GROUP 5: VISION-BASED NAVIGATION OF A MOBILE ROBOT

Introduction:
In this paper, we introduce a vision system for the navigation of a ground vehicle. The major tasks inthe project are low level motor control and image processingUnlike the majority of industrial robots that can move only in a specific workspace, mobile robots have the special feature of moving around freely within a predefined workspace to achieve their desired goals.
This mobility capability makes them suitable for a large repertory of applications in structured and unstructured environments.

Problem Statement: The project aims at improving the idea of intelligent navigation by incorporating a camera into the robot's perception stack.

The localization and ultimately the movement of a mobile robot within an environment is one that can be achieved in different ways. Railed robots, in warehouses, or line tracking robots, in industry have become increasingly dominant, however, the need to accurately perceive and map the environment has fueled the need of incorporating addition sensors, like, cameras, radars an lidars, all this, for increased autonomy.

Justification: The use of cameras in vehicle and robot mobility is one that elevates the perception abilities significantly. The ability of a robot to distinguish objects, people, colors and even read signs is a great measure of intelligence.
Using behavior-based control, we seek to leverage the use of artificial intelligence methods, that is deep learning for computer vision, and the camera's vision capabilities to train the robot to understand and clearly distinguish elements in its immediate environment.

Objectives

1. **Motion** : Tele-operation
   Autonmous Navigation
2. **Event [Behavior]:** Obstacle Avoidance
   Lane Detection

Control Logic

Perception

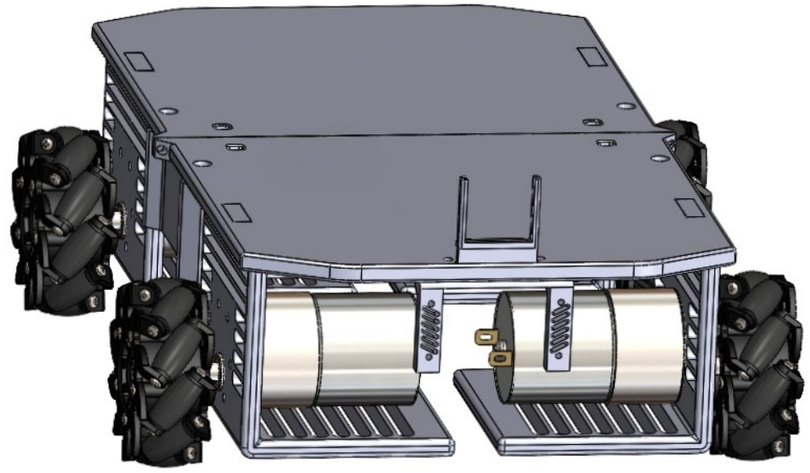
The image first is converted to a gray scale and then to a binary image. In the implementation the size of captured image is to be 240 by 320 pixels. The reduction in picture element for the input image to be used with our model is on the basis of getting maximum efficiency -speed and computing power -from the limited graphical processing power of the controller.

Prediction

Open-source software library for machine learning and artificial intelligence leveraging its training and inference of deep neural networks capabilities, Open-CV for image processing and Keras, an interface for TensorFlow library that enables fast experimentation with deep neural networks. The entire framework for the mobile robot is run from a raspberry pi, that in-turn runs a native operating system, the Raspbian OS.

Control

- Detect an obstacle and allow for tele-operation for its avoidance.
- Position the mobile robot at the lane center.
- Recognize signs on the environment for autonomous navigation.



3D Chassis to be Printed

ROS GAZEBO KiCad SOLIDWORKS OpenCV