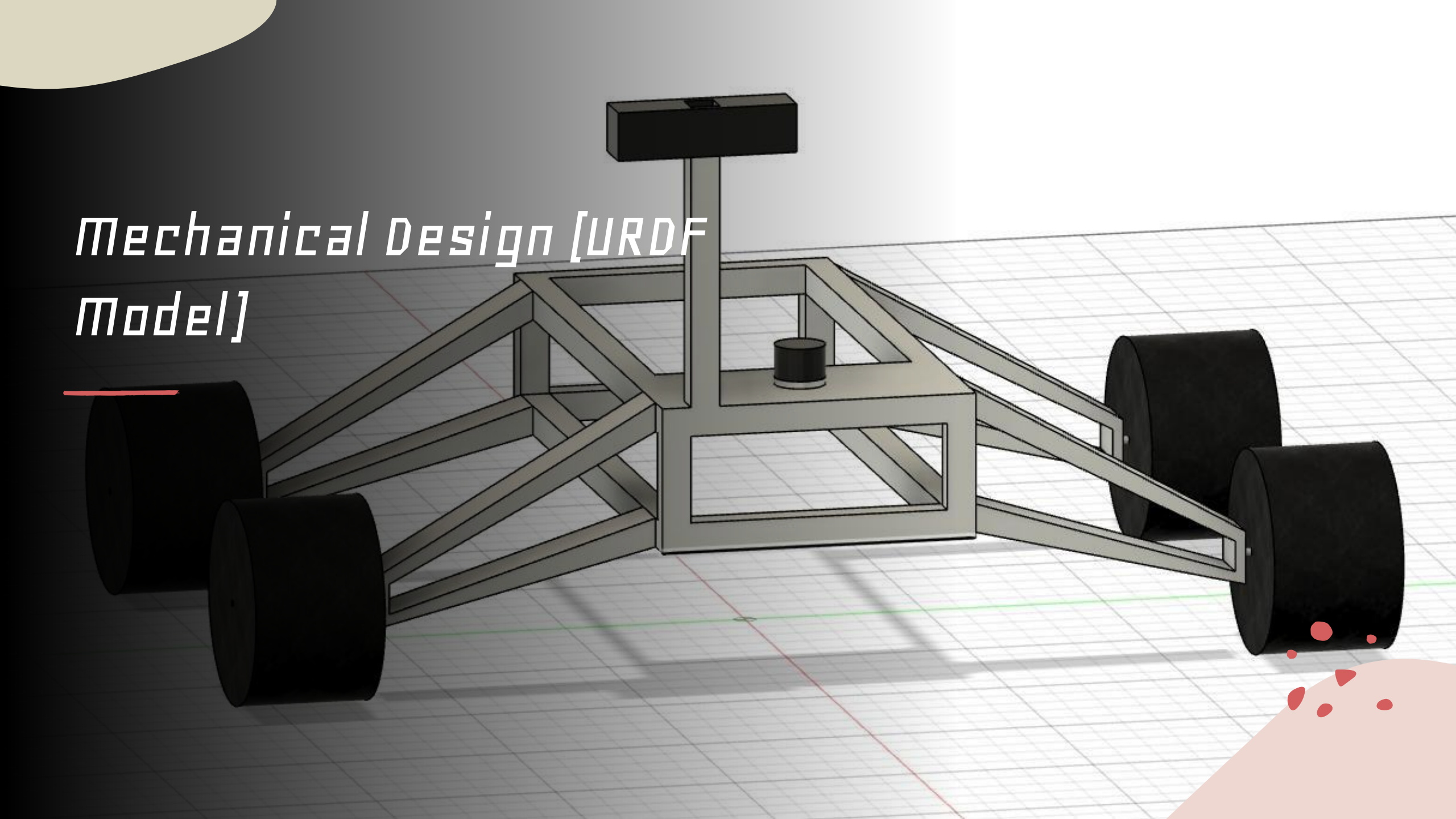
Autonomous Mars Rover

Description

- This project was started as a passion project to work with a mobile manipulator
- Eventually, I formed a team and got funding to build this rover
- This portfolio only shows the initial stages of the design. I am not allowed to show the entire project because it is an ongoing competitive project of Team Kosmos
- The public working video can be seen at the Team Kosmos Instagram

Mechanical Design [URDF Model]



