TRANSNAVIGATORS:

Voice Controlled Wheelchair

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Overview

- Objective
- Background
- Systems
  - Mechanical
  - Electrical
  - Software
- Financial Pro Forma
- Recommendations
- Questions

Objective

"Increase the independence of wheelchair users"

- Autonomously navigate using voice commands
- One possible application: patients in a hospital setting

Wheelchair usage

- In the United States
  - *3.3 million people use a wheelchair*
  - *2 million new wheelchair users every single year*
- *In nursing homes, 80%* of residents spend time sitting in a wheelchair every day

Existing Technology

- MIT Singapore Alliance for Research and Technology (SMART)
- WHILL NEXT

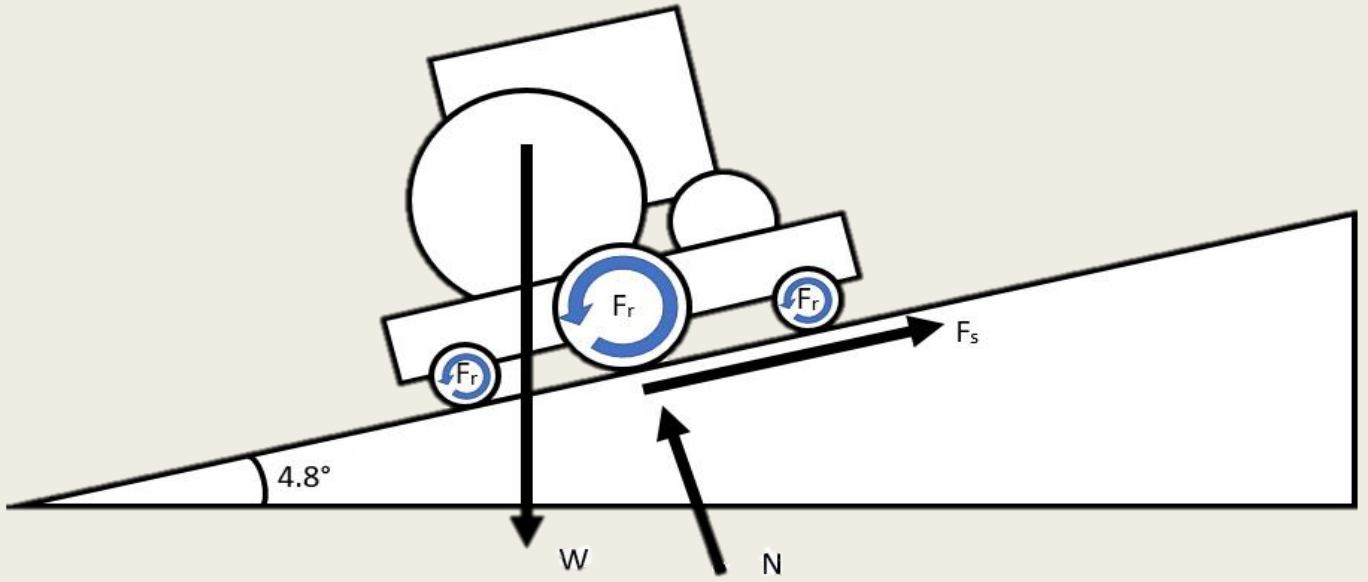
Why a Platform?

- Platform vs Modified Wheelchair
- Users can use existing wheelchair
- Modularity

