SAITM ROBOTICS CHALLENGE 2016
SRC '16

Faculty of Engineering, at South Asian Institute of Technology and Medicine (SAITM), is conducting the SAITM Robotics Challenge (SRC) in April 2016, for the fourth consecutive year.

UNDERGRADUATE CHALLENGE

- This year's competition, SRC '16 is open to undergraduates from universities around the country. The challenge is to develop an autonomous robot that can arrange objects in a grid based arena.

- The challenge emulates a factory floor and challenges the robot to collect three rings (toroid shaped objects in red or blue) and stack them on a pole.

- A grid of black lines laid out on a white surface will aid the robot to navigate the arena.

- The robot wins the challenge if it can complete the task and return to start position within the shortest possible time.

> **DATE:** **29TH APRIL 2016**
>
> **VENUE:** **SAITM, MALABE**

- Teams can register via www.robotics.saitm.edu.lk **before 31st of March 2016.**

ELIGIBILITY

- Participants should form a team of up to 5 undergraduates. Any number of teams from a university/ higher education institute can enroll in the competition.

- All members of the team should be registered students in an undergraduate degree program at the same university or tertiary education institute, at the time of their participation in the competition.

- Each member will be asked to produce a valid identification to prove their eligibility to participate, on the day of the competition.

TECHNICAL SPECIFICATIONS

ROBOT SPECIFICATIONS

- The dimensions of the robot must be within 25 cm X 25 cm (length x width). There is no height restriction.

- The robots power supply must be internal (no external power is allowed) and maximum voltage between any pair of points inside the robot cannot exceed 24V at any time.

- The robot must be wheeled and should not split into two or more units.

- The robot should have a clearly indicated START switch. Once the robot is switched on it should be self-navigating; it should not receive any kind of aid from outside. The starting procedure should not involve giving the robot any manual force or impulse in any direction.

- Once started, the robot can expand itself (beyond the dimensions given, if necessary), provided it does not damage the arena in anyway.

- The robot should not leave any parts or marking in the arena at any stage. Any kind of damage to the arena will result in an immediate disqualification.

- The robot should work under any ambient lighting conditions.

ARENA

- The arena is a 2.44 m X 3.66 m (8 feet × 12 feet) area, divided into two sub-arenas "Play field 01" (coloured blue) and "Play field 02" (coloured red) as illustrated in Figure 01 and Figure 02. Two teams can compete in the arena (one in each play field) at any given time.

- All surfaces open for navigation, will be white in matt finish. All guidelines for navigation will be black in matt finish. The width of the guidelines will be 3 cm at all times.

- Each play field will be fully bound by an aluminum fence. The fences are 8 cm high with an aluminum bar passing through at 4cm height. The guideline will have a minimum clearance of 15 cm from the fence.

- Starting position is indicated by a blue or red square (outline only), with 25 cm side length and 0.5 cm line thickness in blue or red.

- The layout of the guidelines will be as given in Figures 01, 02 and 03. However, exact dimensions of guidelines, will be disclosed at the time of the competition, after all teams have submitted their robots.

- The arena specifications listed above are provided as general aids. The robot should be capable of accommodating up to 5% deviations from the specifications given. Plane surfaces may have differences in height up to 5 mm.

