SC25
Introduction

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Content Overview

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1

Robot specifications

Robot specifications

Weight	With battery & no water	106 kg / 233.69 lbs
Battery	Battery type	$LiFePO_4$
	Battery capacity	40 Ah
	Rated voltage	24 V
	Max. run time	Up to 3 hrs
	Avg. charging time	Max 3 hrs
Sensor	Max Lidar coverage	25 m / 82 ft (radius) 120 m / 656 ft (radius) (optional 3D LiDAR)

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Cleaning specifications

Cleaning width	366 mm / 14.4 in (w/o side brush) 654 mm / 25.7 in (w/ side brush)
Squeegee width	590 mm / 23.2 in
Water capacity	22 L / 5.8 gal (clean water tank) 25 L / 6.6 gal (waste water tank) 0.6 L / 0.16 gal (chemical tank)
Cleaning speed	0.6 - 1 m/s 1.3 - 2.2 mph
Practical efficiency	350 - 800 m²/hr 3767.4 - 8,611 ft²/hr
Operating sound level	64 dB

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Front view

- **A** Sonar
- **B** Blue light
- **C** Depth cameras
- **D** Battery compartment
- **E** 2D LIDARs
- **F** Side brushes

* One extra depth camera presented in the front - not available in the picture

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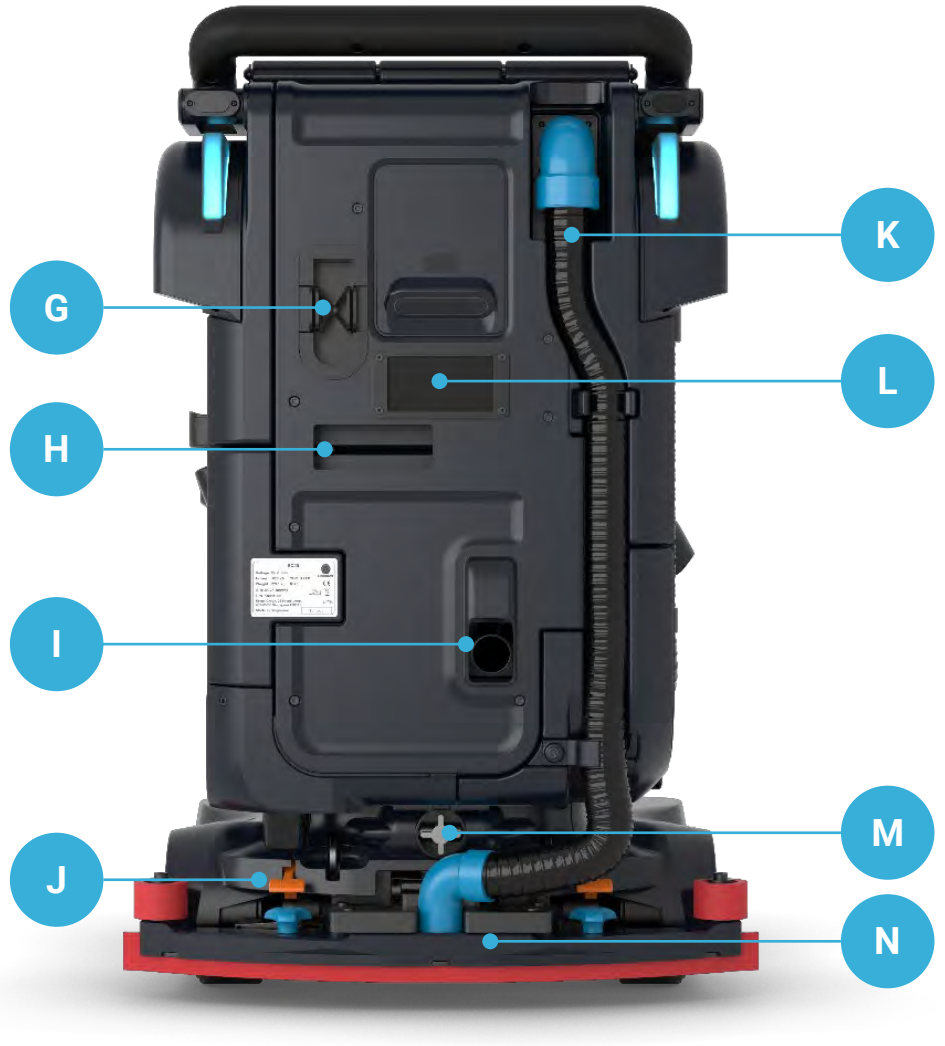
Back view

- **G** HEPA Filter
- **H** Clean water inlet (dock)
- **I** Waste water outlet (dock)
- **J** Safety brake lever
- **K** Squeegee hose
- **L** Docking contactor
- **M** Clean water drain valve
- **N** Squeegee



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Side view

- **O** Key switch
- **P** Manual drain hose
- **Q** Manual charging port
- **R** Brush & debris hopper
- **S** Chemical tank
- **T** Manual clean water inlet

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Top view

- **U** Touchscreen
- **V** Waste water hatch
- **W** Wheel unlock button
- **X** Emergency button

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2

Sensors & safety

Diagonal 2D LIDARS

Primary sensors

360°
Field of View (FOV)

25 m/82 ft (radius)
Effective range

18 cm/0.59 ft
Lidar height

LIDAR use pulsed light waves to detect objects when the light waves are rebounded back. The object's distance is calculated based on the time it takes to rebound back.

LIDAR cannot detect glass, mirrors, polished steel. Its accuracy is also affected by cloth, black and absorbent surfaces.

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3D cameras

5
Depth cameras

5
3* In front and each sides for obstacle detection & avoidance

2 m
Effective range

5 cm
Min. detectable object height

Uses IR projection to estimate depth of images. RGB image gives the robot a better understanding of the environment. The camera is able to detect and segregate objects.

Performance could be affected by bright/direct sunlight or very low light/dark areas.

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Sonars

15
Premium Grade Sonars

0.9 m
Effective range

Sonars work by emitting sound waves and calculate the time it takes to rebound.

It has a shorter range compared to LIDARs but can be used for detecting glass, shiny objects (e.g. mirrors, shiny metal etc), and black objects.

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3D cameras

What it sees

Point cloud-based scene understanding

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Emergency stop

The red emergency stop (E-stop) button is located at the top of the robot.

Pressing this button cuts off power to the internal motors of the robot and causes all lights on the robot to blink red.

To resume function of the robot, turn the button clockwise to release the E-stop and enter PIN

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Wheel lock / unlock

Wheels will be unlocked when

- Wheel unlock button is green, or
- Manual mode is clicked

You can push the robot around freely without any resistance.

No Light: Disabled
Cannot press to unlock wheels
(when in non-resting states e.g. E-stop, autonomous/ manual cleaning, docking etc.)

Blue: Wheels Locked
Can press to unlock wheels
(only when robot is in resting state)

Green: Wheels Unlocked
Can press to lock wheels

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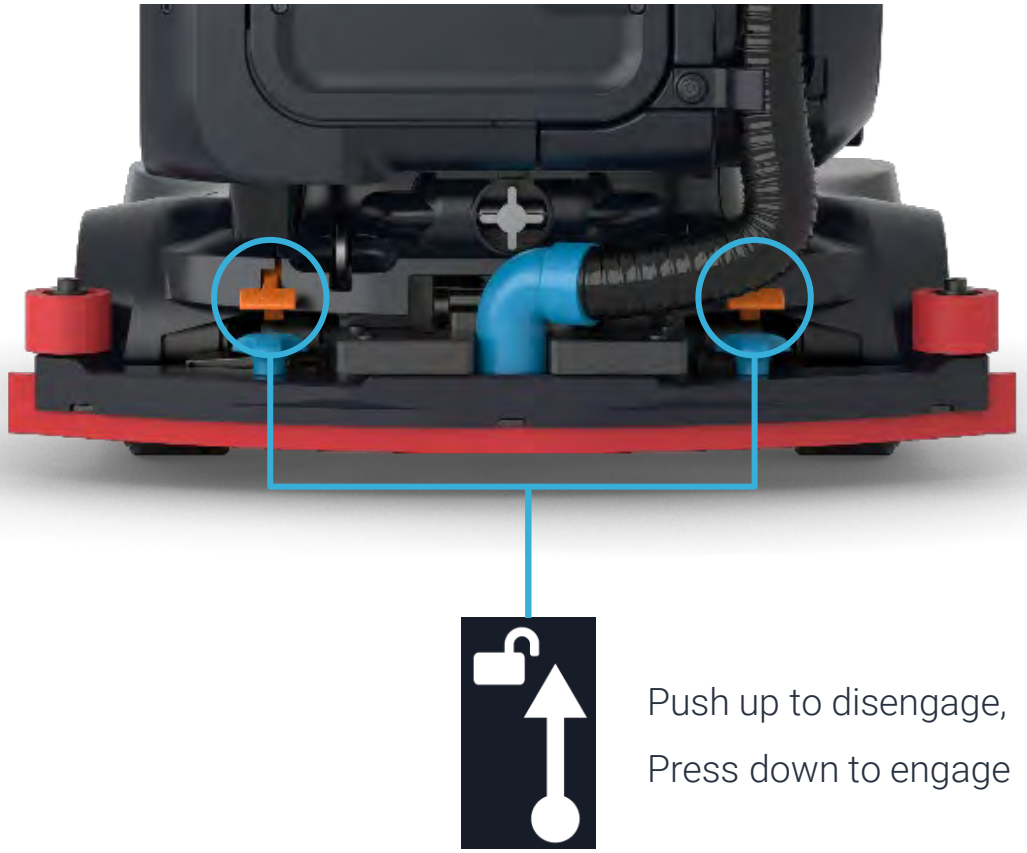
Brake safety lever

You can disengage the safety levers to unlock the wheels **only in the event that the robot cannot be switched on.**

When the robot is switched on, the safety levers must be engaged. Leaving the safety lever disengaged at any point is a safety hazard.



Push up to disengage,

Press down to engage

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Compliance related safety behaviours

Robot will terminate cleaning or any autonomous movement when it encounters these safety hazards

Too close to an obstacle

To prevent robot from hitting something or someone

Near drop-off areas

To prevent robot from falling off stairs, ledges and other negative obstacles.

On slopes > 5% (2.86°)

To prevent robot from slipping down slopes

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LED colours

Blue (flashing)	Setting up when first turned on
Blue (steady)	Localised and ready
Purple	Not localised
Orange	In restricted zone
Red	Critical emergency / E-stop triggered

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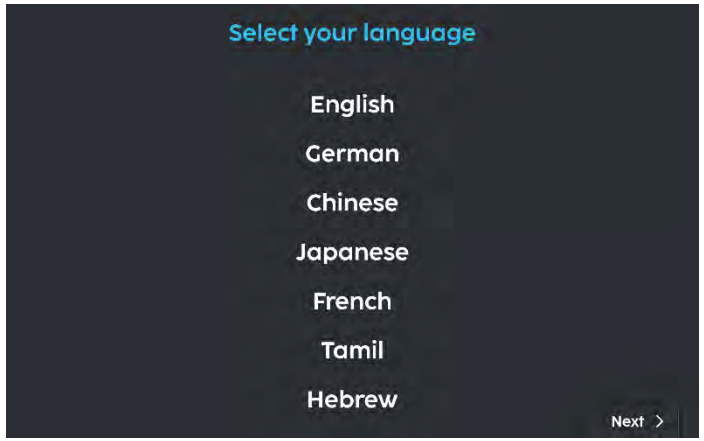
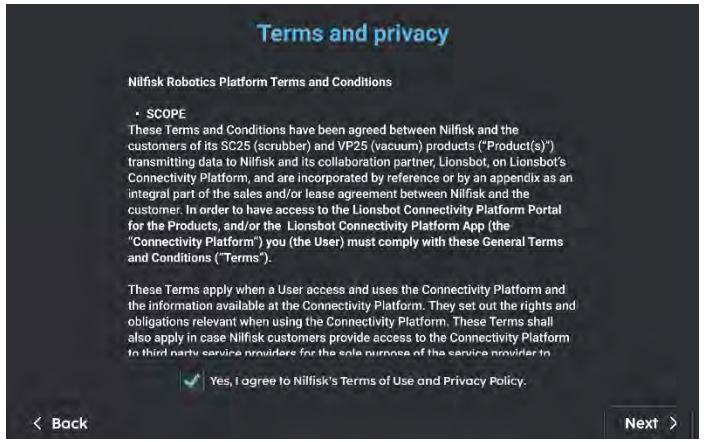
How to setup

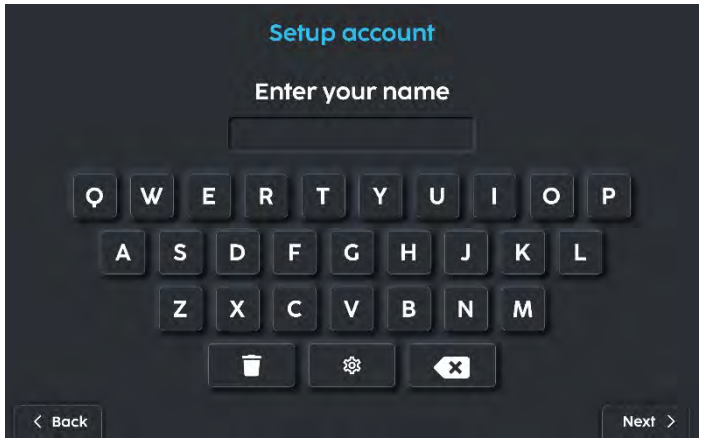
Setup Admin account on the robot



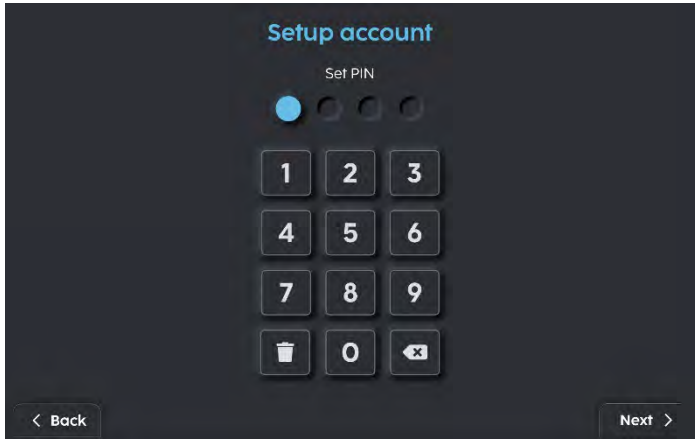
1 When starting the robot, select your preferred language



2 Read and agree to the Terms of Use and Privacy Policy

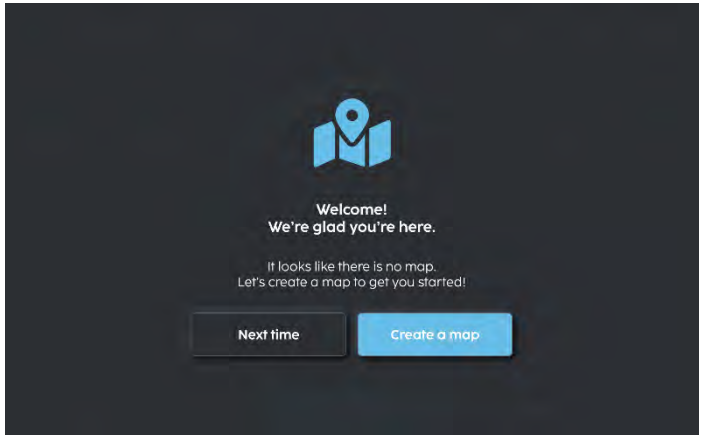


3 Set your preferred admin account name



4 Set your preferred password & re-enter to confirm

5 Read and acknowledge proper usage instructions



6 After set-up, choose to create a map or go to homepage

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SC25 connectivity

The robot requires internet connectivity for

- Over-the-air (OTA) software updates
- Syncing the latest info to Nilfisk Robotics Cloud
- App control via Nilfisk Robotics App
- Remote support

Cellular data is preferred because WiFi usually does not work well across whole building due to WiFi “blind spots”.

