Longthin Hauler

BeyondTech

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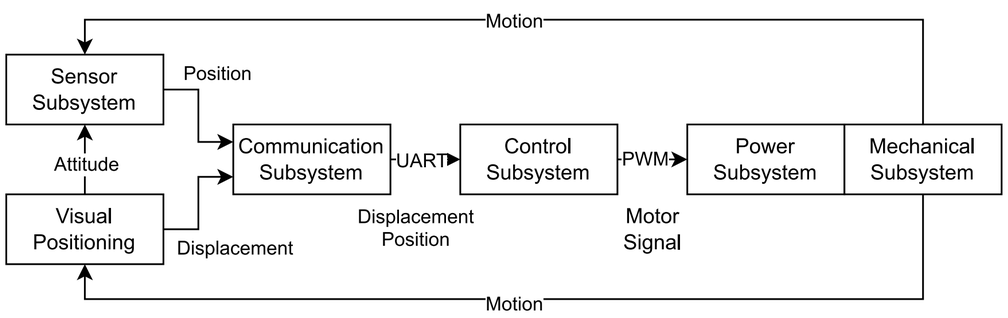
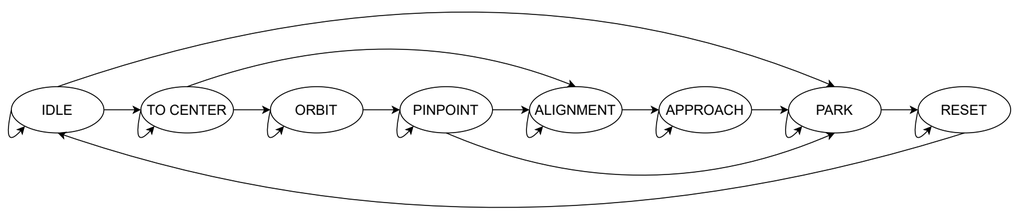
Project Description

The Long Thin Hauler is an autonomous vehicle project developed by BeyondTech, designed to address the challenges of parking in restricted urban spaces. This project, created by final-year Electrical and Electronics Engineering students, demonstrates the application of autonomous navigation technologies, enabling the vehicle to efficiently park within a compact 3m by 3m area.

System Design





Requirements

- The chassis should be metallic.
- The length should be more than 50cm, and the width should be between 3cm and 10cm.
- The sensors should be on the front, and the actuators should be on the rear with at least 30cm apart from the sensors.
- The communication between sensors and actuators should be wireless through the hollow tube.
- The parking spot width can be at most 1.5 times the width of the vehicle.
- The parking should be completed under 1 minute with forward only motion.
- The vehicle should operate at least 60 minutes.

Energy Budget

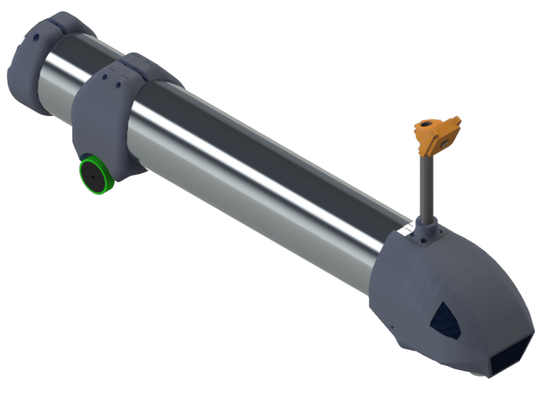
Front:

Component	Power
Raspberry Pi 5	6.5 W
Raspberry Pi Pico	250 mW
ESP8266	165 mW
Total	7 W

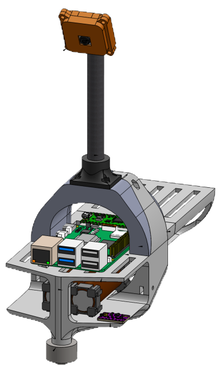
Rear:

