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NIRBHAYA: A Step Towards Safer Streets

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Abstract: *Women's safety is a major concern in today's society. This project focuses on the design and study of a real-time personal safety system using an AI-based public surveillance approach. The system observes movement patterns to detect unsafe situations such as sudden falls or abnormal behavior.*
The proposed system is developed using existing technologies and follows a scalable and reliable system architecture. Special importance is given to user privacy by avoiding identity-based monitoring and focusing only on behavior analysis.
The project is implemented in a phased manner, starting with essential system components. This work demonstrates that an effective, reliable, and ethically responsible safety system can be developed to enhance women's security in public areas.

Keywords: Women's Safety System, Microservices Architecture, Real-Time Data, AI Anomaly Detection, Data Privacy, GDPR, DPDPA, Flutter, Polyglot Persistence, Event-Driven Architecture

I. INTRODUCTION

Women's safety has become a serious issue in today's society due to the increasing cases of harassment, violence, and unsafe incidents in public places. Many women face difficulties in getting immediate help during emergencies because traditional safety methods depend mainly on manual reporting and delayed response.
To overcome these problems, this project titled **"NIRBHAYA: A Step Towards Safer Streets"** focuses on developing an intelligent safety system using modern technology. The system uses **AI-based public surveillance** to monitor movement patterns and detect abnormal or dangerous situations such as sudden falls or unusual behavior.
The main aim of this project is to provide a **proactive safety solution** that can identify risky situations in real time and help in faster response. Special importance is given to **privacy and ethical use of technology**, wherethe system avoids personal identification and focuses only on behavior-based analysis.
This project demonstrates how artificial intelligence and modern system architecture can be used to improve women's safety and contribute towards creating safer public environments.

II. LITERATURE SURVEY

Women's safety has been an important research area due to the increasing number of incidents in public places. Many researchers have proposed different technological solutions to improve safety using mobile applications, GPS tracking, and alert mechanisms.
Several existing systems focus on emergency alert generation, where a user can send an SOS message to family members or police. Although these systems are helpful, they mainly depend on manual activation, which may not always be possible in critical situations. This limitation can delay response time and increase risk.
Some studies have explored the use of crime data analysis and machine learning techniques to predict unsafe areas. Research such as *crime pattern analysis and prediction models* highlights how historical crime data can be used to identify high-risk locations. However, these systems are mostly predictive and do not provide real-time detection of emergencies.
Other research works suggest using surveillance systems and computer vision techniques to monitor public places. These systems analyze video feeds to detect abnormal activities such as sudden movements, falls, or crowd

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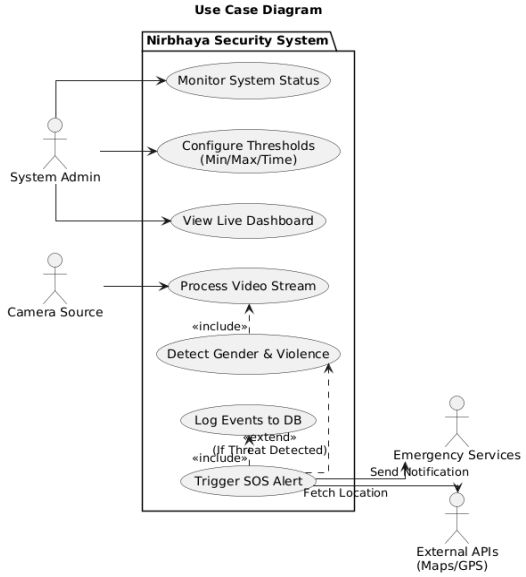
disturbances. While effective, many traditional surveillance systems raise privacy concerns due to identity tracking and facial recognition.

Recent studies emphasize the importance of **privacy-aware and ethical AI systems**. Researchers recommend behavior-based anomaly detection instead of identity-based monitoring to reduce bias and protect individual privacy. This approach focuses on detecting unusual actions rather than identifying people.From the literature review, it is observed that existing systems provide partial solutions. There is a need for a **real-time, proactive, and privacy-focused safety system**. The proposed project addresses these gaps by combining AI-based behavior detection with a scalable system architecture, offering a more effective and ethical solution for women's safety.