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User interface

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Magic mode

Home page

More menu

Battery

Options
More operational features for robot

Manual
Used for manual cleaning

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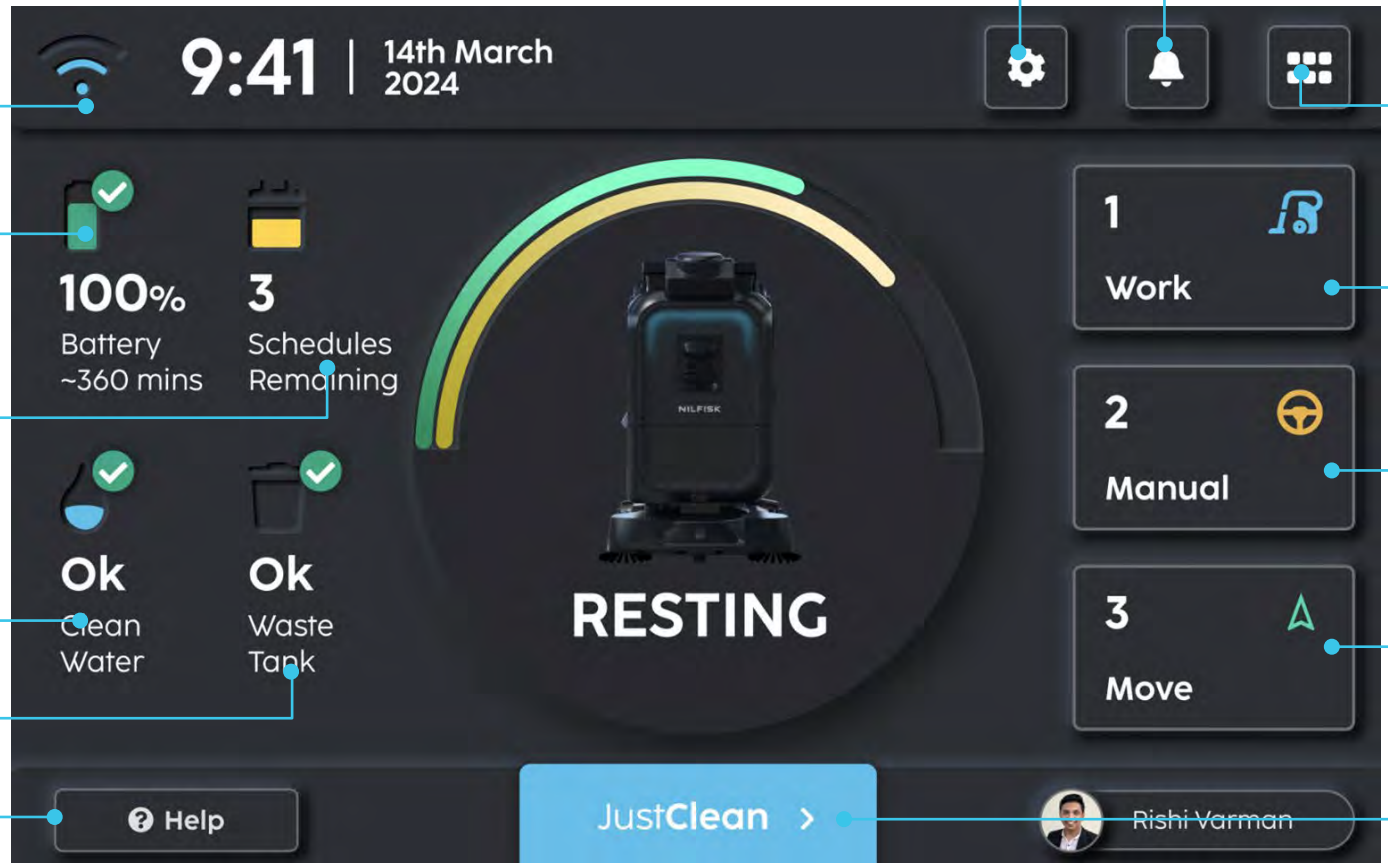
Pro mode

Home page



Settings

Wifi strength

Battery level

Schedules remaining

Clean water level

Waste water level

Maintenance quick help

Alert notifications

More options

Autonomous cleaning mode

Manual cleaning mode

Point-to-point movement

Simple mapping & zoning function

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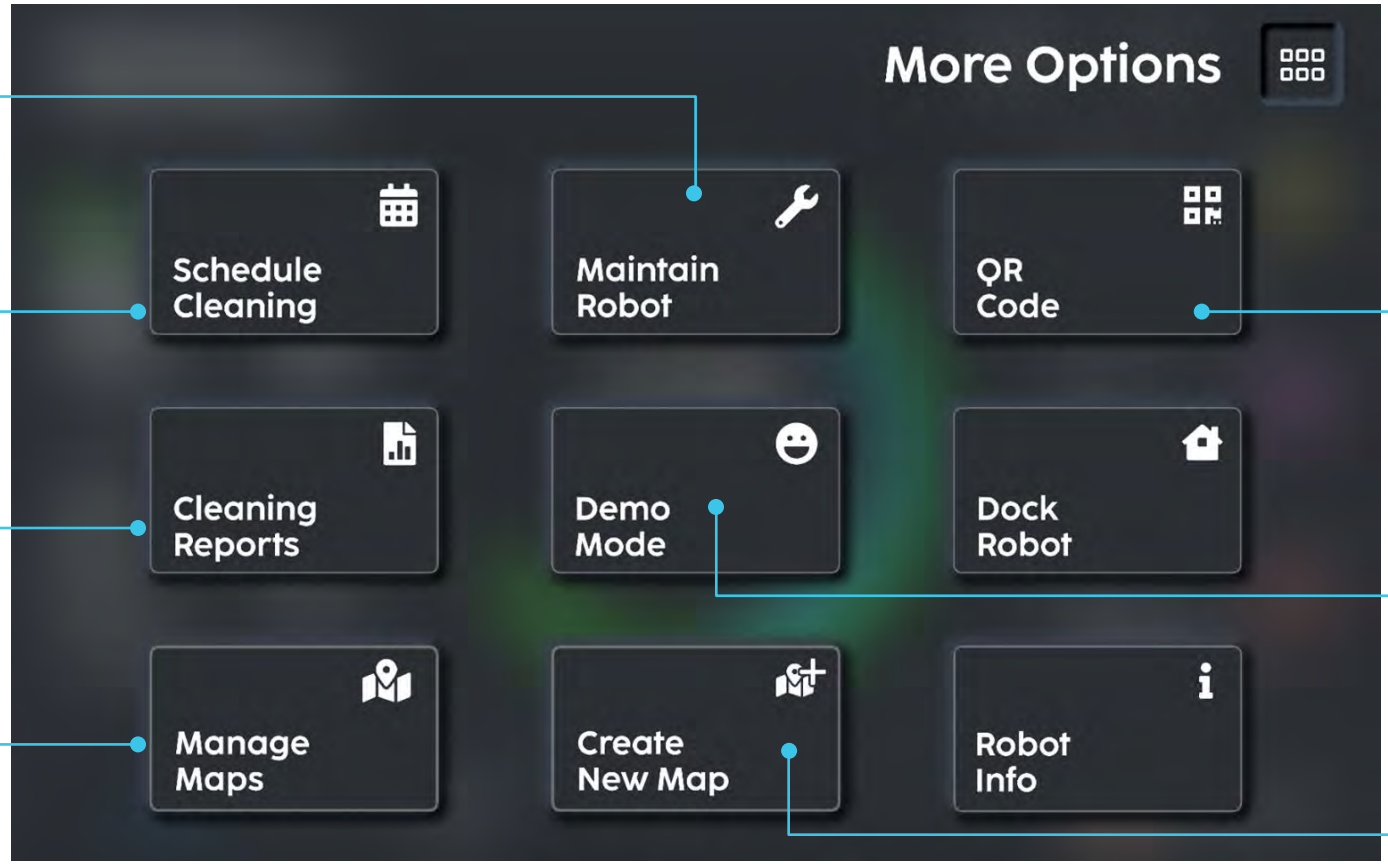
More options page

Robot sensors diagnostics

Set cleaning schedules

Offline cleaning reports

Manage all saved maps



QR to scan & control via app

Demo mode with pre-built sequences

Map a new area

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How to operate

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Switch on & prepare for cleaning

1 **Turn key switch to ON** and wait for the robot to startup.

2 Insert hose into clean water tank inlet of the robot and **fill it with water.**

3 Ensure that the clean water indicator on the screen says “OK” or “Full” and there is enough battery level before starting to clean.

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Send to clean with Magic Tag

1 Push robot to face a MagicTag

2 Scan MagicTag using robot's camera

3 Start cleaning

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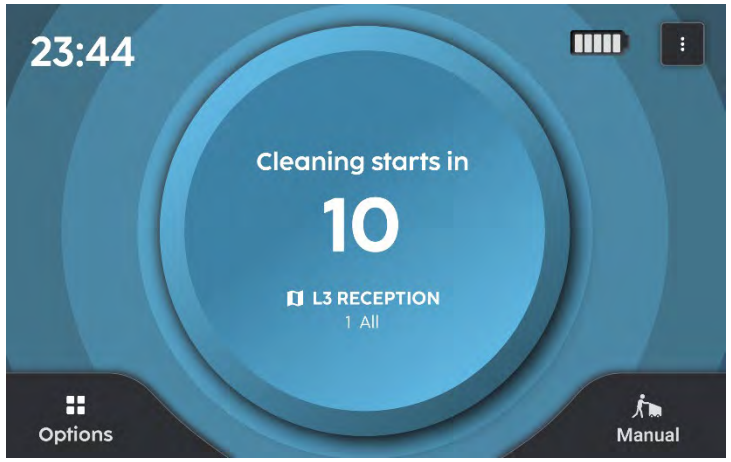
Send to clean with Docking Station

Docking Station has a MagicTag attached.

After cleaning, robot will automatically dock to charge and perform water exchange.

1 Push robot to face a Docking Station

2 Robot detects Docking Station



3 Start cleaning

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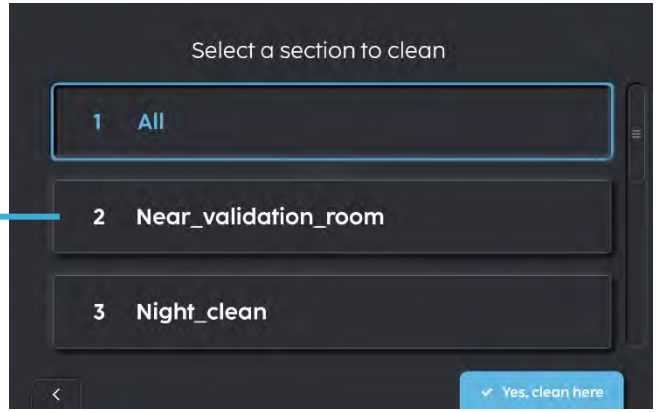
Cleaning in Magic Mode

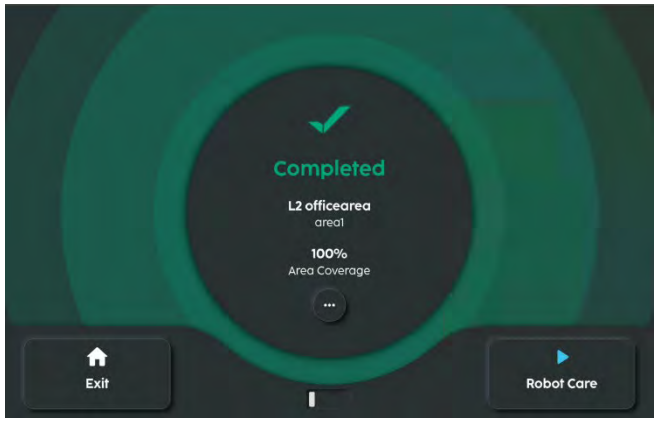
Before cleaning starts,

- If the map has multiple cleaning plans (sections), user can click on the edit icon and choose the desired section
- Else the robot will default to the first cleaning plan



After cleaning

- For MagicTag, the robot will go back to where magic tag is located and show cleaning completed screen
- For Docking Station, the robot moves back to charge and exchange water



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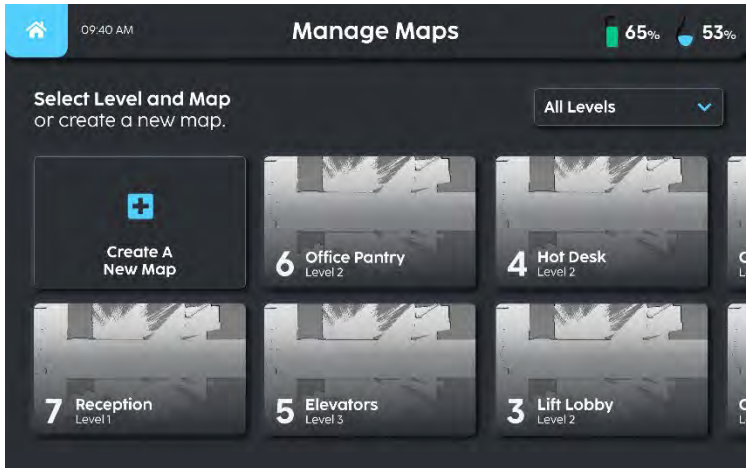
Cleaning in Pro Mode

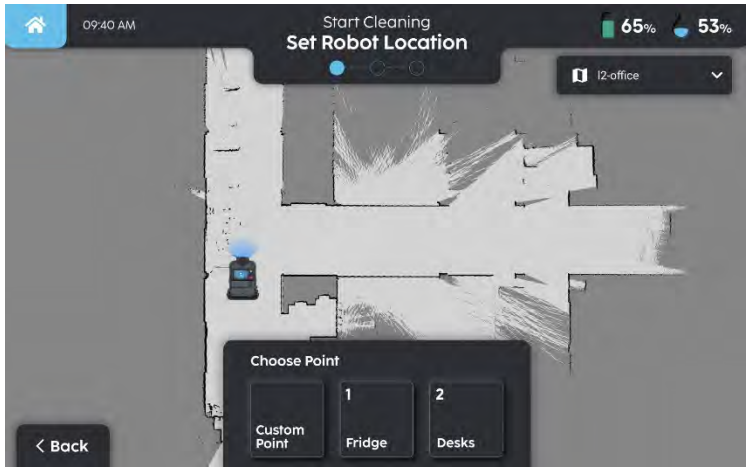
1. Push robot to predefined start point of the map and click “Work” on home screen.

