



15° IEEE Students Latin
American Robotics Competition

**Rules of the Open category
2016-2017**

Version 1.2 - March 2016

Milker Robot

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Introduction

The IEEE Latin American Robotics Competition proposes a challenge based on a real problem for 2016 and 2017 IEEE Open Competition.

There has been an increasing demand for quality food in the recent past. Consumers call for organic products with a known origin and free of pesticides. With respect to animals, consumers demand that the meat they consume comes from cage free and hormone free animals. Additionally, there is an increasing trend to demand that animals are not mistreated during the whole production process.

The task focuses on the problem of milking the cows “on-site”, to avoid the stress involved in taking them to the milking barn, and thus improving milk quality.

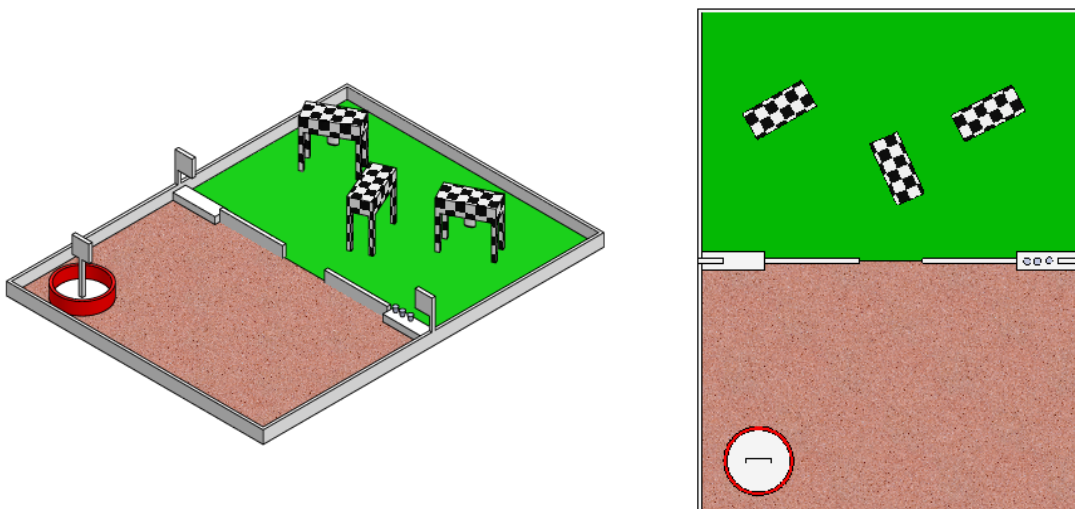


Figure 1 - Scenario

Goals

General Goals

- Get as much milk from the cows as possible and store it back on the milk tank.

Specific Goals

- Get the empty terrines from the *empty terrines zone*
- Choose, locate and milk a cow, placing the milk in the terrine
- Take the terrine with milk to the *milk tank*.
- Pour the milk from the terrine to the milk.

The scenario

The scenario represents a small countryside area. The main scenario components are:

- The Field
- The Cows
- The Terrines
- The Milk Tank
- The Markers

Each component is described below.

The Field

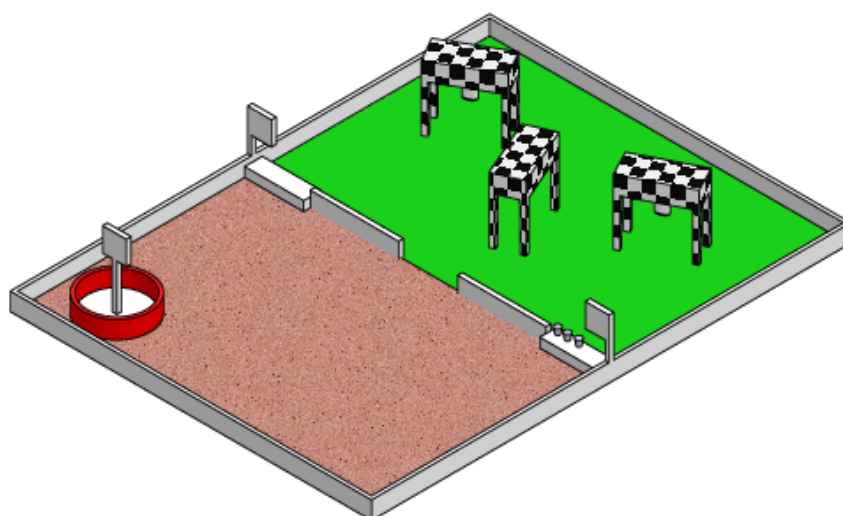


Figure 2 - Empty scenario.

