9th IEEE Latin American Robotics Competition for Students

Rules of SEK category

Pipeline Repair Robots

Version 1.0, April 19, 2010

1. INTRODUCTION

The respect for the environment has been of increasing concern among various sectors of society worldwide. This is a concern also present in the oil industry in Brazil and throughout Latin America, which points to a trend of increasing independence among those involved in the distribution pipeline.

The pipeline system is always seeking new technology to better perform, among them we can mention reducing the risk of leaks, detection of fugitive emissions in transport, and reducing repair time and environmental impact. The idea is not just to improve what is already known worldwide, but to seek new concepts and new technology. The safety of pipeline transportation in the world is increasingly demanding and the countries that built large meshes in the past have legacy systems that can bring great harm to the environment.

Given this search for innovation, the teams are challenged to prepare the best pair of robots capable of repairing pipelines, and build alternative pipelines in the shortest time possible, to avoid environmental damage and disruption in production.

2 GOAL

The arena simulates an area with a leaking pipe and tubes around to be used in the repair of the pipeline, besides the construction of an alternative pipeline, in order to reduce the time of interruption in the flow of oil. To ease the challenge, the distribution pipes within the scenario is always the same, i.e., the scene of the arena will always be the same throughout the competition.

The robots are initially positioned at opposite ends of the arena, one at the bottom and another at the top. The robots will work collaboratively to build an alternative pipeline to the detriment of an old and ancient duct that has already leaked.

2.1 Avoid environmental damage and restore production

The robot has a major challenge to stop the leak in order to reduce the environmental damage and to restore oil production as soon as possible. There are penalties for environmental damage due to weather, and the lack of replenishment. The robots must work quickly and efficiently to reduce environmental damage and restore the supply, otherwise we pay high fines if such goals are not achieved.

2.2 Alternative duct assembly

Robots will build a pipeline from the valve alternative # 1 of the main duct with this duct's objective being to divert the flow of oil production as the main duct is repaired.

2.3. Location of the beginning of the challenge

Upon beginning the challenge, the situation is dramatic. With the damage of the main duct, oil spill is occurring in the environment and thus the provision that the account be suspended because it reaches its destination Platform (Receiving). Thus, there are fines from the Government for the damage to the environment and very high financial losses due to the lack of supply. The challenge for robots is to restore order, prevent the spill of oil supply and return, receiving the minimum fine and avoiding major losses. The robots more efficiently will, working together, be able to save more money at the end of the task.

