# Corsinha 2022 Team Description Paper

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**Abstract.** The present document serves as requirement for the 2022 Team Description Paper to be submitted for qualification in the Salão de Robótica. Firstly, Corsinha is a robot entirely build with LEGO tools, such as the Mindstorms EV3, and it has as main line of research the study and analysis of the impact that two ultrasonic sensors can have in a Sumo Lego match.
In this approach it is important to describe some problems that the robot development has come across, being the main one the developing process of a robot that fits in the category of Lego Sumo, since the weight is restricted by 1 kilogram. Secondly, the study of strategies took a while, given that the goal is to build a smart robot with wide vision space. Nevertheless, the team overcame all these obstacles and managed to make a functional robot for the competition.
In this view, it is important to study the multi-sensor approach to contribute for the Lego robots community, so it is expected that this mechanism helps in robot performance on a match.

## 1 Introduction

Corsinha is a robot built with lego and programmed in the Python programming language. The idea was born from the desire to make a robot with front and back vision sensors, so it can identify enemies from wherever it is. This type of robot belongs to the Lego Sumo 1 kilogram category.

Once the premise of using the two sensors was established, the robot was built to study the main advantages and disadvantages of this type of approach so that improvements can be made later.

Thus, highlighting the main challenges during the elaboration of the robot is fundamental, since it records the main aspects that the team faced during this period. These challenges were all overcome so that in the end, the robot could finally participate in the competition.

## 2 The construction

The construction of the robot took place through stages and constant dialogues about difficulties encountered previously in lego competitions, in this sense, the elaboration of the robot was divided into 3 main stages, being the ideation, the development and finally the revision of the robot structure, as a whole.

First, about the conception, the members raised possible features for Corsinha, which could improve his performance during fights. After successive debates about mechanisms for the robot, it was decided to create a robot with two ultrasonic sensors. The sensor works by measuring the time interval of the echo propagation. This type of sensor is a smart approach to Sumo matches, as enemies can be easily spotted.

In another stage, the robot was actually builded, the builders always had in mind the premise of making a robot that had protection around itself to prevent other robots from lifting it. In this line, it was established that the robot should make the most of the dimensions proposed by the category.

Finally, to finish the construction of the robot, the robot structure was reviewed, in order to avoid unnecessary parts and respect the weight limit. In this perspective, it should be noted that the structure of the robot was revised later after the tests were performed, as they provided a good basis for what the robot should improve.

### 2.1 Construction challenges

The construction of the robot was effective and carried out successfully, however throughout all these stages the developing team was faced by some challenges to be overcome, which will be mentioned in this topic. In this sense, among the main impasses to be mentioned, the proposition of ideas that were efficient for the Corsinha context, the elaboration of a structure that would guarantee stability to the robot and, finally, the development of a structure that would fit the dimensions of the category.

First, about the conception phase of the project, it is important to highlight that the team has already participated in several competitions of the category, and thus has conceptions of functionalities that proved to be better or worse during the fights.

Proposing the idea of a robot that would innovate and be efficient was an initial challenge, which was overcome once it was raised that during fights knowing where the other robot is is one of the crucial points for victory, thus, it was understood that a coherent approach would be to increase the robot's vision space by using more than one ultrasonic sensor.

Furthermore, the development of a stable body for the robot was also an obstacle experienced by the team. In this perspective, it is understood that during fights, it is essential to prevent itself to be lifted by other robots, as this can make it easier for the robot to be pushed out of the dojo. In this premise, to avoid such an incident, the idea of placing devices that avoid ramps alongside

the robot was proposed, and this could be done basically by developing a kind of fence that completely surrounds the robot.

Finally, another obstacle experienced by the team was to fit the dimensions of the category, in terms of weight, width and length. In this line, along the development, in some moments it is common to exceed the dimensions of the category, and this in the fight would cause the disqualification of the robot. Thus, to avoid such an obstacle, the team designed a mold, that follows the dimensions of the competition rules, so that the robot could be constantly checked and evaluated.

## 3 The robot's programming

The robot's programming was developed in Python programming language, in particular, using MicroPython, so in this case it is essential to detail how this process was carried out in the context of Corsinha.

It is commonly observed that robots made with lego often use block-based programming, which is a simplified way of giving instructions to the robot. Such programming modality can be performed quickly, since the software provides a great help during development. However, this implementation modality limits the functionality that the robot could have, since some logics cannot be implemented. With this in mind, using Python guaranteed flexibility during development.

The programming of Corsinha was based on giving instructions to the robot, so that it used intelligent mechanisms to combine vision and movement, since as mentioned before, the robot has a front and back field of vision. Thus, the strategy was proposed of constantly looking for an enemy, and once found, moving quickly in its direction. Also, it is important to ensure that the robot does not go out of the dojo, for that, all movements were tested beforehand.

### 3.1 Obstacles in the programming phase

The stage of programming Corsinha was done with great care and analysis, since it is the main part in the elaboration of a lego robot. The main obstacles observed at this stage were to ensure the good use of ultrasonic sensors and to propose strategies that efficiently coordinate vision and locomotion.

