

Robocon International Design Contest 2023

Theme of Robocon International Design Contest 2023

Background

Thai cuisine is popular worldwide. Eating Thai food is a famous activity for tourists in Bangkok. The most popular dish is “Tom Yum Goong”, the spicy shrimp soup. Recently, another traditional dish has been included on the Oxford Dictionary website, the “**Pad Thai**”. Formerly, pad Thai was called “Guay Tiew Pad”, which originated during World War II, Thailand suffered a rice shortage due to the war and floods. To reduce domestic rice consumption, the Thai government under Prime Minister Plaek Phibunsongkhram promoted consumption of noodles instead. His government promoted rice noodles and helped to establish the identity of Thailand.

Pad thai is made with rice noodles, which are stir fried with eggs and chopped firm tofu, flavored with tamarind juice, fish sauce, dried shrimp, garlic, shallots, may add red chili pepper and palm sugar, and served with lime wedges and often crushed roasted peanuts. It may contain other vegetables like bean sprouts, garlic chives, preserved radish, and raw banana flowers. It may also contain fresh shrimp, crab, squid, chicken or other fish or meat. Many of the ingredients are provided on the side as condiments, such as the red chili pepper, lime wedges, roasted peanuts, bean sprouts, spring onion and other miscellaneous fresh vegetables

Reference

https://en.wikipedia.org/wiki/Pad_thai

<https://www.thaijbworld.com/pad-thai-officially-included-in-oxford-dictionary/>

Crafting Pad Thai

This year we would like to invite you to learn more about Thai cuisine by design and build the robots for Pad Thai cooking. The cooking can be separated into 2 major steps: 1) the sauce preparation which is done online by the manipulator and 2) stir fried which is done onsite by robot and grasper. All 3 machines must collaborate to serve the most appetizing Pad Thai.