Design Criteria

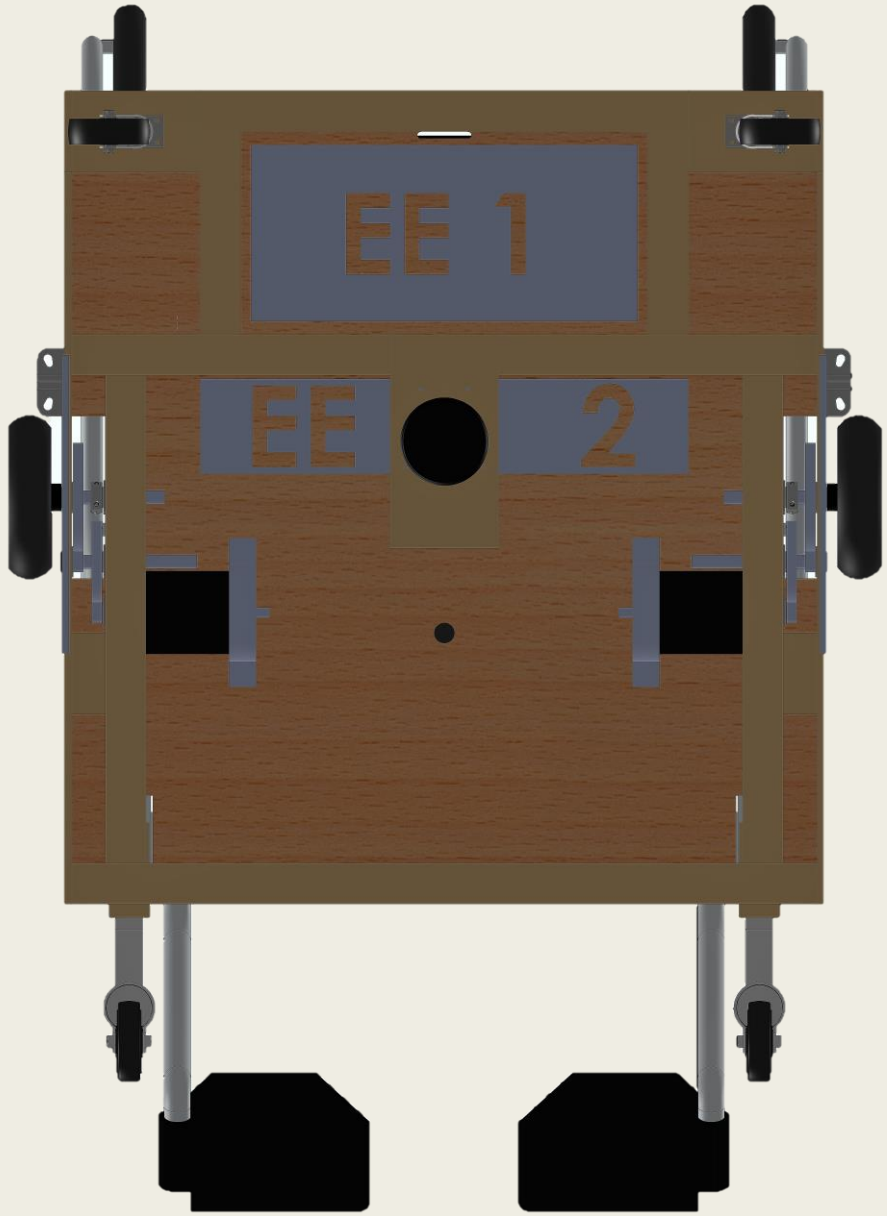
- Holds a standard self-propelled wheelchair
- Climb ADA Ramps: 4.8°
- Fits Through Doors
- Receives Voice Commands

