

Centre for Development
of Advanced Computing



CAN-Based Intelligent Driver Alert & Automatic Braking System

Using STM32 Microcontroller

CDAC - HYDERABAD



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

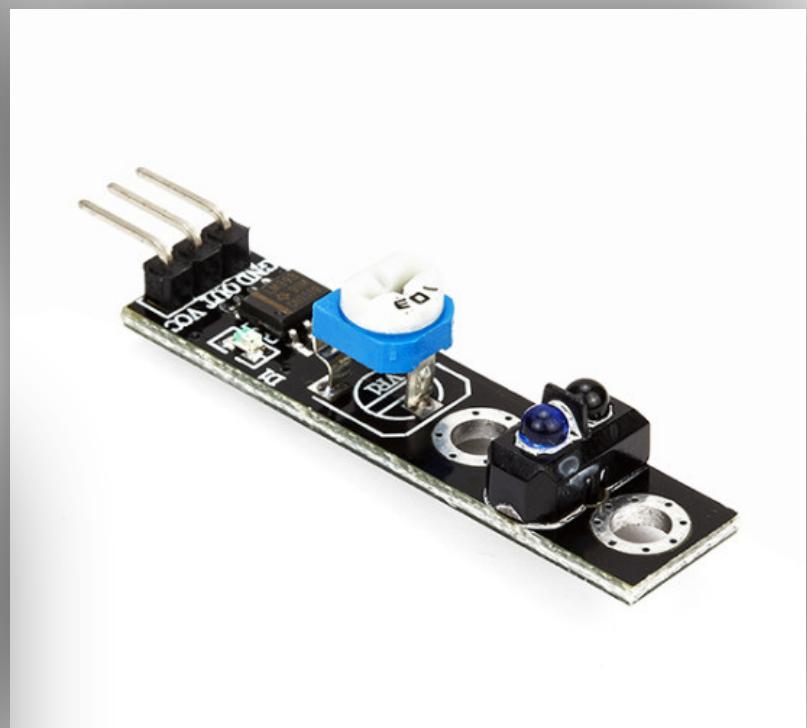
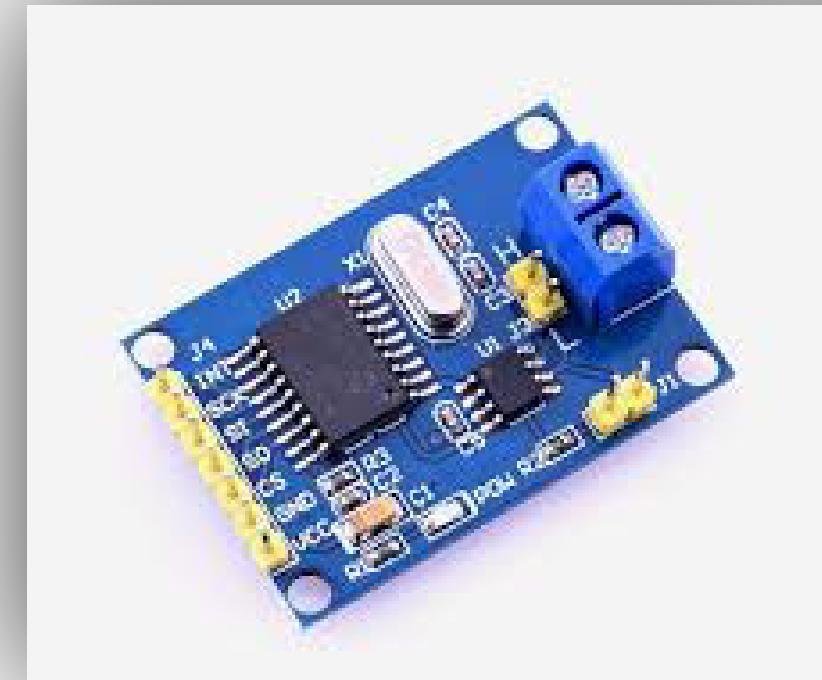
Ultrasonic Sensor for Front Detection

- 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





System Block Diagram

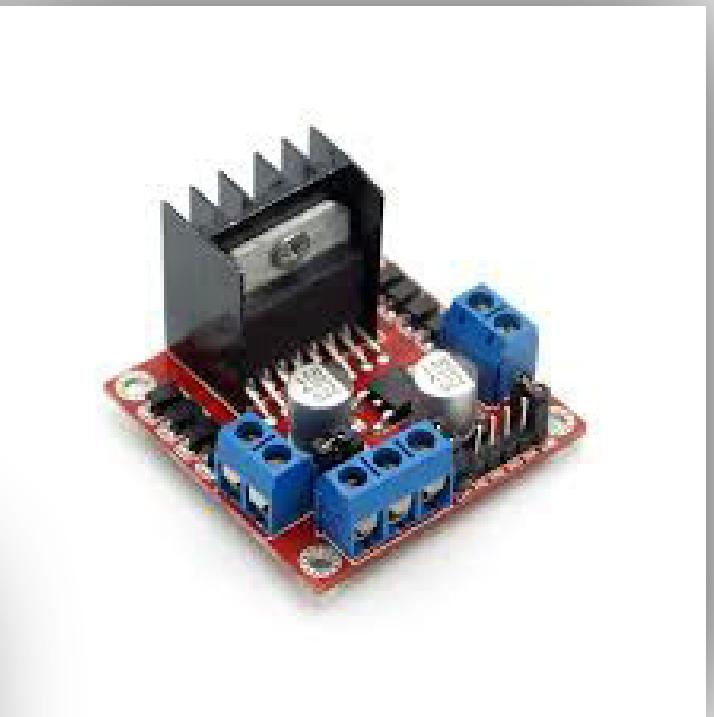
Transmitter Node: Sensor Data Acquisition

