Railly Clean

User Guide

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Introduction

Thank you for purchasing a **Railly Clean** robot!

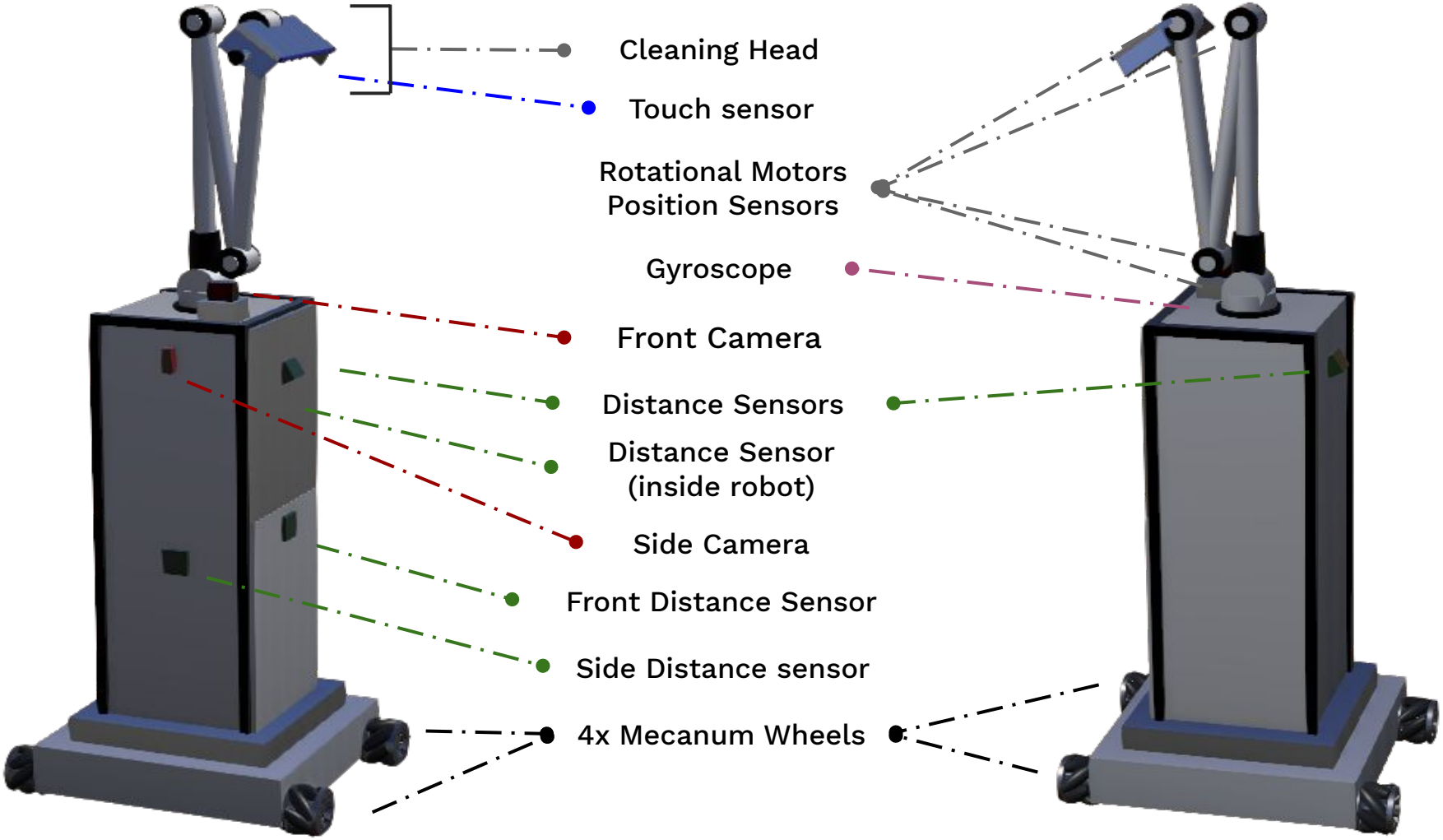
Railly Clean is a train sanitizing robot capable of automatically cleaning and sanitizing the most often touched surfaces on the train like tables and the door opening button, and collecting rubbish left behind by careless customers.