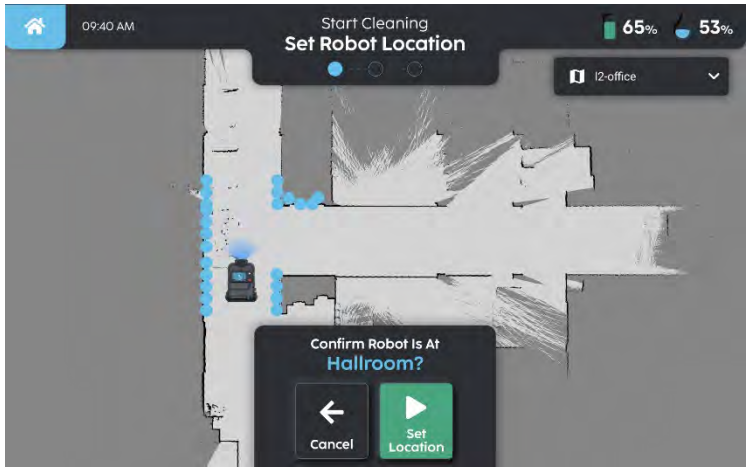
2. Select the map of the area that you are cleaning. This will be one of the maps that you have created & saved before.

3. If the robot does not know where it is, you will need to help specify its current location.

4. Once you hit confirm, it will scan the surrounding area to check if it is indeed at that spot on the map.







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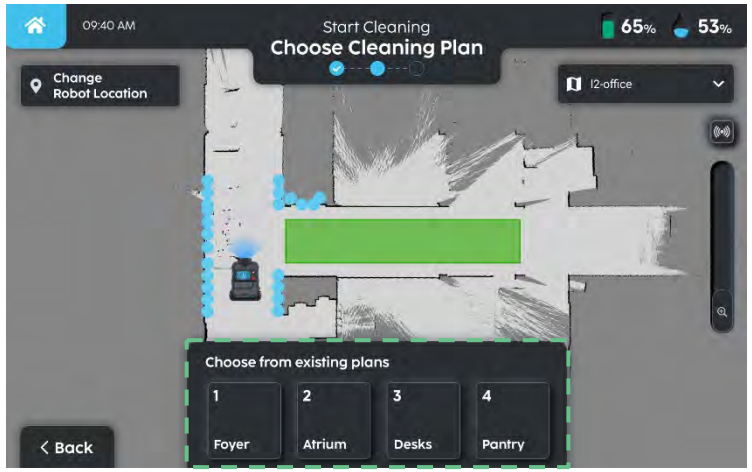
Cleaning in Pro Mode

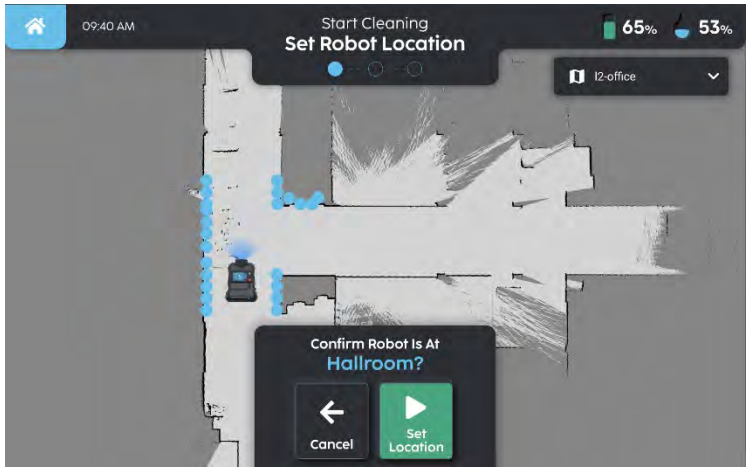
5 Choose the cleaning plan that you want to run.

6 Once you confirm, the robot will start the cleaning task.

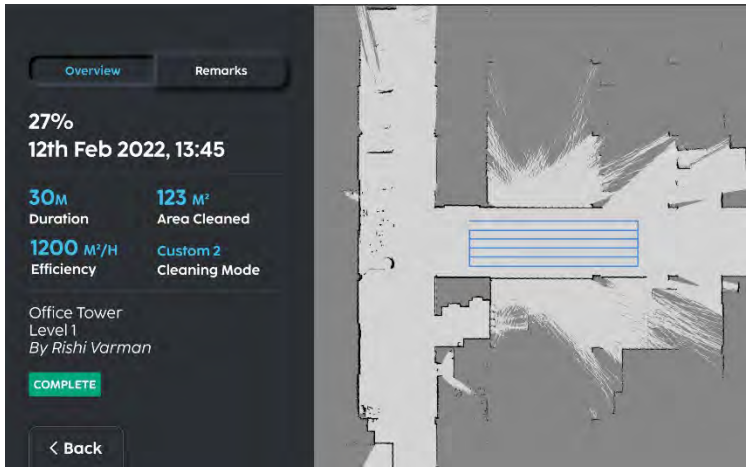
7 Click on cleaning mode (Fig. 6) to adjust the cleaning configs such as brush speed, spray interval etc.

8 Once cleaning is completed, you will get a cleaning report on the area that is cleaned.





(Fig. 6)



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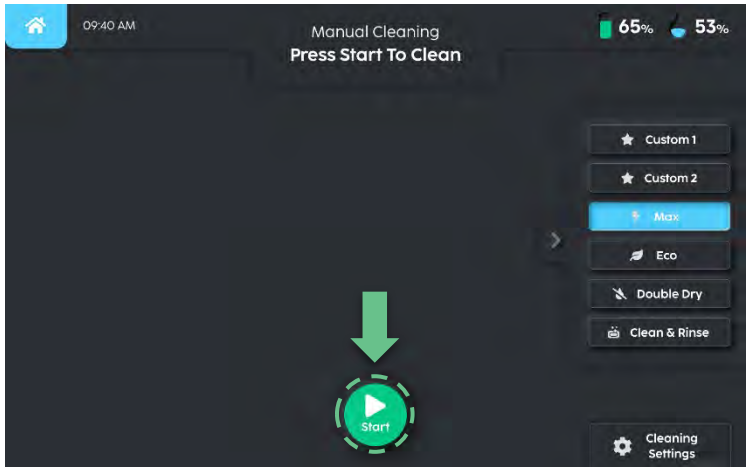
Manual cleaning mode

There might be ad-hoc situations (e.g. random spills) where users need to quickly clean up an area manually.

1. Click “Manual” on home screen and push robot to the area to clean.
2. Click “Start” to start cleaning. Similar to “Work” mode, you can also adjust the cleaning settings.
3. Click “Pause” to stop. The robot will take 10s to exit the mode as it tries to suck up the remaining water on the floor.



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Cleaning settings

Squeegee (0-1): Set to 1 to lower squeegee

Side Brush Speed (0-1): Set to 1 to spin side brushes

Side Brush Pressure (0-1): Set to 1 to lower side brushes

Brush Pressure (0-3): Controls how much the brush rotates

Brush Speed (0-3): Controls how fast the brush rotates

Suction (0-3): Strength of vacuum, level 1 or 2 is good enough for most cases

Spray Interval (0-7): Controls water usage, level 1 or 2 is sufficient for most cases.

Chemical Concentration (0-3): Controls mixing ratio 1:100, 1:80, 1:50

Cleaning Speed (0-2): only applicable for Work mode. Cleaning speed in Manual mode depends on how fast user pushes.

There are also preset modes that you can use.

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Easy to maintain

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6 steps of daily maintenance

6 steps checklist

1. Clean side brushes
2. Clean brush & debris tray
3. Rinse squeegee & hose
4. Drain & clean waste water tank
5. Fill up clean water tank
6. Charge robot

Lastly, dry and clean with
microfibre cloth

Easy to replace batteries

1. Turn the two blue knobs on the sides of the robot from the front to remove the panel
2. Pull the battery tray out to remove the battery
3. Load a new battery, and push in the battery tray
4. Close the panel

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Periodic maintenance

Operation	Weekly	1-3 months
Clean brush deck	✓	
Clean side top-up filter	✓	
Clean sensors	✓	
Check waste water discharge hose & manual drain hose for chokes	✓	
Replace brushes		✓
Clean or replace clean water filter		✓
Replace or clean HEPA filter		✓
Clean or replace the debris tray hopper rubber		✓
Replacing squeegee rubber		✓
Clean castor and main traction wheels		✓

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Cleaning performance

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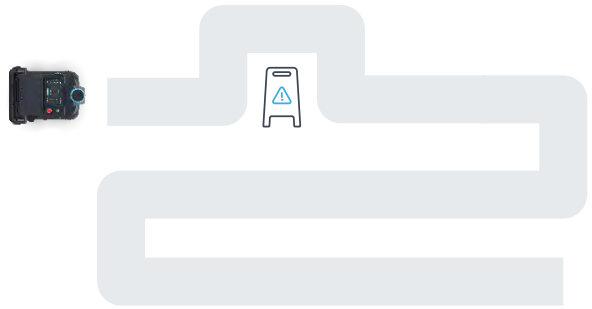
Autonomous obstacle avoidance

Non-stop cleaning AI that will try its best to finish the cleaning mission

No obstruction

- Robot will move based on planned cleaning path



Partial obstruction

- Obstacle is small and blocks a part of robot's path
- Robot skirts around obstacle and continues with original cleaning path

Complete obstruction

- Obstacle is large and blocks robot from advancing
- Robot automatically re-evaluates the surroundings and create a new cleaning strategy to cover the intended cleaning area

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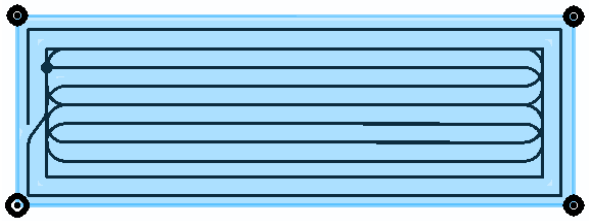
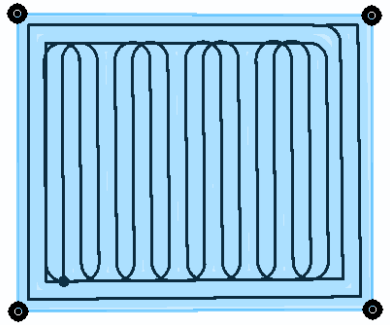
Cleaning efficiency

Efficiency varies for different shapes even if cleaning area is the same



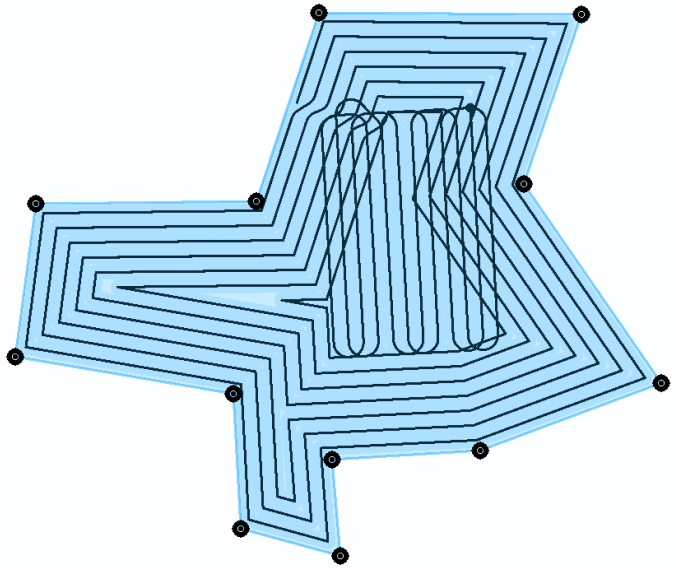
Path A

High efficiency with long straight paths and less turns



Path B

Medium efficiency with straight paths but more turns



Path C

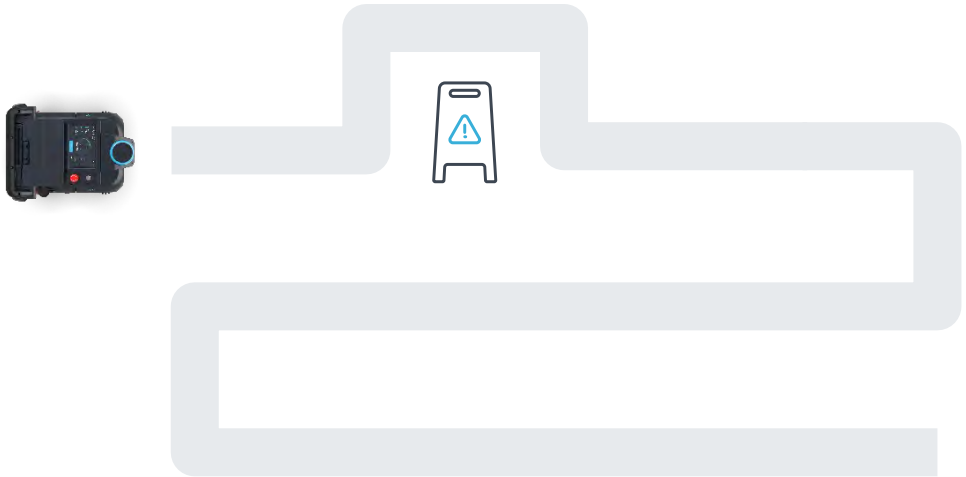
Low efficiency with many turns and irregular paths

