

QUICKRESQ : Real-Time Accident Detection with Severity Classification and Emergency Alert System

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Abstract

Road accidents often lead to severe consequences, not only due to the impact itself but also because of delays in receiving timely assistance. In many cases, help arrives late since accident detection relies on manual reporting or bystander intervention. To address this issue, this project introduces QuickResQ, an intelligent system that automatically identifies accident scenarios and initiates emergency response without human involvement. The system analyzes visual inputs such as images and videos using computer vision techniques to detect accidents and assess their severity. Based on this assessment, it generates alerts containing essential details like location and seriousness of the incident, which are then shared with nearby emergency services, including hospitals and law enforcement authorities. The workflow integrates detection, classification, and alert mechanisms into a unified platform. By automating critical steps in the response process, QuickResQ reduces the time between accident occurrence and emergency assistance. The system is designed to function under varying environmental conditions, making it suitable for practical deployment. This approach contributes to faster response systems and improved road safety outcomes.

Keywords: Accident Detection, Emergency Alert System, Computer Vision, Machine Learning, Severity Classification, Road Safety, Real-Time Monitoring, Image Processing, Video Processing.

1. Introduction

Road accidents remain a significant challenge, especially in regions where immediate reporting and response systems are not reliable. In many cases, victims depend on passersby or witnesses to inform emergency services, which can result in critical delays. Such delays often worsen the situation, reducing the chances of timely medical intervention[1].

With the advancement of artificial intelligence, there is an opportunity to move beyond manual reporting and develop systems that can independently recognize accident situations. While some existing solutions provide basic detection or alert features, they often lack the ability to evaluate how serious an accident is, which is crucial for deciding the level of response required.

This work presents QuickResQ, a system designed to automatically detect accidents from visual data and assess their severity in real time. The system combines image analysis with machine learning techniques to interpret accident scenarios and determine their impact level. Based on this evaluation, it generates alerts and communicates relevant information to nearby emergency services[2,3].

By integrating detection, severity analysis, and alert generation into a single workflow, the system aims to minimize response delays and improve coordination during emergencies. The proposed approach focuses on creating a reliable and practical solution that can assist in faster decision-making and better emergency management on roads.

2. Materials and Methods

The proposed system, QuickResQ, is designed as an integrated solution for accident detection and emergency alert generation. It follows a modular approach, combining frontend, backend, and machine learning components to ensure efficient processing. The system focuses on analyzing visual data, detecting accidents, classifying their severity, and sending real-time alerts to emergency services, providing a smooth and reliable workflow.

2.1 System Design

The system is designed using a three-layer architecture consisting of frontend, backend, and database components. The frontend is developed using HTML and CSS providing a simple and user-friendly interface where users can upload images or videos and view the results. The backend is implemented using Flask, which handles data processing, model integration, and communication between different modules. The system uses a machine learning model to analyze visual inputs and detect accident scenarios along with their severity levels. A database is used to store input data, detection results, and alert information for future reference. All these components are integrated to ensure a smooth flow from data input to accident detection and emergency alert generation.

