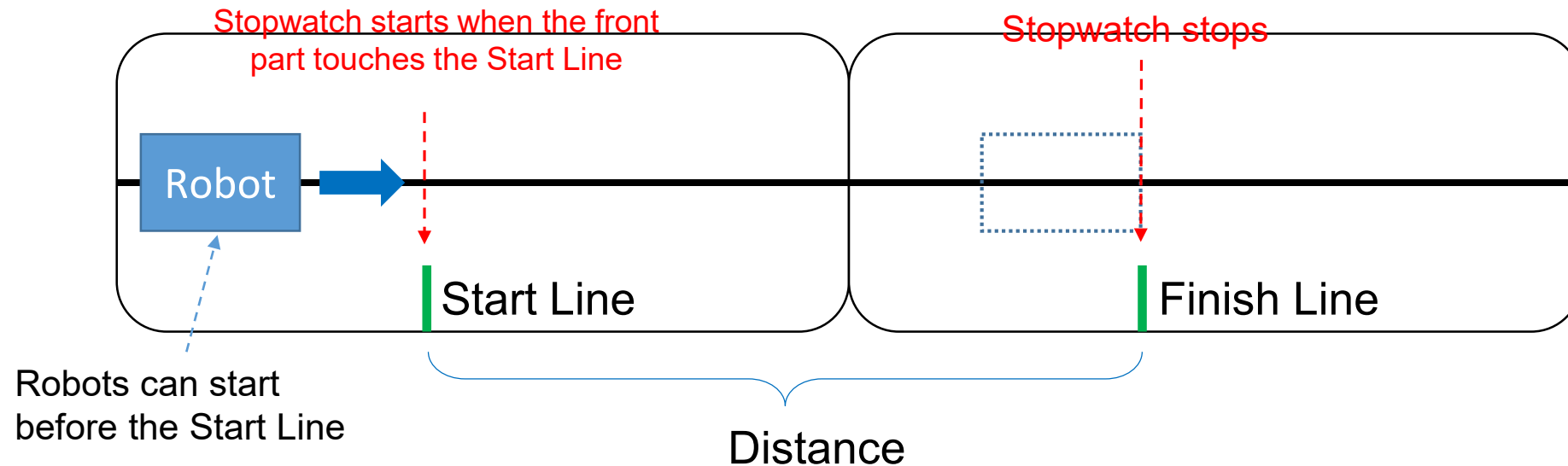
<https://www.robofest.net/images/2324/RoboParade2024Checklist.pdf>

8.2 How Robot Speed is Measured during the Test Parade

- Tested on a straight line as shown below; Suggested travel distance is between 100 cm and 200cm
- Robot will be timed from a start line to a finish line using a stopwatch
- Speed Calculation:

$$Speed = \frac{Distance\ Between\ Lines}{Time}$$

- The measured speed will be compared to the speed displayed on the robot (must be within ± 1.5 cm/sec)



9. RoboParade Judging Rubric

(*) Judging Score

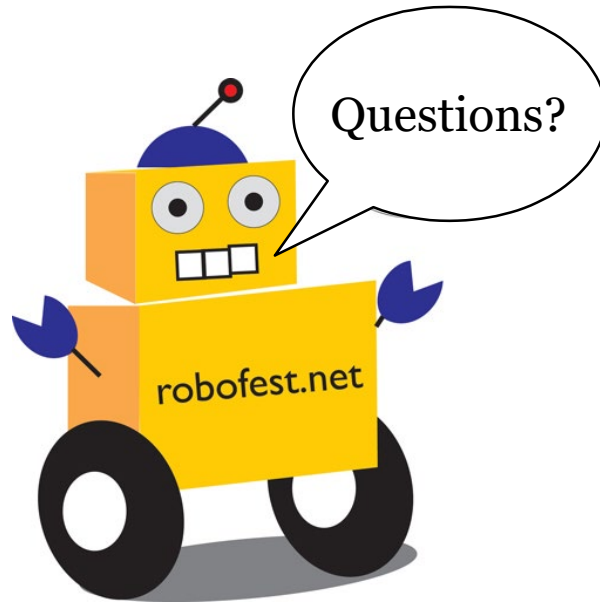
5: Strongly Agree	excellent, outstanding, advanced, exemplary, or amazing
4: Agree	good, accomplished, or proficient
3: Neutral	average, intermediate level, or acceptable
2: Somewhat Disagree	attempted but needs work
1: Disagree	little attempted or needs lots of help

1 - 5

Judging Category	Sub Categories	Weight	Score*
1. Artistic Creativity	Robot float is unique, artistically appealing, and aligned with theme.	15%	
2. Robot Design & Float Performance	Students applied unique, technically creative and innovative elements to the robotics project. Robot mechanical design is creative, user-friendly, sturdy, robust, and performed reliably.	10%	
	Robot size and rear bumper requirements are perfectly satisfied and did not cause any issues during "Judging Parade". If the robot has a numbered flag, suggested score is 4 or 5. If the robot has a lettered flag, check the Test Parade Checklist** items 1 and 2.	5%	
3. Interactions	There are elements of wireless interaction between the robot and the team players using sensors or other communication technologies.	10%	
4. Robot Parade (line-following) Performance	Robot meets Test Parade Checklist** items 3 & 4 for robust and reliable parade performance. If the robot has a numbered flag, suggested score is 4 or 5. If a lettered flag, 1 or 2 is suggested.	10%	
	Robot reliably and successfully negotiates two official 2-minute "Judging Parade" autonomously (without human touch). If both are successful: this score is 5. Only one success: 3. no success: 1	15%	

4. Robot Parade (line-following) Performance	Robot meets Test Parade Checklist** items 3 & 4 for robust and reliable parade performance. If the robot has a numbered flag, suggested score is 4 or 5. If a lettered flag, 1 or 2 is suggested.	10%	
	Robot reliably and successfully negotiates two official 2-minute "Judging Parade" autonomously (without human touch). If both are successful: this score is 5. Only one success: 3. no success: 1	15%	
5. Teamwork	Teamwork and team spirit are evident. Division of labor (who did what) explained clearly during the team introduction. <i>Note: If the team only has one member, the score should be 1 or 2 depending on the quality.</i>	10%	
6. Robot Speed Display	Displayed speed is as accurate as the measured speed. Check Test Parade Checklist** items 6 and 7.	5%	
	Students are able to explain displayed speed through math, physics and coding concepts. Check both the Test Parade Checklist** item 8 and inspect their code by visiting team tables.	10%	
7. Team Independence	I believe the project was mostly designed, developed, and programmed by the students, not by adult coaches, parents, or mentors. (Interviews with students are needed)	10%	
Total		100%	

<https://www.robofest.net/images/2324/RoboParade2024Rubric.pdf>



RoboParade Committee Members

Pam Sparks (Chair)
Katie Bis
Kevin Gallatin
Jennifer Minaudo
Daniel Oliver
Dr. CJ Chung
Shannan Palonis
Dr. Chris Cartwright

robofest@LTU.edu