The field consists of a 4 by 3 meter rectangle, made of wood (melamine panel 15 mm thick). It is in turn divided in two 2 by 3 meter regions, the *corral zone* and the *loading zone*. The ground in the corral will be covered with natural grass (between 1 and 4 cm tall), while the one in the loading zone will consist of grabble. A melamine wall will divide the environment into these two separate regions. Two gaps and a door in the melamine wall will be the only passway between the regions. One of them is the *exchange zone* and the other it is the *empty terrines zone*. Both, the *exchange zone* and the *empty terrines zone* consist of a 15 by 50 cm rectangle, and 10 cm of height. In the middle, there is a door which allows robot to go from one zone to the other. The door between both zones is 50 cm wide. At the beginning of the competition the empty terrines will be **only** in the *empty terrines zone*, as shown in figure 2 at the mid-right side.

The arena dimensions are shown in the following image.

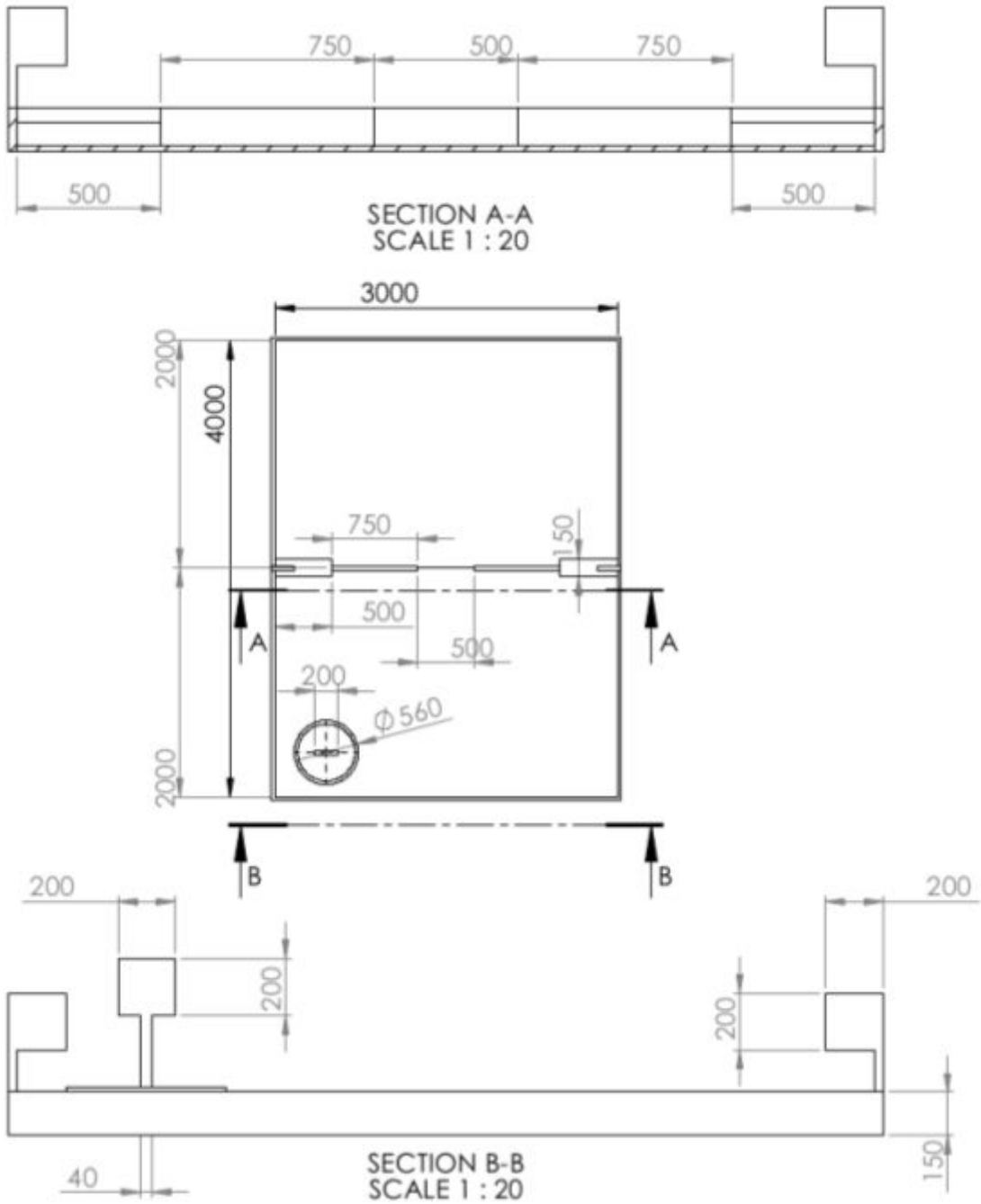


Figure 3 - Arena dimensions

Cows

The cows will be made of wood with black and white rectangles, following a checkered pattern. The dimensions of the cow are shown in the following image. A water-filled latex glove will hang from the middle of the body of each cow. Small holes in the tips of the glove fingers will allow the robot to extract the water from them.

Note: The cylinder that hangs from the middle of the cow, should be replaced with the latex glove, making sure the lowest tip is at 150 mm from the lower part of the cow's body (see figure 5).

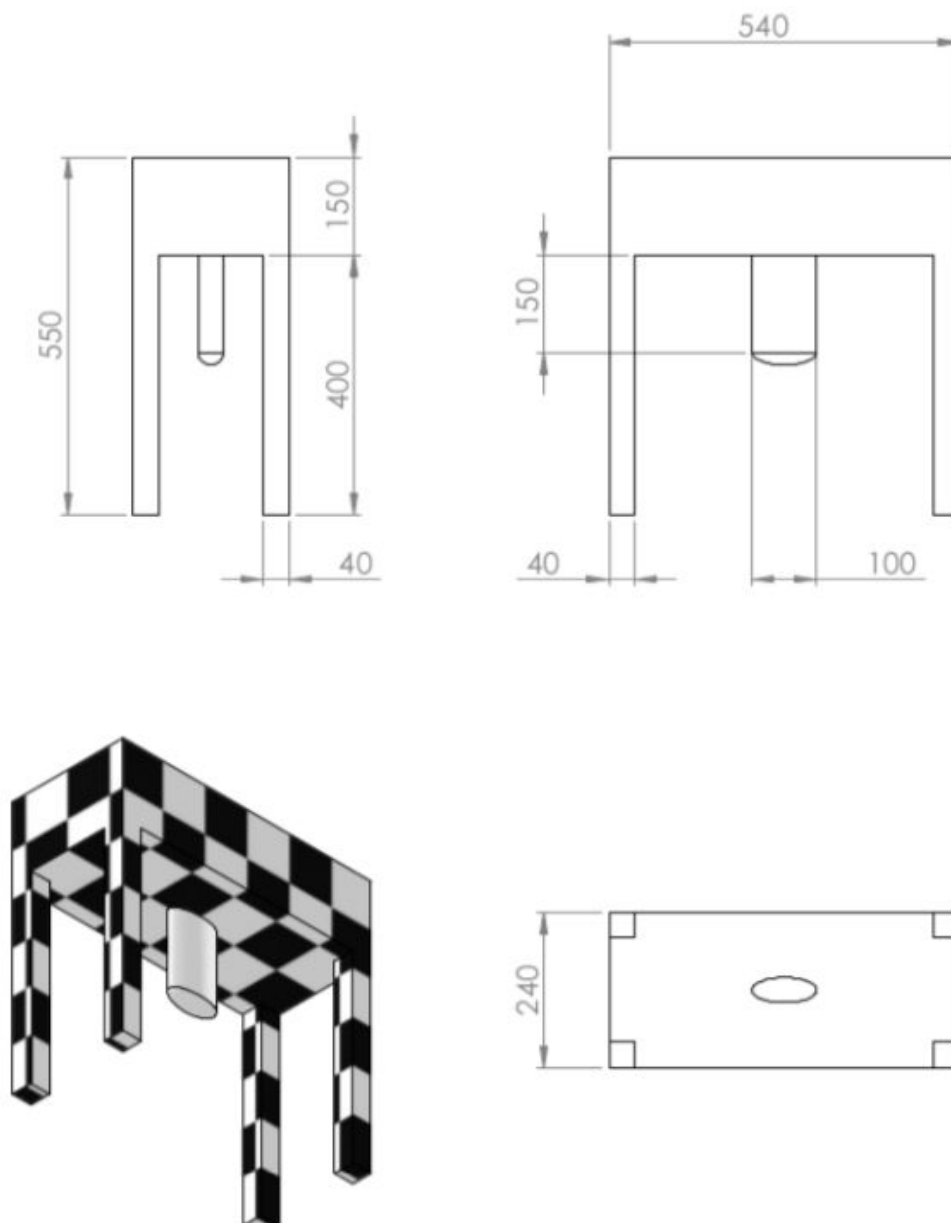


Figure 4 - Cow dimensions.

