SYNOPSIS FOR PROPOSED WORK

Name of the College : DKTE Society's Yashwantrao Chavan Polytechnic, Ichalkaranji.

Name of the Program : Computer Science & Engineering

Name of the Student : Mr. Tushar Sadashiv Neje
Miss. Neha Rajgonda Patil
Mr. Sandesh Gajendra Pol

Name of the Guide : Mr. A. S. Salavi (Kumbhar)

Proposed Title : Auto Sentinel: Integrating Driver Behaviour Analysis, Eye-Face Authentication, Emotion Detection, and Anti-Hypnosis Features

1. Introduction

In today's rapidly advancing technological landscape, ensuring road safety and preventing accidents is of paramount importance. The integration of cutting-edge technologies has the potential to revolutionize the way we approach driver behavior analysis, authentication, and emotional well-being within the context of driving. Project AutoSentinel addresses these critical aspects by seamlessly combining advanced driver behavior analysis, eye-face authentication, emotion detection, and anti-hypnosis features into a single, comprehensive solution.

1. Comprehensive Driver Behavior Analysis: AutoSentinel employs sophisticated algorithms and sensors to analyze driver behavior in real-time, providing invaluable insights into driving patterns, responsiveness, and alertness. By monitoring factors such as steering input, acceleration, braking, and lane discipline, this project enhances driver

awareness and helps prevent potential accidents resulting from distracted or reckless driving.

2. State-of-the-Art Eye-Face Authentication: Traditional methods of vehicle access and ignition are susceptible to unauthorized use and theft. AutoSentinel revolutionizes vehicle security through advanced eye-face authentication technology, ensuring that only authorized drivers gain access. This feature leverages biometric data to authenticate the driver's identity, significantly reducing the likelihood of vehicle theft and unauthorized access.

3. Emotion Detection for Safer Driving : Emotional states have a profound impact on driver behavior and decision-making. AutoSentinel's emotion detection capabilities utilize facial expressions to gauge the driver's emotional state, enabling the system to respond proactively. For instance, if the system detects signs of stress or fatigue, it can adjust the driving environment, provide calming prompts, or engage the driver in a conversation via a voice assistant to improve focus and emotional well-being.

4. Combatting Driving Hypnosis: Long hours on the road can lead to a phenomenon known as driving hypnosis, where drivers become less aware of their surroundings due to monotonous conditions. AutoSentinel's anti-hypnosis features detect signs of driver drowsiness or inattention and take corrective actions. This can include altering cabin conditions, prompting the driver to take a break, or even initiating a conversation with the voice assistant to re-engage the driver's attention.

2. Relevance

AutoSentinel focuses on the comprehensive analysis of driver behavior, elevating road safety to unprecedented levels. Through advanced algorithms and sensor fusion, the system monitors driving patterns, alerting drivers to potential hazards and promoting safer driving practices. But that's just the beginning.

Incorporating state-of-the-art eye and face detection, AutoSentinel introduces an unparalleled authentication layer. Gone are the days of unauthorized vehicle access, as the system ensures that only authorized drivers take control. By scrutinizing the unique

characteristics of a driver's eyes and face, AutoSentinel guarantees a secure and personalized driving experience.

But AutoSentinel doesn't stop at security; it also delves into the realm of emotions. Our advanced emotion detection technology reads subtle facial cues, enabling the system to empathize with drivers and respond accordingly. Seamlessly integrated with a voice assistant, AutoSentinel understands and adapts to the driver's emotional state, providing assistance and support when needed most.

One of the key concerns addressed by AutoSentinel is driving hypnosis, a potentially perilous condition often overlooked. Through continuous monitoring of driver engagement, the system proactively detects signs of drowsiness or distraction, intervening to avert potential accidents caused by driving hypnosis.

Project AutoSentinel represents a holistic approach to driving safety, combining driver behavior analysis, eye-face authentication, emotion detection, and anti-hypnosis features. Our vision is a world where every journey is not just a destination, but a secure, comfortable, and emotionally attuned experience. Join us as we redefine the road ahead with Project AutoSentinel. Your safety is our priority.

