IEEE Open 2016-2017
Milker Robot
Version 1.1

Sumary

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.

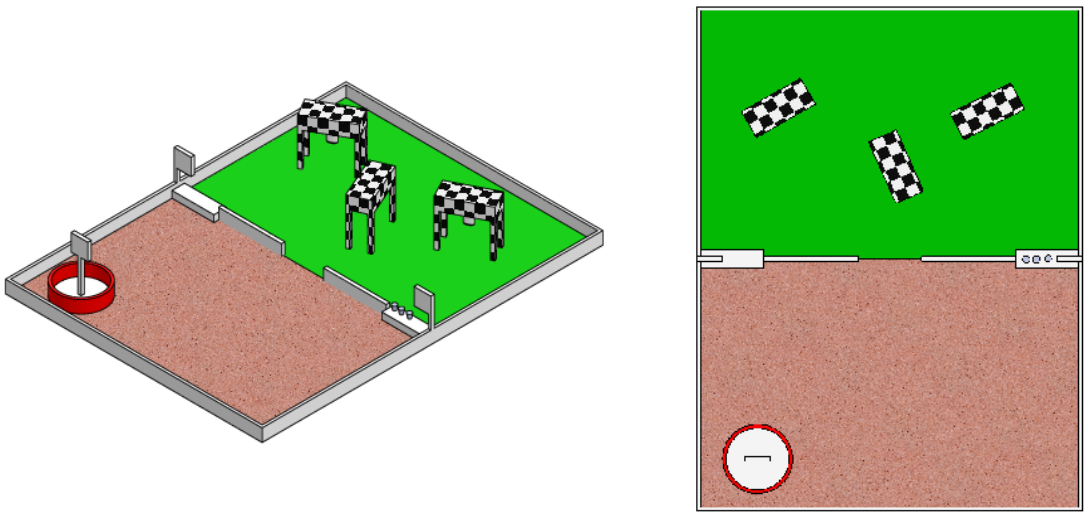

Figure 1 - Scenario

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

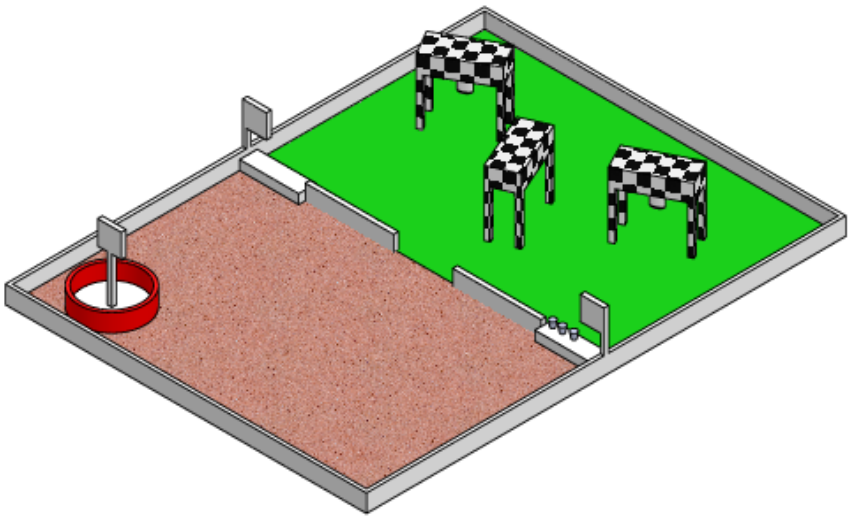

Figure 2 - Empty scenario.

The field consists of a 4 by 3 meter rectangle, made of wood (melaminic 20mm 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 *exchance 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 begining 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.

