Unified Sumo Robot/ArtBot - Bartending

Rene Diyarza, David Feetterer, Jose Villegas, Yousef Alghareeb

Department of Mechanical Engineering, Northern Arizona University, Flagstaff, AZ

Abstract

In sumo wrestling, there are two individuals who face each other within the *dohyo*, a circular ring, with the goal of pushing each other off the ring. For this project, matches will follow the same rules of a sumo wrestling. The objective of this competition is for robots to push each other out of the arena. The competition will be held within the university and will be competing with other students. Each match will have three rounds each within three minutes. A team wins a round either by pushing the other robot off. All the teams will be participating in the mega/humanoid class which consist of a remote-controlled robot and an autonomous robot.

Another requirement for the project was to pick an event from ROBOGAMES. From the website, the team chose to do the "ArtBot – Bartending". The minimum that is required for this robot is it needs to prepare any mixed drink with one mixer and spirit. Following the competition, there are objectives that must be met. The following requirements are: aesthetics, style, delivery, and versatility.

Introduction

The Sumo 3kg (R/C and auton) is a competition that is organized by the RoboGames. Teams are required to construct a robot for each of the classes they want to participate in. Northern Arizona University wants to replicate this competition for the Department of Mechanical Engineering. Teams that are participating in the school's version of the competition will follow the rules and restrictions that originally with the RoboGames. The following table shows the engineering requirements that were derived from the rules on the RoboGames website.

Table 1: Engineering Requirements and Restrictions

Engineering Requirements	Restricitions
L	<20 cm
W	<20 cm
H	Unlimited
Total Weight	<3000 g
Start Up	5 s
Controllers	75 Mhz
Edges	<.005"

The team will follow the requirements for the ArtBot – Bartending but will have no competition. The following requirements are: aesthetics, style, delivery, and versatility.

Engineering Design

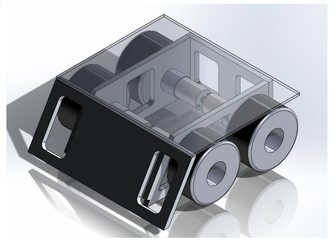

Figure 1: Autonomous Robot

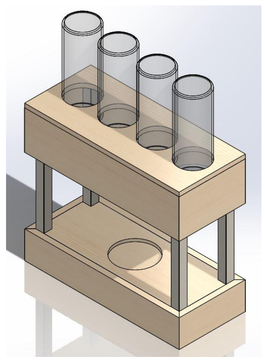

Figure 3: Bartending Robot

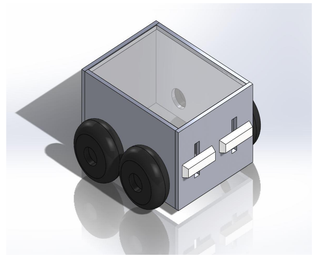

Figure 5: R/C Robot

Autonomous Robot

Two type of sensors were used to identify the edge of the arena, line sensors, and opponent sensors. Two of QTR-1A were used to sense the edge line on the right and left front of the robot. Five of Keyence Multibeam pz-g41p infrared sensors were used to detect the opponent and push it out of the arena. In general, motors were used to move the robot with batteries connected on series to double the delivered current. The robot was programed using an Arduino coding language. The algorithm for the robot is to wait 5 seconds when it started because it is one of the requirements for this robot. If the sensors detect opponent while rotating then it would start going forward to push the opponent.

Bartending

There are no restrictions for the design of the robot; only that it must prepare any mixed drink with one mixer and spirit. The design of the robot consist of wooden frame both at the top and bottom, which house the internal components. The top is where the pumps are connected to a 3D printed cradle for the bottles can sit. FDA approved tubing is attached to the pumps to and all are met at the opening located at the opening to where the liquids are dispensed. The bottom is where the board and Arduino is located, underneath the drip tray. Programming of the Arduino consists of the functioning of the pumps and a code to dispense recipes.

R/C Robot

In designing the R/C robot, the issue is making the controller communicates efficiently with the radio receiver. The receiver then outputs the incoming signal from the remote to the Sabertooth. The Sabertooth will limit parts like servomotors for the weight restrictions and the can control the wheels in tank mode. Tank mode eliminates the need of using servos to steer the robot making the Sabertooth a powerful yet light component. All motors drive the robot simulating an all wheel drive system of a car for maximum torque having a ratio of 75:1. Four neoprene wheels are used to increase the friction of the wheels to the surface of the arena. The design of the frame is a rectangular box making it hard to flip when at head to head impact. The bumpers take the impact and can be adjusted height wise.

Table 2: Parts Included in Robots

Parts	Robots		
	Autonomous	R/C	Bartending
Processor	Arduino MEGA2560	Sabertooth 2x5	Arduino MEGA2560
Sensors	PZ-G41P, QTR-1A		
Flow Rate			195 ml/m
Pumps			Peristaltic
Material	AL 6061-T651	AL 6061-T651	PLA, Wood, Steel
Wheels	Neoprene	Neoprene	
Battery	2000 mAh	2000 mAh	AC/DC Wall Outlet

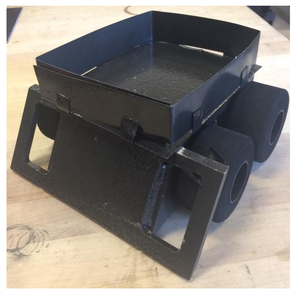

Figure 2: Final Autonomous

Figure 4: Final Bartending

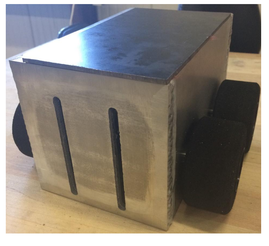

Figure 6: Final R/C

Competition Outlines

DATE: April 28, 2017

LOCATION: Flagstaff, AZ

CLASS: Mega Sumo (RC and Autonomous)

RUNDOWN:

- Each match consists of 3 rounds, within a 3 minute time period
- A team wins a match when they obtain a total of two points
- An extended match maybe be placed by judge's decision if neither team has won a point within the time frame.

The teams goal is to at least participate in this competition without any issues. With both the RC and autonomous being fully functional during the competition, the team has met its goal. If the team places in either of the classes, it has overly met the expectations the team already had.

Acknowledgements

Dr. David Trevas
Perry Wood
NAU Baja Team 2017
NAU Machine Shop
Dr. Jennifer Wade

References

Robogames.net, 'Unified Sumo Robot Rules', 2015. http://robogames.net/rules/all-sumo.php

Robogames.net, 'ArtBot - Bartending', 2015. http://robogames.net/rules/art-bartending.php