LANE TRACKING BY USING IMAGE PROCESSING TECHNIQUES

Adhiraj Alatage
Dept. of Electronics and Communication Engineering
KLS Gogte Institute of Technology
Belagavi

Atharva Nathbuva
Dept. of Electronics and Communication Engineering
KLS Gogte Institute of Technology
Belagavi

1. INTRODUCTION

In order for the vehicles to be able to watch safely in a series, the part of the vehicle path separated by lines is called lane. A good lane monitoring enhances the enjoyment of going on the road. Solving heavy traffic and solving other disrup ons can become more streamlined with drivers taking some responsibility. If an autonomous vehicle is not traveling, the driver should: A er providing the road and traffic control without deciding to pass the vehicle, first to check the mirrors according to the direc on of departure, to check whether there is a vehicle in the blind spot and wait for the vehicles to pass, to give the appropriate signal to the direc on of exit, not to get too close to the passing vehicle and a er passing the vehicle to pass immediately, to overtake in cases where overtaking is prohibited, service vehicles and buses minibuses briefly public transport vehicles to pay a en on to the superiority of the transi on.

In addi on to all these responsibili es, it is also not necessary to test how dangerous overtaking is wrong. It is also important to not leave the current lane and center the lane. Because in this case the accident is inevitable and people in other vehicles have added to the risk of having an accident. But thanks to autonomous vehicles, the passengers pass a comfortable journey without the need of the driver's responsibili es
The algorithm of autonomous vehicles allows the protection of the lane. Gets an idea with the algorithm written about the lanes to be traveled according to the route of the vehicle and determines the path accordingly. The vehicle has an idea about the lanes to be traveled according to the route of the vehicle and determines its path accordingly.

The algorithm in the study is on lane tracking. The algorithm is designed to track lanes. First of all, with the operation of the autonomous vehicle, the image on the road is taken through the camera. The received image is a video image and is divided into image frames called frames.

Using specific image processing algorithms, the lanes in these frames are detected. When the determination of the lane, the vehicle is given the instructions to continue straight to the vehicle according to the angles determined by the lane and to turn right or left.

2. Determination of Lane Lines

Canny edgedetection, Hough transformation and Sobel filter methods are the methods used to find the lane lines. Canny edge detection is a method of edge detection. The lanes are lines and edges and the purpose is to discover optimal edge detection. In this way, the edges in the image as well as unwanted noise called pixels to eliminate the full image recognition is done. Hough transformation method is a method that finds and shows shapes.

Since the lane lines have a shape, lane lines can be found by the Hough transform method.

Sobel filter method is a separate method used to find the edge.

It is seen in all the studies obtained the use of the edge detection algorithm in images with a grayscale colour space is closer to the edge information in the actual image.

3. **Design of Lane Following Autonomous Car**

The design part of the car is divided into two parts. These are the movement of the software and the hardware of the vehicle. The software field is algorithm design and coding.

3.1. Software

The designed code has a layered architecture. There is a python file with a main structure named Main. Methods in other Python files are imported and run by calling the methods respectively. The lane lines must be determined in the algorithm of the car following the lane. For this, lane detection algorithm is used. Image processing techniques are used in the lane detection algorithm. These image processing techniques are described in the below.

Some libraries used for image processing are: Numpy, OpenCV, Math, RPI.GPIO. The Numpy library was used for sequencing. This array operations; dividing the video video taken from the camera into frames and keeping them in a sequence, keeping the curves of the lane lines in the frames in one sequence, keeping the inclination angles of the road in the forward path in a sequence. The Math library is used to perform mathematical operations in the algorithm. The OpenCV library focuses on image processing, video capture and analysis, including features such as face detection and object detection. This library was used to detect objects and lanes in the image. The RPI.GPIO library is used to manage the pins on the raspberry pi and to locate the wheels, sensors and batteries that we have connected in the algorithm.

Frames with original RGB color space were converted to frames with HSV color space and color saturation was gained. These frames have been rendered grayscale image processing so that an image with saturated color characteristics are converted to shades of gray more clearly. If this was done without converting from the RGB color space to the HSV color space, the frame converted to grayscale would receive shades of gray with less transition and the details of the clear shapes on the frame would not be visible. The Canny edge detection method was used on the grayscale frame and the lines including the detailed lines in the frame were reached. After these image processing methods, the lanes in the original path obtained were detected. The lanes were determined by Hough Transform and Sobel filter methods.

For the car to go in the middle of the lanes, there is a variable called center lane in the code, and the centerline is a line that centers the two lanes [13]. Here you must first find the right and left

lanes, and the mainline of code written for the detection of the left lane is as follows.
left_fit_average = np.average (left_fit, axis = 0)

left_line = make_coordinates (image, left_fit_average)

The following mainline of code is written for Centerline.

lines = cv2.HoughLinesP (frame, 2, np.pi / 180, 100, np.array ([]), minLineLength = 40, maxLineGap = 5)

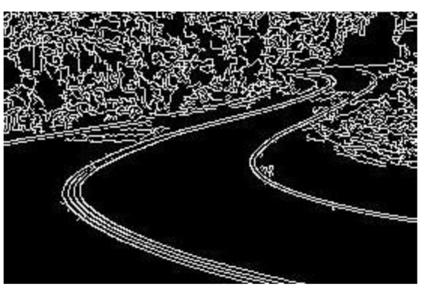
For the centerline, the following line of code is written. center_lines = average_slope_intercept (frame, lines)
The algorithm written for ROI detection is called here and the calculation of the ROI is done in this algorithm. The ROI-finding algorithm maintains the intersecting and polygon definition region on the image. This is the area between the lane and the horizon.

