Advanced Driver Assistance System (ADAS) for Vehicle Direction Detection

This presentation explores the Advanced Driver Assistance System (ADAS) with a focus on vehicle direction detection. ADAS technologies are designed to enhance safety and improve the driving experience by reducing human error. We will delve into the key features of ADAS, the specifics of vehicle direction detection, and its integration with other safety systems.

What is ADAS?

Reducing Human Error

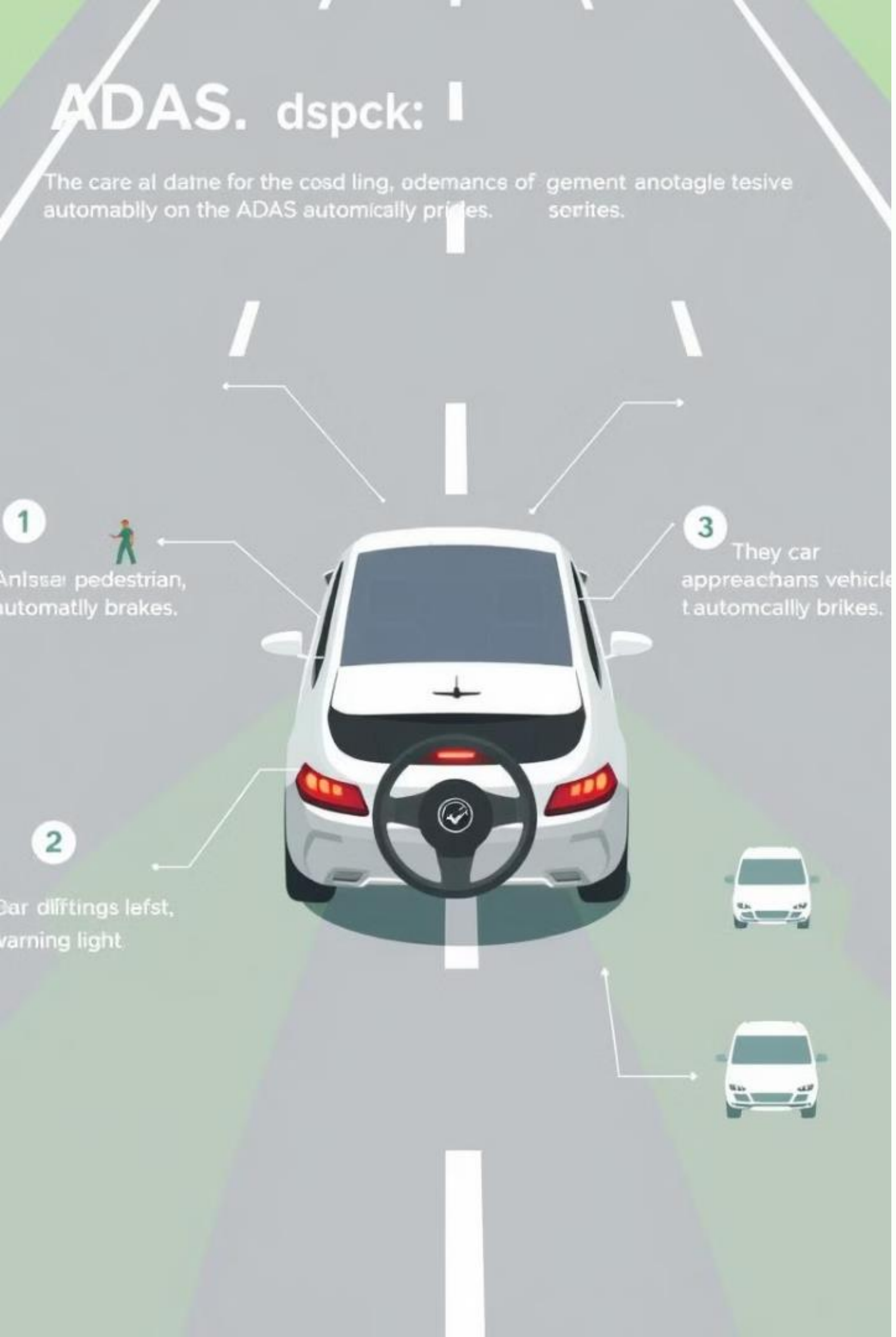
Most car accidents are caused by human error. ADAS is designed to mitigate these risks by providing assistance to drivers.

