ARTIFICIAL INTELLIGENCE IN TRANSPORTATION INDUSTRY

A Project Work Synopsis

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ABSTRACT

The integration of Artificial Intelligence (AI) in the transportation industry has ushered in a new era of mobility characterized by efficiency, safety, and sustainability. This abstract explores the multifaceted role of AI in revolutionizing various domains within transportation, ranging from autonomous vehicles and traffic management to logistics and predictive maintenance.

Driver fatigue monitoring system is a real-time system that can detect driver fatigue and distraction using computer vision approaches. In this paper, a new approach is introduced for driver hypervigilance (fatigue and distraction) detection based on the symptoms related to face and eye regions. In this method, face template matching and horizontal projection of top-half segment of face image are used to extract hyper vigilance symptoms from face and eye, respectively. Head rotation is a symptom to detect distraction that is extracted from face region.

The extracted symptoms from eye region are percentage of eye closure, eyelid distance changes with respect to the normal eyelid distance, and eye closure rate. The first and second symptoms related to eye region are used for fatigue detection; the last one is used for distraction detection. In the proposed system, a fuzzy expert system combines the symptoms to estimate level of driver hypo-vigilance. There are three main contributions in the introduced method simple and efficient head rotation detection based on face template matching, adaptive symptom extraction from eye region without explicit eye detection, and normalizing and personalizing the extracted symptoms using a short training phase. These three contributions lead to develop an adaptive driver eye/face monitoring. Experiments show that the proposed system is relatively efficient for estimating the driver fatigue and distraction.

Timeline/Gantt Chart

S.N	Strategies	1st week	2nd week	3rd week	4th week	5th week	6th week
1)	Problem Identification						
2)	Research & Analysis						
3)	Design						
4)	Coding						
5)	Implementation & testing						
6)	Project finalisation						
7)	Documentation						

1. INTRODUCTION

Artificial intelligence is revolutionizing the way we travel and ensuring our safety on the roads.As technology continues to advance at a rapid pace, it is becoming increasingly important for the transport industry to keep up with the latest innovations. One such innovation is the use of AI-powered systems, which have the potential to transform the way we move around.From autonomous vehicles to traffic management systems, AI has already made significant strides in improving the efficiency and safety of transportation. But perhaps one of its most important applications is in the area of driver fatigue monitoring.

Driver fatigue is a serious issue that affects millions of people every year. It can lead to accidents, injuries, and even fatalities. By using AI to detect signs of fatigue in drivers, we can prevent these tragedies from occurring and make our roads safer for everyone.

Improvement of public safety and the reduction of accidents are of the important goals of the Intelligent Transportation Systems (ITS). One of the most important factors in accidents, especially on Truck Drivers, is the driver fatigue and monotony. Fatigue reduces driver perceptions and decision making capability to control the vehicle. Researches show that usually the driver is fatigued after 1 hour of driving. In the afternoon early hours, after eating lunch and at midnight, driver fatigue and drowsiness is much more than other times. In addition, drinking alcohol, drug addiction, and using hypnotic medicines can lead to loss of consciousness

In different countries, different statistics were reported about accidents that happened due to driver fatigue and distraction. Generally, the main reason of about 20% of the crashes and 30% of fatal crashes is the driver drowsiness and lack of concentration. In single-vehicle crashes (accidents in which only one vehicle is damaged) or crashes involving heavy vehicles, up to 50% of accidents are related to driver Hypervigilance . According to the current studies, it is expected that the amount of crashes will be reduced by 10%–20% using driver fatigue monitoring systems .

The driver fatigue monitoring system is a real-time system that investigates the driver physical and mental condition based on the processing of driver face images. The driver state can be estimated from the eye closure, eyelid distance, blinking, gaze direction, yawning, and head rotation. This system will alarm in the hypervigilance states including fatigue and distraction. The major parts of the driver fatigue monitoring system are imaging, hardware platform, and the intelligent software.

1. Problem Definition:

In this project, we try to implement different types of classifiers that helps to overcome the challenges of driver fatigue. Design and implement a Driver Fatigue Monitoring System that utilizes technology to detect and alert drivers when they are showing signs of fatigue or drowsiness while operating a vehicle. The primary goal is to enhance road safety by preventing accidents caused by driver fatigue.

2. Project overview:

A computer vision system that can automatically detect driver fatigue in a real time video stream and then play an alarm if the driver appears to be fatigue or drowsy. This revolutionize the vast transport system, preventing massive human and financial losses. In this program we check how long a person's eyes have been closed for. If the eyes have been closed for a long period i.e., beyond a certain threshold value, the program will alert the user by playing an alarm sound.