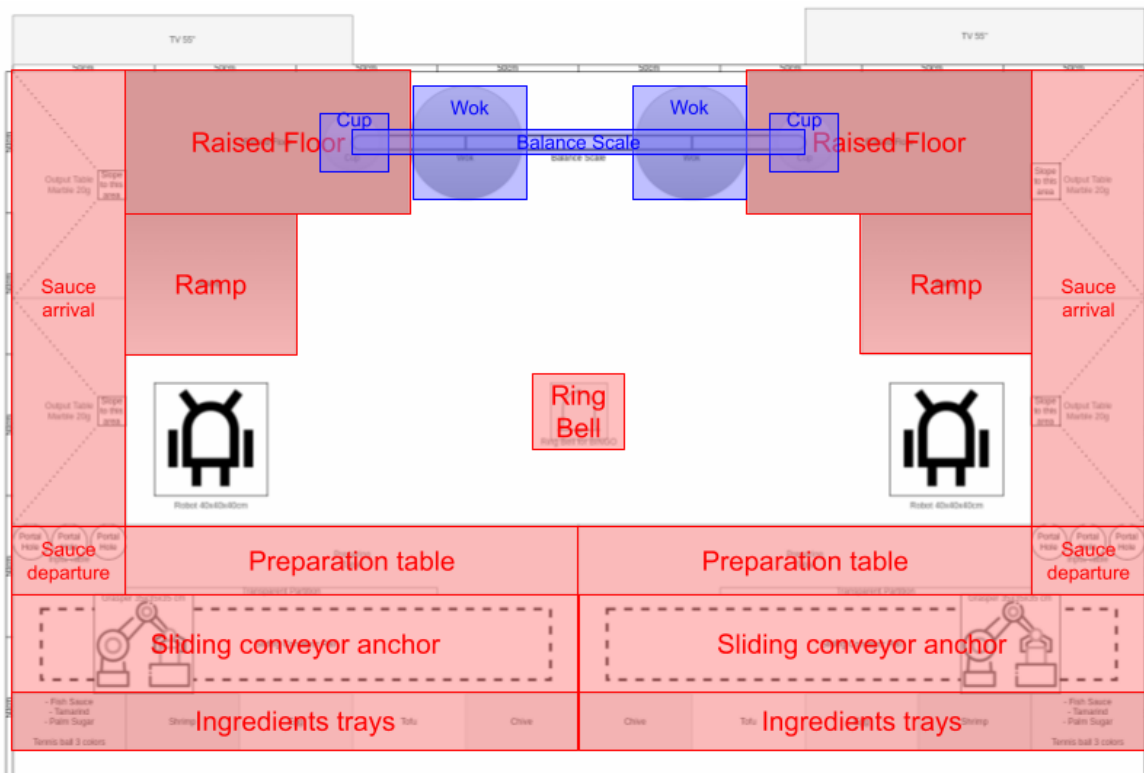


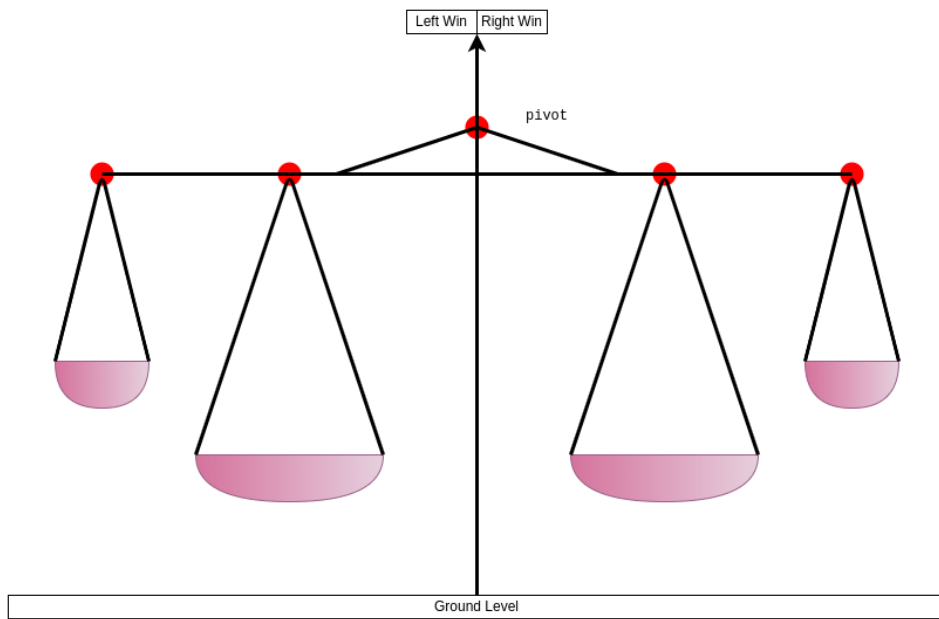