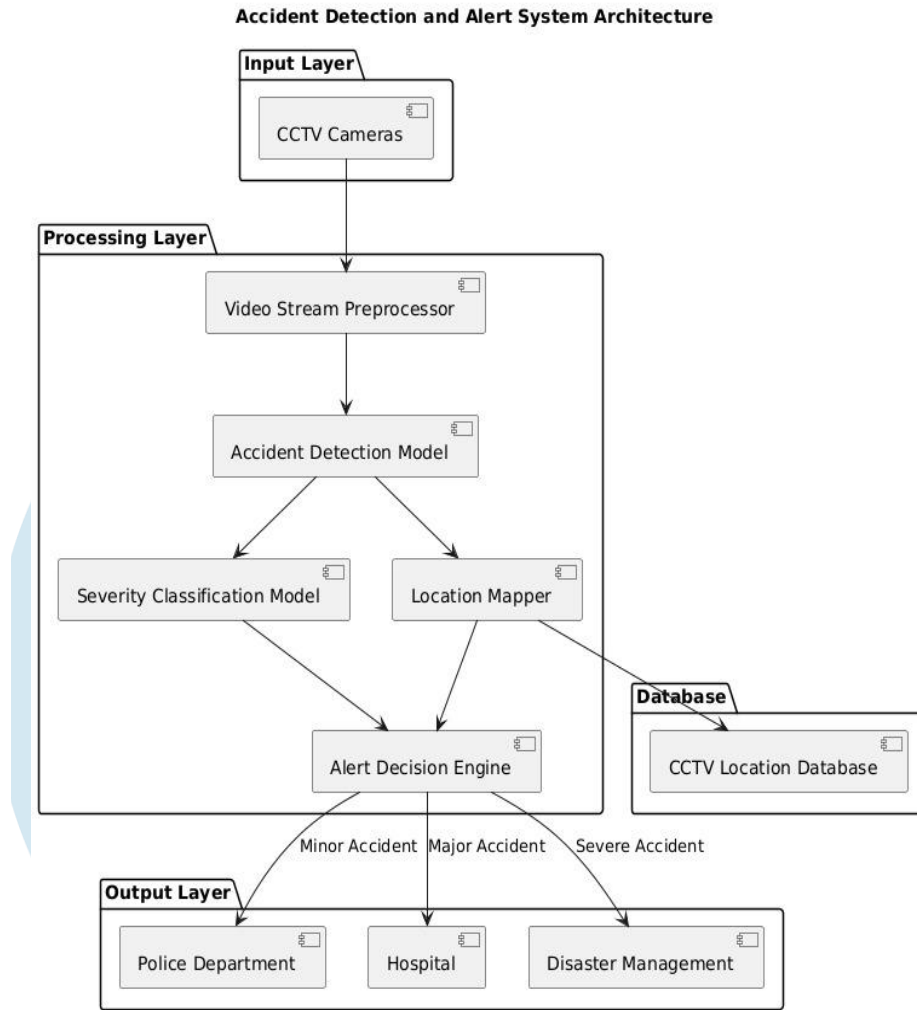


Fig. 1 System Architecture of QuickResQ

Fig.1 illustrates the overall architecture of QuickResQ, showing the flow from video input through accident detection and severity classification to alert generation. It highlights how different modules work together to process data and notify emergency services efficiently.

2.2 Accident Detection Module

The accident detection module is responsible for identifying accident scenarios from visual inputs such as images or video frames. The system processes the input data using computer vision techniques and a trained machine learning model to recognize patterns associated with road accidents. It analyzes features such as vehicle position, collisions, and irregular movements to determine whether an accident has occurred. The model is designed to handle variations in lighting, angles, and traffic conditions, ensuring reliable performance in real-world environments. Once an accident is detected, the output is passed to the next stage for severity classification and further processing.

2.3 Severity Classification Module

The severity classification module determines the seriousness of the detected accident based on the analyzed visual data. After an accident is identified, the system evaluates various factors such as the extent of damage, vehicle condition, and impact level to classify the situation into different severity levels. A machine learning model is used to perform this classification, ensuring consistent and accurate results. This step is important for prioritizing emergency response, as more severe cases require immediate attention. The classified output is then forwarded to the alert generation module for further action.

2.4 Alert Generation Module

The alert generation module is responsible for notifying emergency services once an accident is detected and its severity is classified. Based on the analysis, the system automatically generates alerts containing important details such as the location of the incident and the severity level. These alerts are then sent to nearby emergency services, including hospitals, police authorities and disaster management teams based on severity of the accident, to ensure a quick response. The module is designed to minimize delays and ensure that critical information is delivered accurately and efficiently. This helps in reducing response time and improving the chances of timely assistance.

2.5 Dashboard Interface

The system includes a user-friendly dashboard that allows users to interact with all the functionalities of QuickResQ in a single place. Through the dashboard, users can upload images or videos for accident detection and view the results, including accident status and severity level. It also displays alert information and provides a clear overview of detected incidents.

2.6 Workflow of the System

The workflow of QuickResQ begins with the user uploading an image or video through the dashboard interface. The input data is then processed by the system, where the accident detection module analyzes the visual content to identify whether an accident has occurred. If an accident is detected, the data is passed to the severity classification module, which evaluates the seriousness of the situation based on the observed features. Once the severity level is determined, the alert generation module is activated to send notifications to nearby emergency services, including hospitals, police authorities and disaster management teams based on severity, along with relevant details such as location and severity. The results are also displayed on the dashboard for user reference. This step-by-step process ensures a smooth and efficient flow from input to response, enabling timely action and improving emergency management.

