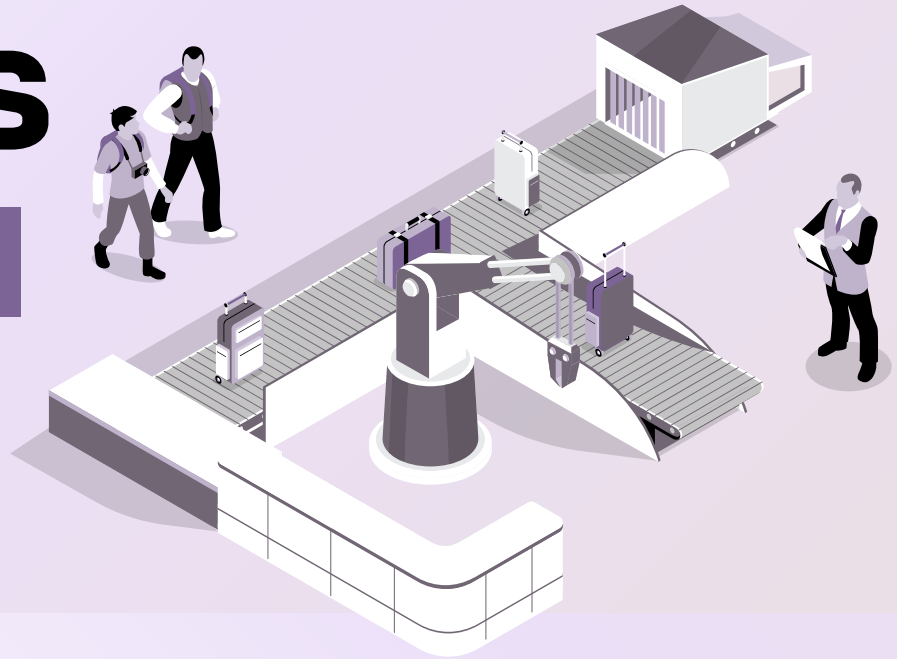
Assembly Avengers

Devils Invent 2024
Elevating the Aerospace Workforce

Honeywell



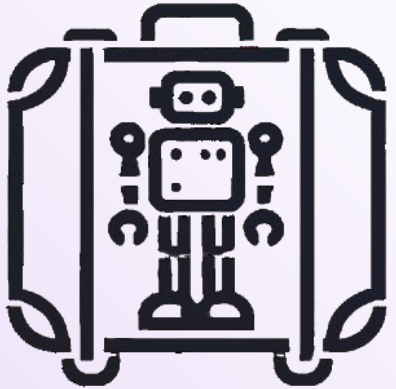
Problem Statement

- Aircrafts spend too much time at the gate
  - The average US domestic flight is delayed 14 min
  - A recent 5% spike has pushed the cost of jet fuel to over $6.21/gal
  - The average operating cost for a plane is $100.80 per minute on the ground
  - Delays cause an estimated $23 billion loss each year in the industry
- Continued growth in air travel is challenging baggage infrastructure in airports
  - 6.3 Million bags are lost or mishandled yearly
- The aviation industry is trending towards single pilot cockpits
  - A single pilot cockpit would require the workload of a pilot to decrease significantly, starting with the rigorous calculations and analysis performed before flights

Therefore we ask: “How can we automate luggage handling operations with a robotic solution in order to streamline services at the gate and decrease delay times improving overall airport efficiency?”