Core Components

ADAS uses cameras, sensors, and computer technology to help drivers, prevent accidents, and improve the overall driving experience.

Improving Safety

The primary goal of ADAS is to enhance road safety for both drivers and pedestrians by providing real-time assistance and warnings.



Key Features of ADAS

1 Pedestrian Detection & Avoidance

Alerts the driver or automatically applies the brakes if a pedestrian is detected, preventing potential accidents.

2 Lane Departure Warning & Correction

Warns the driver if the vehicle is drifting out of its lane and can steer it back automatically, ensuring lane discipline.

3 Traffic Sign Recognition

Identifies and interprets road signs to assist the driver, providing crucial information about speed limits and other regulations.

4 Automatic Emergency Braking

Applies the brakes automatically to prevent or reduce the impact of a collision, minimizing potential damage and injuries.

Understanding Vehicle Direction Detection

Directional Awareness

Vehicle Direction Detection helps the car understand which way it is going, enhancing its awareness of its surroundings.

Road Sign Recognition

A camera reads road signs and determines whether the vehicle is turning left, turning right, or driving straight, providing directional context.

Real-Time Feedback

The system assigns unique values to each direction and gives real-time feedback to the driver to ensure they stay on the correct path, improving navigation.

How It Works with Other Systems

1

GPS Navigation

Vehicle Direction Detection works with GPS navigation to guide the car to its destination efficiently, optimizing route planning.

2

Lane Detection

Ensuring the car stays in the correct lane, enhancing lane discipline and preventing unintended lane departures.

3

Highway Warnings

Alerting the driver about road conditions or potential hazards, providing timely warnings to avoid accidents.

4

Wrong-Way Detection

Preventing the car from entering or exiting a highway in the wrong direction, ensuring safe highway maneuvers.

Objective

1

Develop MATLAB Simulink Model

Create a MATLAB Simulink model based on the given requirements, ensuring accurate representation and functionality of the ADAS system.

2

Generate Code

Generate code from the Simulink model while maintaining a consistent sample time of 0.01 seconds for all signals.

