

Warehouse of the Future

MIEIC02-DS

Context

- An assembly line for cars that frequently requires a specific list of items from their warehouse.
- Getting an item wrong results in millions in losses.
- Automatically getting the items is too expensive.
- Manually getting them causes a lot of mistakes.

Solution

Add devices to each warehouse container

Create a software that:

- Represents the warehouse
- Displays devices communicating with each other
- Displays devices and their issues
- Proposes new shelf layouts

VERTICALS

- Data lake
- Mesh communication
- Playground
- Layout Optimization

1. **DATA LAKE**



Data collection and processing for the
warehouse

TEAM PRESENTATION



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REST API

Data Lake 1.0
[Base URL: /]
[/swagger.json](#)

Data Lake for Warehouse

Global Data Global Data related operations ▼

Manifests Manifests related operations ▼

Sensors Sensor related operations ▼

Devices Devices related operations ▼

Staff Staff related operations ▼

Stock Stock related operations ▼

Layouts Layouts related operations ▼

Buckets Buckets related operations ▼

Shelves Shelves related operations ▼

Racks Racks related operations ▼

GenerateData Generate random data to simulate the warehouse. This endpoint is only used by the populate worker. ▼

Grafana



2.

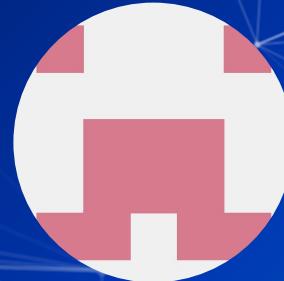
MESH COMMUNICATION

Simulation of the devices' mesh network (visual and text): communication, battery depletion, failure detection, and detailed temporal analysis.

TEAM PRESENTATION



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João Martins
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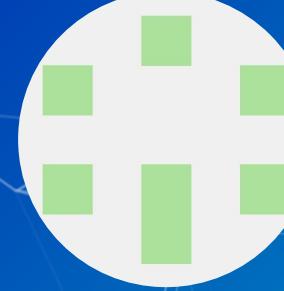
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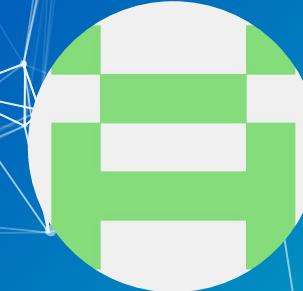
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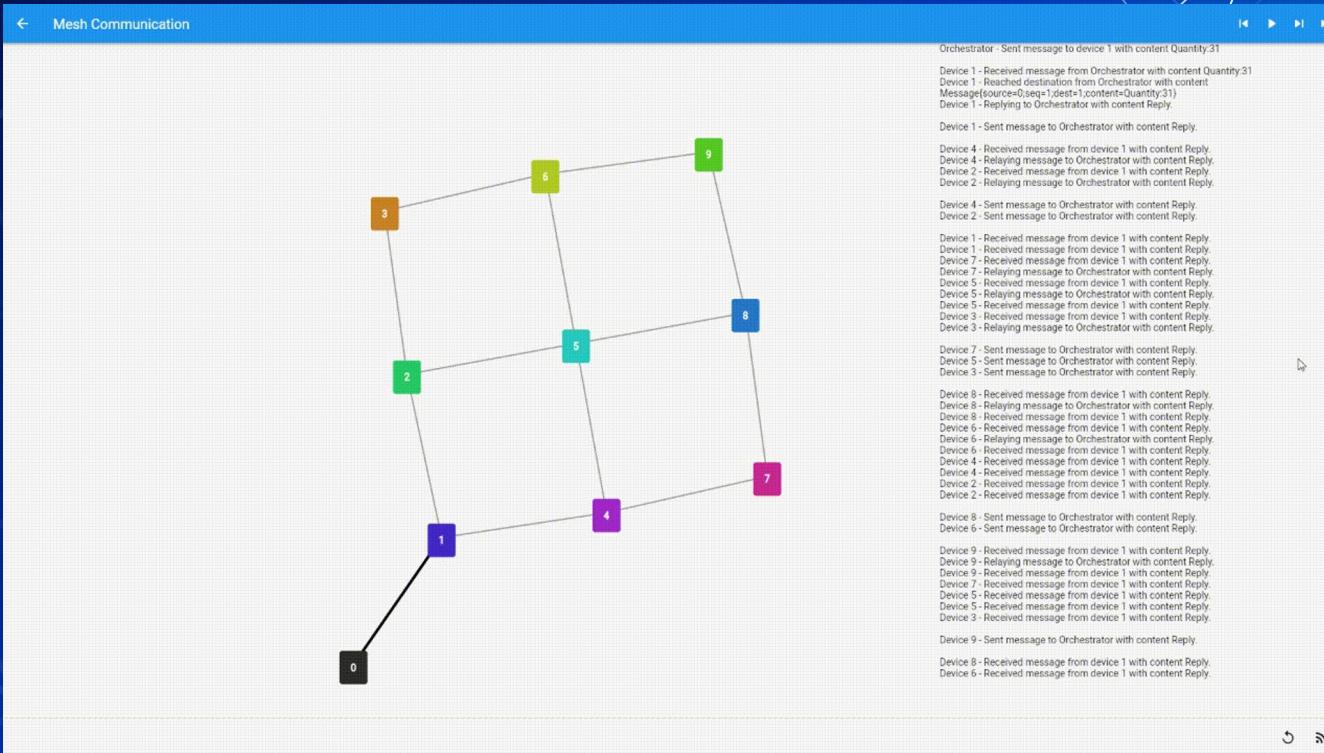


