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AI-Based Real-Time Survivor Detection System

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Abstract - *Natural disasters such as earthquakes, floods, landslides, and building collapses often leave many people trapped under debris or stranded in dangerous environments. One of the major challenges faced by rescue teams during such situations is identifying survivors quickly and accurately. Traditional search methods rely heavily on manual inspection and rescue dogs, which may require significant time and resources. Delays in locating survivors may reduce the chances of saving lives. This research proposes an* ***AI-based real-time survivor detection*** *with rescue alert system that helps detect human survivors using a smartphone camera. The system consists of an Android mobile application integrated with an artificial intelligence detection model. The application captures live camera frames and analyzes them using computer vision techniques to detect human presence. When a human is detected, the system automatically captures the device's GPS location and generates an alert. The alert information is stored in a cloud database and notifications are sent to rescue teams through push notifications. The system supports two types of users: normal users and rescuers. Normal users initiate the detection process through the mobile application, while rescuers receive alerts and view survivor locations through a dedicated dashboard. The proposed system aims to improve disaster response efficiency by enabling faster survivor detection and assisting rescue teams in locating them quickly. By combining artificial intelligence, mobile technology, and real-time alert mechanisms, the system provides a cost-effective and scalable solution for emergency rescue operations. In addition, the system can support large-scale disaster management by allowing multiple users to participate in the detection process. This collaborative approach increases the chances of locating survivors quickly, especially in large disaster areas where rescue teams may have limited manpower.*

***Key Words*: Artificial Intelligence, Survivor Detection, Disaster Management, Computer Vision, Mobile Application, Real-Time Alert System, Human Detection, GPS Location Tracking, Image Processing, Cloud Database, Push Notifications, Emergency Rescue System.**

1. INTRODUCTION

Natural disasters such as earthquakes, floods, landslides, and building collapses cause severe damage to both human life and infrastructure. During such events, many people may become trapped under debris or remain stranded in unsafe locations. Locating survivors quickly becomes one of the most important tasks for rescue teams. Traditional rescue operations rely on manual searching, rescue dogs, and specialized equipment. Although these techniques are effective in many cases, they often require significant time and manpower. Searching large disaster areas manually can be slow and difficult, especially when visibility is poor or when debris blocks access to certain locations. Advancements in artificial intelligence and computer vision technologies have created new opportunities for improving disaster management systems. AI-based detection models are capable of analyzing images and identifying human presence with high accuracy. By integrating such technologies into mobile applications, it is possible to develop systems that assist rescue teams in locating survivors more efficiently. This research proposes an **AI-Based Real-Time Survivor Detection** with Rescue Alert System that uses a smartphone camera and AI detection technology to identify possible survivors and automatically notify rescue teams with location details. The importance of such systems has increased significantly in recent years as disasters have become more frequent due to climate change and urban development. In many cases, the first few hours after a disaster are critical for saving lives. Therefore, technologies that can assist in faster detection and communication play an essential role in improving rescue outcomes.

1.1 Background of the Study

Artificial intelligence has become an important technology in many modern applications. It is widely used in fields such as healthcare, security surveillance, transportation systems, smart homes, and disaster management. AI systems help computers perform tasks that normally require human

intelligence, such as recognizing objects, analyzing images, and making decisions based on data.

One important area of artificial intelligence is computer vision. Computer vision allows machines to understand and interpret visual information from images and videos. Using computer vision techniques, systems can automatically identify objects, recognize patterns, and analyze visual data. These capabilities make computer vision useful for many real-world applications where image analysis is required.

Deep learning models used in object detection have become very powerful in recent years. These models are trained using large datasets so that they can recognize different types of objects with high accuracy. They are widely used in applications such as security monitoring systems, autonomous vehicles, smart surveillance platforms, and industrial inspection systems. These models can detect human figures, vehicles, and other objects in images and process the information in real time.

In disaster situations, AI-based detection systems can play an important role in helping rescue teams locate survivors more quickly. Instead of relying only on manual searching, AI models can analyze camera images and automatically identify human presence. This can help rescue teams save time and focus their efforts on areas where survivors are likely to be present.

When AI detection technology is integrated with mobile devices, the system becomes more portable and accessible. Smartphones are widely used and already include features such as cameras, internet connectivity, and location services. Because of this, mobile-based AI systems can be easily deployed in emergency situations without requiring specialized equipment.