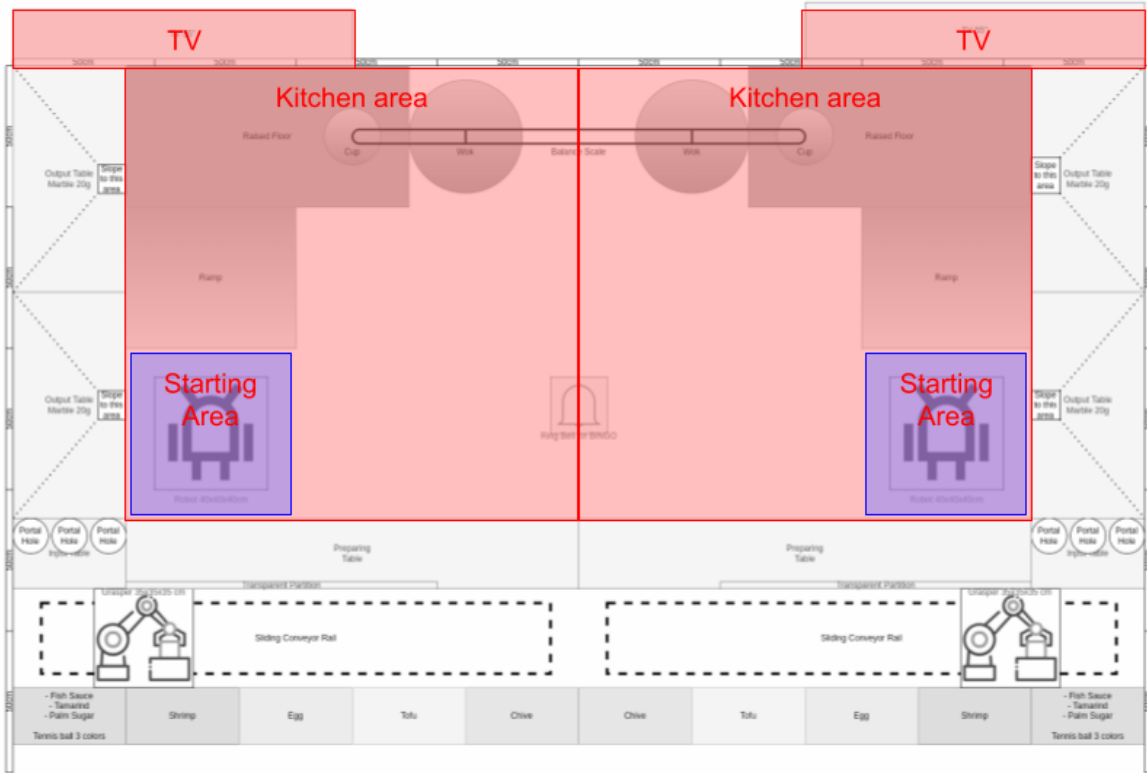
Field Descriptions