3. Literature Review

[1] Soukaina Bouhsissin , Nawal Sael , and Faouzia Benabbou Laboratory of Information Technology and Modeling, Faculty of Sciences Ben M'Sick, Hassan II University of Casablanca, Casablanca 20000, Morocco[IEEE]

The aim of this paper is to Driver behavior is receiving increasing attention because of the staggering number of road accidents. Many road safety reports regard human behavior as the most important factor in the likelihood of accidents. The detection and classification of aggressive or abnormal driver behavior is an essential requirement in the real world to avoid deadly road accidents and to protect road users. The automatic detection of a driver's behavior aids in the prevention of dangerous situations for the driver and all other participants in the driving environment, as well as the implementation

of corrective measures. This paper presents a systematic literature review (SLR) of driver behavior classification. This study aimed to highlight and analyze the different types of driver behavior, types of studies, data sources, datasets, features, preprocessing techniques, and artificial intelligence algorithms used to classify driver behavior and its performance. Based on the results obtained from the analysis of the selected works, we aim to identify the key contributions and challenges of studying driver behavior classification and propose potential avenues for further directions for practitioners and researchers

[2] Chirag Dalvi, Manish Ratho, Shruti Patil, Shilpa Gite and Ketan Kotecha Symbiosis Centre for Applied Artificial Intelligence (SCAAI), Symbiosis International University (Deemed University), Pune 412115, India

Computer Science and Information Technology Department, Symbiosis Institute of Technology, Symbiosis International University (Deemed University), Pune

412115, India[IEEE]

Facial expressions are mirrors of human thoughts and feelings. It provides a wealth of social cues to the viewer, including the focus of attention, intention, motivation, and emotion. It is regarded as a potent tool of silent communication. Analysis of these expressions gives a significantly more profound insight into human behaviour. AI-based Facial Expression Recognition (FER) has become one of the crucial research topics in recent years, with applications in dynamic analysis, pattern recognition, interpersonal interaction, mental health monitoring, and many more. However, with the global push towards online platforms due to the Covid-19 pandemic, there has been a pressing need to innovate and offer a new FER analysis framework with the increasing visual data generated by videos and photographs. Furthermore, the emotion-wise facial expressions of kids, adults, and senior citizens vary, which must also be considered in the FER research.

[3] Peng Cheng And Utz Roedig - School of Cyber Science and Technology and the Key Laboratory of Blockchain and Cyberspace Governance of Zhejiang Province, Zhejiang University, Hangzhou 310007, China (e-mail: peng_cheng@zju.edu.cn)

School of Computer Science and Information Technology (CSIT), University College Cork, Cork, T12 YN60 Ireland (e-mail:u.roedig@cs.ucc.ie)

Personal voice assistants (PVAs) are increasingly used as interfaces to digital environments. Voice commands are used to interact with phones, smart homes, or cars. In the United States alone, the number of smart speakers, such as Amazon's Echo and Google Home, has grown by 78% to 118.5 million, and 21% of the U.S. population own at least one device. Given the increasing dependency of society on PVAs, security and privacy of these have become a major concern of users, manufacturers, and policy makers. Consequently, a steep increase in research efforts addressing security and privacy of PVAs can be observed in recent years. While some security and privacy research applicable to the PVA domain predates their recent increase in popularity, many new research strands have emerged. This article provides a survey of the state of the art in PVA security and privacy. The focus of this work is on the security and privacy challenges arising from the use of the acoustic channel. Work that describes both attacks and counter measures is discussed. We highlight established areas such as voice authentication (VA) and new areas such as acoustic Denial of Service (DoS) that deserve more attention. This survey describes research areas where the threat is relatively well understood but where countermeasures are lacking, for example, in the area of hidden voice commands. We also discuss work that looks at privacy implications; for example, work on management of recording consent. This survey is intended to provide a comprehensive research map for PVA security and privacy.