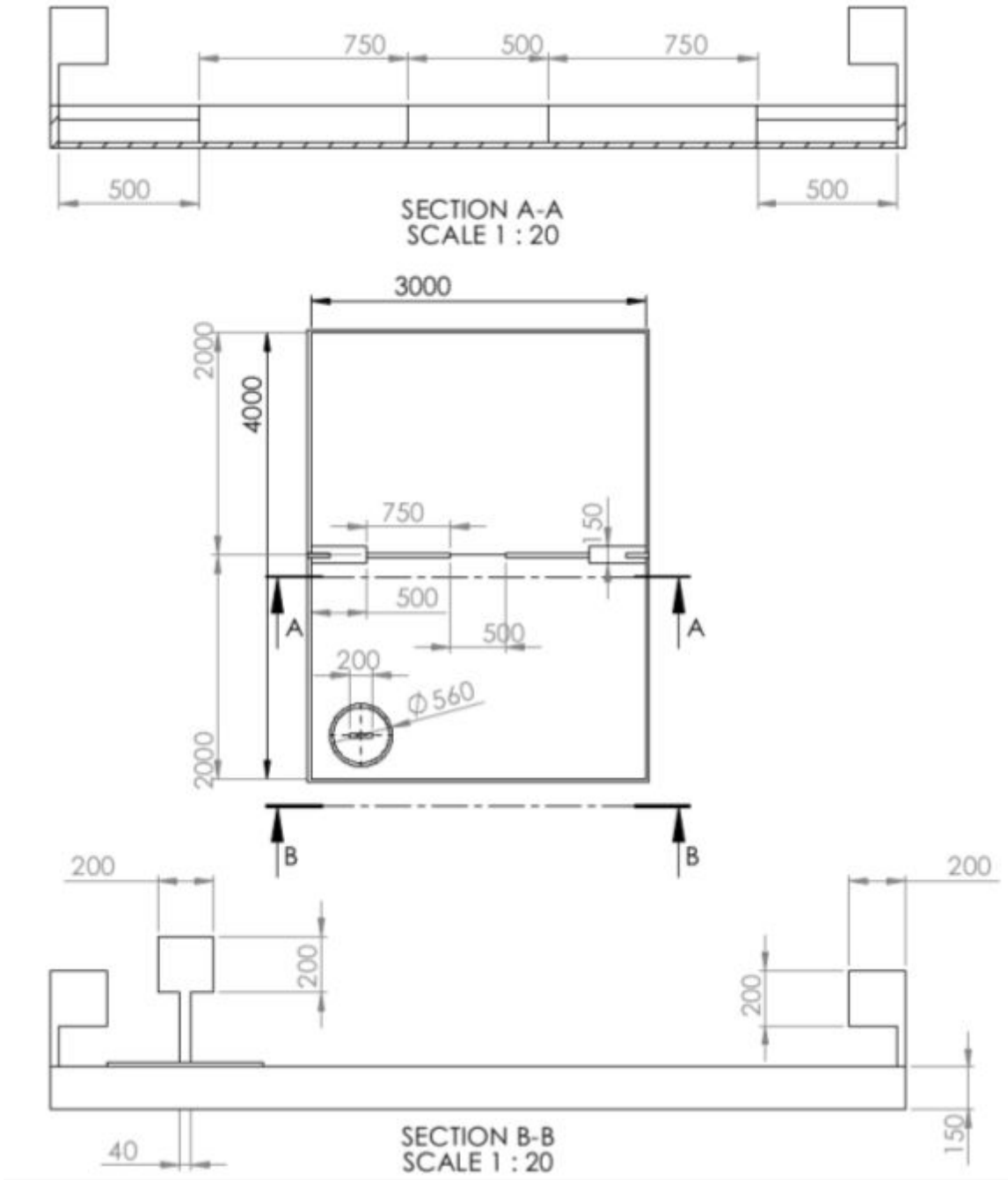

Figure 3 - Arena dimensions

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 cilinder 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).