Several tests were carried out during the programming, which helped to verify the robot's performance. It is also worth mentioning that the code underwent several versions, and this mechanism was guaranteed through Git.

Lastly, the promotion of creative strategies was a challenge. In this sense, in order to do this, the team reviewed footages of previously competition, and identify the strengths and weakness of various robots, even from other institutions.

## 4 The impact of vision during a lego robot fight

As detailed previously, Corsinha was built out of a desire to assess the impact that multiple view spaces can have on a Lego competition. In this sense, once the robot was developed, the main advantages and disadvantages of this approach were raised.

About the pros, it was observed that using this mechanism, the robot was constantly able to identify where its enemy was, and this ensured that the process of searching for another opponent was drastically reduced. Finally, it is established that using such functionality guaranteed good detection parameters for the robot, which further increases the chance of victory during a fight.

Once the advantages have been raised, it is also important to talk about the observed disadvantages of this type of approach. In this sense, coordinating locomotion and vision is a difficulty during the development of a robot with two ultrasonic sensors, complex situations may arise, such as when the two sensors detect something at same moment. Furthermore, using two sensors takes up a lot of space in the robot structure, and thus, designers end up having to remove some other components from the robot to guarantee space for the sensors.

After reporting such points, it is credible that the functionality has more advantages, and that the disadvantages can be overcome through constant testing. Therefore, it is understood that vision represents a huge factor in the fight, and in a large number of moments, it is considered to be a decisive factor for the robot's victory.

## 5 Background

This topic is committed to highlighting the lego robot competition scenario in the country and also mentioning how the Yapira team positioned itself. Sumo robot fights take place throughout Brazil, and most competitions have this modality.

The teams elaborate different tools in order to always make a creative robot with mechanisms that guarantee victory. In the context of Yapira, the team has two other robots of the modality, called Judy and Gaitaço, the first being made with EV3, and the second with NXT.

In this sense, the team is constantly studying the scenario, and proposing tools so that the robots always have the most updated and tested mechanisms, in order to give their best. Although Corsinha is the team's new project, it has been tested with robots that have been made previously, and their performance is tested through friendly matches.

## 6 Achievements

Corsinha's main achievement were the victories obtained against the old robots of the team, considering that the robots have already been tested in several competitions, and have won a good amount of matches, like Judy, the other lego robot from the team that won four matches at IRONCup2020. In this sense,

the performance of Corsinha has been constantly evaluated in order to prevent possible errors.

The team also considers elaborating good strategies as an achievement. In this premise, the proposed strategies aim to make Corsinha a robot that can predict possible fight situations, scenarios in which the enemy cannot be seen, or in which it is at the edge of the dojo.

## 7 Conclusions and future work

It was concluded with the development of Corsinha, the importance of knowing how to coordinate locomotion and vision in a robot. In this sense, it was noticed that the proposed mechanism is thriving for new possibilities and strategies, and, it is expected to evolve the robot's functionalities so that it constantly has valuable aspects for the fights.

In this premise, it is expected that in future upgrades, the structure may be reevaluated, in order to guarantee a better use of the area disposed by the robot. Still, it is expected that the algorithms implemented in the development has continuous improvements, and that new strategies can be implemented.

Finally, it is expected that the competition will raise points of improvement for Corsinha, so that it can increasingly expand its knowledge baggage, and will use its sensors in its favor in order to win.

## References

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2. MicroPython. Micropython. https://micropython.org.
3. Roboteducation. Tudo sobre o ev3! https://roboteducation.com.br/planos-de-aula/mindstorms-ev3-45544/tudo-sobre-o-ev3/.

## Softwares used in the robot

We use EV3, which has the Sitara AM1808 as a processor, with a 32-bit ARM9 core .

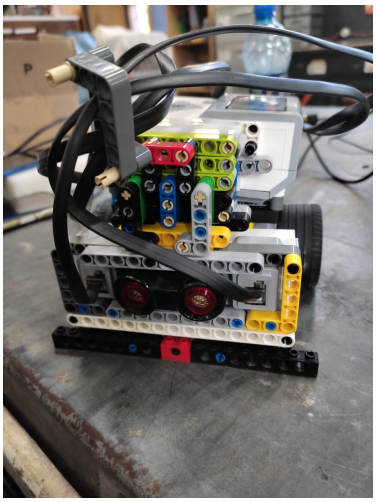

**Fig. 1.** Robot Corsinha

### Robot's Software Description

*For our robot we are using the following software:*

- Platform: EV3.
- Face recognition: None
- Object recognition: Ultrasonic sensor, which detect objects at a distance x, for the present case a distance of 30 cm was used.

### External Devices

*Corsinha robot relies on the following external hardware:*

- Ultrasonic Sensor

## 8 Robot's characteristics

- Dimension: 15.2x15.2.
- Weight: 860g.
- Traction Type: Motors (2)
- Number of sensors: 2