Cleaning efficiency

Realistic average cleaning efficiency

350 - 800 m²/hr

Taking into account turning during cleaning and obstacle avoidance



Tips to size cleaning area and increase efficiency

- Cleaning area should be smaller than 1200 – 2400 m² in order for SC25 to clean the area in one charge
- Deploy and clean when there are less people
- Deploy in areas where robot can move in long straight unobstructed paths
- Avoid areas with direct sunlight or reflective surfaces

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Deployment areas

Suitable areas for deployment

Min. cleaning aisle

Min. door width

Min. area for dock

Max. slope angle

* The SC25 features a zero-degrees turning capability. However, for safety reasons, its autonomous operational footprint could be larger, and the additional turning space must be considered when doing a site assessment

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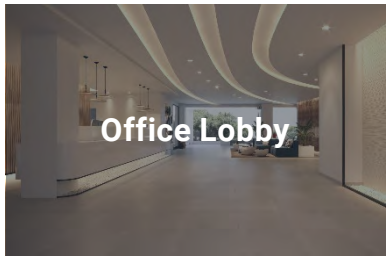
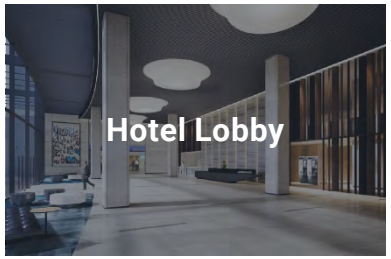
Ease of deployment

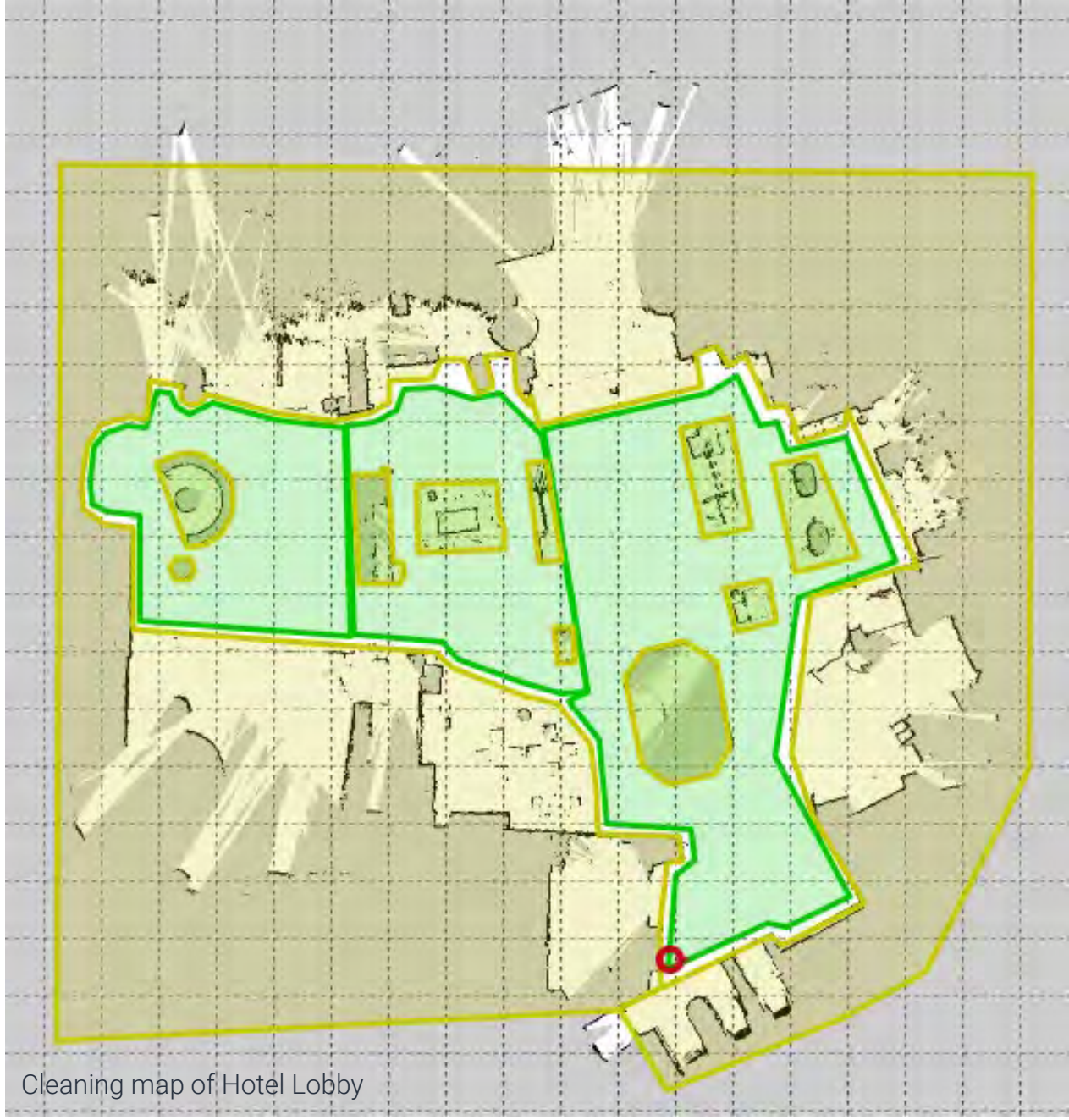
Easy

Characteristics

- Wide open spaces with minimal obstacles so that the robot can move in straight, unobstructed cleaning paths
- Even ground with minimal curbs & slopes, so there is minimal need to set restricted zones.
- Well-lit with consistent lighting so that robot sensors can perform with higher stability







Cleaning map of Hotel Lobby

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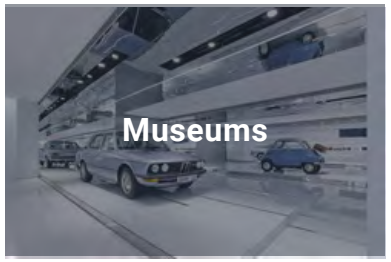
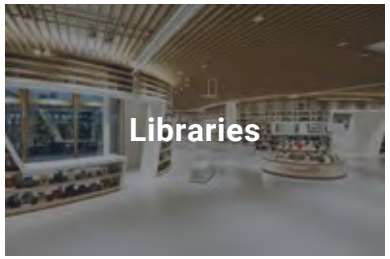
Ease of deployment

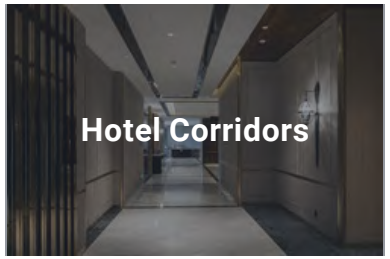
Medium

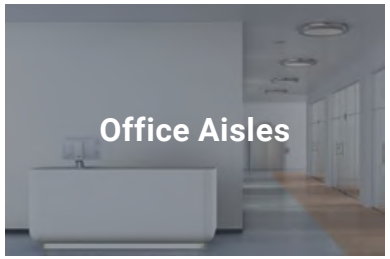
Characteristics

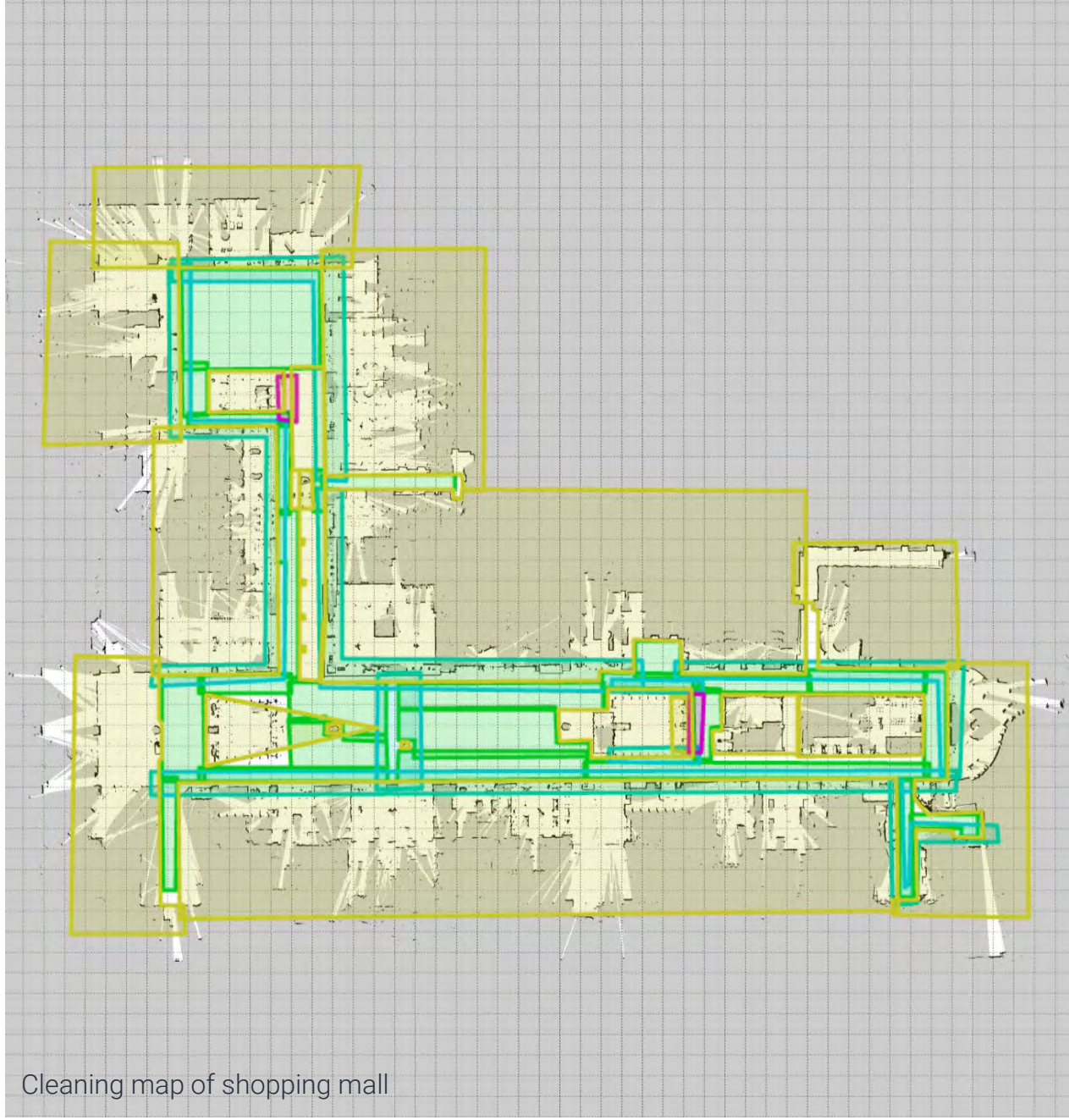
- Open but irregular spaces so robot might have to maneuver around occasional obstacles while cleaning
- Often have high amounts of human traffic with limited pockets of time for cleaning
- Presence of glass/reflective surfaces, low light that might impede the performance of the sensors











Cleaning map of shopping mall

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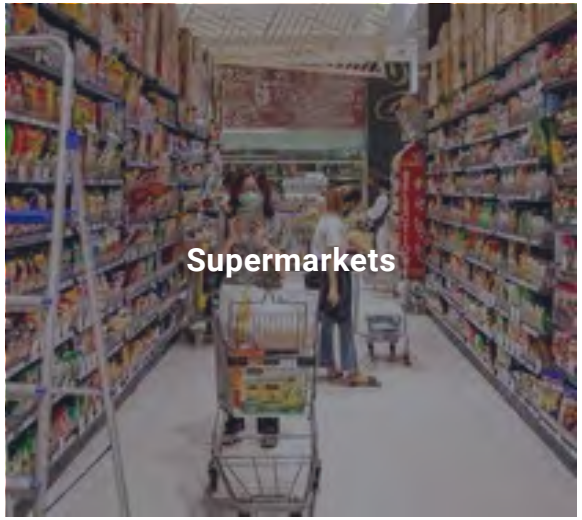
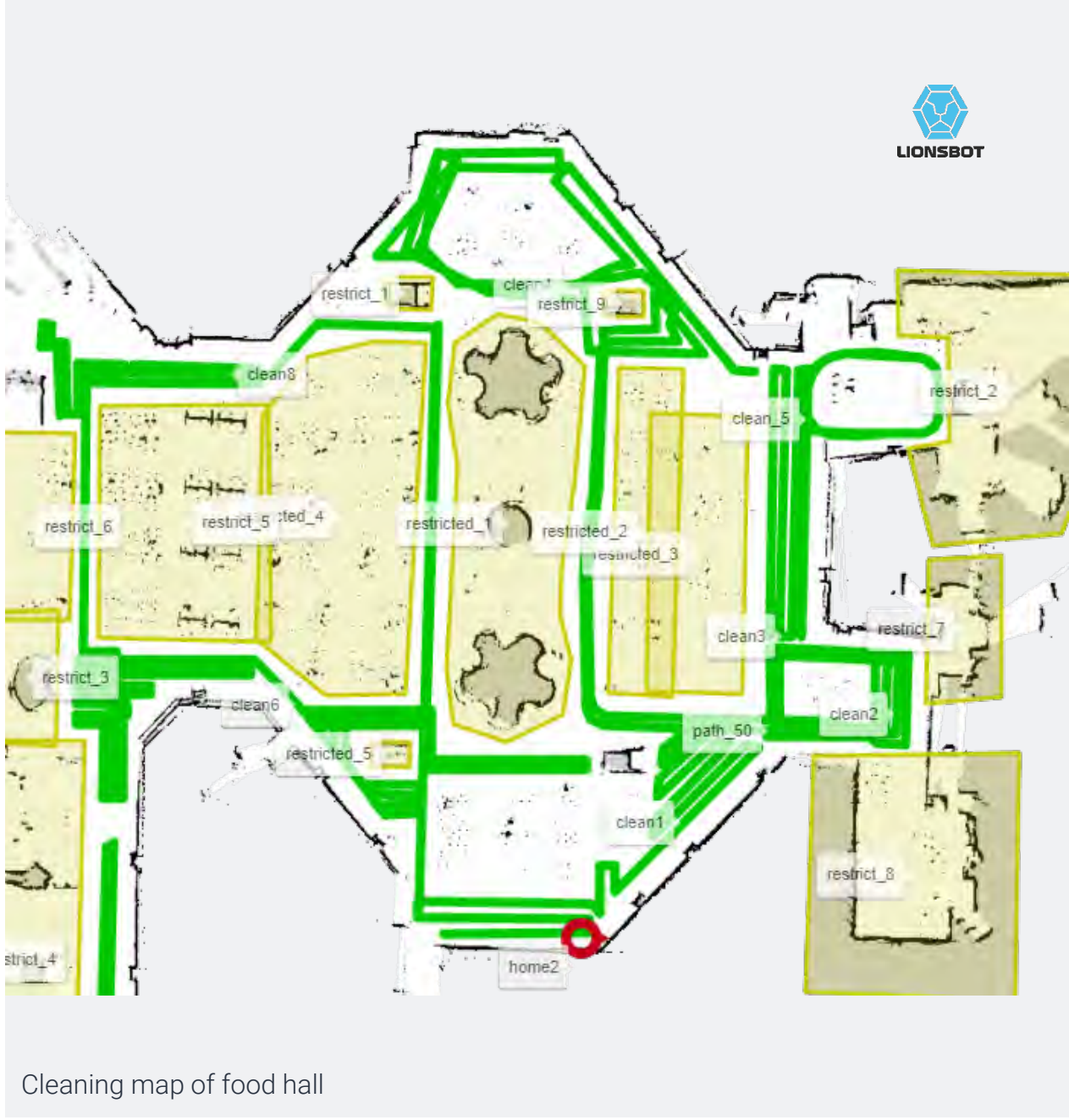
Ease of deployment

