# 25th LAWRENCE TECHNOLOGICAL UNIVERSITY ROBOFEST 2024

# Kickoff II Meeting

November 2, 2023

This file can be found on the Robofest website on the **Get Involved→2024 Main** page


www.robofest.net robofest@ltu.edu 248-204-3568

**Room J233 Taubman Complex, LTU**

**21000 West 10 Mile Road, Southfield, MI 48075, USA**

# Kickoff Meeting Agenda

- *Introductions*
- *Robofest Overview and Schedule*
- *General Competition Rules Highlights*
- *Competition Categories*
- *Open Competition Categories Highlights*
- *Exhibition Rules Highlights*
- *Q & A - Break*
- *Game Rules*
- *Q & A and Wrap Up*

# Robofest Staff

- Elmer Santos, Robofest Director
- Shannan Palonis, Assistant Director
- Pam Sparks, Coordinator
- Steven Kryskalla, Database Web App Developer
- Marilyn Weisman, MCS Department Admin

Student Assistants:

- Stephen Arnold
- Devson Butani
- Giovanni DeRose
- Robert Newberry
- Carly Palonis
- Nicholas Sparks

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# LTU Executive Council

- Dr. CJ Chung, Professor of Computer Science, Robofest Founder, Advisory Board Chair
- Dr. Christopher Cartwright, Associate Professor of Math, Robofest Director, 2021-2023; Chief Judge 2009-2020
- Dr. Eric Martinson, Associate Professor, Math & Computer Science; 2023 Exhibition Judge

# Robofest Advisory Board

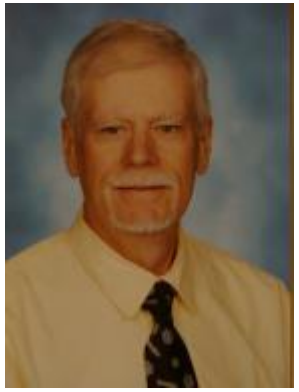
Paul M. Akangah

Emma Alaba

Phil Bigos

CJ Chung (Chair)

Gavin Coleman



Scott Eisele

Linda Pence

Josh Siegel

Gordon Stein

Maurice Tedder

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# Technical Committees

- Define/design/refine competition rules
- Judging World Championship events and qualifying competitions
- A short Bio of each member on the category pages of the Robofest website

| Game |
|---|
| Elmer Santos (*) |
| John Arnold |
| Chris Cartwright |
| Peter Guenther |
| Wisam Bukaita |
| |
| CJ Chung (**) |

| UMC |
|---|
| Elmer Santos (*) |
| Curtis Sharif |
| Daniel Oliver |
| Destiny Anyaiwe |
| Scott Eisele |
| |
| CJ Chung (**) |

| Exhibition |
|---|
| Shannan Palonis (*) |
| Ben Gonzalez |
| Jelani Stowers |
| David Carbery |
| Elmer Santos |
| Ajay Choudhary |
| CJ Chung (**) |

| RoboArts |
|---|
| Pam Sparks (*) |
| Kevin Gallatin |
| Erik Rosvold |
| Curtis Sharif |
| Elmer Santos |
| |
| CJ Chung (**) |

| BottleSumo |
|---|
| Elmer Santos (*) |
| Chris Parker |
| Peter Guenther |
| David Carbery |
| Karthik Devaraj |
| |
| CJ Chung (**) |

| Vcc |
|---|
| Erik Rosvold (*) |
| Tejaskumar B Patil |
| Rodrigo Rodriguez |
| Emily Trudell |
| Nathaniel Johnson |
| Steven Lowe, Jr |
| CJ Chung (**) |

| RoboMed |
|---|
| Yawen Li (*) |
| Choongbae Park |
| Hao Jiang |
| Aleksandra Kuzmanov |
| Andrew Ulaszek |
| CJ Chung (*) |
| |

| RoboParade |
|---|
| Pam Sparks (*) |
| Kevin Gallatin |
| Katie Bis |
| Daniel Oliver |
| Jennifer Minaudo |
| |
| CJ Chung (**) |

(*) Chairperson (**) Advisory

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# Robofest Sponsors







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# Overview and Schedule

# What is Robofest®

- Founded in 1999 by the Math and Computer Science Department at Lawrence Technological University
- A festival of competitions with autonomous robots offering students the opportunity to master principles of STEAM while having fun
- Since 1999, over 34,600 students have competed in Robofest, including teams from 18 US States and over 30 Countries and Regions
- ROBOFEST is a trademark of Lawrence Technological University

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# Robofest Mission Statement

Our mission is to:

- Generate excitement and interest among young people for Science, Technology, Engineering, Arts, and Mathematics (STEAM), Computer Science, and AI
- Develop essential skills such as teamwork, leadership, creativity, communication, and problem solving
- Prepare students to excel in higher education and technological careers

# Features of Robofest

- **Developed and managed by Lawrence Technological University**
- **100% Autonomous** - sensors required
- **Any Robot Platform / Programming Language** - for most categories
- **Small Teams** - Max 5 students per team for most categories (average size is 3)
- **Challenging** - dynamic playing fields, unknown factors, and no direct adult help allowed
- **Recognition** - All participants receive personalized medals and certificates
- **Affordable** - reuse old kits, off-the-shelf parts, $75 team registration fee
- **Variety** of competition categories for more opportunities in STEAM learning
- **Accountable** - Anonymous surveys of participants before and after competition to measure success of the program

# Robofest LTU Scholarship Opportunity

- Robofest team members who choose to attend Lawrence Technological University may apply for a $3,000 annual renewable scholarship (total of $12,000)
- After submitting an LTU Application, complete the Robofest Scholarship application on the LTU.edu Scholarship/First Year Students page along with a 400-word essay regarding your Robofest experience and your career goals
- Submit a letter of recommendation from one of your Robofest adult coaches or mentors
- Robofest can assist with letter of recommendation
- Submission Deadline: April 1, 2024

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# Robofest World Champion LTU Scholarship

- $17,000 annual Robofest World Champion LTU Scholarship certificate is presented to all team members of the World Championship First Place Sr Game, Sr Exhibition, Sr RoboArts, Sr RoboMed, Sr UMC, and Sr Vcc teams (total of $68,000)
- Students receiving this scholarship must enroll at LTU the same year as their High School graduation, and must meet LTU admission criteria and scholarship criteria of High School GPA of 3.0 or better
- Renewable each year provided the student is enrolled for a least 12 credit hours each semester and maintains at least a 3.0 GPA

# Fall UMC Scholarship Competition

- THIS SATURDAY – OPEN TO THE PUBLIC
- Special Unknown Mission Challenge for High School students
  - 1st Place: $17,000 Annual LTU Scholarship ($68,000)
  - 2nd Place: $12,000 Annual LTU Scholarship ($48,000)
  - **Sat, Nov 4, 2023,** 1:00 PM ~ 5:00 PM at LTU
  - Individual students will be challenged to build and program a robot to solve a task in a limited amount of time
  - The registration fee: $25
  - Limited to LEGO NXT, LEGO EV3, LEGO SPIKE Prime/Robot Inventor, or VEX IQ kits

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# Michigan 99h Grant Funding

- Michigan Department of Education 99h Robotics Competition Grant provides funding to Public School Districts, Intermediate School Districts, and Nonpublic Schools to participate in Robofest
- Grants between ***$500 and $1,200*** for teams and Coach Stipends ***between $1,000 and $1,500*** are available for Robofest teams that are pre-registered in the Robofest Registration system by December 1, 2023
- More information and detailed instructions is available on the Michigan Department of Education Tech Plan website: https://www.techplan.org/edtech-initiatives/rdi/competitive-99h-robotics-competition-grant/
- "Introduction to Robofest Coaching" Workshop for new coaches will be held at MISD on December 12 at 4:30 pm to offer strategies for a successful team experience

# MCWT Grant Funding

- Robofest Sponsor, Michigan Council for Women in Technology, provides ***$750 grants*** for up to 10 all-girls Robofest teams
- Applications are being accepted now!
- Applications are reviewed at the end of each month beginning in October, 2023
- Applications may be submitted as long as awards are available or until March 8, 2024
- More information and application: https://www.mcwt.org/programs/list/K-12-Initiatives/ROBOTICS-GRANTS

# Site Host Opportunity

- Robofest relies on local volunteer host sites
- Hosting Robofest Competitions provides great visibility for your organization
- Showcase your facility, staff and students to prospective students (clients) and their parents, major media outlets, and the community at large
- Opportunities for STEAM Outreach in your local area
- Robofest Qualifying competitions are usually only half-day (4 hour) events
- Flexible Scheduling – Week night, Saturday or Sunday Morning or Afternoon

# Site Host Opportunity

What LTU Provides to Host (at no cost):

- Promotion of your organization as an official Robofest Site Host
- Information management website for team and volunteer registration
- Competition preparation – Judge and volunteer training, game materials
- Event support – signage, name badges, program/agenda template
- Participant recognition – trophies, medals, certificates, and volunteer recognition

LTU Asks Host Organization to Provide:

- Facility - A gym or a large multipurpose room such as a cafeteria or banquet room with consistent lighting
  - Competition Area
  - Secure Pit Area (Game, BottleSumo or RoboParade categories)
  - Exhibition area (Exhibition category)
  - Audience seating
- Staff/Volunteers:
  - Site Host, Registration, MC and Chief Judge)
  - PLUS the amount required to manage each category and age division (Judges, Proctors, Set-up/Clean-up)
- Optional Concessions
- Optional Team Check-in Fee of up to $20 per team to offset costs

# 2024 Robofest Pre-Season Schedule

- **Sep 30, 2023:** Initial Rules Published
- **Oct 1:** US Team Pre-Registration Opens
- **Oct 6:** Kick-off meeting I on Zoom
- **Nov:** International Competitions Begin
- **Nov 2:** Kick-off Meeting II at LTU and Zoom
- **Dec 12:** New Coach Workshop at MISD in Clinton Twp
- **Jan 13, 2024:** Kick-off Meeting III at LTU and Zoom
- **Jan ~ Feb:** Workshops for Registered Teams

# 2024 Robofest Competition Schedule

- **Feb 10:** Game Warm-up and Judge Training at LTU
- **Feb 17:** US Competitions Begin
- **Apr 14**: US and International Qualifiers End
- **Apr 15:** Video Qualifier Submissions Due
- **Apr 18:** Video Qualifier and Wait List Teams Notified of Advancement to WC
- **Apr 19 & 20:** Michigan Invitational Events Hosted at LTU
- **May 9, 10 & 11:** 25th Robofest World Championship Events at LTU

# 2024 Robofest Technical Workshops

- On-campus workshops in Computer Science Robotics Lab - J234
- Free for Registered Game or Exhibition Teams
- Students can register for multiple workshop types (categories/languages)
- Workshop materials will be posted to the eAcademy page on the Robofest website
- **Coaches may attend workshops**
- Schedule may change – List and Registration links on the “Registration” page under “Available workshops” menu

# 2024 Robofest Technical Workshop Schedule

- Saturday, Jan 20:
  - 9:00am ~ Noon: VEX IQ with VEXcode
  - 1:00pm ~ 4:00pm: LEGO EV3 with Scratch
- Saturday, Jan 27:
  - 9:00am ~ Noon:  LEGO EV3 with Scratch
  - 1:00pm ~ 4:00pm: LEGO SPIKE Prime/Robot Inventor with Scratch
- Saturday, Feb 3:
  - 9:00am ~ Noon: LEGO SPIKE Prime/Robot Inventor with Python
  - 1:00pm ~ 4:00pm: (New for 2024!) Intro to Exhibition LEGO EV3 with Scratch

# General Competition Rules Highlights

– IMPORTANT – SUMMARY ONLY –
COMPLETE OFFICIAL GENERAL COMPETITION RULES DOCUMENT IS AVAILABLE ON THE 2024 Main Page ON ROBOFEST.NET