[4] 2018 IEEE International Conference on Vehicular Electronics and Safety (ICVES) DOI: 10.1109/ICVES.2018.8519595

In this paper, we propose a novel, real-time driver emotion monitoring system “in the wild” based on face detection and racial expression analysis. A camera is placed inside the vehicle that continuously looks at the driver's face and monitors the driver's emotional state at regular time intervals. Camera based monitoring of the driver's attentiveness based on the driver's emotional state in naturalistic driving environments is a non-intrusive approach and an important part of an automated driver assistance system (ADAS). Our work employs a face detection model based on mixture of trees with shared pool of parts to robustly detect the drivers face in varied environmental conditions. We also extract racial landmark points, and use them to enhance our emotion recognition system. In our proposed work, we use convolution neural networks. In the first, we use VGG16 to extract appearance features from the detected face image and in the second VGG16 network, to extract geometrical features from the racial landmark points. We then combine these two features using an integration method to accurately recognize the emotions. Based on the recognized emotional state of the driver, the driver can be made aware of his emotional state in case necessary. Experimental results on publicly available driver and face expression datasets show that our system is robust and accurate for driver emotion detection.

[5] Sensors (Basel). 2023 Apr; 23(7): 3404. Published online 2023 Mar 23. doi: 10.3390/s23073404 A Recognition Method for Road Hypnosis Based on Physiological Characteristics

Road hypnosis is a state which is easy to appear frequently in monotonous scenes and has a great influence on traffic safety. The effective detection for road hypnosis can improve the intelligent vehicle. In this paper, the simulated experiment and vehicle experiment are designed and carried out to obtain the physiological characteristics data of road hypnosis. A road hypnosis recognition model based on

physiological characteristics is proposed. Higher-order spectra are used to preprocess the electrocardiogram (ECG) and electromyography (EMG) data, which can be further fused by principal component analysis (PCA). The Linear Discriminant Analysis (LDA), Quadratic Discriminant Analysis (QDA), and K-Nearest Neighbor (KNN) models are constructed to identify road hypnosis. The proposed model has good identification performance on road hypnosis. It provides more alternative methods and technical support for real-time and accurate identification of road hypnosis. It is of great significance to improve the intelligence and active safety of intelligent vehicles.

4. Problem Statement

The proposed work aims to develop an AI Based Anti-Hypnosis Driver Behavioral analysis and Authentication system for Advanced Cars

5. Objectives

1. Develop a robust and accurate driver behavior analysis system.
2. Implement a secure and reliable eye-face authentication mechanism for driver identification.
3. Integrate an emotion detection system based on facial expressions with a voice assistant for improved driver experience.
4. Design and implement an anti-hypnosis feature to prevent driver fatigue and drowsiness.

6. Proposed work

The proposed work mainly focuses on emotion detection and to prevent driving hypnosis happing on highways. Facial emotion classification is a fascinating and crucial area of research within the field of computer vision and artificial intelligence. Human emotions are complex and dynamic, often conveyed through subtle changes in facial expressions. The ability to accurately detect and classify these emotions from facial images holds immense potential for various applications, ranging from human-computer interaction to healthcare and entertainment.

In recent years, significant advancements in deep learning and convolutional neural networks (CNNs) have revolutionized the field of facial emotion classification. These technologies have enabled computers to not only recognize basic facial expressions such as happiness, sadness, anger, fear, surprise, and disgust, but also to capture nuanced emotional states, making human-computer interactions more natural and empathetic.

The process of facial emotion classification involves a series of steps that transform raw facial image data into meaningful emotional insights. By analyzing key facial features, patterns, and contextual cues, a well-trained model can infer the emotional state of an individual and provide appropriate responses or actions.

