INTELLIGENT BRAKING SYSTEM

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Abstract: In today's rapidly changing world, road safety remains a major concern, with countless accidents attributed to human error and lack of effective collision avoidance systems. Conventional braking systems often rely only on the driver's reaction time, resulting in very little time for error and increasing the risk of collisions, especially in unpredictable conditions such as congestion. This highlights the need for active collision avoidance systems that can independently identify obstacles and help prevent accidents by controlling the vehicle's speed to warn them of danger.[1]

This paper presents an intelligent braking system designed to enhance vehicle safety through real-time obstacle detection and speed control. The proposed system uses an ultrasonic sensor to identify obstacles and persons in the path of the vehicle as required. Blended with intelligent decision making, our smart brakes are not just about preventing accidents; These are about mental peace on every journey.

Keywords: Road safety, intelligent braking system, collision prevention, autonomous driving, hazard detection, advanced sensing technologies, insurance premiums, liability costs.

1.Introduction:

Road safety is a critical concern globally, with millions of lives lost each year due to traffic accidents. Many of these accidents are preventable and often occur due to human error or inadequate safety systems in vehicles. Traditional braking systems, while effective to a certain extent, rely heavily on the driver's reaction time and may not be sufficient to prevent collisions in all scenarios. Therefore, there is a pressing need for proactive collision avoidance systems that can autonomously detect hazards and take appropriate action to mitigate risks. In response to this need, this paper presents an innovative solution: an intelligent braking system equipped with an ultrasonic sensor for real-time obstacle detection and speed regulation. By combining advanced sensing technologies with intelligent control algorithms, our system aims to revolutionize vehicle safety, reducing the incidence of accidents and saving lives on the road. This research represents a significant step forward in the quest for safer and more reliable transportation systems, with the potential to make a profound impact on road safety worldwide.

1. Need of Attachment

Reason Behind selection of intelligent braking system is because it is requirement of safety during driving.

Solutions:

- The intelligent braking system offers a proactive solution to address the limitations of traditional braking systems in preventing accidents.[1]
- By integrating advanced sensing technologies such as ultrasonic sensors, the system can detect obstacles and potential hazards in real-time.[1]
- Intelligent control algorithms analyze sensor data to autonomously adjust vehicle speed and activate the braking mechanism, when necessary, significantly reducing the risk of collision.[1][5]

2.Problem Statement

- Despite advances in automotive technology, accidents from road-based and pedestrian traffic remain a significant concern.
- Conventional braking systems are based on the driver's reaction time, which is often not enough to prevent collisions, especially in unpredictable conditions such as congestion.
- There is a clear need for active collision avoidance systems, which can independently detect accidents and prevent accidents by controlling vehicle speed.
- This project addresses this critical need by developing an intelligent braking system, which includes a braking system equipped with an ultrasonic sensor for real-time obstacle detection and speed control.

3. Objectives

- Integrate Develop an intelligent braking system capable of real-time obstacle detection.
- Implement intelligent control algorithms to analyze threat levels and autonomously regulate vehicle speed.
- Ensure timely activation of the braking mechanism to bring the vehicle to a safe stop in critical situations.
- Validate the effectiveness and reliability of the system through real-world testing

4.Proposed Structure:

This system is similar to Forward AEB, AEB works in conjunction with the Forward Collision Warning (FCW) system. It is capable of detecting pedestrians, obstacle and even large animals. If FCW detects a pedestrian in front of the vehicle, AEB applies the brakes to slow or stop the vehicle even if the driver has not applied the brakes.[2]

Concept Explanation:

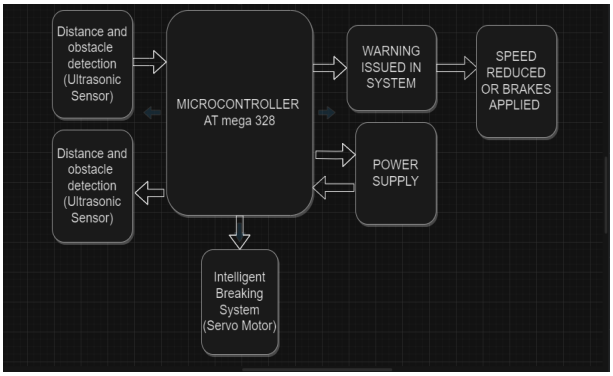


Fig- Block Diagram of Intelligent Breaking System

- Intelligent Braking System Overview:

The intelligent braking system integrates advanced sensing technologies and control algorithms to enhance vehicle safety.

It comprises an ultrasonic sensor for real-time obstacle detection, a microcontroller for data processing, and a braking mechanism for immediate response.

