

# Sumo Robot - Kit Competition Rules

Seamus Plunkett<sup>1</sup>(Chair),Sean Hastings<sup>2</sup>

## Competition Description

Two teams place an autonomous Pololu Zumo robot in a circular ring called a Dohyo, and much like the traditional Japanese martial art of Sumo wrestling, each robot attempts to push the opposing robot out of the ring. Once one of the robots has been pushed out of the ring, the round is over, and the one who remains in the Dohyo is considered the winner. Whichever team's robot successfully wins two rounds is permitted to proceed to the next tier of the competition. In the kit competition, all teams will have the exact same robot; it is up to the team to write the best and most strategic code in order to win.

### Corresponding emails:

<sup>1</sup>plunketts8@students.rowan.edu

<sup>2</sup>hastings1@students.rowan.edu

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## 1. Eligibility

### 1.1 IEEE Membership

All competitors must be an IEEE member with the University they are representing.

### 1.2 Team Size

Each team shall consist of 1-4 members from any discipline.

### 1.3 Graduate Students

Graduate students are allowed so long as the team consists of at least 50% undergraduate students. For example, a team consisting of 3 members can only have 1 graduate student.

### 1.4 Team Roster

A team roster shall be presented to the competition organizers as well as the judge(s) prior to the start of the event.

#### 1.4.1 Change in Team Roster

If there is a change in the roster prior to arriving to the event, it is up to the team to report the change to the competition organizers. Arriving with a team which contains members which were previously undeclared or missing team members is grounds for a denial to compete.

### 1.5 IEEE Funding

Those teams receiving funding from IEEE shall have at least one member who is a National Member of the IEEE at the time of the competition.

## 2. Robot Classifications

### 2.1 Mini-Class Robot

For the Rowan University Kit Competition, the Mini-class robot will be used. The Pololu Zumo kit robot qualifies as a Mini-Class robot. A Mini-class robot must abide by the following specifications:

- Mass Limit: 500 grams (1.1 lb), Lift can not reduce the robot below the required limit.
- Size Limit: Width and depth cannot exceed 10 x 10 centimeters (3.93 x 3.93 inches)

## 2.2 Pololu Zumo Kit Robot

Those teams who wish to purchase their robots must purchase one of the following kits in its entirety.

### 2.2.1 Disassembled Kit

1. Zumo 32U4 Robot Kit (No Motors): \$99
2. 50:1 Micro Metal Gearmotor HP, Qty. 2 : \$19.98
3. Four AA Batteries: \$2
4. **Total Cost**: \$120.98 (Not including tax & shipping)

### 2.2.2 Assembled Kit

1. Zumo 32U4 Robot (Assembled with 75:1 HP Motors)
2. **Total Cost**: 149.95 (Not including tax, shipping, or batteries)

## 3. Robot Design Rules

### 3.1 Self-Contained

The robot shall be self-impelled and self-controlled. Once the robot has been positioned and the start sequence has been initiated, no re-positioning, remote control, or additional power can be used.

### 3.2 Robot Materials

The robot is permitted to utilize the materials provided by the Pololu Zumo Kit as mentioned in Section 2, as well as additional sensors. The choice of these sensors is left to the discretion of the team.

### 3.3 Power Source

The robot shall be powered by up to 4 alkaline batteries. Other battery technologies, chemistry, or power sources are not allowed in this competition.

### 3.4 Human and Robot Safety

The robot shall be non-offensive, non-destructive, and non-harmful to humans as well as to the facilities at the competition. Failure to comply to these terms is grounds for disqualification of the bot from the competition, whether the infraction was intentional or not.

#### 3.4.1 Judge's Discretion

The acting referee of the match will judge to their discretion whether or not the infraction warrants disqualification.

#### 3.4.2 Safety Inspection

In an attempt to prevent these incidents from happening, all robots are required to go through a safety inspection which can include but is not limited to: demonstration of robot, handling of the robot, and requesting to see source code.



