A Seminar Report

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CERTIFICATE

This is to certify that the Seminar report entitled **"Road Lane Detection"** is being submitted by **Navnit Amrutharaj (Roll No:TIB02 & Division:B)** is a record of bonafide work carried out by him under the supervision and guidance of **Prof. Monali Bansode** in partial fulfillment of the requirement for **Bachelor of Engineering – 2019 course** of Savitribai Phule Pune University, Pune in the academic year 2023-2024.

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Abstract

This project demonstrates a powerful lane detection system developed using Python, which is important in the field of autonomous vehicles and advanced driver assistance systems (ADAS). The main purpose of the system is to detect and visualize lane markings on the road and provide the necessary information for control management and lane management algorithms.

The system uses computer vision and image processing to analyze images or videos captured from the vehicle's perspective. This process includes important steps such as grayscale conversion, Gaussian smoothing, edge detection using the Canny algorithm, region of interest masking, and Hough line detection.

Line detection is done by dividing the detected lines into positive and negative areas representing left and right lines. Further analysis was performed to determine the average position and slope of these lines. The system then estimates the line between these lines to create a visual representation of the line.

The launch of the system is a video system with key statements and decisions, ensuring clarity and understanding of the model. This project demonstrates Python's potential as a tool for creating advanced driver services and provides an important building block for the future of driverless vehicles.

Road research reveals the importance of computer vision in improving road safety and easing the transition to transportation. This project supports ongoing efforts to develop smart, reliable commercial vehicles to make roads safer and transportation more efficient.

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CHAPTER 1

INTRODUCTION

In an era of rapid transportation changes and advances in autonomous driving, health and information on our roads have never been more important. Vision Knowledge is a pioneering project to meet this urgent need. This mission combines the best ideas of PC vision with continuous image processing to improve road health and make our roads and streets safer for everyone.In an era of rapid transportation changes and advances in autonomous driving, health and information on our roads have never been more important. The Consciousness Approach is a pioneering project that aims to meet this urgent need. This mission combines the best ideas of PC vision with continuous image processing to improve road health and make our roads and streets safer for everyone.

Researchers' development of wireless sensor networks such as Advanced Driver Assistance Systems (ADAS) should be able to analyze road conditions like humans. Road analysis is an important, complex and difficult task and includes: road search (including the location of the road, determination of the relative position of the vehicle and road traffic, and analysis of the vehicle in the forward direction) and visual impact (based solely on the search for problems occurring in the vehicle's path). Determining the road boundary, estimating the road geometry and vehicle space are important tasks in this context because they require lateral and longitudinal control of the vehicle. Cloud-free vision is widely used in this field because it has many advantages over other active sensors such as radar or lidar (higher resolution, low energy consumption, low cost, easy aesthetic integration and non-invasiveness).

At first glance, the problem of finding road geometry from visual data seems simple, and early work in this area has been fruitful. However, the different conditions required by the job and the high level of success make the search method lively. This article provides a comprehensive review of visualization techniques in visualization.

INTRODUCTION TO ROAD LANE DETECTION SYSTEM

Lane detection is a technique that uses computer vision, machine learning, and real-time data processing to identify and determine the path in the vehicle's field of view. This technology is welcomed for its ability to improve road safety, assist driving, and enhance advanced driver assistance systems (ADAS).

Roadmap is a technological solution designed to search and visualize images from embedded images or videos. The main aim is to help drivers make informed decisions and provide reliable and up-to-date information about lines, signs and boundaries to make driving easier.The main products and functions of the line calling system include: usually from the built-in camera. These cameras capture road conditions and provide the necessary information for lane detection.
Computer Vision Technology: This project uses computer vision algorithms to analyze image data and identify lines. Traditional methods include edge detection, color segmentation, and line detection. This project well includes implementation of the project in python.
Lane detection algorithm: The core of the system consists of a process that can detect lane markings and lane boundaries in input images or snapshots. These algorithms take into account various factors such as line width, curvature, and line type (e.g. solid, dashed).
Visualization and feedback: The process often shows visible lines by overlaying original images or videos. This view helps the driver understand the visible lane and its locations.