Table -1: Use case Diagram of Nirbhaya Security System



III. METHODOLOGY

The methodology followed in this project is systematic and phased to ensure proper design, development, and evaluation of the women safety system.

First, a detailed **requirement analysis** is carried out to understand the existing problems related to women's safety and the limitations of current systems. Based on this study, functional and non-functional requirements such as real-time detection, reliability, scalability, and privacy are identified. Next, the **system architecture** is designed using a microservices and event-driven approach. The system is divided into independent modules so that each component can function separately, improving fault tolerance and performance. Privacy and ethical considerations are included during the design stage.

After design, the **AI-based behavior detection module** is developed. This module analyzes movement patterns to detect abnormal activities such as sudden falls or unusual movement. The focus is kept on behavior analysis rather than personal identification to ensure privacy.

The **backend services** are then developed to process detected events and manage system communication. All modules are integrated carefully to ensure smooth data flow and real-time response.

Finally, the system undergoes **testing and evaluation** under different scenarios to check accuracy, response time, and reliability. Necessary improvements are made based on testing results, ensuring the system meets project objectives and ethical standards.

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IV. HARDWARE AND SOFTWARE REQUIREMENTS

4.1 Hardware Requirements

The hardware required for this project should be capable of handling real-time video capture and AI-based processing. A system with a good processor and sufficient RAM is necessary to run the detection models smoothly. Storage is required to store the system files, models, and temporary data. A camera device is needed to capture live video for analysis. An internet connection is essential for accessing external services such as maps, location services, and alert databases.

Figure 4.1: Hardware Components

Sr. No.	Component	Description
1	Processor	Intel Core i5 / AMD Ryzen 5 or higher for AI processing
2	RAM	Minimum 16 GB for smooth model inference
3	Storage	512 GB SSD for fast data access
4	Camera	Built-in webcam / External USB camera / IP camera
5	Graphics (Optional)	Integrated / Dedicated GPU for faster AI inference
6	Internet Connection	Required for APIs, maps, and Firebase

4.2 Software Requirements

The software requirements include the operating system, programming languages, frameworks, and tools needed to develop and run the system. The backend uses Python and FastAPI to process data and manage APIs, while the frontend uses React for user interaction. AI libraries are used for real-time video analysis. Database and cloud services are required to store alerts and system data. Development tools help in writing, testing, and deploying the application.

Figure 4.2: Software Components

Sr. No.	Software	Description
1	Operating System	Windows 10 / 11
2	Programming Language	Python 3.8+, JavaScript
3	Backend Framework	FastAPI
4	Frontend Framework	React JS
5	AI & CV Libraries	OpenCV, YOLO, NumPy, Torch
6	Database	Firebase Realtime DB / Firestore
7	Mapping Tools	Leaflet, Google Maps
8	Development Tools	Visual Studio Code, Node.js

V. RESULTS AND OUTPUTS

The proposed **NIRBHAYA** system successfully demonstrates the use of AI-based surveillance for improving women's safety in public places. The system is able to monitor movement patterns and identify abnormal or unsafe behavior such as sudden falls or unusual movements in real time.

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When an abnormal activity is detected, the system generates alerts promptly, which helps in faster response. The microservices-based architecture ensures smooth operation, scalability, and reliability of the system even under multiple event conditions.

The project outputs confirm that the system follows privacy and ethical guidelines by avoiding identity-based monitoring. Overall, the results show that the proposed system is effective, reliable, and suitable for real-world safety applications.

VI. CONCLUSIONS

The **NIRBHAYA: A Step Towards Safer Streets** project successfully presents an AI-based women safety system designed to detect unsafe situations in public places in real time. The system focuses on analyzing movement patterns to identify abnormal or dangerous behavior, providing a proactive approach to safety.

The proposed system is built using a scalable and reliable architecture, ensuring smooth operation and quick response. Special importance is given to privacy and ethical considerations by avoiding identity-based monitoring and using behavior-based analysis only.

Overall, this project demonstrates that modern technologies such as artificial intelligence and advanced system architecture can be effectivelyused to improve women's safety. The system offers a practical, ethical, and future-ready solution that can contribute to creating safer public environments.

VII. ACKNOWLEDGEMENT

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