Western Kansas Lego Robotics Competition

April 28, 2017

Fort Hays State University

WELCOME

FHSU is hosting our 11th annual Lego robotics competition. The competition is open to all area middle school students (grades 5-8).

This event will be held at the campus of Fort Hays State University on Friday April 28, 2017. The event will start at 10:00 a.m. (registration begins at 9:00 a.m.) in the Ballroom of the Memorial Union. Parking permits will be supplied to teachers at check-in. The event will end at 3:00 p.m. after the award ceremony.
OVERVIEW

Each team of students will compete in at least one event and up to as many as they wish (there will be a total of 5 events). A team may consist of 1-5 members. Multiple teams from one school are permitted.

Each competing robot must be constructed solely from parts found in a standard Lego robot kit: either NXT, or NXT 2.0, or EV3 (retail or educational) kits may be used (sumo bots may use parts from multiple kits). Also, all events require that the robots be autonomous. Teams with robots found to be in violation of the rules will be disqualified. If competition courses are set up outside of the main event areas, teams may use them for practicing. However, teams may not practice on courses set up in the competition area unless given permission by the judges. Remember, due to time constraints this is purely a competition event. Students are expected to have fully working programs upon arrival.

It is expected that all robots will be programmed to begin competing at the press of the center orange (NXT) or center grey (EV3) button. Calibrations of sensors (e.g. black/white light/color sensor intensity calibrations) will be allowed (and is encouraged). The contest will begin upon the final pressing of the orange/grey button (sometimes a delay between pressing the button and robot motion will be required—see the Sumo bot event!). Teams will get only two chances to successfully start their robot. This means that if the wrong program is started by accident the team can tell the judges and have one more chance to start their robot. Note that teams must use their “second chance” immediately; no additional programming can be done once the team has been called to compete. It is not required for the robot to automatically stop at the completion of an event unless otherwise specified; when the judges have finished they will indicate that the robot can be picked up and deactivated.

Awards will be given for 1st, 2nd, & 3rd places in each event, as well as an overall traveling trophy for the team that acquires the largest number of total points (first place team award). Second and third place team awards will also be given. Points will be awarded for the top-five ranked teams: 1 pt for 5th place, 2 pts for 4th place, 3 pts for 3rd place, 4 points for 2nd place, and 5 pts for 1st place. Exception: only the top 4 teams will be awarded points in the Sumo Bot event. No points will be awarded to teams who place below the top five in each event.

Any eventualities which arise that are not discussed herein will be decided by the event’s final arbiter.
EVENTS

1) Line Follower

This event is a combination of a line-following race and obstacle detection. The goal is to follow the track (0.75 in. wide black electrical tape placed on a white board) as rapidly as possible. Robots must leave the start area and traverse the line course. The line forks into two lines. The fork is symmetric with an angle value of 90°. Once the robot reaches the fork in the road, it should choose the direction towards an obstacle box (17 oz Honey Nut Cheerios box, unopened), which is placed 6 in. beyond the end of the line. The distance between the fork and the box will be less than or equal to 24 in. No other obstacles will be present within a 48 in. range from the fork. The robot should follow the line towards the box, then turn around without touching the box and go back to the start position. Teams may only use one light or color sensor, and one ultrasonic sensor. An example line following course is depicted at the right. When a team is ready to begin (just before pressing their robot’s start button) the judges will randomly place the Cheerios box at one of the two possible end-of-fork positions. The robot that traverses the course in the least amount of time will be awarded first place. Point scores for the first five teams will be given; 1st place (quickest robot) gets 5 points, 2nd place gets 4 points, etc.

2) Sorting Colors

A color sensor will be used to detect and sort colors of M&M chocolate candies (oblate spheroid shapes). Red and blue M&M candies will be used on an 8.5 in. wide white mat (letter paper, with several taped together for additional length). The mat will be divided into two equal halves with a piece of 0.75 in. wide black electrical tape. Ten candies will be placed (centered) on the tape in random-color order, at least 5 cm (center-to-center) apart from one another. Robots start outside of the mat (but the illuminated sensor area may be just on the mat) moving along the electric tape. The task is to sort (move) the blue candies to the left side of the tape and red ones to the right side (from the robots perspective). Candies should not leave the mat, and also must not be on the black tape to qualify as correctly sorted. Time will be stopped when the color sensor illumination area reaches the end of the tape. The robot’s travel time will be recorded with a stop watch from the beginning till completion of the exercise. Teams may use 4 motors or less and only one color sensor. Teams which correctly sort all candies will be ranked by shortest time; fastest gets 1st place with 5 points, the next quickest gets 2nd place with 4 points, etc.
3) Slalom