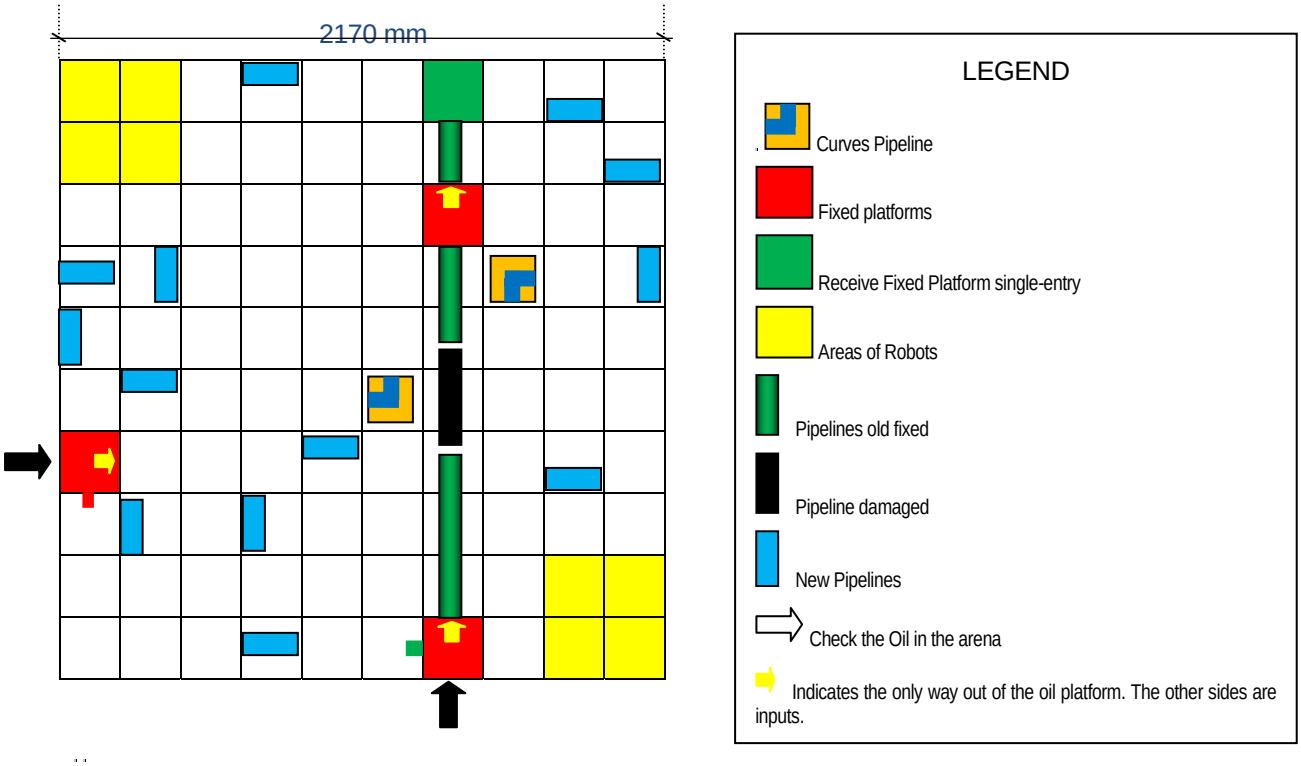


Figure 1. Arena in its initial configuration

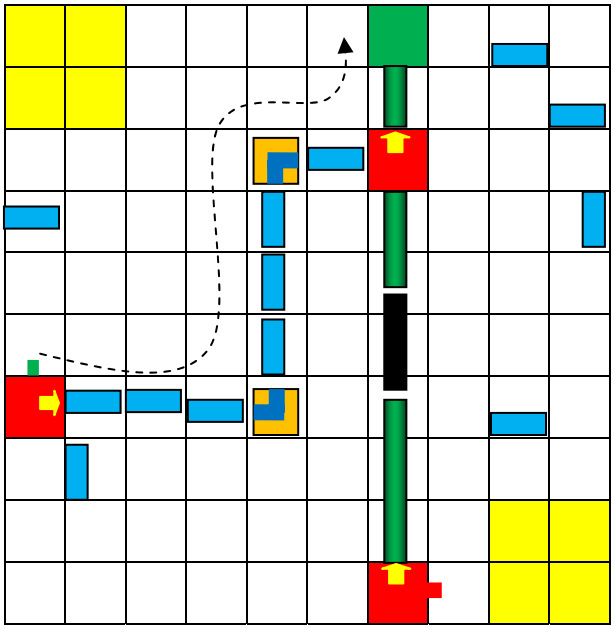
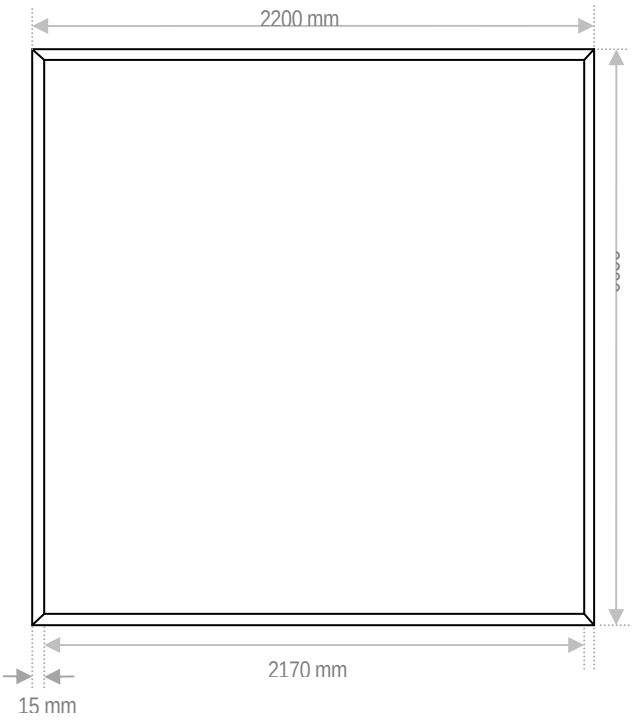