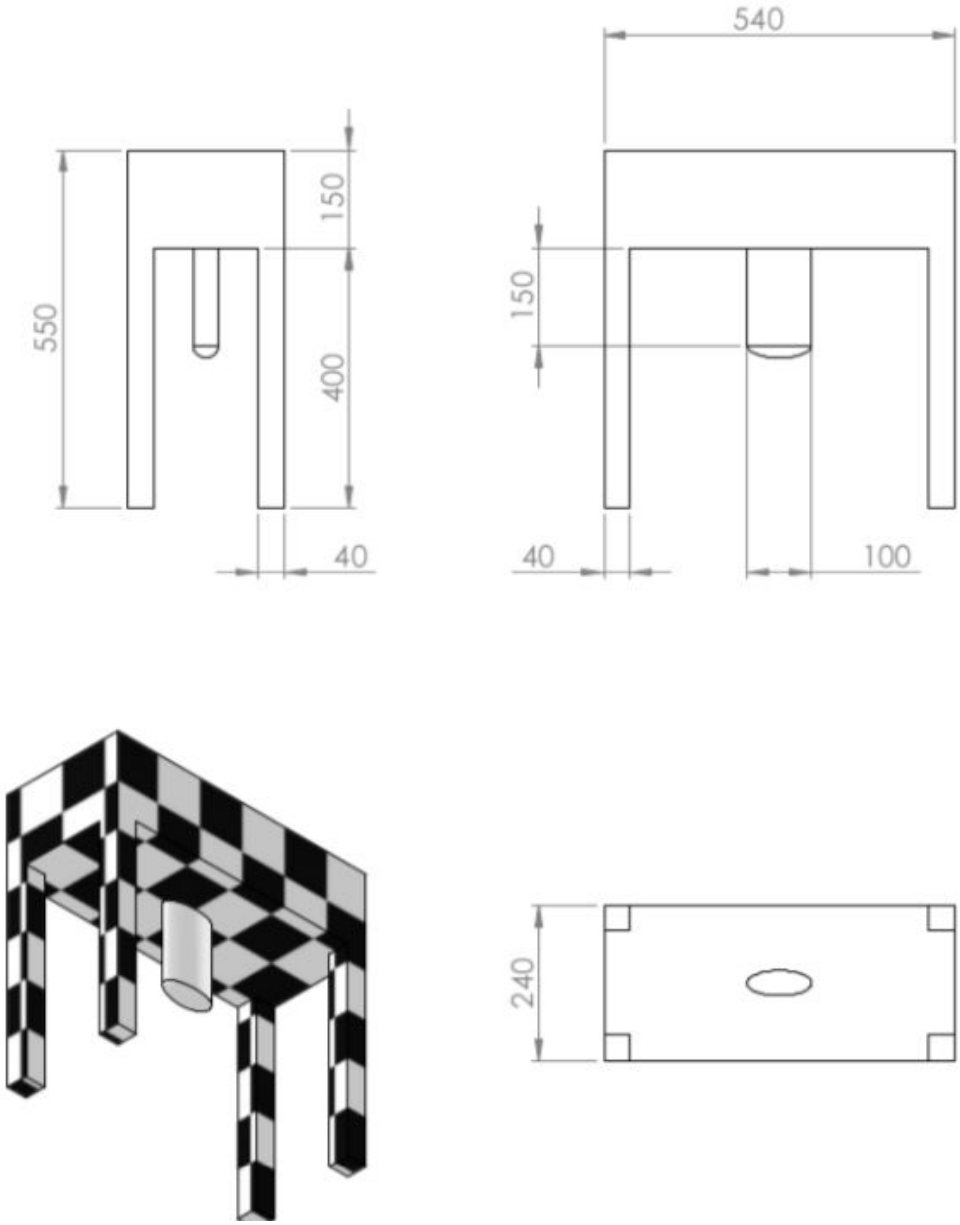

Figure 4 - Cow dimensions.

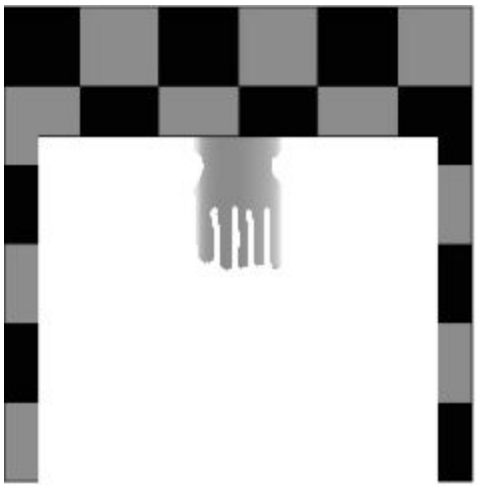

Figure 5 - Cow lateral side with glove

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 kind of gloves should be like the one below.

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 gloves will be a fault for the team.

The Milk Tank

The milk tank is a 56 cm diameter by 20 cm tall plastic red cilinder. This cilinder colud be placed in any part of the load zone by the judges. The robot shoud have the ability to find it.

Zones Markers

There are some identification marks present in the environment to help robots localization. This markers are like artoolkit 20cm x 20cm fiducial mark and will indicate where the exchange zone is and another mark will indicate empty terrines zone. The milk tank will also has a marker. Each marker is diferent. Markers are presented below.

