



# CAN-Based Intelligent Driver Alert & Automatic Braking System

Using STM32 Microcontroller



# Introduction & Project Context



## Addressing Road Safety Challenges

- Focus on reducing accidents caused by slow driver reactions
- Targets issues like low visibility and sudden obstacles



## Intelligent Alert & Braking Systems

- Utilizes real-time sensors for proactive safety measures
- Combines driver alerts with automatic braking intervention



## Developed at C-DAC Hyderabad

- Built using STM32 microcontroller for robust performance



# Problem Statement & Solution



## Road Safety Threatened by Delayed Reactions

Human reflexes often too slow to prevent collisions



## Conventional Braking Systems Fall Short

Lack of timely alerts and automatic intervention



## Intelligent System for Real-Time Protection

Sensors and CAN bus enable rapid detection and response



# System Architecture Overview

## Transmitter Node: Sensor Data Acquisition

- Ultrasonic and IR sensors gather real-time obstacle data
- STM32 microcontroller processes and classifies risk levels

## CAN Bus: Reliable Automotive Communication

- Sensor data transmitted as CAN frames for robust, low-latency exchange

## Receiver Node: Alerts and Automatic Braking

- STM32 decodes CAN frames to trigger driver alerts and PWM-based braking
- Layered response adapts to risk level for enhanced safety







# Sensor Suite & Detection

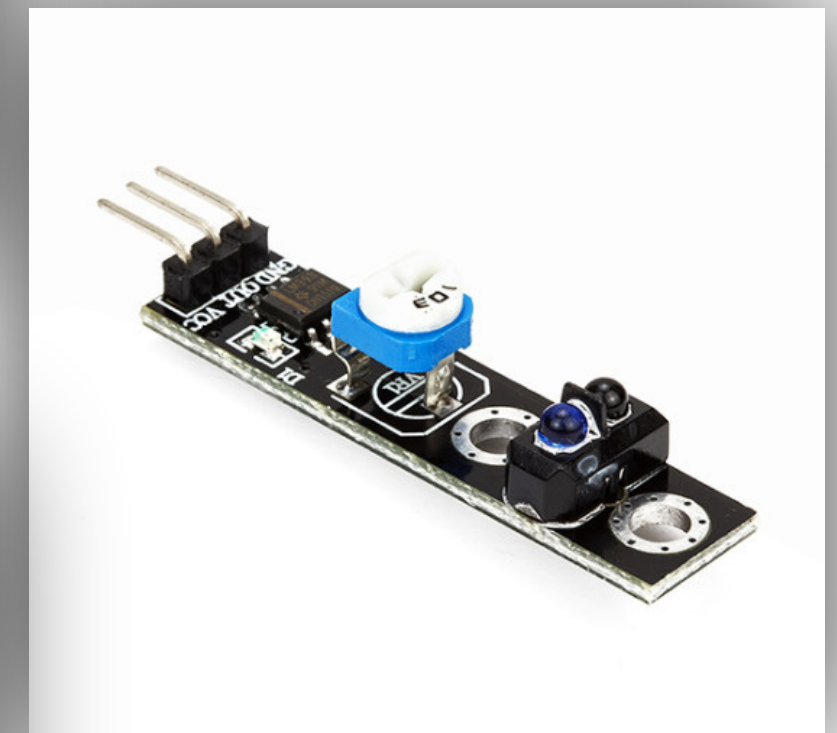
## Ultrasonic Sensor for Front Detection

- Measures precise distance to obstacles ahead
- Enables early collision risk assessment



## IR Sensors for Side and Rear Safety

- Detects objects in blind spots and rear zones
- Supports close-range collision avoidance



## Continuous Scanning and Sensor Fusion

- Real-time data integration from multiple sensors
- Enhances overall safety and response accuracy