We have been working on making Railly Clean as autonomous as possible to take off the burden from a cleaning staff. However, it will still require human supervision, and it cannot clean every surface, or deal with unexpected situations like a human can. That's why Railly should work alongside existing cleaners.

This guide will walk you through how **Railly Clean** works and what it can do *[Hardware Overview, Software Overview]*, how it works, how to set it up and work with it *[Operating the robot]*, what to do if it does not work as expected *[Troubleshooting]* and maintenance.

Hardware Overview

2.1 Internal and External Hardware



Hardware Overview

2.2 Components

Raspberry Pi 3	**Raspberry Pi camera**	**EV3 Ultrasonic sensor**	**EV3 Medium motor**
			
EV3 touch sensor	**Mecanum wheels**	**Acrylic tube (for arm)**	**Li-on battery**
			

Software Overview

3.1 Install application on your smartphone

Railly Clean will work directly out of the box.

A mobile app is also provided to allow our customers to enter in certain setup parameters to customise and optimise Railly Clean to different trains, right on your smartphones.

Before Starting...

Please ensure that your smartphone has Bluetooth enabled and is connected to the Internet—this allows us to bring Railly Clean important updates!).

Android:

1. Open **Play Store** on your smartphone
2. Tap **Search Bar** and search **RCapp**
3. Tap **Install** and wait until downloaded

iOS:

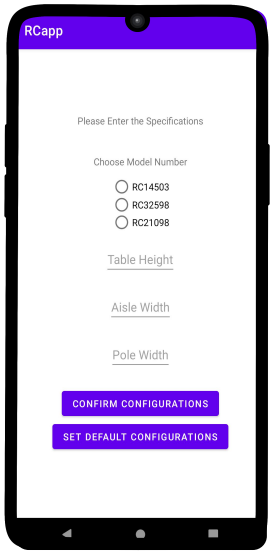
1. Open **App Store** on your smartphone
2. Tap **Search** and search **RCapp**
3. Tap **GET** and wait until downloaded

Software Overview

3.2 Setting up train parameters

Once you have installed and opened the app, you will see a page to enter in different parameters.

The guide provides you an overview on how to set up the parameters.



1. Select the **model number** of the robot UUID picked up by the phone's Bluetooth connection.

❑ If you do not sure the model number you are looking for, please move closer to the robot and restart the app.

2. Please fill in **Table Height**, **Aisle Width** and **Pole Width** to optimise the robot's performance.

Table Height - The height of the table from the ground in meters

Aisle Width - The distance from one end of the aisle to another in meters

Pole Width - The diameter of the poles beneath the tables in meters

3. Tap **Confirm Configurations** to finish the process. Clicking this button will transfer the environment setup data to the robot.

IMPORTANT!

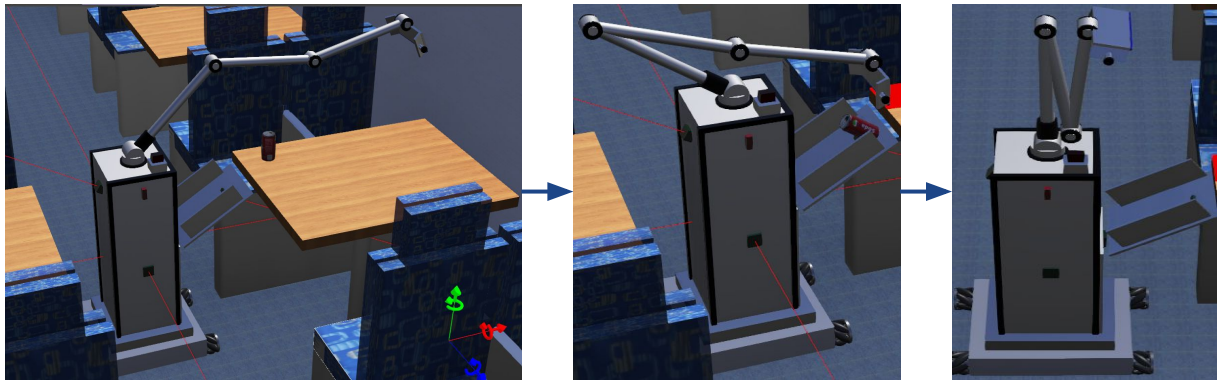
❑ If you do not have the values required, it is advised to get the measurements first.

