Machine Learning based driver assistant system to reduce road accidents

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Project Proposal Report

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Declaration

We declare that this is our own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

.......Ravi....... ....16/08/2024.......

Signature of the supervisor Date

(Mr. Ravi Supunya)

Abstract

Road safety is a big concern in Sri Lanka because there are many traffic accidents and deaths. Even though the government has tried to improve safety, the main problems like how drivers behave, how well they follow road signs, and how they stay in their lanes still need more attention. Our research looks at how drivers react to different road conditions, how they read and follow road signs, and how accurately they park. We studied data from a certain period to understand these issues better and find ways to make the roads safer.

One of the main problems we found is that many drivers in Sri Lanka drive recklessly and don't follow the rules. Drivers often ignore road signs, don't stay in their lanes, and cut across lanes without thinking about other vehicles. These dangerous habits are made worse by poor driver education and weak enforcement of traffic laws. For example, it's common to see drivers not using signals when changing lanes, or parked vehicles blocking lanes, which makes driving more dangerous.

Another issue is that road signs are often unclear or not followed properly. Some drivers don't know what the signs mean, or they simply ignore them, which leads to unsafe driving. Additionally, road signs and lane markings are not always visible or clear, making it harder for drivers to stay in their lanes and navigate safely. This shows that there is a need for better driver education and improved road signs to help drivers make safer choices.

To help with these problems, we are creating a driving assistant application. This app will include features like a virtual instructor that gives drivers real-time advice on how to drive safely. It will also have warnings when drivers are about to leave their lane, blind spot detection to avoid crashes, and systems to help drivers stay safe on the road. By using this technology, we aim to improve driver awareness, encourage better driving habits, and reduce the number of accidents in Sri Lanka. Our goal is to make driving safer for everyone through a combination of education and advanced tools.

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Table 1 - List of Abbreviations

CNN	Convolutional Neural Network
MFCC	Mel-Frequency Cepstral Coefficients
QA	Quality Assurance
DAS	Driver Assistant System
AI	Artificial Intelligence

1. INTRODUCTION

1.1 Background

Driving safely is very important, especially in places where there are many traffic accidents. To help improve safety and security, we are introducing a driver identification and vision monitoring system. This system uses a camera installed inside the vehicle that faces the driver. The camera captures the driver's face and checks it against driver profiles stored in a database. This way, the vehicle can make sure that the right person is driving. The system doesn't just rely on facial recognition. It also includes a microphone inside the vehicle to capture the driver's voice. This voice data is compared with the biometric information stored in the driver's profile. If the voice matches, it confirms the driver's identity. If the system detects an unauthorized driver, it immediately sends a security alert to the vehicle owner, adding another layer of protection to prevent unauthorized use.

Once the driver is verified, the system continues to monitor the driver's behavior while they are driving. The camera keeps an eye on the driver's face and checks where they are looking. If the driver looks away from the road for too long, the system will issue a warning. This feature helps remind drivers to stay focused on the road, reducing the chances of getting distracted by other activities while driving.

The main goal of this system is to ensure that drivers are always paying attention while driving. By monitoring their face and eye movements, the system can catch when a driver is not focused, such as when they are looking at something inside the car or outside the road. This helps to keep the driver's attention on the road, making it safer for everyone.

In conclusion, this driver identification and vision monitoring system not only boosts the security of the vehicle by ensuring only authorized drivers can operate it, but it also promotes safer driving. By keeping drivers focused on the road and alerting them when they are distracted, this system aims to reduce the risk of accidents and enhance overall road safety.

1.2 Literature Review

Driver identification and vision monitoring systems have become increasingly important for improving both vehicle security and road safety. By verifying that only authorized drivers are operating the vehicle and monitoring drivers' focus on the road, these systems can prevent accidents caused by distraction, drowsiness, and unauthorized vehicle access. However, existing research often treats driver identification and vision monitoring separately, limiting the overall effectiveness of these solutions. The integration of these functions into a single system can significantly enhance safety and security.

Recent studies have focused on driver monitoring systems that detect signs of distraction or drowsiness. For instance, Shi et al. [1] reviewed various driver monitoring systems designed to assess a driver’s attention and state of alertness, such as systems that detect signs of drowsiness or distraction. However, these systems often do not address the issue of verifying whether the correct driver is behind the wheel. Similarly, Ghosh and Ghosh [2] developed a machine learning-based approach to detect distracted driving behaviors, but their system did not verify the identity of the driver, which is essential for security and personalized feedback.

Driver identification systems using biometrics, such as facial recognition or voice authentication, have been explored extensively. Cortes and Vapnik [3] introduced the use of Support Vector Machines (SVMs) for facial recognition, which can be effective for verifying a driver's identity. However, these systems are generally implemented at the beginning of a journey and do not continuously monitor the driver's identity throughout the trip. Eriksson and Kumar [4] further explored the use of face and speaker recognition for continuous driver verification, improving security by continuously confirming the identity of the driver.

The use of deep learning in driver monitoring has gained popularity in recent years. Gunes and Piccardi [5] discussed temporal segment detection and affect recognition from facial and body displays, which could be used to monitor a driver's emotional state, such as stress or anger. Additionally, Li et al. [6] developed a deep learning model that uses convolutional neural networks (CNNs) for facial recognition, showing promise in identifying drivers under challenging conditions, such as low lighting or

facial obstructions. Chen et al. [7] combined driver identification and vision monitoring using deep learning, creating a more integrated system that significantly improved performance.

Despite advancements in these technologies, challenges remain, particularly in terms of real-world reliability. Biedert et al. [8] explored using infrared cameras for driver identification, addressing issues related to low visibility. Similarly, Abate et al. [9] investigated the use of biometric techniques, such as facial thermography, to enhance driver identification accuracy in challenging conditions. These techniques are promising but require further refinement to ensure reliability across various environments.

