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Development of a robotic prototype for automated waste collection

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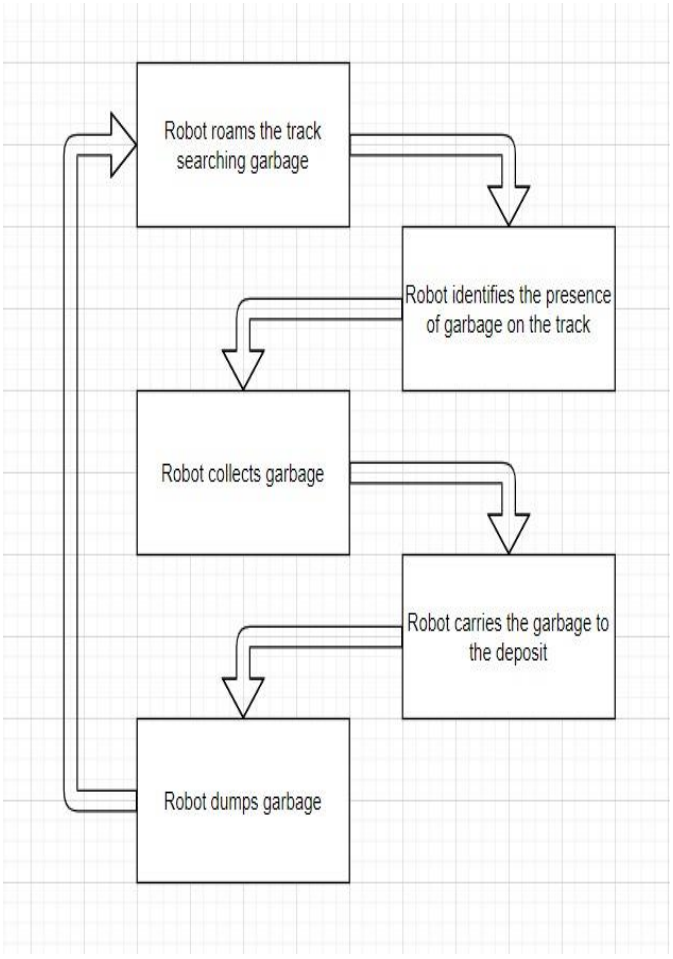
Graphical Abstract



Abstract

One of the main difficulties in the world is the inadequate disposal of waste, which generates several environmental and social problems, such as pollution, flooding and damage to public health. The main goal of this project is to develop a robot prototype to collect waste in an automated way, generating efficiency and agility. The LEGO Mindstorm EV3 kit was used to build the robot, using color and presence sensors. The robot follows a certain path, defined by a black line detected with the color sensor. Upon detecting an object in its front, the robot collects and loads the waste until the end of the route that was defined as appropriate place for disposal, marked by a gate. After the end of the route, the process is automatically restarted. The robot performs the proposed tasks as expected. This robot prototype contributes to the reduction of the aforementioned problem, collecting the waste and disposing of it in the appropriate place. This project is a robot prototype that can be developed for real situations using other robotic resources.

Introduction

One of the main difficulties in the world is the inadequate disposal of garbage, which generates several environmental, social and health problems. Among these problems, the pollution, flooding, and risks to health public. In a hospital, for example, the handling inappropriate of garbage can be very harmful to the health human, because the people who handle the waste hospital are subject to disease and various other types of contamination (ZANON, 1990).

Developing a robot used to demonstrate the collection of waste of way automated is the main aim of this study.

Materials and Methods

The LEGO Mindstorm EV3 (LEGO, 2020) kit was used to build the robot. Several parts of this kit were used, with emphasis on the gears that allow the controlled movement of the claws, and on the presence and color detecting sensors that allow the autonomy of the robot (Figure 1).

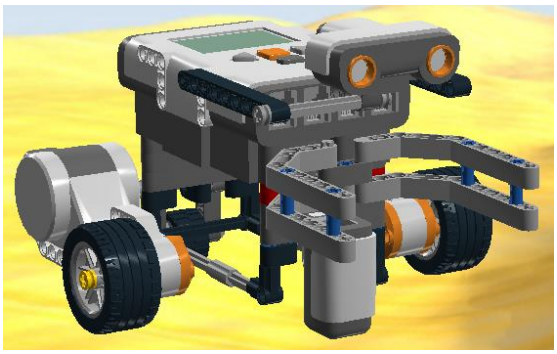


Figure 1 – Illustration of the developed robot

The developed robot was programmed to follow a certain path, defined by a black line detected with the color sensor. Upon detecting an object in front of it with the presence sensor, the robot collects and loads the garbage until the end of the route, which would be the appropriate place for disposal, marked by a gate. After the end of the route, the process is automatically restarted.

To perform tests, a track was produced that consisted of demarcations with black tape on top of a reused door. The gate was made with wood and an electric button, which when pressed opened the door. The garbage used as a model were crumpled papers and container lids.

The programming was done directly on the LEGO platform, using the block system, based on the parameters obtained by the robot sensors, which marked when to perform each action. In more detail, the code works within a loop, which is interrupted when the robot detects the gate. Within this first loop , there is another loop , which allows the robot to follow the path traced and when it detects the garbage, it picks it up and continues its route. After detecting the gate, the robot lowers an "arm" to open the gate and then deposits the trash in the appropriate place. Once the route is completed, everything is automatically restarted.

Results and Discussion

Several tests were carried out during the execution of the project, aiming to improve the robot, developing improvements in its physical structure and in its code. Also performed changes on the track to analyze the robot's behavior in more complicated routes. In addition, several tests were performed with paper waste to test the prototype's capacity.

A video of the working prototype was added to Youtube, at the link below: https://youtu.be/Q7EL4toIcn0

A related study also developed a prototype for collection of garbage hospital using Lego Mindstorm kit (PFEIFER, 2006).

Conclusions

The developed robot performs the proposed tasks as expected, collecting the garbage and disposing of it in the appropriate place. This project is a robot prototype that can be developed for real situations using other robotic resources.

References

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