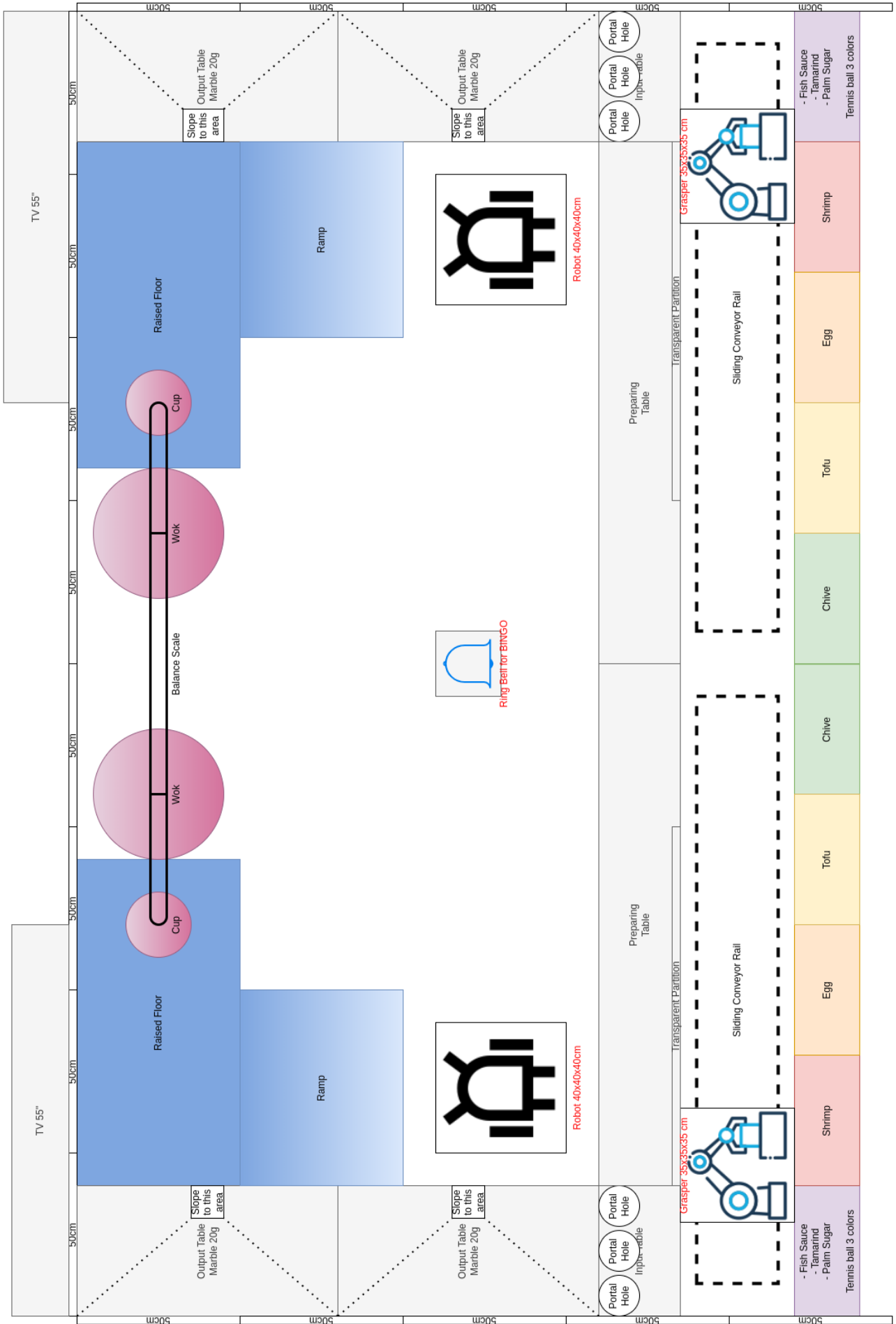
Onsite Arena

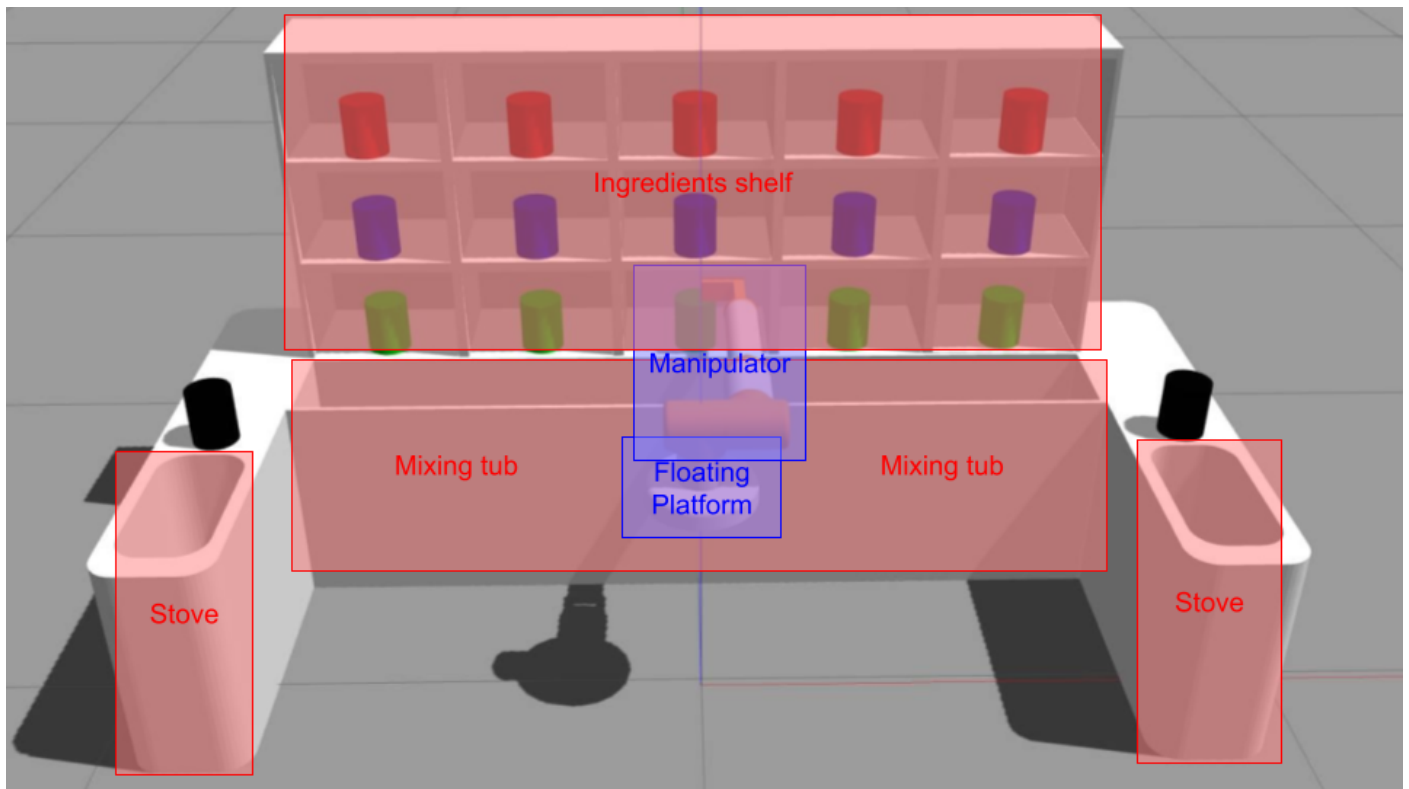
The arena is separated into the left side and the right side for the red team and the blue team, respectively. On each side, there are several components placed in reflected fashion to another side. The components are as follows.