**Coaches are responsible for communicating rules and updates to participants**

Participants are responsible for following all
2024 General Competition and Category Rules

# Coach Qualifications and Responsibilities

- Adults with no criminal record
- Review and understand General and Category Rules – Communicate with team members
- Have a valid/confirmed email address and must check the email account regularly
- Register team for competitions - Enter and verify information and pay fee before registration closes
- Coordinate the completion of the **Informed Consent, Release and Media Authorization Form** per event for each team member with their parent or guardian (online or hard copy)

# Coach Qualifications and Responsibilities

- Coordinate pre- and post-assessments online to help Robofest administration gather data
- Facilitate, transport, and oversee team members at team meetings and at Robofest competitions
- Ensure that students do the work.  Coaches, parents, teachers or mentors **may not** directly assemble the robots, or write/edit the program code for the team at any time
- Agree to and abide by the Coach Pledge

# Robofest Coach Pledge

*As a Robofest coach, I have read and agree to abide by the Robofest 2024 general and category specific rules as they exist now and as they may be set forth during the Robofest season.*

*As a coach, I am responsible for communicating and enforcing the Robofest rules to team members, team volunteers, and others affiliated with my team. I understand that any rule updates, guidelines, additional information, and announcements will be communicated to me, officially via emails, or webpage updates. I am responsible for reading the information and I will relay it to all the people affiliated with my team. If any changes are made to my email account, I will notify Robofest administrators as well as update my coach profile.*

*As a Robofest coach, I understand that the students come first. Robofest is about the students learning computer technologies, science, engineering, and mathematics. Everything my team does starts and ends with the principle: the students do all of the work. My team members will do the designing and building of the robot, problem solving and programming. Adults can help them find the answers, but cannot give them the answers or make the decisions in detail.*

*I intend to uphold and maintain the Spirit of Robofest.*

# Team Formation

- Any organization such as a school, home school, civic organization, or club can form teams
- Review Grade Level Divisions for each competition category
- “Age Division Waiver Request” may be completed during registration for any exceptions in a student’s grade
- A team member may join multiple teams, but not in the same category
- A team can register at multiple qualifying sites if they would like a second chance to qualify

# Team Responsibilities

- Students do all the work. Coaches and mentors should only teach and guide the team to find their own solutions
- Observe all General and Category Rules
- Observe event check-in time set by the Site Host
- Bring all materials needed on competition day
- Follow Pit area Rules
  - Only teams and authorized adults in the pit
  - NO communicating with coaches/parents/mentors during work time
- Respect other teams and spectators
- Maintain the Spirit of Robofest

# Robofest Team Pledge

*As a Robofest team member, I understand that the focus of Robofest is about learning through competition.*

*I will show personal integrity by honoring all Robofest rules, valuing fair competition and respecting judges and all other participants.*

*I will do my own work. I will NOT receive outside help from coaches, mentors, electronic devices or other sources during competitions and I will strictly follow impounding procedures.*

*I pledge to make Robofest 2024 great by upholding the Spirit of Robofest.*

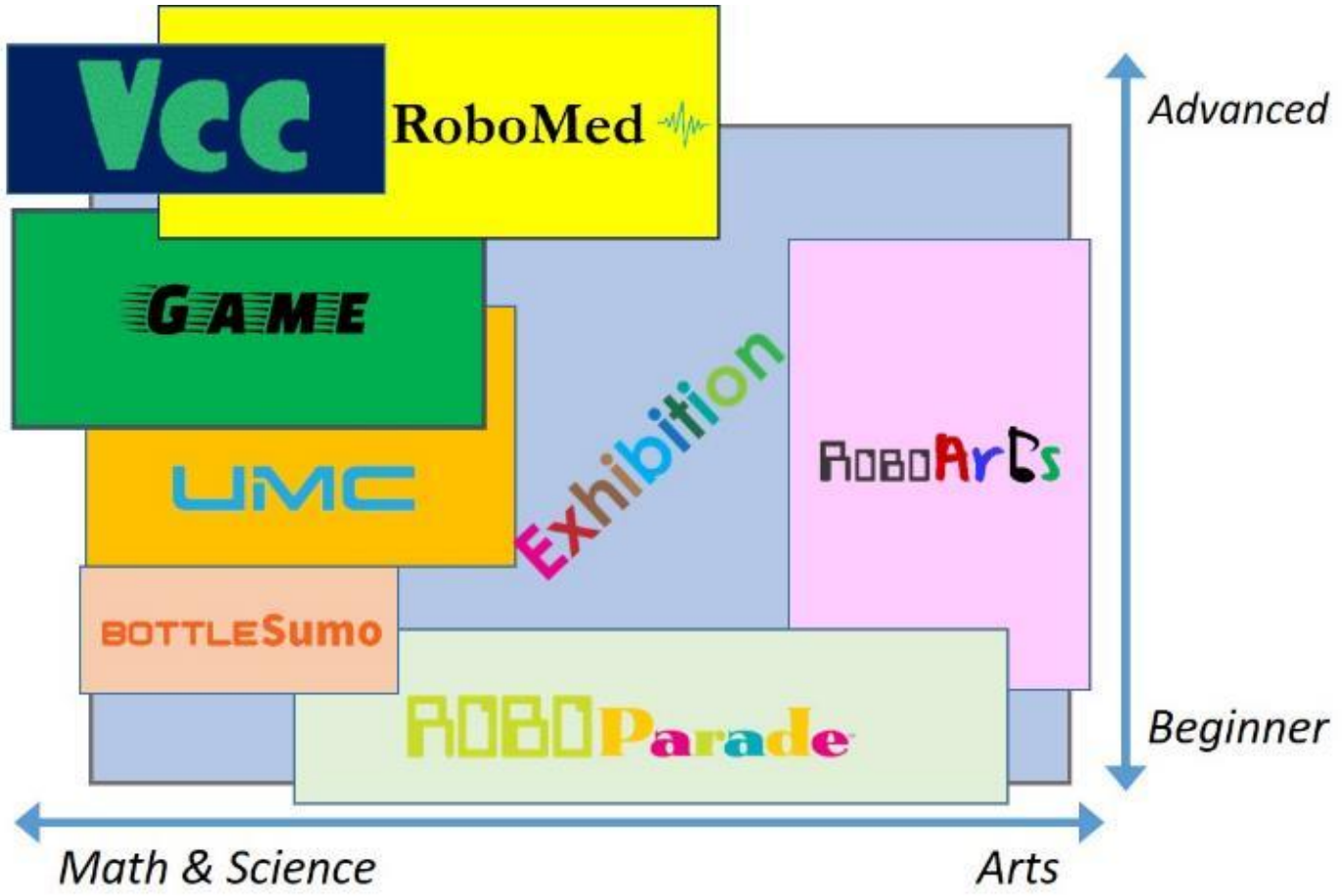
# Competition Categories

2024 Qualifier Categories

2024 Open Categories

# Robofest 2024 Competition Categories

- 8 Competition Categories
- Qualifiers vs. Open Categories
- Different skill and experience levels
- Varied STEAM subjects
- Game Style (fixed rules) or Exhibition Style (project based)



# 2024 Qualifier Categories

Teams must compete at a 2024 In-Person or Video Qualifier competition in order to advance to the Robofest World Championship Final events at LTU on May 11, 2024

| Qualifier Competition Category | Age (Grade*) Divisions | Maximum Team Size | Robot Platform | Unknown Factors |
|---|---|---|---|---|
| 2024 Game: **Autonomous Taxi** | Jr. (5~8) & Sr. (9~12) | 5 | Any | Unknown factors are unveiled during the competition |
| Exhibition | Jr. (5~8) & Sr. (9~12) | 5 | Any | Lighting Conditions that may impact robot sensors |

*(*) School Grade in spring 2024* - For exceptions to student's grade, complete the online "*Age Division Waiver Request"* at the time of registration

# 2024 Open Categories

Any team from US or non-member countries may register as long as space is available, with no qualification necessary. Some US Sites may also host open category competitions.

International Member Country Delegates are selected by their Director based on a set quota.

| Open Competition Category | Age (Grade*) Divisions | Maximum Team Size | Robot Platform |
|---|---|---|---|
| BottleSumo | Jr. (5~8) | 3 | LEGO NXT, EV3, SPIKE Prime/Robot Inventor, or VEX IQ |
| | Sr. Classic (9~12) | 3 | |
| | Sr. Unlimited (9~12) | 3 | Any |
| Unknown Mission Challenge (UMC) | Jr. (5~8) & Sr. (9~12) | 4 | LEGO NXT, EV3, SPIKE Prime/Robot Inventor, or VEX IQ |

*(*) School Grade in spring 2024* - For exceptions to student's grade, complete the online "*Age Division Waiver Request"* at the time of registration

# 2024 Open Categories

Any team from US or non-member countries may register as long as space is available, with no qualification necessary. Some US Sites may also host open category competitions.

International Member Country Delegates are selected by their Director based on a set quota.

| Open Competition Category | Age (Grade*) Divisions | Maximum Team Size | Robot Platform |
|---|---|---|---|
| RoboArts | Jr. (5~8) & Sr. (9~12) | 5 | Any |
| 2024 RoboParade: **On the Farm** | Expanded Jr. (4~8) | 5 | Any |
| RoboMed | Jr. (5~8) & Sr. (9~12) | 5 | Any |
| Vision Centric Challenge (Vcc) | Sr. (9~12) | 5 | Any |

*(*) School Grade in spring 2024* - For exceptions to student's grade, complete the online "*Age Division Waiver Request"* at the time of registration

# Registration Fees

- ***Some International Site Hosts may have different fee structure**
- Separate Fee applied to each event
- No refunds will be given
- Sites may request additional site check-in fee
- Teams who advance to the Robofest World Championship will pay a separate Registration Fee to LTU Robofest

| Event/Format | Fee* |
|---|---|
| Qualifier - In-Person | $75 |
| Qualifier - Video Submission | $75 |
| Open Events - In-Person | $75 |
| World Championship Events (Finals and Open Category) | $75 |

# Advancing to World Championship

Michigan Teams

US (non-Michigan) Teams

International Teams

# Advancing to World Championship

Advancement to the Robofest World Championship Game and Exhibition Finals differs depending on the category and on where a team is located.

