

# Overview

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SafeDrive is a comprehensive driving safety application designed to enhance road safety through real-time monitoring, accident detection, and driver assistance features. The application combines multiple technologies to create a holistic safety experience for drivers.

## Core Features

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### 1. User Authentication System

- Secure login/signup functionality
- Profile management with personal and vehicle details
- Token-based authentication with JWT
- Session management with refresh tokens

### 2. Driver Dashboard

- Central hub for all driver information
- Profile display and management
- Driving mode toggle
- Access to safety features and monitoring tools

### 3. Driving Mode

- Activatable driving mode that enables safety monitoring features
- Real-time status indication when active
- Toggleable interface to start/stop monitoring

### 4. Real-time Location Tracking

- GPS-based location monitoring
- Speed calculation and display
- Current location identification and mapping
- Nearby accident detection within configurable radius

### 5. Speed Monitoring and Alerts

- Real-time speed tracking and display
- Overspeeding detection based on defined thresholds (80 km/h default)
- Visual and audio alerts when speed limits are exceeded
- Speed data recording for safety analysis

### 6. Drowsiness Detection

- Real-time facial monitoring for signs of drowsiness
- Integration with device camera
- Alert system for drowsy driving detection
- Periodic drowsiness checks during active driving

### 7. Accident Detection System

- Accelerometer-based sudden motion (jerk) detection
- Automatic accident detection algorithms
- Emergency contact notification in case of detected accidents
- Test simulation feature for system verification

### 8. Navigation and Mapping

- Live map display showing current location
- Route planning and navigation
- Integration with mapping services
- Accident-prone area visualization

### 9. Emergency Response System

- Automatic emergency alerts when accidents are detected
- Emergency contact management
- Location sharing with emergency contacts
- SMS/notification dispatching in emergency situations

### 10. Driver Monitoring Interface

- Dashboard for real-time driving statistics
- Tab-based interface for different monitoring aspects
- Visual indicators for speed, location, and safety status

- Alert system for potential dangers

## How the App Works

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### Initialization and Authentication

1. Users register with personal details and vehicle information
2. Secure login with JWT token-based authentication
3. Token validation on app startup to maintain sessions

### Driver Dashboard Experience

1. Upon login, users are presented with the driver dashboard
2. Dashboard displays profile information and driving statistics
3. Toggle switch enables/disables driving mode
4. Profile management options available via dashboard

### Active Driving Mode

1. When driving mode is activated:
  - Location tracking begins using device GPS
  - Speed monitoring becomes active
  - Drowsiness detection initializes (if camera access granted)
  - Accident detection systems are activated
2. Real-time monitoring includes:
  - Current speed display with overspeeding alerts
  - Location tracking on live map
  - Accelerometer data processing for jerk detection
  - Facial monitoring for drowsiness signs

### Safety Features in Action

1. Overspeeding Detection:
  - Compares current speed against threshold (80 km/h)
  - Provides visual warnings and alerts when limit exceeded
2. Drowsiness Detection:
  - Analyzes driver's face for signs of drowsiness
  - Issues alerts when drowsy patterns detected
3. Accident Detection:
  - Monitors accelerometer for sudden changes in acceleration
  - Detects potential accidents based on motion analysis
  - Triggers emergency protocols when accidents detected
4. Emergency Response:
  - Automatically notifies emergency contacts with location data
  - Sends alerts with accident details and coordinates
  - Provides emergency instructions to driver and contacts

### Data Management

1. Location and driving data stored in Redux state management
2. User profile information persisted in database
3. Optional accident history recording for safety analysis
4. Emergency contact information management

## Technical Implementation

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The application is built using:

- React with TypeScript for the frontend
- Redux for state management
- Express.js backend for API services
- MongoDB for data persistence
- JWT for authentication
- Geolocation APIs for location tracking
- Device sensors (accelerometer, gyroscope) for motion detection
- Camera integration for drowsiness detection

## Safety Testing

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The application includes a "Test Accident Detection" feature that allows users to simulate an accident scenario for testing the emergency response system without

actually experiencing an accident.