Q1:**Identify the robot of your interest in last 3 years paper and write it's functioning algorithm or working principal:**

Name: Jaysh Muhammad: **ID: 450074** **Course: Mobile Robot**

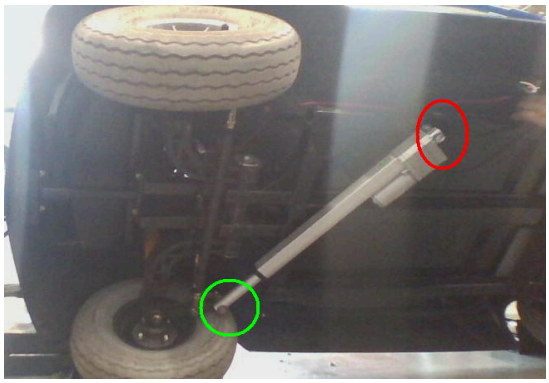
OpenPodcar:

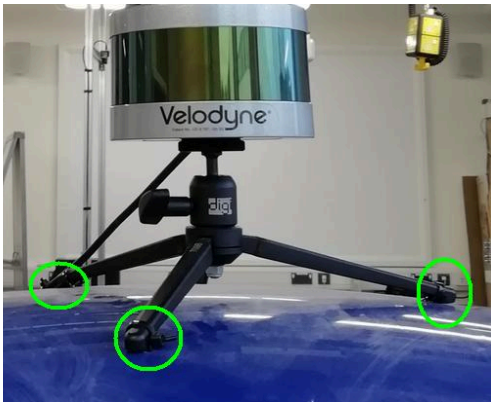
An Accessible Platform for Exploring Self-Driving Car Technology

The working principle of OpenPodcar is as follows:

USING Pihsiang TE-889XLSN hard-canopy scooter

- A linear actuator is attached to the front axle, controlled by a motor controller. This allows for precise steering control.
- An Arduino Uno replaces the manual throttle, sending speed commands to the motor controller. This enables precise speed control.
- A LiDAR sensor mounted on the roof provides 360-degree perception of the environment. This data is essential for localization, mapping, and obstacle detection.
- A custom PCB centralizes power and communication for all electronic components.





Software Integration:

- LiDAR data is processed by GMapping SLAM to create a map of the surroundings. This map is used for localization and path planning.
- ROS navigation stack with TEB planner is used for path planning and control. It receives target locations, plans collision-free paths, and sends velocity and steering commands to the controllers.
- OpenPodcar incorporates a pedestrian detection and tracking system using SVM classifier and a Bayesian tracker. This allows the vehicle to identify pedestrians and adapt its behavior accordingly.

Safety Features:

- A human safety override button acts as an emergency stop mechanism.
- A watchdog ensures communication between ROS and Arduino, stopping the vehicle if communication is lost.
- Software limits prevent commands that could damage the steering mechanism.
- Fuses protect the electrical system from overcurrent situations.

In a Nutshell:

Imagine a scooter that's been tricked out with some tech to drive itself. That's the basic idea behind OpenPodcar. Here's how it works:

- **Special Parts:** They added a small engine for steering (like a strong muscle), a new way to control speed and a lidar on top to see what's around.
- **Brainpower:** A mini computer uses the lidar info to build a map and figure out where to go. It then tells the steering muscle and speed controller how to move.
- **Safety First:** Just in case, there's a big red button to stop anytime, and a watchful program that makes sure everything is talking properly. Special limits are also set to avoid hurting the steering or overloading the power.
- **Extra Smarts:** OpenPodcar can even spot people with its laser sensor and slow down to be safe!

Referrences:

- OpenPodcar: an Open Source Vehicle for Self-Driving Car Research by *Fanta Camara, Chris Waltham, Grey Churchill, Charles Fox (9 May 2022)*
- *Published in the Journal of Open Hardware*

A BRIEF REPORT

(Notes: Paraphrased using AI)

Introduction

The development of self-driving car technology is rapidly progressing, and with it comes a growing need for accessible platforms for research and education. This report examines the OpenPodcar project, an open-source self-driving car platform built upon a readily available mobility scooter. This analysis focuses on the project's affordability, core technologies employed, and its potential as a valuable tool for those new to the field of autonomous vehicles.

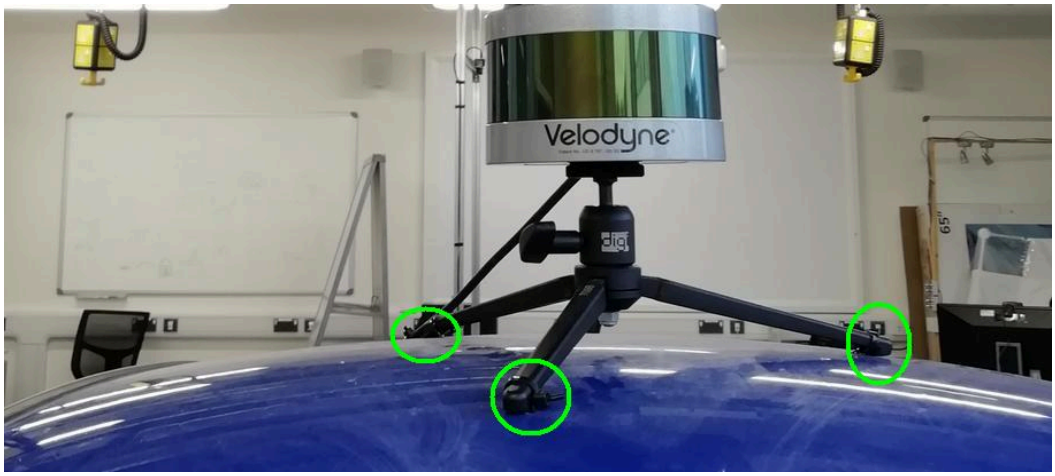
Affordability: A Gateway for Beginner Researchers