- Michigan Game Teams
- Michigan Exhibition Teams
- US (non-Michigan) Game Teams
- US (non-Michigan) Exhibition Teams
- International Teams

All Michigan and US teams may register for Open Category events at the World Championship as space allows

# Advancing to World Championship – MI Game

- 1st Place Award-winning Game team from each qualifying competition will automatically advance to the Robofest World Championship Game Finals
- Other Game teams may be invited to the Robofest World Championship Game Finals based on their qualifying score
  - Teams will be notified of advancement no later than Monday April 15, 2024
- Teams who would like a second chance to qualify for the World Championship Finals may register to compete again at
  1. Another local qualifier
  2. Video Qualifier USA submission
  3. Michigan Invitational event at LTU on April 19-20
  - Team must register with a new team number and pay a new registration fee
  - Total number of teams advancing to the Finals will be decided by the team's scores

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# Advancing to World Championship – MI Exhibition

- 1st Place Award-winning Exhibition team from each Qualifying competition will automatically advance to the Robofest World Championship Exhibition Finals
- Other Exhibition teams may be invited to the Robofest World Championship Exhibition Finals based on their Preview Video and score
  - Preview Video link must be uploaded to the team's registration page
  - Teams will be notified of advancement no later than Monday April 15, 2024
- Exhibition teams who would like a second chance to qualify for World Championship Finals may register to compete again via Video Qualifier USA submission
  - Team must register with a new team number and pay a new registration fee
  - Total number of teams advancing to the Finals will be decided by the team's scores

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# Advancing to World Championship – US (non MI) Game

- 1st Place Award-winning Game team from each qualifying competition will automatically advance to the Robofest World Championship Game Finals
- Other Game teams may be invited to the Robofest World Championship Game Finals based on their qualifying score
  - Teams will be notified of advancement no later than Monday April 15, 2024
- Game teams who would like a second chance to qualify for the World Championship Finals may register to compete again via Video Qualifier USA submission
  - Teams must register with a new team number and pay a new registration fee
  - Total number of teams advancing to the Finals will be decided by the team's scores

# Advancing to World Championship – US Exhibition

- 1st Place Award-winning Exhibition teams from each Qualifying competition will automatically advance to the Robofest World Championship Exhibition Finals
- Other Exhibition teams may be invited to the Robofest World Championship Exhibition Finals based on their Preview Video and score
  - Preview Video link must be uploaded to the team's registration page
  - Teams will be notified of advancement no later than Monday April 15, 2024
- Exhibition teams who would like a second chance to qualify for World Championship Finals may register to compete again via Video Qualifier USA
  - Teams must register with a new team number and pay a new registration fee
  - Total number of teams advancing to the Finals will be decided by the team's score

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# Advancing to World Championship - International

- International Game, Exhibition and Open Category teams in Member Countries will compete at Member Country Events
- List of International Directors is available at Robofest.net
- Qualified teams will be advanced to the World Championship through the Director
- International Game and Exhibition teams in non-member countries may compete via Video Qualifier International Submission, due April 15, 2024
- International Open Category teams in non-member countries can register directly for the Robofest World Championship Open Category events as space permits

# World Championship – International Team Quota

The number of teams each National Organizer may advance to the 2024 Robofest World Championship events is based on the number of local events* and teams hosted and is set as follows:

| Game and Exhibition Categories; Junior and Senior Divisions** | |
|---|---|
| # of Teams Competing at Local Event in Category/Division | # of Teams Advancing to Robofest World Championship Finals |
| 5-49 | 1 |
| 50+ | 2 |

| Open Categories; Junior and Senior Divisions*** | |
|---|---|
| # of Teams Competing at Local Event in Category/Division | # of Team Entries for Robofest WC Open Category Event |
| 1-49 | 1 |
| 50-99 | 2 |
| 100+ | 3 |

* Official event registered in the Robofest Management System. ** Maximum number of Game and Exhibition teams per country is 2

*** Maximum number of Open Category Teams is 3 for any category. If an open category is not hosted, one team per open category may be selected to represent the country at the World Championships

The quota is conditional only when national directors fulfil the requirement defined in the LOA. Group photo to verify the # of students/teams is required for each division.

# Video Qualifier Submission

- International Game and Exhibition teams in non-member countries may register in Video_Qualifier_International
- US Game and Exhibition Teams may register in Video_Qualifier_USA
- Registration Fee: $75
- Game Unknown Tasks and Factors (UTF) will be emailed to the coach on Thursday, April 4, 2024
- Submission Deadline is 11:59 pm Eastern Time, Monday, April 15, 2024
- Adults may help produce the video. Team should acknowledge everyone involved in the video production in the end credits
- Upload the video to a video sharing site (YouTube, Vimeo, etc.). Insert link on Team Registration page

# Open Competition Category Highlights

# BOTTLESumo

- Be the first robot to intentionally push a bottle off the table OR be the last robot remaining on the table
- Three Divisions:
  - **Junior:** (Grades 5~8): Limited to LEGO NXT, LEGO EV3, LEGO SPIKE Prime/Robot Inventor, and VEX IQ
  - **Senior Classic:** (Grades 9~12): Limited to LEGO NXT, LEGO EV3, LEGO SPIKE Prime/Robot Inventor, and VEX IQ
  - **Senior Unlimited:** (Grades 9~12): Any robot platform
- Maximum team size: 3
- New table configurations and Unknown Tasks for 2024 season
- Rules, score cards, and examples: robofest.net → **BottleSumo**

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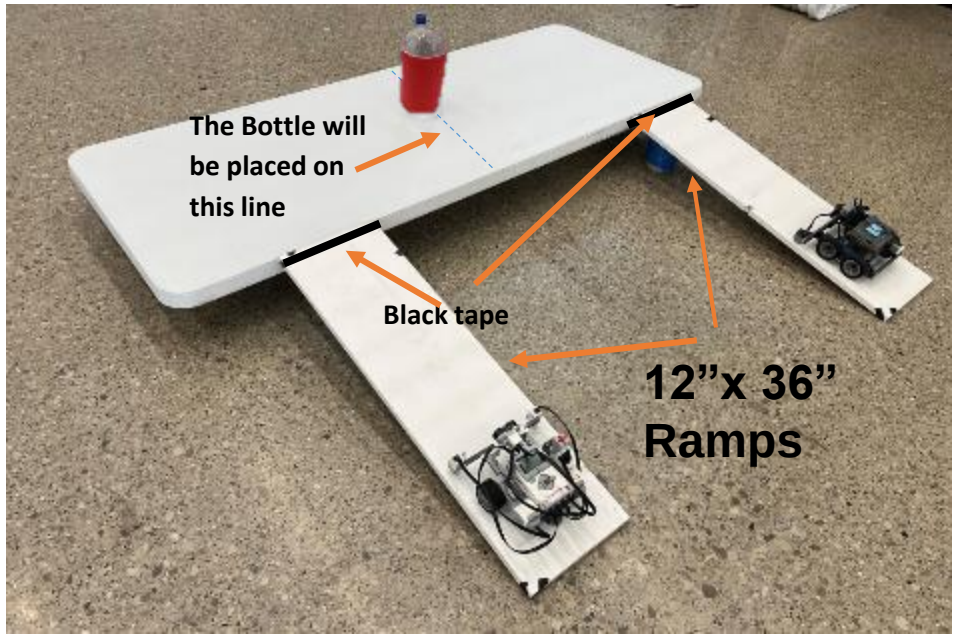
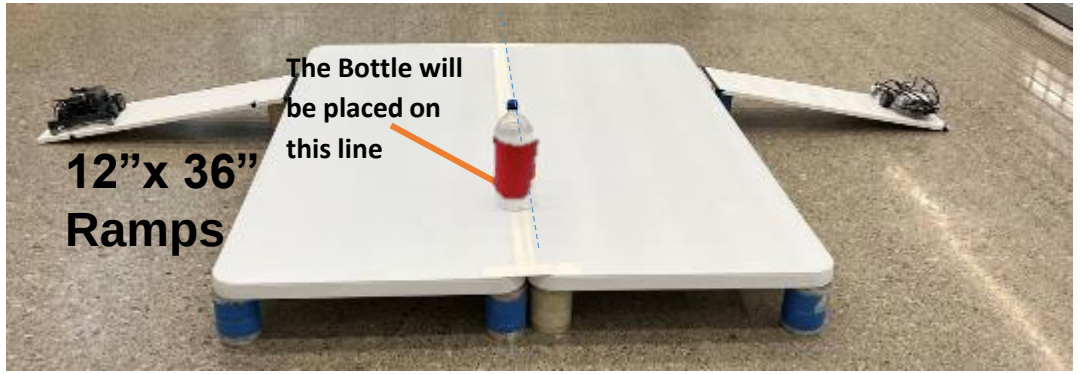
# BottleSumo Playing Fields

- **Junior Division**: Made up of one table and two ramps




- **Senior Divisions**: Made up of two tables and two ramps (configuration will be unveiled)




Connect tables with tape of a matching color

- Robot must be able to start anywhere on a ramp and in any orientation
- Exact ramp location will be unveiled prior to each match Sample match

# Unknown Mission Challenge

- Missions are completely unknown until the day of the challenge
- All robot components must be un-assembled at start of event
- Two Age Divisions:
  - **Junior:** (Grades 5-8)
  - **Senior:** (Grades 9-12)
- Maximum team size: 4
- Limited to LEGO NXT, LEGO EV3, LEGO SPIKE Prime/Robot Inventor or VEX IQ kits
- Senior Division World Championship winning team awarded $17,000 renewable LTU scholarship certificate
- Rules to get started (not the mission): robofest.net → UMC

# Vision Centric Challenge

- Vision based robot challenge for advanced High School students
- 2024 Challenge "Vision Based Measurement System"
- Visual Inspection challenge simulating a Manufacturing environment
- **One Age Division:**
  - **Senior:** (Grades 9-12)
- Maximum team size: 5
- World Championship winning team awarded $17,000 renewable LTU scholarship certificate
- Rules will be posted in November to robofest.net → Vcc

# Vcc Scenario

- Manufacturing involves making parts that meet the dimensional requirements of the blueprint. Teams will be given:
  - A blueprint with a number of dimensions
  - Ten numbered sample parts to measure
- The objective of the game will be to inspect each of the parts and to:
  - Identify if each dimension meets the print requirements or not
  - Provide the dimensions for a single Key Product Characteristic (KPC) on each part
    - The KPC is the key dimension on the part that must have the numeric value recorded
    - The KPC will be explicitly identified on the print (see examples)
    - Note: Even though there are 5 dimensions to measure, only one, the KPC needs a value reported
- Measurement must be done using visual/non-contact techniques
  - Students may touch parts to load and unload parts
- Teams will learn and utilize real world skills such as:
  - Inspection
  - Blue-Prints

# RoboArts

- Exhibition style projects specifically focused on the visual which includes drawing/painting, kinetic arts, and sculptures, and performing arts including dance, music, and skits
- Two Age Divisions:
  - **Junior:** (Grades 5-8)
  - **Senior:** (Grades 9-12)
- Maximum team size: 5
- Senior Division World Championship winning team awarded $17,000 renewable LTU scholarship certificate
- Rules and Rubric: robofest.net → RoboArts

# RoboMed

- Exhibition style projects of intelligent and interactive (bio) medical robotics/devices or related to (bio)medical and healthcare fields using sensors and/or actuators
- Promotes on entrepreneurial mindset
- Two age divisions:
  - **Junior:** (Grades 5-8)
  - **Senior:** (Grades 9-12)
- Maximum team size: 5
- Senior Division World Championship winning team awarded $17,000 renewable LTU scholarship certificate
- Rules and Judging rubrics: robofest.net → **RoboMed**

# RoboParade

- Robots are constructed and programed by student participants to follow the parade route, detect other vehicles, stop and start without human help
- 2024 World Championship Event Theme: **“On the Farm”**
- **Local events may have their own theme**
- Robots pull or carry decorative parade floats. Moving parts are allowed
- One Expanded Age Division
  - Junior - 4th ~ 8th Grade (no waiver needed) Perfect for beginners
- Maximum team size: 5
- Rules and Judging Rubric: robofest.net → **RoboParade**

# Exhibition Rules Highlights

# Exhibition

- **Qualifier Category:** Teams compete at local or online qualifiers, or through video submission, to advance the Robofest World Championship
- Team has complete freedom to create interactive and intelligent robotics projects
- Two Age Divisions:
  - **Junior:** (Grades 5-8)
  - **Senior:** (Grades 9-12)
- Maximum team size: 5
- Senior Division World Championship winning team awarded $17,000 renewable LTU scholarship certificate
- Rules and Judging Rubric: robofest.net → **Exhibition**

# Project Requirements/Limitations

- Prior to competition day, teams are required to provide:
  - Brief written project description
  - Preview Video link uploaded to the Robofest registration system
  - Source code one week prior to competition for judge review. Code inspector(s) may recommend points for programming
- Teams must bring all the necessary materials for their Exhibition presentation
- Any material that is safe for humans can be used
- Robot-to-robot as well as human-to-robot interactions strongly encouraged
- Wireless program controlled remotes are allowed
- Must employ sensors
- Demonstration space for each team is limited to a maximum of 64 square ft
- Projects entered in a previous competition category of any kind can be entered, but team must add new features and/or significantly improve or change one or more features

# Q&A

Overview
General Rules
Open Categories
Exhibition Qualifier

LAWRENCE TECHNOLOGICAL UNIVERSITY ROBOFEST 2024

GAME 010 1010

# Autonomous Taxi

## V 1.0 – Initial Version for 2024 season

– NOT OFFICIAL RUES –

Official Rules document can be found on the **Game** page on the robofest.net website