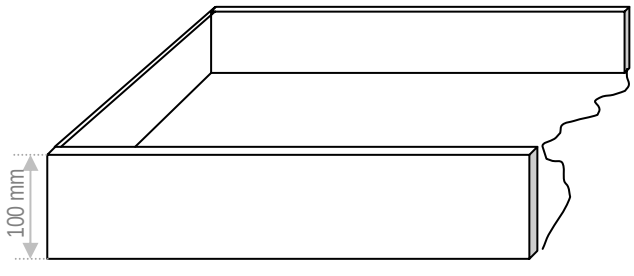
Figure 2. Example of a solution to the arena with the alternative flow identified

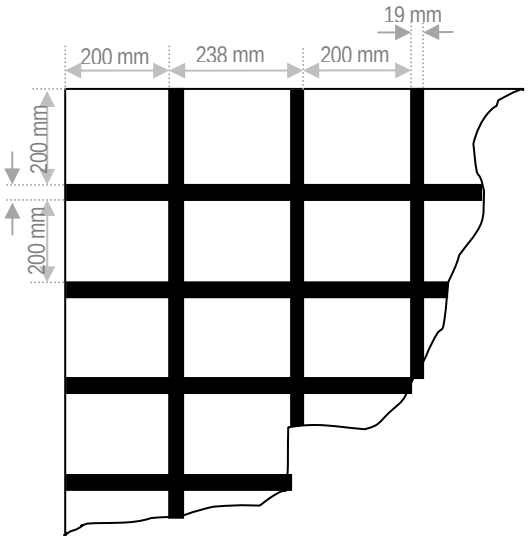
3. ARENA

The scenario of the arena should be built of MDF, 15mm thick, rectangular in shape with a width of 2200mm and length 2200mm. On the side, the wall should be 1.5cm thick and 10cm high, leaving a square floor area of 2.17 m x 2.17 m. Scenery and walls should be in a white matte.

The arena is divided, then, in a 10x10 matrix with black electrical tape 3M ® or 19mm wide bands painted matte black 19mm. There is a black belt or duct tape on the corners of the walls. Each square, which we will call home, should be a matrix surrounded by black bands and must be 20cmx20cm. Tapes will have 9 / black stripes vertically and 9 horizontally.



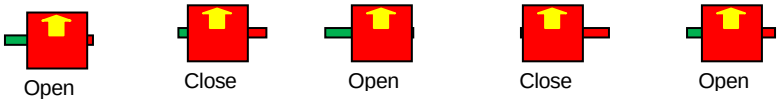




3.1 Components of the Arena

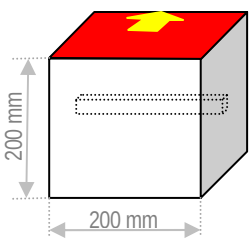
3.1.1. Fixed platforms

- Four (4) wood decks painted in red on the upper surface of 200mm x 200mm x 200mm (height x width x length) represent the fixed platforms.
- These platforms are fixed on the floor of the arena with nails or screws.
- The two platforms have fixed entry system for opening and closing. This system is perpendicular to the output of the oil platform. It consists of a timber passing through the center of the platform with a green tip (which is always left exit) and a red tip (which is right). When the red is more prominent than the green, the platform is considered closed. Conversely, if the green part is more prominent, the platform is open. If both are noticeably alike, it will be considered open. See examples below:

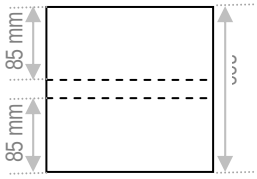


Sizes and formats::

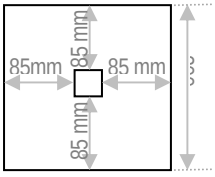
3D design



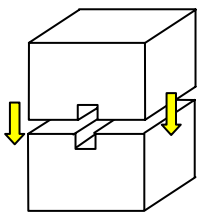
Top View



Side View



Tip Assembly



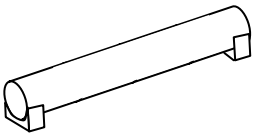
Wood that opens and closes the valve:

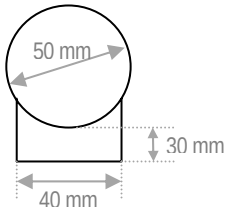
3.1.2. Curves Pipeline

- Two curved pipe styrofoam painted orange on the upper surface of 150mm x 150mm x 150mm (height x width x length), can be dragged or rotated to any position. These curves have an L-shaped blue design on the top, which identifies the flow direction of the ducts.

