DETERMINE THE SPEED OF THE VEHICLE

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Abstract. In this paper, Vehicle speed detection and estimation is an important task for many traffic control and safety systems. In this study, we propose a new computer vision-based method for real-time vehicle speed estimation and detection. To detect cars and determine their speed, our system first analyzes video images of moving vehicles using image processing algorithms. On a dataset of real traffic scenarios, we test the proposed algorithm and the results show that it performs very well in terms of accuracy.

Keywords. OpenCV software, time identifier, model window, optical flow, PPM (pixels per meter), radar, Supabase and MongoDB database, video data, cascade classifier, real-time mode.

Introduction. Over the past few years, the number of road accidents has significantly increased due to the rise in the number of vehicles on the road. Monitoring and controlling vehicle speed in specific areas or zones is crucial. Road traffic safety. Although methods for measuring speed using radar are regularly employed for this purpose, they may have some limitations, such as identifying smaller vehicles with weak radar reflections or errors in detecting vehicles that

change speed very quickly or frequently. As a result, there is a growing demand for more precise and effective systems to calculate the speed of moving vehicles.

In research, programs based on Python, OpenCV, NodeJS, Supabase, and MongoDB are used to develop software for detecting vehicle speed. The development process of the software is described step by step, including tools, tables, and algorithms. The requirements for the application, including functions, necessary models, and safety issues, are thoroughly analyzed.

For detecting objects on the road from images, OpenCV is chosen. At this time, the effectiveness and efficiency of these tools in object detection tasks have been recognized. For web development, NodeJS is selected for its extensive capabilities in integrating FRONTEND and BACKEND radar detector technologies.

MongoDB (NOSQL) and Supabase (PostgreSQL) are two types of databases used to create a database for storing user information and calculating speeds for related vehicles. These databases provide high scalability and manageability in storing security information and unprocessed data, enabling the implementation of an object detection model for managing large data sets effectively on the OpenCV-powered backend of a website, implemented with Pyt and Nodejs.

The databases - MongoDB for user registration and login to the system. Supabase is a database for creating user interfaces using HTML and JavaScript programs for user registration and login to identify the vehicle and speed identifiers. The user interface is created using model views and components designed for user registration and login.

The algorithm for calculating vehicle speed is performed in the following sequence:

1. Import the necessary libraries: Supabase, Os, Cv2, Dlib, time, Math, Dotenv.
2. Establish connection to the Supabase database using the provided URL and key.
3. Load the cascade classifier for vehicle detection.
4. Open the video file for processing.
5. Set the width and height for processing the video frames.

6. Define the "Estimatespeed" function to calculate the speed based on the location of the vehicle along the trajectory.

The model for detecting and classifying vehicles' location and speed is implemented using the HAAR CASCADE program. The system for calculating vehicle speed utilizes image pixel manipulation and processing through OpenCV. By leveraging computer software from OpenCV, we have developed a system to determine vehicle speed in this research. The technology captures vehicle speeds in video images, allowing for real-time speed detection and monitoring. Various methods for image processing, such as image resizing, contour identification, and evaluating vehicle location, are available.

After placing the vehicles on the road tracks, their speeds are determined by calculating the distance covered over a certain period. Subsequently, this data is stored in a database for future monitoring and analysis. The system's operation involves processing the written images according to standards, including accuracy, processing speed, and efficiency in calculating speed.

Method: The research results showed that the proposed vehicle speed detection system using OpenCV effectively demonstrated high accuracy in real-time detection and monitoring of vehicle speeds, proving its capabilities in accurately identifying vehicles under various road conditions and lighting environments.

Furthermore, the processing speed of the system was sufficient for real-time applications, allowing for immediate access to and control of vehicle speed data. However, it should be noted that the system's performance may be affected by factors such as the camera object, camera dimensions, and weather conditions. Therefore, further research may be necessary to optimize the system's robustness under such conditions.

One of the potential areas for improvement is the integration of vehicle learning methods such as deep learning. Convolutional neural networks can enhance the detection and adaptability of this system to various scenarios. Additionally, incorporating more complex tracking algorithms, such as Kalman filters or particle filters, could lead to improved tracking efficiency and speed estimation.

Results: In conclusion, the vehicle speed detection system developed using OpenCV demonstrates promising results in real-life applications, offering valuable tools for traffic management and law enforcement. Future research and development could help optimize this system and expand its application in various transportation conditions and environments.

The potential applications of the proposed approach include traffic monitoring, law enforcement agencies, and intelligent transportation systems. Overall, this research contributes to the development of accurate and efficient methods for detecting and assessing vehicle speeds, which can significantly enhance traffic management and safety. The problem description, proposed solution, learning methods, and findings are briefly outlined. This highlights the contribution of the research and emphasizes its significance and potential applications.

This article presents a unique method for quickly and accurately assessing the speed of moving vehicles without the use of expensive sensors like radars. The proposed solution integrates into a video stream of moving cars and filters the data to calculate their speed. The process is divided into four main categories, which can be grouped based on the necessary components to accomplish the task:

1. Defining the area of interest through video: This involves identifying the specific area in the video where vehicle detection will occur.

2. Detecting vehicle objects from video frames: In this step, computer vision techniques are employed to recognize and track vehicles within the video frames.

3. Using the PPM (pixels per meter) algorithm to evaluate the speed of moving objects:This algorithm is crucial for determining the speed of vehicles by analyzing the distance covered over time in the video frames.

4. Creating a precise file image to record the vehicle's speed and

the image of the vehicle moving at that speed: This final stage involves saving both the detected speed and the corresponding image of the vehicle in a single file for further analysis.

The significance of this research lies in its potential to provide accurate and effective methods for determining vehicle speed, which can enhance traffic

management and safety. The proposed solution is applicable in various fields, including transport monitoring, law enforcement, and intelligent transport systems.

This article details a proposed methodology, including the methods and algorithms used to measure the speed of moving vehicles. Section 2 also presents the experimental setup and evaluation results for the proposed strategy. Our findings indicate that the proposed method improves upon traditional methods in accurately determining the speed of moving vehicles.

The proposed approach, along with the methods and algorithms used to measure the speed of moving vehicles, is fully explained in Section 2. The experimental setup and evaluation results for the proposed strategy are presented in Section 3. The study concludes in Section 4 with a discussion of the contributions, potential applications, and future development of the proposed approach. The detection model implementation is based on OpenCV. The website backend implementation will be done using Python and Node.

In **conclusion**, road traffic management and law enforcement agencies can greatly benefit from the implementation of an automated vehicle speed detection system. The system can accurately detect and monitor vehicle speeds in real-time. Utilizing computer vision methods like OpenCV, and potentially incorporating more sophisticated tracking algorithms by analyzing vehicle flow and adding complexity, allows for increased speed detection accuracy, identification of violations, provides valuable data for traffic analysis, and contributes to improved overall road safety.

While the current system shows promising results, further testing and optimization are needed to ensure its robustness and efficiency under varying conditions such as camera positioning, weather, and lighting. Vehicle speed detection systems are projected to become even more valuable tools for promoting safety, and as computer vision and vehicle speed detection technology continues to advance, it encourages more responsible driving behavior on our roads.

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