

SIRIUSX

A mobile robot with arm that
prototypes a space junk collector

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Concept of Operations

01

Aimed mission

Uses advanced analysis and obstacle avoidance for safe orbital operations. The MasterPi robot demonstrates a long-term satellite management and debris mitigation.

02

Who uses it

applicable in manufacturing, logistics, and research. Designed for space agencies, satellite operators, and space sustainability efforts.

03

How it works

Utilizes camera-based analysis and obstacle avoidance for precise operations.



Specifications

Obstacle Avoidance

Ultrasonic sensor acts as a vigilant sentinel, detecting obstacles and triggering adjustments in light colors for heightened awareness.

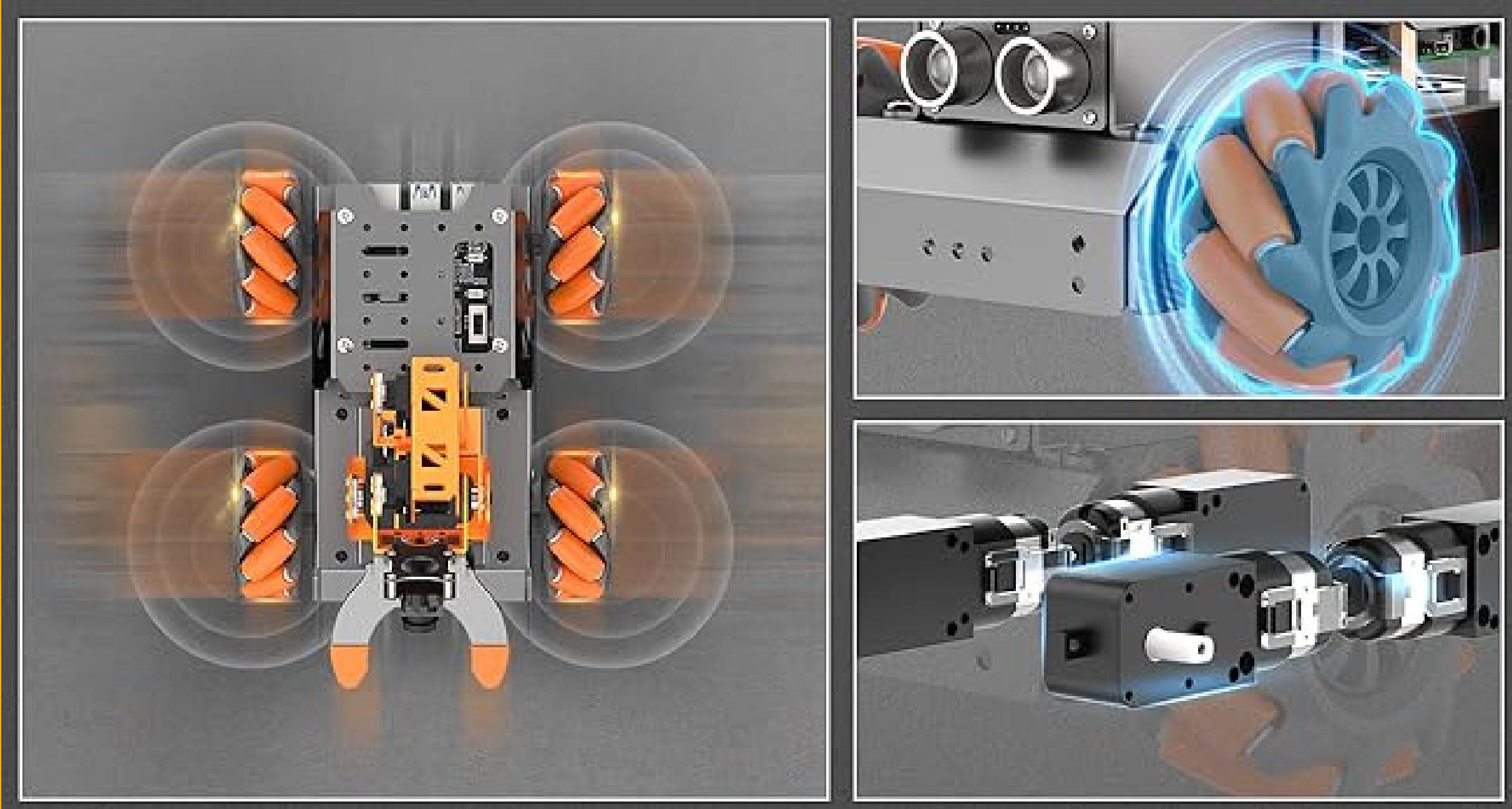
Line Following

takes OpenCV as image processing library and utilizes FPV to recognize and locate the target block so as to realize color sorting, color recognition, line following

Object Analysis

leverages OpenCV for region of interest (ROI) extraction and adept image processing, enabling seamless and efficient line following operations. The capability of visual optics will ensure accurate target tracking, color sorting, and line following.