- Ultrasonic Sensor Functionality:

The ultrasonic sensor emits high-frequency sound waves and measures the time taken for the waves to reflect back, determining the distance nearby obstacles.[4]

This sensor provides crucial input to the system, enabling it to detect obstacles accurately and in real-time.[2]

- Microcontroller Operations:

The microcontroller receives data from the ultrasonic sensor and processes it using intelligent control algorithms.[3]

It analyzes the sensor data to assess the threat level posed by detected obstacles and determines appropriate speed adjustments or braking actions.[2]

- Braking Mechanism Activation:

Based on the analysis conducted by the microcontroller, the system activates the braking mechanism when necessary to prevent collisions.[2]

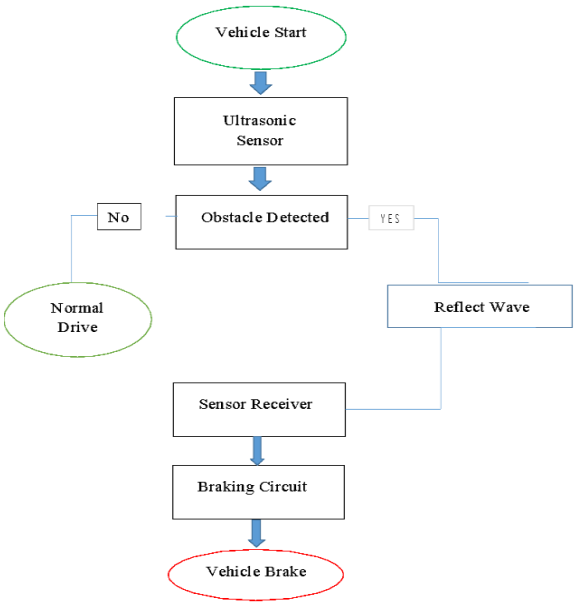
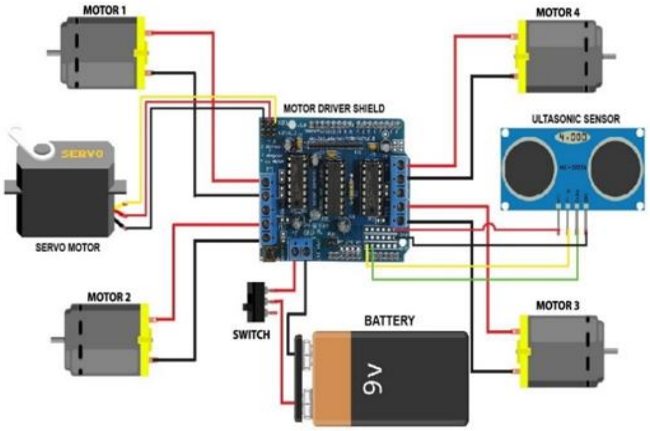


Fig – Flow chart of Automatic Braking System.

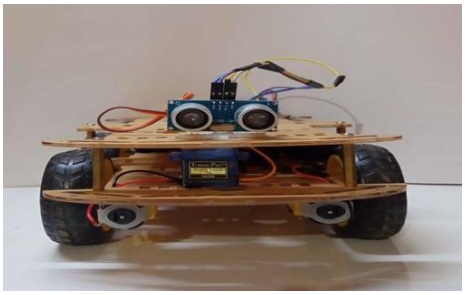
5.Actual Circuit Diagram:



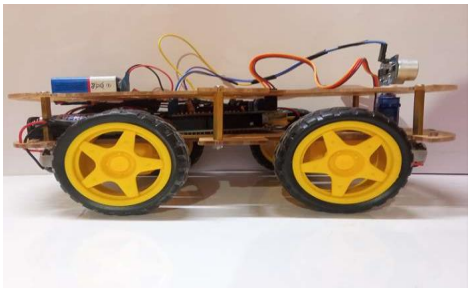
6.Components used in the model:

Sr no.	Name of component	
1)	Ultrasonic Sensor (HC – SR04):	
2)	Arduino UNO (AT MEGA 328)	
3)	Motor Driver Sheild (L293D)	
4)	DC Motor (SG-400)	
5)	Servo motor (SG-90)	
6)	Battery (9v zinc carbon battery)	

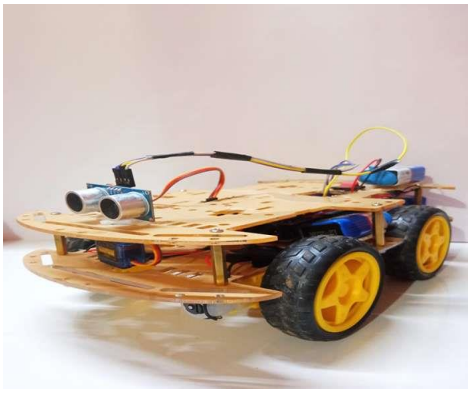
7. Photographs of the actual developed model:



Front view



Side view



Isometric view

8.Scope of research work/ future work:

Future enhancements to the intelligent braking system could include:

- Integration with other sensor technologies (e.g., radar, lidar) for enhanced obstacle detection capabilities.
- Implementation of machine learning algorithms for adaptive speed regulation and collision prediction.
- Evaluation of the system's performance in various driving conditions and environments to further validate its effectiveness and reliability.

9.Conclusions:

An important step forward in vehicle safety technology is the development of intelligent braking systems. This system can help reduce the risk of accidents by identifying obstacles in an emergency, controlling the speed of the vehicle, and activating the braking mechanism when necessary. This will not only reduce the impact of human error, but also improve passenger safety. Along with this, another requirement is to study and test this technique to further improve it.

10. References

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