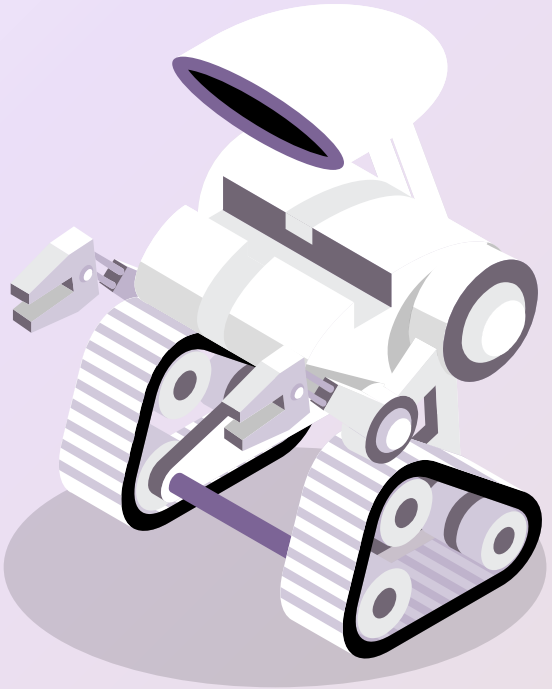
LugBot

Automated Luggage Handler



Improving At-The-Gate efficiency For Faster Flight

The LugBot Experience



Baggage Handling and Organization

Check-In

Bags are weighed and tagged at check-in

Luggage Stacking

Proprietary software calculates appropriate bag stacks and generates grids

Bags Delivered to Gate

Bags are brought to a conveyor leading to aircraft luggage bays

LugBot Distributes

LugBot uses the grids to stack luggage strategically inside the aircraft

Summary

Summary of weight totals and distribution sent to the pilots

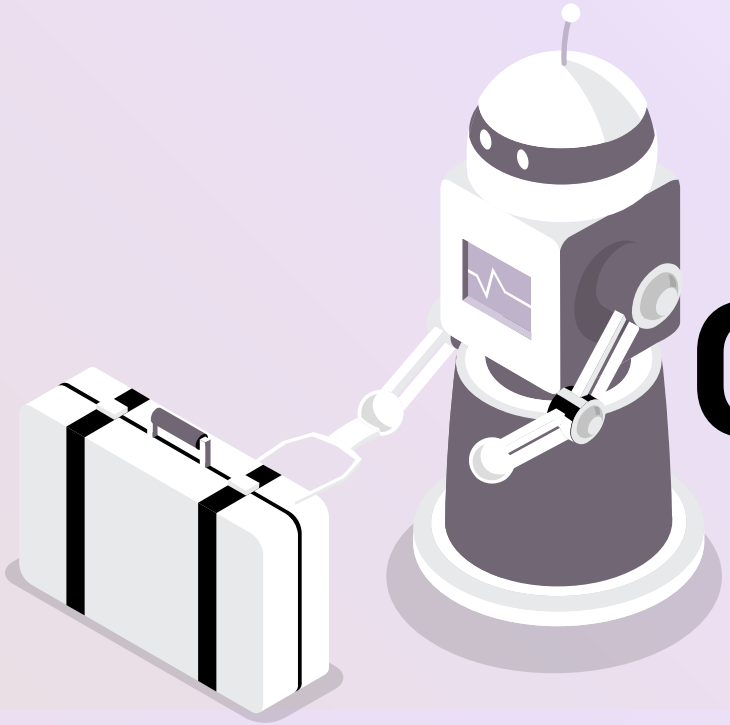
Supporting Infrastructure & User Friendly Design

Infrastructure

- LugBot charges just like a Roomba
- Strategic charging stations in luggage sorting areas already in airport terminals

Easy to Use Design

- Grab and go design with grab handles built in
- Lightweight aluminum infrastructure allows LugBot to weigh less than the average suitcase



Software Capabilities

A Closer Look at LugBot's Capabilities

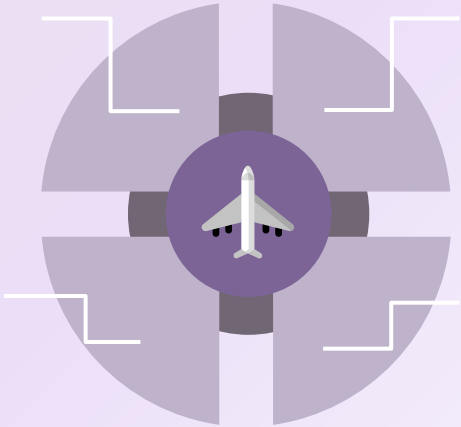
Logistics

Data Collection

- Bag Identification and Tagging
- Bag Dimensions
- Item Weight

Integration

- Integrate with existing luggage systems in airports
- Utilize machine learning to constantly improve efficiency and stacking