- There may be reference lines (pencil marks) on the arena floor. These lines are unreadable by the robot.
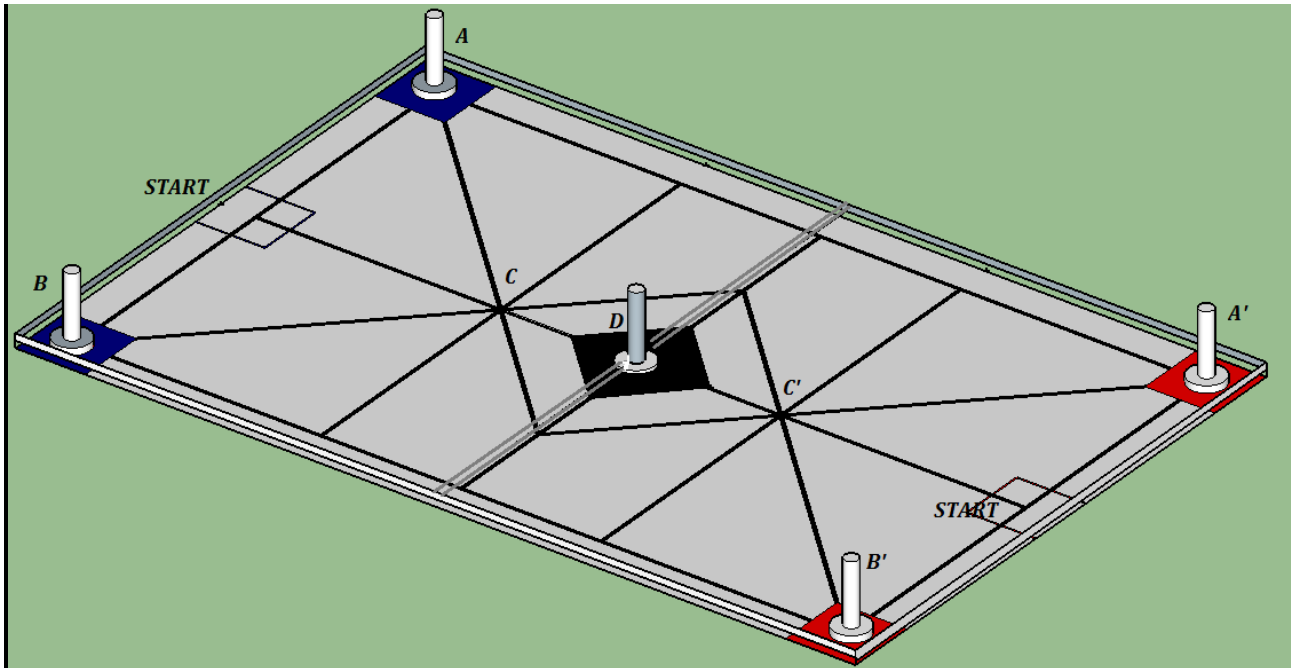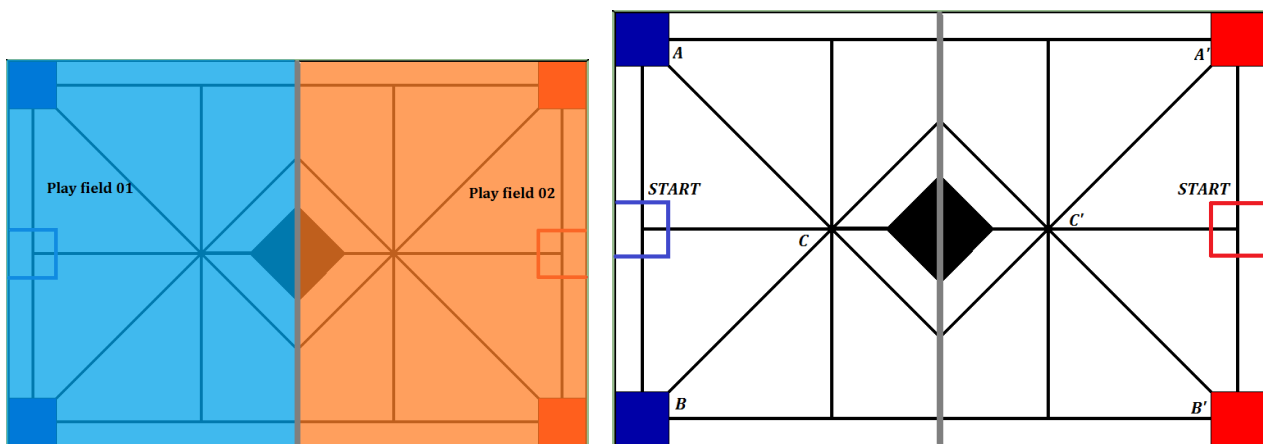
Figure 01: Arena layout - Side View

Figure 02: Arena layout - Top View

- There are 12 cm high poles with 5 cm diameter (2 inches) at four corners of the arena as illustrated in Figure 01, where each team has access to two poles located in their play field.

- [Update] The red/blue squares at the four corners are of side length 25 cm, and each will have a pole placed at its center.

- [Update] There is a cylindrical base for each pole with diameter 20 cm.

- There is a 20 cm high center pole with 2.5 cm diameter (1 inch) common to both playfields.

- All poles are in white colour, and placed on a 2 cm high white base as denoted in Figure 03.

- At the start of each match there will be three stainless steel rings in red/blue colour weighing around 75g - 100g placed in each play field.

- There will be a ring placed in each corner pole (two rings per a playfield) and a third ring placed at C (or C').