3

Ensure Smooth Performance

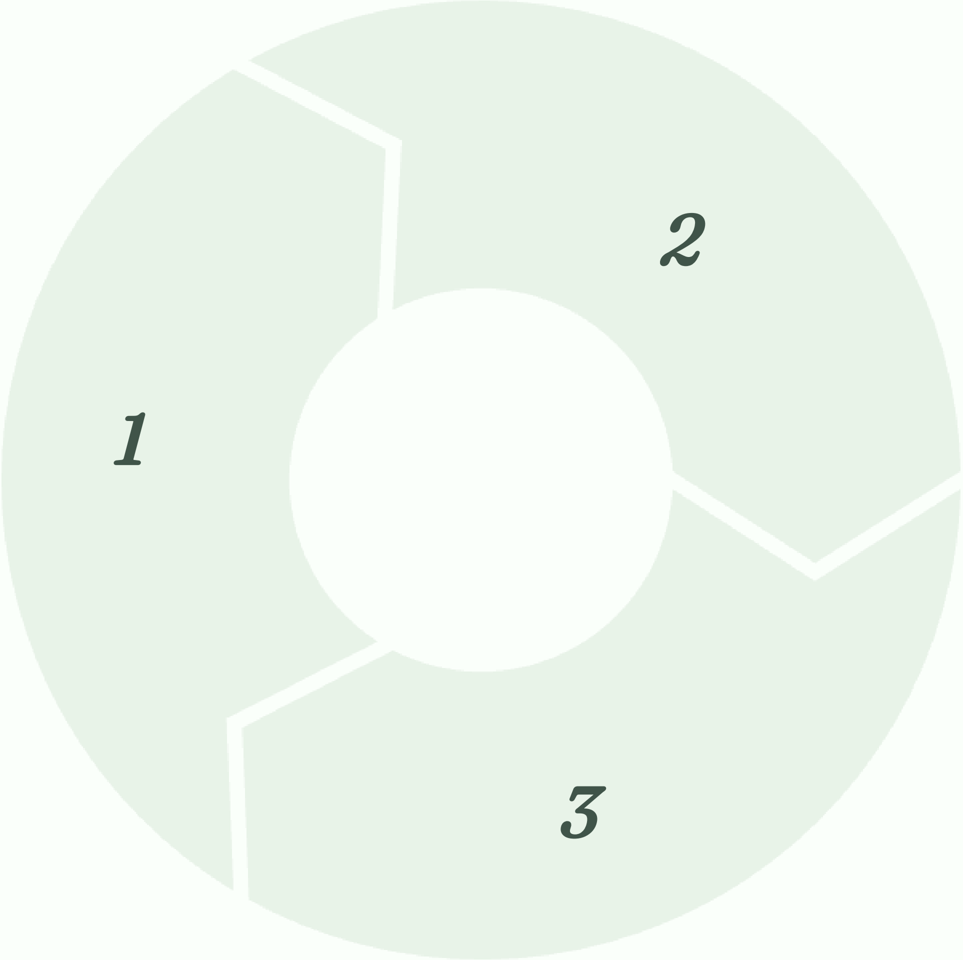
Maintain a consistent sample time of 0.01 seconds for all signals to ensure smooth and reliable system performance, optimizing system responsiveness.

System Requirements

The ADAS system must meet specific requirements to ensure accurate and reliable vehicle direction detection. These requirements are designed to integrate steering input, road sign data, and system outputs to provide real-time directional guidance. The system is developed using MATLAB Simulink, emphasizing precise control and monitoring of system parameters.

The system requirements are divided into two key areas: detecting steering direction and confirming the turn using road signs. Each requirement involves specific inputs, comparisons, and outputs to ensure the vehicle moves in the correct direction.

Requirement 1: Detecting Steering Direction



Steering Input

The system takes steering wheel input as yaw rate (Steering_Input_YawRate).

Angle Limits

This value is compared with three predefined angle limits to determine the vehicle’s direction.

Local Signal

The result is stored in a local signal (Turn_Direction_Status).

This entire function should be placed inside a subsystem for better organization, ensuring modularity and maintainability of the ADAS system.

Requirement 2: Confirming the Turn Using Road Signs

1

Comparison

The system compares Turn_Direction_Status with predefined road sign values.

2

Road Sign Data

Uses Road Sign Data (RoadSign_Input_Camera) from the camera.