Omni-directional Movement

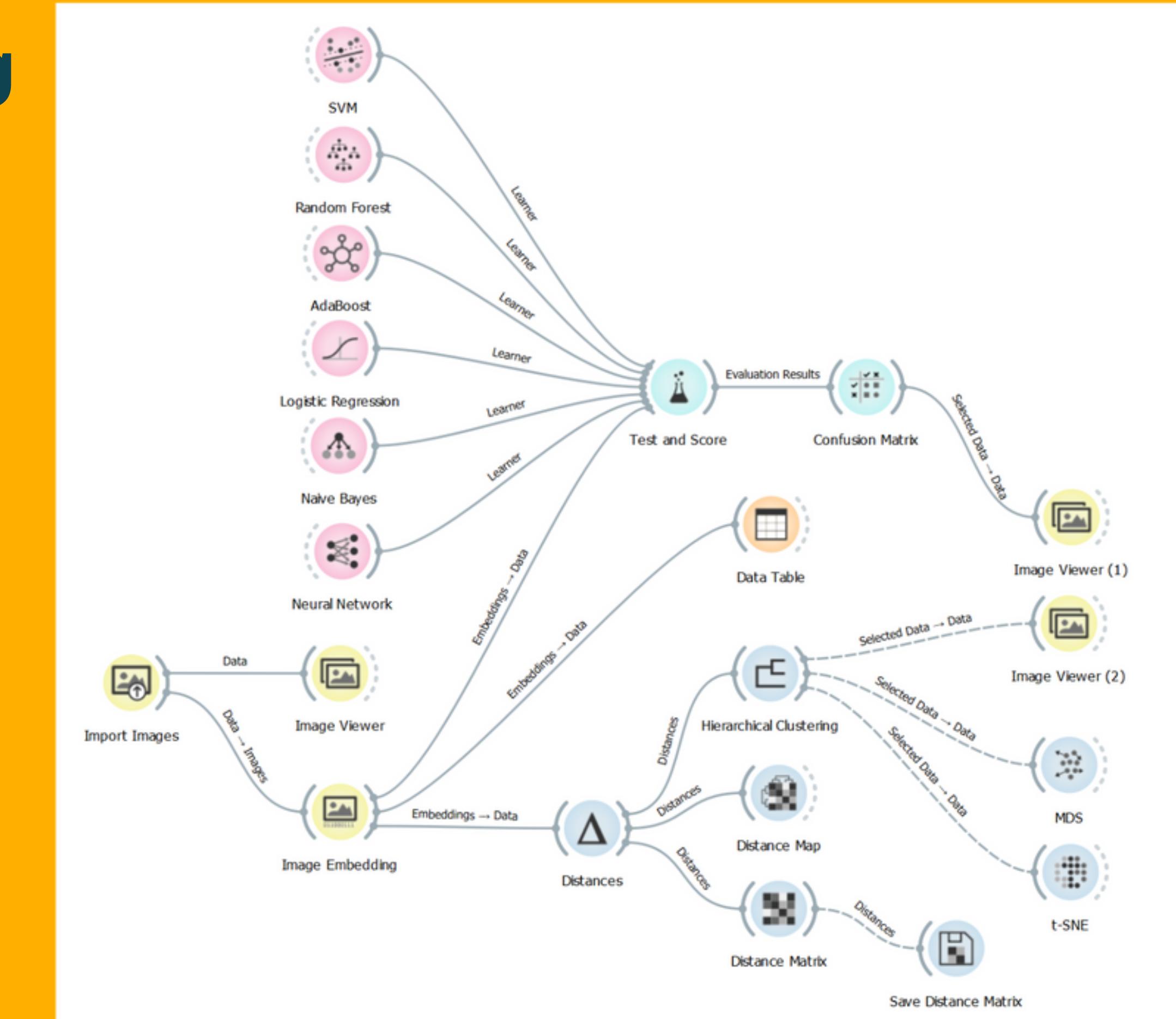


- Mecanum wheel design enables omni-directional movement
- Robot moves in all directions: forward, backward, sideways, and diagonally
- Provides unmatched agility for navigating intricate routes
- Figure highlights dynamic movement capability, showcasing versatility.

Machine Learning

Orange Data Mining

- The algorithm processes images from the 'debris' directory
- 'debris' contains eight distinct folders: Astronaut, CubSat, LaunchVehicle, Meteoroid, Payload, Planet, Satellite, and Tool
