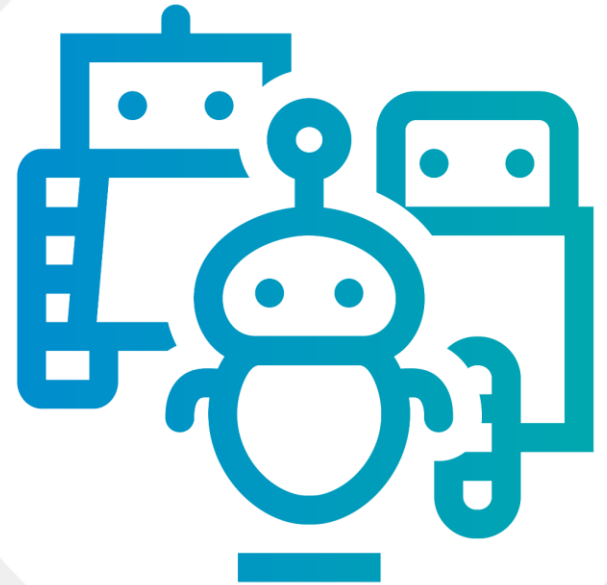
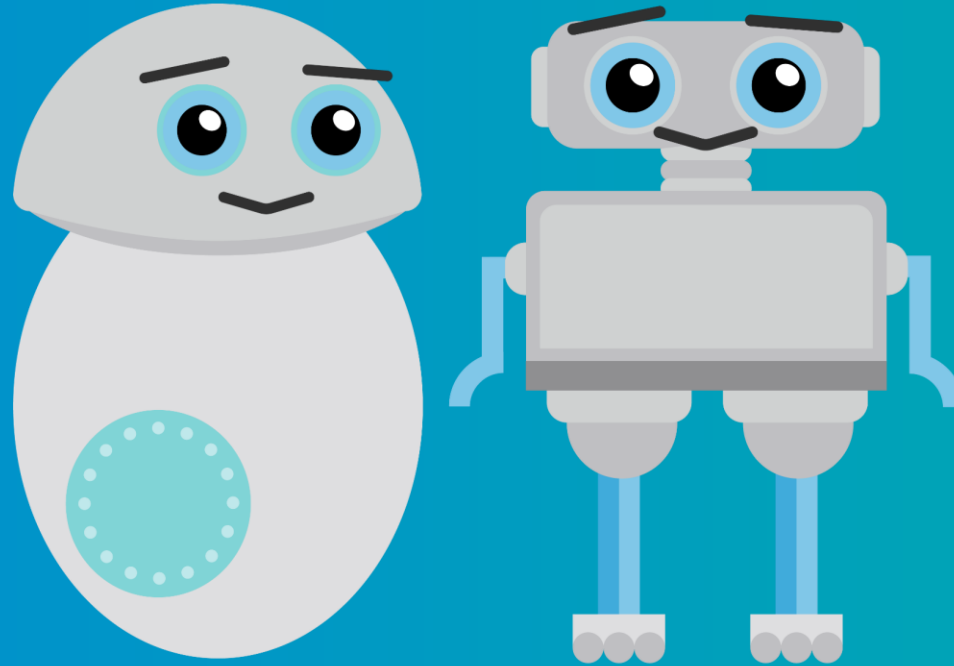


Bosch AGV Control System Cloud Robotics



BEG/PJ-IOT-C MAY 2020

What is Bosch AGV Control System?

