# CAN Bus System Overview

## CAN Overview

- Type: Serial, asynchronous, multi-master communication protocol
- Use Cases: Automotive, industrial automation
- Data Rate: Up to 1 Mbps
- Features: Real-time support, high error resilience, built-in error checking

## CAN Bus Architecture

- Signaling: Differential - CAN High & CAN Low
- Cabling: Twisted pair with 120 Ohm termination
- Topology: Multi-master - any node can initiate communication

## CAN Voltage Levels

- High-Speed (ISO 11898-2)
  - Dominant: ~2V difference (logical 0)
  - Recessive: ~0V difference (logical 1)
- Low-Speed (ISO 11898-3)
  - Dominant: ~2V
  - Recessive: ~5V

## CAN Frame Types

1. Data Frame - Carries sensor data
2. Remote Frame - Requests data from another node
3. Error Frame - Broadcasts errors to all nodes
4. Overload Frame - Inserts delay to prevent overload

## Bus Arbitration

- Protocol: CSMA/CD + AMP (Carrier Sense Multiple Access / Collision Detection with Arbitration on Message Priority)

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- Mechanism: Bit-wise arbitration - lowest ID wins, ensuring priority-based communication without collision

## Hardware Components

- Microcontroller: STM32F407 Discovery Board
- Sensors:
  - LM35 - Temperature
  - HCSR04 - Ultrasonic Distance
- CAN Transceiver: MCP2551
- Outputs:
  - 20x4 I2C LCD
  - Buzzer

## Software Tools

- STM32CubeIDE:
  - Peripheral configuration (ADC, CAN, Timer)
  - Auto code generation
  - Debugging tools
- HAL Libraries: Simplify low-level hardware interaction

## System Architecture

Transmitter Node:

- Reads data from LM35 & HCSR04
- Sends 3-byte CAN message (LED status, temperature, distance)

Receiver Node:

- Receives and parses CAN messages
- Displays data on LCD
- Controls buzzer and LED based on thresholds

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## Receiver Logic

- Display: Temperature & Distance on LCD
- Alert Conditions:
  - Temp > 40°C
  - Distance < 10 cm
  -> Buzzer ON
- LED: Blinks on successful reception

## Testing & Results

- Real-time updates on LCD (updated every few ms)
- Buzzer ON when thresholds exceeded
- LED Blink confirms message Tx/Rx