**An updated version with clarifications from Kickoff I and Kickoff II will be uploaded by November 10, 2023**

**Final Rules with all updates and clarifications will be uploaded in January, 2024**

**Send questions to robofest@ltu.edu**

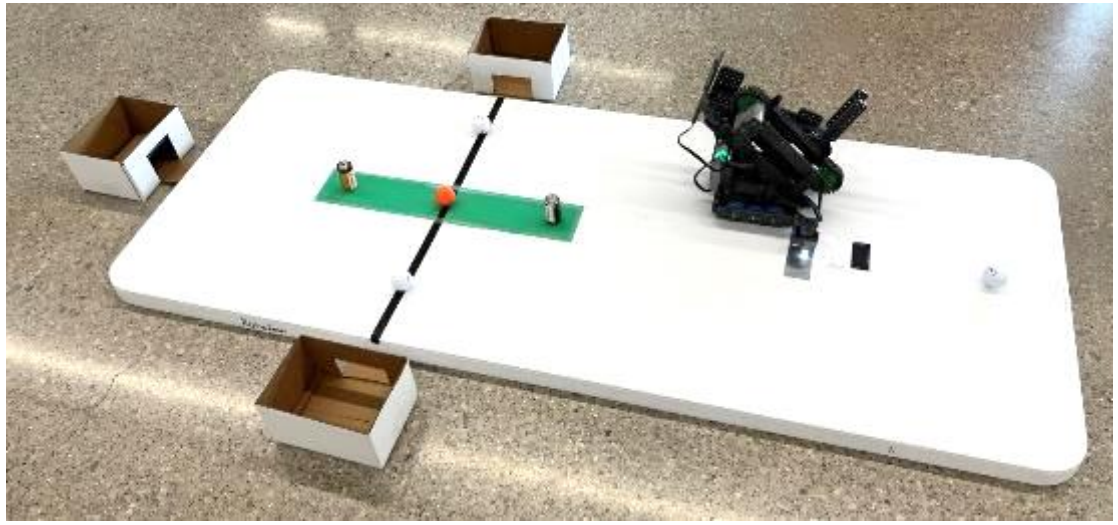
# 1.1 Game Scenario

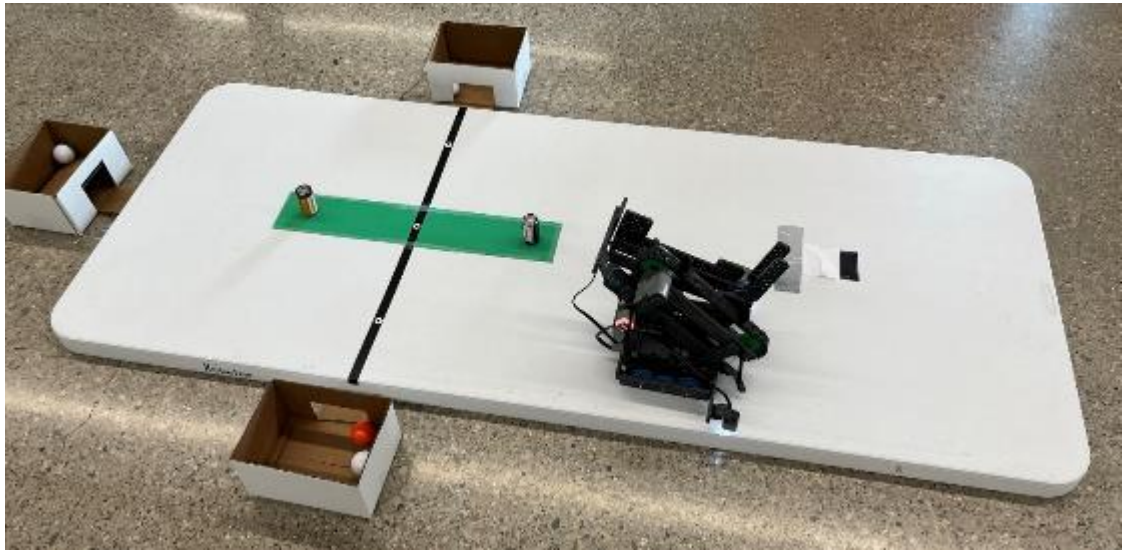
For those who cannot or choose not to drive, self-driving vehicles could be safe and reliable transportation. Those with a disability or the elderly would be able to travel without putting others at risk. Self-driving vehicles could reduce the stress of driving, eliminate driver distraction, lower the number of accidents, and make traveling more sustainable.

Imagine a world where an autonomous taxi can take people to where they want to go or deliver their food.  In addition, imagine if the autonomous vehicle can help an elderly or disabled person get to the second floor of a building.

**Qualifier Category:** Teams compete at local qualifiers, or through video submission, to advance to the Robofest World Championship Finals

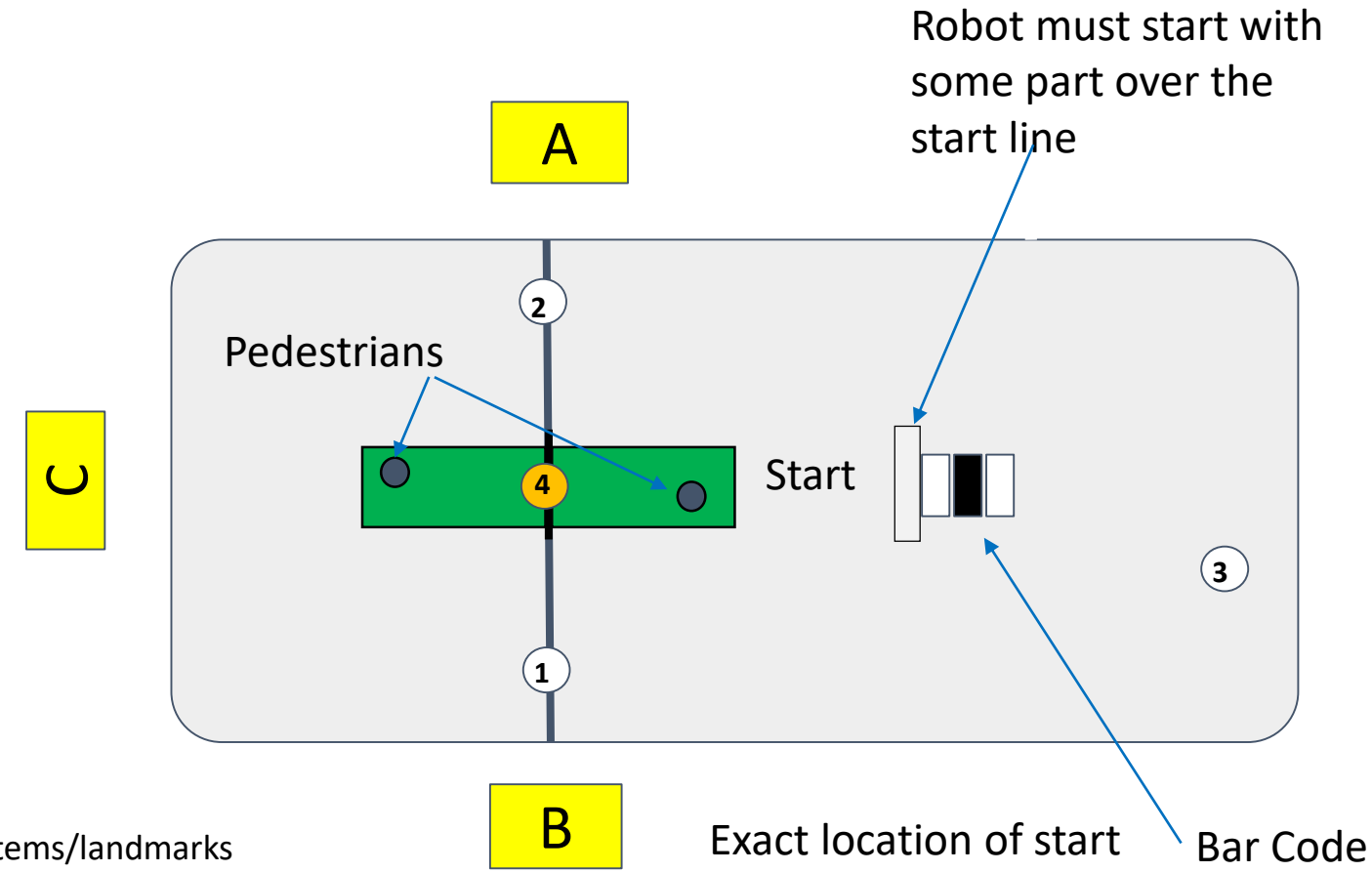
# 1.2 Game Synopsis





- Autonomous vehicle has to take three passengers and a food delivery to their desired destinations while obeying traffic laws and avoiding collisions
- For a game run, max 2 minutes are given and one full-reset is allowed
- All the tasks must be done autonomously without any external help
- UTF (Unknown Tasks and Factors) will be unveiled just before the 30 minute work-time:
  - Passenger destinations (except passenger 3 for Sr Division)
  - Game-Ending Task
  - Items/landmarks may be added for the Game-Ending Task
- STEM Learning Goals
  - Geometry/degrees/logic/computational thinking
  - Localization and navigation
  - Object detection and manipulation

# 1.3 Game Details - Jr Division

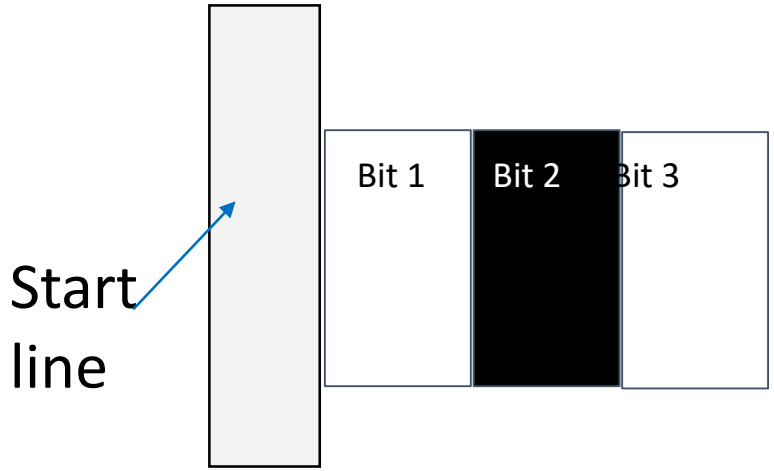



Note: Items/landmarks may be added or modified for the World Championship Finals

- Passenger 1 needs to go to Building C second floor
- Passengers (2, 3) have to be brought to Building A,B or C
- Passenger (2, 3) delivery destinations unveiled before worktime
- Food (orange ball 4) delivered to Building B
- Robot must avoid two pedestrians in the green median
- Robot must stop for at least 1 sec each time it crosses the line or will get a penalty