Key challenges in facial emotion classification include dealing with variations in lighting conditions, pose, occlusions, and individual differences in facial anatomy. Researchers and practitioners in this field continually strive to improve the robustness and accuracy of emotion classification models, leading to innovations that have the potential to reshape the way we interact with technology and understand human behavior.

In this exploration of the facial emotion classification process, we delve into the methodologies, techniques, and technologies that enable computers to interpret and respond to human emotions based on facial expressions. Through a combination of data preprocessing, feature extraction, deep learning, and model evaluation, we unlock the

ability to decipher the rich tapestry of emotions that humans convey through their faces. As we uncover the intricacies of this process, we gain insight into the potential applications and implications of facial emotion classification across various domains, ultimately contributing to more empathetic and intuitive interactions between humans and machines.

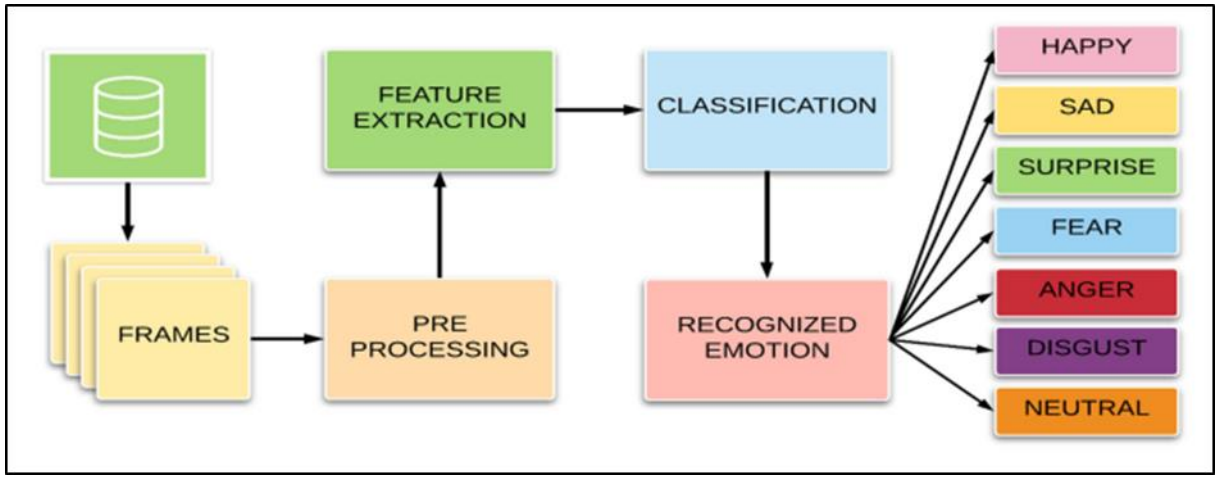
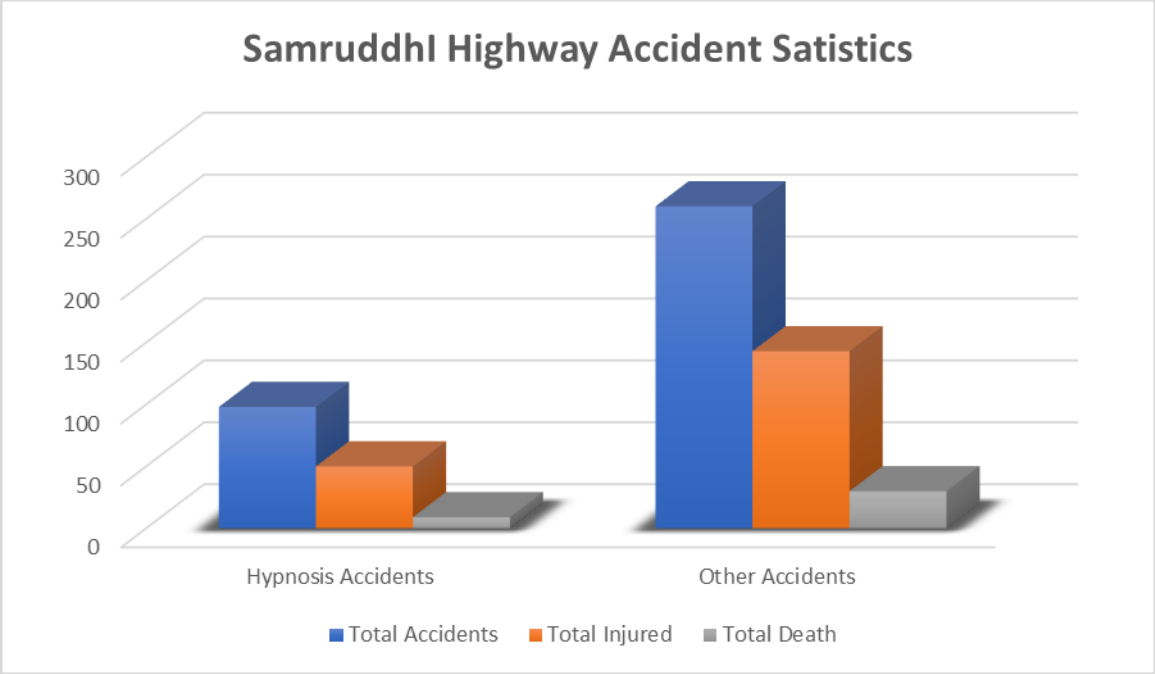