# System Block Diagram

## Transmitter Node: Sensor Data Acquisition

Ultrasonic and IR sensors gather obstacle information

## CAN Bus: High-Speed Communication

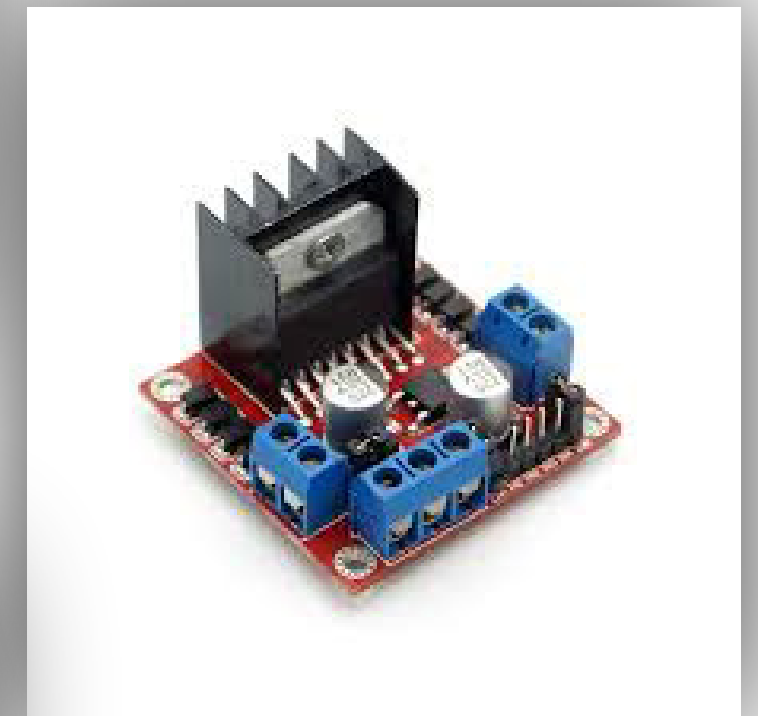
Transmits risk-classified data frames between nodes

## Receiver Node: Alert and Braking Control

Processes incoming data for driver alerts and motor intervention

## Integrated Hardware Components

STM32F4, MCP2515, L298N, buzzer, LEDs





# Transmitter Node Operation

## Continuous Sensor Data Acquisition

Ultrasonic and IR sensors provide real-time obstacle data.

## Dynamic Risk Assessment

Classifies environment as safe, warning, or critical based on sensor input.

## CAN Frame Formation and Transmission

Encodes risk and sensor data into CAN frames for rapid communication.

## Optimized for Timely Response

Ensures minimal delay from detection to alert and braking actions.





# Receiver Node & Motor Control



## CAN Frame Decoding and Validation

- Receiver node parses incoming CAN frames for sensor data
- Ensures data integrity before processing alerts



## Risk-Based Alert Activation

- Triggers buzzer and LEDs based on detected risk level
- Provides immediate feedback to the driver



## PWM Motor Control for Braking

- Adjusts motor speed using PWM for smooth braking
- Implements adaptive braking profiles for safety





# Layered Alert & Braking Logic



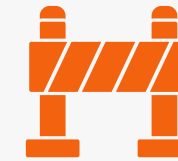
## Three-Tier Safety Zones

Safe ( $>100\text{cm}$ ), Warning ( $50\text{-}100\text{cm}$ ),  
Critical ( $<50\text{cm}$ )



## Adaptive Braking Profiles

Braking intensity adjusts based on  
detected distance



## Maximum Intervention in Critical Zone

Immediate braking and alerts when  
obstacles are very close



# Key Advantages & Future Scope

## Proactive Safety Measures

Early warnings and automatic braking reduce accident risk.