- The dimensions of the ring are indicated in Figure 04.
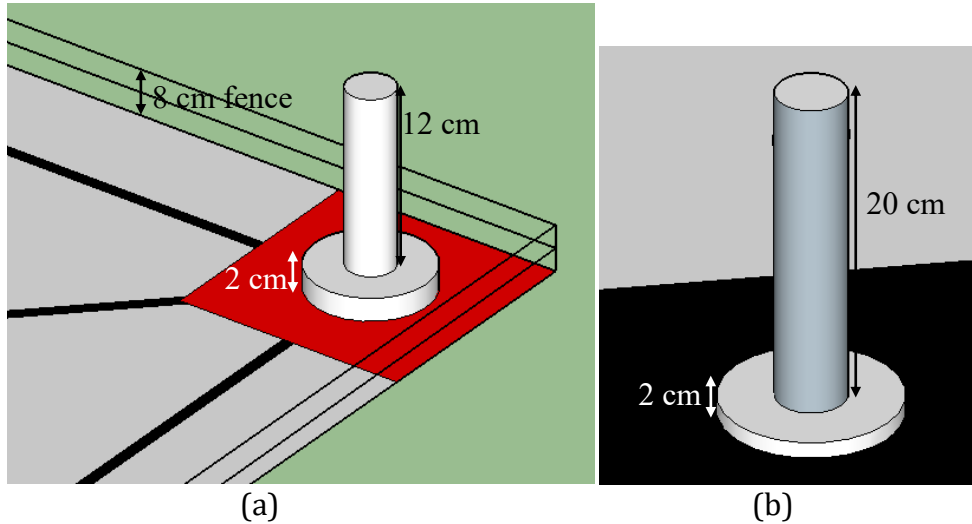

(a)   (b)

Figure 03: (a) 3D close up view – Fence and poles at the corners of the play field A, B
(b) Pole at the corner of the play filed, D common to both play fields

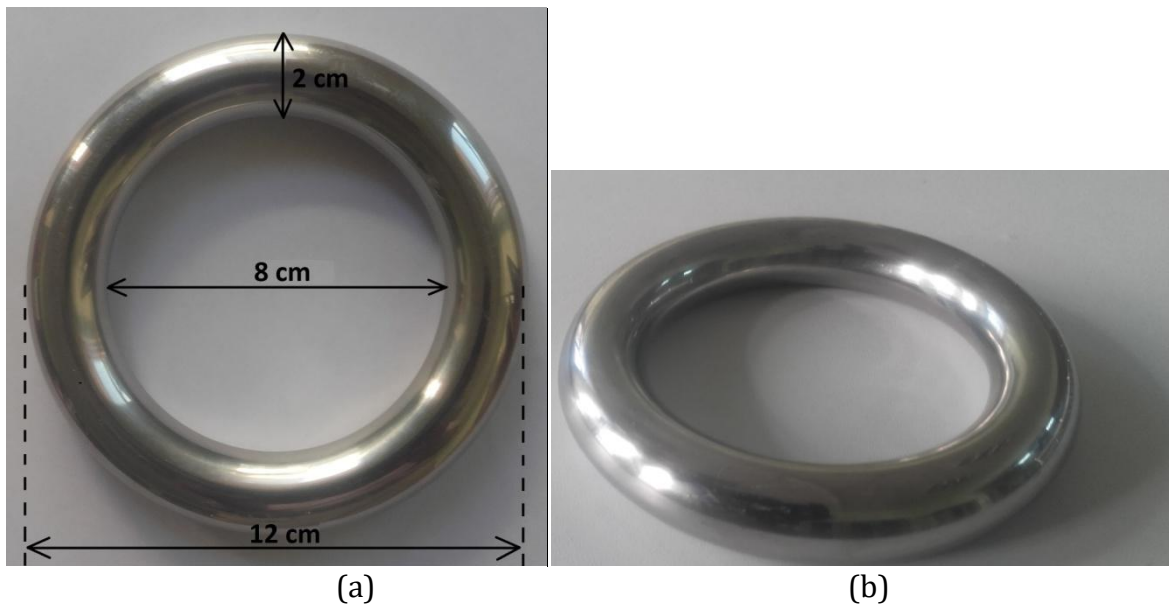(a)   (b)

Figure 04: Stainless steel ring before applying colour (a) with dimensions (b) side view
(Note: The rings will be in red or blue colour according to the relevant playfield)

CHALLENGE

From the starting position, the robot should navigate through the play field with the aid of the guidelines, collect three rings and place them on the center pole D. The robot should be following a guideline at all times, there will be a penalty for losing the line and re-acquiring.