Difficult

Characteristics

- Very narrow spaces with a lot of human traffic and obstacles that impede robot movement
- Changes in object position within the environment e.g. chairs or empty shelves, creates a lot of map changes which affects cleaning efficiency





Cleaning map of food hall

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What to avoid

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Places not suitable for SC25

Swimming pool

Slippery surfaces around the pool will cause the robot to skid while cleaning. There is a chance that it might fall into the pool. Moreover, chlorine water from the pool will corrode the internal components of the robot.

Outdoor / semi-outdoor areas

The robot cannot be operated in areas that are exposed to rain. These areas will also have exposure to direct sunlight which affects the sensor performance.

Train platforms

With its small base area, there is a risk that the SC25 might drop into the train track if it is cleaning too close to the edge.

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Places not suitable for SC25

Warehouses

SC25, being small and short, might be hidden behind tall stacks of boxes. This might easily result in accidents if boxes topple or forklift operators drive and hit it without noticing.

Carparks

Similar to warehouses, cars might not notice the SC25 when they reverse or turn as it is very short. Moreover, potholes in the ground might cause SC25 to get stuck.

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Things to avoid

Escalators

Do not clean near escalators as there is a risk that the robot might go up the escalator and/ or fall down from it. Stay at least 2 m away and clean outward away from the escalator.

Stairs and slopes

Do not operate within 2 m of stairs as there is a risk that it will fall off. Slopes exceeding 5% / 2.86° are also not advisable because the robot will slip while cleaning.

Bright light & reflective surfaces

Bright lights on the floors will affect the sensors and the robot might think that there is a hole/cliff in front off it. Hence, avoid cleaning in such environments.

Things to avoid

Foaming chemicals / solvents

Do not use bleach, foaming chemicals, acids and solvents with the robot as it will corrode the water tank which is made of aluminium.

Carpet and loose cables

As the SC25 has a vacuum, when it goes over carpet (that is not secured well) or loose cables, there is a risk that these things will be sucked and tugged away. Moreover, the loose cables might be tangled in the wheels or brush.

Direct water spray

The robot is not waterproof. Do not spray water on it directly to clean. Use a cloth to wipe down during cleaning.

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10

Magic mode setup

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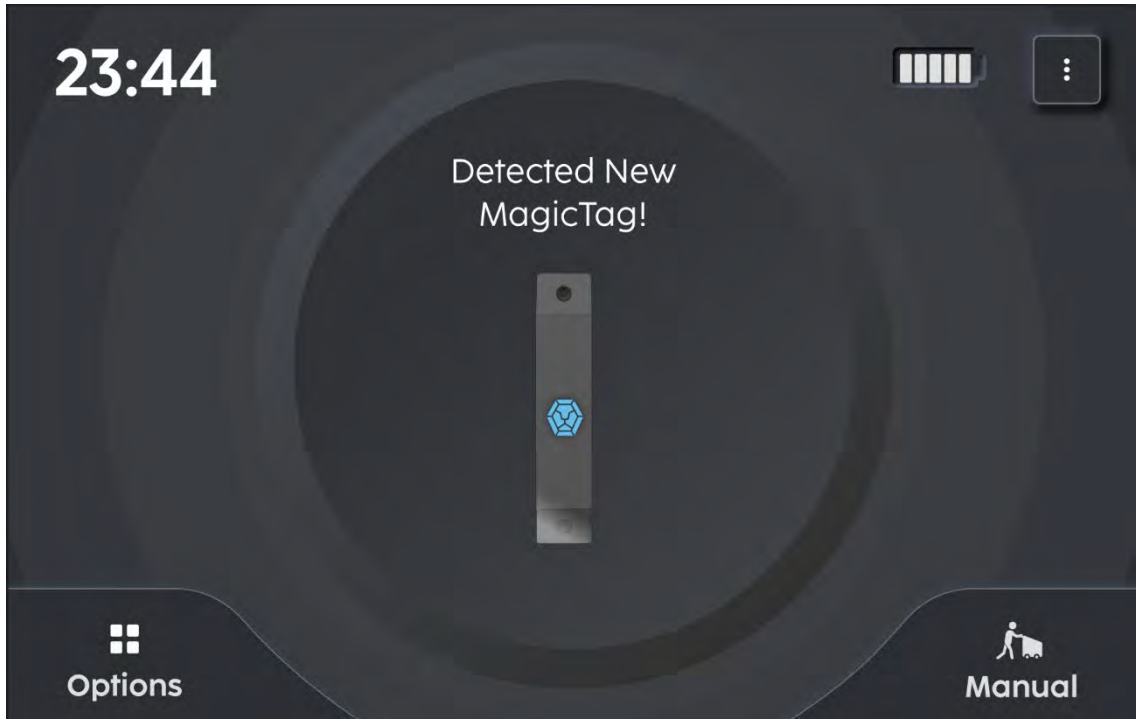
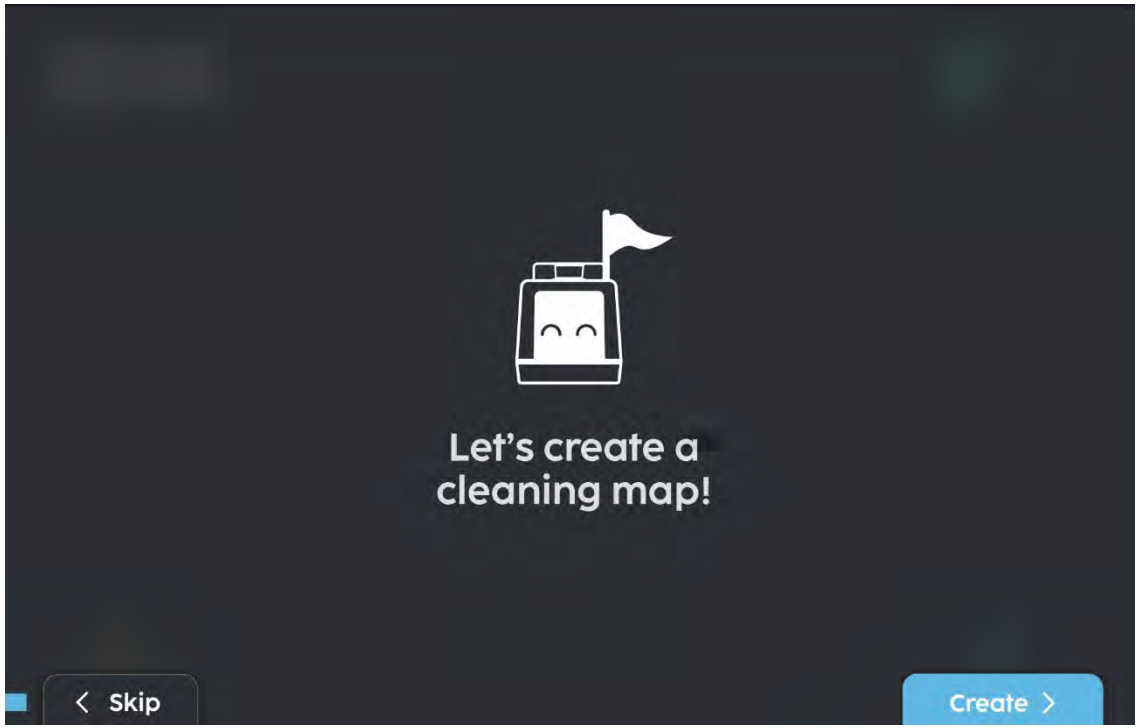
Creating a new map

- When a new MagicTag is near the robot, it will trigger a guided workflow to setup a map
- This feature is only available on Magic Mode home screen.





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11

MagicTag setup

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Set up good home point

MagicTag

- Home point is where SC25 starts and ends cleaning.
- Ensure that home point is not blocked at all times & has direct access to the cleaning area.
- As SC25 will move off and come back to home point, ensure that the robot operation does not block the walkway or any other site operation.

Ideal positions

- Near a corner with no obstacles within 50cm radius
- Near an end of a corridor or near a corner with minimal human traffic

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Bad home point

Should not be near doors, areas with high human traffic

Should not be near obstacles where SC25 cannot move off and return easily

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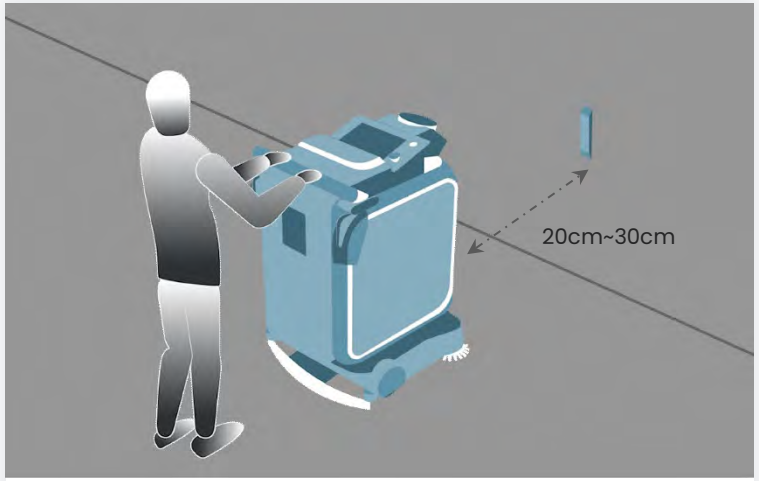
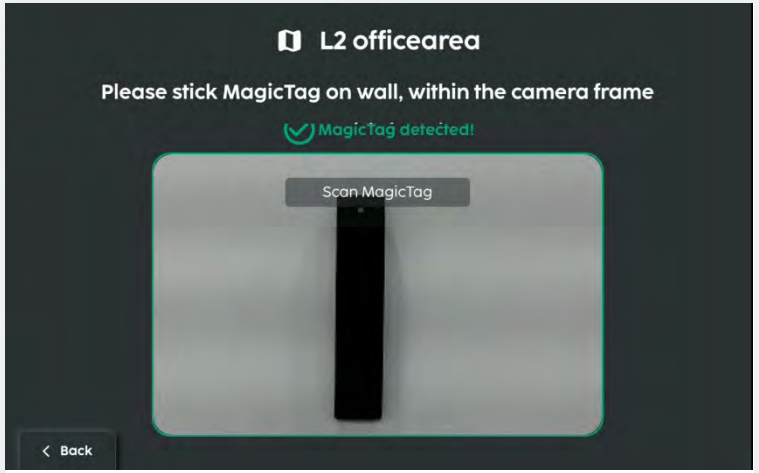
Pasting & scanning MagicTag

- Always position MagicTag vertically.
- MagicTag **should not be** placed on glass, reflective surface, patterned surface and in a dimly lit area.



- Ensure MagicTag is placed parallel to the front camera of the robot so that MagicTag can be scanned.
- Keep a minimum of one foot distance from the MagicTag to the robot.



- This is how the robot will scan the MagicTag with the help of the front camera.
- Once the MagicTag is detected, press **"Next"** to continue.

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Docking Station setup

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Docking Station

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Requirements

1. Ample open space
   a. 2m (W) x 2m (L)

2. Water inlet (Our hose uses ½” Female)
   a. To ½” Male hose
   b. To ½” Male adapter

3. Wastewater outlet (11/4” Diameter Hose)
   a. Drainage should be on the ground not higher than the hose from the docking station

Set up good home point

Docking Station

- Access to a power supply
- Access to water source and drain
- Near a corner with no obstacles within 1.5m radius
- Near an end of a corridor or near a corner with minimal human traffic

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Bad home point

Docking Station

Docking Station should not be placed near doors, or area with high human traffic

Ensure that there is a minimum space of 2m x 3m before setting up the Docking Station

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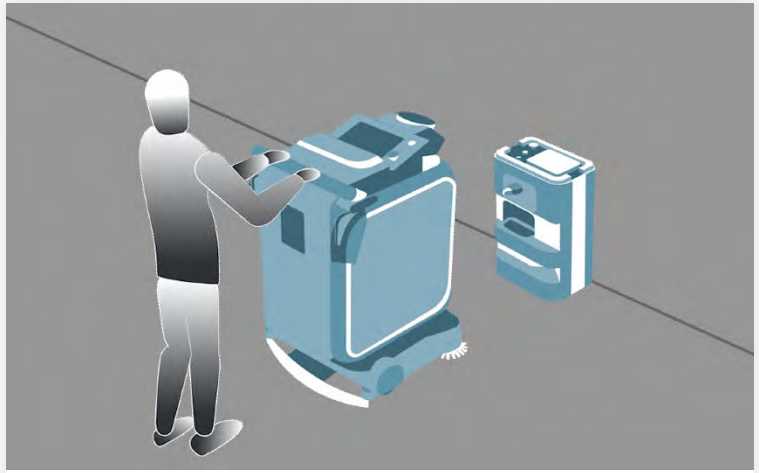
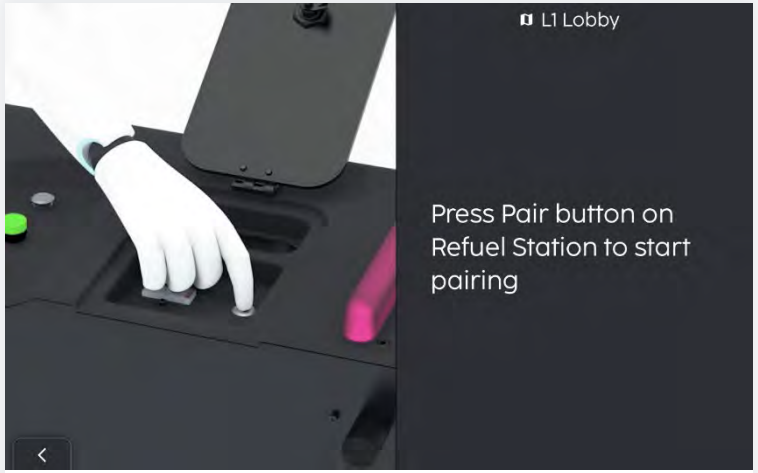
Connecting to Docking Station



- Face the Docking Station, leaving about 1 foot space between the station and SC25.
- Do not push SC25 too near the docking station.