## Automotive-Grade Reliability

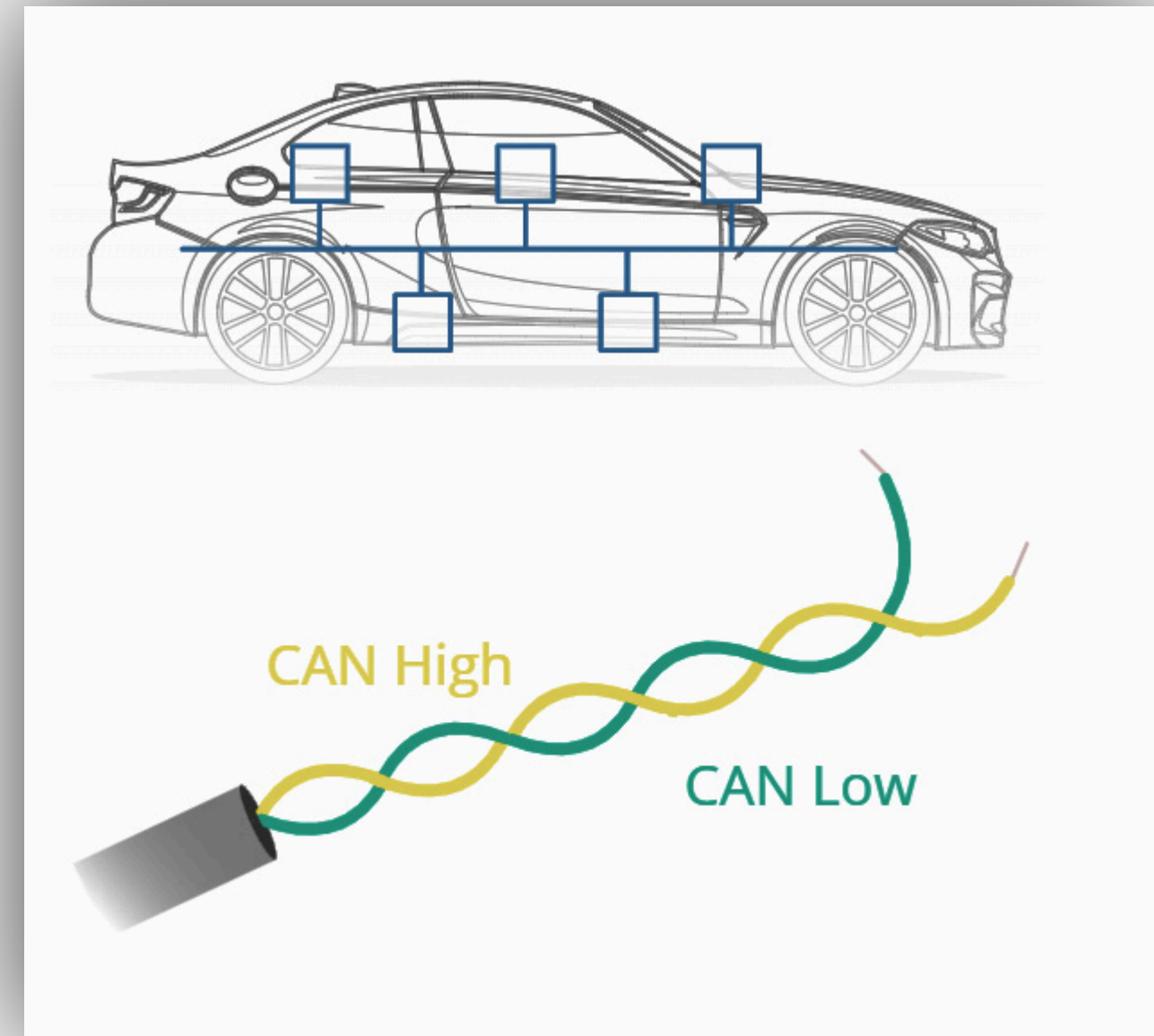
CAN bus ensures robust, real-time communication.

## Modular & Scalable Design

Easily adaptable for future ADAS features and vehicle integration.

## Future-Ready Enhancements

Supports camera/radar fusion and adaptive cruise control.





*Thank  
you!*

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