

LaserBot (Laser Tag)

Our team built two robots that entertain by playing laser tag, human vs. human, human vs. robot, or robot vs. robot. These robots therefore entertain both the players and audiences of any size. To build these robots, we needed to implement several systems: the body and control system, a visible/audible interface, an infrared emitter and detector, and an AI.

- 1. *Body and controls: how to play.*** The robots use a square base with omni wheels in order to maximize mobility. The left joystick on the wireless controller moves the robot linearly while the right rotates the robot. The robot turret has a “gun” with an infrared LED and a visible LED and an ultrasonic sensor mounted below. Channel 5 rotates the turret, limited by a shaft encoder to prevent wires tangling or coming unplugged. (Initially, we used a cord detangler to enable infinite rotation, but the ultrasonic added too many wires, though in theory a detangler for more wires could be manufactured.) Buttons 7D and 8D fire the gun.
- 2. *Interface: what you see and hear.*** The robots are equipped with 2 LEDs and a sound system. The green LED lights when the robot is in AI mode. The red LED flashes more quickly each time the robot gets hit, finally lighting solid when the robot loses. The robot also uses three sounds to indicate its state: a chime upon each hit, a warning beep when only one hit remains, and a siren when the robot is defeated. Because no VEX parts existed that could serve these purposes, we used piezo buzzers and built simple transistor circuits switched by a digital out signal pin in order to drive sufficient current.
- 3. *Infrared array: implementing laser tag.*** Because VEX line tracking sensors would not function as guns / detectors, we used standard infrared LEDs and detectors used for remote control signals / data transfer. The “gun” LED is on a driving circuit consisting of an IC switched by a Cortex digital output, while the receiver—actually an array of 8 in parallel, to maximize likelihood of capturing a hit—is read by an analog input that reads low when hit. Narrow-beam LEDs minimize false positives and the gun shafts further restrict spread to improve accuracy.
- 4. *Artificial Intelligence: playing against the robot.*** The robot can entertain in many ways: two people can play against each other, or one can play against the computer on the other robot, or even sit back and watch while the two fight it out. As our video shows, the robots can entertain crowds, as well. The AI executes random maneuvers for avoidance while searching with the ultrasonic sensor for a target in range. If it finds one, it fires its gun. Consequently, these robots are ideal for use in open arenas.

With even more laser tag robots, players could conduct massive battles and open the possibility for cross-robot communication for sophisticated AI opponents.