# 1.3 Bar Code - Jr Division

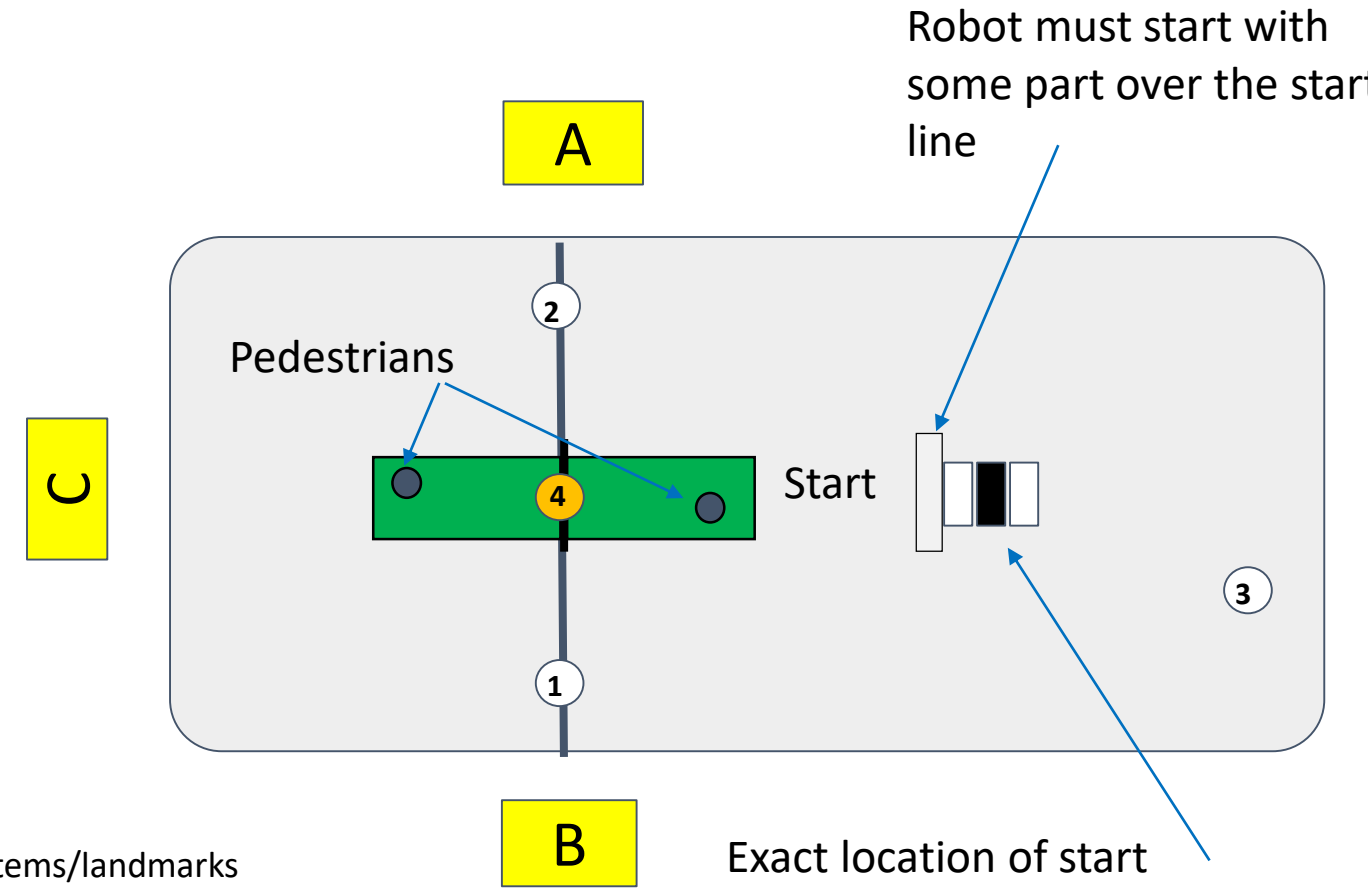
- Bar code may be used for the end task
- Code unveiled after impound




Examples:

- Display the color of Bit 2 at the end of the round
- Stop in front of Goal A if Bit 1 is black, stop in front of Goal B if  Bit 1 is white

# 1.4 Game Details - Senior Division

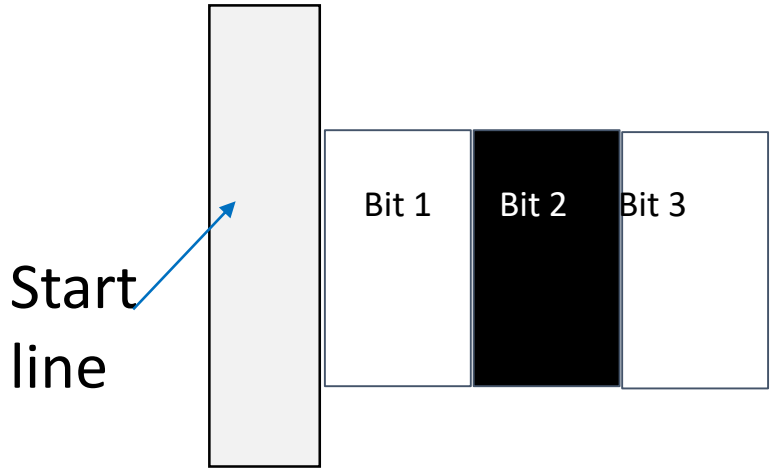



Note: Items/landmarks may be added or modified for the World Championship Finals

- Passenger 1 needs to go to Building C on the second floor
- Passengers (2, 3) have to be brought to Building A,B or C
- Destination for Passenger 2 unveiled before work time
- Destination for Passenger 3 is unveiled via a bar code just before the start of the round.
- Food (orange 4) needs to be delivered to Building B
- Robot must avoid two pedestrians in the green median
- Robot must stop for at least 1 sec each time it crosses the line or will get a penalty

# 1.4 Bar Code for End Task - Sr Division

- As with Jr Division, bar code may be used for the end task for Sr Division
- Code unveiled after impound

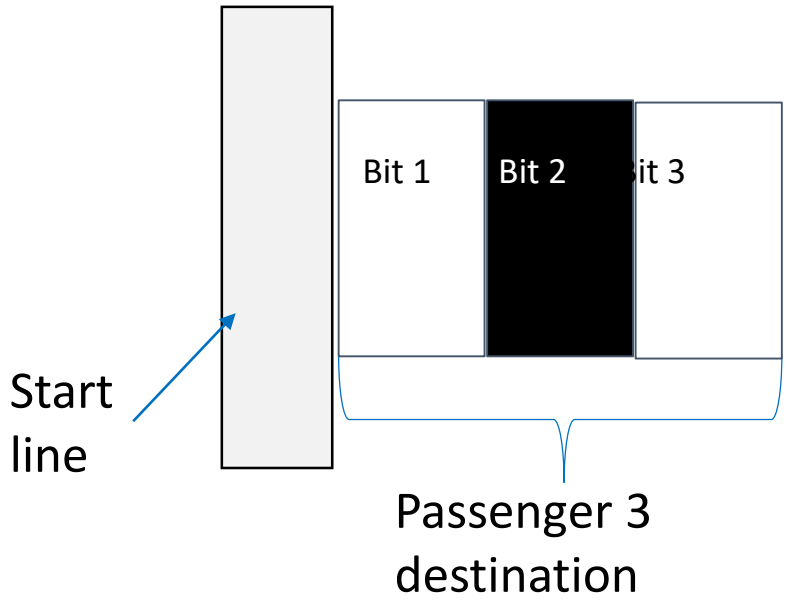



Examples:

- Display the colors of Bit 1, Bit 2 and Bit 3 at the end of the round
- Stop in front of Goal A if Bit 1 is black, stop in front of Goal B if  Bit 1 is white
- Display the sum of Bit 1 + Bit 2+ Bit 3 (assume white 0, black =1)

# 1.4 Bar Code for Destination - Sr Division Only

- 3 bit sequence used for destination of Passenger 3
- Each segment is a binary digit representing a destination
- White= 0, Black =1




| Bit 1 | Bit 2 | Bit 3 | Destination |
|---|---|---|---|
| 0 | 0 | 0 | A |
| 0 | 0 | 1 | A |
| 0 | 1 | 0 | A |
| 0 | 1 | 1 | B |
| 1 | 0 | 0 | B |
| 1 | 0 | 1 | B |
| 1 | 1 | 0 | C |
| 1 | 1 | 1 | C |

THIS EXAMPLE:  Passenger 3 to Building A

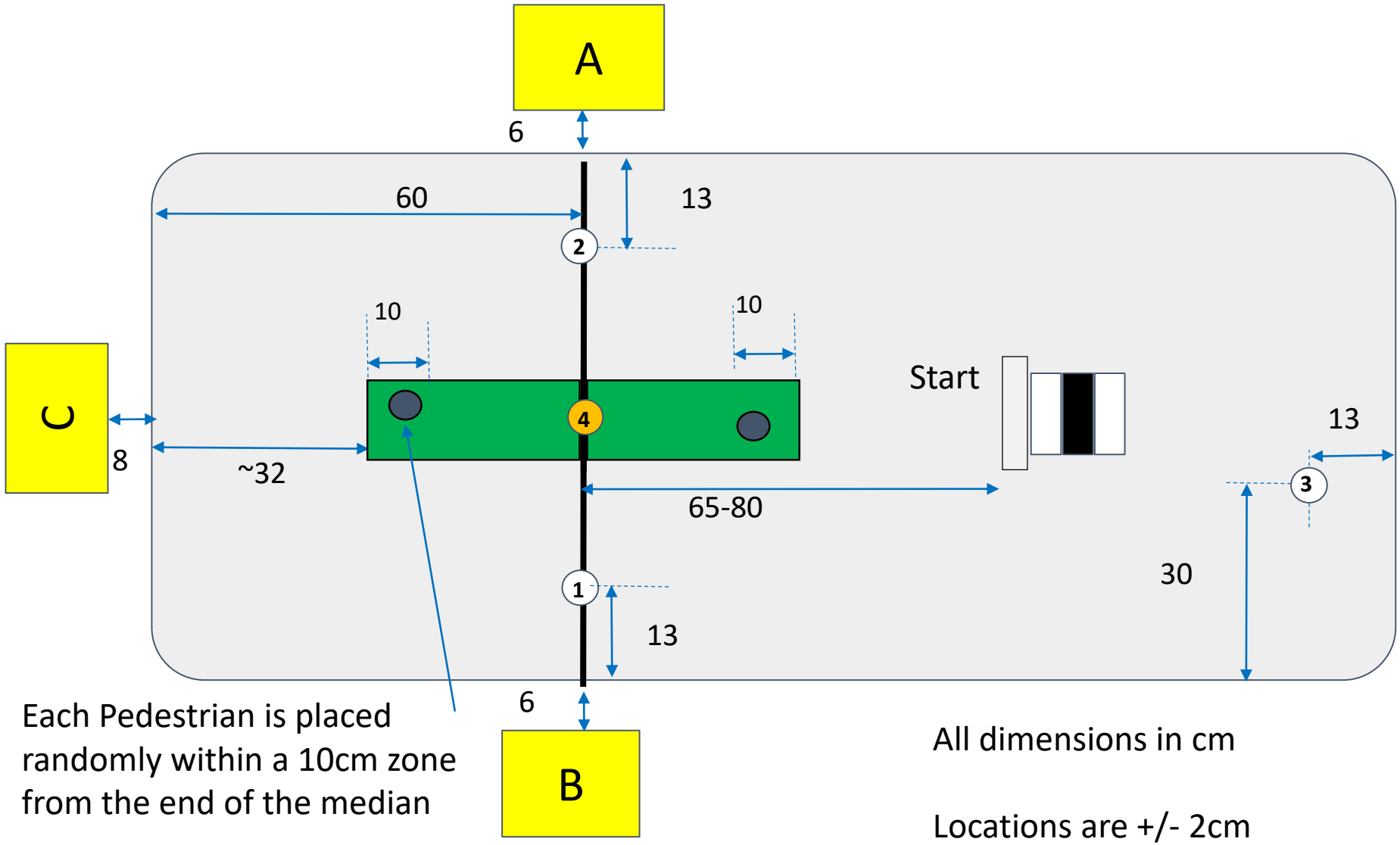
# 2 Age Divisions and Team Size

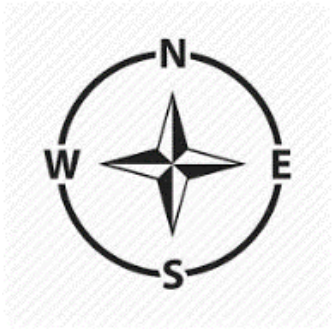
- Two Age Divisions:
  - Junior: (Grades 5-8)
  - Senior: (Grades 9-12)
- Maximum Team Size: 5
- Senior Division World Championship winning team awarded $17,000 renewable LTU scholarship certificate