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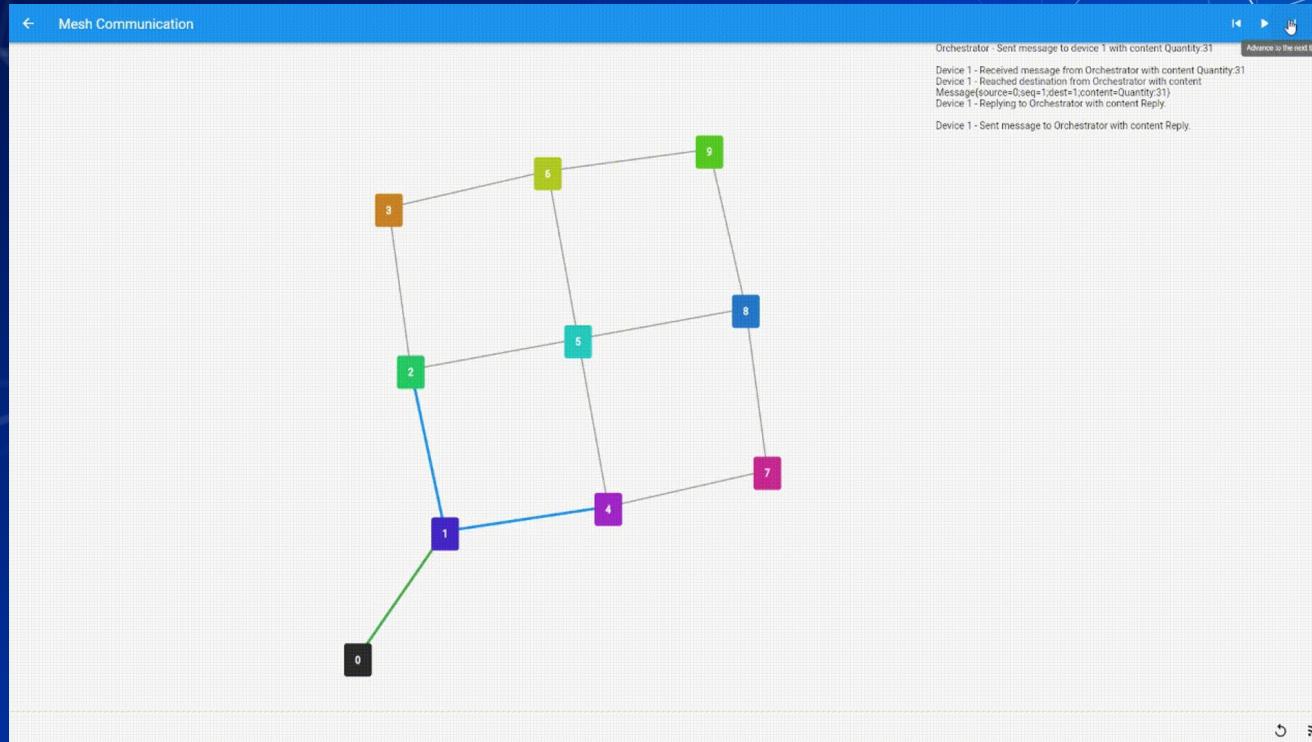