Steps of Image Processing methods on Path:

a) **Original Frame**

b) **HSV Frame**

c) **Grayscale frame**



d) **Canny edge Frame**

Lane tracking using image processing techniques has numerous benefits, particularly in the context of autonomous vehicles and advanced driver assistance systems (ADAS). Some of the key advantages include:

Improved Safety: Lane tracking systems help enhance road safety by assisting drivers in maintaining their position within the lane. This reduces the risk of unintentional lane departures and potential collisions.

Lane Departure Warning: By continuously monitoring the vehicle's position within the lane, lane tracking systems can provide timely warnings to the driver if they are drifting out of their lane, reducing the likelihood of accidents caused by drowsiness or distraction.

Lane Keeping Assist: Many modern vehicles equipped with lane tracking can actively steer to keep the vehicle within the lane. This feature can provide a significant safety net by gently correcting the vehicle's course if the driver does not react to warnings.

Adaptive Cruise Control: Lane tracking is often integrated with adaptive cruise control, enabling the vehicle to adjust its speed and maintain a safe following distance based on the detected lane and the behavior of the vehicles ahead.

Future Scope:

Autonomous Vehicles:

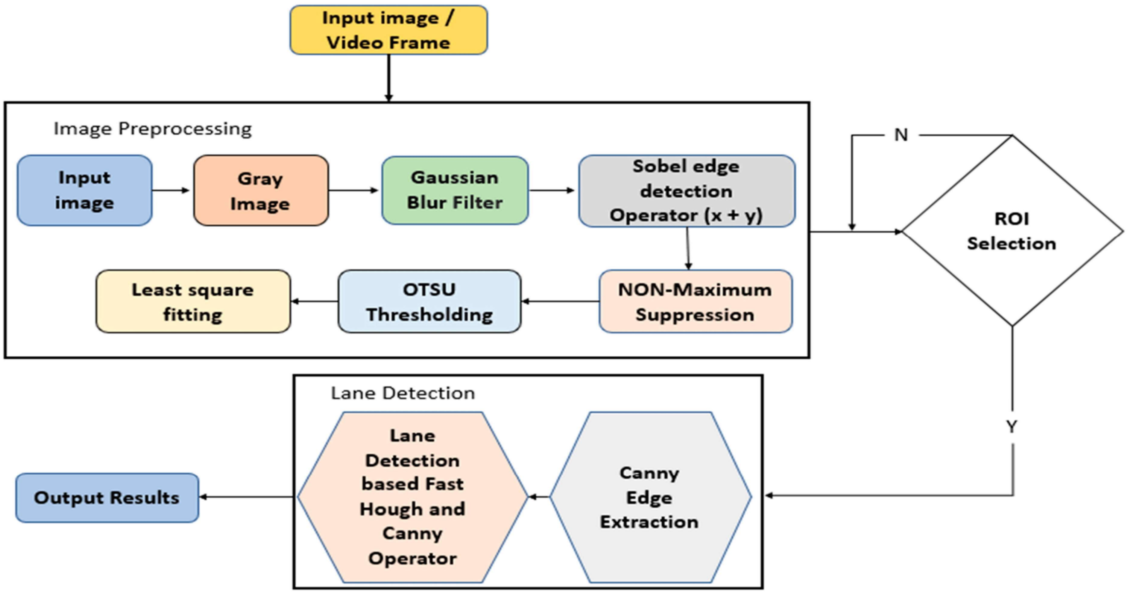
Lane tracking is a fundamental technology for autonomous vehicles. As self-driving cars become more common, lane tracking systems will continue to play a pivotal role in ensuring the vehicle stays in its designated lane, navigates complex road scenarios, and maintains safety.

Improved Accuracy and Robustness:

Future lane tracking systems will likely feature improved accuracy and robustness. This includes better handling of adverse weather conditions, challenging lighting situations, and complex road geometries.

Multi-Lane Tracking:

Advanced lane tracking systems will be able to track multiple lanes simultaneously, allowing autonomous vehicles to navigate complex highway interchanges, urban intersections, and other multi-lane scenarios more effectively.



Block Diaram:

Challenges Faced:

Variable Lighting Conditions:

Changing lighting conditions, such as shadows, glare, and low-light environments, can make it difficult for image processing systems to accurately detect and track lane markings.

Weather Conditions:

Adverse weather conditions like rain, snow, and fog can obscure lane markings and reduce the visibility of the road, making lane tracking more challenging.

Faded or Worn Lane Markings:

Lane markings on roads can become faded or worn over time, which can make them difficult to detect and track accurately.

Irregular or Missing Lane Markings:

In some areas, road markings may be irregular or even missing altogether, making it challenging for lane tracking systems to identify the lanes.

Complex Road Scenarios:

Complex road scenarios, such as intersections, highway ramps, and construction zones, can pose challenges for lane tracking systems, as they must accurately identify and track lanes in these situations

REFERENCES

[1] David C. Andrade, Felipe Bueno, Felipe Franco, Rodrigo A. Silva, Student Member, IEEE, João H. Neme, Erick Margraf, Student Member, IEEE,
William Omoto, Felipe Farinelli, Angelo M. Tusset, Sergio Okida, Max M. Santos, Senior Member, IEEE, vel Strategy for Road Lane Detection and Tracking based on Vehicle’s Forward Monocular Camera”, IEEE Transactions on Intelligent Transportation Systems, September 2018.

[2] Aharon bar hillel, Ronen Lerner, Dan Levi, Guy Raz, “Recent progress in road and lane detection: A survey”, Machine Vision and Applications 2011.