Mechanical Design

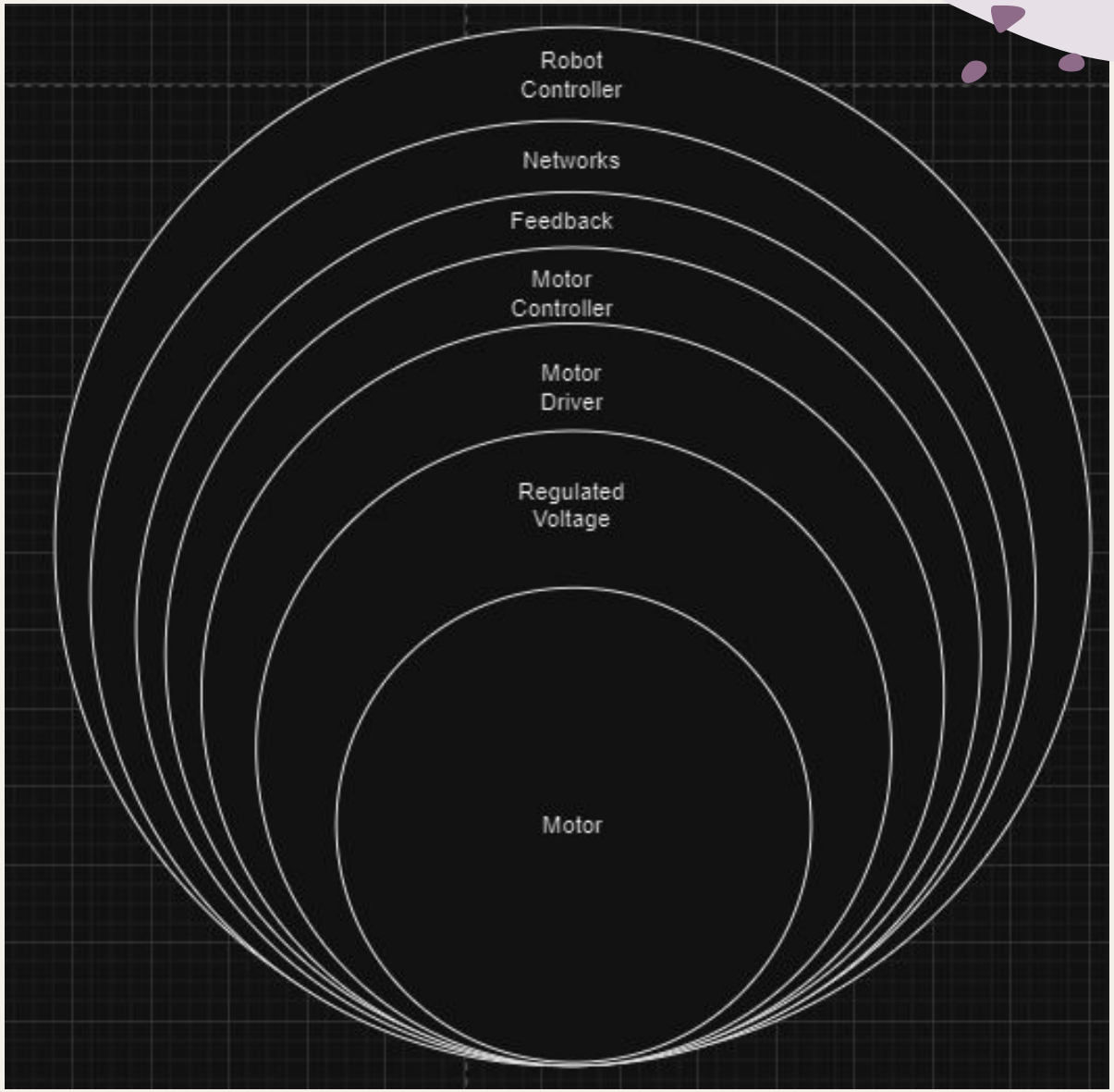
The mechanical design consisted of a hollow aluminum chassis and acrylic cover

Initial stage had a quad suspension system which was later replaced by a rocker bogey