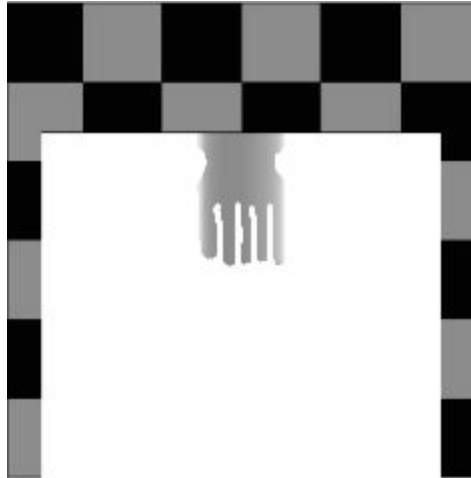


Figure 5 - Cow lateral side with glove

Gloves

The water will be in latex surgery gloves hanging from the center of the cow. The gloves will have small holes on the tips. The gloves's brand should be like the one shown below, as they were the ones that performed best in the preliminary tests.



Figure 6 - Latex surgery gloves



Figure 7 - Glove hanging. The water comes out only when the glove is pressed.

Terrines

The terrines will consist of standard plastic cups as you can see in the next image.



Figure 8 - Terrine.

The robot will have to pour the water from the gloves into the terrines. The gloves should be treated with care. Damage to the gloves will result in a fault for the team.

The Milk Tank

The milk tank will be a 56 cm diameter by 20 cm tall plastic red cylinder. This cylinder could be placed in any part of the loading zone by the judges. The robot should have the ability to find it.

Zones Markers

There are some identification marks present in the environment to help the robot's localization. These will be artoolkit-like 20 cm x 20 cm fiducial markers. The empty terrine zone, the exchange zone and the milk tank will all have a distinctive marker. Markers are presented below.



Figure 9 - Empty terrines zone marker (20 cm x 20 cm).



Figure 10 - Exchange zone marker.



Figure 11 - Milk tank marker.

Lighting conditions

The environment can be placed inside a gymnasium or on a patio outdoors. Thus, some parts of the scene can be exposed to direct sunlight. Therefore, robots should be able to see in any conditions of interior / exterior lighting and then robots must be calibrated by team members for the lighting conditions of the scene. Once the competition begins, the teams will play in the conditions of the scenario without and can recalibrate before restarting if necessary.

Dimensions

Every dimension specified could have an error of +/- 3 cm. The robots should be able to deal with uncertain dimensions.

The Robot

The robot/s must be autonomous. It must be able to move through the scenario and achieve his goals without human intervention, without any communication with a computer, cell phone or any external device. The robot needs to process the data obtained from its sensors in an onboard processor. Robot can be aerial or land robot. The use of more than one (1) robot of any kind will be permitted. The sum of the weight of all robots of a team should not exceed 10 kg. All the robots must fit inside a cube of 50 cm edge before the match starts

Below it is the list of compatible characteristics on measures of robots :

- The robot (or robots) must be initialized just by pushing a single button (per robot) in any round of the competition.
- External communication with any device is prohibited.
- The scenario can not be changed by the robot.
- Teams will be disqualified from the competition if their robot violates any of the above restrictions.
- Only at beginning each competitor could set his/her robot/robots in any position of the field. In case of restart the robot/robots position will be chosen by the judges.

Rules

General

There is going to be about 6 competition instances. There is going to be a schedule showing the time each team has to show up in the arena. If the team does not show up will lose his turn.

The moment when each team will compete will be randomly chosen, and has at maximum one minute to show up in the arena. If not, it will lose the opportunity.

About restarting: The clock will not be stopped and the team will be penalized with -10 points due to restarting. The team has 2 minutes to restore the robot(s) to compete. It is allowed to calibrate or small changes (hardware or software). There is no limit of restarts.

Penalties

About penalties: The clock will not be stopped, some penalties would not need to restart but others will need. The environment will not be reset and the score will not be restored. The robot will receive a negative score (penalty) for any task failure (i.e. move a cow, leave a terrine in the grass, damage a glove).