System Logging

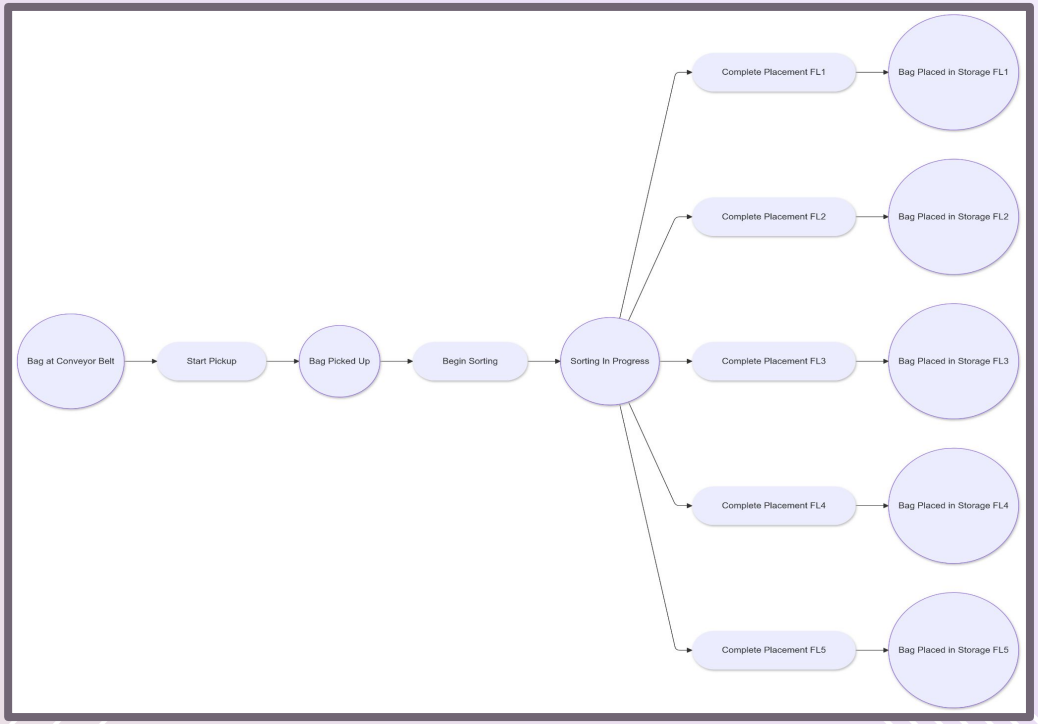
- Logs every stage from check-in to baggage claim
- Error logging and analysis to quickly alter potential failure points

Reporting Tools

- Real time reporting
- Integrates with existing apps such as ForeFlight and Garmin Pilot

Tetris-Like Stacking

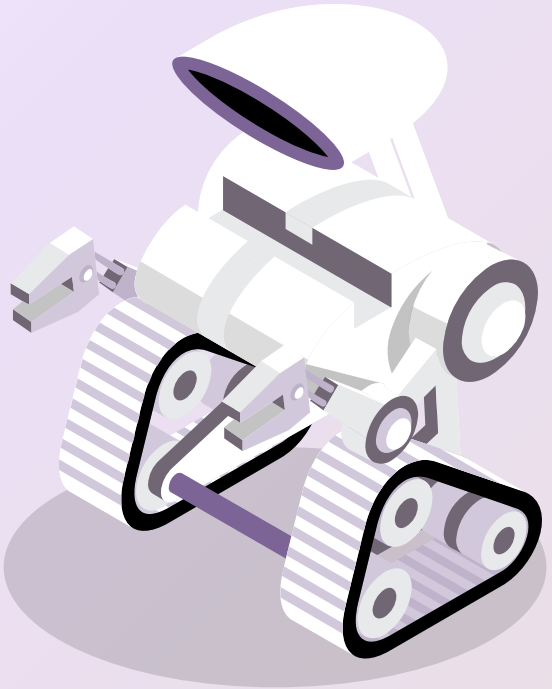
- Like the game of tetris where your goal is to fill rows without gaps.
- Each compartment is treated like a grid divided into cells (Ex: F1, A1, B1)
- Calculates available space using dimensions of bags in compartments.
- Uses proven pattern algorithms similar to the Honeywell Palletizer



Petri-Net theory

Bag Representation: Each bag is represented as a token in the "Luggage arrives" place.
Classification and Routing: Transitions direct bags to specific compartments and locations based on weight capacity and slotting requirements.
Weight Tracking: Tokens in "Weight available" monitor the remaining capacity in each compartment.
Dynamic Updates: Transitions adjust weight tokens after each bag is loaded.
Efficiency and Safety: Ensures efficient distribution of bags, prevents overloading, and maintains balance.
Operational Benefits: Enhances safety, efficiency, and balance in loading operations.

