Collision Avoiding System

Detecting and Preventing Collisions with Hedy MCU

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Abstract

The Collision Avoiding System is an intelligent safety mechanism designed to prevent accidents by detecting obstacles and applying brakes automatically. It utilizes an ultrasonic sensor to measure the distance between vehicles. If the vehicle gets too close, the ESP8266 microcontroller triggers LED and buzzer alerts. If the distance continues to decrease, a servo motor applies the brakes, preventing a collision. This system is cost-effective, scalable, and energy-efficient, making it suitable for autonomous vehicles, industrial automation, and smart transportation.

Introduction

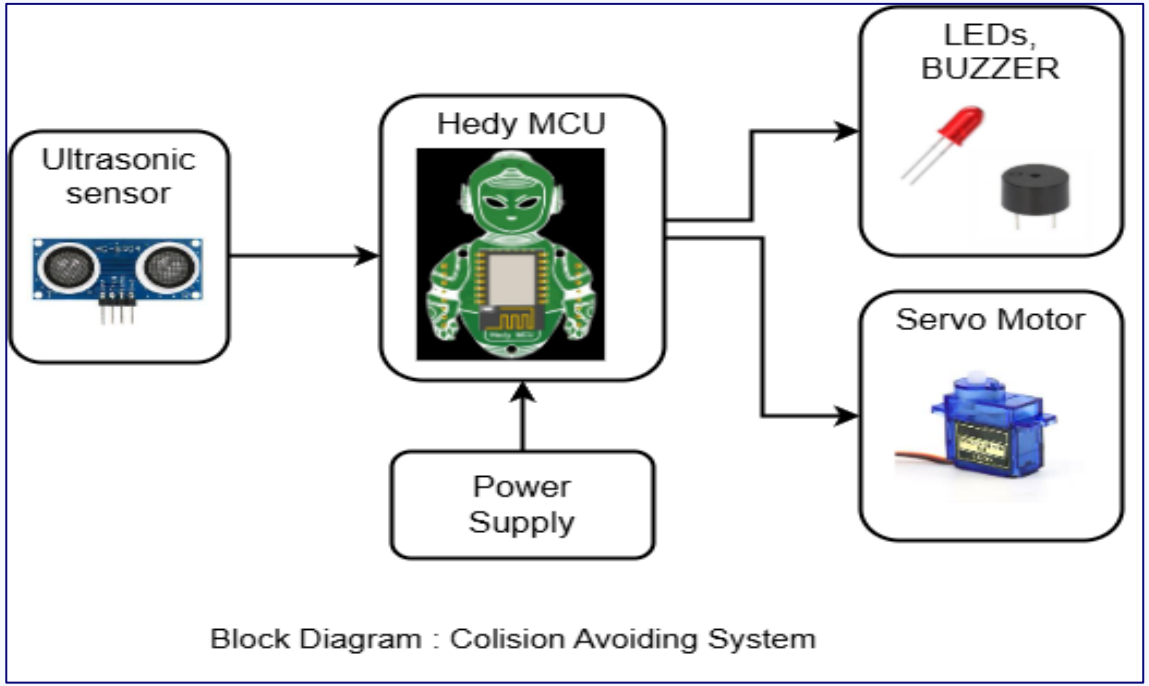
Road accidents are a major concern worldwide, often caused by human error and delayed reaction time. The Collision Avoiding System aims to reduce crashes by using real-time obstacle detection and automated braking. The system operates in three stages:

- Obstacle Detection – The ultrasonic sensor continuously monitors the distance between vehicles.
- Warning Alert Activation – If the distance is unsafe, the LED and buzzer alert the driver.
- Automated Braking – If no action is taken, the servo motor applies the brakes automatically.

This project enhances vehicle safety and can be applied to autonomous cars, industrial automation, and smart traffic systems. Future improvements, such as AI-based decision-making and sensor fusion, will further enhance its effectiveness in reducing accidents and improving road safety.