Research has also shown the benefits of multimodal systems that integrate various biometric data for enhanced security. Wu et al. [10] proposed a multimodal biometric system that combines facial recognition, voice authentication, and fingerprint scanning, offering more robust driver identification. Similarly, Abdallah et al. [11] used deep learning techniques to integrate facial and speech recognition for continuous driver verification, improving the reliability of the system.

Moreover, advancements in the field of driver behavior prediction have added another dimension to road safety. Kang et al. [12] investigated the use of driver behavior data combined with biometric data to predict unsafe driving patterns, which can complement traditional driver monitoring systems. This predictive approach, using machine learning, could potentially allow systems to anticipate risky behaviors before they occur. Lee et al. [13] also examined combining physiological data, such as heart rate and skin conductance, with biometric systems to provide a more comprehensive understanding of the driver's state. These physiological measurements can enhance both driver identification and monitoring by providing additional layers of information.

The evolution of sensor technologies has further expanded the capabilities of driver identification and vision monitoring systems. Zhou et al. [14] demonstrated the integration of various in-vehicle sensors with biometric systems to enhance the accuracy of driver identification and behavior monitoring. Their work highlights the potential of combining sensor data with machine learning algorithms to develop more advanced and reliable systems. Similarly, Karatas et al. [15] explored the use of wearable sensors that monitor drivers' physical conditions, such as fatigue and stress levels, integrating these data with existing vision monitoring and biometric systems.

In conclusion, while significant progress has been made in the areas of driver identification and vision monitoring, challenges remain in developing systems that perform reliably in real-world conditions. By integrating continuous driver verification with real-time vision monitoring and incorporating additional biometric data and sensor technologies, future systems can significantly enhance road safety and vehicle security. These integrated solutions can ensure that the authorized driver remains focused on the road, reducing the likelihood of accidents caused by distraction, drowsiness, or unauthorized access.

1.3 Research Gap

Despite advancements in driver assistance technologies, a critical gap remains in integrating driver identification with vision monitoring systems. Current research has either focused on identifying drivers or monitoring their attention, but these aspects are often treated separately, limiting the overall effectiveness of the systems in enhancing road safety.

For example, Shi et al. [1] developed methods to monitor driver attention, particularly focusing on drowsiness and distraction detection. However, these systems do not include a mechanism for continuous driver identity verification, making them vulnerable to unauthorized vehicle use. While they ensure that the driver remains attentive, they do not verify if the correct driver is operating the vehicle throughout the journey, which poses a significant security risk.

Similarly, Ghosh and Ghosh [2] tackled distraction detection using machine learning, but their work does not address verifying the driver's identity. Without continuous verification, it becomes difficult to ensure that the driver has not changed mid-journey or that an unauthorized individual hasn't taken over the vehicle.

Identification methods such as facial recognition, as discussed by Cortes and Vapnik [3], primarily focus on initial authentication but fall short of continuous monitoring. Once the initial verification is complete, the system does not track if the same driver remains in control, leading to potential security gaps. These systems also struggle with real-time monitoring challenges, including variations in environmental conditions, facial expressions, or obstructions.

Eriksson and Kumar [4] explored the potential of continuous face and speaker recognition, but these systems still face long-term reliability challenges, especially in maintaining high accuracy across different environmental conditions. This underscores the need for a more robust, integrated solution that combines continuous driver identification with real-time vision monitoring to ensure that both the authorized driver remains in control and their focus stays on the road.

The proposed Driver Identification & Vision Monitoring system aims to bridge this gap by continuously verifying the driver's identity while simultaneously monitoring their vision to prevent unauthorized driving and enhance road safety. This integration addresses the limitations of current systems, ensuring both security and safety. The system also overcomes challenges related to sensor fusion, high-performance computing needs, and environmental factors like lighting and weather conditions.
Furthermore, the lack of standardized protocols for integrating identification and monitoring systems complicates development efforts. Current solutions are often proprietary, making widespread adoption difficult. The proposed system seeks to contribute to developing such standards, enabling broader implementation across various vehicle models and environments.

Table 2 - Research Gap

Feature	Existing Solutions	Proposed System
Driver Identification	Initial verification only, no continuous monitoring after start of the journey [1] [3].	Continuous driver identity verification using facial and voice recognition.
Vision Monitoring	Detects driver distraction or drowsiness [1] [2] [16], no integration with identity verification.	Real-time vision monitoring integrated with identity verification.
System Integration	Separated identity verification and vision monitoring [4].	Fully integrated system combining identity verification and vision monitoring.
Security	Lacks real-time driver verification during the journey [3].	Prevents unauthorized driving by continuously verifying the driver's identity.
Environmental Challenges	Struggles with real-time operation under varying conditions like lighting and weather [16].	Robust real-time operation designed to handle various environmental conditions.
Standardization	Proprietary systems, lacking universal standards for integration [4].	Contributes to the development of standardized protocols for broader adoption.
Real-Time Reliability	Challenges with real-time continuous monitoring [4].	Optimized for real-time continuous monitoring with high accuracy.

1.4 Research Problem

The basic investigate issue tended to by the Driver Identification & Vision Monitoring component is the squeezing require for coordinates frameworks that can both ceaselessly confirm the personality of the driver and screen their consideration to the street. Current drivers help innovations tend to treat these two functions driver recognizable proof and driver consideration monitoring separately. This division can lead to potential security vulnerabilities, as well as security issues. For case, whereas a few frameworks might viably confirm the driver's character at the starting of a trip, they may come up short to persistently screen whether the same individual remains in control of the vehicle all through the travel. On the other hand, frameworks centered on checking driver consideration may ignore the basic security viewpoint of guaranteeing that the individual driving the vehicle is in fact authorized to do so.

