Traffic Sign Detection App

Requirements Model

Version 1.1

Team Members:

Hayden Jones

Shreya Komarabattini

Rishigesh Rajendrakumar

Aidan Mao

Jacob Heffelmire

Title: Traffic Sign Recognition Application	
Version: 1.1	Date: 10/5/25

Revision History

Date	Version	Description	Name
10/5/25	1.0	First draft	Hayden Jones
10/30/25	1.1	Update product backlog	Hayden Jones

Title: Traffic Sign Recognition Application	
Version: 1.1	Date: 10/5/25

Requirements

Functional Requirements:

The team will develop a fully functional Traffic Sign Recognition (TSR) app for Android devices:

- The app accepts input from a live camera feed or uploaded images/videos.
- The app processes images and detects traffic signs using a CNN-based recognition model.
- The app displays recognized signs visually on-screen with bounding boxes and labels.
- The app provides text-to-speech (voice) feedback announcing recognized signs.
- The app shows confidence percentages for each detected sign.
- Users can select regional sign sets (e.g., U.S., EU, Asia) for detection.
- The app uses offline operation, using preloaded models and datasets.
- A testing mode allows developers or students to evaluate recognition performance using sample images or videos. Metrics such as accuracy, precision, and recall are reported.
- Users can adjust settings for audio alerts, visual overlays, and detection thresholds.
- Critical alerts (e.g., Stop, Yield, Wrong Way) are prioritized to prevent alert congestion when multiple signs appear simultaneously.
- The app is optimized for real-time performance, maintaining at least 15–30 FPS with latency under 200 ms per frame.

Non-Functional Requirements

Security:

- The app processes all camera images locally; no cloud upload is required.
- Camera feed and voice input is not saved.

Efficiency & Performance:

- The app must maintain real-time recognition without causing phone lag or crashes.
- The model must be lightweight enough to run on mid-range Android devices.

Usability:

- The UI must be simple and intuitive, suitable for hands-free driving interaction.
- Large buttons and clear labels must be provided.

Reliability:

- Recognition should be consistent across varied lighting, weather, and speed conditions.

- The system should recover gracefully if the camera feed fails.

Product Backlog

Backlog Items	**Progress**
1.0 Frontend Setup	
1.1 Front end design	**Done**
1.2 Create front end UI	**Done**
1.3 Integrate camera functionality	**In Progress**
1.4 UI-Backend Data Handling	**Not Started**
2.0 Backend Setup	
2.1 CPU Tensor Operations	**Done**
2.2 Logger Class	**Done**
2.3 GPU Tensor operations	**Done**
2.4 OpenCV preprocessing	**Not Started**
3.0 Model Training	
3.1 Dataset Preparation	**Not Started**
3.2 Setup model layout	**Not Started**
3.3 Loss function and gradients	**Not Started**
3.4 Data loading	**Not Started**
3.5 Training loop	**Not Started**
3.6 Parameter Management	**Not Started**
3.7 Model Export	**Not Started**
4.0 Output & feedback	

4.1 JNI integration	**Not Started**
4.2 Display Results	**Not Started**
4.3 Text-To-Speech	**Not Started**
5.0 Testing & Optimization	
5.1 Unit & integration testing	**Not Started**
5.2 Performance tuning	**Not Started**
5.3 Device Compatibility	**Not Started**

User stories

Driver / User:

- As a driver, I want to see recognized traffic signs on my screen so I can respond quickly while driving.
- As a driver, I want the app to announce detected signs via voice so I don't have to look away from the road.
- As a driver, I want the app to prioritize critical signs like Stop or Yield when multiple signs appear, so I receive the most important alerts first.
- As a driver, I want to select a region's traffic signs, so the app recognizes signs relevant to where I am driving.
- As a driver, I want the app to work offline, so I can receive alerts even in areas without internet connectivity.
- As a driver, I want to be able to use voice commands to keep my hands free while driving to control settings and start/stop the app.

Use Case Diagram:

Title: Traffic Sign Recognition Application	
Version: 1.1	Date: 10/5/25