- Series of transformations initiated on the images:
- Begins with Image Embedding widgets
- Followed by data testing and scoring



Orange Data Mining

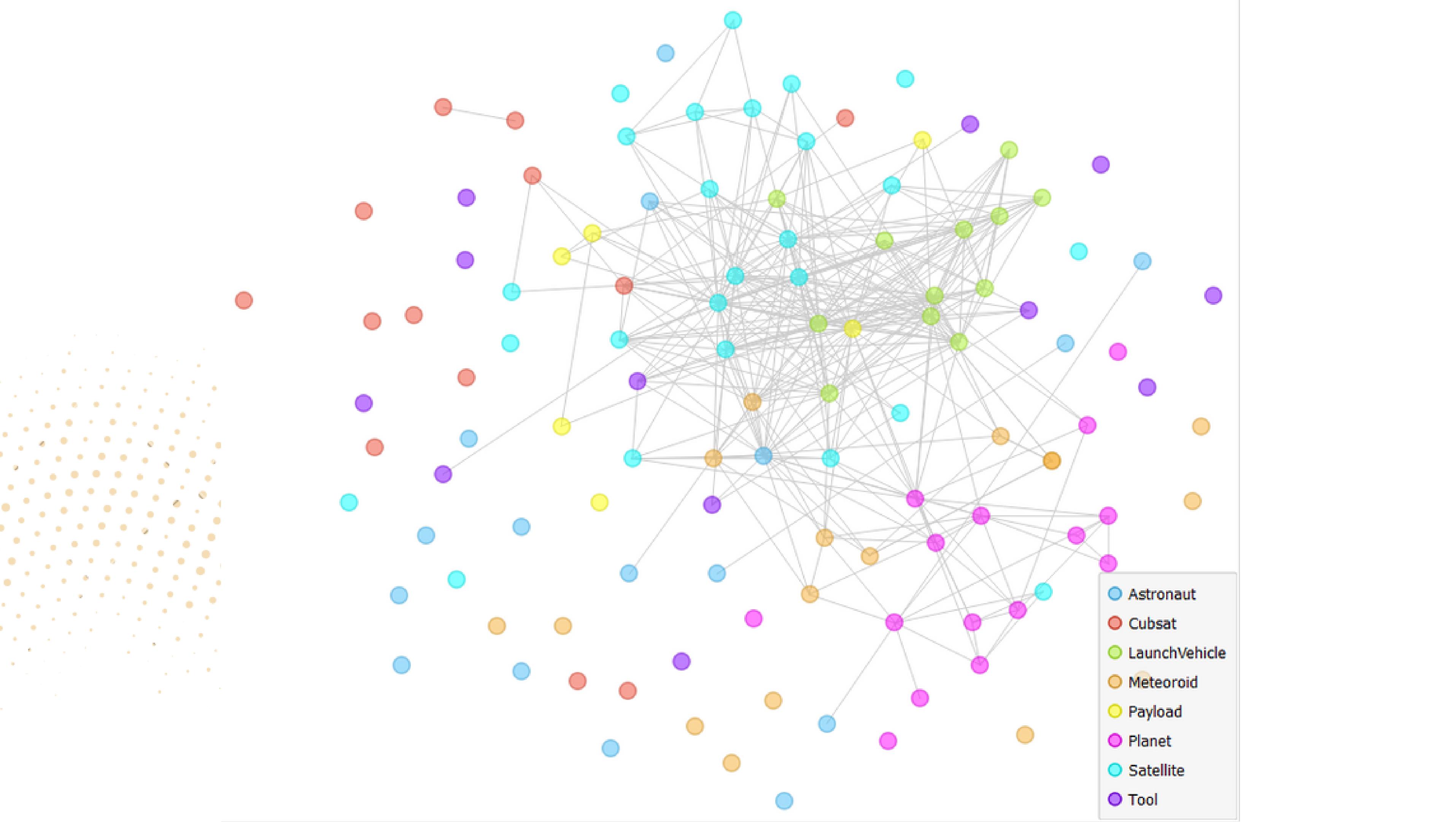
- Area under ROC is the area under the receiver-operating curve.
- Classification accuracy is the proportion of correctly classified examples.
- F-1 is a weighted harmonic mean of precision and recall.
- Precision is the proportion of true positives among instances classified.
- Recall is the proportion of true positives among all positive instances in the data.