A significant barrier to entry in self-driving car research often lies in the cost of specialized hardware. OpenPodcar addresses this challenge by utilizing a commercially available mobility scooter as its base platform. This significantly reduces the financial investment required, making it an attractive option for students, hobbyists, and researchers with limited budgets. This affordability broadens the accessibility of self-driving car research, fostering a more inclusive environment for innovation.

Technological Insights: Core Components

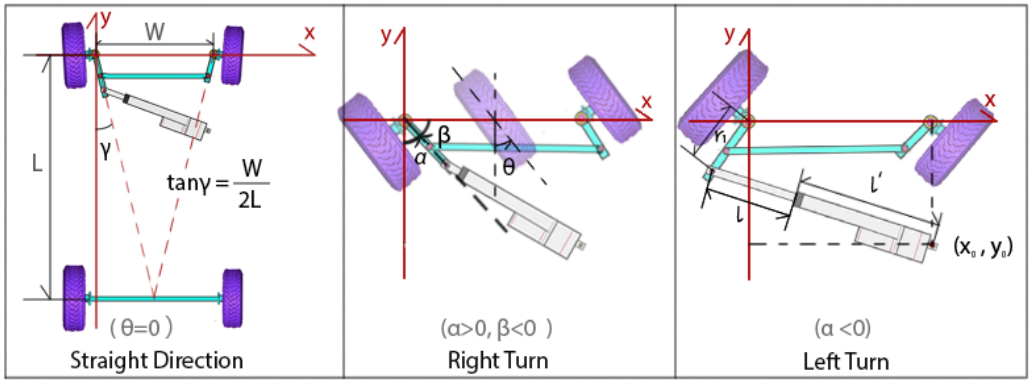
The OpenPodcar project integrates a combination of commercially available sensors, actuators, and control systems to achieve autonomous navigation. Here's a breakdown of some key components:

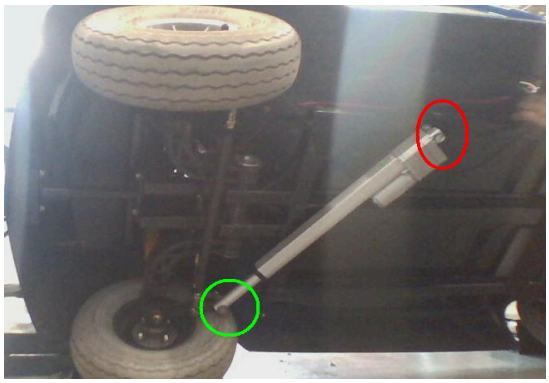
- **Velodyne VLP-16 LiDAR Sensor:** This sensor functions as the robot's primary perception system, generating a 3D point cloud representation of the environment. This allows the OpenPodcar to identify obstacles and navigate its surroundings effectively.



- **Steering Actuation:** A linear actuator connected to the front wheels facilitates steering

maneuvers. This actuator receives precise control signals from a Pololu motor controller, which translates software commands into smooth and controlled steering movements.





- **Motor Speed Control:** The OpenPodcar employs an Arduino microcontroller paired with a digital-to-analog converter (DAC) to manage the mobility scooter's motor speed. This system ensures smooth acceleration and deceleration, enhancing the overall driving experience.
- **Robot Operating System (ROS):** The central nervous system of OpenPodcar is the Robot Operating System (ROS) running on a laptop. ROS provides a framework for communication between the various hardware components and software modules, enabling coordinated operation of the entire system.

Software Exploration: Learning Opportunities

The software aspect of OpenPodcar presents a compelling learning opportunity for those new to self-driving car technology. Understanding how ROS functions and how to leverage it for controlling the robot's behavior is a crucial step. Additionally, exploring core packages like move_base and gmapping offers valuable insights into autonomous navigation. These packages play key roles in environmental mapping, route planning, and guiding the robot towards its designated goals.

The open-source nature of the project empowers users to delve deeper by examining the codebase. This allows for a deeper understanding of the system's inner workings and facilitates modifications for experimentation with diverse functionalities.

Conclusion: A Promising Platform for Beginners

The OpenPodcar project stands out as a promising platform for beginners to explore the exciting field of self-driving cars. Its affordability, open-source design, and integration of readily available technologies make it an ideal gateway for gaining practical experience. By delving into the software aspects and exploring the potential for modifications, individuals can acquire valuable knowledge and skills in the domain of autonomous vehicle development. OpenPodcar serves as a testament to the democratization of self-driving car research, fostering innovation and paving the way for a more inclusive future in this rapidly evolving field.