Component	Power
Motors	7.2 W
Raspberry Pi Pico	325 mW
ESP8266	165 mW
Total	7.7 W

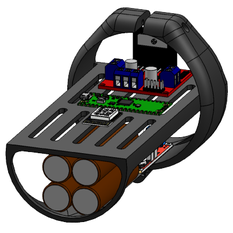
Mechanical Design



Final Assembly

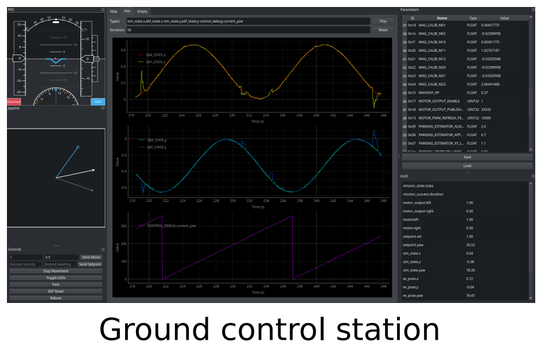


Front

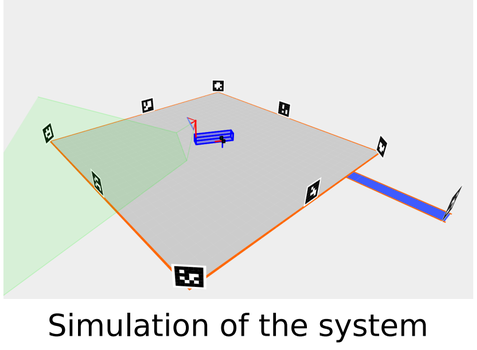


Rear

Software Design



Ground control station



Simulation of the system

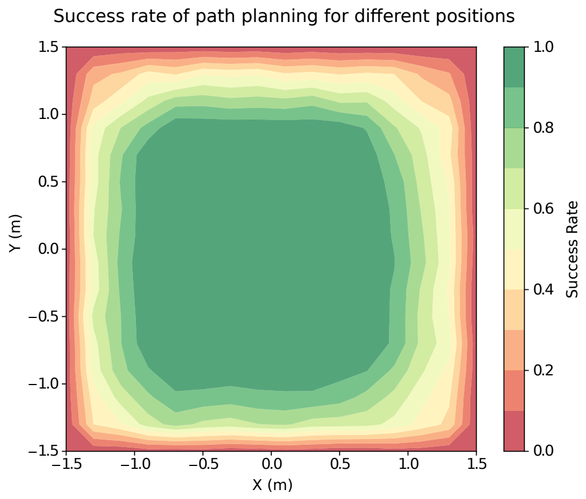
Features

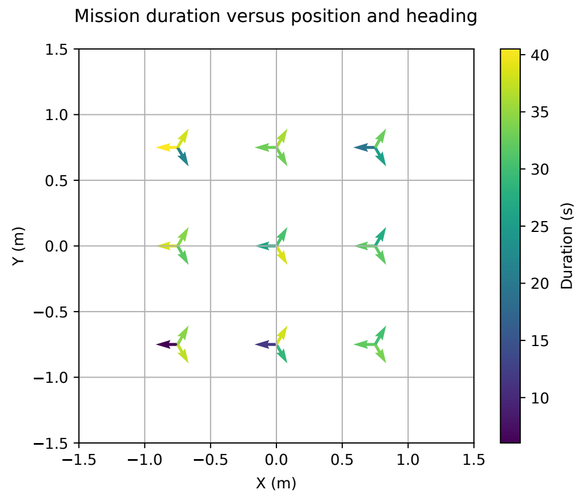
- Modular design for mechanical components
- Portable and easily deployable parking area and spot
- Complete software stack for autonomous navigation
- A ground station for monitoring and live tuning of the vehicle
- The software suite available as a PyPI package
- Use of LED and buzzer to indicate the status of the motion of the vehicle

Compliance with Requirements

Requirements	Test Result	Compliance
Autonomous park of the vehicle	87% success	✓
Communication at a distance greater than 30 cm.	99.5% success	✓
Parking under 1 minute.	Parking in 30.44s in average	✓
Operating time longer than 60 minutes	Continuous operation for 120 minutes	✓

Test Results and Performance





Cost Breakdown

Component	Quantity	Total Price
Raspberry Pi 5 + Cooler	1	$107.3
Raspberry Pi Camera Module 3	1	$37.15
Raspberry Pi Pico	2	$9.82
ESP8266	2	$2.94
Pololu Motor 3.6 kg-cm 140 rpm	2	$42.8
Metal Tube 50 cm, 8 cm diameter	1	$9.32
Wheels	2+1	$14
18650 Li-ion Battery + BMS	6+2	$29.56+$3.5
LN298N Motor Driver	1	$2.08
MPU9250 IMU	1	$8.59
LM2596 Buck Converter	2	$1.74
Others	-	$24.5
Total	-	$293.92

Deliverables

- Autonomous Vehicle
- Parking Area and Spot
- Software Suit as PyPI Package
- Test Document and Results
- User Manual and Assembly Instructions