Block Diagram

The block diagram of Collision Avoiding System using Hedy MCU is as follows:



Block Diagram : Colision Avoiding System

Blocks of Collision Avoiding Systems

Input Device - Ultrasonic Sensor

- The sensor emits an ultrasonic pulse.
- It measures the time taken for the pulse to return after bouncing off an object.
- The distance is calculated using the formula:

$$Distance = Time \times Speed\ of\ Sound/2$$

- If the detected distance is below the threshold, the system activates warnings.

Figure : Ultrasonic Sensor

Blocks of Collision Avoiding Systems

ESP8266 Microcontroller & Testing

- The ESP8266 is a powerful microcontroller with built-in Wi-Fi capability.
- It is programmed using Arduino IDE.
- It reads sensor data, processes the information, and triggers alerts or braking actions.
- Testing Process:
  - The ultrasonic sensor is tested for accurate distance measurements.
  - The buzzer and LED responses are verified.
  - The servo motor is calibrated to ensure smooth braking.

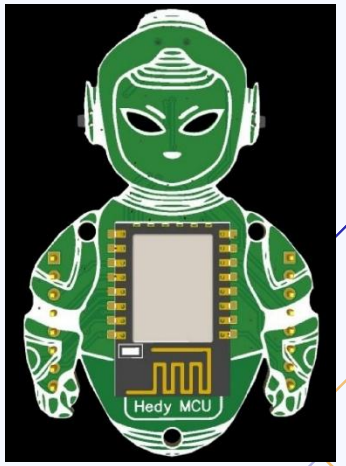


Figure : ESP8266 Microcontroller

Blocks of Collision Avoiding Systems

Output Devices (LED, Buzzer, and Servo Motor)

1. LEDs & Buzzer:

- LEDs turn on and the buzzer sounds when an obstacle is detected.

2. Servo Motor (Braking System):

-If the obstacle gets too close, the servo motor rotates to apply brakes automatically.

Figure : LED

Figure : Buzzer

Figure : Servo Motor

Working Principle

Obstacle Detection:

- The Ultrasonic Sensor continuously measures the distance between the vehicle and any obstacle in front of it.
- It sends ultrasonic waves, and based on the time taken for the waves to reflect back, it calculates the distance.

Warning Signal Activation:

- If an obstacle is detected within a predefined safe distance, the Hedy MCU processes the data.
- The MCU triggers visual (LED) and audio (buzzer) alerts to warn the driver of a potential collision.

Automatic Braking Mechanism:

- If the distance between the vehicles continues to decrease despite the warning signals, the Hedy MCU activates the servo motor, which automatically applies the brakes, bringing the vehicle to a stop.
- This prevents a collision by ensuring a safe stopping distance.

Result

- The system successfully detects obstacles in real-time.
- LED and buzzer alerts activate when an obstacle is within the warning range.
- The servo motor effectively engages braking when the obstacle is too close.
- The ESP8266 ensures fast and reliable processing of sensor data.
- Testing showed an quick response time, making the system practical for safety applications.

Conclusion

The Collision Avoiding System is a smart safety solution that integrates real-time obstacle detection with automatic braking to reduce accidents and improve vehicle safety.

Key Takeaways:

- The system successfully detects obstacles and prevents collisions.
- The integration of ESP8266, ultrasonic sensors, and servo motors ensures fast and accurate responses.
- The solution can be implemented in autonomous vehicles, robotics, and industrial applications.

Future Scope

- AI & Machine Learning Integration
  – AI can improve obstacle detection accuracy by analyzing patterns and predicting potential collisions.
- Integration with Cloud & IoT
  – The system can send real-time alerts to cloud servers and allow remote monitoring.
- Advanced Braking Systems
  – Integration with ABS and electronic braking systems for smoother and more effective stopping.
- Autonomous Vehicle Applications
  – Expansion into self-driving cars, industrial automation, and smart city traffic management.

Thank you!