1. **Starting area** is the boundary which the robot can start within.
2. **Ingredients trays** store 4 types of ingredients for stir fried and 3 types of ingredients for sauce.
3. **Preparation table** is the place where stir fried ingredients are transferred to the kitchen.
4. **Sliding conveyor anchor** is the attachment point of the grasper. The grasper can move along the rail and transport the ingredients.
5. **Sauce departure** is the place where sauce ingredients are transferred to the online world.
6. **Sauce arrival** is the place where finished sauce is delivered back to the onsite world.
7. **Kitchen area** includes all ground level of both sides of the arena
8. **Ramp and raised floor** provide a handicap for pouring sauce and ingredients into the wok and sauce cup.
9. **Wok and cup** for collecting all ingredients and the sauce respectively.
10. **Balance scale** holds woks and cups for both sides.
11. **TVs** are for online monitoring of each side.
12. **Ring bell** is placed at the center of the kitchen. Contestant rings the bell when the dish is ready to be served.









Online Arena

The online world of each side is simulated separately. The simulation world is based on ROS and GAZEBO (http://wiki.ros.org/gazebo_ros_pkgs).

The simulation consists of several components.

1. **Ingredients shelf** is the place where the ingredients from the onsite world are spawn at.
2. **Manipulator** is a 4 dof robotic arm with a hook which the contestant can adjust and control.
3. **Floating Platform** can translate in 3D space and can be controlled by the contestant.
4. **Stove** is where the sauce is prepared. Stove includes a charcoal slot for starting the fire.
5. **Mixing tub** is placed on the stove.

Onsite Arena Default Setup

1. There are 2 pieces of each type of stir fried ingredients in the ingredients trays. The ingredients are placed on the 'x' marks.
2. One additional piece of each type of stir fried ingredient is presented at the preparation table. The ingredients are distributed evenly throughout the table.
3. All 3 types of sauce ingredients are placed at its own mark in the ingredients tray.
4. The sliding conveyor anchor is positioned at the center of the rail without attachment.
5. The sauce departures are empty.
6. Sauce is transferred in sauce pod packages which are represented by 16 balls that must be held in place on each side of the arena.
7. Woks and cups must be empty.
8. The balance scale should stay at the center e.g. no light on any side.
9. TVs show the online world of each team via meeting software.

Online Arena Default Setup

1. Ingredients shelf is empty.
2. The Floating Platform is at the center of the space and the manipulator points straight to the upward direction.
3. There are 2 charcoal on the stove at the 'x' marks.
4. Mixing tub is empty.