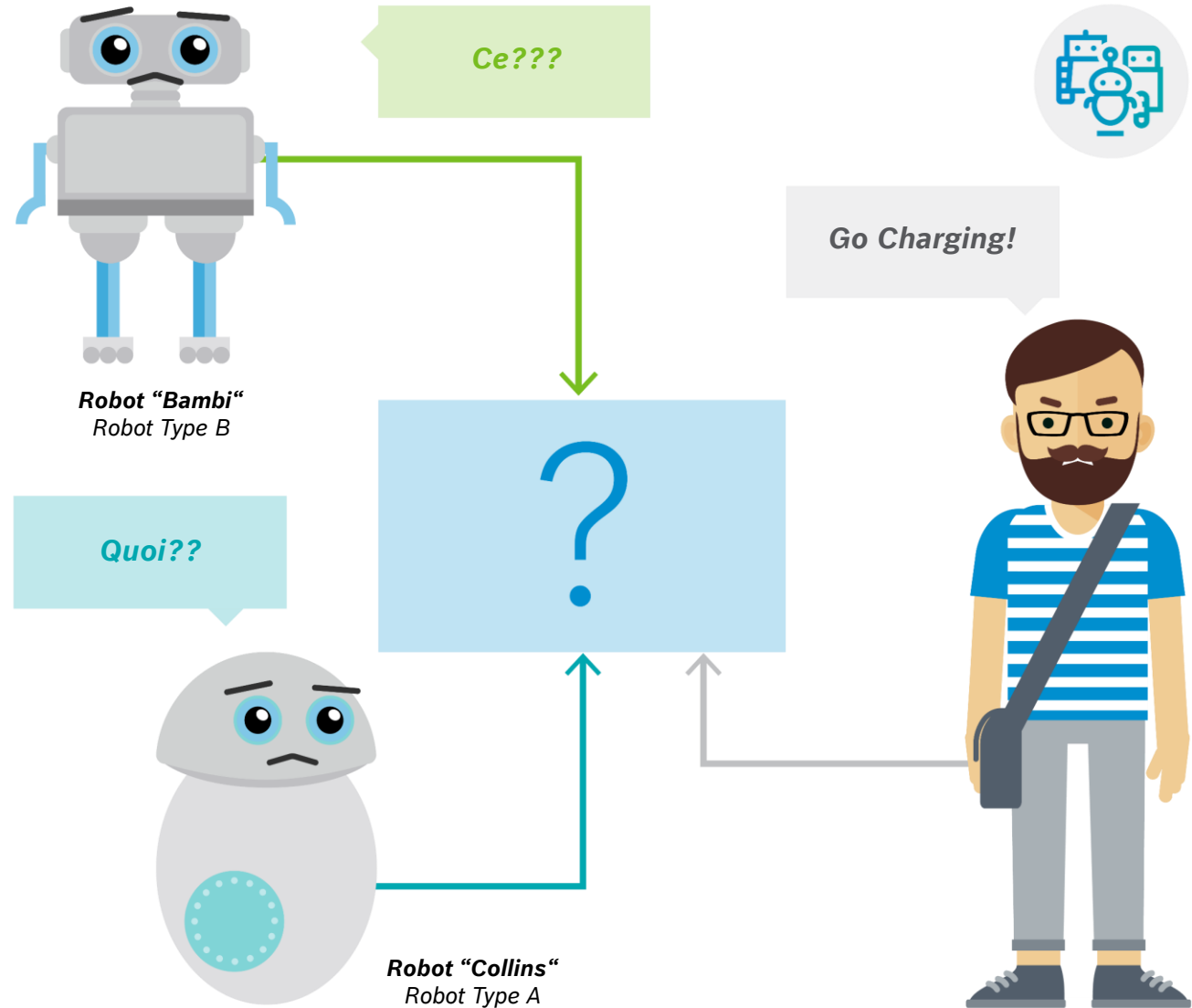


AGV Control System

Why AGV Control System?

There are lots of different robot manufacturers on the market with a great variety of functionalities. As a customer, you have to buy several types of mobile robots from separate manufacturers to cover all requirements originating from various use cases. This leads to the problem that robots cannot cooperate with one another because they cannot communicate with robots from other manufacturers due to each using different platforms, systems and standards.

That is why a centralized mission control and fleet management platform is needed to connect mobile robots so they can communicate with one another allowing them to intelligently cooperate to solve sophisticated tasks. This leads to profit increase to the customer because of: reduced operation cost, reduced human error, increased uptime, increased efficiency.



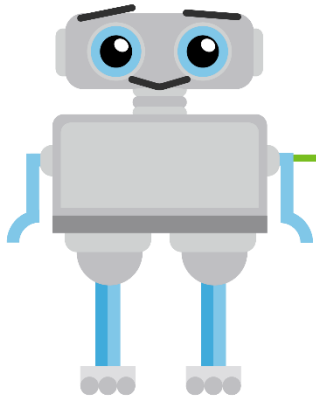
Bosch AGV Control System is a platform that connects mobile robots from different manufacturers to **communicate with one another** allowing them to **intelligently cooperate** to solve sophisticated tasks.



AGV Control System

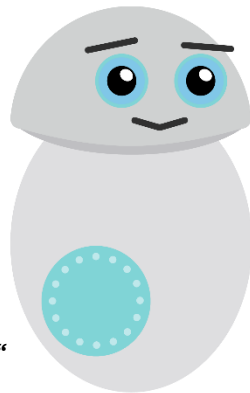
How does it work?

Bosch has developed a robot management service that can read and translate actions and messages in both directions!

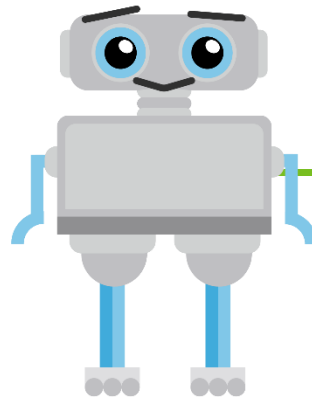


**Robot
"Pocahontas"**
Robot Type B

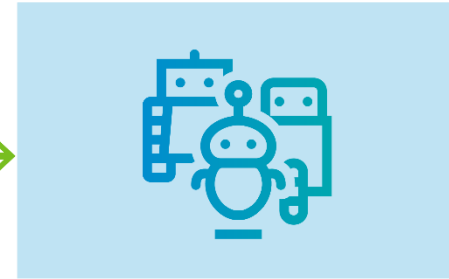
The translation of raw robot messages, written in its native language, into Bosch AGV Control System compatible generic messages.



Robot "Collins"
Robot Type A



Robot "Bambi"
Robot Type B



**Robot Management
Service**

The translation of generic system actions that can be triggered by the system or the user through the interface results in a specific action for each robot type.

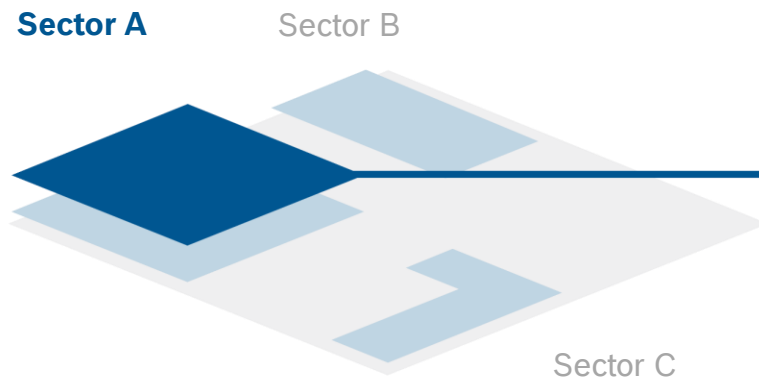
Fahrt zum Laden



AGV Control System

How does it work?