Another advantage of using mobile-based AI systems is their flexibility. Since smartphones are commonly available, many people can use the application during disaster situations to assist in the detection process. This makes the proposed solution practical for both developed and developing regions where advanced rescue infrastructure may not always be available. By combining artificial intelligence with mobile technology, it becomes possible to create efficient and affordable solutions for disaster management and rescue operations.

1.2 Objectives of the Study

The main objective of this research is to develop a mobile-based system that can detect human survivors using artificial intelligence and automatically notify rescue teams during disaster situation. The system uses a smartphone camera to capture images and analyze them with an AI-based human detection model to identify possible survivors. When a person is detected, the application automatically collects the device's GPS location and generates an alert. This alert is then stored in a cloud database so that rescue teams can access the information easily. The system also sends real-time notifications to rescuers, helping them respond quickly and reach the survivor's location faster. In addition, the application provides a dashboard where rescue team members can view survivor alerts along with their location details. The system is also designed to be simple and easy to use, so that people can operate the application quickly even during stressful disaster situations without needing any technical knowledge.

1.3 Problem Statement

During disaster situations, rescue teams face many difficulties while searching for survivors. In many cases, victims may be trapped under debris or located in areas that are difficult to reach.

Traditional rescue operations depend heavily on manual searching and specialized equipment. While these methods can be effective, they often require a large amount of time and effort. In large disaster zones, searching every area manually may delay rescue operations.

Another problem is the lack of real-time information about survivor locations. Rescue teams may not always know where survivors are located, which makes the search process even more challenging.

There is a need for a system that can automatically detect human presence and immediately inform rescue teams about possible survivor locations.

The proposed AI-based detection system addresses this issue by using a smartphone camera and computer vision technology to identify human presence and generate alerts with GPS location information.

2. Literature Review

Various technologies have been studied and developed to improve disaster rescue operations. Researchers and engineers have proposed different systems to help rescue teams locate survivors more quickly and efficiently during emergency situations. These technologies aim to reduce the time required for searching large disaster areas and increase the chances of saving lives.

One common approach that has been explored in many research studies is the use of drones equipped with cameras. Drones can fly over disaster-affected areas and capture images or videos from above. This allows rescue teams to scan large areas in a short amount of time and identify possible survivors. Drones are especially useful in locations that are difficult or dangerous for humans to reach. However, drone-based systems require specialized equipment, trained operators, and proper maintenance.

Because of these requirements, they may not always be practical or affordable for every rescue team.

Another technology that has been used in disaster rescue operations is thermal imaging. Thermal cameras detect the heat emitted by the human body and display it as a thermal image. This makes it easier to identify survivors even in low-visibility environments such as darkness, smoke, or areas covered with debris. Although thermal imaging can be very effective, thermal cameras are usually expensive and may not be easily available in many regions or rescue organizations.

With the advancement of artificial intelligence and deep learning technologies, computer vision systems have become more powerful and accurate. AI-based object detection models are capable of analyzing images and automatically identifying objects such as humans, vehicles, and other important elements. These models can process visual data quickly and provide detection results in real time. Because of this capability, AI-based systems can assist rescue teams by automatically detecting human figures in camera images.
The proposed system in this research focuses on using AI-based human detection integrated with a smartphone application. This approach reduces the need for expensive hardware while still providing an effective way to detect survivors. Since smartphones are widely available and easy to use, this method makes the system more accessible and practical for different environments.

In addition to detection technology, many recent studies have also highlighted the importance of real-time communication during disaster rescue operations. Systems that combine detection methods with instant notification or alert mechanisms can greatly improve coordination between rescue teams and emergency responders. Quick communication ensures that rescue teams receive important information immediately and can respond faster to save survivors

3.1 Proposed System

The proposed system is a mobile-based application designed to help detect human survivors and inform rescue teams during disaster situations. The application uses the smartphone camera to capture real-time images, which are then analyzed using an artificial intelligence detection model to identify whether a human is present. If the system detects a person in the captured image, it automatically collects the GPS location of the device and creates an alert. This alert information is stored in a cloud database, and a notification is immediately sent to rescue teams. The system supports two types of users: normal users and rescue team members. Normal users start the detection process using the mobile application, while rescue team members receive alerts and view survivor locations through a dashboard. The system works in real time so that alerts can be generated instantly after a survivor is detected. This helps rescue teams respond faster and reduces the delays that usually occur in traditional search and rescue operations.

