

AUTOMATIC REVERSE BRAKING SYSTEM

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ABSTRACT

Automatic Reverse Braking System is a safety system used in vehicles to prevent accidents while reversing. It uses sensors to detect obstacles behind the vehicle. When an object is detected at a short distance, the system automatically applies the brakes to stop the vehicle. This system improves safety and helps avoid collisions during reversing.

Keywords: Micro controller, actuator, control unit, ultrasonic sensor, solenoid.

1. INTRODUCTION

The Automatic Reverse Braking System (ARBS) is an intelligent safety feature developed to reduce accidents that occur when a vehicle is moving backward. Reversing is one of the most challenging driving maneuvers due to restricted rear visibility, blind spots, and distractions, especially in areas such as parking lots, driveways, and urban environments. Many collisions during reverse motion involve pedestrians, obstacles, or nearby vehicles, making reverse safety systems increasingly important.

The automatic reverse braking system continuously monitors the area behind the vehicle using advanced sensing technologies such as ultrasonic sensors, radar systems, and rear-view cameras. These sensors detect obstacles and calculate the distance and relative motion between the vehicle and objects in its path. When the system identifies a high risk of collision, it initially alerts the driver through visual or audible warnings. If the driver does not respond in time, the system automatically applies the brakes to slow down or stop the vehicle, thereby preventing or minimizing the impact.

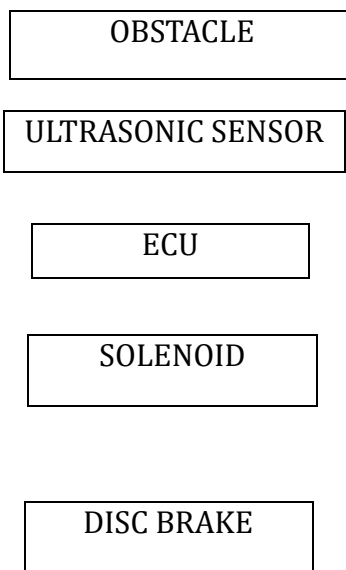
ARBS works in coordination with other vehicle control system such as electronic braking system and engine control units to ensure smooth and controlled braking. Modern implementations may also integrate artificial intelligence and image processing to better recognize pedestrians, animals, and objects of varying sizes. By reducing dependence on driver reaction time, the automatic reverse braking system enhances overall vehicle safety, lowers accident rates, and contributes to the development of advanced driver assistance systems (ADAS) in modern automobiles.

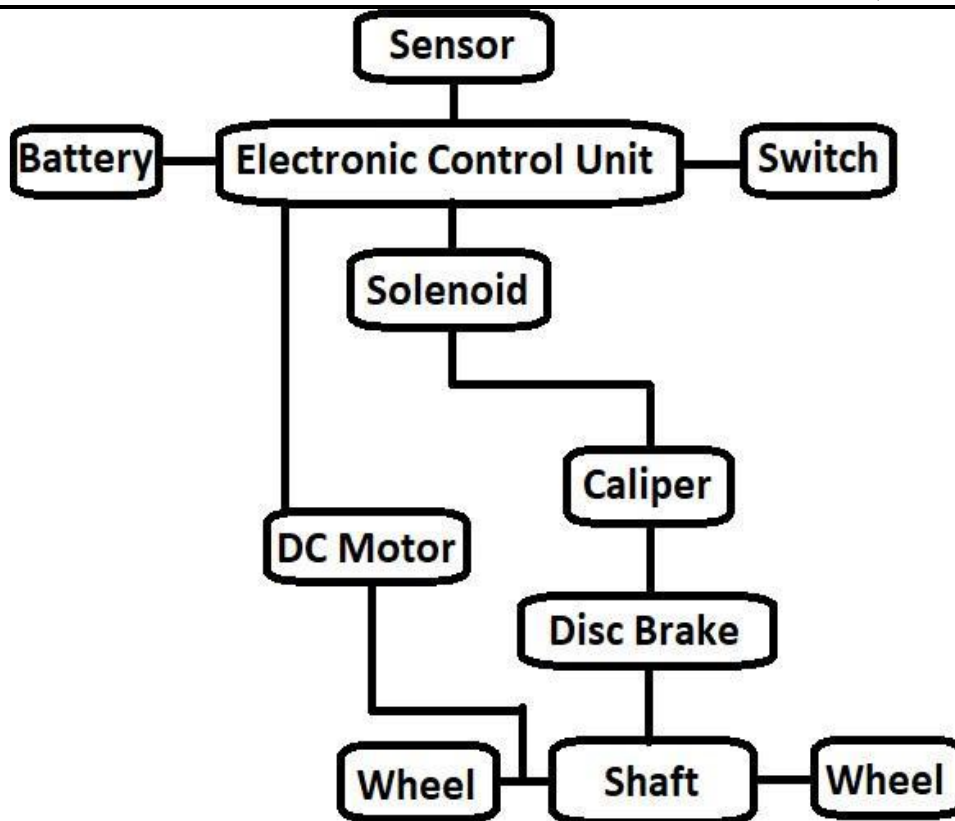
An Automatic Reverse Braking System (ARBS) is an advanced vehicle safety technology designed to prevent collisions while a vehicle is moving in reverse. Reversing accidents are common due to blind spots, limited rear visibility, and driver inattention. The ARBS addresses these issues by automatically detecting obstacles behind the vehicle and applying the brakes when a potential collision is imminent.