- Wait for the Docking Station and SC25 to connect.



- When successfully connected, finish off the docking station set up by pressing onto the pair button.
- The colour of LED light will change from sky blue to pink when the button is pressed.

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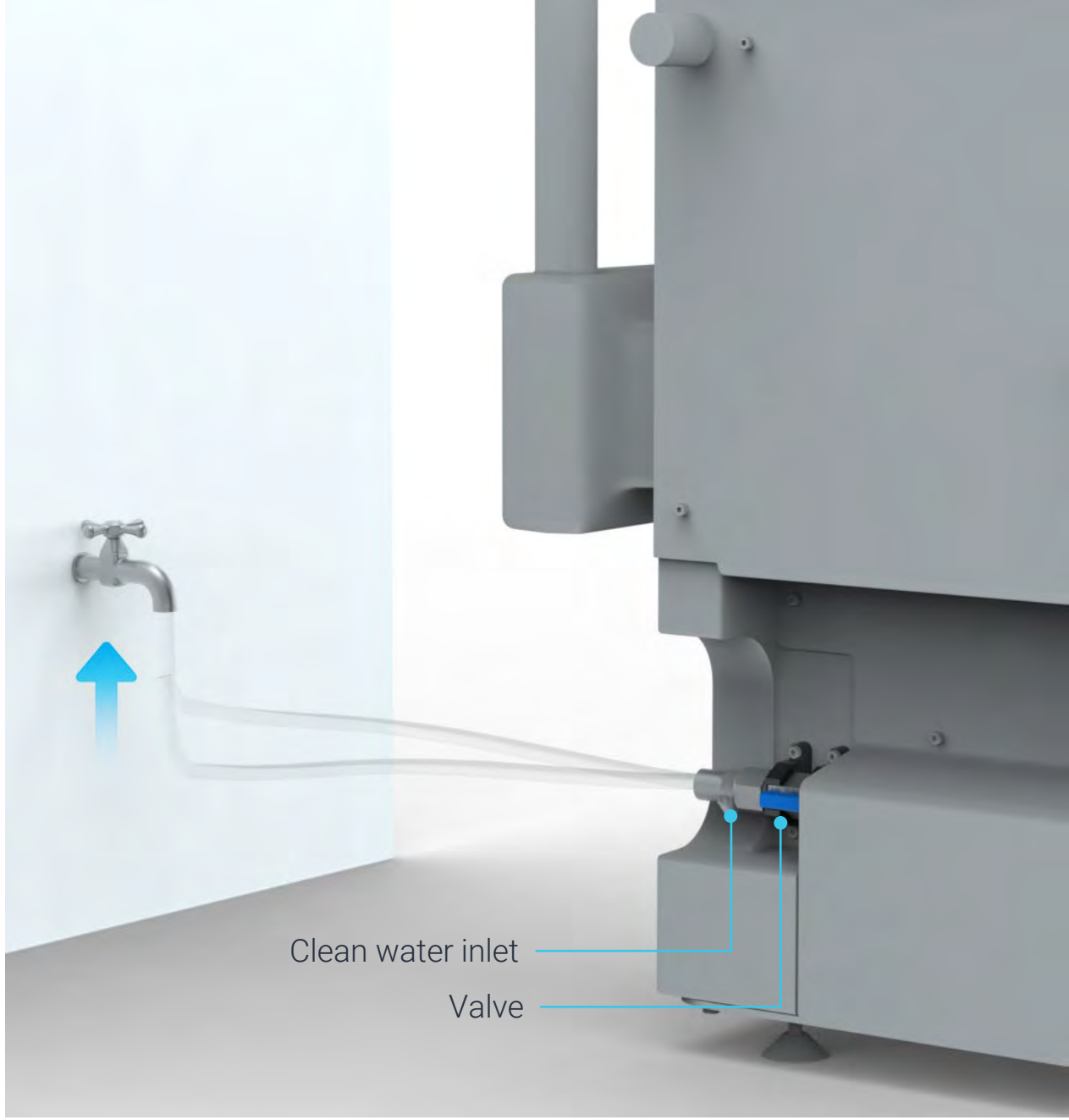
Connecting the clean water supply

- Prepare a hose for the clean water inlet.
- Attach the hose to a tap, push the hose over the tap and tighten the hose clip.
- Attach the other end of the hose to the clean water inlet
- See the next slide for interconnections.
- Turn on both the water tap and the water valve.



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Connecting the clean water supply

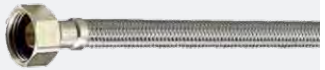
1/2" pipe outlet
(user site)

Direct connection

1/2" hose
(docking water inlet)

3/4" pipe outlet
(user site)

3/4" to 1/2 inch female to male fitting



1/2" hose
(docking water inlet)

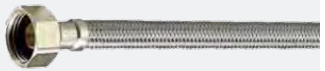
1/2" or 3/4" female pipe outlet
(user site)

1/2" or 3/4" to 1/2" male to male fitting

1/2" hose
(docking water inlet)

PVC hose
(user site)

1/2" male to required size PEX adapter



1/2" hose
(docking water inlet)

PVC pipe
(user site)

Quick connectors 1/2" male to user PVC pipe sizing

1/2" to 1/2" male to male fitting

1/2" hose
(docking water inlet)

Check all fluid fittings and hoses for leaks before using station.

Do not use faulty hoses and damaged fittings.

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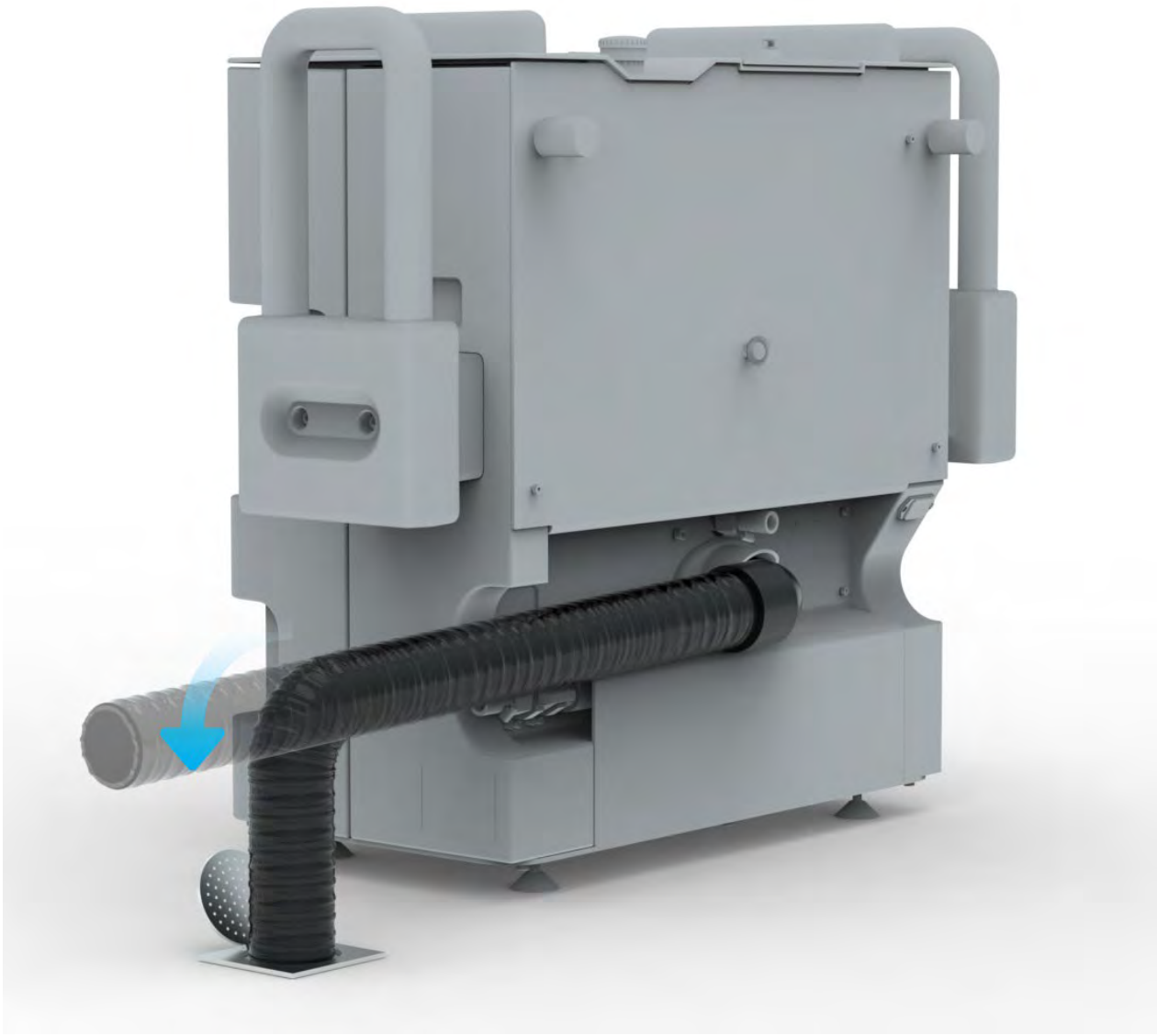
Connecting the waste water drainage

- Connect the hose to an elbow connector or pipe (1 1⁄4“diameter) connected to the drain
- The drain hose must be flexible enough to be adjusted to point in the desired direction.
- Drainage should be on the ground not higher than the hose from the docking station



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13

Cleaning & restricted area

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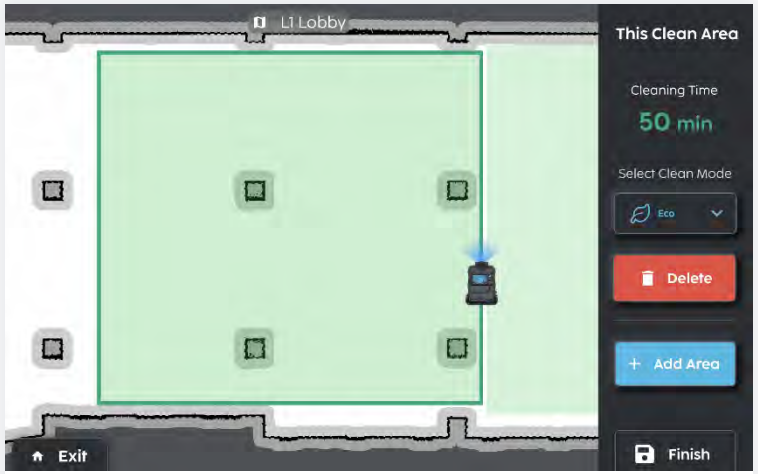
Creating cleaning area

- After setting up the MagicTag or Docking Station, choose route or boundary to create cleaning area.

- Use boundary to clean larger areas
- Use route to clean areas with many obstacles within it



- When the area has been created, adjust the cleaning settings according to your preference.

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Creating restricted area

- To create a restricted area, create at least 3 corners.
- Be sure to restrict areas and objects that are not visible on the map (eg. carpet, cables) as it could be dangerous.
- Refer to "Things to avoid" slide for all areas to beware of.

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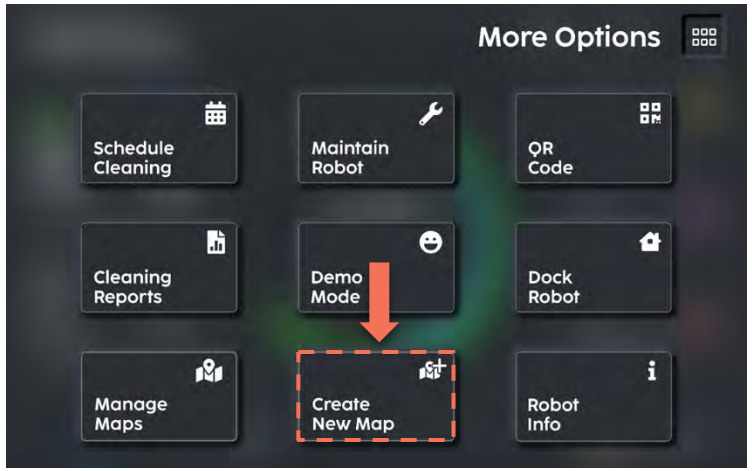
14