Fig. Classification of Facial Emotion Process.

2. Driving Hypnosis –

Samruddhi Mahamarga, a vital thoroughfare connecting regions and facilitating economic growth, has been a significant driver of progress. However, with the expansion of road networks and increased vehicular traffic, the issue of road safety has come to the forefront. This statistical analysis focuses on understanding the impact of road hypnosis and other contributing factors on accidents occurring along Samruddhi Mahamarga.



3. Driver Behavioural Categorization.

Driver behavior plays a pivotal role in road safety and traffic management. Categorizing driver behavior allows us to understand and address potential risks and issues on the road. In this analysis, we will categorize driver behavior into four distinct types: Abnormal, Aggressive, Line Deviation, and Vehicle Stopping. Each category provides insights into different aspects of driver conduct, contributing to a comprehensive understanding of road dynamics.

1. Abnormal Behavior:

Abnormal driver behavior encompasses actions that deviate significantly from expected norms and pose a potential risk to road safety. This category includes behaviors such as sudden lane changes without signaling, abrupt braking, erratic acceleration, and unusual driving patterns. Abnormal behavior may indicate distracted driving, impairment, or lack of awareness, and it warrants attention to prevent accidents and maintain a smooth traffic flow.

2. Aggressive Behavior:

Aggressive driving involves behaviors that display hostility, impatience, or a disregard for traffic rules. This category includes tailgating, excessive speeding, weaving in and out of traffic, aggressive gestures, and road rage. Aggressive drivers create an unsafe environment for themselves and others on the road, increasing the likelihood of collisions and road conflicts.

3. Line Deviation Behavior:

Line deviation behavior refers to actions where drivers fail to maintain their lane or repeatedly cross lane boundaries without valid reasons. This behavior can be caused by driver fatigue, distraction, or impairment. Line deviation can disrupt traffic flow, increase the risk of side collisions, and compromise overall road safety.

4. Vehicle Stopping Behavior:

Vehicle stopping behavior involves abrupt or unexpected stops on the road, which can be hazardous to following vehicles. This category includes sudden stops without proper signaling, stopping in non-designated areas, or halting in the midst of traffic. Vehicle stopping behavior can lead to rear-end collisions, traffic congestion, and road hazards.

Methodology:

1. To categorize driver behavior into these four types, a combination of sensor data, video analysis, and machine learning algorithms can be employed. Here's an overview of the process:

2. Data Collection: Collect data from vehicle sensors, cameras, and other sources to capture driver actions, vehicle dynamics, and road context.