Onsite & Online Components Details (See Appendix A)

Design Regulation

Robot

- The robot is built only from the provided materials which are shared with a grasper, excluding any tools.
- The robot must be **within a 40x40x40 cm³ cube** at the starting time. Your entire robot must be less than **5 kg** excluding the control unit. The robot can navigate freely on the kitchen area and the ramp of its own side.
- The robot can be controlled only by the remote control.
- The robot can grasp any objects of its team and put them on the wok or the cup. The robot cannot remove any object out of another wok or cup.
- The robot can touch the wok or cup at playing time, but when the game is finished the robot must not touch any object connected to the balance scale or the balance scale itself.

Grasper

- The manipulator is built only from the provided materials which are shared with a robot, excluding any tools.
- The manipulator must be attached to the sliding conveyor anchor safely. Weight of the manipulator **must not exceed 2 kg** and must be **within a 35x35x35 cm³ cube** at the starting time
- The manipulator can be controlled only by the remote control.
- The manipulator can grasp any objects of its team and put them on the preparation table or the sauce departure.

Manipulator

- The online manipulator is predefined as a 4 dof manipulator with a hook. It is placed on the floating platform. Team can adjust the length of the manipulator's link in the file "config.yaml".
- The manipulator can be controlled via set of keyboard key defined in the file "config.yaml"

Rules & Regulations

General Principles

1. These rules are intended to create opportunities to learn engineering.
2. Your mission is to design and build robots to help chefs to craft the Pad Thai.
3. Fair play is encouraged and intention to destroy other robots or arena is forbidden.
4. Those things not specifically forbidden are allowed.

Game Set Up

5. The onsite and online arenas are set to default settings.
6. Each team has **60 seconds to set up** both robot and grasper. The robots are placed within the starting area. The graspers are mounted onto sliding conveyor anchors. Teams responsible for checking the functions of the robot and the grasper.

Game Mechanism

7. **Countdown timer starts at 180 seconds.**
8. **Activating online ingredients:** When the grasper puts all 3 sauce ingredients into sauce departure in the correct position, 15 pieces of ingredients spawn on the shelf in the online world.
9. Grasper can help the robot by supplying more stir fried ingredients onto the preparation table.
10. Any **ingredients that touch the kitchen floor are spoiled**, thus it must not be used anymore.
11. **Manipulator starts the fire** by putting charcoal into the stove. Then the manipulator grabs the ingredients and puts them into the mixing tub.
12. **Activating onsite sauce pod:** When the manipulator puts all 3 sauce ingredients into the mixing tub (at least one piece of each type) and the fire is started, the sauce pod in the onsite world is poured into the sauce arrival area.
13. The manipulator can continue to add more sauce ingredients into the mixing tub. The manipulator stops 30 seconds before the game ends e.g **the manipulator has 120 seconds to play.**
14. Robot collects stir fried ingredients and sauce pod and puts them into the wok and cup respectively.
15. The contestant can **ring the bell** if the BINGO condition is met. By touching the bell, the team cannot play further even if the BINGO condition is not met.
16. At the end of the game, the **robot must not touch the balance scale** or any object connected to the balance scale. If prohibited, the team loses the game.

Scoring

17. **BINGO:** If the team can manage to put exactly 2 pieces of each stir fried ingredient into the wok and some sauce pod into the cup, the team wins the game.
18. When the game ends, the sauce ingredients in the mixing tub in the online world are counted as an **extra sauce pod**. The equal number of sauce pods are added to the cup.
19. After adding the extra sauce pod, if **the light on any side of the balance scale is on**, that team wins the game, otherwise both teams tie.

Winning & Advancing

20. The seeding round is held to sort the teams for the qualifying round. Each team has 180 seconds to play without an opponent and can continue playing after the BINGO. Teams are ranked according to 1) BINGO status, 2) total weight of stir fried ingredients and sauce pod, and 3) number of sauce pods.
21. The contest consists of the qualifying round and final tournament.
22. Qualifying round is a four-group league match. Three teams are competing in a league, and the top two teams in each league will advance to the final tournament. Some teams are tied for wins in a league, a team with a higher total score is more advantageous.
23. The final tournament is a single elimination one.
24. If a match is finished in a tie, the team with more sauce pods is the winner. If the sauce pod is equal, the sudden death match is held. The sudden death match is the game without stir fried ingredients. The first one who can put sauce into the cup is the winner.