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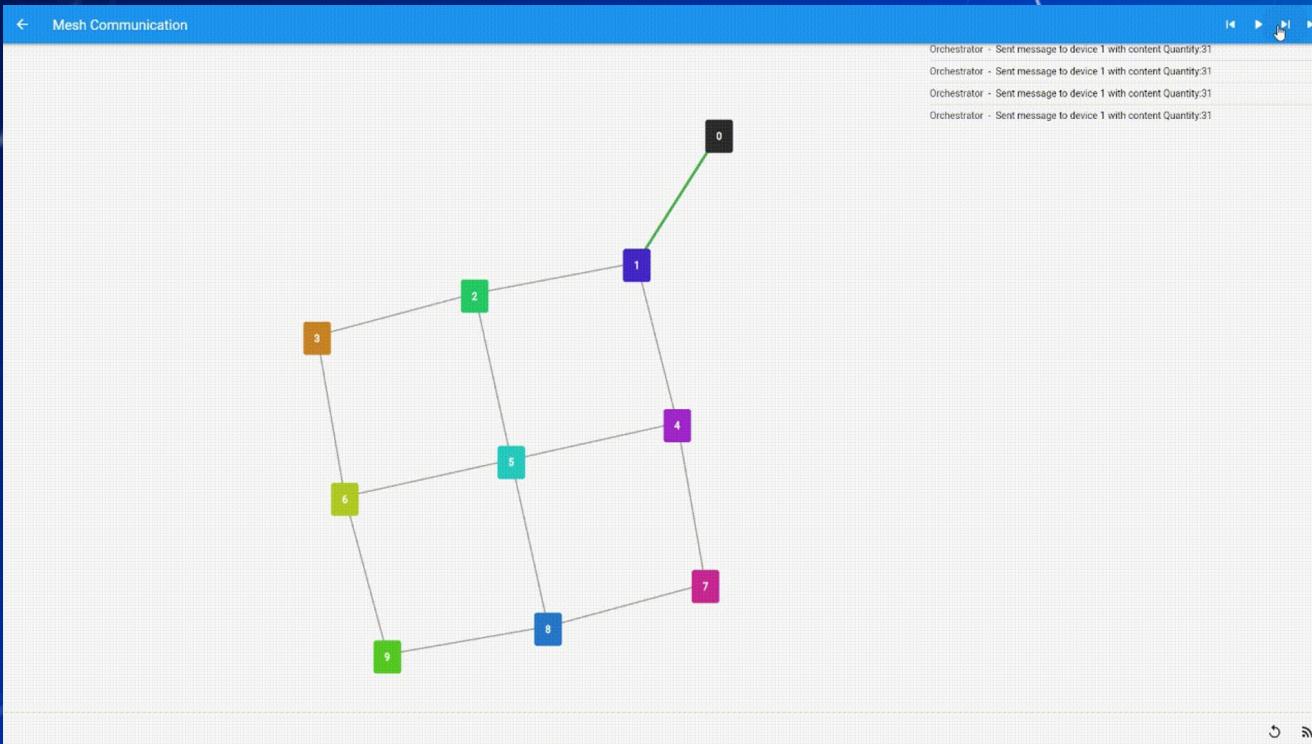
Request and reply



Message relaying



Message failure



User control and logging

The user has several commands available to control the simulation:

- Play/Pause the simulation.
- Step forward in time (single and multi-step)
- Go backwards in time (single and multi-step)
- Command the orchestrator to communicate the current manifest to the devices.

All these actions appear in the logs, so the user can analyze the results in detail.

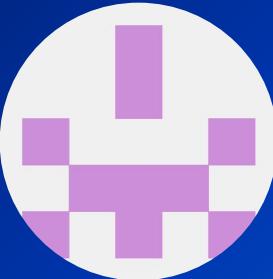
3. PLAYGROUND

A web-app focused on providing maintenance staff a tool to visualize the real-time status of the warehouse