The robot must carry the ring and not drag it. If the robot drops the ring, it can make any number of attempts at collecting the ring; however there will be a penalty for each drop.

The robot can turn back, after releasing the ring. For a successful placement, the ring should come to rest on the pole base or over another ring already on pole.

TASK 1: Collect Ring from Junction C (or C') and place it on the pole

On start, robot should identify the ring (tennikoit ring) at Junction C (or C') collect and carry the ring to pole D and place it on the pole.

TASK 2: Collect Rings from poles A, B (or A', B') and place them on the pole

The robot should then reach corners A, B (or A', B'), denoted using a blue/red square of side length 25 cm, collect one ring from each pole, carry these rings to pole D and place them on the pole. [Update] The robot may enter blue/red square to pick-up a ring, but it should not climb over the base of the pole.

The robot may carry both rings together, or it can collect and place one ring and return for the other ring.

TASK 3: Return to "START"

After placing all three rings on the pole, the robot should return to the starting position to complete the task.

COMPETITION PROCEDURES

- The arena will be a 2.44 m X 2.44 m (8 feet × 8 feet) area, divided into two sub-arenas "Play field 01" (coloured red) and "Play field 02" (coloured blue). Two teams will compete in the arena (one in each play field) at any given time during the competition.

- Each arena is fully enclosed by a fence. There is no penalty for hitting the fence; however it is the responsibility of the team to make sure that the robot does not damage the arena or the opposing team's robot.

- Competition consists of a qualifying round, and a final round. For qualifying rounds there will be NO head to head matches. Each team will individually run their robots. Eight teams qualifying for the final round will compete with each other in a knockout format.

QUALIFYING ROUND

- Each team will be given three attempts to complete the challenge, and all three attempts must not exceed 06 minutes. Teams will be given additional 2 minutes to set up the Robot at the start.

- During the qualifying round each team's attempt will be scheduled such that only one robot is reaching for the pole at D at any given time.

- Each team will be given points based on the successful completion of the three tasks of the challenge. Detailed scoring system and penalties will be updated on the competition website two weeks before the competition. Best score from the three attempts will be taken as the score of the team. In the event of two identical scores, the fastest attempt will be counted.

- The team can decide to stop the robot anytime and be credited with the tasks completed up until the robot stops.

FINAL ROUND

- Eight teams qualifying for the final round will compete with each other in a knockout format.

- Teams will be ranked according to their total score and time taken for completion at the qualifying round. Top 8 teams from the ranking will qualify for the final round.

- Final round consists of four quarterfinals, two semifinals and the final. Based on their rankings, teams will have to compete with each other in the quarterfinal rounds as illustrated in Figure 05.

- The winners of each stage will proceed to the next stage of the competition as shown in Figure 05. The two teams loosing the two semifinals will compete for the third place.

- In each match, two teams will compete against each other, running their robots side by side in the contest arena. Teams will be declared as red team or blue team based on a coin toss before every match. Blue team will run their robot in the blue sub-arena (Play field 01) and red team will run their robot in the red sub-arena (Play field 02).

- In each match, it is possible for both robots to reach pole D at the same time. It is the responsibility of each team to ensure collisions are avoided.

- Teams will be given 2 minutes to set up the Robot at the start of a match. The time taken by a team to complete the challenge, in a single match, should not exceed 03 minutes.

- Timing starts once the start signal is given. Robot should start on the signal, constructing robot to start in minimum possible time on the press of the START button is in the interest of the team.