1.3 Hardware Specifications:

- Processor – 64-bit eight-core, 2.5GHz per core.
- RAM – Minimum 4GB required.
- Hard Disk – SSD or HDD minimum 40GB free space required.

1.4 Software Specifications:

- Edition - Windows 10/11
- OS build 19043.1526
- Python installed – version 3.7 to 3.10
- OpenCV library Installed
- Any python compiler or system terminal

2. LITERATURE REVIEW

The driver fatigue monitoring systems can be divided into two general categories. In one category, driver fatigue and distraction is detected only by processing of eye region. There are many researches based on this approach. The main reason of this large amount of researches is that the main symptoms of fatigue and distraction appear in the driver eyes.

Moreover, the processing of the eye region instead of the processing of the face region has less computational complexity. In the other category, the symptoms of fatigue and distraction are detected not only from eyes, but also from other regions of the face and head. In this approach, in addition to processing of eye region, other symptoms including yawning and head nodding are also extracted.

2.1 Existing System:

[1] Driver fatigue monitoring system includes some main parts: face detection, eye detection, face tracking, symptom extraction, and driver state estimation. These main parts are reviewed in different systems in the current section.

[2] In the most of driver face monitoring systems, the face detection is the first part of the image processing operations. Face detection methods can be divided into two general categories feature-based and learning-based methods.

[3] Learning-based face detection uses statistical learning methods and training samples to learn the discriminative features. These methods benefit from statistical models and machine learning algorithms. Generally, learning-based methods have less error rates for face detection, but these methods usually have more computational complexity.

[4] Almost in all driver fatigue monitoring systems, because of the importance of symptoms related to eye, the eye region is always processed for extracting the symptoms. Therefore, before the processing of eye region, eye detection is required. Eye detection methods can be divided into three general categories: methods based on the imaging in the infrared spectrum, feature-based methods and other methods.

[5] In the driver face monitoring systems, useful symptoms for fatigue and distraction detection can be divided into three general categories: symptoms related to the eye region; symptoms related to the mouth region; symptoms related to the head.

[6] Yawning is one of the hypervigilance symptoms related to the mouth region. This symptom was extracted by detecting the open mouth.

[7] Some fatigue and distraction symptoms are related to head. These symptoms include head nodding and head orientation. Head nodding can be used for fatigue detection, and head orientation can be used for both fatigue and distraction detection. Driver nodding and lack of driver attention to the road can be detected by estimating the angle of head direction.

These are the seven research papers that we have reviewed and these are the systems they used.

2.2 Proposed System:

The proposed system is a driver fatigue monitoring system that can detect driver fatigue and drowsiness by processing of eye and face regions. After image acquisition, face detection is the first stage of processing. Then, symptoms of Fatigue are extracted from face image.

A computer vision system that can automatically detect driver fatigue in a real time video stream and then play an alarm if the driver appears to be fatigue or drowsy Additionally, a template matching method is used for detecting the head rotation. We use different types of Classifiers to detect the drowsiness.

3.PROBLEM FORMULATION

The AI in Transportation project aims to address the challenges within the transportation sector using advanced AI and ML techniques. The problem formulation involves identifying key issues and defining the project's scope and objectives.

Problem Statement:

The problem at hand is to leverage Artificial Intelligence (AI) to create a comprehensive solution that enhances within the transportation industry. This encompasses areas such as road safety.

4.OBJECTIVES

AI (Artificial Intelligence) has the potential to revolutionize the transportation industry in numerous ways, making it more efficient, safe, and sustainable.

The objectives of AI in transportation projects can vary depending on the specific application and goals, but here is a common objective:

Enhance Safety: One of the primary objectives is to improve the safety of transportation systems. AI can be used to develop Driver Fatigue Monitoring systems (DFMS) that help vehicles avoid challenging driving conditions. Additionally, AI can analyze real-time video stream to detect the Fatigue and alert Drivers accordingly.

5.METHODOLOGY

In this project, we will be using OpenCV for gathering the images from webcam and feed them into a Deep Learning model which will classify whether the person's eyes are 'Open' or 'Closed'. The approach we will be using for this project is as follows:
Step 1 – Take image as input from a camera.
Step 2 – Detect the face in the image and create a Region of Interest (ROI).
Step 3 – Detect the eyes from ROI and feed it to the classifier.
Step 4 – Classifier will categorize whether eyes are open or closed.
Step 5 – Calculate score to check whether the person is drowsy.

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