TEAM PRESENTATION



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Reports

Playground | Warehouse of the Future



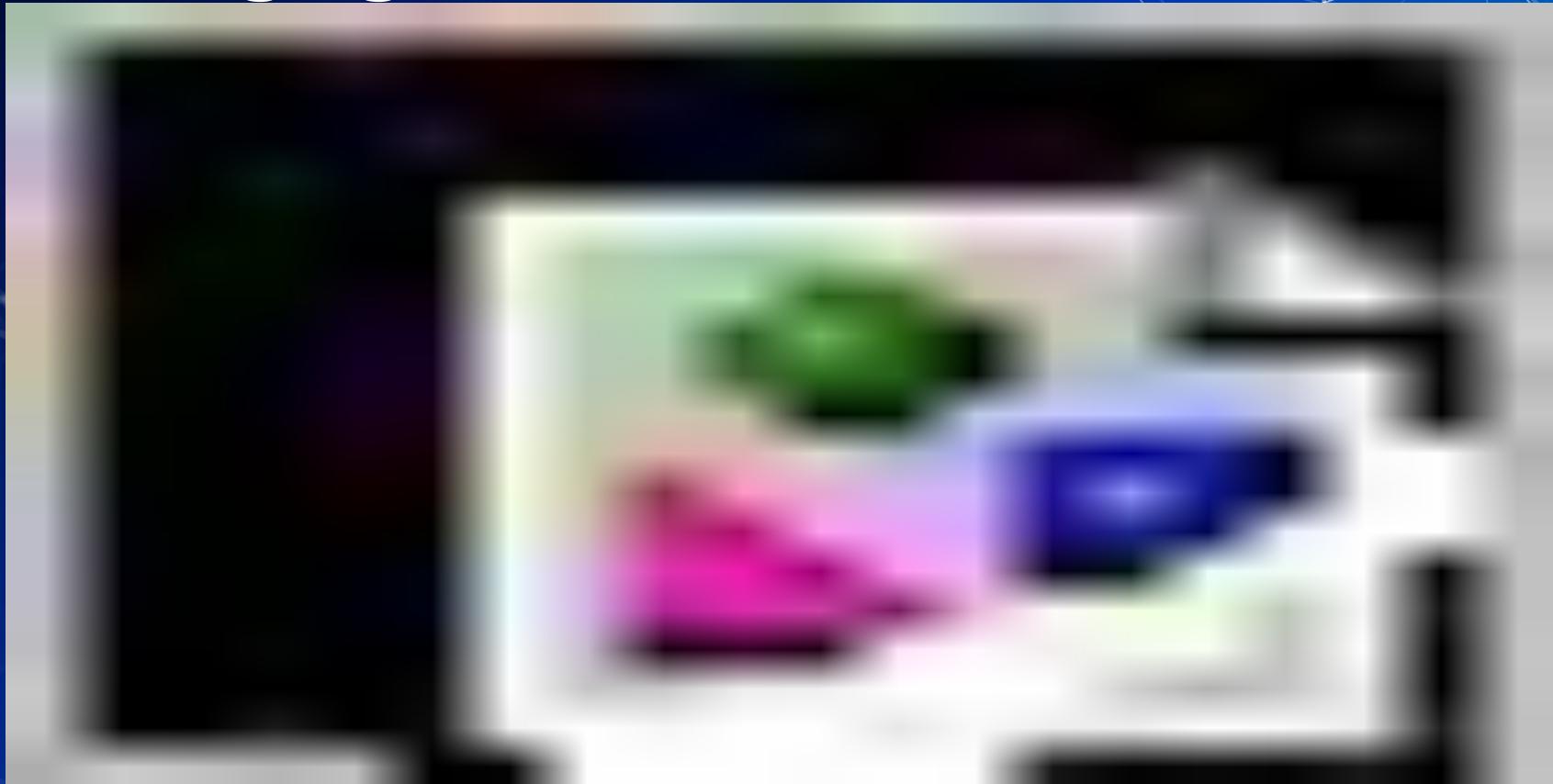
REPORTS SIMULATION

Search reports

Anomaly on device.

Something went wrong

Messaging



4.

LAYOUT OPTIMIZATION

Genetic algorithm approach for efficient multi
criteria shelf layout

TEAM PRESENTATION



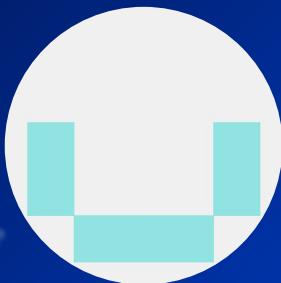
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1 200

Average hours wasted each year on unnecessary motion at the warehouse.

U.S. Census Bureau Data

Optimization Criteria

- Weight
- Time
- Human Error Minimization
- Multi Criteria Optimization

Human

Warehouse

Optimize Travel Distance - Frequent Together

Optimize Weight Lifting

Optimize Chest Level

Minimize Worker Error

1

1

Optimize By Type of Sector

Factor

Generate

Algorithm Result

- Smart Warehouse Organization Layout.
- 2D Results Rendering.
- Connection with Data Lake:
 - Genetic Algorithm Data Feeding

THANK you!

Any questions?

You can find the final project at

- <https://github.com/softeng-feup/ds-meic2>