This crevice between nonstop character confirmation and consideration observing can lead to a few dangers. Unauthorized driving becomes a noteworthy concern, especially in scenarios including shared vehicles, car rentals, or armadas where different drivers may get to the same vehicle. The need for nonstop confirmation can moreover decrease the adequacy of driver help frameworks, as these advances depend on the suspicion that the driver remains the same all through the travel. Within the occasion of unauthorized access, these frameworks might be rendered incapable or indeed counterproductive. Besides, occupied or oblivious driving postures are a genuine security hazard, contributing to an expanded probability of mischances, particularly in situations where activity teach is conflicting or laws are not entirely implemented.

This issue is especially basic within the setting of Sri Lanka's driving environment. In Sri Lanka, challenges such as rash driving, destitute path teach, and conflicting authorization of activity laws compound the dangers related with occupied driving and unauthorized vehicle operation. The combination of these variables creates a perilous circumstance on the streets, where both security and security are compromised. A comprehensive framework that coordinates both driver recognizable proof and real-time vision checking might play a significant part intending in these challenges.

By creating an arrangement that ceaselessly confirms the character of the driver and at the same time screens their consideration to the street, the proposed Driver Recognizable proof & Vision Checking framework points to upgrade both security and street security in a cohesive way. This framework would not as it was anticipating unauthorized people from working the vehicle but would moreover effectively bolster the driver in keeping up center on the street. The double usefulness of this coordinate's framework is outlined to relieve the dangers of unauthorized driving, diminish the chances of mishaps caused by diversion or carelessness, and eventually make a more secure driving environment for everybody.

In expansion, this approach adjusts with broader worldwide patterns in car security and security, where there's an expanding accentuation on creating savvy frameworks that go past conventional driver help innovations. By tending to both security and security concerns in a coordinate's way, the framework points to set a modern standard for driver help innovations, especially in locales like Sri Lanka where street security remains a critical concern.

The key objective of this venture is to construct a progressed framework that ceaselessly confirms the character of the driver while checking their consideration to the street in real-time. This framework is planned to handle two major concerns in driving:

guaranteeing that as authorized drivers can work the vehicle and making beyond any doubt that the driver remains centered on the street. By always checking the driver's personality and following their vision and consideration, the framework makes a difference anticipating unauthorized utilize of the vehicle, lessening the hazard of robbery or abuse. At the same time, the framework effectively works to keep the driver caution and mindful, which altogether brings down the chances of mishaps caused by diversion or inattentiveness. This dual-purpose approach combines security and security into one cohesive arrangement, making driving more secure and more secure for all street clients.

2. OBJECTIVES

2.1 Main Objective

The key objective of this venture is to construct a progressed framework that ceaselessly confirms the character of the driver while checking their consideration to the street in real-time. This framework is planned to handle two major concerns in driving guaranteeing that as it were authorized drivers can work the vehicle and making beyond any doubt that the driver remains centered on the street. By always checking the driver's personality and following their vision and consideration, the framework makes a difference anticipating unauthorized utilize of the vehicle, lessening the hazard of robbery or abuse. At the same time, the framework effectively works to keep the driver caution and mindful, which altogether brings down the chances of mishaps caused by diversion or inattentiveness. This dual-purpose approach combines security and security into one cohesive arrangement, making driving more secure and more secure for all street clients.

2.2 Specific Objectives

- **Continuous Driver Verification**

Execute a vigorous instrument utilizing facial acknowledgment and voice confirmation innovations to persistently confirm the driver's character all through the trip. This objective guarantees that as authorized people can work the vehicle, avoiding unauthorized utilize and progressing by and large vehicle security.

- **Real-Time Attention Monitoring**

Create progressed frameworks to screen the driver's eye developments and head position in real-time. This will help identifying when the driver's consideration is occupied from the street. By giving alarms and notices, the framework points to keep drivers centered and diminish the chance of mischances caused by diversions.

- **Security Alert System**

Plan and actualize a security component that informs the vehicle proprietor in case an unauthorized driver is identified or on the off chance that critical consideration slips happen. This includes points to supply quick cautions and reactions, in this way strengthening vehicle security and guaranteeing convenient mediation in case required.

- **Adaptation to Local Driving Conditions**

Customize the system to address specific driving challenges prevalent in Sri Lanka, such as reckless driving and poor lane discipline. This adaptation involves incorporating features and adjustments that respond to local driving behaviors and conditions, thereby making the system more effective in the context of Sri Lankan Roads.

3. METHODOLOGY

The method of creating the Driver Identification & Vision Monitoring framework starts with carefully arranging how all the parts of the framework will work together. This incorporates choosing how cameras, mouthpieces, and program programs will connect to each other to form beyond any doubt the framework works well. We'll begin by planning graphs that show how each part will connect with the others. These graphs will help direct us in selecting the proper equipment components, like cameras that can take clear pictures of the driver's confront, indeed when the lighting isn't culminate, and mouthpieces that can capture clear voice recordings, indeed when the vehicle is loud. These early steps are significant for making beyond any doubt the framework works easily and effectively once everything is set up.

Once we have a clear arrangement and the design is set, the following step is gathering information. Collecting high-quality information is exceptionally critical for making beyond any doubt the framework can accurately recognize drivers and screen their consideration. We'll collect an expansive sum of information that incorporates facial pictures, voice recordings, and video films of drivers in completely different circumstances. This information will be utilized to prepare the framework to distinguish drivers and screen their behavior in a wide run of real-life driving conditions. We'll moreover make beyond any doubt that the information we collect comes from numerous diverse sorts of drivers. This will help the framework work well for an assortment of individuals, notwithstanding facial highlights, highlights, or any changes in their appearance, like wearing glasses or caps.