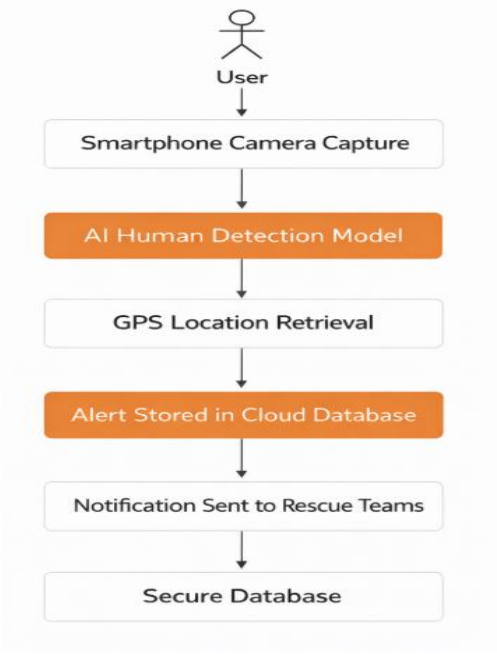

Fig -1: Overall System Workflow

3.2 Core Modules

The proposed system is divided into several core modules that work together to detect survivors and send alerts to rescue teams. Each module performs a specific function to ensure that the system operates smoothly and efficiently during disaster situations.

[1] User Authentication Module
The User Authentication Module is responsible for managing the login and registration process of users. The system allows users to create an account using their email and password. Firebase Authentication is used to securely verify user credentials and control access to the application.
During registration, users select their role in the system. There are two types of users: normal users and rescue team members. After logging in, the system checks the user role and redirects them to the appropriate dashboard. This module ensures that only authorized users can access the system.

[2] Camera Detection Module
The Camera Detection Module is responsible for capturing images from the smartphone camera. When the user starts the detection process, the camera is activated and begins capturing frames continuously from the surrounding environment.

The captured frames are then sent to the AI detection model for analysis. This module plays an important role in collecting visual data that is used for identifying human presence during disaster situations.

[3] 3.3 AI Detection Module

The AI Detection Module is responsible for analyzing the captured images and detecting human figures. This module uses an artificial intelligence model based on deep learning and computer vision techniques.

The AI model processes the frames received from the mobile application and checks whether a human is present in the image. If a human figure is detected with sufficient confidence, the system considers it as a possible survivor detection. This module helps automate the detection process and reduces the need for manual searching.

[4] Location Tracking Module

The Location Tracking Module retrieves the GPS location of the device when a survivor is detected. The system automatically captures the current latitude and longitude coordinates using the smartphone's location services.

This location information helps identify the exact position where the detection occurred. The captured location data is included in the alert message so that rescue teams can quickly reach the detected location.

[5] Alert Generation Module

The Alert Generation Module is responsible for creating alerts when the system detects a possible survivor. The alert includes important information such as the captured image, location coordinates, time of detection, and user details.

This information is stored in the cloud database so that it can be accessed by rescue teams. The alert system ensures that detection results are properly recorded and shared with authorized users.

[6] Notification and Rescuer Dashboard Module

This module sends push notifications to rescue team members when a new survivor detection alert is generated. Firebase Cloud Messaging is used to deliver notifications in real time.

Rescue team members can open the application dashboard to view the alert details, including the survivor image, location, and time of detection. The dashboard also allows rescuers to navigate to the detected location using map services.

4.1 System Architecture

The system architecture of the proposed solution is made up of several important components that work together to detect survivors and send alerts to rescue teams. These components include the mobile application, the AI detection module, the backend server, and the cloud database. Each part of the system has a specific role in ensuring that the detection and alert process works smoothly.

The mobile application is the main interface used by the user. It runs on a smartphone and uses the device's camera to capture images or frames from the surroundings. These captured images are then sent to the AI detection module for analysis. The application also manages user interaction, such as starting the detection process and displaying detection results.

The AI detection module is responsible for analyzing the captured images using computer vision and artificial intelligence techniques. The detection model processes the images and checks whether a human figure is present. If a human is detected in the image, the system considers it as a possible survivor and prepares to generate an alert.

Once a survivor is detected, the system automatically retrieves the current GPS location of the device. This location information helps identify the exact place where the detection occurred. The alert details, including the captured image, location coordinates, and time of detection, are then stored in a cloud database for further access and monitoring.