**Figure 1.** Diagram of the Dohyo with two blue sumobots placed antiparallel, as is prior to the start sequence. The orange line represents the center of the Dohyo and **will not** present on the Dohyo used during the competition.

## 4. Dohyo

### 4.1 Construction

For this competition, the Dohyo seen in Figure 1 will be used in the competition. This Dohyo is constructed of panel wood and has the following dimensions:

- Diameter - 77cm
- Height - 1.5cm
- Border Width - 2.5cm

### 4.2 Interference Area

There will be a circle with diameter of 138.5cm centered at the center of the Dohyo which acts as the Interference Zone. This zone shall remain unoccupied and will not contain any obstacles which could inhibit the proper functionality of the robot. The only time a person is allowed within this area is when setting up, starting, or retrieving a robot.

## 5. Competition Structure

### 5.1 Tournament Style

The competition shall be structured as a Double Elimination Competition. Teams will begin in the “winners bracket” at the start of the competition.

#### 5.1.1 Winners Bracket

This bracket will contain only those who have not lost any match, up until the semi-final rounds. The winner of a match occurring in this bracket will move on to further matches

within the bracket. Those teams who lose in this bracket fall to the losers bracket.

#### 5.1.2 Losers Bracket

Once a team has lost a round from the Winners Bracket, they are placed into the Losers Bracket. If a team loses a match while competing in this bracket, they are eliminated from the competition. The team which can move forward in this bracket without accruing another loss will be placed back into the winners bracket to compete in the semi-final rounds.

## 5.2 Matches

A match between two robots shall be broken up into three individual rounds. The first robot to receive two victories is considered the winner.

#### 5.2.1 Bowing

A member from each team who has been chosen to place and start the robot must bow to each other to promote the respect and friendliness of the competition.

## 5.3 Rounds

#### 5.3.1 Setup

The robots shall be placed anti-parallel to one another in the center of the Dohyo as seen in Figure 1.

#### 5.3.2 Initializing Robot

At the beginning of each round, the referee will say “Ready. set. Go!”. At the end of this phrase, the team member which placed the robot will press a physical switch which will initialize the robot.

#### 5.3.3 Starting Delay

The robot shall not begin moving until after five seconds have passed since the pressing of the button.

**5.3.3.1 False Start** If a robot begins operation before the five-second wait period, the round will be restarted and a warning will be issued.

**5.3.3.2 Warnings** If two warnings are received in a single match, that robot forfeits the match and receives an automatic loss for the match.

#### 5.3.4 Leaving the Interference Area

During the 5 second delay, all human contestants and judges must leave the Interference area, standing at least one (1) meter away from the Dohyo.

## 5.3.5 Ending a Round

A round shall end at the end of three minutes of combat or if a robot leaves the Dohyo (see 5.3.5), whichever comes first.

## 5.3.6 Leaving the Dohyo

Leaving the Dohyo is defined as **ANY** part of the robot touching the floor that the Dohyo is placed on. The robot that leaves the Dohyo first for any reason is considered the loser of the round.

## 5.4 Special Conditions

### 5.4.1 Match Delay

If for any reason, a team has not placed their robot on the Dohyo after five minutes of the beginning of the match, the other team will automatically be declared the winner of the match.

### 5.4.2 Overtime

In the event that a round extends past the three minutes allotted, the round is considered to be a tie. Should all three rounds be declared a tie, both teams shall be sent to the loser's bracket.

**5.4.2.1 Third Round Overtime** If a tie occurs in the third round when the score is at 1 to 1, a fourth round shall be added. If at the end of this round there is a tie, both teams shall be sent to the losers bracket.

### 5.4.3 Malfunction

A round can be ended if a round begins to smoke, leak, falls apart, or acts in such a way that poses a threat to the people nearby. If this occurs, the robot which is still intact is declared the winner of the round.

### 5.4.4 Mutual Draw

A round can be ended early if both teams agree to a tie as the result of the round. This is to allow teams to not damage their bots due to stalled motors or other harmful circumstances. Both teams must agree to the draw for this to occur.