❑ You can choose to use the factory presets values by tapping **Set Default Configurations**.

How It Works

Railly Clean down the aisle continuously unless it has detected a table or moved off the centre line by a significant amount.

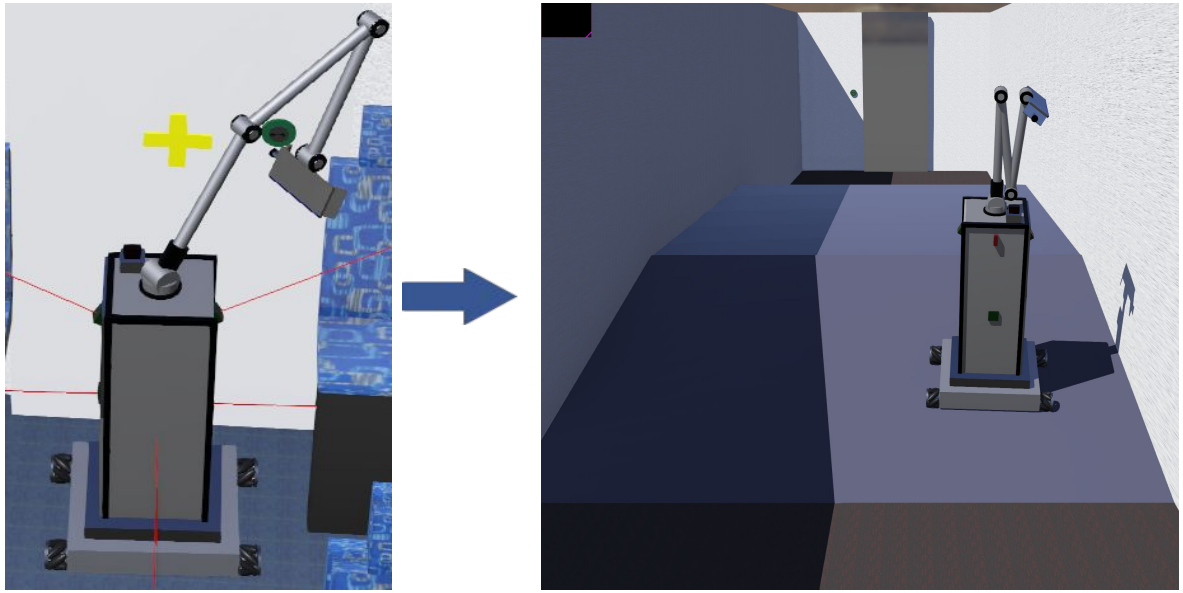
1. Upon detecting a table's pole, Railly Clean moves back to the starting edge of the table, then opens the bin compartment and begins the cleaning process.
2. Each sweep involves extending the arm out to the wall of the train, then moving the arm down until the right contact pressure is reached.
3. As the arm tucks in, Railly Clean will wipe and pull rubbish off the table.
4. Once fully tucked in, Railly Clean moves forward along the table to repeat the process to clean the whole table.



*Distance sensor rays and blocks captured are for illustrative purposes only

How It Works

1. Railly Clean will stop and detect door button to clean at either end of the carriage.
2. After cleaning one side, Railly Clean will turn around to clean the other side.
3. Upon completing both sides, Railly Clean will push the button at the door it came in from to exit.
4. Railly Clean will navigate off the train using the accessible ramp set up in front of the carriage.