The system is based on different map types, which serve as references for the robots so that they can locate themselves indoors and outdoors. Because Bosch AGV Control System can coordinate and manage robot types from different manufacturers in one tool, each type requires a specific reference map. Sectors have to be created so that all robots moving in the same area can communicate with one another in spite of distinct maps. Sectors define the accessible area by grouping robots and their associated reference maps.



Map Layers in Sector A



Wifi Heat Map



Path Network Map



Laser Maps



Blueprint Map



Geographical Map



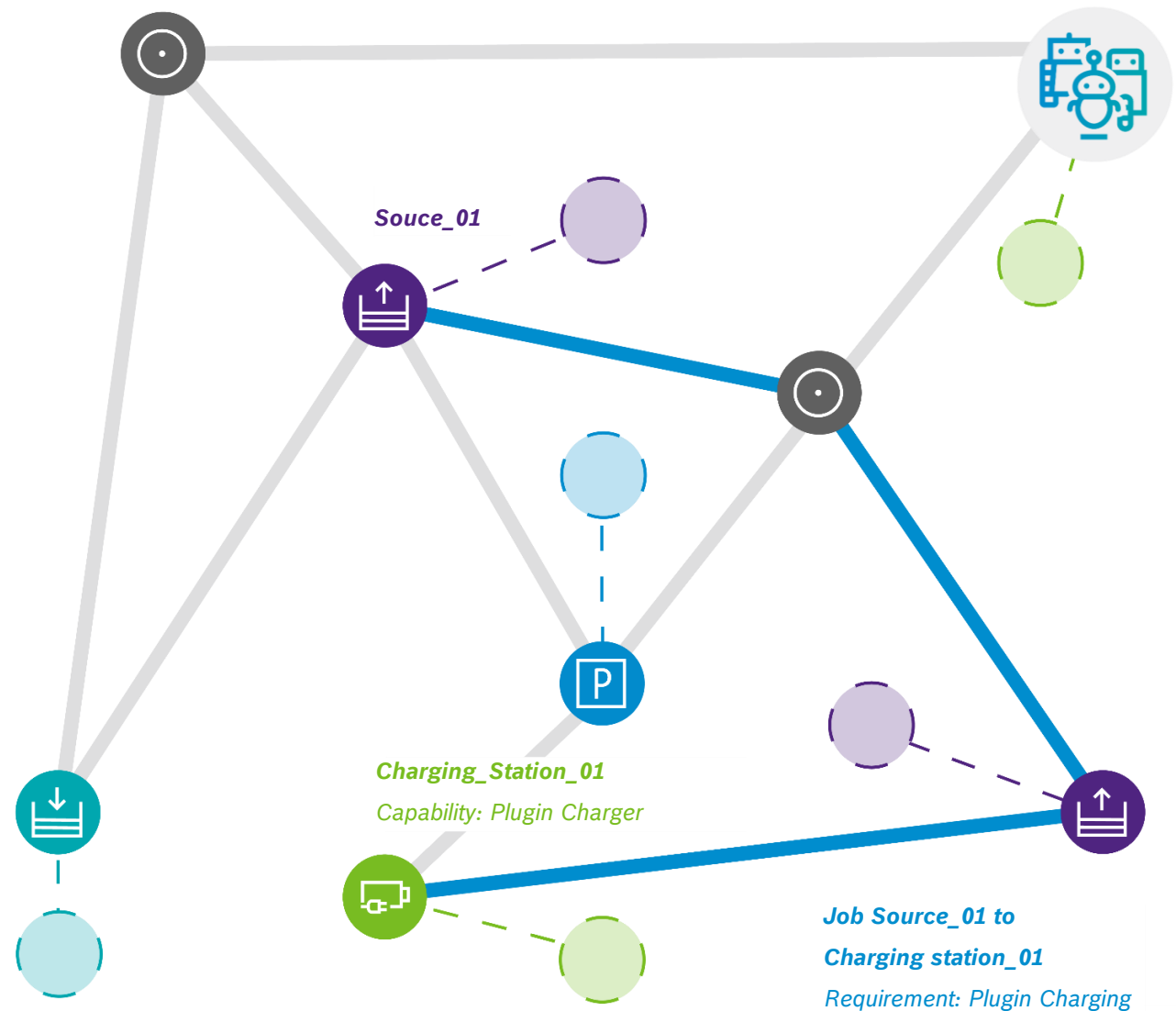
AGV Control System

How does it work?

These maps later can be used to create a path network that applies to the entire sector. All robots in this sector operate in a common network.

Path elements have specific capabilities (pick up, drop off, charge, etc). Each robot type also possesses different capabilities to complete various actions. Therefore the actions of one path element can only be completed by a specific robot type with the corresponding capabilities.

When the user now starts a job, the intelligent fleet management considers the path network to find the shortest path and the closest robot with the fitting capabilities to complete the job. This way it is guaranteed that jobs are always completed in the fastest and most efficient way.



AGV Control System

How does it work?