QUATER FINALS	SEMI FINALS	FINAL

RANK 1
RANK 8
QF 1

RANK 5
RANK 4
QF 2

RANK 3
RANK 6
QF 3

RANK 7
RANK 2
QF 4

WINNER OF QF1
WINNER OF QF2
SF 1

WINNER OF QF3
WINNER OF QF4
SF 2
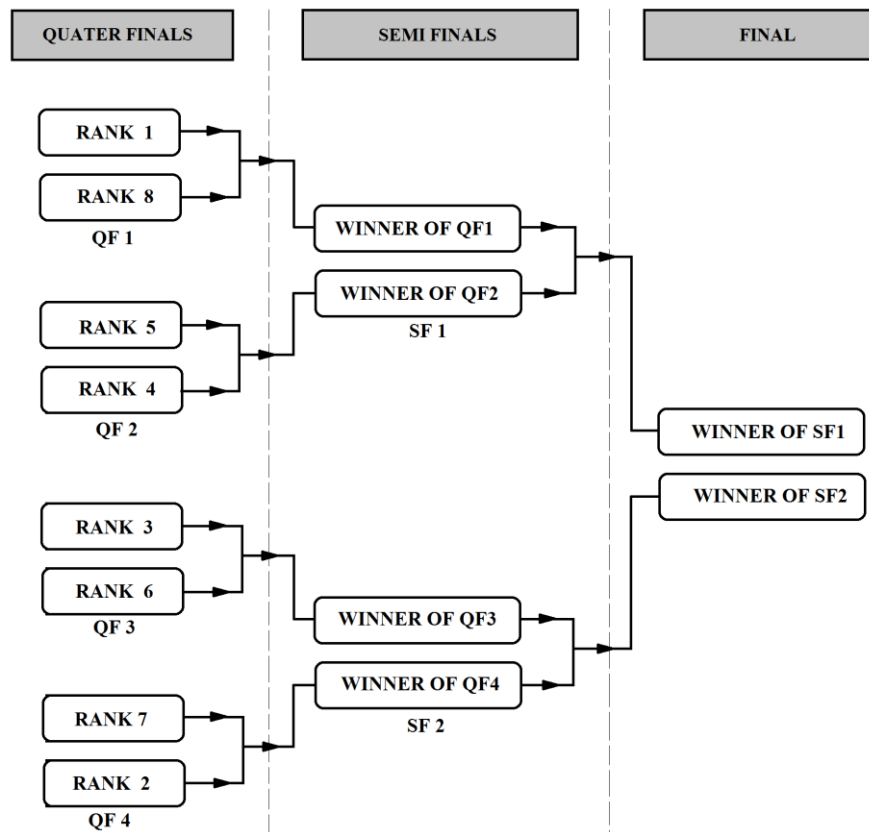
WINNER OF SF1
WINNER OF SF2

Figure 05: Final Round - Draw

- Once the Robot moves, team members will not be allowed to touch the Robot or enter the Contest Arena, unless the team is taking a retry or on request to stop the robot.

- If the contestants enter the arena during the match, it would be counted as a retry.

- A team can take as many retries as it want within 3 minutes without any penalty but only the total time taken by the team will be recorded. Separate time for individual retries will NOT be recorded or maintained.

- The team must replace all rings at their starting positions before each retry and start the robot again from the "START" position.

- In the event of a retry the point scoring would restart from zero.

- When a team takes a retry it is only allowed to restart the robot. Changing the microcontroller or reprogramming the robot is Not Allowed.

- Time would be stopped as soon as robot crosses the finish line.

- If a team wants to stop their robot during the match, the team should inform the judges. The team can then turn off their robot but they must not move it. The time at which the robot is stopped would be recorded as the final time. The team is not allowed to take a retry after the time has stopped.

- On completion of the match, the winner will be decided based on the scores of each team.

- If both teams have equal scores, the fastest team will be declared as the winner.

- If none of the team is able to finish the task in the allocated 3 minutes, the team having more points at that time would win the match.

- If both the teams have scored same points but are not able to complete the task in allocated time slot decision of the winner will be decided on the time taken by each robot.

- In case of tie, the contestant will be required to run a rematch.

GENERAL RULES

- All the teams must submit their robots to the organizers at the beginning of a round. After that, teams are not allowed to make any modifications to their robot.

- At the start of each attempt, a team should place the robot inside the starting position. The team can arrange the physical position of the robot to their liking; however no part of the robot is allowed to exceed the "START" area before the current run is started.

- The team should switch ON the robot, on the signal from the judges. Once the robot is switched ON it should be self-navigating.

- The robot should be following the grid lines at all times.

- If the robot drifts out of the line to the extent that no part of it is on top of the line, the judges will consider it as loosing the line. Any robot that loses the line course and fails to reacquire within 10 seconds will be asked to stop the current attempt, and will be credited with the tasks completed up until that point.

- Robot may navigate through the arena using any suitable technique. During its motion, the robot may touch the fences of the arena without displacing or damaging them.

- The time measured by the panel of judges will be final, and will be used in selections, and deciding winners. Time measured by the contestants, by any other measure, is not accepted.

- The decisions of the panel of judges regarding rules and the conduct of the event will be final. The organizers reserve the right to make any amendments to the above rules, and such amendments will be notified on the website, robotics.saitm.edu.lk.

TEST RUN

- Contestants will be given time for trial run one day before the contest to calibrate their robot/sensors on a trial field, with similar features, but not the same layout.

SCORING SYSTEM

- Detailed scoring system and penalties will be updated on the competition website two weeks before the competition.