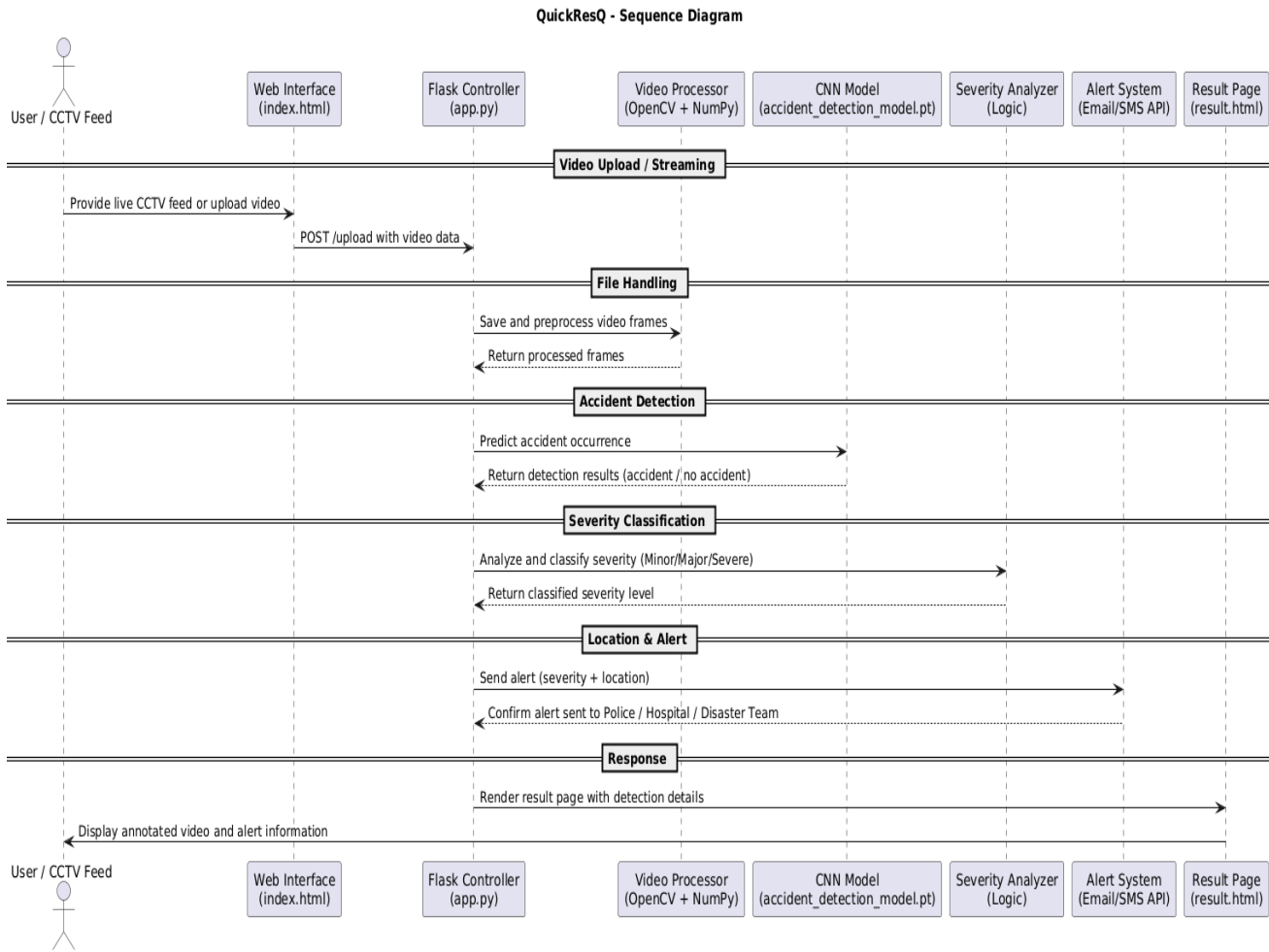


Fig. 2 Workflow of QuickResQ System

Fig. 2 represents the workflow of QuickResQ, showing how the system processes video input from upload or live feed through detection, severity classification, and alert generation. It clearly illustrates the step-by-step interaction between different components to ensure timely response and result display.

