RHENUS LOGISTICS

THROUGHPUT OPTIMIZATION WITH AUTOMATED FORKLIFTS

PROBLEM STATEMENT

Warehouse throughput is constrained not by hardware, but by aisle congestion and poor slot assignments. We model picker movement, aisle occupancy, and pallet flow using a SimPy discrete-event simulation to test congestion-aware routing and slot scoring heuristics. Experiments across warehouse conditions, identifying the combinations that maximize pallets/day while minimizing travel distance and aisle congestion.

CURRENT

- Aisle clustering
- Queue buildup
- Higher waiting/idle time

OPTIMIZED

- Congestion-aware rack scoring
- Slot scoring
- Balanced workload

RESULTS

CONGESTION & QUEUE LOSSES REDUCED

CONGESTION PROBABILITY	AVG. CONGESTION DELAY
29% → 14.5% (~50% LESS)	36 S → 5 S (≈ 85% SHORTER DELAY)

THROUGHPUT & PRODUCTIVITY IMPROVED

IDLE TIME REDUCTION	THROUGHPUT INCREASED
15–20 MIN / FORKLIFT/ SHIFT	~100 PALLETS/DAY

APPROACH

- 🎯 **Set baseline & target**
- 🔍 **Loss identification**
- 🧮 **Parameter Extraction (KPI's)**
- 🧩 **Algorithm Design and Visualization**
- 📊 **Scenario Comparison**

FUTURE SCOPE

- **Real-Time data:** Integrate live forklift position, rack occupancy for routing.
- **Adaptive tuning**: Regularly recalibrate scoring weights and congestion thresholds.
- **Pilot testing:** Run A/B trials to validate throughput gains on the floor.
- **Model expansion:** Add battery/charging, breaks, downtime, and priority orders.

CONCLUSION

- Bottleneck was routing, slot-selection logic, not hardware or fleet size.
- Congestion-aware routing picks racks with lowest expected conflict.
- Slot scoring minimizes travel and avoids congested paths.

TEAM

Company Representative: Frederic Koss (Projektmanager)

Sai Adarsh Varma Chittari	Product Owner + Developer (115 Hours)	Veeragangadhar Kandula	Developer (113 Hours)
Aaradhya Deotale	Scrum Master + Developer (115 Hours)	Nagasai Vegur	Developer (110 Hours)
Sanjeevappa Akilesh	Developer (101 Hours)	Ian Sony Cherian	Developer (100 Hours)