COLLEGE CODE: 3108

COLLEGE NAME:JEPPIAAR ENGINEERING COLLEGE

DEPARTMENT: INFORMATION TECHNOLOGY

STUDENT NM-ID:
989A2A73D1A44389FD848A013EF7DA56

ROLL NO: 310823205039

DATE: 21-04-2025

Completed the project named as

AI-EBPL -AUTONOMUS VEHICLES AND ROBOTICS

SUBMITTED BY:

NAME: JUDITH VARSHA.S

MOBILE NO: 7904863488

PHASE 1: PROBLEM DEFINITION AND DESIGN THINKING

USERCASE: AUTONOMOUS VEHICLES AND ROBOTICS

TITLE: TRAFFIC SIGN RECOGNITION USING AI

PROBLEM STATEMENT

Traffic Sign Recognition (TSR) is a critical component of autonomous vehicles, enabling them to navigate safely and efficiently through roads and highways. The goal of TSR is to detect, classify, and recognize traffic signs in real-time, using AI-powered computer vision algorithms. However, TSR poses several challenges, including variability in traffic signs, environmental factors such as weather and lighting conditions, and the need for real-time processing. To address these challenges, AI-powered solutions utilizing computer vision, deep learning, and object detection algorithms can be employed. By optimizing these algorithms for real-time processing, accurate traffic sign recognition can be achieved, leading to improved safety, increased efficiency, and enhanced autonomy for autonomous vehicles.

TARGET AUDIENCE:

1. Autonomous Vehicle Manufacturers: Companies like Waymo, Tesla, and Cruise that are developing and manufacturing autonomous vehicles.

2. Automotive Technology Companies: Companies like NVIDIA, Qualcomm, and Intel that are developing automotive-grade AI and computer vision technologies.

3. Transportation Agencies: Government agencies responsible for transportation infrastructure and safety, such as the US Department of Transportation.

4. Technology Enthusiasts: Individuals interested in AI, robotics, and autonomous vehicles, including hobbyists and makers.

5. Academic Institutions: Universities and research institutions with programs in AI, robotics, and autonomous vehicles.

OBJECTIVES

1. Develop Accurate Traffic Sign Detection: Achieve high accuracy in detecting traffic signs in various environments and conditions.

2. Improve Traffic Sign Classification: Develop an AI-powered classification system to categorize traffic signs into different types (e.g., stop signs, traffic lights).

3. Enhance Real-time Processing: Optimize AI algorithms for real-time processing to enable quick and accurate traffic sign recognition.

4. Increase Autonomous Vehicle Safety: Improve the safety of autonomous vehicles by enabling them to recognize and respond to traffic signs.

5. Reduce False Positives and Negatives: Minimize false positives and negatives in traffic sign detection and classification.

6. Improve Overall Autonomous Vehicle Efficiency: Enhance the overall efficiency of autonomous vehicles by enabling them to navigate through roads and highways more safely and efficiently.

DESIGN THINKING APPROCH

EMPATHIZE

1. **User Interviews:** Conducted interviews with autonomous vehicle drivers, passengers, and pedestrians to understand their experiences and pain points related to traffic sign recognition.
2. **User Observations:** Observed autonomous vehicles navigating through roads and highways to identify areas where traffic sign recognition is crucial.
3. **Pain Points:** Identified key pain points, including:
    - Difficulty recognizing traffic signs in adverse weather conditions
    - Limited visibility of traffic signs due to obstruction or damage
    - Inability to recognize traffic signs in unfamiliar territories

Key User Concerns

- **Safety:** Autonomous vehicle drivers and passengers are concerned about the safety of the vehicle, particularly in situations where traffic signs are not recognized.

- **Reliability:** Autonomous vehicle manufacturers are concerned about the reliability of traffic sign recognition systems, particularly in adverse weather conditions.
- Efficiency: Autonomous vehicle drivers and passengers are concerned about the efficiency of the vehicle, particularly in situations where traffic signs are not recognized, leading to delays or detours.

Define

Design a traffic sign recognition system using AI that can accurately recognize traffic signs in various environments and conditions.

Key Features Required:

- Accurate recognition of traffic signs in adverse weather conditions
- Ability to recognize traffic signs in unfamiliar territories
- Real-time processing and alert system for drivers and passengers

Ideate

1. Smart Traffic Sign Recognition System
2. Autonomous Vehicle Navigation
3. Traffic Sign Detection using Drone Technology
4. AI-powered Traffic Management
5. Traffic Sign Recognition for Visually Impaired
6. Real-time Traffic Sign Update System
7. Autonomous Robot Navigation

Brainstorming Results:

- Utilize computer vision and machine learning algorithms to recognize traffic signs
- Integrate camera and sensor data to improve accuracy and reliability
- Develop a database of traffic signs from various regions and countries
- Implement a real-time alert system for drivers and passengers
- Utilize edge computing to reduce latency and improve real-time processing

Prototype

Develop a Functional Prototype: Create a functional prototype that integrates AI-powered computer vision and machine learning algorithms to recognize traffic signs.

Key Components of Prototype:

- Camera and sensor suite to capture images and data
- AI-powered computer vision algorithm to detect and recognize traffic signs
- Machine learning algorithm to classify traffic signs
- Real-time processing and alert system for drivers and passengers

Test

1. Testing Scenarios:

- Day and night testing
- Adverse weather conditions (rain, snow, fog)
- Various lighting conditions (low light, high light)
- Different types of traffic signs (speed limit, stop sign, traffic light)

2. Testing Metrics:

- Accuracy of traffic sign recognition
- Reliability of the system in various environments and conditions
- Real-time processing and alert system performance

TESTING GOAL

Primary Goal: Achieve an accuracy of 95% or higher in recognizing traffic signs in various environments and conditions.

Secondary Goals:

- Improve the reliability of the system in adverse weather conditions and low light environments.
- Enhance the real-time processing and alert system performance to reduce latency and improve safety.