- Top Speed: 4mph
- 300 Pound Load
  - *Average male: ~200lbs*



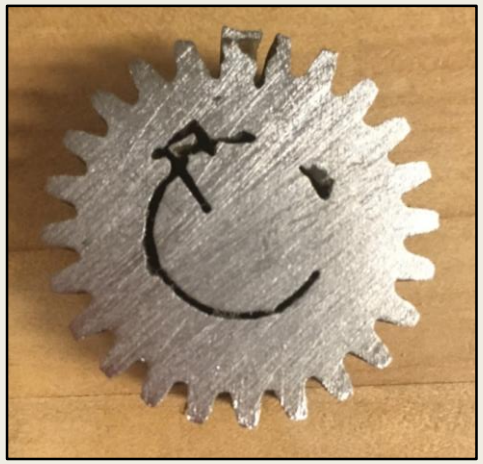
Mechanical System

- Wood Structure
- Differential Drive
- Drive Train
- Wheelchair Attachment



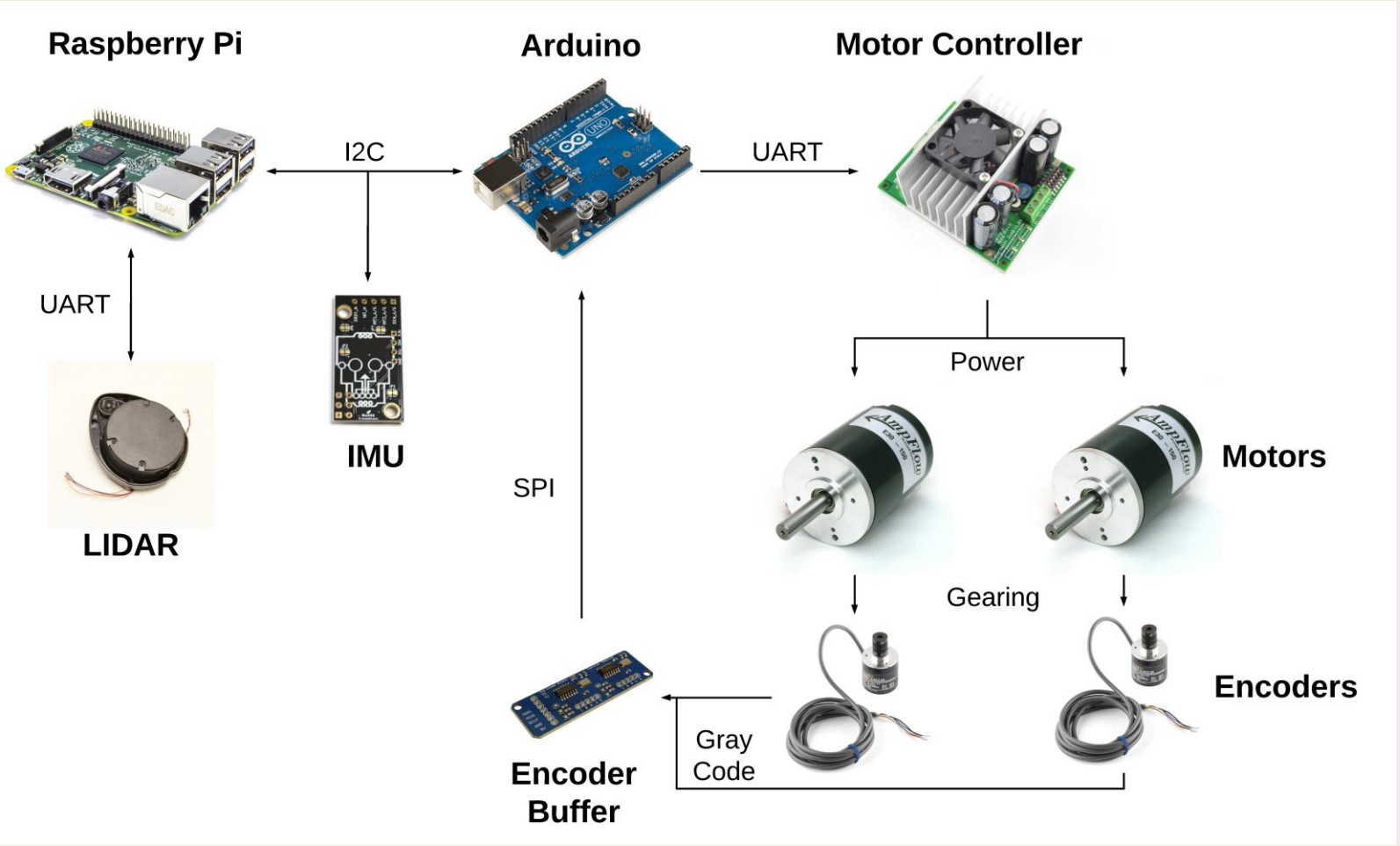
Issues

- Machining gears
- Set screws wear shafts
- Large load → bending



Electrical System

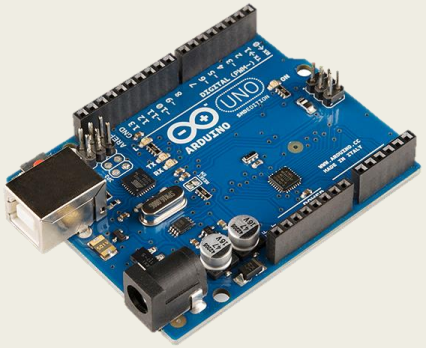
- Components
  - Sensors
  - Electronics
- Velocity Control
- Serial Interfaces