3. Results and Discussion

The QuickResQ system was tested using different image and video inputs to evaluate its ability to detect accidents under various conditions. The system successfully identified accident scenarios in most cases, even with variations in lighting, camera angles, and traffic environments. Fig.3 shows the input stage of QuickResQ, where users can upload video or enter camera details for accident detection. It provides a simple interface to initiate the process and view detection results.

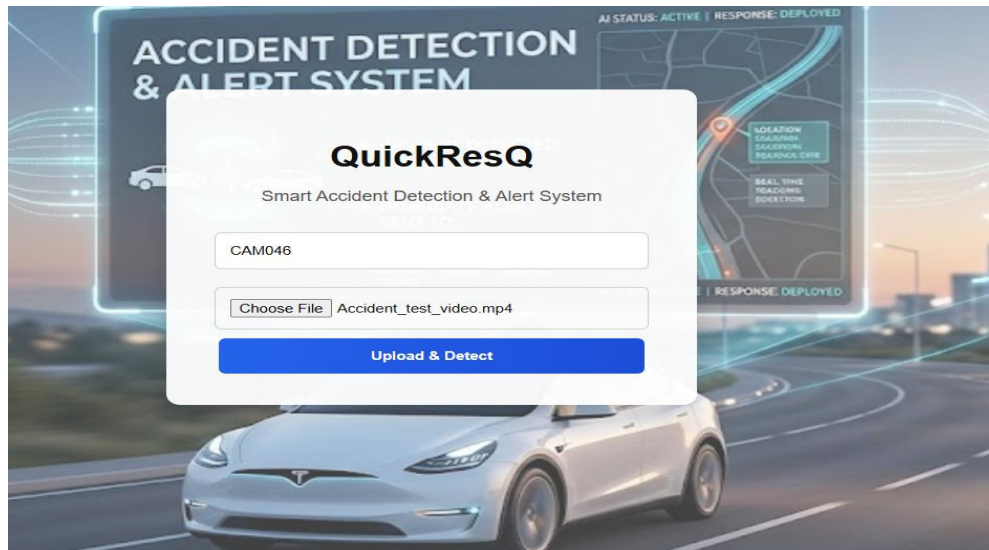


Fig. 3 Accident Detection Input

After detecting an accident, the system classifies its severity based on the level of damage and impact observed in the visual data. The model effectively distinguishes between different severity levels, helping prioritize emergency response. These cases usually do not pose serious risk to passengers and may not require immediate emergency assistance. Fig.4 shows the output of a minor accident detected by QuickResQ, where the system identifies a low-impact incident with minimal damage. The result is clearly displayed along with the location.