Type A Profile

Related Robots

“Collins”

Robot Class Wallees

Capabilities Pick up,
Drop off, Flying, Plugin
Charger

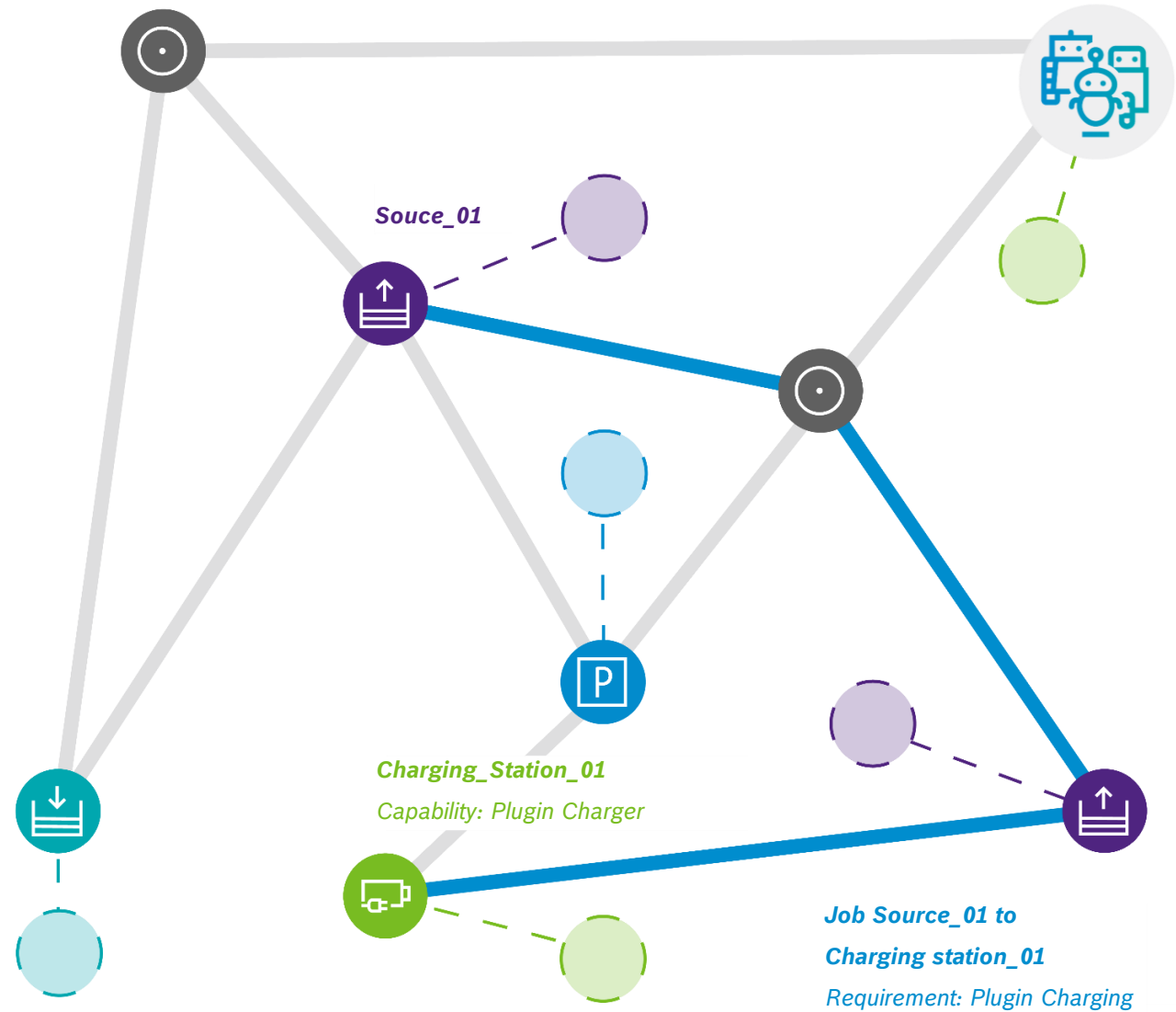
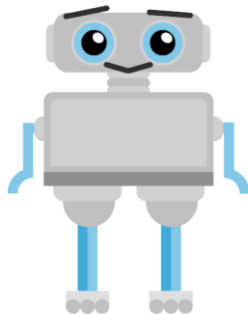
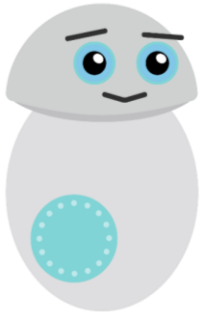
Type B Profile

Related Robots

“Pocahontas“, “Bambi“

Robot Class Wallees

Capabilities Pick up,
Drop off, Swimming,
Inductive Charger



AGV Control System

Role Management



The Viewer

The Viewer is only enabled to view the current state. He is not allowed to make any changes.



The Executer

The Executer is authorized to execute and cancel jobs.



The Planner

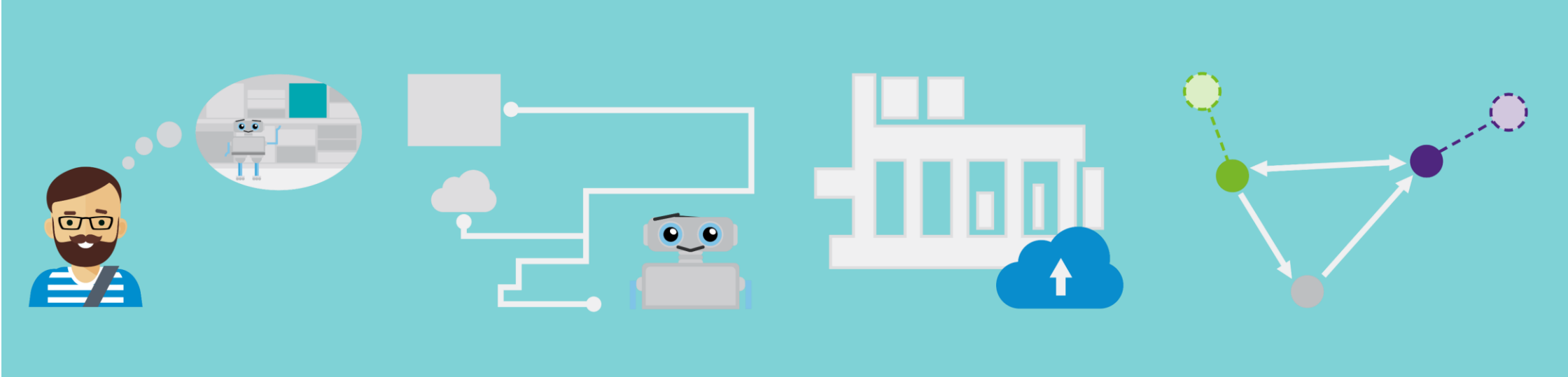
The planner is responsible for planning maps and jobs, registering robots and their overall administration.