Control

25. Team members must control their own machines. Two team members at a maximum can be actively involved in manipulating the controls.
26. All control must be accomplished without contacting the robot.
27. Control may be achieved via wireless devices supplied by the referees and IDC staff.
28. A contestant may not deliberately interfere with the remote control of the opposing player.

Robot Configuration

29. Materials: Your entire robot must be made from the kit materials and components in a specified list. Electric components must be authorized by the referees. Screws, Bolts, Nuts, Washers, Stick Glue, Vinyl tape for electric insulators are prepared in the machine shop. They can be used adequately when needed, but are not allowed to be used as structural materials. Grease is also prepared in the machine shop. Un-functional ornaments can be attached.
30. Control Unit: One control unit and a transmitter with a receiver are distributed for each team. Those functions of the control unit can be controlled manually by the control pad. The control unit is NOT allowed to be used as structural material for each robot, i.e. a robot must be designed so that the control unit can be quickly-released. Battery charging in the control unit MUST be operated by only IDC staff to avoid accidents and damaging batteries.
31. Fabrication: You can use machines in the machine shop, for example, bench drilling machines, band saws, lathes, benders, shearing machines. Tools for hand working are also available, e.g., saws, hand drills, taps, dies, soldering irons etc. You may ask technical advisers in the machine shop and IDC staff how to use them.
32. Set-up for match: Your machine may be reconfigured between rounds. One reason to reconfigure is to accommodate the differences between the right and left sides of the field. You will know at least 5 minutes before you complete which side your machine will be assigned. You will have access to set up your machine within the starting box prior to each round. You should be able to complete your set set-up fully in less than three minutes.

Fair Play & Safety

33. Once scoring is accomplished, it cannot be reversed by defensive actions, but additional scoring can be prevented.
34. Damaging, overturning, pushing and lifting an opponent's robot is not allowed (although blocking without intentionally touching an opponent's robot is allowed).
35. Damaging the contest arena and or control equipment is strictly forbidden.
36. In the case of destruction deemed by the judges to be accidental, the judges may permit repairs and a rematch.
37. Contestants and spectators (i.e. any human beings) may not directly affect the motion of the machines or anything else in the arena.
38. Any robot components or arena items that depart the arena cannot be manually re-introduced to the arena during a round.
39. Nets or entanglement devices are not permitted, but other defensive devices generally are permitted.
40. After the time limit, the referee judges the winner of the match according to the scoring as mentioned.
41. NO DANGEROUS MACHINES. THE JUDGES' DECISIONS ON SAFETY MUST BE RESPECTED AND OBEYED PROMPTLY.

General questions may be asked of all participating faculties, graduate students, undergrad assistants, and staff of IDC2023. However, all officially sanctioned rule interpretations will be made by the referees. The key rulings will be discussed in daily meetings.

List of tools and materials (See Appendix B)

