



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 5, May 2025

AI-Based Smart Vehicle Accident Detection and Emergency Alert System

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ABSTRACT: The Car Damage Detection System uses AI, deep learning, and image processing to automate vehicle damage assessment and accident notifications. It collects vehicle images from sources like Roboflow datasets and real-time camera feeds. Preprocessing involves techniques like bounding box regression and IOU to localize damage areas accurately. A CNN-based model classifies damage into categories such as scratches, dents, or severe structural damage. The model is trained on a large, labeled dataset for high accuracy and adaptability. Edge computing ensures real-time processing with minimal latency. Once damage is detected, alerts are sent via email, SMS, and alarms to emergency services and insurers. This enhances emergency response and streamlines insurance claims. The system is robust across various lighting, angles, and vehicle types. It reduces manual inspection, human error, and operational costs for insurers, police, and rental services.

KEYWORDS: AI-driven vehicle damage detection, CNN classification, real-time processing, edge computing, accident alerts, automated inspection.

I. INTRODUCTION

- **AI-Powered Damage Detection:** Utilizes AI, deep learning, and image processing to automate and improve vehicle damage assessment.
- **CNN-Based Classification:** Employs a trained CNN model with $S \times S$ grid segmentation to classify damage types accurately.
- **Real-Time Processing:** Uses edge computing for low-latency, on-site data processing and immediate results.
- **Accident Notification System:** Sends instant alerts via SMS, email, and alarms to emergency services and insurers.
- **Scalable & Versatile Deployment:** Designed for use in fleet management, insurance, and law enforcement, enhancing efficiency and reducing manual errors.

II. OBJECTIVES

- The system uses AI, deep learning, and CNN models to automate real-time vehicle damage detection and classification.
- It eliminates manual inspection inefficiencies by identifying scratches, dents, and structural damage accurately.
- Edge computing enables low-latency processing, making it suitable for remote and accident-prone areas.
- An automated module notifies emergency services and insurance providers instantly to improve response times.
- The solution is scalable, cost-effective, and ideal for insurance, law enforcement, toll booths, and fleet management.

III. LITERATURE SURVEY

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IV. EXISTING SYSTEM

The existing system uses deep learning and image processing to automatically detect and classify vehicle damage. It collects images from real-time cameras and datasets like Roboflow for training a CNN-based model. Preprocessing techniques like bounding box regression and IoU improve detection accuracy. The system sends instant alerts via SMS, email, and alarms to emergency services and insurers. Edge computing enables real-time processing, reducing latency and improving response efficiency.

DISADVANTAGE:

1. Relies only on image data without sensor fusion.
2. Accuracy drops in poor lighting or weather conditions.
3. Edge devices may have limited processing power.
4. Needs high-quality images for reliable detection.
5. Some human oversight still required for validation.

V. PROPOSED SYSTEM

The proposed system is designed to automatically identify and classify vehicle damage using advanced computer vision and deep learning techniques. It utilizes YOLOv8 (You Only Look Once), a state-of-the-art object detection algorithm, to analyze CCTV footage and detect vehicle accidents in real-time. Upon detecting an accident, the system captures and processes images to evaluate the severity of the damage. It then generates real-time alerts, which are promptly sent via email notifications to nearby hospitals, police stations, and emergency response teams. This immediate communication ensures a swift and efficient emergency response, reducing delays in medical assistance and accident management. The system enhances road safety by enabling seamless and rapid information sharing between vehicles and emergency services, ultimately minimizing casualties and improving resource allocation. By integrating deep learning models with real-time surveillance infrastructure, this project contributes to the development of smarter and safer transportation systems. The proposed solution not only optimizes emergency handling but also paves the way for advanced accident detection systems in smart cities.

ADVANTAGES OF PROPOSED SYSTEM

- Digitalized claim process makes easy to use
- Give the accurate result of the damaged vehicle
- Helps the insurance company to analyze the damaged vehicle and also payment process.

VI. METHODOLOGIES

The system collects vehicle images from datasets and real-time feeds for training. Preprocessing uses bounding box regression and IoU to localize damage. A CNN model with YOLOv8 detects and classifies damage severity in real-time. Edge computing enables fast processing and triggers instant alerts to emergency services.