After storing the alert information, the system sends push notifications to rescue team members through the application. These notifications inform the rescuers that a possible survivor has been detected. The rescue team can open the application dashboard to view the alert details and examine the location information.

Rescuers can access the alert data through the dashboard interface, where they can see the survivor image, time of detection, and GPS location. Using map services integrated into the application, they can easily navigate to the location and start the rescue operation.

The backend server acts as the central component of the entire system. It connects the mobile application, AI detection system, and cloud database. The server receives requests from the mobile application, processes the data, and manages communication between different system components. It also ensures that alert information is stored correctly and that notifications are delivered to rescue teams without delay.

Overall, the system architecture is designed to ensure smooth communication between all components so that survivor detection and rescue alerts can happen quickly and efficiently during disaster situations.

Fig -2: System Architecture

4.2 Software Requirements

The development of the AI-Based Real-Time Survivor Detection and Rescue Alert System requires several software tools and technologies. These tools are used to build the mobile application, implement the artificial intelligence detection model, manage cloud storage, and enable communication between the system components.
The main software requirements for the proposed system are described below.

[7] Android Studio
Android Studio is used as the primary development environment for building the mobile application. It provides tools for designing the user interface, writing application logic, testing the application, and debugging errors. The mobile application developed in Android Studio allows users to capture images using the phone camera and interact with the detection system.

[8] Java Programming Language
The mobile application is developed using Java or Kotlin programming languages. These languages are widely used for Android application development. They handle the core functionality of the app such as user authentication, camera operations, communication with the backend server, and interaction with Firebase services.

[9] XML Layouts
XML is used to design the graphical user interface (GUI) of the Android application. It helps create different screens such as the login page, registration page, user dashboard, camera screen, and rescuer dashboard. XML layouts make the application interface structured and easy to manage.

[10] CameraX API
CameraX is used to access the smartphone camera within the Android application. It enables real-time camera preview and allows the application to capture frames continuously. These captured frames are sent to the AI detection system for analysis.

[11] Python
Python is used for developing the backend system that performs human detection using artificial intelligence. Python is widely used in machine learning and computer vision applications because it supports many powerful libraries for image processing and deep learning.

[12] Flask / FastAPI Framework
Flask or FastAPI is used to create the backend server that communicates with the mobile application. The server receives images from the mobile app, processes them using the AI detection model, and sends the detection results back to the application.

[13] YOLO (You Only Look Once)
YOLO is used as the object detection model for identifying human presence in images. It is a deep learning model capable of performing real-time object detection with high accuracy. In this project, YOLOv5 or YOLOv8 is used to detect human survivors from camera frames.

[14] OpenCV
OpenCV is an open-source computer vision library used for image processing. It helps in reading images, converting image formats, and preparing images before they are processed by the YOLO detection model.

[15] Firebase Authentication
Firebase Authentication is used to manage user login and registration in the system. It allows users to securely sign in using their email and password. The authentication system also helps manage different user roles such as normal users and rescue team members.

[16] Firebase Firestore Database
Firebase Firestore is used as the cloud database for storing system data. It stores user information, survivor detection alerts, location details, timestamps, and other important records generated by the system.

[17] Firebase Cloud Messaging (FCM)
Firebase Cloud Messaging is used to send push notifications to rescue team members. When the system detects a survivor, an alert notification is automatically sent to all rescuers so that they can quickly respond to the situation.

[18] REST API Communication
REST APIs are used to enable communication between the mobile application and the backend server. The mobile application sends captured images to the backend API, and the server returns the detection results in JSON format.

5. Methodology

The proposed system follows a step-by-step process to detect survivors and generate alerts for rescue teams. The methodology focuses on using artificial intelligence and mobile technology to automate the detection process and reduce the time required to locate survivors during disaster situations.

First, the user opens the mobile application and logs into the system using their registered credentials. After successful login, the user is directed to the application dashboard where they can access different features of the system. From the dashboard, the user can start the detection process by activating the detection option.

Once the detection process starts, the smartphone camera is activated. The camera begins capturing frames continuously from the surrounding environment. These frames are then

processed by the AI detection model that is integrated with the system. The detection model analyzes each frame using computer vision techniques to identify whether a human figure is present in the image.

The AI model compares the captured frames with trained patterns to recognize human shapes and features. If the model identifies a human figure with sufficient confidence, the system treats it as a possible survivor detection.