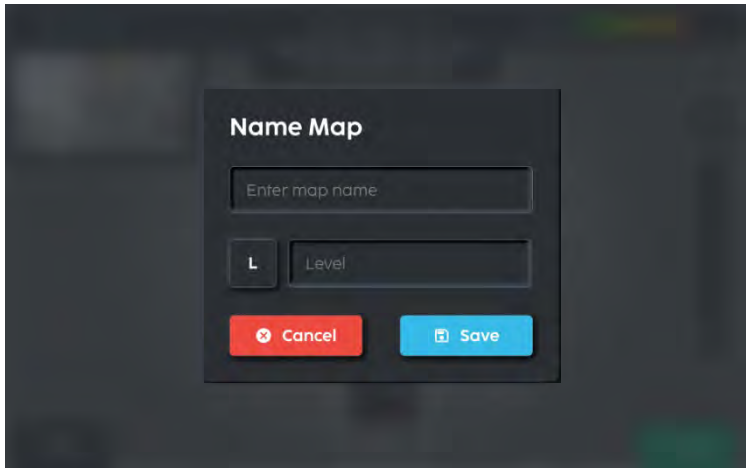
Pro mode setup

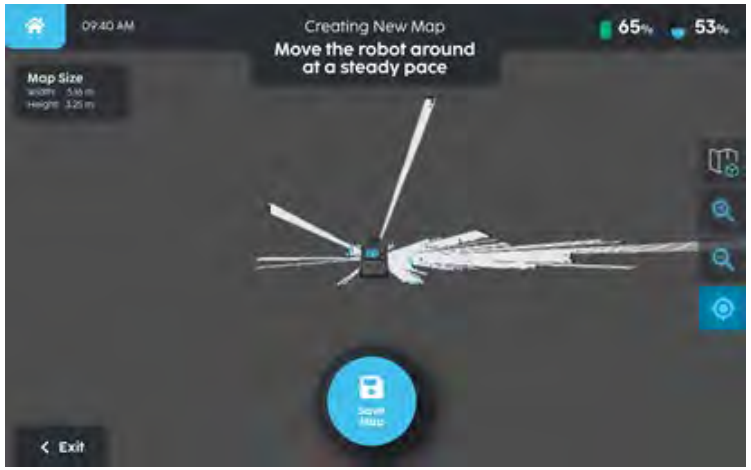
Creating a map

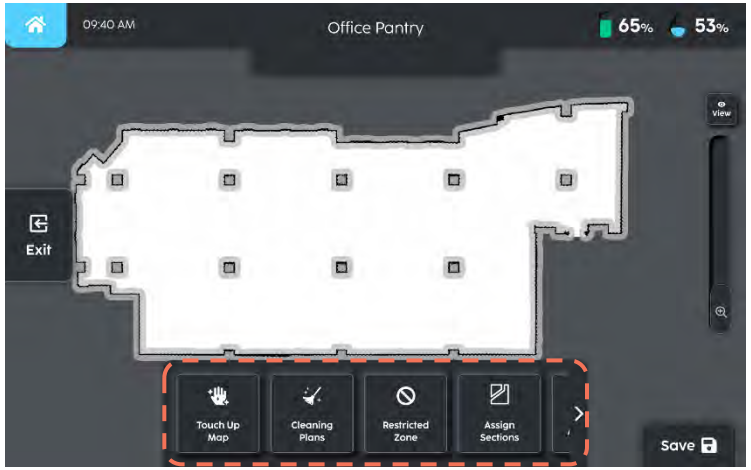
Just clean is great for quick setup. Advanced users can use the Create Map feature for more fine grained controls and optimisations when setting up.

1. Select “More Options” on home page then select “Create New Map”.
2. Name the map and level
3. Push the robot around the area to generate a map.
4. Once done, save the map and you can start adding cleaning zones, set restricted zones and start point based on your needs.









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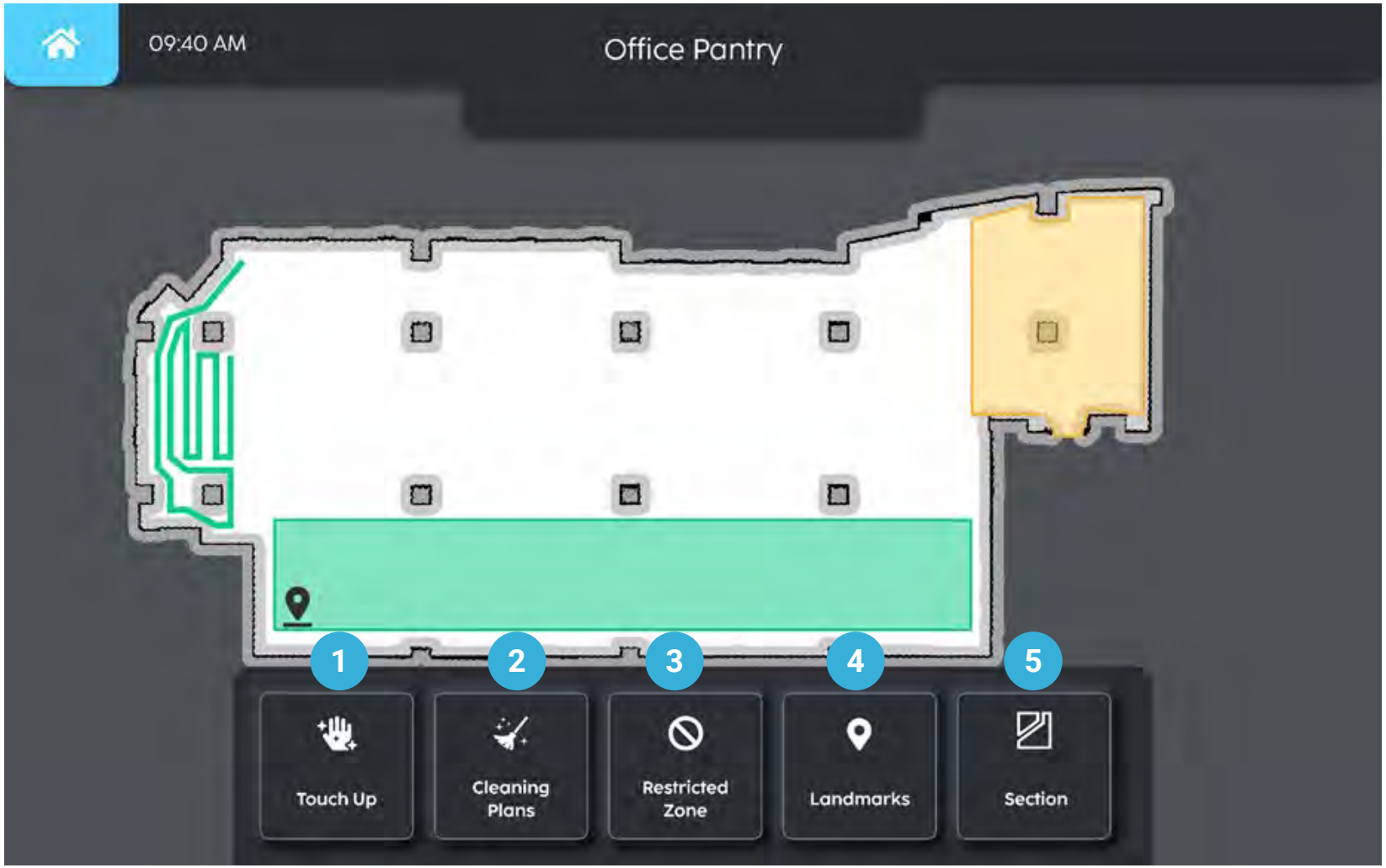
Edit map overview

1. Touch up walls and floors to remove noise
2. Add cleaning areas by drawing or pushing (green areas)
3. Fence out danger areas like ramps, escalators, stairs, cliffs (yellow areas)
4. Set landmarks such as home point for the robot to start from and return to after cleaning
5. Group multiple cleaning areas to clean together



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1. Touch up map

You can remove noise from the map by either adding floor or wall.

Add floor (blue arrows)

There could be black spots on map areas that are not there in the actual environment. By drawing a floor over, it will paint these areas white and let the robot know there are no obstacles there.

Add wall (orange arrows)

Walls might not line up properly or have gaps during mapping (e.g. if the wall is glass). Drawing the walls will help the robot understand the real-world boundaries better.

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2. Create cleaning plans

Mark out the zones to clean on the map

Route

This is used to clean places that are narrow and irregular (e.g. corridor). The robot will clean the specified route.

Area

This is used to clean large open areas (e.g. lobby, halls). By drawing a perimeter, the robot will clean everything within.

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2. Create cleaning plans

There are 4 ways to create zones.

Push robot - teach & repeat

User pushes the robot in the actual environment to create the zone

Point

Click on the map and the lines will join up individual points to form the zone

Draw

Freeform drawing is good for irregular zones (e.g. curved walls)

Drag

This is similar to “Point” but more precise. User drags the map to position the crosshair at the desired point.

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3. Create restricted zones

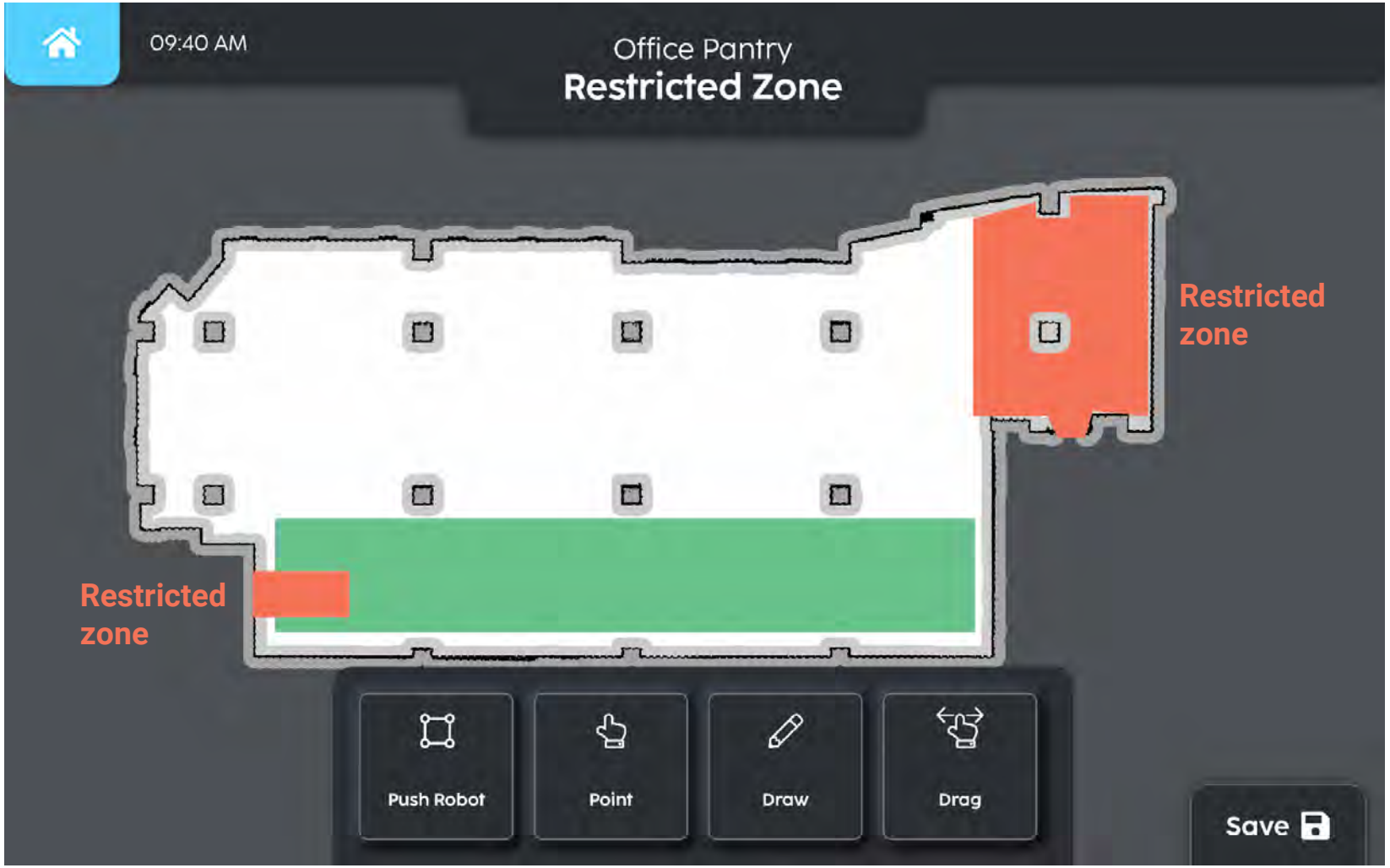
It is important to create restricted zones for safety!

You can create restricted zones (no route) and they can be created in the same way as cleaning zones.

Danger zones to mark as restricted

- Stairs & escalators
- Ramps & slopes
- Cliffs & curbs
- Carpets & cables
- Lifts & doors
- Glass

Restricted zones can be outside of cleaning zones, inside or intersecting. Robots will not be allowed to go there autonomously.



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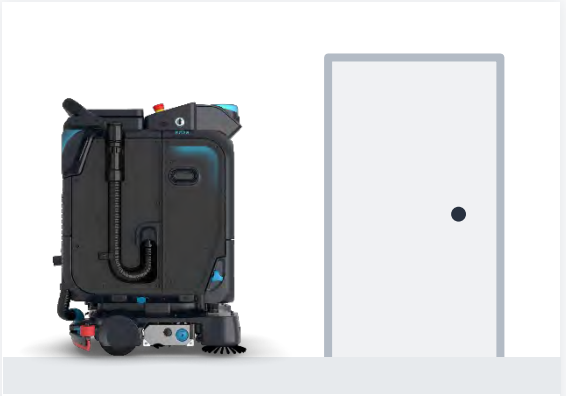
3. Create restricted zones

Slope

Escalator

Stairs, ledge



Doors

Lift

Mirrors, glass

Cables, trunking

Rugs, mats, carpet

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4. Set Landmarks

This is to mark out important points on the map. They can be used for

- Locating the robot if the robot is lost
- Helping the Robot to return back home after finishing its cleaning plan
- Setup MagicTag and Docking station