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



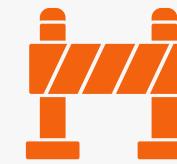
Three-Tier Safety Zones

Safe (>100cm), Warning (50-100cm),
Critical (<50cm)



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

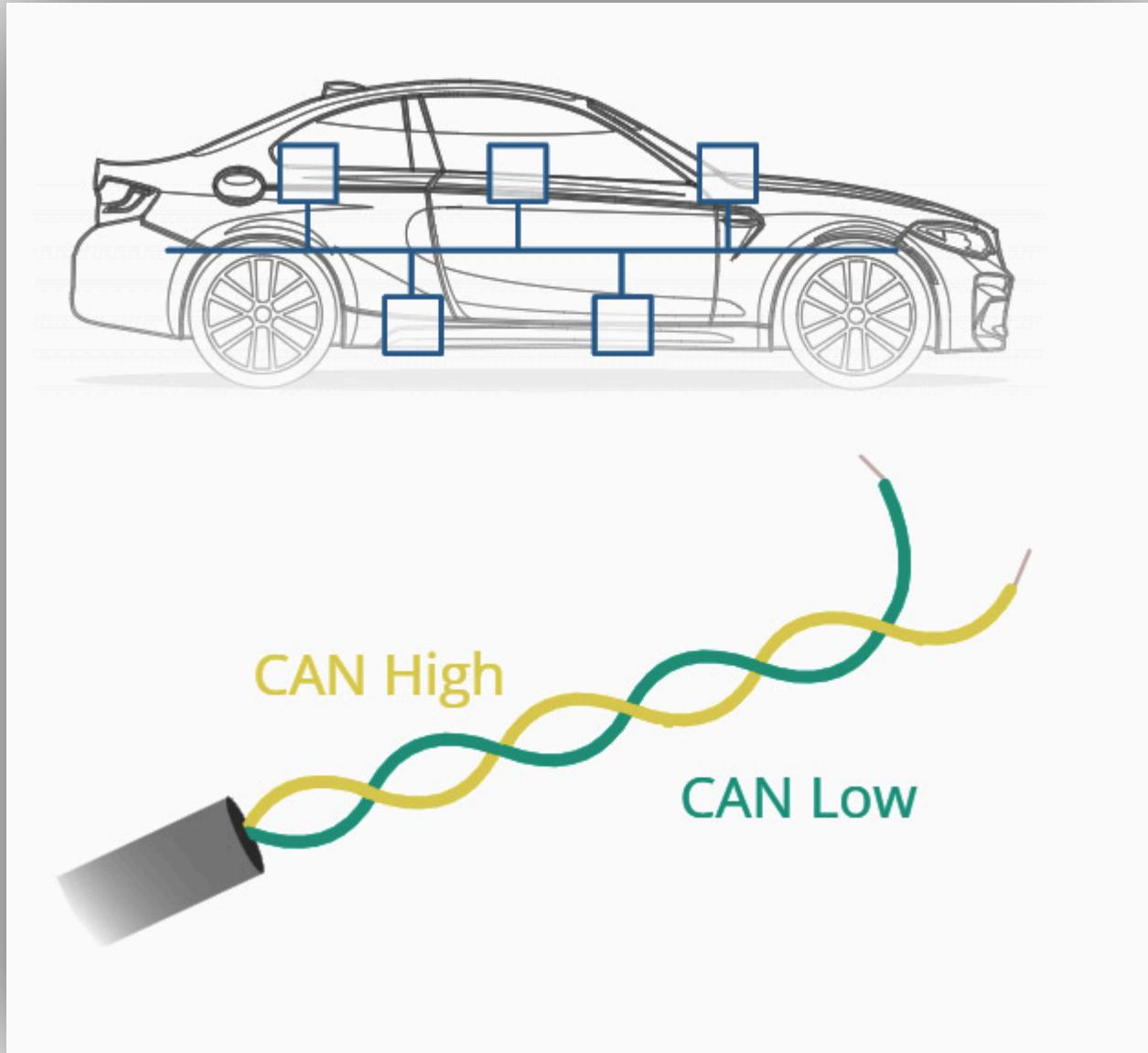
CAN bus ensures robust, real-time communication.

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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