UNIVERSIDAD DE GUADALAJARA

Centro Universitario de los Valles

Maestría en Ingeniería de Software

Administración de la configuración del software.

Baseline.

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Project Title: Virtual Assistant for Recognizing Dangerous Roads

Objective

Develop a virtual assistant that utilizes machine learning techniques to recognize and alert about dangerous roads, contributing to road safety.

Abstract

Any car owner will be able to access the assistant; all they need to do is activate it to begin its operation. This means that the assistant will be able to visualize the user's route in real-time, check for optimal speed, and monitor the time it takes for the journey. It will utilize artificial intelligence to analyze the type of route taken, road conditions, and incline. Additionally, it will have the capability to send alerts to other users as well as emergency services in the event of an accident, utilizing geolocation within at least a 10km radius.

To implement this, machine learning techniques will be employed along with speed sensors, gyroscopes, accelerometers, and cameras. These will be used to gather information, which will then be stored in a database for processing. This will enable the assistant to generate visual or auditory alerts, as well as provide alternate route recommendations.

Key Components of the Virtual Assistant:

Dangerous Road Detection: Employ computer vision algorithms and image processing to identify hazardous features on roads, such as sharp curves, obstructions, damaged or missing traffic signs, adverse weather conditions, etc.

Real-Time Alert System: Integrate an alert system that notifies drivers about detected dangerous conditions on the road. This could include visual alerts on the dashboard, voice messages via the assistant, and notifications on a mobile application.

Real-Time Data Connectivity: Utilize real-time data, such as weather and traffic information, to improve the accuracy of alerts and provide drivers with up-to-date road condition information.

Natural Voice Interaction: Enable drivers to interact with the virtual assistant through natural voice commands to obtain route information, inquire about road conditions, and receive real-time updates.

Dangerous Roads Database: Maintain an updated database of dangerous roads that can be queried to enhance alert accuracy and provide drivers with detailed information about the location and nature of hazards.

Proposed Methods and Technologies:

- Computer vision and deep learning algorithms for hazard detection in images and videos.
- Natural language processing (NLP) for voice interaction with the virtual assistant.
- Integration of real-time weather and traffic data APIs.
- Development of a mobile application for driver interaction.

Project Stages:

- Research and data collection on dangerous roads.
- Development of hazard detection algorithms.
- Creation of the alert system and voice interface.
- Integration of real-time data and development of the mobile application.
- Testing and fine-tuning of the virtual assistant in real driving situations.
- Implementation and deployment.

Main features:

Module 1: Data Acquisition

Functional Requirements:

1.1. The system must be capable of collecting data from multiple sources, such as traffic cameras, vehicle sensors, and real-time weather data.

1.2. The system must efficiently store and manage large volumes of data.

1.3. It should be able to sync and merge data from various sources to gain a comprehensive view of road conditions.

Non-Functional Requirements:

1.4. The system must ensure the security and privacy of collected data.

1.5. System performance must be scalable to handle increases in data volume.

1.6. Data processing latency must be low to enable real-time responses.

Module 2: Data Processing

Functional Requirements:

2.1. The system must apply computer vision and machine learning algorithms to identify dangerous roads.

2.2. It should analyze traffic speed, weather conditions, and other relevant factors.

2.3. It should generate alerts when hazardous conditions are detected.

Non-Functional Requirements:

2.4. The system must process and analyze data in real-time.

2.5. Detection accuracy of dangerous roads must be high.

2.6. The system should be adaptable to various weather and lighting conditions.

Module 3: Alert Generation

Functional Requirements:

3.1. The system must send alerts to drivers through a user-friendly interface.

3.2. It should provide specific recommendations for safe driving.

3.3. It should be able to communicate with navigation systems and voice assistants.

Non-Functional Requirements:

3.4. Alerts must be clear and understandable.

3.5. The system should have redundancy to ensure critical alerts are delivered.

3.6. The speed of alert delivery must be minimal.

Module 4: Monitoring and Maintenance

Functional Requirements:

4.1. The system must monitor the operational status of key components like cameras and sensors.

4.2. It should generate performance and preventive maintenance reports.

Non-Functional Requirements:

4.3. The system must be capable of performing remote software updates.

4.4. It should have high availability to prevent service disruptions.

Module 5: Administration Interface

Functional Requirements:

5.1. It should provide an administration interface for configuring and customizing the system.

5.2. It should allow access to historical data and trend analysis.

5.3. It must be secure and require authentication for access.

Non-Functional Requirements:

5.4. The administration interface should be intuitive and user-friendly.

5.5. It should be compatible with multiple browsers and devices.

Module 6: Vehicle Integration

Functional Requirements:

6.1. The system must integrate with vehicle information and entertainment systems.

6.2. It should provide real-time feedback to drivers through the vehicle's interface.

6.3. It must allow bidirectional communication to receive vehicle telemetry data.

Non-Functional Requirements:

6.4. Vehicle integration should be compatible with a variety of makes and models.

6.5. Latency in communication with the vehicle should be minimal for a real-time driving experience.

Module 7: Notifications to Authorities and Emergency Services

Functional Requirements:

7.1. The system must be capable of sending automatic notifications to traffic authorities and emergency services when extremely hazardous conditions are detected.

7.2. It should include detailed information about the location and nature of the danger.

Non-Functional Requirements:

7.3. Notifications to authorities must be reliable and delivered in real-time.

7.4. The system must comply with regulations and standards for communication with authorities and emergency services.

Module 8: Historical Data Analysis and Report Generation

Functional Requirements:

8.1. The system must be capable of storing and analyzing historical data regarding hazardous road conditions.

8.2. It should generate periodic reports and trend analysis to enhance long-term road safety.

8.3. It should provide data visualization tools for authorized users.

Non-Functional Requirements:

8.4. The system must be efficient in processing historical data.

8.5. Report generation should be configurable and customizable to meet user needs.

8.6. It must ensure the security and privacy of historical data.