3

Turn Status

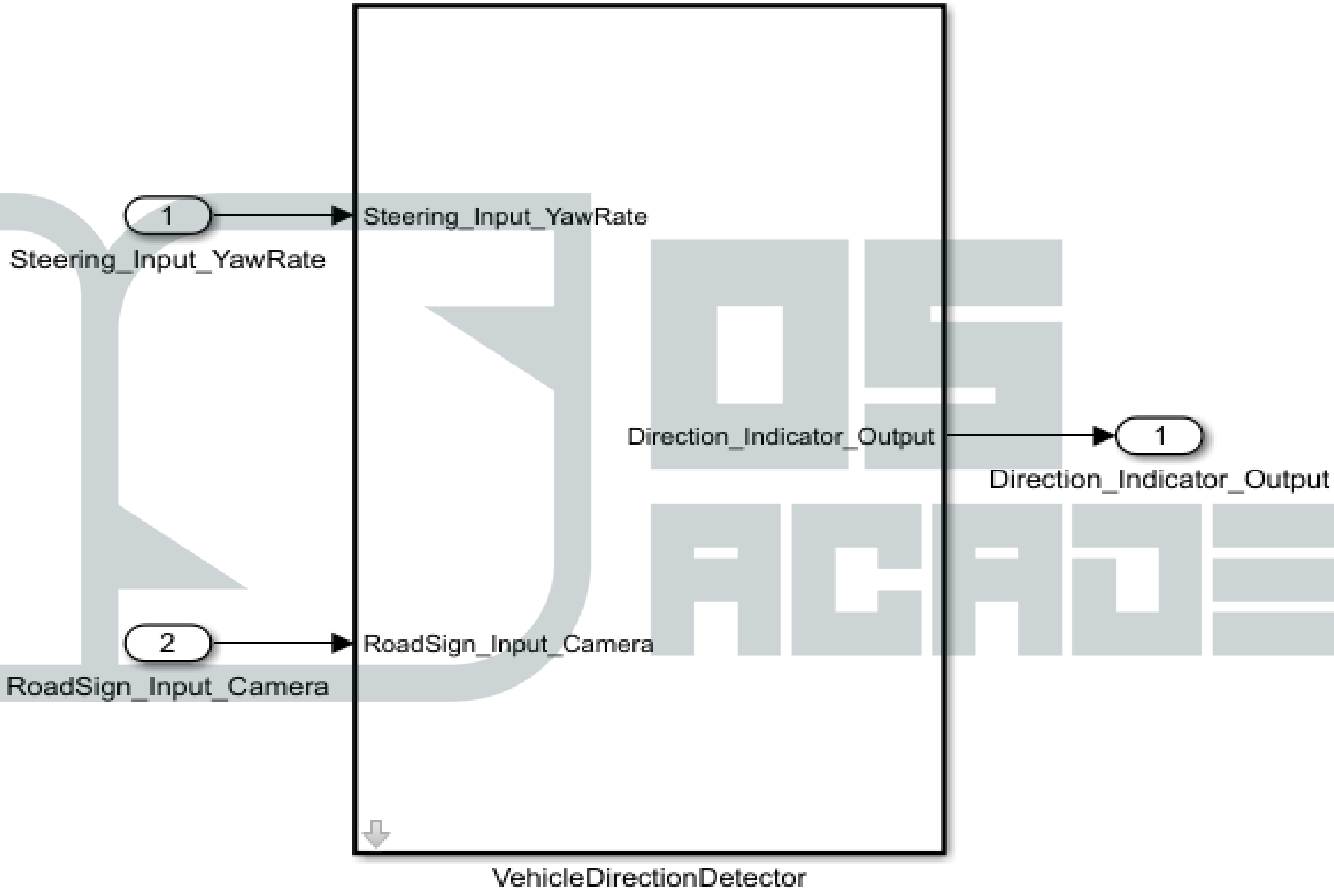
Uses Turn Status (Turn_Direction_Status) from Requirement 1.

If the detected turn matches the road sign, the system confirms the correct direction. The result is stored in Direction_Indicator_Output, which signals whether the vehicle is moving in the correct direction.

Signals and Constant Data

The following table outlines the signals and constant data used in the ADAS system. Each signal is defined by its name, type, data type, range, initial value, and units. This information is crucial for understanding the system's inputs, outputs, and internal variables.

Signal Name	Type	Data Type	Range (Min - Max)	Initial Value	Units
Steering_Input_YawRate	Input	Int16	-180 to 180	-	Degrees
RoadSign_Input_Camera	Input	Boolean	0 to 1	-	-
Turn_Direction_Status	Local	Int16	-180 to 180	-	Degrees
TurnLimit_Right	Constant	Int16	-180 to 180	30	Degrees
Direction_Indicator_Output	Output	Boolean	0 to 1	-	-


1
Steering_Input_YawRate
Steering_Input_YawRate
2
RoadSign_Input_Camera
RoadSign_Input_Camera
Direction_Indicator_Output
1
Direction_Indicator_Output
VehicleDirectionDetector

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