3.1.3. PVC pipes

- Thirteen PVC pipes of 5cm diameter and 20cm in length will be used. The thickness of the pipe must not exceed 3mm. The pipe will be painted in blue and will make all products to be assembled.
- The main duct is fixed, made of PVC pipe 5cm diameter. There will be three green fixed pipes: A 20cm, a 30cm and a 50cm.
- There is a damaged tube, in black, 30cm. This product is mobile and is located 5cm from the duct and also a 50cm 5cm 30cm fixed duct.
- The end of each tube will be placed on a Styrofoam support, the color of the barrel, thereby preventing them from rolling into the arena.

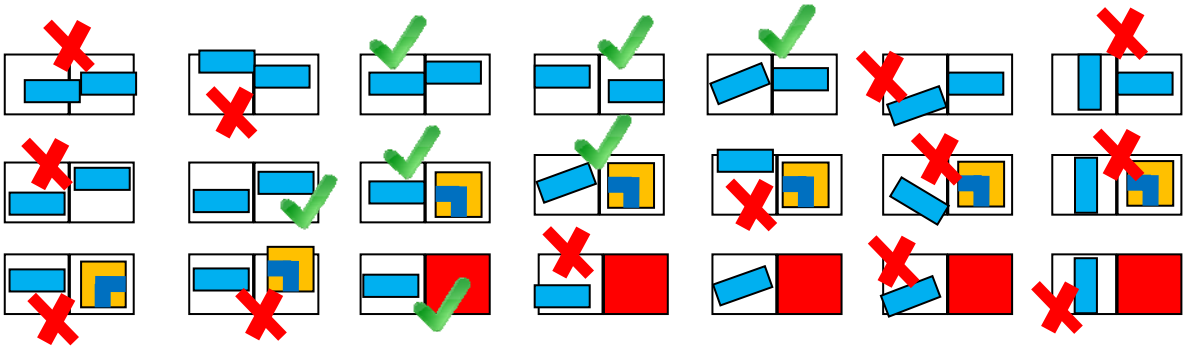




3.2. Connecting pipes and curves

The pipes must connect with other pipes, with platforms and pipelines curves. This connection is possible if following these rules:

1 - A pipe is connected to another barrel if they are inside adjacent houses (no shares out of the house), in the same direction and with parts that identify a connection.
2 - A pipe will be connected to a platform or pipeline curve if each is within an adjacent house and the barrel is toward the house of platform or curved duct.
Examples of valid and invalid connections:



4. THE ROBOT

4.1 General

The robot must be an autonomous mobile device and be able to move across the arena and meet the goals without human intervention. It can only be built with educational kits like LEGO ® (NXT or RCX), PNCA ®, © or MECCANICA VEX Robotics ®, which may take a maximum of six sensors and actuators for robot 6.
The elements of the educational kit cannot be modified. Failure to comply with this clause will be cause for disqualification.

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4.2 Restrictions

- The extent of each robot, before each participation shall not exceed the size of a cube of 250mm from the side. Once the initial participation starts, after the firing of the timer, this restriction no longer counts.
- There should be communication with external devices. The breach of this condition is cause for disqualification. They should not destroy the scenery;

5. THE RULES

Before starting each round, all competitors must leave their robots in space specified by the organization and may at this time be withdrawn from the competition or wait until the round ends. If the robot presents any obvious mechanical problem, and judges and organizers allow, the participating team can operate the robot while racing, with no interruption in timing. It is considered as an evident mechanical problem, for example, the detachment of a wheel, motor, sensor or any difficulty not associated with a poor design that prevents normal operation and can be repaired within the arena.