3. Feature Extraction: Extract relevant features from the data, such as speed, acceleration, lane position, and braking patterns.

4. Model Training: Train machine learning models (e.g., decision trees, neural networks) using labeled data to classify driver behavior. Labeled data can be obtained through manual annotation or automated algorithms.

5. Behavior Classification: Apply the trained models to real-time data to classify driver behavior into the predefined categories.

6. Alert Generation: Generate alerts or warnings for specific behaviors detected in real-time, providing feedback to the driver and alerting traffic management systems.

7. Data Analysis: Analyze aggregated data over time to identify trends, hotspots of specific behavior types, and potential correlations with road conditions or other external factors.

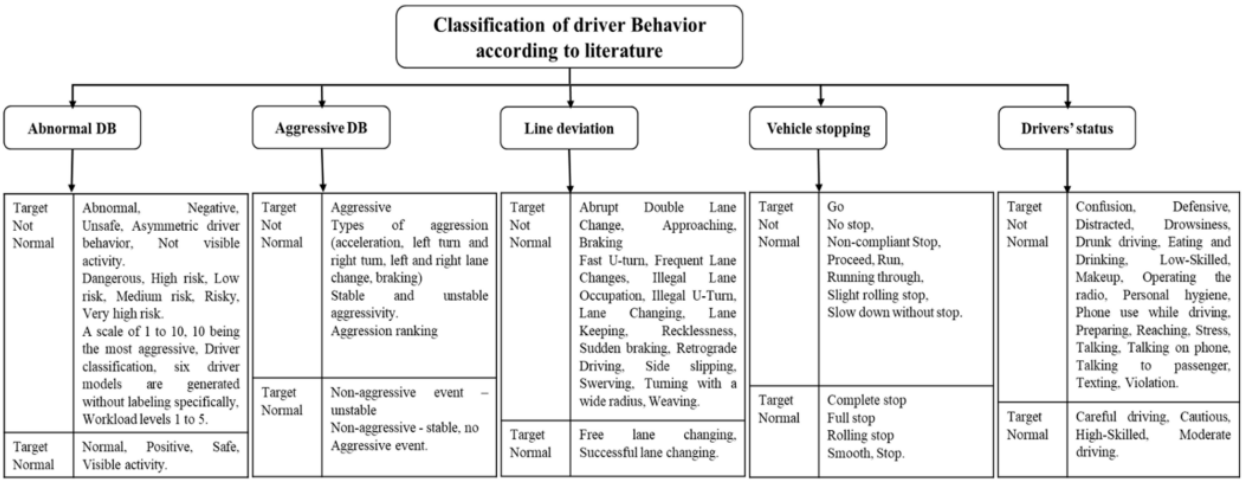
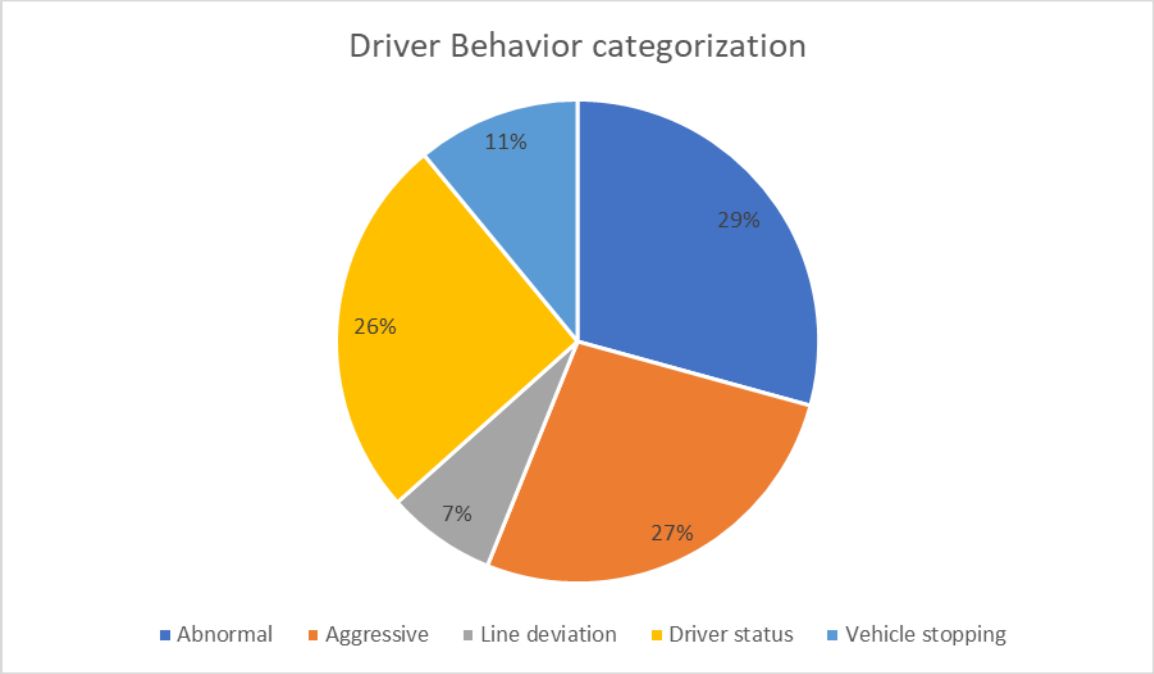