After collecting the information, we'll start creating the two fundamental parts of the framework:

the driver distinguishing proof module and the vision observing module. The driver distinguishing proof module will utilize machine learning methods to recognize who is driving the vehicle. This seems to include facial acknowledgment, where the framework looks at the drivers confront to affirm their character, and voice verification, where the framework tunes in to the driver's voice. The objective is to form beyond any doubt that as authorized drivers can begin and work the vehicle. At the same time, the vision checking module will observe the driver's eyes and head developments to distinguish if they are paying consideration to the street. In case the driver looks away or gets occupied, the framework will send a caution to urge their consideration back on the street. Usually imperative for anticipating mishaps caused by occupied driving.

Once these two modules are built, they will be combined into one framework that works in real-time. This coordinates framework will be planned to persistently check who is driving and whether they are remaining centered on the street. In case the framework recognizes an unauthorized driver or takes note that the driver's consideration is meandering, it'll send alerts. These alerts may well be sent through a virtual right hand that talks to the driver, reminding them to center, or through security notices sent to the vehicle owner's phone. This integration will be key to making beyond any doubt the framework can keep track of both driver personality and driver consideration, without causing delays or lost critical cautions.

With the framework built, the following stage is testing. To begin with, we are going test the driver identification and vision checking modules independently. We'll mimic diverse driving conditions to see how well the framework works in different scenarios, such as when it's dim or when the driver is wearing shades. These tests will help us discover any shortcomings within the framework and fix them some time recently moving on to real-world testing. After testing each portion of the framework, we are going put the whole system together and test it in real vehicles. These tests will be taken in numerous driving situations, like city lanes, interstates, and indeed amid awful climate, to create beyond any doubt the framework works well in all sorts of conditions.

An imperative portion of the testing stage is making beyond any doubt the framework can react to security dangers. For illustration, on the off chance that somebody who isn't authorized tries to drive the vehicle, the framework ought to identify this and send an alarm to the vehicle proprietor. We'll too test how well the framework can keep track of the driver's consideration over long periods, as drivers might gotten to be more diverted or tired the longer, they drive. By testing the framework beneath numerous distinctive conditions, able to guarantee it is dependable and viable in keeping both the driver and others on the road secure. At long last, after the framework is completely tried and all the components are working accurately, we'll archive the whole prepare. This documentation will incorporate nitty gritty reports on how the framework performed amid testing, any issues we experienced, and how we settled them. This data will be exceptionally valuable for moving forward the framework within the future and for exploring commercial applications of the innovation. The documentation will moreover highlight zones where the framework may be improved, such as by including modern highlights or progressing existing ones.

Generally, the advancement of the Driver Distinguishing proof & Vision Monitoring system will include a few key steps, from planning the system architecture to collecting information, building and joining the modules, and altogether testing the complete framework. By taking after this systematic approach, we point to form a dependable framework that can essentially make strides both vehicle security and street security.

Figure 1 - Driver's vision detecting

3.1 Requirement Analysis

Hardware Components:

- **Camera**

A high-resolution camera is introduced interior the vehicle, deliberately situated to center on the driver's confrontation. Its essential work is to capture clear and nitty gritty pictures of the driver's confrontation, which are vital for facial acknowledgment. The camera works persistently whereas the vehicle is in utilize, guaranteeing that it can always screen the driver’s personality. Furthermore, it adjusts to different lighting conditions interior the vehicle, such as moon light amid night driving or shinning daylight amid the day, to guarantee precise picture capture beneath any circumstances.

- **Microphone**

The framework is prepared with a mouthpiece, introduced interior the vehicle, which is planned to capture the driver's voice. This amplifier plays a key part in voice verification, where the framework employs the driver's voice as an extra layer of personality confirmation. The receiver is touchy sufficient to choose up clear voice recordings, indeed with foundation commotion such as the motor or activity. This guarantees that the framework can precisely analyze voice designs and confirm the driver, including the general security of the vehicle.

- **Processing Unit**

At the center of the framework may be a effective preparing unit, which acts like a little computer introduced interior the vehicle. This unit is mindful for handling all the information collected by the camera and amplifier in real-time. It runs machine learning calculations that analyze facial highlights and voice designs to confirm the driver's character. The handling unit moreover oversees other assignments, such as observing the driver's consideration and activating alarms when fundamental. It is optimized for proficiency, guaranteeing that it can handle the tall computational requests of real-time information preparing without abating down or influencing the execution of the vehicle's other frameworks.

Software Components:

- **Machine Learning Algorithms**

The software side of the system uses machine learning to make sense of the data collected by the cameras and microphones. For recognizing the driver's face, the system uses a type of machine learning called CNN. CNN is a powerful tool that is great at recognizing images, such as faces. The camera takes a picture of the driver's face, and the CNN compares that picture to the facial images stored in the system’s database. If the faces match, the system confirms that the driver is authorized to use the vehicle. For verifying the driver’s voice, the system uses another set of techniques. One key technique is called MFCC. MFCC is useful because it can break down the voice into its basic features, making it easier for the system to analyze the voice characteristics. The microphone records the driver’s voice, and then the system uses MFCC, along with other machine learning methods, to compare the recorded voice with the voice samples saved in the system. If the voices match, the system verifies that the driver is the right person.

- **Vision Monitoring**

This part of the system is designed to monitor the driver's eye movements, ensuring that they stay focused on the road. If the system notices that the driver's eyes are drifting away from the road for example, if the driver is looking down at a phone or glancing away for too long it will immediately trigger an alert. This alert serves as a reminder for the driver to refocus their attention on driving. The eye-tracking system works by continuously analyzing the driver's eye position and movements in real-time. Cameras inside the vehicle capture the driver’s face, and the software uses these images to detect where the driver’s eyes are pointing. Over time, these algorithms can learn from different driving situations and improve their accuracy, making the system more effective at detecting distracted driving. In addition to monitoring the driver’s eyes, the system may also track the driver’s head position to further ensure that they are paying attention. The goal is to reduce the chances of accidents caused by distracted driving by keeping the driver’s eyes and attention to where they should be on the road.