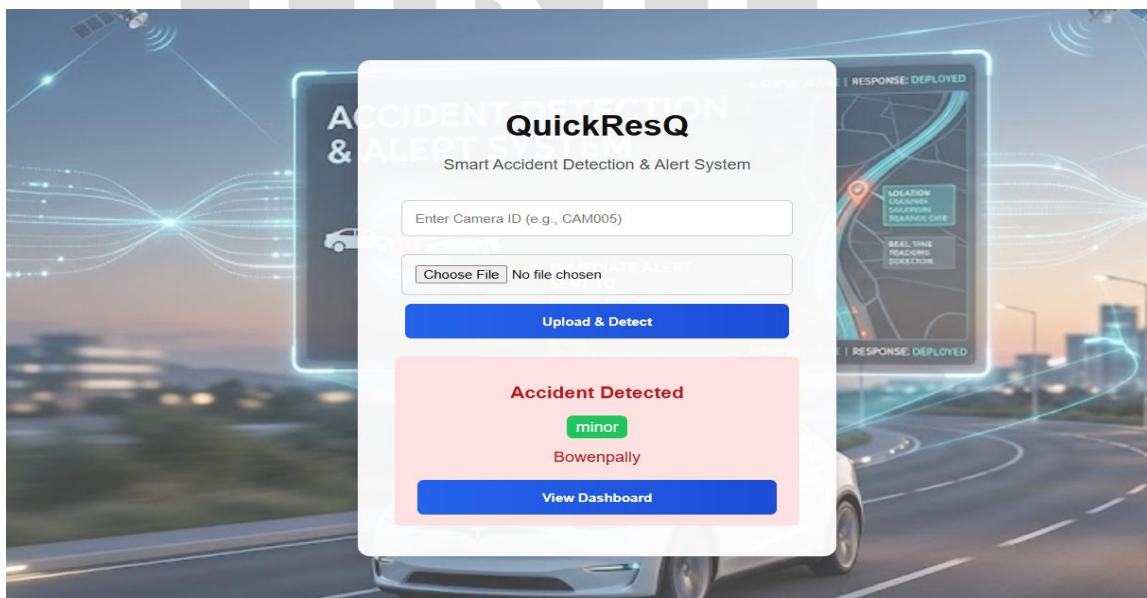


Fig. 4 Severity Classification Output (Minor)

Major accidents indicate a moderate level of impact, often resulting in noticeable vehicle damage and a possibility of injuries. Fig.5 shows the output of a major accident detected by QuickResQ. The result is displayed along with the location, indicating the need for timely emergency response.

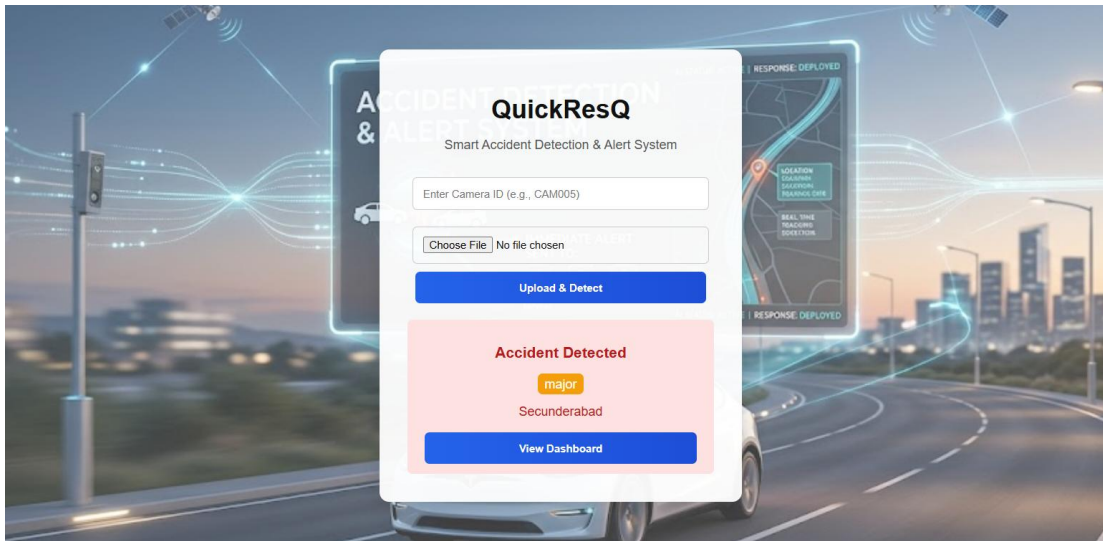


Fig. 5 Severity Classification Output (Major)

Severe accidents represent high-impact collisions with significant vehicle damage and a high risk of serious injuries or fatalities. These cases demand immediate emergency response and quick medical attention. Fig.6 shows the output of a severe accident detected by QuickResQ, where the system identifies a high-impact collision with significant damage. The result is displayed along with the location, indicating the need for immediate emergency response.