Fig. Classification of Driver Behavior according to Literature



6.1 Proposed System Architecture

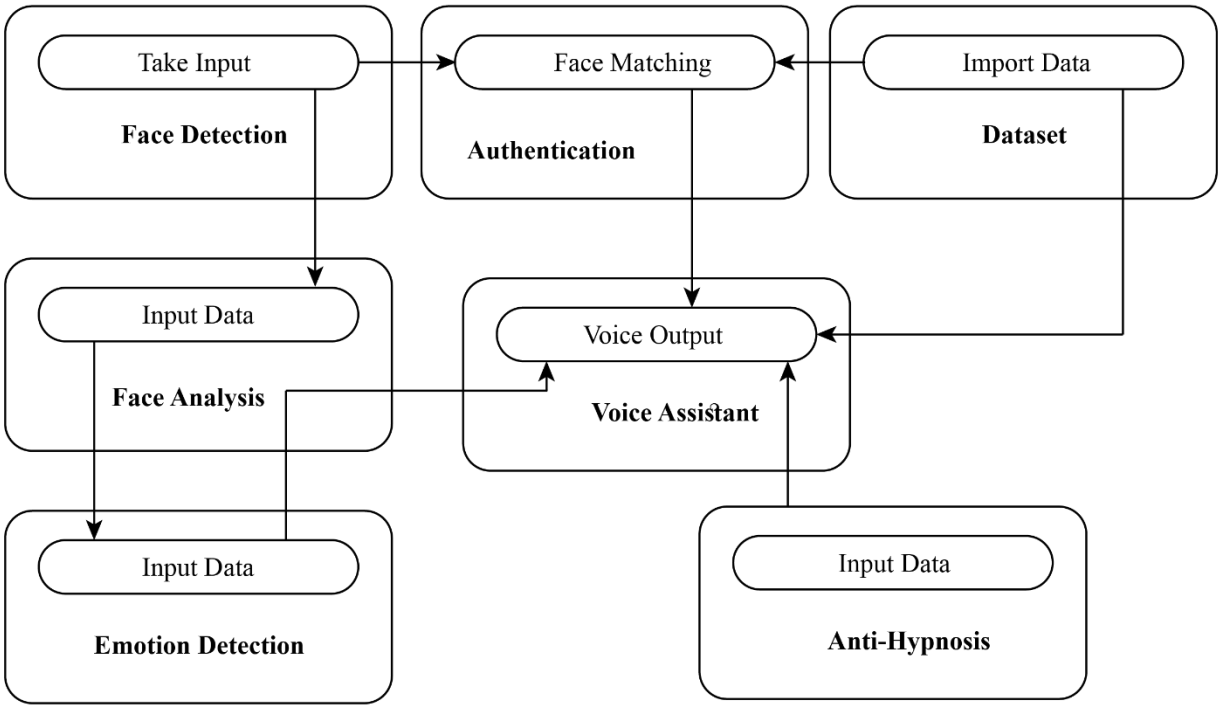


Fig. Architecture of Auto Sentinel System

7. Methodology

Module 1: Face Detection

Face is Detected using cameras and data send to the authentication system.

Module 2: Authentication System

Face Data is Fetched from database of user to match it with newly detected data from face detection if the data matched with dataset's data then it will be authenticated successfully, otherwise error/message will be spoken through the voice assistant

Module 3: Face Analysis

Face is related through the camera and data is processed in Emotion detection to perform operation related to the Emotion.

Module 4: Emotion Detection

Data is Analyzed in Emotion detection and passed a voice command/message to the user based on emotion that user has on face.

Module 4: Anti-Hypnosis

If the Driver is Driving more than 2.5hr then some error/warning message will be Given through the voice assistant

Module 4: Voice Assistant

Voice Assistant will Assist the user as per the given input or analyzed data.

8. Scope

Scope for Project AutoSentinel envisions a comprehensive ecosystem where advanced technologies converge to redefine driver safety, authentication, and emotional well-being. By continuously innovating and adapting to emerging trends, AutoSentinel aims to make driving not only safer but also more enjoyable and emotionally enriching for all users.

9. Requirements

Hardware Requirements:

- **Processor:** Intel Core i3 or Above

- **RAM :** 2 GB DDR3/4 Minimum
- **Hard disk :** 150 GB and above

Software Requirements:

- **Operating system :** Windows 7/10/11