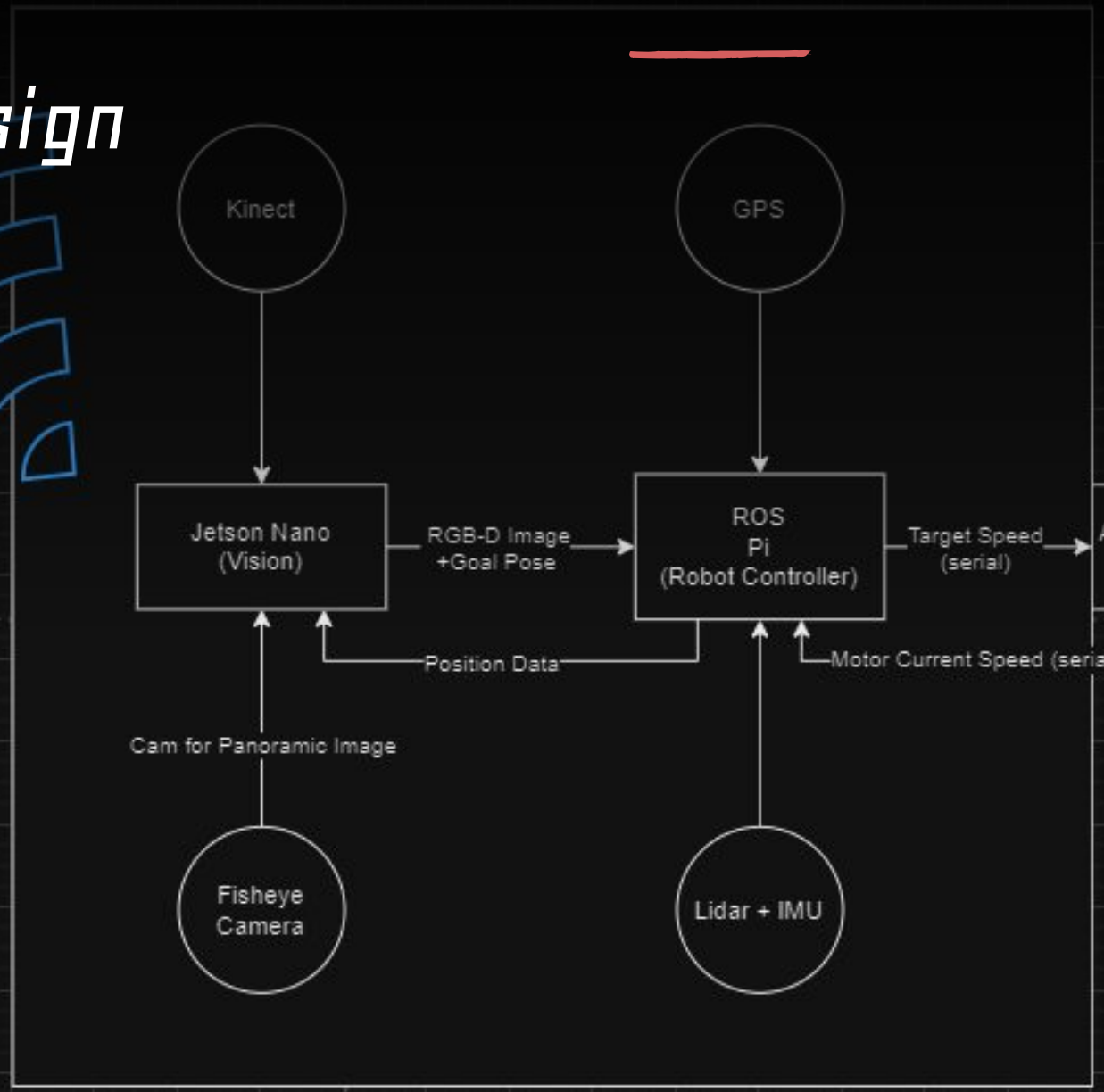
The design goals were to minimize weight and maximize strength

ANSYS was used to do FEA analysis to figure out the maximum weight the chassis can take

Electrical Design [Arm]



Electrical Design [Drive]



Electrical Design

The systems for the arm control and drive control were separate with plans to merge them in the future

The mobile base on skid steer drive was designed to be fully autonomous and create maps of the environment

The vision part of the system was handled by a Jetson Nano flashed with ubuntu and the motion planning was handled by a raspberry pi. These systems were decentralized to ensure that we can drive the rover safely if the camera fails.