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Operating the Robot

5.1 Environment Setup

The robot needs some data about its environment + a sticker set up at each end of the carriage for positioning.

1. At either end of carriage, place the included sticker centred on the door between waist and shoulder height.
2. Update the parameters of the train carriage.
3. Cover the bin compartment with a bin bag.

ATTENTION!

1. The sticker's height is not as important as its being centred — Railly Clean needs it for navigation!
2. The robot holds the parameters in its memory, so skip this step if done previously.

   (see Software for how to use the app)
3. Ensure the side distance sensors and camera are not covered.

5.2 Start Railly Clean

1. At every carriage Railly Clean is expected to clean, set up an accessibility ramp.
2. Once powered on, Railly Clean will automatically move into the train using any standard accessibility ramp.
3. Once on the train, Railly Clean will look for a door button to push and navigate into the carriage.
4. Once inside the carriage, Railly Clean will centre itself in the aisle according to the position of the sticker.
5. Railly Clean will collect trash and wipe tables on both sides of the carriage.

(see Troubleshooting in the case of unexpected behaviours)

Troubleshooting

… Robot goes past tables without cleaning

➔ Check **Table pole width** parameter was correctly set up

➔ Check the side distance sensor is clean

❑ The robot uses the side distance sensor to detect a table by its pole/leg.

… Robot does not wipe all the tables

➔ Check the side distance sensor is clean

❑ The robot estimates the width of the table from the space between the seat and the table's leg.

… Problem persists

➔ Manually adjust **Table pole scalar** parameter in Raspberry PI's memory

… Robot is stuck

Case 1

If the robot is stuck on objects at the side of the aisle:

➔ See *Robot drifts sideways* on next page

Case 2

If the robot is stuck at the end of the carriage:

➔ See *Robot does not turn around at end of carriage* on next page

… Robot knocks items onto the floor

➔ Carefully adjust the head if necessary

❑ The cleaning head should form a U shape, guiding items towards the bin.

Troubleshooting

... Robot does not turn around at the end of the carriage

... Robot turns back before the end of the carriage

➔ Check the front camera and distance sensor are clean

➔ Ensure the sticker was set up as guided

❑ The robot uses the the front camera, front distance sensor and sticker on the end of the carriage to detect the end of carriage.

... Robot is stuck in the middle of the aisle

➔ Check for objects obstructing the robot's movement

➔ Check the wheels of the robot for stuck items

➔ Ensure the robot is turned on successfully set up

... Arm does not make contact with the table

➔ Check `Table height` parameter was set up correctly

❑ The arm uses the `Table height` parameter to find tables and pressure sensor to correct small deviations, but unrealistic parameters can stop it from working.

➔ Carefully check whether any motor is stuck

❑ The arm has multiple joints, each with its own motor.

... Robots drift sideways

➔ Check the front camera and distance sensor are clean

➔ Ensure the sticker was set up as guided

❑ The robot uses the its front camera, front distance sensor and the sticker on the end of the carriage to stay centered.

Maintenance

...Railly Clean needs some maintenance occasionally

7.1 After Each Run...

... Battery

1. Remove and charge the battery
2. Replace with a fully charged battery to ensure the robot can complete the next round

... Robot cleaning

1. Remove the sponge from the end of the arm
2. Clean with water and disinfectants before putting back on the cleaning head
3. Empty the trash compartment
4. Check the wheels for trash stuck between them

7.2 Broken Parts

- ❏ If still under warranty, please get in touch with us at raillyclean@example.co.uk.
- ❏ Outside warranty period, replacement parts are provided for a fee.
- ❏ Similar parts can be purchased from third-party resellers.

If third-party parts greatly differ from the defaults:

- ❏ Hardware parameters may need to be updated in the Raspberry PI's memory.