# 3 Video Demo

- Video Demo
- Video Demo 2

# 4 Field Specifications




Start line, bar code, median, Ball 4, and Building C centered North/South

Each Pedestrian is placed randomly within a 10cm zone from the end of the median

All dimensions in cm

Locations are +/- 2cm

# 5 Differences Between Jr and Sr Divisions

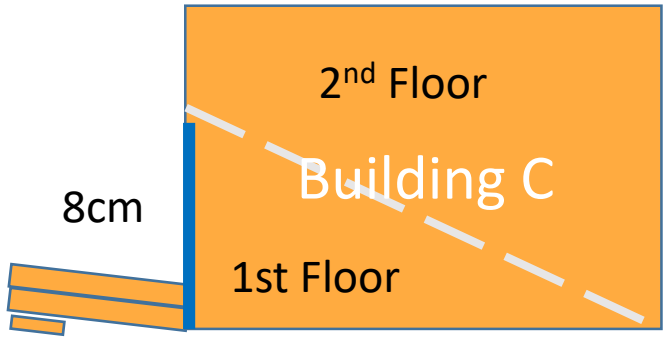
| | Junior (5th ~ 8th grades) | Senior (9th ~ 12th grades) |
|---|---|---|
| Game-Ending Task | Easier – Unveiled before worktime | Harder – Unveiled before worktime |
| Destination of passenger 2 | Unveiled before worktime | Unveiled before worktime |
| Destination of passenger 3 | Unveiled before worktime | Unveiled **after** impound using bar code |
| Number of onboard computer controllers | One | No limit |
| Vision sensor | Not allowed | Allowed |

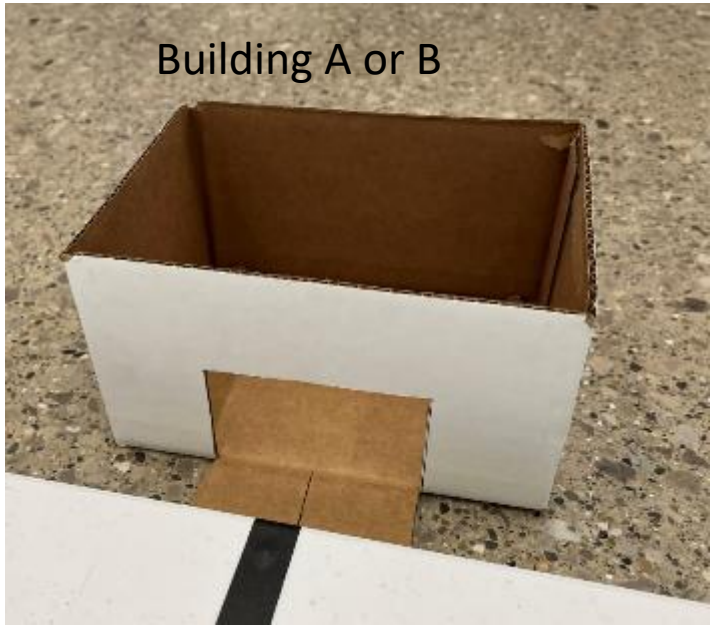
# 6 Materials List

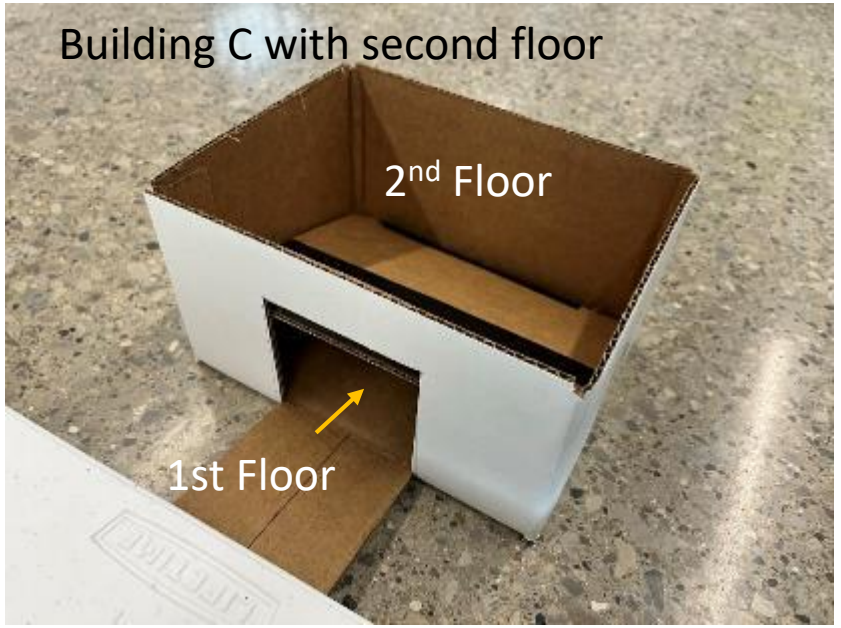
- Field: 6ft plastic folding table placed on the floor:
  - 30in x 72in (actual size is about 75cm x 182cm) - Recommended brand is “LifeTime”
  - Corners are rounded with a radius of 4cm ~ 7cm. Thickness is about 4.5cm
  - Surface is light in color such as white, gray, or almond; exact size, color, brightness, and edge shape is unknown until competition
  - Fold-In-Half plastic tables can be used if the center seam is covered with tape similar to the table color
  - Pieces of plywood cut similarly to the folding tables can be used if plastic folding tables are not available
- Floor color under tables: Unveiled at the beginning of competition day, possibly not homogeneous. However, all the colors should be noticeably darker than the table color
- Passengers/Food objects:  Golf Balls, (3) Standard white=Passengers (link) and (1) orange=Food (link)
- Buildings:  3 Boxes, approx. 8”x6”x4” (20cm x 15cm x 10cm)  See Section 6.1 (link)
- Pedestrians:  2 D sized batteries
- Start line: Foil tape, approx. 50mm wide x 160mm long
- Stop line:  Black electrical or painters tape: approximately 19mm wide
- Median: Green paper (one sheet cut into two approx. 14cm x 11cm pieces)
- Bar code:  Black and/or White paper strips (30mm x 60mm)
- Hole reinforcement stickers: used to mark the location of objects (link)
- Transparent Tape: used to secure the median, bar code and boxes to the table

# 6.1 Buildings

- Balls can be scored from above or through the slot
- Two Building Types
  - Building A and Building B: 10cm wide x 6cm tall slot
  - Building C: 8cm wide x 8cm tall slot, plus a second floor
- Outside color can vary, but flap must be dark so it contrasts with the table

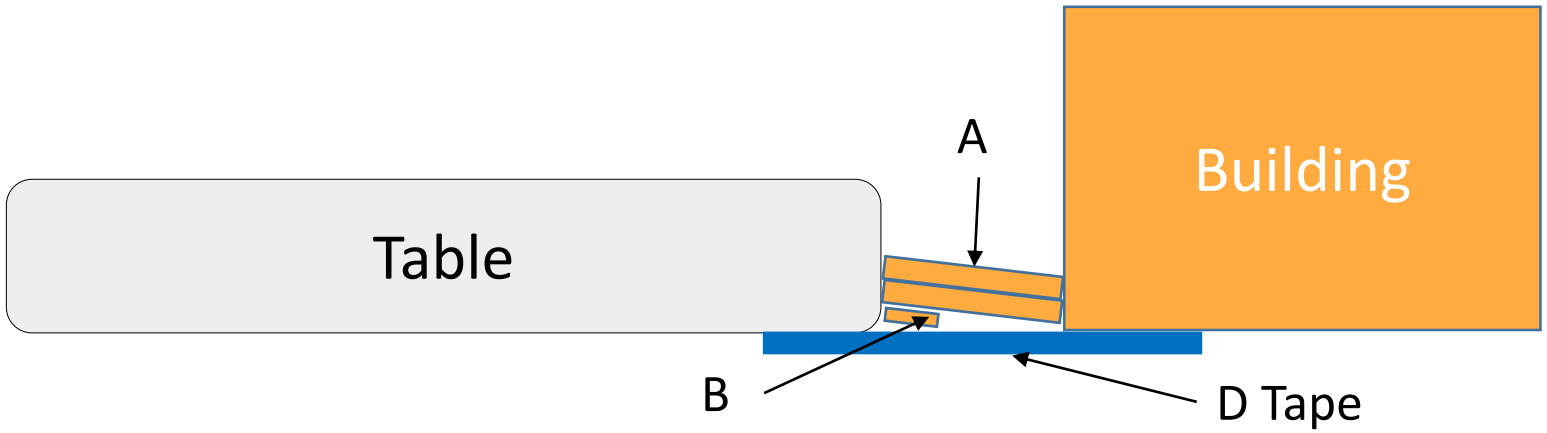


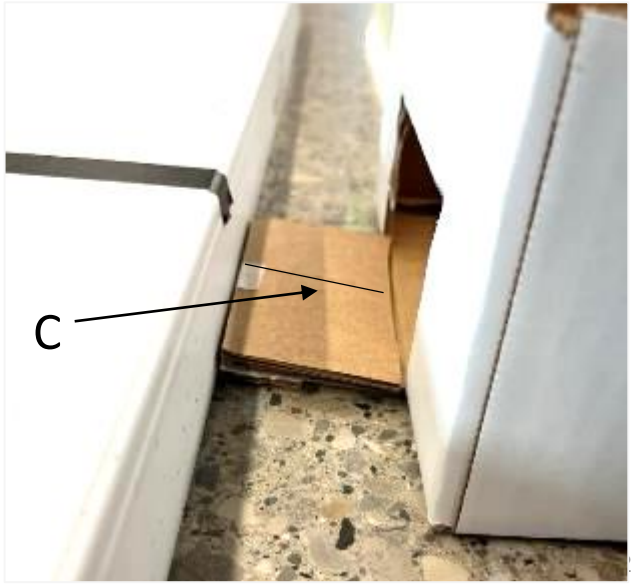



# 6.1 Building Flap Detail

A. Add an additional layer of cardboard (tape or glue) to the flap to help keep balls inside
   - Buildings A and B: 10cm x 6cm
   - Building C: 8cm x 8cm
B. Add a 1” wide piece of cardboard under front of flap to form a ramp
C. Mark the centerline of the flap with pen or pencil to help align to table
D. Tape underside of Building to underside of table

