Automatic Airbag System for Two-Wheelers

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Abstract

The increasing number of road accidents involving two-wheelers highlights the urgent need for enhanced rider safety systems. This project presents the design and development of an Automatic Airbag System for Two-Wheelers, aimed at reducing the severity of injuries during frontal collisions. The system employs accelerometers, gyroscopes, and impact sensors to continuously monitor the vehicle's motion. When the Electronic Control Unit (ECU) detects a sudden deceleration or abnormal angular change beyond a predefined threshold, it activates the airbag inflator module, causing the airbag to deploy within milliseconds. The inflated airbag provides a cushioning effect, minimizing impact forces on the rider's head, chest, and upper body. The proposed system is lightweight, reliable, and compatible with most motorcycles. The study demonstrates that such intelligent safety mechanisms can significantly improve rider protection and have the potential to become an essential safety feature in future two-wheelers.

1. Introduction

Two-wheelers are highly vulnerable to road accidents due to limited structural protection. To reduce rider injuries, an Automatic Airbag System is proposed, which works on the principle of crash detection and rapid inflation. This review summarizes the working, design, performance, and limitations of the system.

2. Objective of the System

To minimize head, chest, and upper-body injuries during collisions.

To provide an affordable crash-protection mechanism for motorcycles.

To reduce fatality rate by rapid deployment of cushioning during severe impact.

3. Working Principle

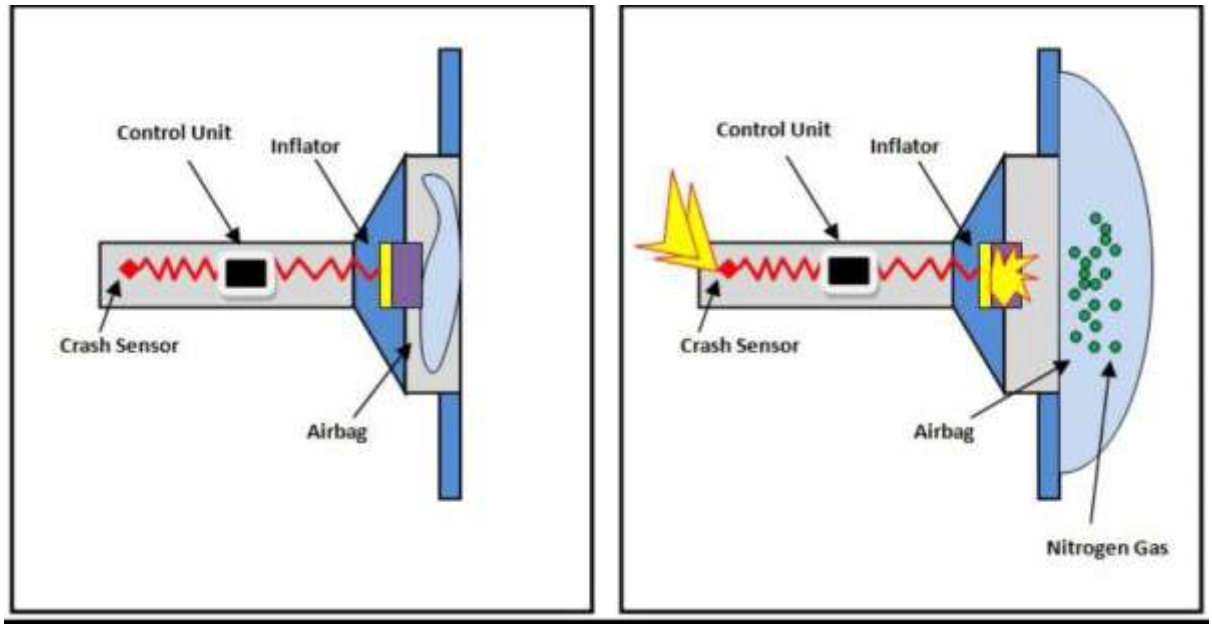
1. Sensors (Accelerometer/Gyroscope): Detect sudden deceleration or angular change.

2. Electronic Control Unit (ECU): Processes sensor data and identifies collision threshold.

3. Trigger Signal: ECU activates the inflator if impact is detected.

4. Inflation: Airbag inflates within 20–40 ms using compressed gas or pyrotechnic inflator.

5. Protection: Airbag forms a cushion between rider and impact zone (handlebar, vehicle front, or road).



4. Major Components

Sensors: Accelerometer, gyroscope, impact sensors.

ECU: Microcontroller-based decision-making unit.

Inflator Module: CO_2 cartridge or electric inflator.

Airbag Fabric: Nylon/polyester, heat-resistant, foldable.

Power Supply: Battery or motorcycle electrical system.

Mounting Assembly: Fixed near handlebar/tank or wearable (jacket).

5. Design Considerations

Fast response time (<50 ms).

Lightweight and compact assembly.

High-strength, tear-resistant airbag cloth.

Accurate sensor calibration to avoid false triggering.

Rider ergonomics and comfort.

6. Advantages

Reduces impact forces on chest and head.

Provides protection without restricting rider movement.

Automatically detects crash without manual input.

Can be integrated with existing scooters and bikes.

Improves overall road safety and survivability.

7. Applications

Motorcycles, scooters, and electric two-wheelers.

Delivery riders and long-distance touring bikes.

Student projects on automotive safety.

Wearable airbag jackets for sports and racing.

8.Conclusion

The Automatic Airbag System for Two-Wheelers is an innovative safety enhancement designed to reduce accident severity. Although costly and still developing, it significantly improves rider safety by offering rapid, intelligent crash protection. The system is promising for future two-wheeler safety standard

9.Reference:

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