Hardware Capabilities



The Lugbot Operation

CLEVER GEOMETRY

Sleek ramped front end allows for easy pickup and placement

CALCULATIONS

Efficiently utilizes limited space inside an aircraft with sorting algorithms

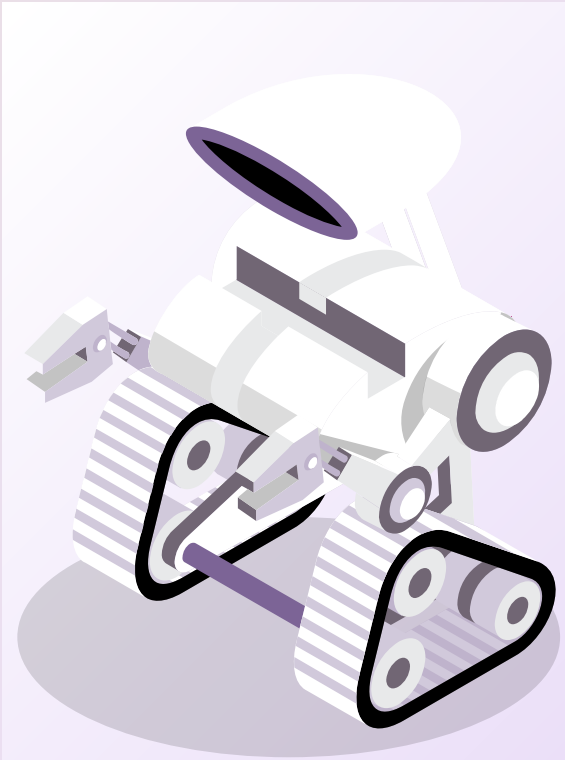
POWERTRAIN

Independent hydraulic pistons ensure smooth lift and drop off

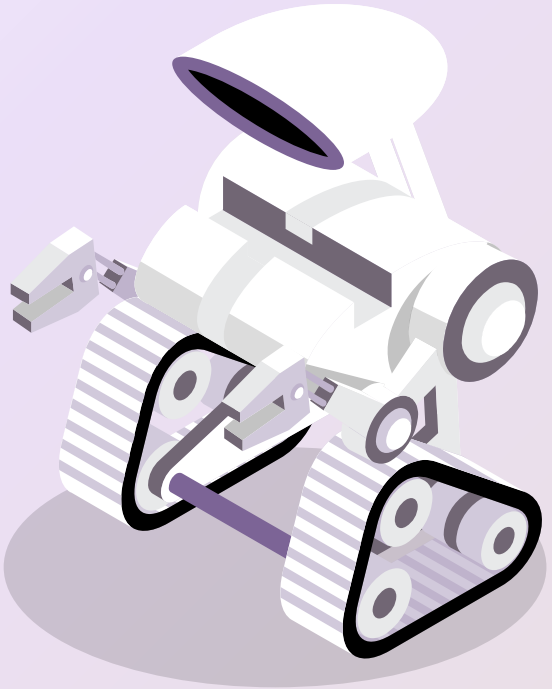
LugBot’s Technical Capabilities

- High torque motors
- Independent hydraulic pistons rated at 30lbs each
- Built in Bag-Tag scanners
- Onboard low profile scale for accurate weight
- Speed, Proximity, & liDAR sensors for awareness and collision avoidance

Built in cloud communication allows for minimal on-board computing power maximizing power efficiency



Why LugBot Works



MARKET TRENDS

Trend in Aviation: Industry is moving towards single-pilot operated aircraft

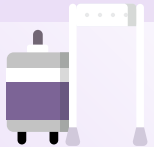
How Lugbot can help:

- Weight Reporting: Generates real-time weight and distribution reports.
- Pilot Support: Provides instant visibility of weight and balance data for the pilot.
- Efficiency: Streamlines the pre-flight process, improving overall operational speed and accuracy.
- Allows for less tasks to be performed by a pilot

Human vs LugBot

Humans

- 3 handlers per bay
- 6 handlers per gate
- $80,000 expenditure /employee
- Random bag placement



LugBots

- 2 Bots, 1 Operator
- Half the time
- Strategic bag placement and cataloging

An airline like southwest operating 30 gates per major airport/hub can save $50 million annually on salary alone

How LugBot Stacks Up to Competition

Speed

15 sec
Human

10 sec
LugBot

Total Load Time

15 min
3 Luggage Handlers

8 min
2 LugBots

$100

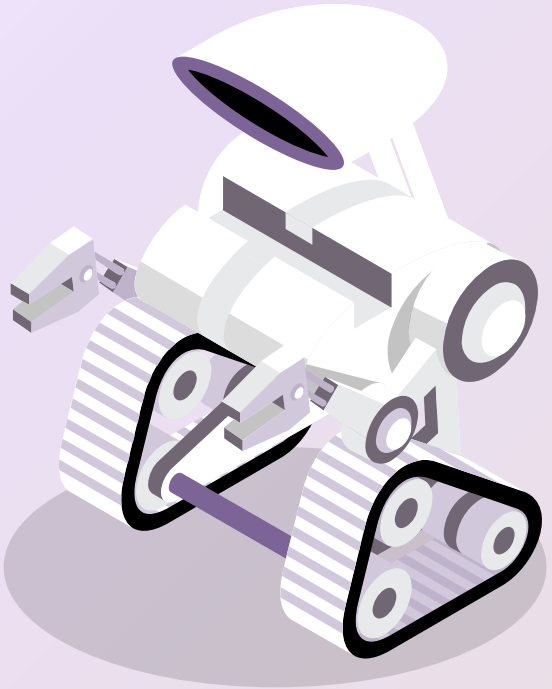
Cost/min to operate an aircraft

$700
Savings/flight

$2.1 million
Savings/day

$767 million
Savings/year

Potential Partnership



Potential Partners