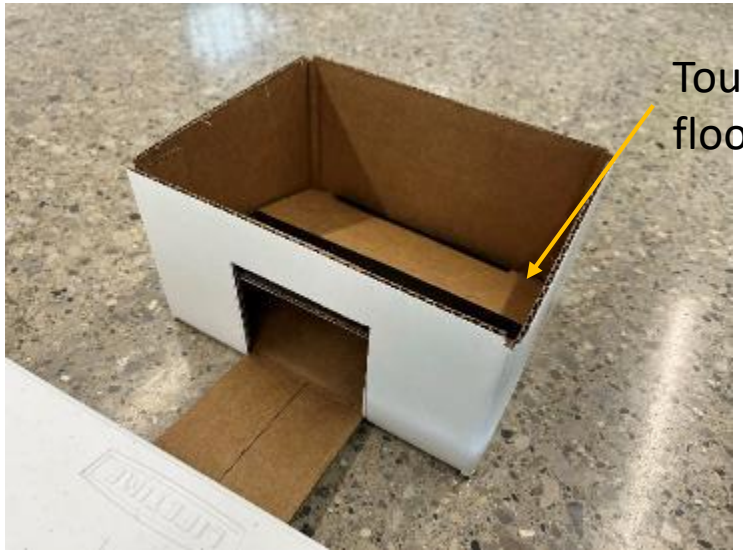


# 6.1 Building C Second floor

8” x 6” (20cm x 15cm) piece is used to make the second floor

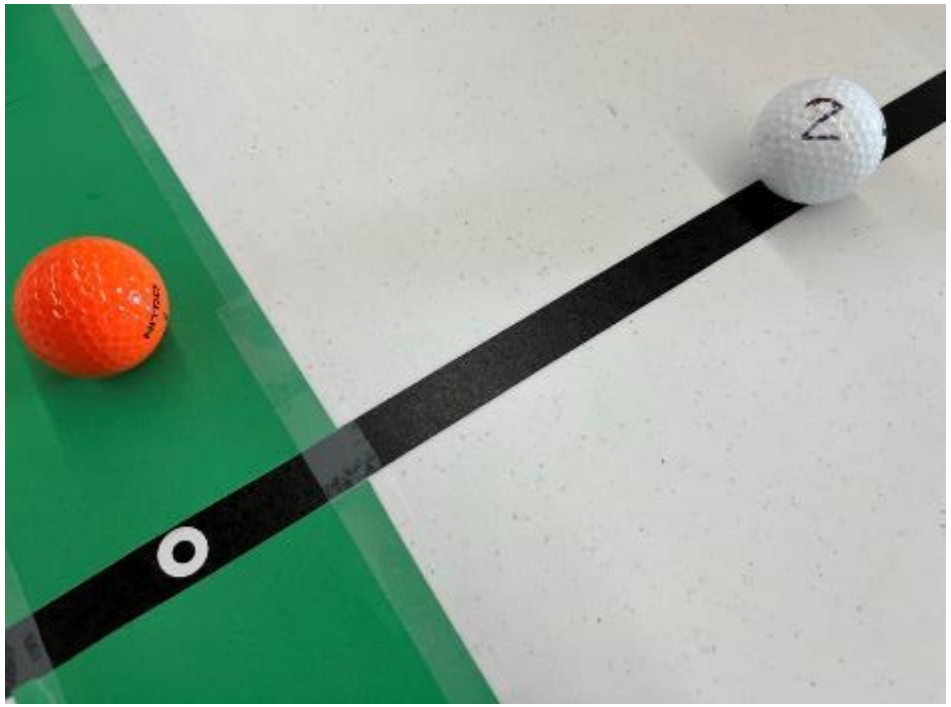
- Can be made by taping two of the long box flaps together


- Passenger 1 needs assistance to go to the second floor of Building C
- Highest points awarded for delivering Passenger 1 to the second floor, and lower points for delivering through the slot to first floor
- Passengers 2 and 3 can be dropped off at either floor (from above or through the slot) for the same points

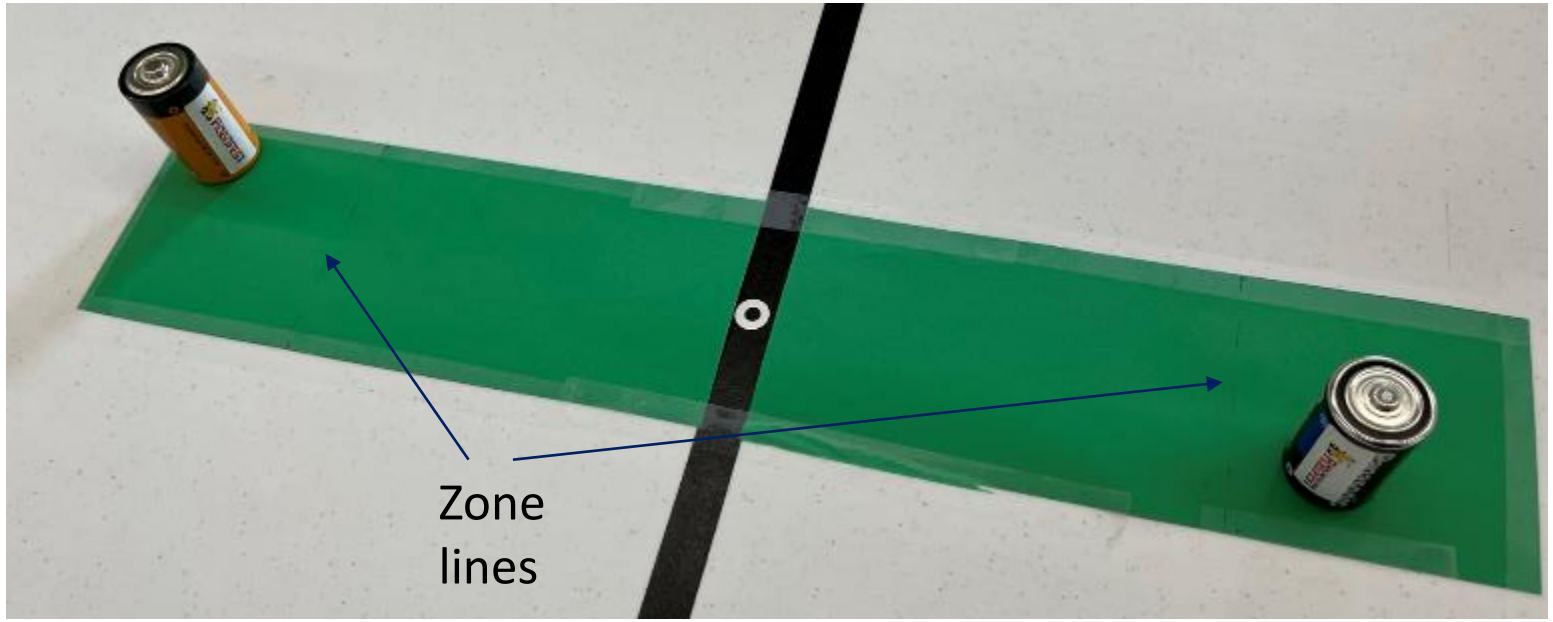
# 6.2 Passengers and Food Objects

- Hole reinforcement stickers are used to mark locations
- Label white passenger balls with a number (1, 2, or 3)
- Orange food ball does not need to be labeled



# 6.3 Green Median

- Cut two 4 ¼” x 11” pieces of green paper (one 8 ½ x 11 cut in two)
- Align short edge of paper with edge of black line and tape down with transparent tape
- Mark 10cm zones with dashed lines



# 7 Robot Specifications

- Robots must be created by students.  If a team is identified to have a robot too similar to another robot (including robots from the same organization and both Jr and Sr divisions) or clearly not their own, team will be subject to investigation and possible disqualification
- Any robot kit/material may be used to construct your robot including tape, glue, bolts and nuts, rubber bands, etc. (Scoring Objects not allowed)
- **Maximum length and width: 35cm x 35cm *including expansion (must show during inspection)***
- Height limitation: none
- Weight limitation: none
- Any number of sensors/sensor types (except vision not allowed for Jr Division) unless harmful to humans
- Any number/type of motors/servo motors (multiplexor is OK to use)
- All the wheels for driving must touch the table surface during inspection
- Labeling requirements:
  - Robofest Team ID (on any visible surface - Team Name optional)
  - “Front” indicator
- Display screen for any Game-Ending Task that requires robot to display numbers

# 8 Violations, Full-Reset, End of Run Declaration

- When any of the following violations occur, Judges shall stop the game play (and robot if still moving) immediately to avoid further disruption of the field:
  - Human touches the robot or field materials. Once the robot starts moving, the player cannot touch it
  - Robot falls off the table (any part of the robot touches the floor)
  - Any other illegal activities that a Judge determines
- The team can request a one-time full-reset (with penalty points) at any time. If reset is selected, time continues to run while Judges reset the table
- Team may declare the end of the run at any time. Players should not move the robot until instructed by the Judge
- If the robot is still moving when team calls “end of run” (or at the time limit) no points will be awarded for the Game-Ending Task which requires the robot to stop

# 9.1 Procedure/Rules to Play 2 Rounds (1/3)

- Only contestants are allowed to access the pit area, team tables, practice fields, and official game fields throughout the competition, including during the setup time before the opening ceremony, during work time, and breaks
- When Unknown Tasks and Factors (UTF) are unveiled, teams will be provided a hard-copy of the UTF and/or it will be projected/displayed on a screen. See 9.1 and 9.2 for UTF examples
- Teams will be given a 30 minute work-time after UTFs are unveiled to work on their robots. Prior to the start of the work time, all people, except contestants and authorized staff/volunteers, will be **dismissed** from the competition area(s)
- During the practice time, teams must share the fields

# 9.1 Procedure/Rules to Play 2 Rounds (2/3)

- All teams must submit their robot to the impound area when the 30 minute work-time has expired. Robots may be taken to be impounded early. Only one team member should deliver the robot to the impound table. Penalty may be applied if not impounded in time
- During the impounding process, Judges will inspect the robots. (Size of the robot, Team ID, “Front” label, number of computer controllers, etc.)
- No power will be supplied at the impound table and the entire robot must be impounded, including rechargeable batteries
- Teams will compete in a predetermined order decided by the site host
- During the Game Rounds, all team members must remain in the team spectator area – no pit access allowed

# 9.1 Procedure/Rules to Play 2 Rounds (3/3)

- When a team is called to compete, a maximum of two contestants per team are allowed to retrieve the robot from the impound area and to be present at the playing field during the run
- Judge (or Emcee) will check if (1) timer is ready (2) Judges' are ready (3) teams are ready. Then count down "3-2-1 - Go" to start a Game Run
- Contestants must stay near the Start Zone. They should not follow the robot. They can approach the robot only to end the run, request a reset, or when Judge tells them
- Final scoring is done after the run is over
- A team member must sign the score card to confirm the team's score
- Teams will play two rounds, each round will have a different set of UTF's (Unknown Tasks and Factors)

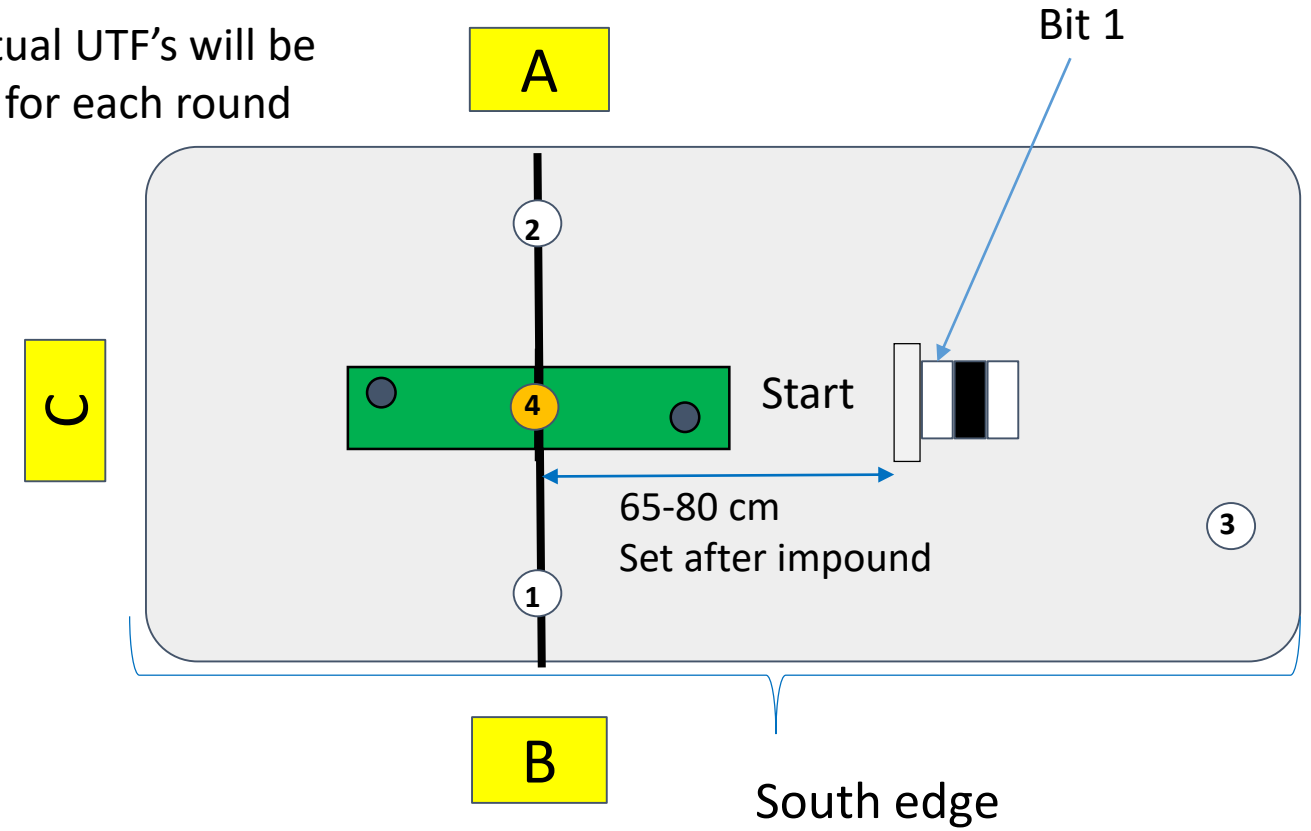
# 9.2 Score Card

[Official Score Card]