1.1 LITERATURE REVIEW

The Automatic Reverse Braking System (ARBS) is a critical safety technology in modern vehicles designed to prevent collisions while a vehicle is reversing by detecting obstacles behind the vehicle and automatically initiating braking action. Early research in this domain initially focused on basic parking assistance using ultrasonic sensors that provided audio or visual warnings to driver about nearby obstacles. However, these early systems were limited by short sensing ranges and lack of automated interventions. As automotive safety technology evolved researchers began integrating more advanced sensors such as radar and camera systems to improve detection accuracy and extend sensing capability. Accuracy and extend sensing capability. Sensor fusion- combining data from multiple sensors-has been widely studied to address the limitations of individual sensing modalities and enhance robustness in various environmental conditions. In recent years, advancements in computer vision and machine learning have further transformed ARBS research, with deep learning-based object detection models such as YOLO and Faster R-CNN being applied to rear-view camera feeds to accurately identify pedestrians, vehicles, and other obstacles in real time.

2. METHODOLOGY AND EXPERIMENTAL SETUP





1. Battery

Supplies electrical power to whole system

2. Switch

Turn the system ON or OFF

3. Sensor

Detects obstacle behind the vehicle

Usually ultrasonic sensor is used

Sens signal to ECU when obstacle is detected

4. Electronic control unit (ECU)

It is the brain of the system

Receives signal from sensor

Processes the signal

Send command to the solenoid and motor

5. Solenoid

Work like electromagnetic switch

When activated , it pushes the brake mechanism

6.DC motor

Rotate the shaft and wheels
Provides motion to the vehicle

7.Caliper

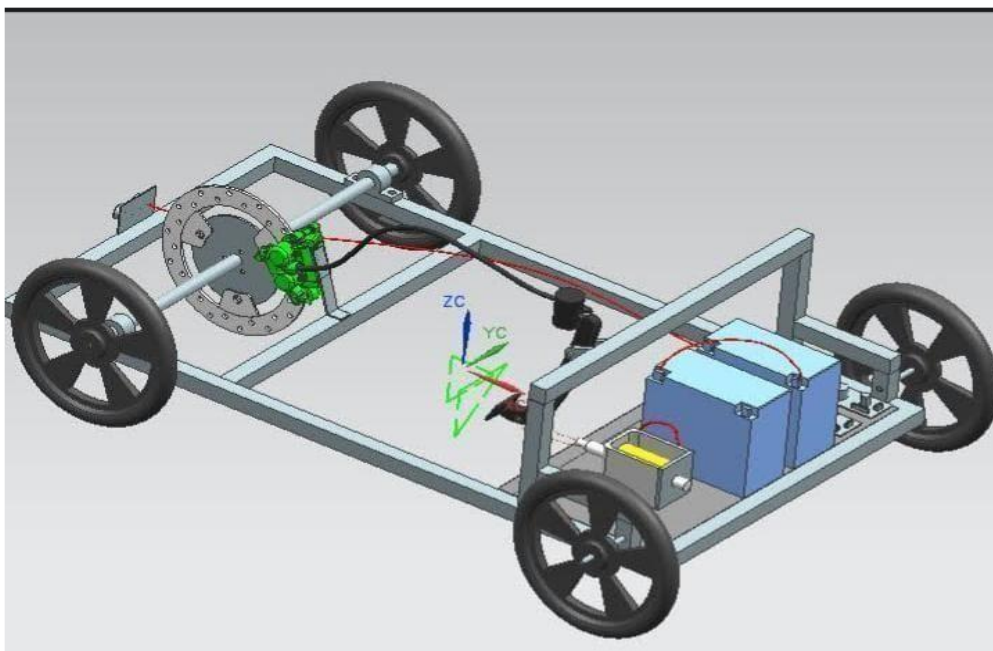
Holds brake pads
Presses brake pads on disc when activated

8.Dick brake

Slow down or stops wheel rotation
Connected to shaft

9.Shaft and wheels

Shaft transmits motion
Wheels rotate to move vehicle



WORKING

The automatic reverse braking system (ARBS) is an advanced vehicle safety feature designed to prevent collisions while a reversing, especially in areas with limited visibility such as parking lots and driveways. The system uses a combination of ultrasonic sensor, radar sensors, and rear-view cameras to continuously monitor the area behind the vehicle. Ultrasonic sensors provide accurate short-range detection, while radar works effectively in low-visibility conditions like rain or fog. The collected data is processed by a control unit that calculates the distance to obstacles and determines the time-to-collision (TTC). If the system detects a high risk of collision, it automatically activates the braking system through integration with the electronic braking system (EBS) and anti-lock braking system (ABS), ensuring smooth and controlled braking. Additional support for electronic stability control (ESC) helps maintain

vehicle stability . the ARBS also provides visual and auditors warning to alert the driver . by using sensor fusion techniques to reduce false alarms , the system enhances safety , minimizes low – speed accidents and increases driver confidence during reversing maneuvers

CONCLUSIONS

The automatic reverse braking system (ARBS) is crucial advancement in vehicle safety , designed to prevent accidents while reversing. By automatically applying the brakes when the system detects an obstacle , ARBS significantly reduces the risk of back over accident , which are common in parking lots or area with limited visibility . this technology works alongside other safety features , such ass parking sensor and backup cameras , to provide a comprehensive layer of protection. While it enhances driver confidence and safety, particularly for those with limited experience or when maneuvering in tight spaces , ARBS those have limitations , such as potential falls positive or negatives due to sensor limitations. However , ass vehicle safety technology continues to evolve , ARBS is accepected to become a standard feature in most vehicle, further contributing to the reduction of accidents and making driving a safer , more intuitive experience .

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