3.2 Feasibility Study

- **Technical Feasibility**

The Driver Identification & Vision Monitoring system is technically feasible because it builds on established technologies. Facial recognition and voice authentication are well-developed areas, with proven success in various applications. The system will use Convolutional Neural Networks (CNNs) for facial recognition, which have already shown high accuracy in many other systems. CNNs are particularly good at identifying faces, even when the images are not perfect. Similarly, voice authentication using machine learning has been effectively used in security systems worldwide. This makes the technology choice for your project reliable and achievable. However, the system must perform well in real-world conditions, which can be challenging. These challenges include,

1. ***Varying Lighting***

The system must work in both bright daylight and dim lighting.

2. ***Background Noise***

The microphone must distinguish the driver's voice from other noises in the car.

3. ***Facial Obstructions***

The system needs to recognize faces even when the driver is wearing sunglasses, masks, or other items that might cover their face.
To overcome these challenges, the system will be trained on a diverse set of data, which includes different lighting conditions, noises, and driver behaviors. By doing this, the system will become more reliable and accurate, ensuring it works effectively in Sri Lanka's driving environments.

- **Economic Feasibility**

From an economic standpoint, the system is feasible because it leverages widely available and affordable technologies. High-resolution cameras and microphones are cost-effective and can be easily obtained without significantly impacting the project budget. The computing power needed to process the data in real-time is also within reach, thanks to modern, efficient hardware.

The main economic concern is the cost of developing the software, specifically the machine learning models. However, this cost can be managed by using existing frameworks like TensorFlow or PyTorch, which are open-source and widely supported. These frameworks allow the development team to build and fine-tune the machine learning models without starting from scratch, saving both time and money.

- **Schedule Feasibility**

In terms of schedule, the project is feasible within a reasonable timeframe. The development process can be broken down into distinct phases:

1. ***Design and Planning***

This initial phase involves creating the system architecture and setting up the development environment. It will take a few weeks.

2. ***Data Collection and Model Training***

Collecting the necessary data and training the models might take a couple of months, depending on the complexity of the dataset.

3. ***Software Development and Integration***

Developing the software components, integrating them with the hardware, and conducting initial tests will require a few more months.

4. ***Testing and Refinement***

Extensive testing in real-world scenarios, followed by adjustments, might take another few months.

3.3 Implementation

- **Development & Training of CNN for Facial Recognition**

To do this, a large dataset of facial images will be collected. These images will be taken under various conditions, such as different lighting environments, angles, and with potential obstructions like glasses or masks. CNN will be trained using this dataset to learn how to identify and distinguish unique facial features. Once trained, the model will be able to match the captured images of the driver with the profiles stored in the system's database, verifying the driver's identity.

- **Voice Authentication Implementation**

Alongside facial recognition, the voice authentication system will be developed. This system will utilize machine learning techniques to analyze the driver’s voice patterns. Just like with facial recognition, the voice patterns will be compared with the stored profiles in the database. The voice authentication system will ensure an additional layer of security by confirming that the person driving the vehicle matches the voice data associated with the stored profile.

- **Vision Monitoring Integration**

This involves integrating eye-tracking algorithms that continuously monitor the driver’s gaze and head position. The system will be trained to detect when the driver’s eyes move away from the road or when their head turns in a direction that suggests they are not paying attention. If such behaviors are detected, the system will trigger alerts to remind the driver to stay focused on the road, thereby enhancing safety.