MOTIVATION BEHIND ROAD LANE DETECTION SYSTEM

The motivation behind the development and implementation of lane search is based on a deep commitment to improving road safety and transforming the future of transportation. There are several important factors that led to the need for this work:

Improving Road Safety: Road accidents, including take-off-related accidents, continue to be a major concern worldwide. Most accidents occur when drivers unintentionally leave the designated lane. The lane detection system aims to prevent such incidents by providing real-time lane guidance and warnings to drivers.

Autonomous Vehicles: With the emergence of the autonomous vehicle era, accurate detection and understanding of traffic lanes has become important. Driverless vehicles need the right lane to drive safely. The project supports the development of autonomous and semi-autonomous vehicles that can reduce human error and improve overall road safety.

Driver Assistance Systems: In addition to self-driving cars, Advanced Driver Assistance Systems (ADAS) are increasingly being incorporated into modern vehicles. Lane keeping, cruise control, and collision avoidance all depend on using the correct lane. The project is based on basic security features.

Safety Management: Lane search is not limited to a single vehicle. It helps in managing all the traffic and helps the traffic control department to monitor the situation and control the traffic. Understanding lane usage in real time allows for better traffic planning and reduced traffic congestion.

OBJECTIVE OF ROAD LANE DETECTION SYSTEM

The purpose of the road detection line is diverse, as it serves many purposes, from improving safety to advanced driver support and autonomous driving. The main objectives of road inspection are:

Improving road safety: The main aim is to improve road safety by reducing exit routes. The system is designed to prevent accidents and collisions by alerting drivers when they unintentionally stray from the designated lane.It involves several mechanisms and benefits that contribute to a safer road environment.

Lane Keep Assist: This system helps the driver maintain the lane. It reduces the possibility of swerving by providing active steps or braking intervention when necessary.This means the car can maintain its position in the lane without the driver having to continue. These features are an important part of increasing road safety and improving driving.

Reduce human error: Looking for ways to reduce human error by providing immediate feedback and assistance is the cause of serious situations. It encourages drivers to make safer and more informed driving decisions.An important aspect of lane detection and advanced driver assistance (ADAS) purposes. It shows the role of responsibility in reducing or preventing the driver's mistakes and judgment errors while operating the vehicle.

Autonomous Driving: This technology is very important for the development of autonomous vehicles. It provides a straight line, allowing the driverless car to navigate safely and accurately with minimal human intervention.It is a type of transportation in which vehicles can move and travel on their own without direct human intervention. This concept represents a major shift in the automotive industry and aims to redefine the way we transport.

AIM & OBJECTIVES OF ROAD LANE DETECTION SYSTEM

AIM:
The purpose of lane searching is to improve road safety, support advanced driver assistance (ADAS) and contribute to the development and use of driving technology. The main goal is to provide timely and accurate information about lane locations and signs to help drivers make informed decisions and keep vehicles safe on the road.

OBJECTIVES:
Effective traffic management: Contribute to traffic management by monitoring lanes, roads and traffic congestion to promote better traffic planning and reduce congestion.

Environmental impact: Promote responsible driving, thus saving fuel and reducing accidents. Emissions are based on sustainable development goals.

A better driving experience: It provides a better and stress-free driving experience, especially on long journeys and difficult rides.

Innovation and technology development: Support innovation in computer vision, machine learning and just-in-time processing to contribute to the development of technology and its applications in the automotive industry.

Research and Development: Continuous research and development in road safety, autonomous driving and advanced driver support makes us insightful and skilled in this field.

Reducing human error: reducing or preventing human error that can even cause accidents, improving overall safety.

CHAPTER 2

LITERATURE SURVEY OF ROAD LANE DETECTION SYSTEM

In this paper, a fast and reliable lane detection and tracking technology is developed, widely available and named "LaneRTD". LaneRTD uses well-known techniques such as Canny edge detection and Hough transform. Additionally, the pipeline uses a wide variety of detection and marking methods to create the final product. The proposed system only requires raw RGB images from a CCD camera mounted behind the car's windshield. LaneRTD's performance has been tested and evaluated using many static images and many live videos. Validation results show that the detection results are accurate and robust, except for one case with complex shadows. Previous time (execution time) testing using a cheap CPU proves that LaneRTD is good for lane detection without spending too much money. The device is therefore well-suited for use in Advanced Driver Assistance Systems (ADAS) or autonomous vehicles. The benefits and drawbacks of the mentioned methods are discussed and analyzed, and suggestions for improvement and future work are presented [1].