Issues

- Encoder pulse counting

- Microcontroller communication

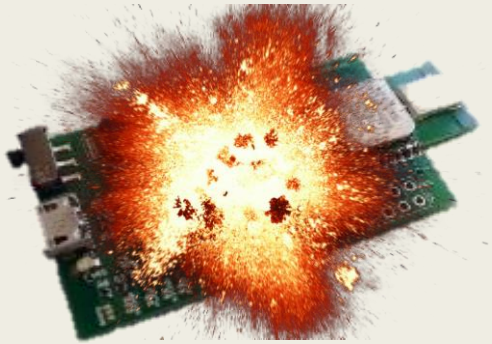


Computer Science

- Python
- Robot Operating System framework
  - Drivers
- Unit testing & continuous integration
- Amazon Alexa integration
  - Alexa→Lambda→IoT→ROS

Issues

- Testing ROS drivers
  - Difficult to test code that interfaces with hardware
- Wi-Fi Problems
  - Localino and Alexa disconnecting
- Raspberry Pi slow



Final Prototype Test

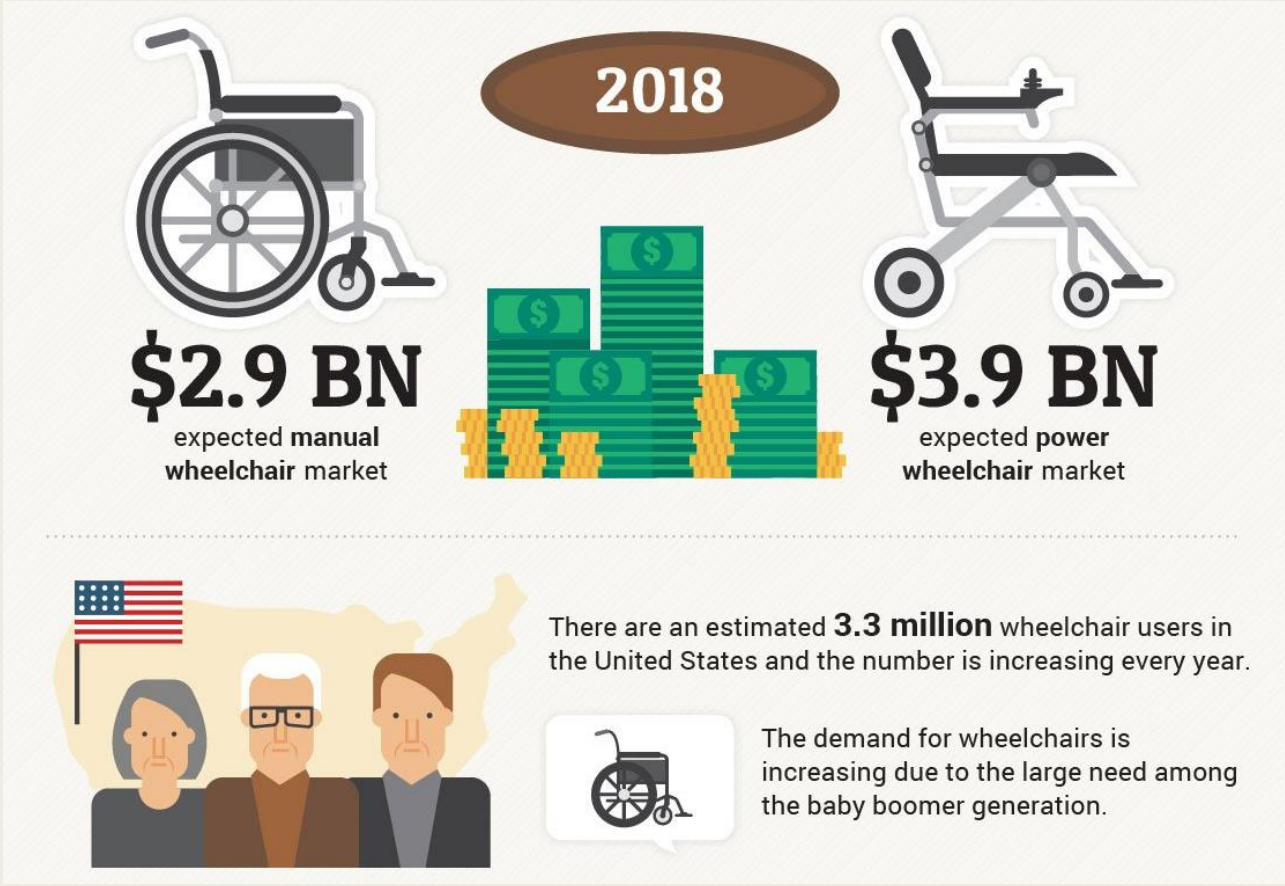
Pro Forma Overview

- Switch to a Metal Chassis Design

- Capital = $145,000
- Labor/Rent/Materials

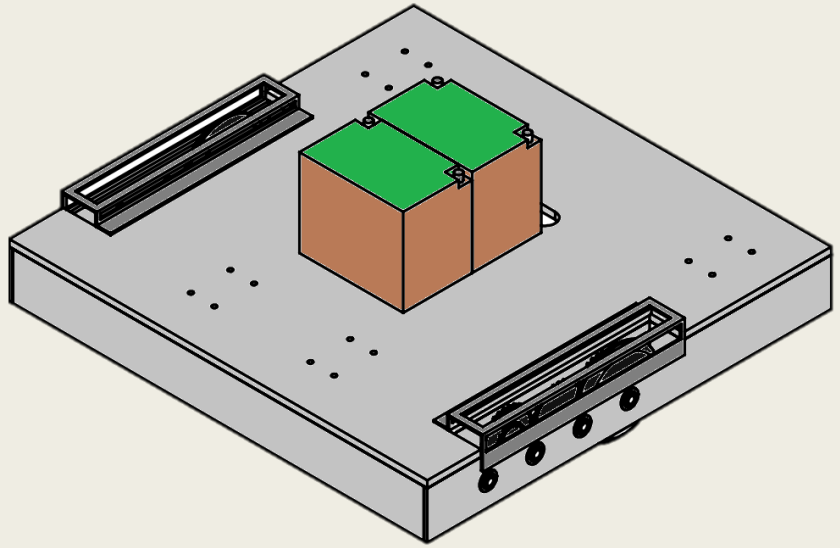
- Selling Price: $3,000
- Hit 0.01% of Users

- 10 Year IRR = 20%



Recommended Improvements

- Metal chassis
- Better Indoor Positioning Sensors
  - *“Bring me my wheelchair”*
  - *“Take me to _____”*
- Alexa
  - *High network latency*