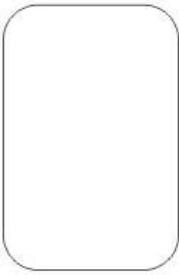


MODULE

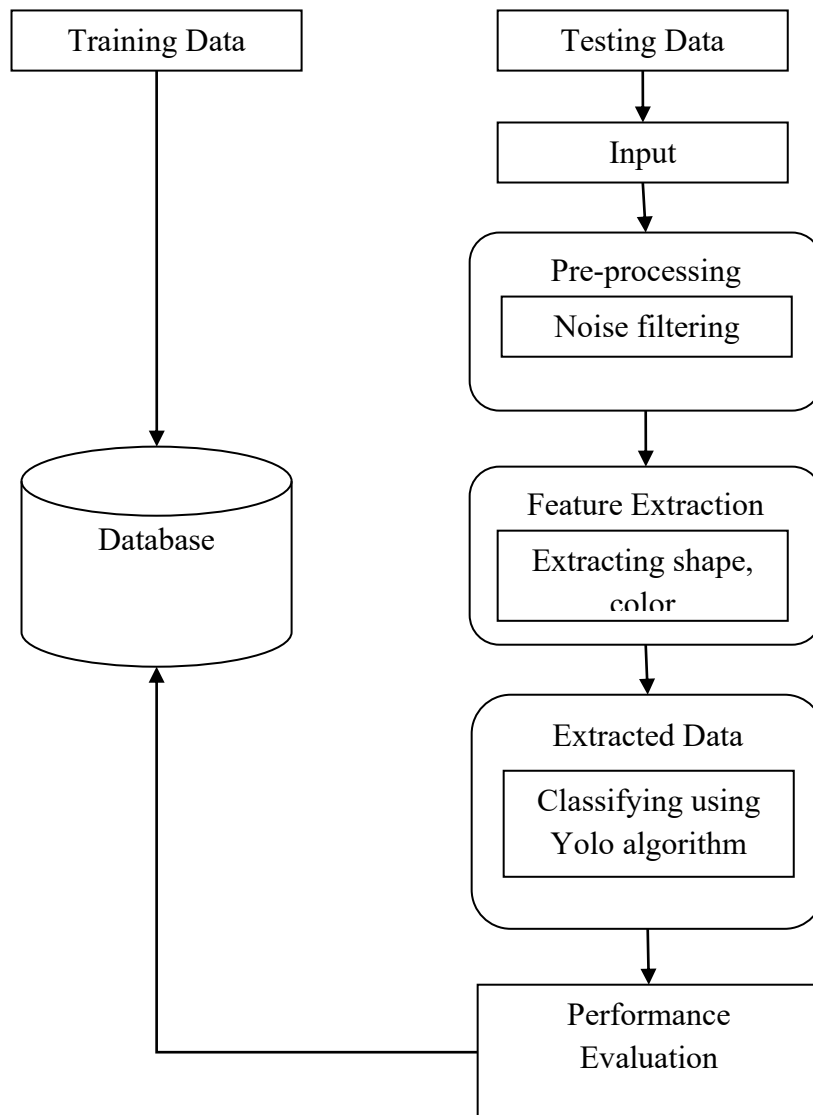
- Framework Creation
- Object Detection
- YOLO algorithm
- Damage Detection

DATAFLOW DESIGN

A two-dimensional diagram explains how data is processed and transferred in a system. The graphical depiction identifies each source of data and how it interacts with other data sources to reach a common output. Individuals seeking to draft a data flow diagram must identify external inputs and outputs, determine how the inputs and outputs relate to each other, and explain with graphics how these connections relate and what they result in. This type of diagram helps business development and design teams visualize how data is processed and identify or improve certain aspects.

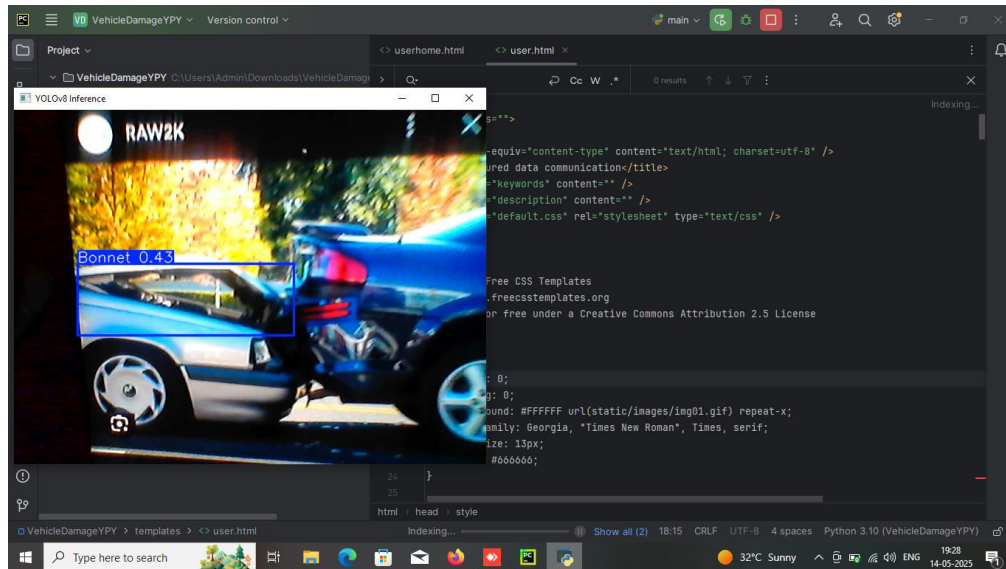
DATA FLOW SYMBOLS:

Symbol	Description
	An entity . A source of data or a destination for data.
	A process or task that is performed by the system.
	A data store , a place where data is held between processes.
	A data flow .

SYSTEM ARCHITECTURE:**SYSTEM IMPLEMENTATION**

- Black box testing involves evaluating software without knowledge of its internal code, focusing solely on inputs and outputs.
- Tests are derived from requirement or specification documents to ensure expected behavior.
- The system is treated as a "black box," ignoring internal logic while observing external responses.
- Programming languages serve as a bridge between humans and machines, impacting software quality.
- Key coding considerations include design-to-code simplicity, memory and code efficiency, and upgradability.
- Implementation is the phase where design becomes a working system, crucial for success and user trust.

DETECTION:



VII. CONCLUSION

The proposed system effectively demonstrates the use of YOLOv8 for real-time vehicle damage detection and accident analysis through CCTV footage. By integrating deep learning with instant alert mechanisms, it enhances road safety and enables swift communication with emergency services. The automated detection and notification process significantly reduces response times and improves emergency management. This project highlights the potential of computer vision in smart transportation, offering a scalable and efficient solution for real-time accident response.

VIII. FUTURE ENHANCEMENT

Future enhancements of this system could focus on increasing detection accuracy by incorporating multi-modal data, such as integrating sensor-based inputs (e.g., accelerometers and GPS). Implementing machine learning-based damage classification can further refine the severity assessment for better decision-making.

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