The Manager

The manager represents the administrative role within the application.

AGV Control System Customer Journey



01 // Create a Sector

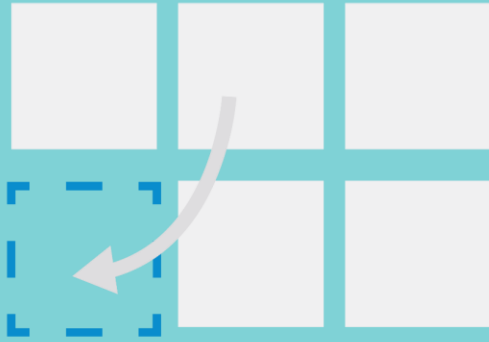
02 // Register a new Robot

03 // Create a new layer

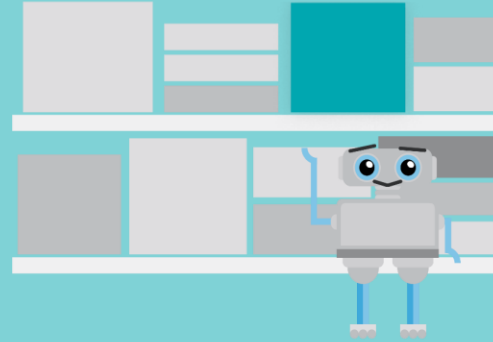
04 // Set up a path network

AGV Control System

Customer Journey



05 // Define a job template



06 // Execute a job template



07 // Information of executed jobs

What our solution looks like...



AGV Control System Feature Overview



General Settings

Sector Management

Cross-System Settings

Notifications Overview

Notifications History

User Profile Mngmt.

User Role Mngmt,

Admiral

Overview of all Robots

Register Robots from
multiple brands

Mng.Robots Relation-
ships with the system

Maps + Layers

Overview of all
integrated map layers

Create new map layer
with many map types

Map Layer Mngmt.

Live map update by real-
time experience of robots

Map View

Monitoring Maps (Path
Network, Laser Map...)

Monitoring Robots (Job
Execution, State ...)

Robot Manual Control

Robot Live Video Stream

Map View Toolbar (Mng.
Map Layers + View)

Mini Map View

Already Developed

Not Yet Developed

AGV Control System Feature Overview



Path Editor

Overview of all set
Path Elements

Detailed Info of all
Path Elements

Edit Information of
existing Path Element

Edit Mode Map View

Path Editor Toolbar for
setting new Elements

Robots

Overview of all register-
ed Robots in the sector

Detailed Robot Informa-
tion about current state

Edit Robot Information +
Settings

Job Library

Overview of all
generated job templates

Executing of existing job
template

Create new standart Job
Template

Set a designated robot/
repetition for execution

Create new complexe
Job Template

Edit/ Delete existing Job
Template

Jobs

Overview of pending &
executing jobs

Priorization of Jobs

Automated job allocation,
scheduling and execution

Intelligent Job planning &
optimization

Information about current
state of job execution

Job History (Job
Recordings, Infos...)

Reporting

Regularly generated
reports

Analytics tool for
visualizing operational
data (jobs, routes, etc.)