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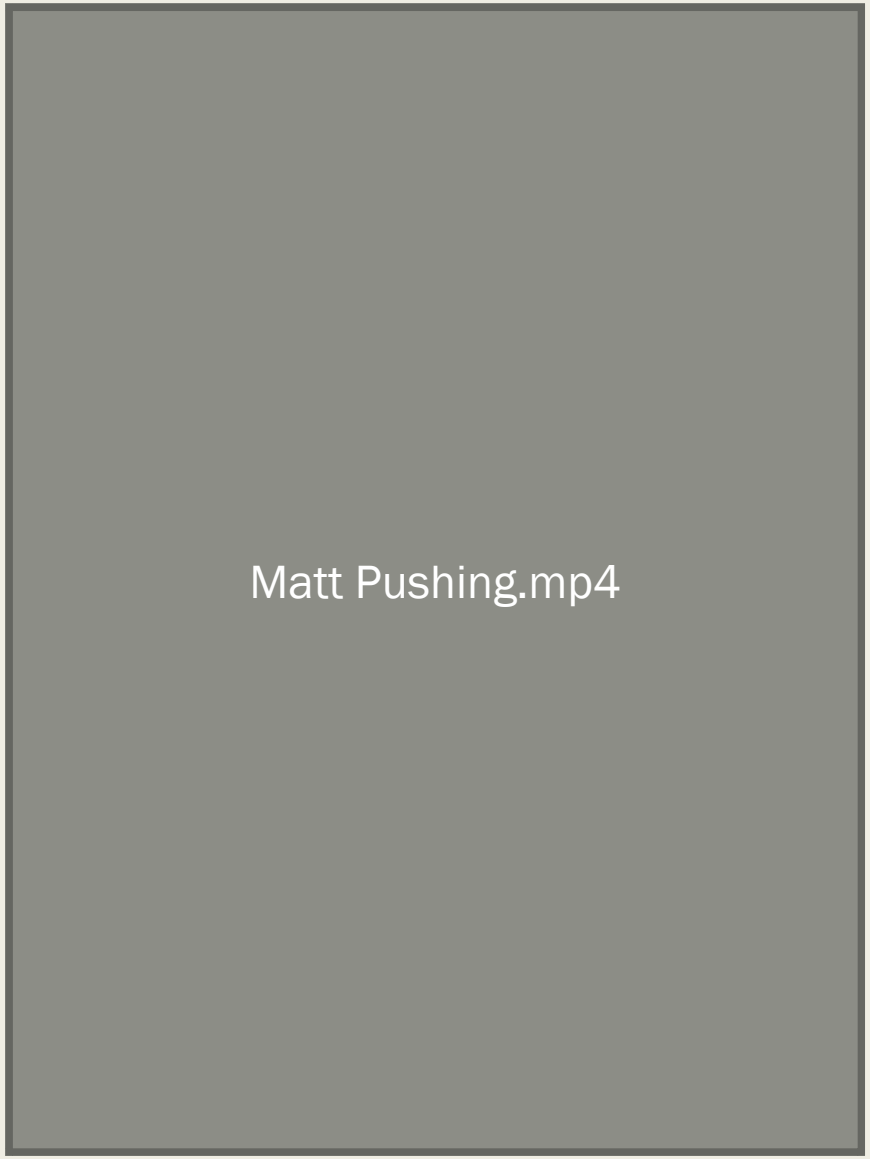
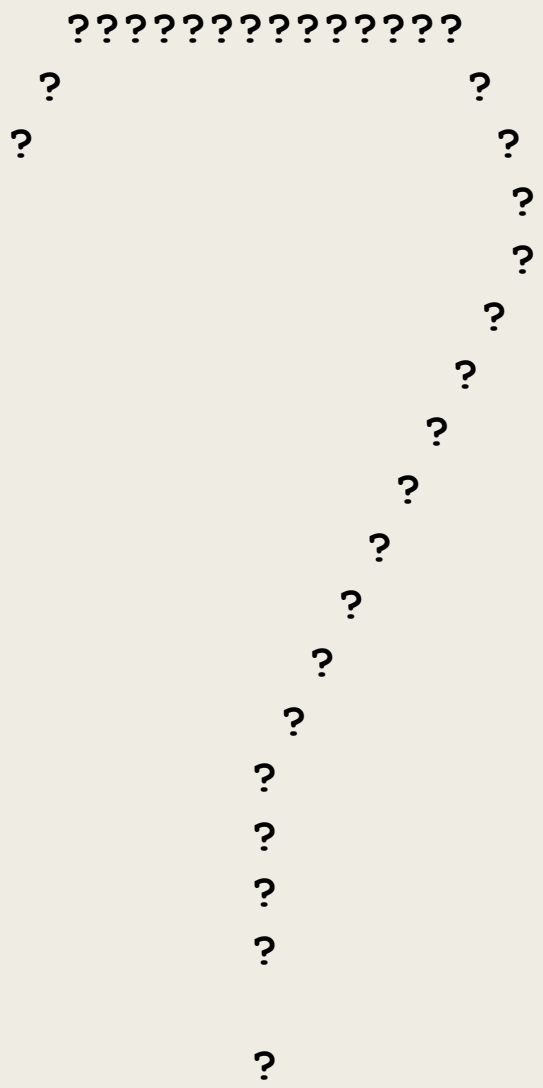


Questions?



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Code Repository:
https://github.com/Transnavigators