- **Programming Language :** Python

Raspberry Pi Requirement's:

- Raspberry Pi (e.g., Raspberry Pi 4 Model B)
- Camera Module (e.g., Raspberry Pi Camera Module)
- Power Supply for Raspberry Pi
- MicroSD Card (16GB or larger) with Raspbian OS

10. References

[1] Soukaina Bouhsissin , Nawal Sael , and Faouzia Benabbou Laboratory of Information Technology and Modeling, Faculty of Sciences Ben M'Sick, Hassan II University of Casablanca, Casablanca 20000, Morocco[IEEE]

[2] Chirag Dalvi, Manish Ratho, Shruti Patil, Shilpa Gite and Ketan Kotecha Symbiosis Centre for Applied Artificial Intelligence (SCAAI), Symbiosis International University (Deemed University), Pune 412115, India

Computer Science and Information Technology Department, Symbiosis Institute of Technology, Symbiosis International University (Deemed University), Pune

412115, India[IEEE]

[3] Peng Cheng And Utz Roedig - School of Cyber Science and Technology and the Key Laboratory of Blockchain and Cyberspace Governance of Zhejiang Province, Zhejiang University, Hangzhou 310007, China (e-mail: peng_cheng@zju.edu.cn)

School of Computer Science and Information Technology (CSIT), University College Cork, Cork, T12 YN60 Ireland (e-mail:u.roedig@cs.ucc.ie)

[4] 2018 IEEE International Conference on Vehicular Electronics and Safety (ICVES) DOI: 10.1109/ICVES.2018.8519595

[5] Sensors (Basel). 2023 Apr; 23(7): 3404. Published online 2023 Mar 23. doi: 10.3390/s23073404 A Recognition Method for Road Hypnosis Based on Physiological Characteristics

Date:

Place: Ichalkaranji.

Student	Guide
Mr. Tushar Sadashiv Neje	**Mr. A. S. Salavi (Kumbhar)**
Miss. Neha Rajgonda Patil	
Mr. Sandesh Gajendra Pol	
(Computer Science and Engineering)	

H.O.D	Principal