3.3.1 System Architecture

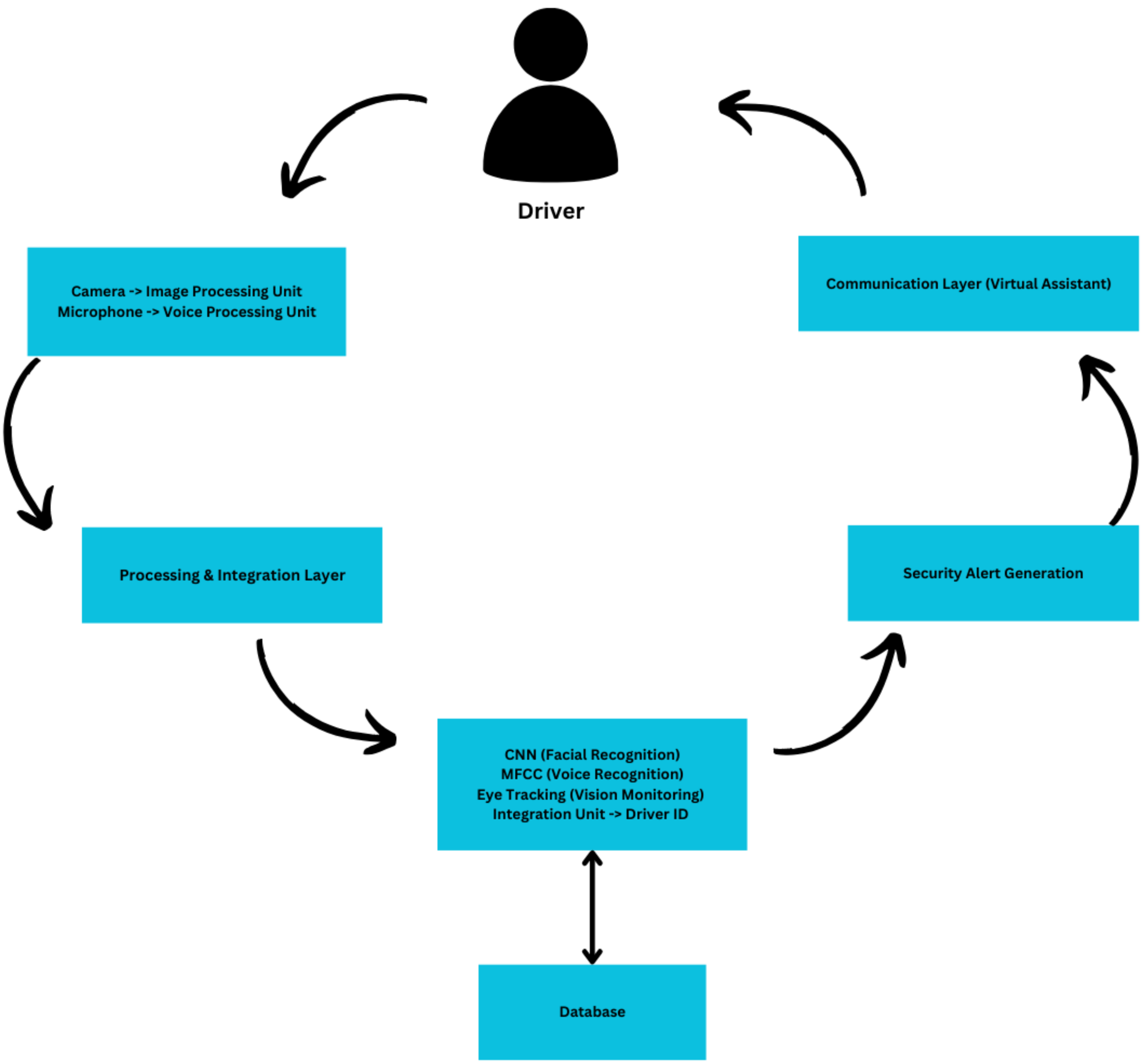

Figure 2 - System Architecture

3.3.2 System Diagram

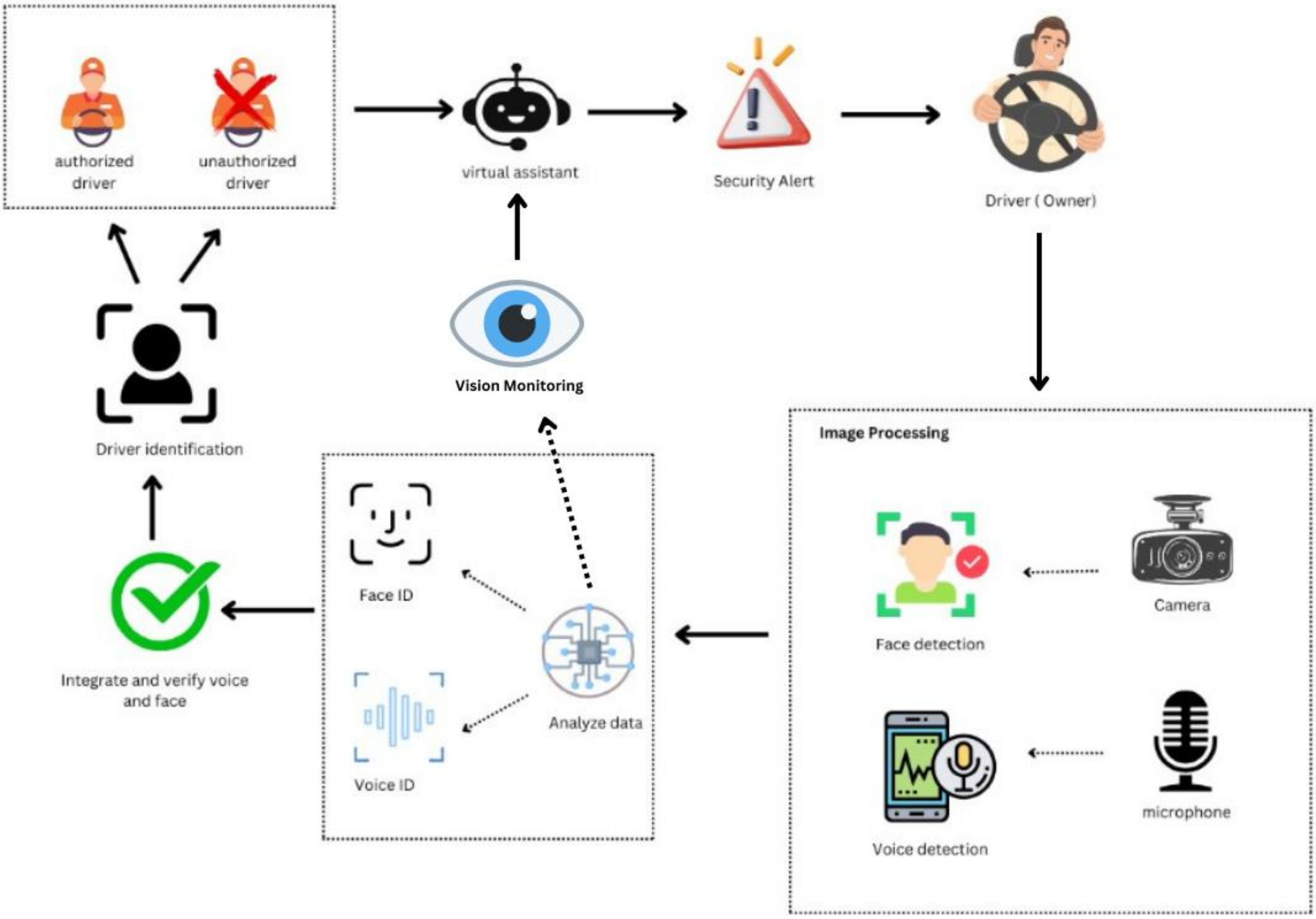

Figure 3 - System Diagram

4. PERSONNEL AND COMMERCIALIZATION

4.1 Personnel

The improvement and execution of the Driver Recognizable proof & Vision Observing framework require a multidisciplinary group of gifted experts. A Venture Director manages the complete venture, guaranteeing convenient and fruitful completion whereas planning between partners and the advancement group. Machine Learning Engineers plan and optimize calculations for facial acknowledgment, voice confirmation, and vision observing, whereas Program Designers coordinated these models into a user-friendly application, taking care of both front-end and back-end improvement. Equipment Engineers are capable for selecting and designing cameras, amplifiers, and preparing units, guaranteeing consistent integration with the program. Information Researchers get ready and analyze expansive datasets to prepare and move forward the framework, whereas Quality Confirmation (QA) Pros thoroughly test the framework to guarantee its vigor and unwavering quality. Security Specialists execute conventions to secure touchy information, such as facial pictures and voice tests, guaranteeing the framework is secure and compliant with information assurance directions. Together, this group guarantees that the Driver Recognizable proof & Vision Observing framework is compelling, secure, and prepared for real-world arrangement.