The goal of this event is to traverse a slalom as quickly as possible. The event will be timed; each robot will be given a total of 90 seconds to traverse the course. The robot which transverses the course from start to finish in the shortest amount of time wins. Robots are allowed to have one ultrasonic sensor, one light or color sensor, up to three touch sensors, and up to three motors. Bumping into the slalom poles or grabbing them is permitted. Slalom poles will be constructed from nominal 1 in. white pvc pipe (the tops will be attached with tees and elbows to the lengthwise sections. The center to center distance between poles will be 12 in., and there will be 10 in. of vertical clearance under the top rail. One of the vertical poles will be missing. Therefore, one of the distances between two poles will be 24 in. The missing pole will vary for different stations, and teams that arrive to compete at a station may randomly be sent to another station. Robots are not allowed to touch the top rail, but can observe it with the ultrasonic sensor. Teams will position their robots at the start such that the front most part of the robot is behind the first slalom pole. Robots can traverse the slalom beginning in a right- or left-handed fashion, but must go around the slalom poles in traditional alternating directions. To finish, the robot must touch the final slalom pole (it does not have to stop; the judges will stop their stopwatches when they see contact and the teams can then retrieve their robots). Judges may be holding the slalom 2 feet from the starting and ending poles, so care should be taken if using the ultrasonic sensor to not trigger on distances greater than ~2 ft. If a team’s robot does complete the course before 90 seconds is up, it will be disqualified. Point scores for the first five teams will be given; 1st place (quickest robot) gets 5 points, 2nd place gets 4 points, etc.

4) Clear the field

The goal of this event is to remove open-end-down plastic cups (16 oz) from a square white mat (with an electrical tape border). Robots are allowed to use one light or color sensor, 3 motors, and one ultrasonic sensor. The footprint of the robot must not exceed 8.5 x 11 in. (standard letter paper size), and the robot cannot have deployable arms or parts that exceed this footprint after starting the competition. Three cups will be placed around the mat (the same arrangement for every team) and the robot can spend up to 90 seconds clearing the field. The robot that clears all three cups off the field first wins! A cup will be considered clear of the field if it is on the black tape but cannot be breaking the vertical plane between the inside tape edge and the white mat. The mat will be square, with 36 in. between opposite inside tape borders. Robots will be started in the center of the mat, oriented in a direction of the team’s choosing. There will be a taped off empty field extending one meter beyond the black tape border where people will not be allowed to stand (so that the ultrasonic sensor is not as confused). Point scores for the first five teams will be given; 1st place (fastest team to completely clear the field) gets 5 points, 2nd place gets 4 points, etc.
5) Sumo Bots

Two robots (from opposing teams) will face off in an elimination style Sumo match! The robots must be autonomous (not externally controlled). The robots will be placed on a painted wood regular octagon (see figure below). The white area in the center is surrounded by a 4” wide black strip, or “danger zone”. Teams will probably want to make use of light (or light/color) sensors (for making sure the robot avoids the “danger zone”) and the ultrasonic sensor (for finding the enemy robot). The robots will start back to back (with 14” between them), and they must be programmed to start moving 5 seconds after pressing the orange button. Any robots starting before 5 seconds has elapsed will be disqualified! Up to two light/color sensors may be used on a robot, but only one ultrasonic sensor may be used. Up to three motors may be used. Parts from multiple kits may be used. Robots with a mass greater than 907.2 g (weight of 2.000 lbs) will be disqualified; the robots will be massed before competing. The robot playing surface will be slightly elevated above the floor; the first robot to fall off the playing surface and touch the floor loses. Also, if any piece of a robot detaches and hits the floor first, that robot loses the match. If both robots are still on the mat after 90 seconds have passed, the robot with the smaller mass will advance. Point scores for the top four teams will be given; (the losers of the semifinal round will face off to get 3rd and 4th place, while the final round will determine 1st and 2nd place). First place gets 5 points, 2nd place gets 4 points, etc.