Creating PDF Exports

Diagnostic Data

AGV Control System

Path Editor Tools



Way Point



Source Point



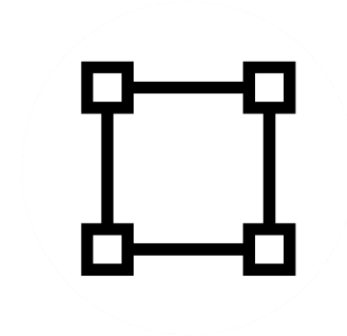
Sink Point



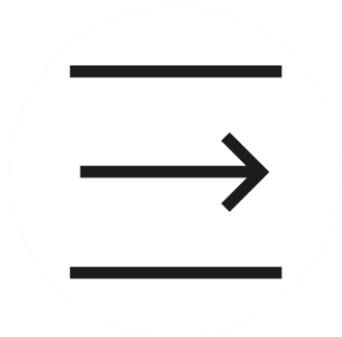
Charging Point



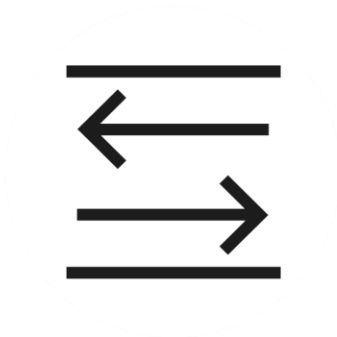
Parking Point



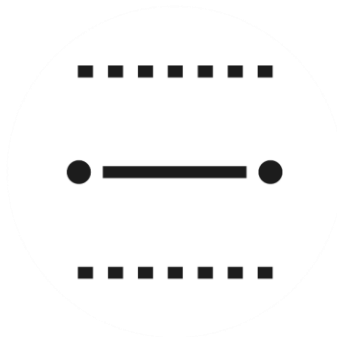
Zones



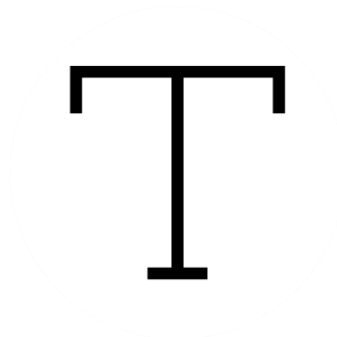
Unidirectional Path



Bidirectional Path



Vestibules



Text Label



IoT Device



Adjusting Layers

AGV Control System Robot Section



It provides an overview as well as detailed information for all registered robots in the opened sector.

Robot State

Robot Current Information

Search Field

The screenshot displays the Bosch Cloud Robotics Empera Home interface. The top navigation bar includes the Bosch logo, 'Cloud Robotics', 'Empera Home', and a '+ New Sector' button. Below this is a secondary navigation bar with 'Path Editor', 'Robots', 'Job Library', and 'Jobs'. The main area is divided into a left sidebar and a right map view.

Left Sidebar: Registered Robots

- Search Field:** A search bar at the top of the sidebar.
- Registered Robots:** A list of robots with their status and details.
 - adventurous bison:** Sleeping Mode, Inactive, Online, Free, 87.04% battery, 0.00 m/s, Inactive task. Buttons: Edit, Delete.
 - intuitive alpaca:** Sleeping Mode, Online, Free, 87.04% battery, 0.00 m/s, Inactive task.
 - empathetic grasshopper:** Deactivated, Online, Free, 87.04% battery, 0.00 m/s, Inactive task.

Right Map View:

- Map View:** A topographic map showing the robots' positions and movement paths.
- Robots on Map:**
 - adventurous bison:** A blue robot icon with a status popup showing 'No job assigned' and 'Task: inactive'.
 - intuitive alpaca:** A blue robot icon.
 - empathetic grasshopper:** A blue robot icon.
- Paths:** Grey lines with arrows indicating the robots' movement paths across the map.

AGV Control System

Job Library Section



The Job Library Section gives an overview of all already created job templates. Job templates contain all information about a job and can be created once and executed several times.