4.2 Commercialization

- **Enhanced Vehicle Security**

The framework increments vehicle security by guaranteeing that authorized drivers can begin and work the vehicle. This implies that some time recently the car can be driven, the driver's character is checked, either through facial acknowledgment or voice confirmation. This additional layer of security is particularly useful for car rental administrations, companies that oversee huge armadas of vehicles, and proprietors of extravagance or high-value cars. By avoiding unauthorized individuals from utilizing the vehicle, the framework decreases the chances of burglary or abuse, giving vehicle proprietors peace of intellect.

- **Improved Road Safety**

The framework makes a difference make driving more secure by checking the driver's consideration to the street. In case the driver gets diverted or tired, the framework will issue cautions to keep them centered. This could anticipate mischances caused by need of consideration, which makes the streets more secure for everybody. Protections companies might discover this highlight important and seem to offer rebates to drivers who utilize vehicles with this innovation. This is not as if it were advancing more secure driving propensities but moreover makes a modern showcase for such progressed security frameworks, engaging buyers and protections suppliers alike.

- **Market Differentiation**

Car producers can set their vehicles separated from competitors by counting this progressed security and security framework as a standard included. Safety-conscious buyers would be more pulled into vehicles that come prepared with these cutting-edge innovations, giving producers a competitive advantage within the car showcase. Advertising such inventive highlights may upgrade the brand's notoriety and make it a favored choice among customers who prioritize security and security.

- **Fleet Management Optimization**

For businesses that oversee huge armadas of vehicles, such as conveyance companies or taxi administrations, the framework can give profitable data approximately how drivers are performing. The information collected on driver behavior and execution can help businesses make strides driver preparing, arrange more proficient courses, and diminish the number of mishaps. By doing so, companies can spare cash on fuel, vehicle upkeep, and protections costs, whereas too progressing in general operational productivity.

- **Monetization Opportunities**

The framework produces riches of information, counting designs of driver behavior and vehicle utilization. This data can be important to third parties, such as protections companies, analysts, or driving schools, who seem to utilize it for different purposes, like making strides security or considering driving propensities. By anonymizing this information to secure the drivers' security, it can be sold to these organizations, making an extra source of income for the system's engineers or proprietors.

- **Aftermarket Sales**

There's critical potential for offering this framework to individuals who as of now claim vehicles. By advertising it as an add-on that can be introduced in existing cars, producers and benefit suppliers can tap into the aftermarket, opening new revenue opportunities. In conjunction with offering the framework, businesses can offer establishment, upkeep, and bolster administrations, making a unused commerce stream centered on updating more seasoned vehicles with present day innovation.

