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Mandatory Installation of Automatic Fire Suppression (Fire Ball) Systems in Automobiles to Reduce Fire-Related Fatalities

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***Abstract*-- Vehicle fire accidents are increasing due to fuel leaks, electrical short circuits, battery thermal runaway, and mechanical failures, accedents. Despite advancements in automotive safety, fire-related fatalities continue to rise, especially passenger (carry humens) in buses and electric vehicles . This paper proposes the mandatory installation of automatic fire suppression devices (Fire Balls) in all vehicles private, commercial, and public transport to prevent loss of life and property. The study analyses recent fire accidents, evaluates fireball technology, and recommends policy-level implementation by Road Transport Authorities (RTOs)..**

***Keywords* -- Vehicle fire accidents, Fire suppression system, Fireball technology, Automotive safety, Electric vehicle fires, Passenger safety, Fire prevention, Road Transport Authority (RTO), Public transport safety, Emergency fire control.**

I. Introduction

Automobile fires pose a serious safety threat worldwide. Unlike collisions, fire incidents spread rapidly and often trap passengers due to electrical failure and structural deformation. In India, several fatal incidents have occurred in recent years, especially involving buses and electric vehicles.

Fire suppression systems in vehicles remain optional, unlike seat belts or airbags. This research highlights the urgent need for automatic fire suppression systems using fire extinguishing balls, which activate instantly during fire outbreaks without human intervention.

II. Problem Statement

- Vehicles today carry highly flammable fuels and
- high-voltage batteries.
- Fires spread within 30–60 seconds, leaving no
- escape time.
- Manual fire extinguishers are ineffective during
- panic situations.
- Current vehicle safety regulations do not
- mandate fire suppression systems.
- Public transport vehicles carry 30–60 passengers,
- increasing fatality risk.

III. Case Studies Of Vehicle Fire Accidents

3.1 Kurnool Bus Fire Accident (India)

- Date: 24 October 2025
- Fatalities: 19 passengers
- Cause: Motorcycle collision → fuel tank
- explosion → electrical short circuit
- Outcome: Doors jammed, passengers trapped
- Conclusion: Fire spread faster than evacuation
- time

Fig.1 (October 24, 2025 2:07 PM 20 People Killed In a Bus Fire Accident In Kurnool District of Andhra Pradesh)

3.2 Electric Car Fire – Hyderabad

- Electric car caught fire at NTR Stadium parking.
- Fire spread to nearby vehicles.
- Highlighted danger of battery thermal runaway.

Fig.2 (Fire Breaks Out From Electric Car In Hyderabad, Spreads To Nearby Vehicle Nov 16, 2025 23:50 pm)

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3.3 EV Battery Fire – Sydney (MG ZS EV)

- Damaged lithium-ion battery ignited.
- Fire spread to four other vehicles.
- Required special firefighting response.

These incidents prove that existing safety systems are insufficient.

Fig.3 (Damaged battery removed from MG ZS EV catches fire, sets 4 other vehicles ablaze at holding yard 13th September 2023, 08:13am)

IV. Fire Ball Technology Overview

Fire extinguishing balls are self-activating fire suppression devices designed for rapid response.

4.1 Construction

- Shape: Spherical
- Material: Lightweight EPS shell
- Weight: 1.3 – 1.5 kg
- Agent: Mono Ammonium Phosphate (MAP)
- Activation: Heat-triggered fuse (3–5 seconds)

Fig.4 (The mechanical design of a fire extinguishing ball is elegantly simple, relying on passive and active deployment mechanisms)

4.2 Working Principle

1. Fire contacts the ball.
2. Heat activates internal fuse.
3. Ball bursts with loud alarm (120–140 dB).
4. Dry chemical powder disperses in 360° radius.
5. Fire is suppressed by oxygen isolation and chemical inhibition.

Fig.5 (Embedded ignition chords or fuses (at least two for redundancy) run through the shell.)

V. Application In Automobiles

Recommended Installation Areas

- Engine compartment
- Battery compartment (EVs)
- Fuel tank zone
- Passenger cabin ceiling
- Bus engine bay

Operation Modes

- Automatic activation during fire
- Manual activation (throw-in during emergency)

Fig.6 (Fix near bus rear engine area}

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Fig.7 (Fix car Back side and fuel area)

VI. Advantages Of Fire Ball System

Feature and Benefit

1. Automatic activation No human intervention required
2. Lightweight: No vehicle load impact
3. No maintenance 5-year shelf life
4. Works without power Effective during electrical failure
5. Low cost Affordable mass deployment
6. Loud alarm Alerts passengers instantly

VII. Comparative Risk Analysis

Vehicle Type: Fire Risk

1 Petrol/Diesel Vehicles: High (fuel leakage)
2 Electric Vehicles: Very High (thermal runaway)
3 Hybrid Vehicles: High
4 Public Buses: Extremely High (passenger load)

VIII. Policy Recommendation

It is strongly recommended that:

1. All new vehicles must be equipped with certified fireball systems.
2. Renewal of vehicle registration should require fireball installation.
3. Public transport vehicles must have multiple fireballs installed.
4. RTOs should include fire suppression checks during fitness certification.
5. BIS / AIS standards to be framed for automotive fireball systems.
6. Government to provide subsidy for retrofitting older vehicles.

IX. Expected Outcomes

- Drastic reduction in fire-related deaths
- Faster emergency response
- Improved passenger confidence
- Lower insurance claims
- Enhanced national road safety standards

X. Conclusion

Fire accidents in automobiles are unpredictable and devastating. Fire extinguishing balls offer a simple, low-cost, and effective solution capable of saving hundreds of lives annually. Making this system mandatory is not only a technological upgrade but a humanitarian necessity.

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