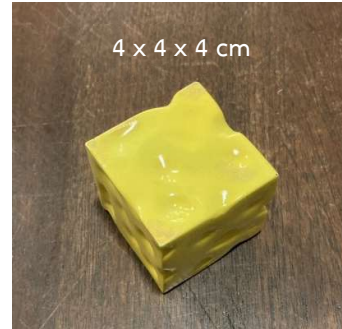
Appendix A

Sauce and ingredients dimension

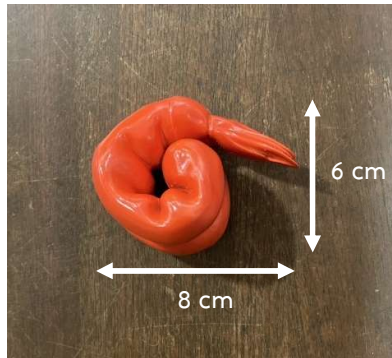
1. Sauce balls



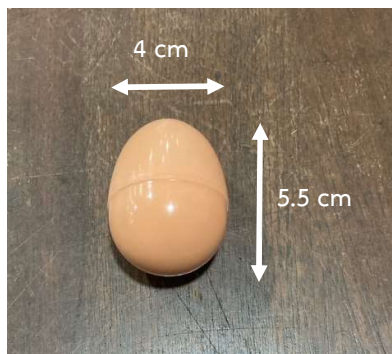
2. Tofu



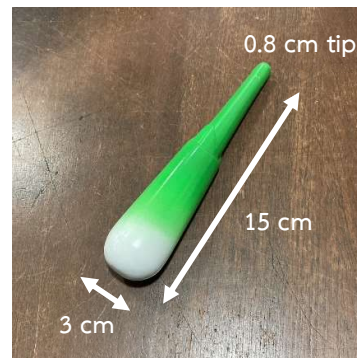
3. Shrimp



4. Egg



5. Chive

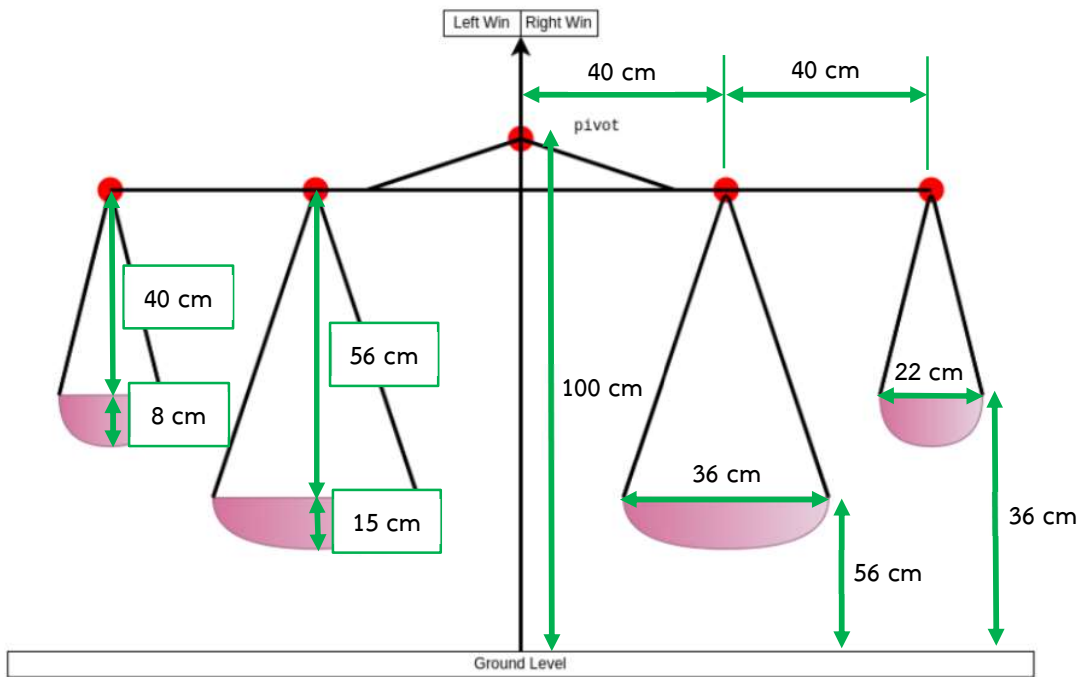


Ingredients for making sauce

- Tennis balls 6.5 cm diameter



Balance scale dimension



Appendix B

List of materials

No.	Materials List	QTY
1	Motor 150 RPM	2
2	Motor 50 RPM	2
3	Motor Flunk	4
4	Motor Mounting Bracket L	4
5	Caster Wheel	2
6	Servo motor 25kg/cm	3
7	Servo motor 20kg/cm	1
8	Motor Connector	4
9	MDF Board 6mm x 60cm x 60cm	2
10	Acrylic sheet 3mm x 60cm x 60cm	1
11	Acrylic sheet 5mm x 60cm x 60cm	2
12	Wheel	2