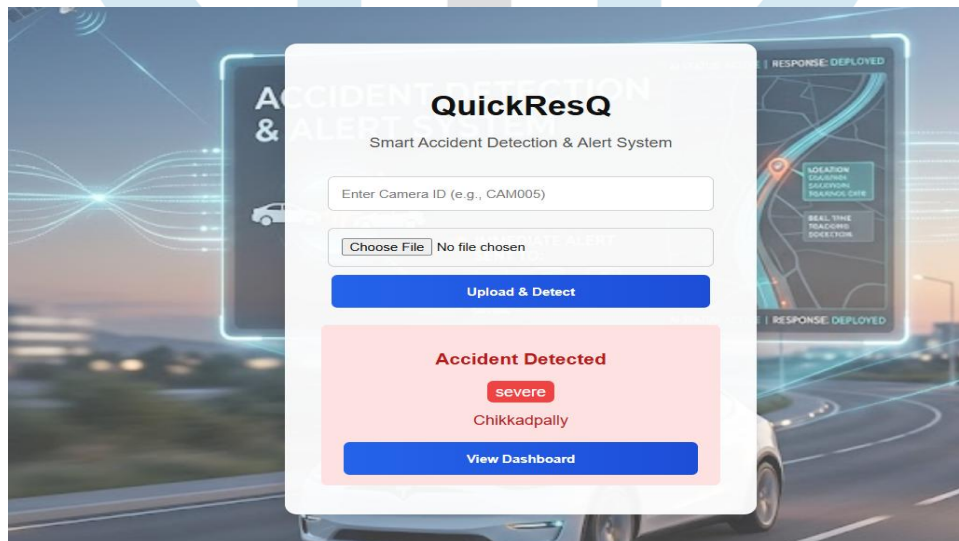


Fig. 4 Severity Classification Output (Severe)

Once the severity is determined, the system automatically generates alerts and sends them to nearby emergency services along with important details such as location and severity level. This ensures quick communication and faster response. Fig.7 shows the alert system of QuickResQ, where notifications are sent based on the severity of the accident to the appropriate emergency services. Minor cases are reported to police, major cases to hospitals, and severe cases to both disaster management teams and hospitals for immediate response.

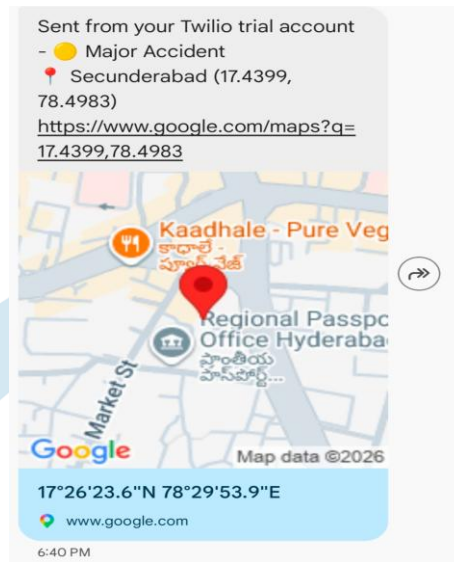


Fig. 7 Alert Notification Output

Fig.8 is the dashboard that provides a simple and user-friendly interface where users can upload inputs, view detection results, and monitor alerts. It combines all system functionalities into a single platform, improving usability and efficiency.

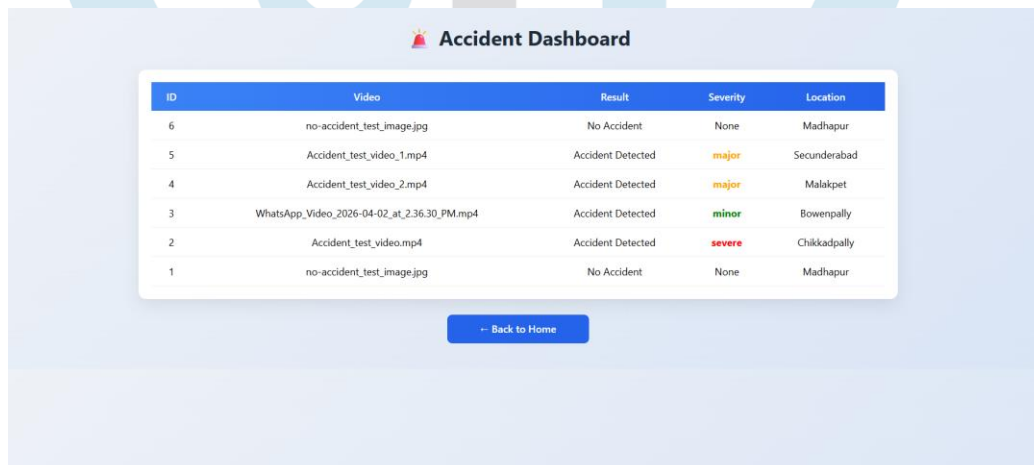


Fig. 8 Dashboard Interface of QuickResQ

The system maintains stable performance across different environments, with only minor variations in accuracy under challenging conditions, indicating its robustness and practical applicability. Fig.9 presents the performance analysis of QuickResQ across different conditions, showing how the system maintains consistent accuracy under varying environments. It highlights that the system performs reliably, with only slight variations in challenging situations like low lighting and blurred images.