1. WORK BREAKDOWN STRUCTURE

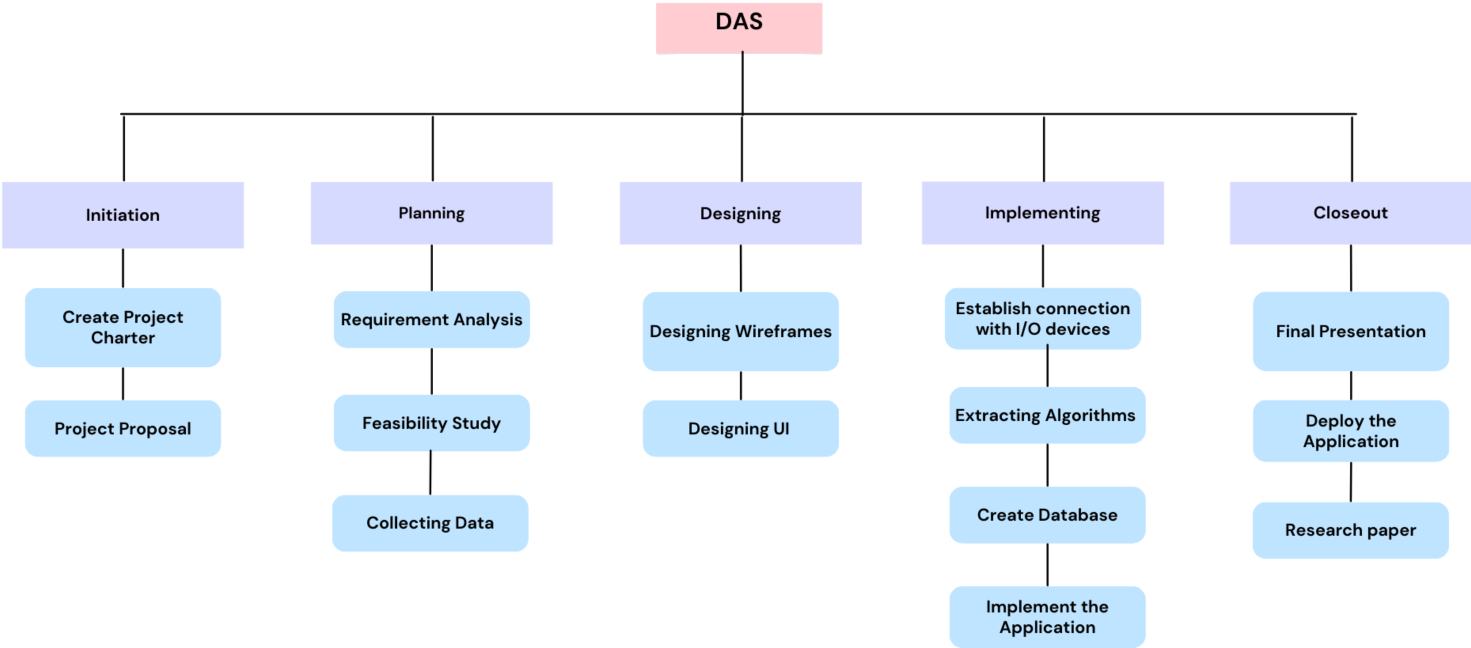

Figure 4 - Work Breakdown Structure

2. GANTT CHART

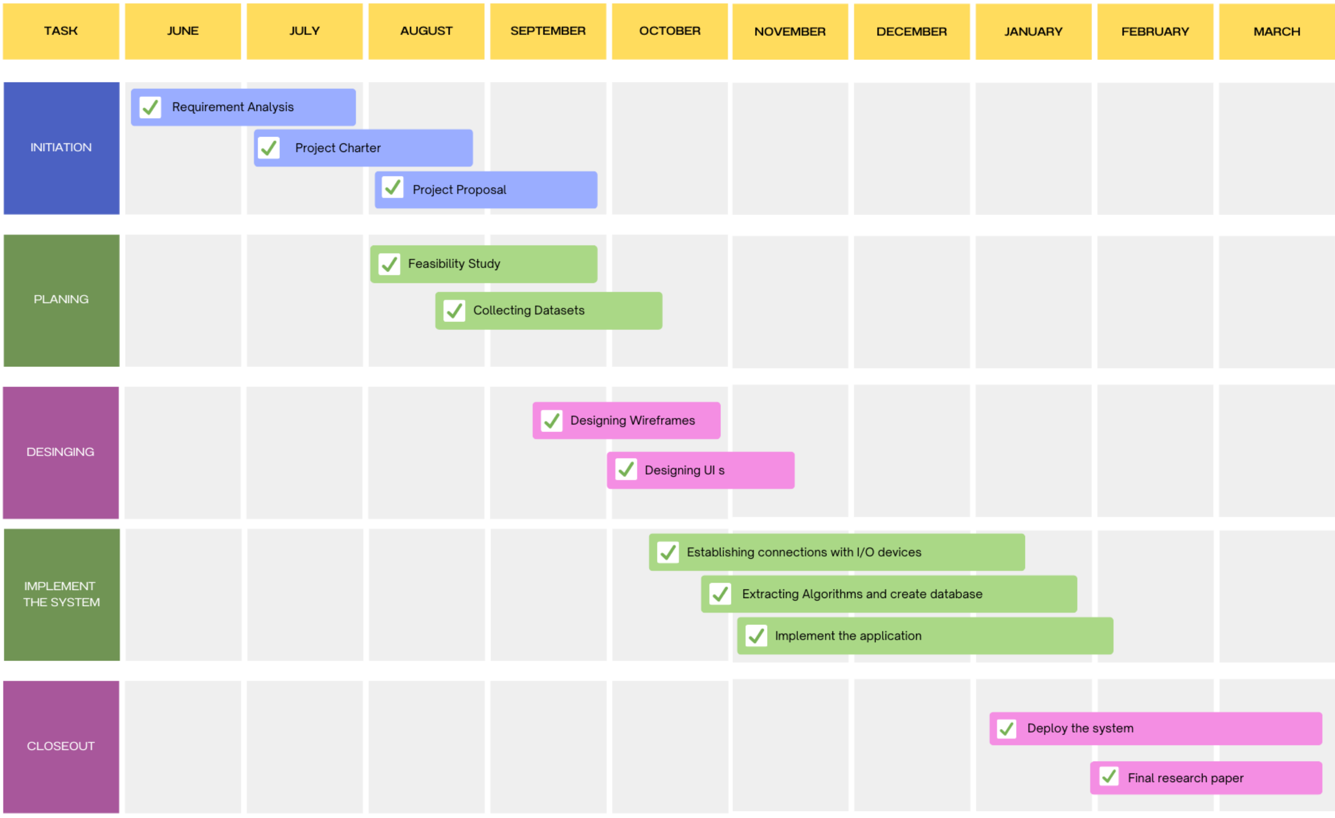

Figure 5 - Gannt Chart

6. BUDGET ESTIMATION

The budget estimation for the Driver identification & Vision Monitoring framework takes into thought both gear components and operational costs crucial for the system's progression and course of action. The fundamental hardware components incorporate a high-quality speaker, which can be utilized to capture the driver's voice for the voice affirmation module, and a 1080P auto-focus web camera for capturing nitty coarse facial pictures for the facial affirmation module. These hardware components are fundamental for ensuring the system's precision in recognizing drivers and watching their thought viably.

In extension to hardware, operational costs are also included in the budget. Web costs are figured in to guarantee smooth communication between the system components and the database where driver profiles are put absent. Typically, regularly basic for real-time dealing with and affirmation. Travel costs are also a principal parcel of the budget, as they cover the taken a toll of gathering data and conducting field tests in completely different circumstances to ensure the system performs well in real-world conditions. This consolidates traveling to zones to test the system underneath diverse lighting, climate, and movement conditions, which is essential to optimizing the system for the Sri Lankan setting.

Other than that, diverse costs may rise during the wander, such as computer program allowing, cloud capacity, or additional gear necessities that ended up apparent during testing. These operational and hardware-related costs have been carefully considered to ensure the system can be made, attempted, and passed on successfully.

Table 3 - Budget Estimation

Item	Estimated Price (Rs)
Microphone	3,000/-
1080P Auto Focus Web Camera	8,500/-
Internet Cost	2,000/-
Travelling Cost	4,000/-
Total	**17,500/-**

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