Major Project Report on

VISION SHIELD
MACHINE LEARNING - COMPUTER VISION

Submitted in partial fulfillment of the demand for the award of the degree of
BACHELOR IN TECHNOLOGY
COMPUTER SCIENCE & ENGINEERING

Under the mentorship of
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Abstract

Vision Shield is a state-of-the-art vehicle security and surveillance system developed to address the global challenge of car theft and enhance urban safety. This project integrates cutting-edge technologies in Machine Learning, Computer Vision, and modern Web Development to deliver a robust and scalable solution. Leveraging Automatic Number Plate Recognition (ANPR) and Optical Character Recognition (OCR), Vision Shield enables real-time identification and monitoring of vehicles. The system utilizes YOLOv10 for license plate detection and PaddleOCR for high-accuracy character recognition. For efficient vehicle tracking, the Breadth-First Search (BFS) algorithm is used to trace flagged vehicles across a network of surveillance inputs.

Designed for real-world applications, Vision Shield features a centralized web-based control system built using **React** for the frontend and **Node.js** for the backend, enabling dynamic dashboards, real-time alerts, and seamless communication with the processing servers. Integration with Google Maps API provides live location tracking and visualization of flagged vehicles.

With its scalable architecture, Vision Shield is ideal for deployment in smart cities, urban traffic management systems, toll monitoring, and large-scale security networks. Its advanced features, such as VIP vehicle prioritization, loop handling for missing vehicles, and automated warning systems, make it a comprehensive and industrial-grade solution for modern challenges in vehicle security.

Proposal

1. INTRODUCTION

Car theft is a global challenge that causes economic and safety concerns. Despite advancements in traditional vehicle security systems, the recovery of stolen vehicles remains inefficient. Vision Shield aims to address this gap by using a blend of Machine Learning, Computer Vision and Web Dev technologies. Its real-time detection and tracking capabilities provide an innovative approach to monitoring vehicles across interconnected surveillance networks, making it a robust solution for modern urban challenges.

2. OBJECTIVE

- **Enhance Vehicle Security:**
  Minimize vehicle theft by providing a proactive and intelligent surveillance system.
- **Real-Time Vehicle Tracking:**
  Use ANPR and OCR technologies for accurate and real-time license plate detection.
- **Optimized Vehicle Tracing:**
  YOLOv10 algorithms and model for seamless tracking across multiple cameras and city servers.
- **Scalability and Adaptability:**
  Develop a system capable of integration with smart city infrastructure for large-scale deployment.

3. SYSTEM ARCHITECTURE

- **Camera Network:**
  Surveillance cameras integrated with a web-based dashboard. Each feed is processed centrally using a backend system powered by **Node.js** for real-time video frame handling and event coordination..
- **Vehicle Detection and Tracing:**
  ANPR and OCR modules for recognizing license plates in real time. BFS algorithm for tracking vehicles across multiple cameras and regions.
- **Web Based Enhancements:**
  Frontend developed with React to provide live dashboards, search functionality, and incident reports. Real-time updates and user interaction handled via WebSockets or RESTful APIs through the Node.js backend. Predictive features and notifications enhance the reliability of vehicle monitorin
- **Centralized Control System:**
  A unified dashboard built using **React** displays all tracking and alert data

4. TECHNOLOGY STACK

- **Programming Languages**
  Python for algorithm implementation. JavaScript for front-end UI Development.
- **Computer Vision Tools**
  OpenCV for image processing and OCR integration. TensorFlow or PyTorch for predictive analytics.
- **Database:**
  SQLite for storing vehicle data and camera logs. Cloud-based storage for scalability.
- **Web Dev technologies: Frontend using React.js and Backend using Node.js**

5. CONCLUSION

Vision Shield provides a futuristic solution to vehicle security by integrating AI, IoT, and Computer Vision. Its real-time monitoring capabilities, combined with efficient tracing algorithms, ensure faster recovery of stolen vehicles and improved traffic management. With scalability and adaptability at its core, the system can be deployed in urban settings, toll management systems, and logistics monitoring, paving the way for smarter and safer cities.