The low level control with PID used an Arduino microcontroller and the communication between the boards was using I^2C and WiFi

Navigation system

The goal positioning system used GPS coordinates when available and translated the goal by 1 meter in the X direction when in exploration mode

The rover used RTAB slam to build a dense point cloud map of the unexplored area and navigate the known environment

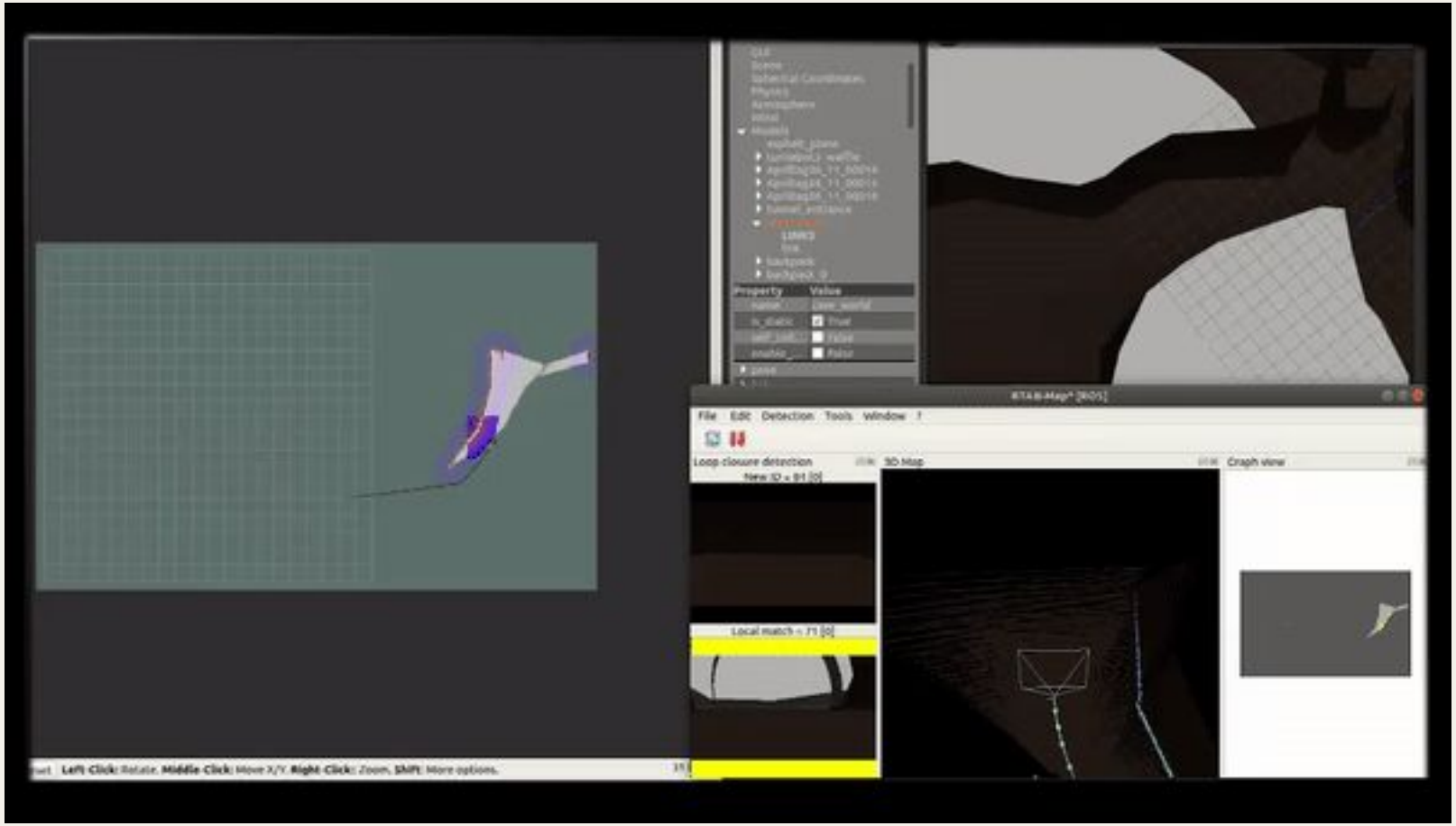
The planner used in this system was the DWA planner from the Nav stack

The localization algorithm was based on AMCL

A custom node was written to apply EKF to fuse GPS and IMU position to update belief

The Rover could switch to teleoperation from the base station

RTAB Initial Simulation in exploration mode [Sped up 10x]




IoT Patrol Bot

Description

This bot was designed to add an auxiliary layer of automation to CCTV monitoring

In most parts of India, CCTV monitoring is done by human guards who tend to fall asleep during night duty

For most small-time retailers, an AI solution is unaffordable or requires some sort of subscription

This bot solves that problem by patrolling the shop at night and contacting the guard on duty if there is an alert, all while costing 15% of what a standard CCTV system costs

Working Video

The full report can be found here:

https://shorturl.at/hryAF

If the video doesn't work, here is an alternate link to view it:
https://shorturl.at/uARUX