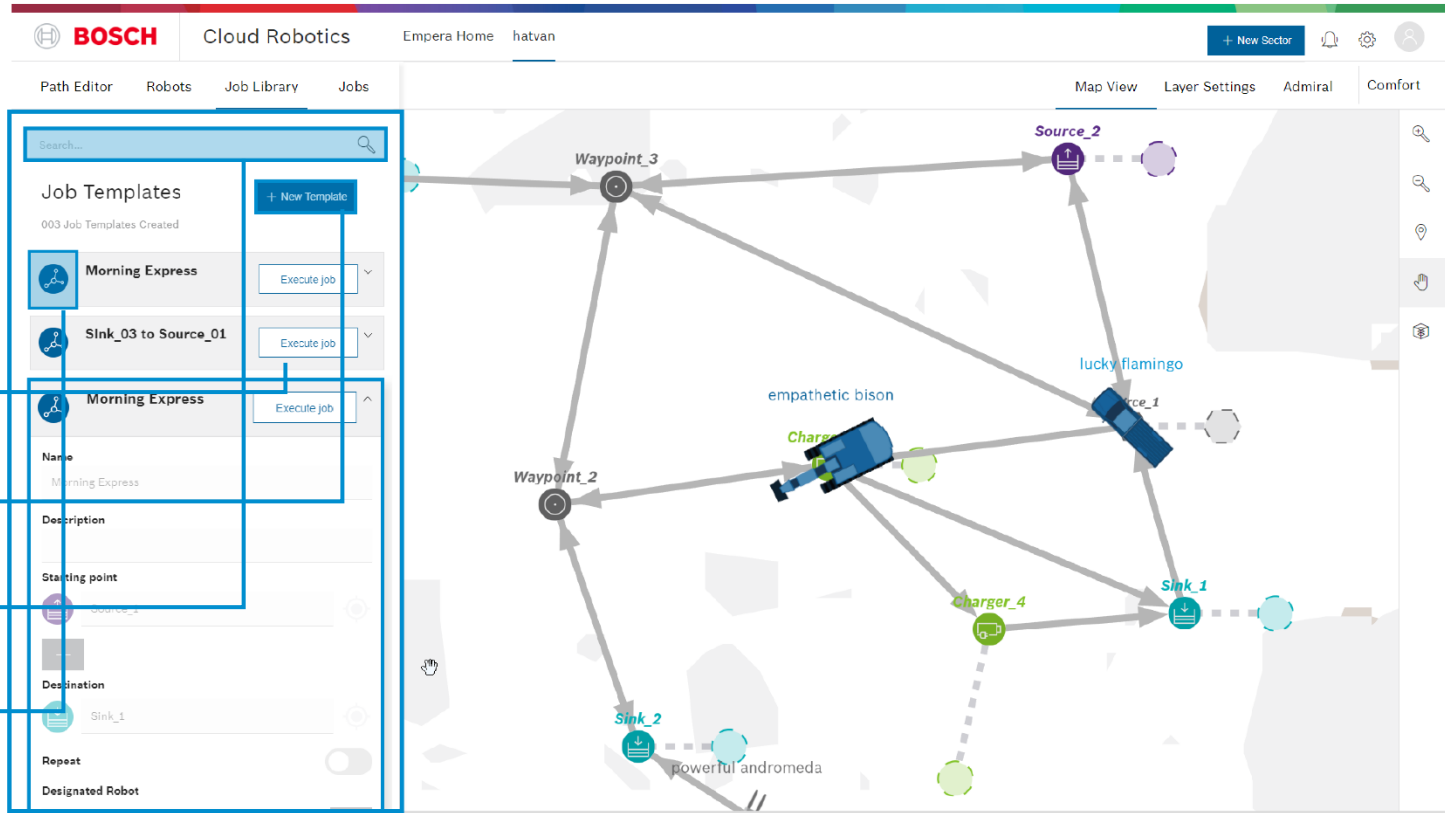
Quick Selection Job Execution

Create new Template

Search Field

Job Template Species

Job Template Information



AGV Control System

Job Section



This section provides an overview and detailed information about all current, pending, and already executed jobs. Job Templates can be executed as well.