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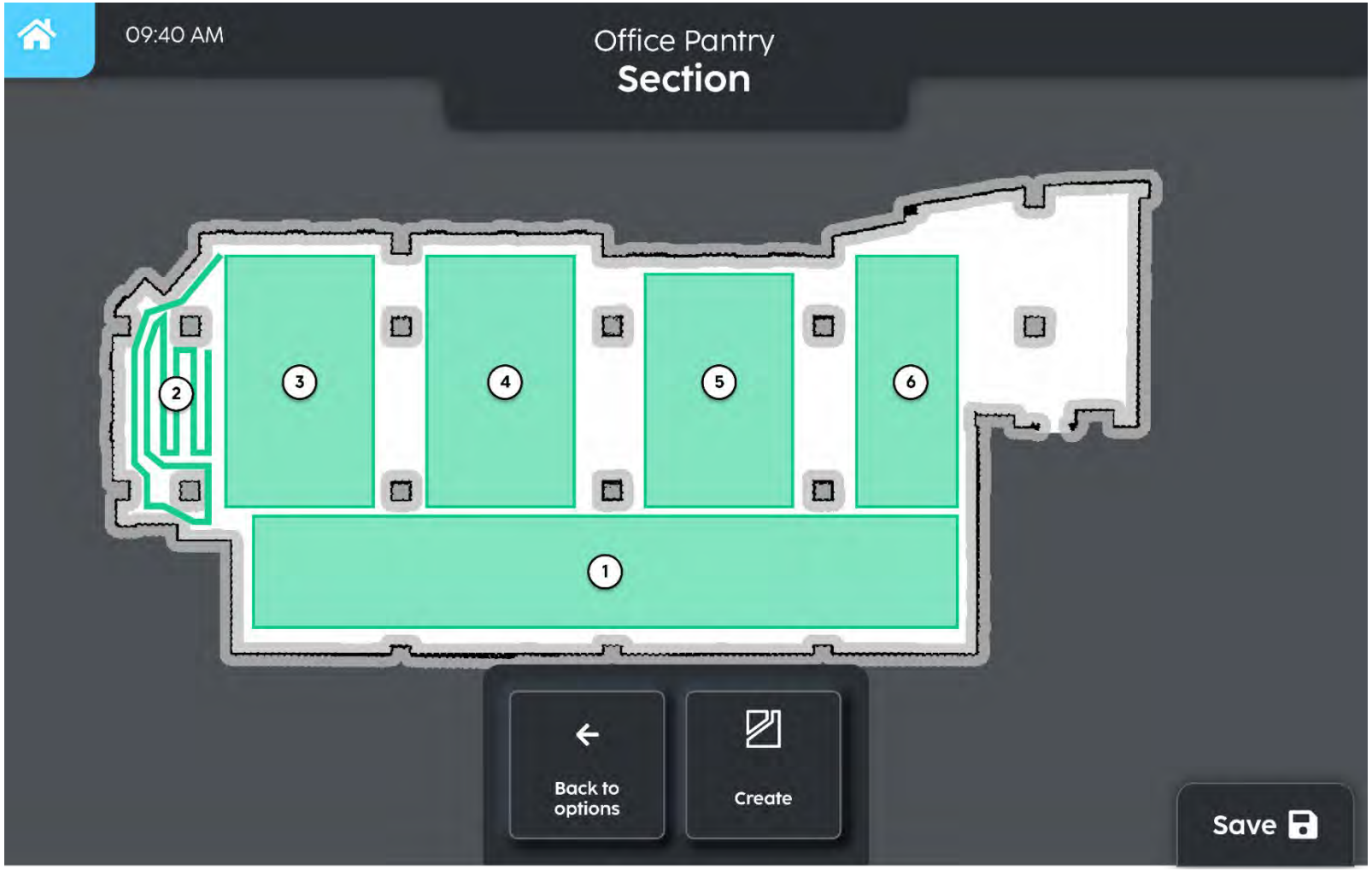
5. Sections

After creating multiple cleaning zones, you can clean them together in a job by grouping them into Sections.

When you create a section, you can click the route/area and the robot will clean them back-to-back in the sequence you clicked.

A map can have multiple sections, so users can run different cleaning jobs depending on the time of the day/week.



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Schedule cleaning

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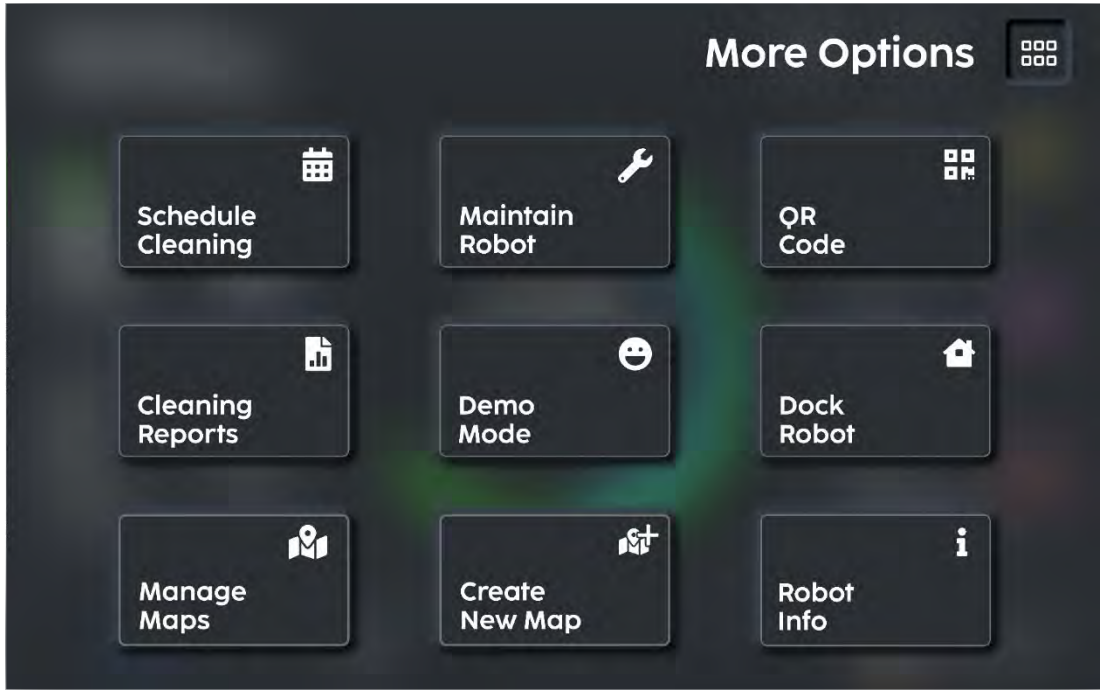
Setting a schedule



Schedules can be found under Options > Schedule.

Click on “Add Schedule”.

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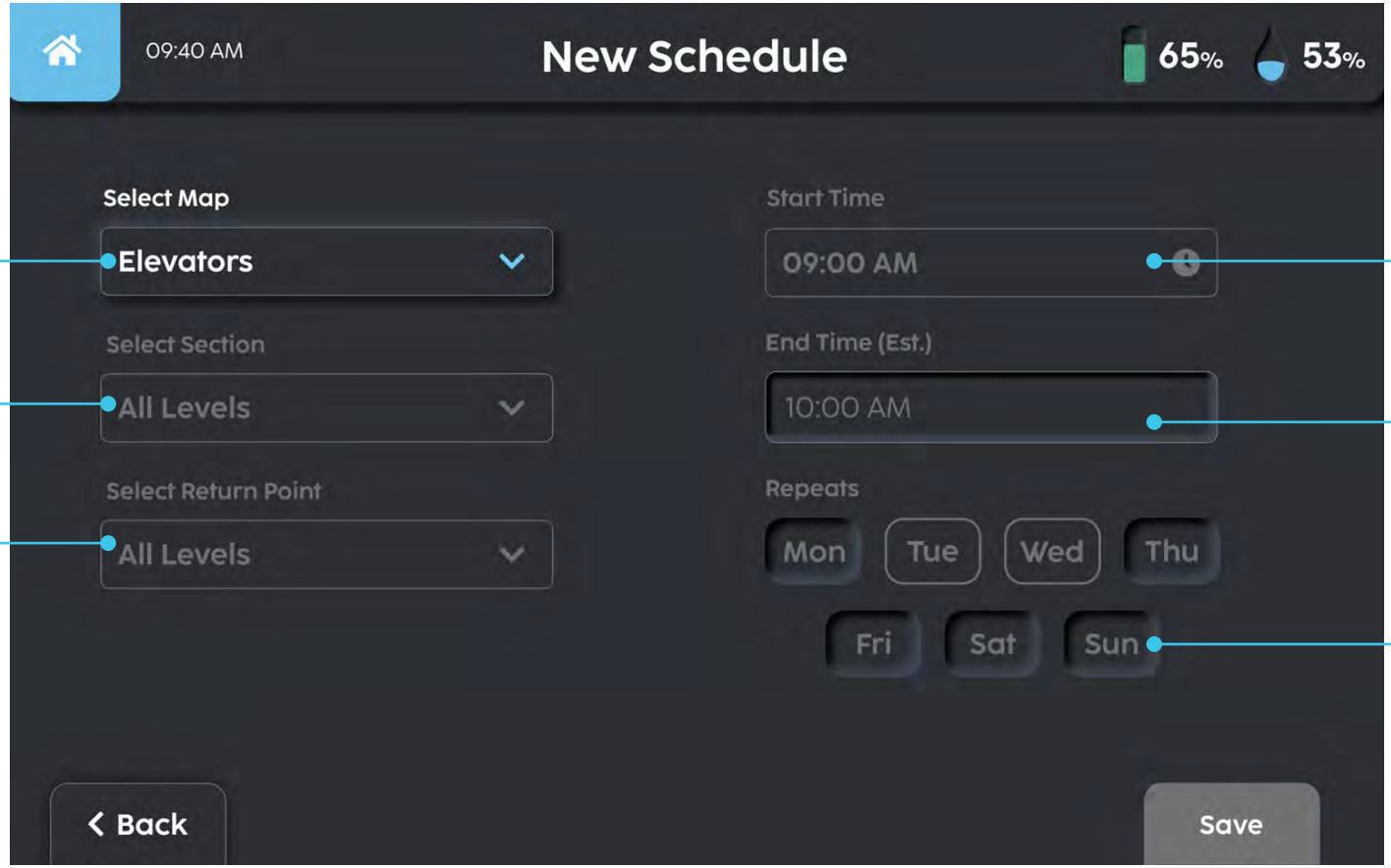
Setting a schedule

Select a map to set schedule for

Select a section

Select a return point

If section and/or return point cannot be selected, the map does not contain these. Please add section and home point to set a schedule.



Select a time the schedule should start

An estimated end time is displayed

Select to set a recurring schedule (Optional)

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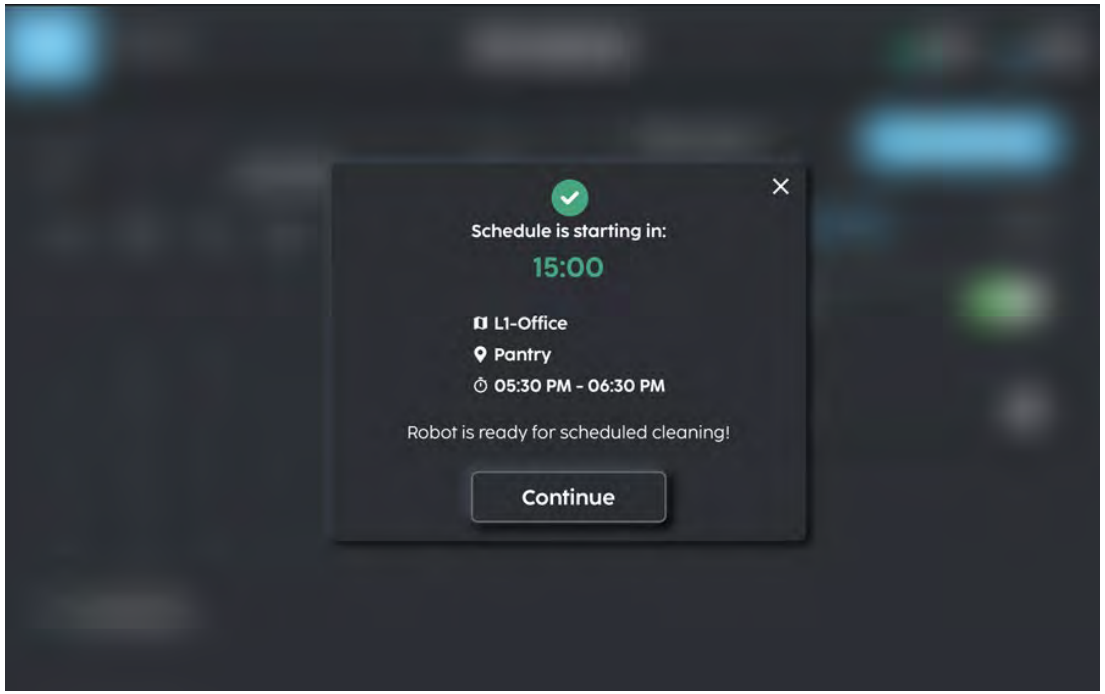
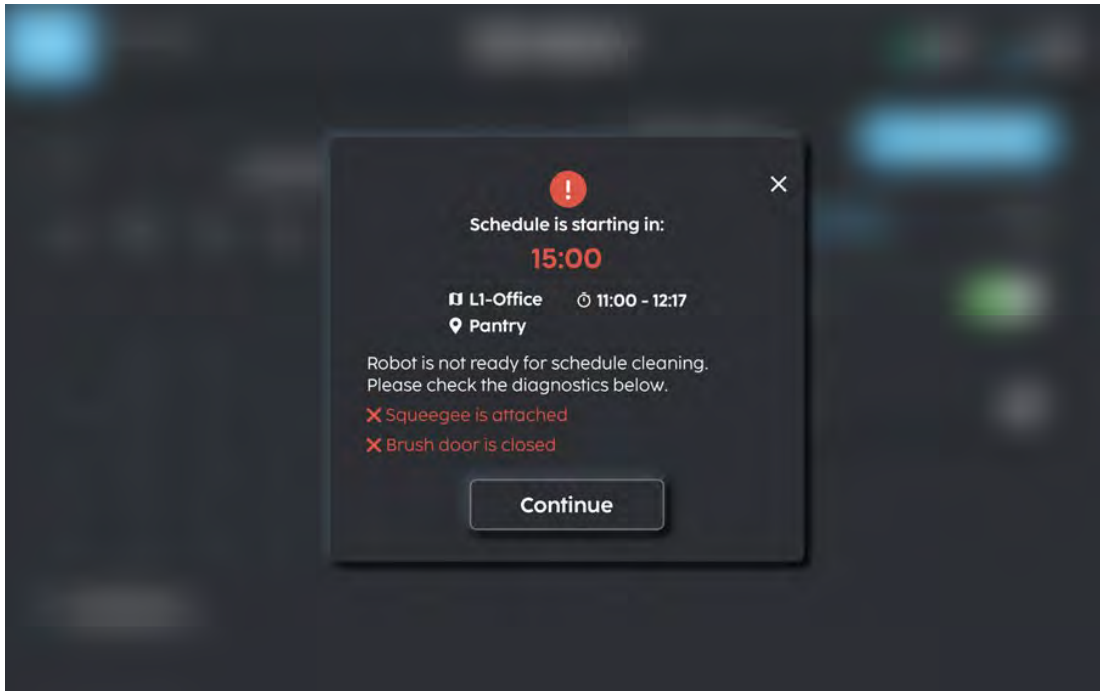
Setting a schedule

Scheduled clean starts in 15 minutes, the robot conducts a check to ensure it can start cleaning.



Robot is ready to start scheduled cleaning



Robot is not ready to start scheduled cleaning.
Check the diagnostics to start.

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Thank you!

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