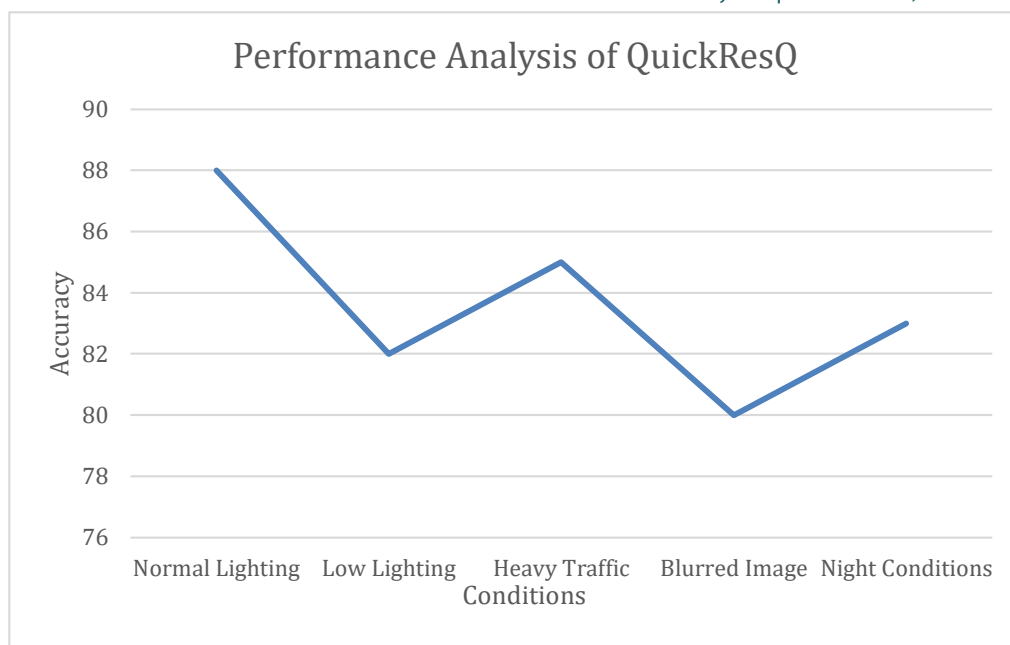


Fig. 9 Performance Analysis of QuickResQ

Table 1: Feature Comparison of QuickResQ with Existing Solutions

Tool	Accident Detection	Severity Classification	Alert System	Accuracy	Remarks
Tesla Autopilot	Yes	Partial	Yes	80%	Limited to in-vehicle use
CCTV Surveillance Systems	Partial	No	No	70%	Requires manual monitoring
AI Detection Tool	Yes	Partial	No	75%	No alert system
QuickResQ	Yes	Yes	Yes	85%	Integrated

4. Conclusion

QuickResQ demonstrates how artificial intelligence can be applied to improve emergency response in road accident scenarios. By combining accident detection, severity evaluation, and alert generation into a single system, it reduces the reliance on manual reporting and helps initiate faster action when incidents occur. The system was able to identify accidents and classify their severity with reasonable accuracy across different test conditions, showing its ability to adapt to real-world variations. The integration of an automated alert mechanism ensures that important information reaches emergency services quickly, which can make a significant difference in critical situations.

One of the key strengths of the proposed system is its end-to-end workflow, where detection and response are closely connected without unnecessary delays. This makes it more practical compared to solutions that focus only on detection without further action. Further improvements can be made by enhancing model accuracy in complex environments, supporting continuous video analysis, and expanding integration with live emergency networks. With such enhancements, the system can evolve into a more robust and widely deployable solution.

QuickResQ provides a meaningful step toward smarter and faster accident response systems, contributing to improved safety and more efficient emergency management.

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