| Judging Items (to be checked at the end of the run) | | | Count | Actual Count | Point Value | Score Earned/Lost | max |
|---|---|---|---|---|---|---|---|
| #1 | Passenger 1 | Building C Second Floor | 0 (no) 1 (yes) | | 20 | | 20 |
| | | Building C First Floor | 0 (no) 1 (yes) | | 12 | | |
| | | Building A or B | 0 (no) 1 (yes) | | 10 | | |
| | | Moved | 0 (no) 1 (yes) | | 5 | | |
| #2 | Passenger 2 | Correct Building | 0 (no) 1 (yes) | | 15 | | 15 |
| | | Incorrect Building | 0 (no) 1 (yes) | | 10 | | |
| | | Moved | 0 (no) 1 (yes) | | 5 | | |
| #3 | Passenger 3 | Correct Building | 0 (no) 1 (yes) | | 15 | | 15 |
| | | Incorrect Building | 0 (no) 1 (yes) | | 10 | | |
| | | Moved | 0 (no) 1 (yes) | | 5 | | |
| #4 | Food (orange) | In Building B | 0 (no) 1 (yes) | | 15 | | 15 |
| | | Moved | 0 (no) 1 (yes) | | 5 | | |
| #5 | Pedestrians | In median( completely in green) | 0, 1, 2 | | 5 | | 10 |
| | | On table outside median | 0, 1, 2 | | 2 | | |
| | | Off table | 0, 1, 2 | | -1 | | |
| #6 | Game Ending Mission achieved | | 0 (no) 1 (yes) | | 15 | | 15 |
| #7 | Stop Line violations | | | | -2 | | 0 |
| #8 | Robot remained intact throughout the run | | 0 (no) 1 (yes) | | 10 | | 10 |
| #9 | Reset was requested (reset penalty) | | 0 (no) 1 (yes) | | -3 | | 0 |
| | | | | | **TOTAL SCORE** Total maximum score = 100 | | 100 |
| | | | | | **Time Left in Seconds** Record only if score is 100 | | |

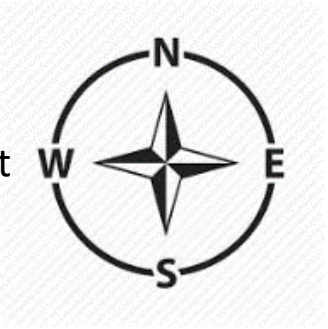
# 9.3 UTF Example (Jr)

Note: actual UTF's will be different for each round




| Passenger | Destination |
|---|---|
| 1 | C |
| 2 | A |
| 3 | B |

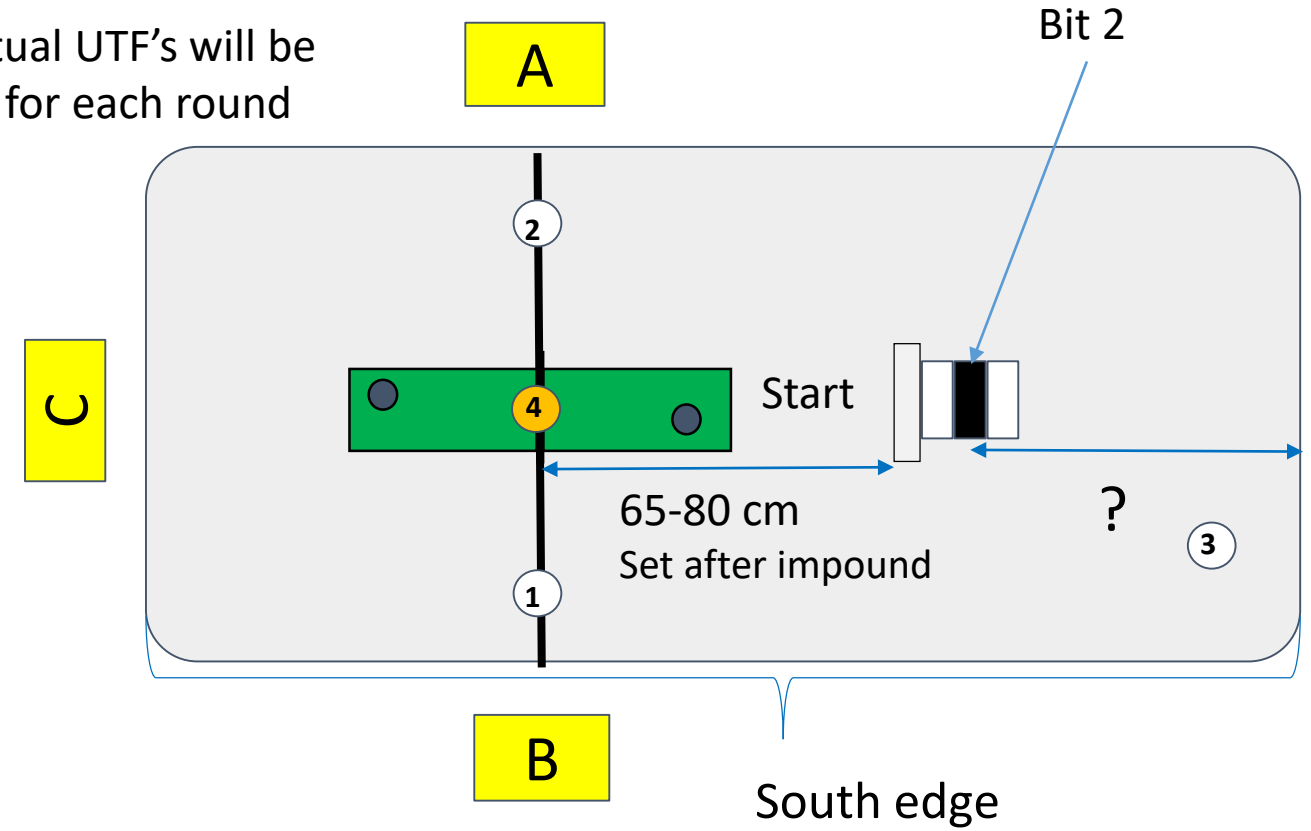
Exact location of start line and bar code be unveiled after impound




Game-Ending Task: the robot must be stopped with a sensor positioned over the south edge of the field and displaying the status of Bit 1 (0 if white, 1 if black)

# 9.4 UTF Example (Sr)

Note: actual UTF's will be different for each round




| Passenger | Destination |
|---|---|
| 1 | C |
| 2 | A |
| 3 | ? |

Exact location of start line and bar code will be unveiled after impound


Game-Ending Task: the robot must be stopped with a sensor positioned over the south edge of the field and display the distance from Bit 2 (midpoint) to the East edge of the table in centimeters (cm)

# 9.5 Rules to Determine Winners and Break Ties

- Winners in each age division will be decided by the **(Best + Average)/2** score of the 2 rounds
- Tie breakers will be: (1) best score of two rounds, (2) highest time left from best score(if 100pts), (3) rerun, if needed
- For example:

| Team Name | Round 1 score | R1 time left | Round 2 score | R2 time left | **Avg. Score** | **(2) Best score** | **(1) (Best+Avg)/2 score** | **(3) Time left best score** | **Rank** |
|---|---|---|---|---|---|---|---|---|---|
| Team A | 80 | | 100 | 15 | 90 | 100 | 95 | 15 | **1** |
| Team B | 100 | 10 | 80 | | 90 | 100 | 95 | 10 | **2** |
| Team C | 100 | 20 | 70 | | 85 | 100 | 92.5 | | **3** |
| Team D | 60 | | 100 | 5 | 80 | 100 | 90 | | **4** |
| Team E | 90 | | 90 | | 90 | 90 | 90 | | **5** |

# 11 FAQ

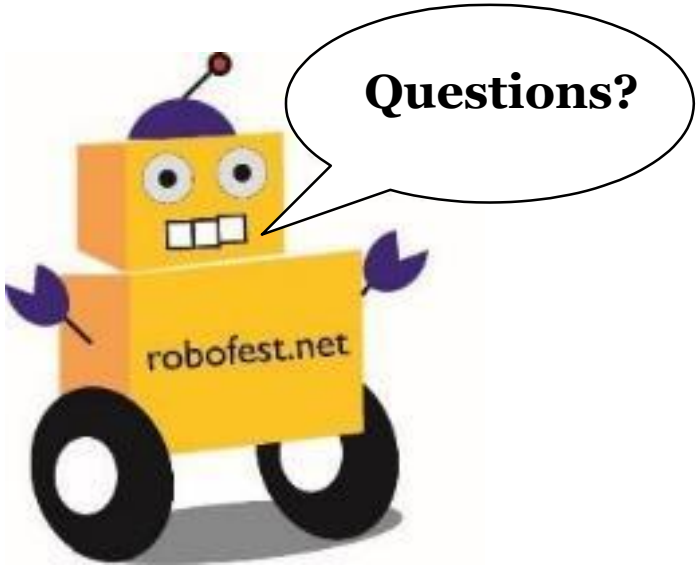
- Is there any limit on the number of controllers in Robot Game? For example, can I use 2 Spike Prime Hubs? **Jr Division is limited to one controller. There is no limit for Senior Division**
- Do passengers have to be picked up or dropped off in a specific order? **No, scoring will be done at the end of the round so there are no requirements on order**
- Can the slot in the box be used to score? **Yes, balls (passengers) can be put in the box from the top or the opening on the side**
- A player failed in starting the robot. Can the player retouch the robot to start? **Yes. Will not be considered a rerun. Timer will continue to run**
- Robot is touching objects at the end of run. Is this OK? **Yes. The object will be scored the same as if there was no contact with the robot**
- Can more than one passenger be sent to the same destination? **Yes. There is no restriction for Passenger 2 or Passenger 3, so their destinations could be the same.**

# 11 FAQ

- Is Building A a potential destination for Passenger 2? **Yes. There is no restriction for Passenger 2, so the destination could be A.**
- How will judges know if the correct passenger is in the box? **Passengers (balls) will be have numbers on them.**
- Is a sensor required to detect the color of the balls? **No, while a color or vision sensor may be helpful, enough information is provided or unveiled to do the challenge without them.**

LAWRENCE TECHNOLOGICAL UNIVERSITY
ROBOFEST

# Little Robots, Big Missions




Game Committee Members

Prof. Elmer Santos *
John Arnold
Dr. Wisam Bukaita
Dr. Christopher Cartwright
Prof. Peter Guenther
Dr. CJ Chung

* Committee Chair

Send questions to: robofest@LTU.edu

ROBOFEST Lawrence Technological University

# Q & A

Next Kickoff Meeting: January 13, 10:00 am

Rules documents will be adjusted for clarity and to add any questions/answers

Send questions to robofest@ltu.edu