Main Project | Warehouse Race

ECE 3331 | Robotics Project Laboratory | Spring Semester 2025

Project Description

The Surplus Inventory Warehouse at Texas Tech is looking to optimize their package delivery system. To support this goal, they have created a competition to find a robot which can quickly move packages from the warehouse to the delivery platform. The fastest robot will be determined through a single-elimination tournament. During each round of the tournament, robots will race to collect a randomly assigned package and place it on the delivery platform.

Game Diagram

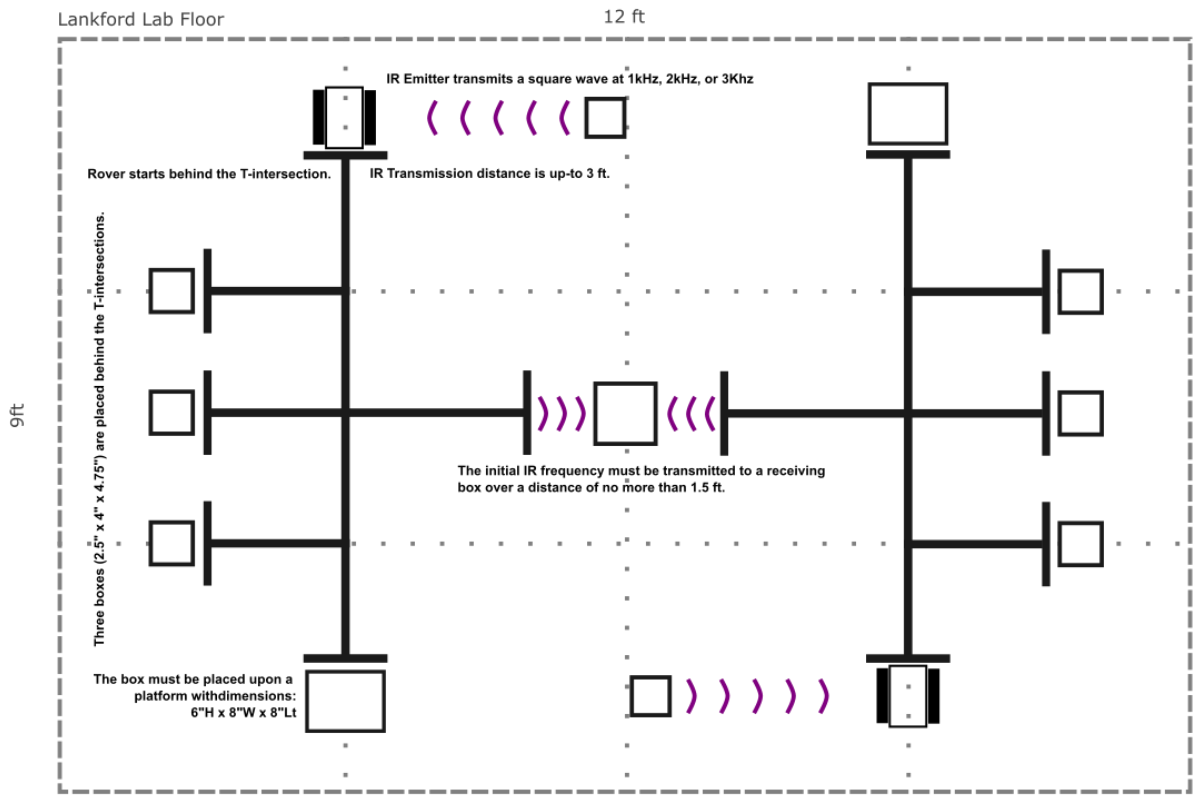

Figure 1: The Warehouse Race game field and elements.

Game Tasks

During each round, robots must complete the following tasks. Figure 1 shows a schematic depiction of the game field and game elements.

1. Once powered on, each robot will wait to receive a periodic IR ($\lambda = 890nm$) square wave with a frequency of 1kHz, 2kHz, or 3kHz.
2. Once the IR signal has been received, each robot will navigate down a track composed of 1" metallic tape covered with black gaffer's tape.
3. Three packages will be located to the right of the main track with perpendicular paths leading to T-intersections beyond which the boxes are placed.
4. Each robot must pick up only the box which was indicated by the frequency of the IR starting signal (e.g. 1kHz = Box 1, etc.)
5. Each robot must then carry the box to a 6" tall platform at the end of the main path and place the box upon the platform.
6. Once the box is placed, robots will navigate to the station at the center of the field and transmit the IR starting signal to the station.
7. The first robot to place a box and transmit the IR starting signal to the end station will be declared the winner of the round.

Additional Rules

- Once the IR starting signal is activated, students may not touch the robot until the end of the round.
- Students may place their packages prior to the start of the round in any orientation or position so long as the package is behind the T-intersection.
- The package must be placed entirely within the bounds of the delivery platform.

Engineering Constraints

- Each robot must be fully autonomous and untethered during each round.
- All logic must be performed via the FPGA on the Basys3 board.
- Each robot must be powered via a single 9.6V battery.