Model	AUC	CA	F1	Prec	Recall	MCC
Logistic Regression	0.953	0.793	0.788	0.787	0.793	0.760
Naive Bayes	0.873	0.141	0.124	0.384	0.141	0.200
Neural Network	0.946	0.786	0.782	0.782	0.786	0.754
AdaBoost	0.694	0.472	0.473	0.480	0.472	0.389
Random Forest	0.782	0.479	0.463	0.478	0.479	0.394
SVM	0.924	0.603	0.574	0.732	0.603	0.567



Confusion matrix for Logistic Regression

	Predicted								
	Astronaut	Cubsat	LaunchVehicle	Meteoroid	Payload	Planet	Satellite	Tool	Σ
Astro	37	0	0	0	0	0	3	0	40
Cubsat	1	21	0	0	0	0	8	0	30
LaunchVehicle	0	0	26	0	4	0	0	0	30
Meteoroid	0	1	0	37	0	0	2	0	40
Payload	0	1	5	0	7	0	0	7	20
Planet	1	0	0	2	0	36	0	1	40
Satellite	4	4	0	2	0	5	44	1	60
Tool	0	0	0	0	1	0	7	22	30
Σ	43	27	31	41	12	41	64	31	290



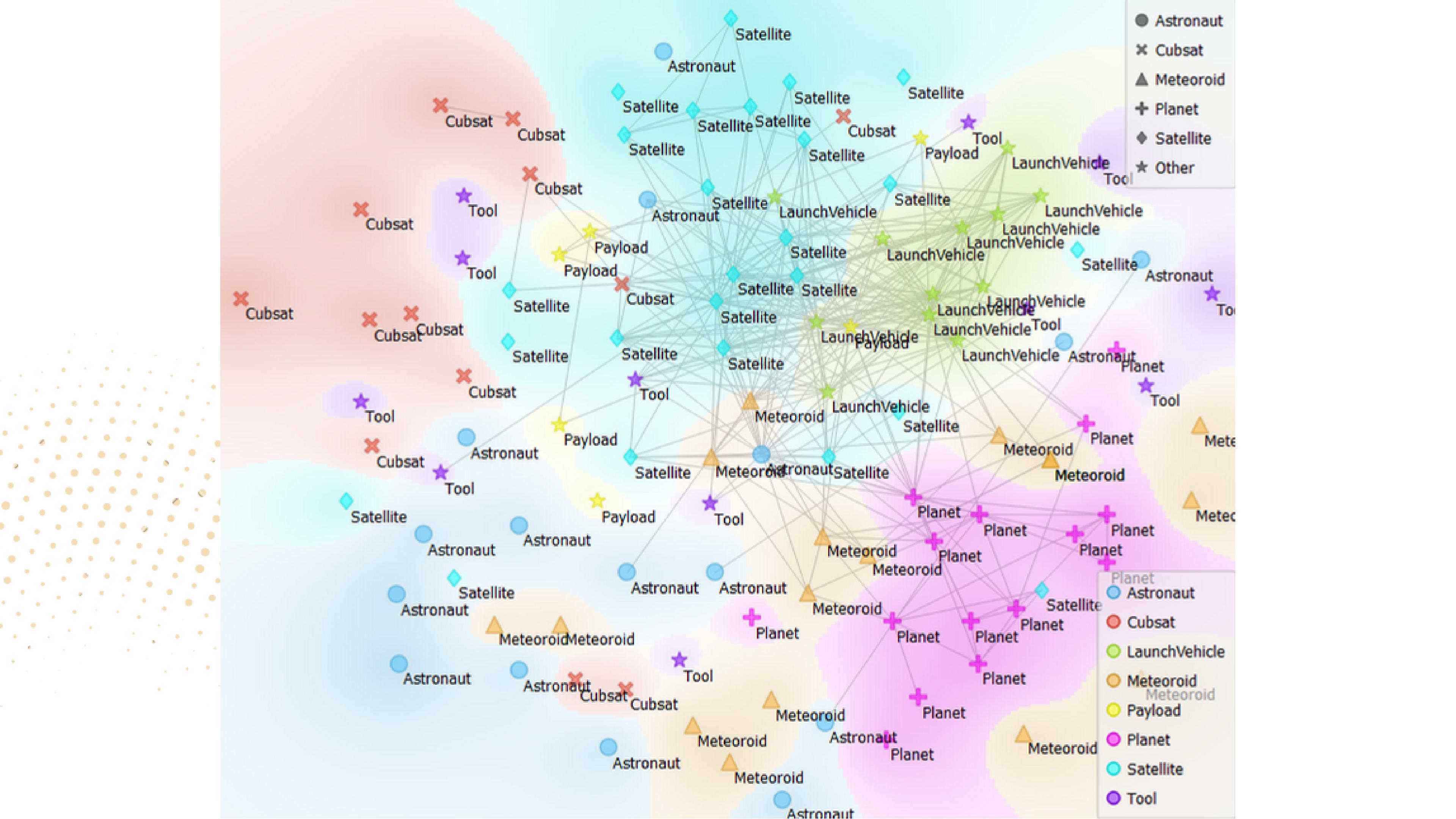


Image Viewer (1) - Orange

Image Filename Attribute

S image

Title Attribute

C category(Logistic Reç)

Image Size



LaunchVehicle



LaunchVehicle



LaunchVehicle



LaunchVehicle



LaunchVehicle



Send Automatically



System Components

Processor

- Raspberry Pi 4Bb

Control

- Mecanum wheel
- 5 degrees of freedom (5DOF)
- 6-channel PWM servo

Analysis

- HD, 120° visual angle camera
- Ultrasonic Sensor



Final Report

Overview

Demonstration

Live - Through VNC

THANK
YOU