About penalties and restarting:

- The robot can not have more than two terrines at the same time. If it takes more than two terrines it has to restart.
- In case of more than one robot, they can communicate with each other.
- The total time to complete the task is fifteen (15) minutes.
- Each team can restart unlimited times. The restart position will be chosen by the judges. The team have two (2) minutes to set up the robots.
- If the robot continuously touches a cow leg or body for more than 6 seconds, the team must restart.
- If the robot damages a glove, the team must restart.

Arena initial configuration

- The arena could have 2 or 3 cows. This will be selected by a draw.
- The position of each cow will also be the result of a draw.
- There will be twelve (12) terrines in the empty terrines zone. The empty terrines will be uniformly distributed.
- Each competitor could set his/her robot/robots in any position of the field only the first time.
- The milk tank position will be chosen randomly by the judges.

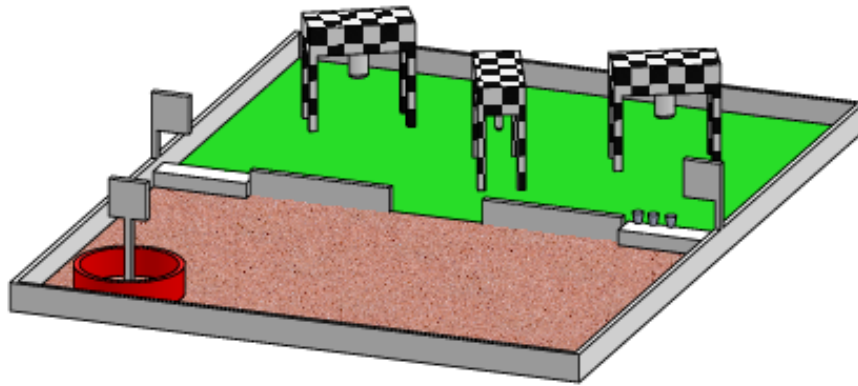


Figure 12 - Scenario initial configuration

Scores

- Pick empty terrine +2
- Cross from the corral zone to the load zone with a terrine with milk +6 (for each terrine)
- For each 40 ml stored in the milk tank +10
- For each terrine on the floor or outside the field -2
- If your robot restart and has a terrina with milk then it will win 1 point for each 4 ml.

Announcements and rounds

An announcement with an hour of antecedence will be given for starting tests and present the day schedule.

All robots will compete in each round:

- All registered teams may participate
- Judges will generate random positioning for the cows, terrines and milk tank.
- The first, second and third places of the IEEE LARC Open category will be awarded.
To obtain the first, second and third position the judges will sum the point of all the runs without the worse of them.

Registration

In order to participate the IEEE Open competition, a team of up to 6 people from any institution must be made. The team members must be students or former students that have obtained their degree up to two years ago. The teams must be registered in the website. The registered team list will be announced in the LARC website. It is required during registration to present a technical report using the IEEE template. This report must describe the main

robots concepts, construction and programming. After the competition, the winners will briefly present their robots to the other teams. The report must be sent through the event website. Failure in presenting this document will prevent the participation of the team in the competition, as it is important to the teaching, development, and knowledge transferring between contestants. All teams participating the IEEE Open competition will receive a participation certificate. In addition, the teams classified in the first three places will receive a winner certificate.

Honor rules

Fair Play and cooperative behavior is expected from all teams during the entire competition, in particular:

- while evaluating other teams,
- while refereeing, and
- when having to interact with other teams' robots.

This also includes:

- not trying to cheat (e.g. pretending autonomous behavior where there is none),
- not trying to exploit the rules (e.g. not trying to solve the task but trying to score), and
- not trying to make other robots fail on purpose.

Based on fair competition, LARC competition encourages friendships and the exchange of ideas, showcases accomplishments, advances robotics, and seeds interest in future generations of robot builders.

The rules are designed to support those principles. But, a written document is unable to cover all the circumstances and conditions of an event. The referee and contest organizers have complete discretion to interpret and alter these rules, at any time, to meet the intended spirit of the games.

Whenever reasonably possible, referees should provide helpful explanations and opportunities for correction to allow even novice contestants every chance to participate and have an enjoyable experience. When disagreements arise, participants and spectators should be flexible and remain respectful.

The jury

The jury will be composed of experts in robotics. One of them could be a competition organizer, and the remaining two guests. The names of the judges will be announced before the competition.

On extraordinary situations during competition

Any extraordinary situation regarding rules or the score will be considered by the judges and the organizers of the Open category and they will issue a verdict with honesty and impartiality.