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

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 at the time of testing. Since the competition began, the teams will play in the conditions of the scenario without discussing or making any complaint.

Dimensions

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

The Robot

The robot must be autonomous mobile, 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 a onboard processor. Robot can be air or land type. The use of more than 1 robots of any kind will be permitted. The sum of the weight of all robots of a team should not exceed 10kg. All of them must fit inside a cube of 50 cm edge before match starts

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

- The robot (or robots) must be initialized just by pushing a single button in any round of the competition.
- External communication with any device other than robots of the same team is prohibited.
- The scenario can not be changed by any robot.
- Teams will be disqualified from the competition if their robot violates any of the above restrictions.
- At begining each competitor could set his robot/robots in any position of the field. The position choosed by de competitor will be used in case of restart.

Rules

As soon as the competition starts, all teams must leave the robots in a “waiting area”, a space
designed by the competition commission outside the task environment. The robots can be

withdrawn from this area during the competition and in the end of each round. All teams will have the same time limit for robot adjustments. The moment when each team will compete will be randomly chosen, and only in this moment, a team member can withdraw a robot from the waiting area.

While in the waiting area, the robots cannot be modified. Any hardware or programming changes will only be allowed once to all contestants in the end of a round.

About restarting: The clock will be stopped and the team will be penalized with -10 points due to restarting. The team has 3 minutes to restore the robot(s) to compete. It is not allow to change the robot programming or leave the competition area. There will be permitted at most two restarts. The idling time will not be accounted on the total time, but the time used up to the restarting will be added to the total time.

About penalties: The clock will not be stopped, the robots must continue its activities, the environment will not be reset and the score will not be restored. The robot will receive a score
penalty for any task failure.

- The robot can not have more than two terrines at the same time. If take more than two terrines it has to restart.
- Robots can comunicate each other.
- The total time to complete the task is 15 minutes.
- Each team has 2 restart posibilities. The restart position will be the same as the one choosed at the beginning of the round.
- If the robot touch a cow leg or body more than 6 seconds must restart.
- If the robot damage a glove must restart

Arena initial configuration

- The arena could have 2 o 3 cows. This will be drawed.
- The position of each cow will be choosed by draw.
- Will be 12 terrines in the empty terrines zone. The empty terrines will be uniformly distributed.
- Each competitor could set his robot/robots in any position of the field. The position choosed by de competitor will be used in case of restart.
- The milk tank position will be choosed randomly by the judges.

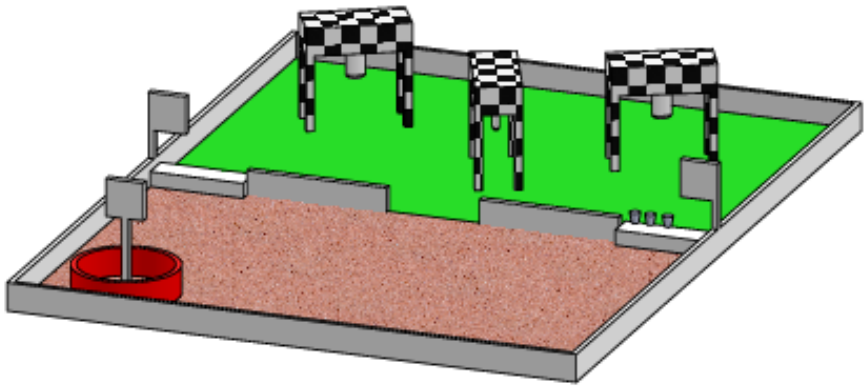

Figure - Scenario initial configuration

Scores

- Pick empty terrine +2
- Cross from the corral zone to the load zone with a terrine with milk +6
- For each 40 ml stored in the milk tank +10
- For each terrine on the floor or outside the field -2

Announcements and rounds

An announcement with an hour of antecedence will be given for starting tests and the exact hour the robot must be in the waiting area. This time may be used by the teams to adjust the robots. There will be a qualifying and a final round.

Qualifying round:

- All registered teams may participate
- Each team can have two tries to do the task.
- Judges will generate random positioning for the cows, terrines and milk tank.
- The four teams with the highest scores will qualify to the Final Round.

Final

- Only the qualified teams may participate
- Each team will have at least two rounds
- 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

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 finished their studies in at most two years. 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 robots' conception, 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 deny participation of the team in the competition, once 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.

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 situtations 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.