5.1 General

Each team will be advised in advance of its participation.
At the time of competing, the members of each team will be responsible for initiating
programs for both robots.
Once the team has started to compete, it cannot interact in any way with robots. If this happens the team's participation will be terminated.
The robots can interact with each other by any means (Bluetooth, infrared, radio, sound, light, etc.). The means used must not have third party intervention. It is considered a third party any human or electronic agent that is not incorporated into robots.

The participation of the team may be terminated in two ways:

- Competitors agree to withdraw their participation before completing the challenge. The team will be given the maximum time (five minutes)..
- Complete the maximum time for the challenge

6. SCORE

6.1 General

- Each team starts the round with a score represented in dollars, with a value of US$ 2,000..
- With every restart there is a loss of US $ 500 without resetting the time. There is a maximum of two restarts per participation. To summarize:
    - If the team decides the restart, the time will be stopped,
    - the arena will return to the initial configuration,
    - All the penalties will be reset,
    - the team will lose $ 500 and
    - the time will again be counted from where it left off.

6.2. Penalties

Here are fines and financial loss:

- The Every 10 seconds without oil at the other end of the duct is lost U.S. $ 20.00
- In the leaked oil every 25 seconds, there is a fine of $ 50.00 for environmental damage and occurs every 1 minute over an additional fine of $ 100.00
- If the damaged pipeline, to be removed from the site, is placed somewhere other than the yellow area of the robot, will be charged a fine of $ 300.00 once.

6.3. Credit Bônus

After each round, among the teams who have completed the task, the teams with the three highes balances in the round will receive a bonus as follows:

- the first place of the round: Balance Challenge + U.S. $ 500.00
- the second place of the round: Balance Challenge + U.S. $ 250.00
- the third place of the round: Balance Challenge + U.S. $ 100.00
- If there is more than one team in any setting, the bonus will be divided equally between the tied teams.

7. ROUNDS AND STEPS

Before starting the round, teams will be warned in advance and given time, according to the amount of teams, so they can prepare their robots. If the judges deem necessary, each team will have 1 extra minute before their participation, to perform calibrations of luminosity. There will be two stages: the classifying and the final.

7.1 Classifying Stage

- All participating teams enter in the LARC 2010, SEK category
- Each team participates in a maximum of six rounds. This amount may vary at the discretion of judges and amount of teams.
- Maximum time for the task: 5 minutes.
- Restarts: each team can have up to 2 reboots for participation. For every restart there is a penalty and the clock is not reset.
- Score: The final rating will be decided according to the best team score in a round..
- Tie: the tie-breaker will be given in this order::
  - Ranks who completed more rounds
  - If the tie persists, ranks who obtained the highest score (value) by adding the six rounds.
  - If the tie persists, there will be a bonus round.
- Time to call: after being called, each team will have 1 minute to present themselves at the arena. Once this period has elapsed, the count for the participation of the team starts counting

7.2 Final

- Team needs to be among the first 4 places in the qualifiers
- This phase consists of three rounds. This amount may vary at the discretion of the judges.
- Maximum time for the task: 5 minutes.
- Restarts: each team can have up to 2 reboots for participation. For each restart there will be a penalty and the clock will not be reset..
- Score: The final score will be decided by assessing the best score from each team in one of three rounds.
- Tie: to define the position, there will be played a fourth round tie between the teams.
- Time to call: after being called, each team will have 1 minute to present themselves at the arena. Once such period has elapsed, the time to participate in the team starts counting.
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8. . REQUIREMENTS TO PARTICIPATE IN THE COMPETITION

Those interested in participating in the Latin American Robotics Competition LARC 2010 IEEE SEK category must form teams of undergraduate students in any educational institution in any country.

To register, teams must submit a document describing the development and operation of the robot (TDP) in IEEE format. This TDP will be used for the winners of seats to make a brief report to the other competitors after verifying the shipping dates on the event website.

9. THE JURI

The jury will consist of one participant of the organizing team of the competition who is familiar with the rules and who is a professional in the field of robotics..

10. EXTRAORDINARY SITUATIONS DURING THE COMPETITION

If there is any situation not covered under the above mentioned rules, or any doubt about the score, it will be up to the judges and the organizers of the competition to consider the case in the greatest possible impartiality and make a decision.