This article shows a method to visualize the line in real time. Split the image into sections and remove the shadow path. The canny operator is used to define edges that represent a line or road boundary. Hyperbola method model to handle bottlenecks and imperfect method. Various experiments show that using the Hough transform to detect lines in a limited search space, approaching their intersection will create the final scan point called the horizon. Additionally, to find the left and right vector points representing the direction of the line, the line scan boundary stage uses the edge image and horizontal lines along with the left and right Hough lines as the material used to provide the context. of the line. Two hyperbolas prove this. Test results show that the system can meet the criteria, provide important information to drivers and ensure safety
[2].

In this paper,Computer vision is related to image processing and machine learning. Computer vision as a general subject is closely related to the discipline of image creation.
Photography itself lends itself to many tasks, especially the analysis of images to obtain necessary information. Building on its work in the development of computer vision, remote sensing has expanded into other sectors such as robotics, computer and human communications, healthcare, and satellite communications. Scientists interested in computer vision can use this information to predict an event by analyzing images and videos and extracting features. Since the development of computer vision is closely related to image processing and machine learning, it can be used in various research fields to predict or detect features and characteristics, as well as human activities and natural phenomena. Figure: (a) Example of an object rendered in black and white; (b) An example of an object whose size differs from its original size due to the measurement scale; (c) A sample of a transparent material or color combination; (d) In proportion
figure, the change in position of a black and white object differs from its actual ideas
[3].

CHAPTER 3

SEMINAR RELATED OTHER CHAPTER

Importing Libraries:

```
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
import numpy as np
import cv2
import os
```

This code segment imports necessary libraries:

- matplotlib.pyplot and matplotlib.image are used for image visualization.
- numpy (as np) is for numerical operations.
- cv2 is OpenCV, a popular library for computer vision and image processing.
- os is used for interacting with the file system.

Loading Test Images:

- This reads the image from time to time to complete it. It assumes a list containing a number of image frames (such as video frames). It uses the os library to write directory information and mpimg to read each image and load it into the test_images directory. Each image is stored as a NumPy array.

Creating A Video Writer:

```
fourcc = cv2.VideoWriter_fourcc('M','J','P','G')
videoOut = cv2.VideoWriter('output2.avi', fourcc, 20.0, (im.shape[1], im.shape[0]))
```

- This code initializes a video writer to create an output video. It uses the MJPG codec, writes to a file named 'output2.avi', sets the frame rate to 20 frames per second, and specifies the frame dimensions based on the first loaded image.

Processing Each Image(& Algorithm):

- Takes several photos in steps:
- Convert the image to grayscale.
- Apply Gaussian smoothing to reduce noise.
- Remove edges using the Canny edge detection algorithm.
- Create a mask to isolate the region of interest (or even the path).
- Apply a mask to the visible edges of the image to preserve only the edges.
- Uses the Hough transform to detect the line that should represent the line in the mask.
- Divides the detected line into positive slope and negative slope, corresponding to the left line and right line respectively.
- Calculates the slope and intercept of the mean line for the future plot.
- Puts visible lines on the original image.
- Writes the resulting frame to the output video.
- Repeat this process for each frame in turn.

Releasing The Video Writer:

videoOut.release()

- Finally, run the video recorder, recording the output video with visible lines.

This project creates videos by analyzing images, checking and tracking errors in each frame, and creating a video showing the errors found. This is an important step in the development of autonomous vehicles and advanced driver assistance systems (ADAS).

CONCLUSION

In short, this project is an important step in the development of technology related to autonomous driving and advanced driver support. It takes photos of the road, processes them and creates a video output that clearly and visually displays the road lines. The process of this study includes basic steps such as edge detection, region of interest masking, Hough line detection and line extrapolation. Programming code as the basis for lane finding in autonomous vehicles and helping them understand and navigate the road by: Detecting and following lane markings. The ability to accurately identify and see lane markings is essential for steering control, lane keeping, and many other safety features in modern vehicles.This project demonstrates the ability of computer vision and image processing technology to extract valuable information from visual data, helping to improve safety and better transportation. Lane detection is just one part of a larger area of research aimed at making driving more realistic and improving driver safety.

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