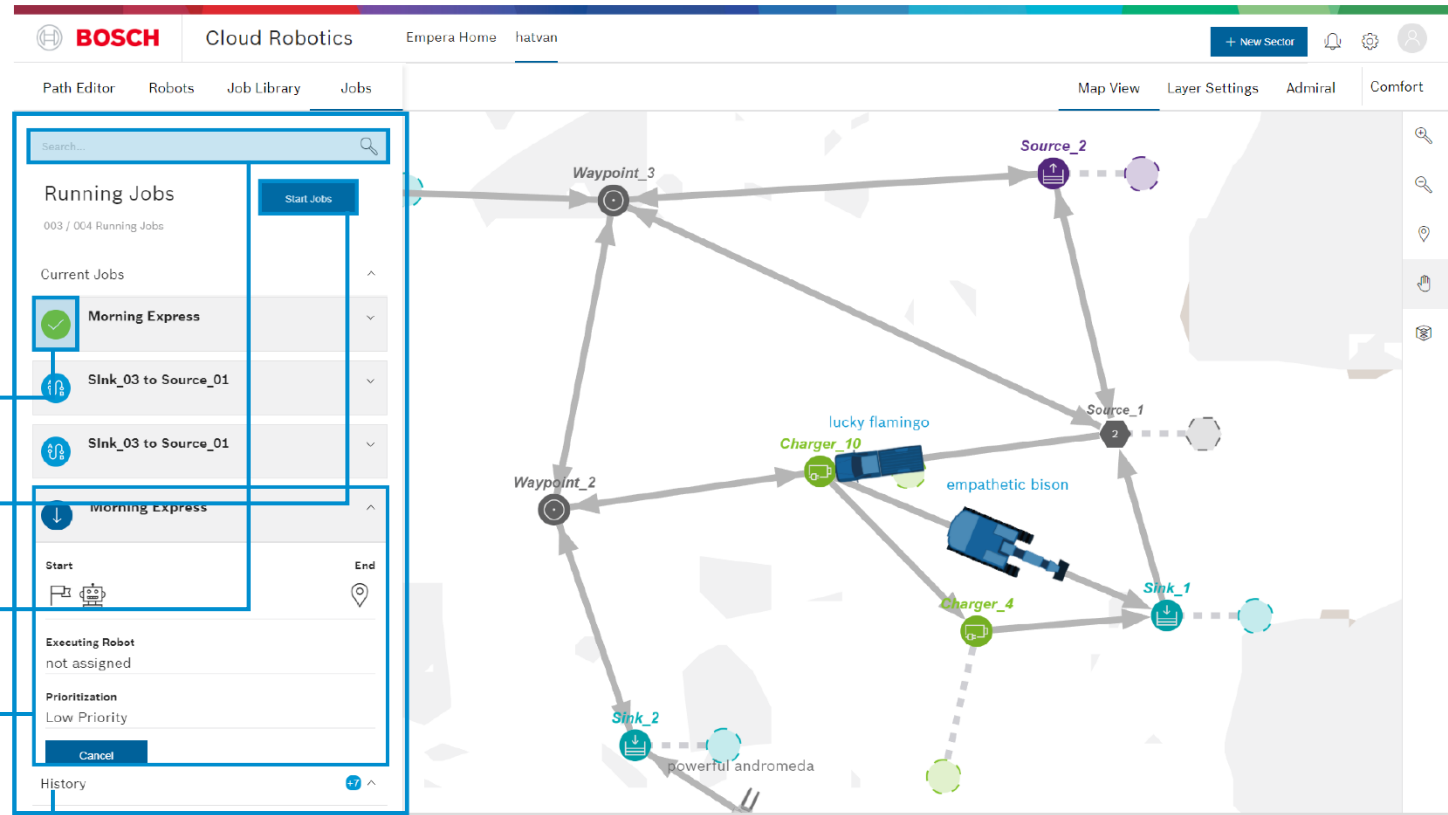
Job State

Direct Job Execution

Search Field

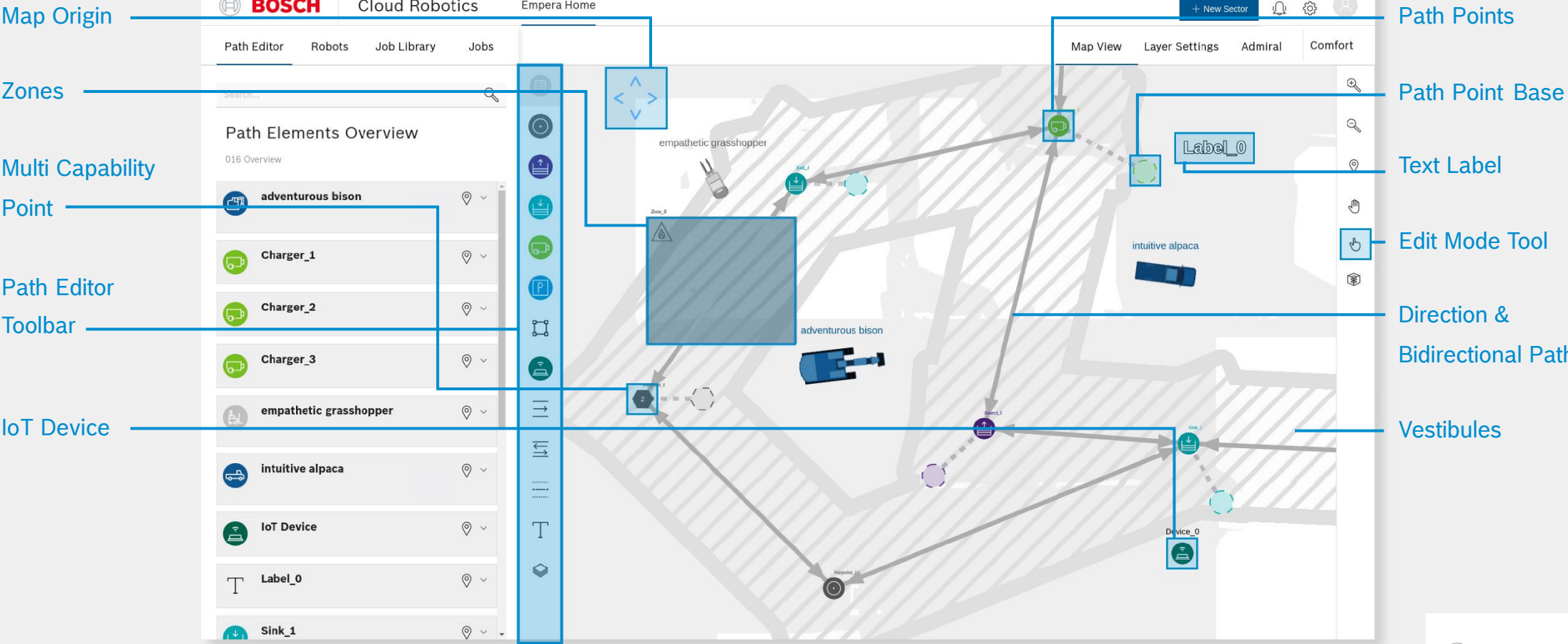
Job Information

Job History

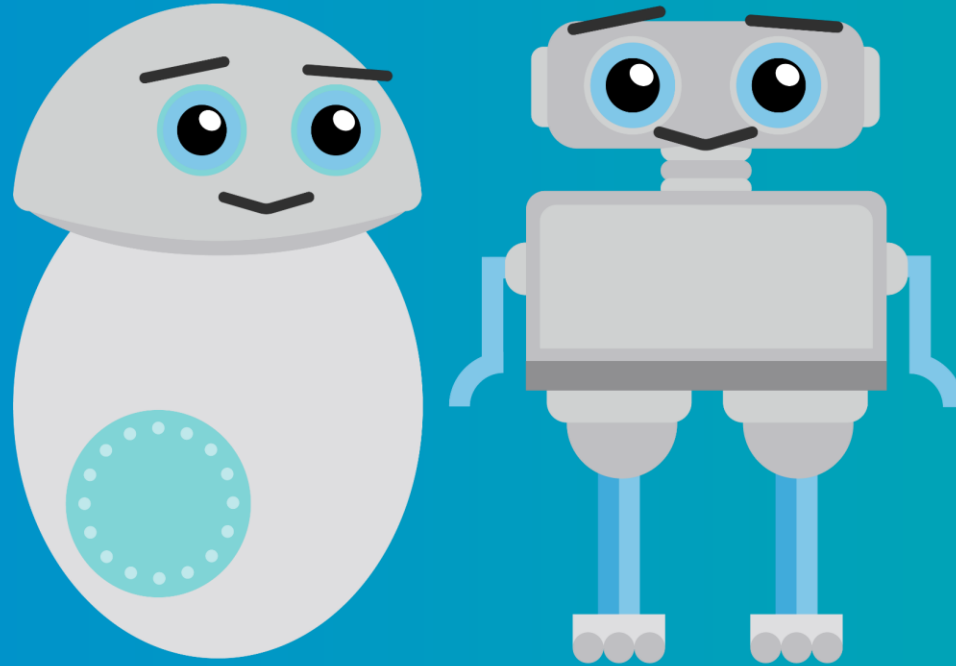


AGV Control System

Path Editor



Happy Fleet Management Cloud Robotics Team!



AGV Control System

Contact for further information



Jürgen Sojka

Project Manager

Tel. +49 7062 911 1984

Mobile +49 152 549 805 12

Juergen.Sojka2@de.bosch.com



Jordi Bas

Product Owner

Tel. +49 711 811 14410

Mobile +49 173 860 765 1

Jordi.Bas@de.bosch.com



David Lenhart

Technology & Engineering

Tel. +49 7062 911 7147

Mobile +49 173 609 309 9

David.Lenhart@de.bosch.com



Anna-Lena Borck

UX/UI Concept & Design

Tel. +49 7062 911 7147

Mobile +49 173 566 749 8

Anna-Lena.Borck@de.bosch.com