After a human is detected, the system automatically retrieves the current GPS location of the device. This location information helps determine the exact position where the detection occurred. The system then creates an alert that includes the captured image, GPS coordinates, and the time of detection.
This alert information is stored securely in the cloud database so that it can be accessed by authorized rescue team members. At the same time, push notifications are sent to the rescue teams through the application. These notifications inform rescuers that a possible survivor has been detected and provide them with the necessary information to respond.

Rescue team members can open the application and view the alert details on their dashboard. The dashboard displays important information such as the detected image, location coordinates, and the time of detection. Using the integrated map service, rescuers can navigate directly to the location and begin rescue operations.

The methodology is designed to focus on automation, speed, and ease of use. The system minimizes manual effort by automatically detecting survivors and sending alerts. This ensures that the system can operate efficiently even during emergency situations where quick response is extremely important

Fig -3: Survivor Detection and Alert Process Flow

6. Results and Discussion

The proposed system demonstrates how artificial intelligence and mobile technology can be used together to support disaster rescue operations. By using a smartphone camera along with an AI-based detection model, the system is able to identify the presence of humans in real time. Once a human figure is detected, the system automatically generates an alert and sends the information to rescue teams. This helps in reducing the time required to locate survivors during emergency situations.

Another advantage of this system is that it is cost-effective. The system does not depend on expensive equipment such as drones or thermal imaging cameras, which are often used in advanced rescue operations. Instead, it uses smartphones, which are already widely available and easy to use. Because of this, the system can be deployed quickly in different environments without requiring special hardware or complex setup.

The integration of GPS location tracking and push notification technology plays an important role in the system. When a survivor is detected, the system automatically captures the current location of the device and sends this information along with the alert. Rescue teams receive the notification immediately and can view the exact location of the possible survivor.

This quick communication can significantly improve response time during emergency situations and increase the chances of saving lives.

In addition, the system promotes collaboration between normal users and rescue teams. People present in a disaster-affected area can use the mobile application to help detect survivors by simply scanning the surroundings with their phone camera. When multiple users participate in this process, the overall coverage area becomes larger. This collaborative approach increases the possibility of locating survivors more quickly, especially in large disaster zones where rescue teams may not be able to search every area immediately.

Overall, the proposed system shows how modern technologies such as artificial intelligence, mobile applications, and real-time communication can work together to support disaster management and improve rescue operations.

7. Conclusion

This research presented an AI-Based Real-Time Survivor Detection and Rescue Alert System that is designed to assist rescue teams during disaster situations. The main purpose of the system is to help detect human survivors quickly and send alerts to rescuers so that they can reach the location as soon as possible. The system uses a smartphone camera along with artificial intelligence technology to identify the presence of humans in the surrounding environment.

In this system, the mobile application captures images using the device camera and sends them to the AI detection model for analysis. When the system detects a human figure, it automatically retrieves the current GPS location of the device and generates an alert. This alert information is then

stored in a cloud database and shared with rescue teams through notifications. By providing both detection results and location details, the system helps rescuers quickly identify where a possible survivor is located.

One of the main advantages of the proposed system is that it is simple and cost-effective. It does not require expensive equipment such as drones, thermal cameras, or specialized rescue devices. Instead, it uses smartphones, which are already widely available and easy to operate. Because of this, the system can be implemented in different regions without requiring complex infrastructure or high costs.

The integration of artificial intelligence with mobile technology allows the system to perform detection and communication in real time. Rescue teams can receive alerts quickly and view the location of the detected survivor through the application dashboard. This faster communication can help improve response time during emergency situations and increase the chances of saving lives.

8. Future Scope

The proposed system provides a basic platform for detecting survivors and sending alerts to rescue teams. However, the system can be further improved by integrating additional technologies that can increase detection accuracy and make rescue operations more effective. Future developments can help make the system more reliable and capable of working in complex disaster environments.

One possible improvement is the integration of drones for aerial search operations. Drones equipped with cameras can scan large disaster areas quickly and capture images from locations that may be difficult for humans to reach. By connecting drone cameras with the AI detection system, it would be possible to detect survivors from the air and send alerts to rescue teams more efficiently.

Another improvement could be the use of thermal imaging sensors. Thermal cameras detect heat emitted by the human body and can help identify survivors even in dark environments or areas with poor visibility. Combining thermal imaging with the existing AI detection system could improve the accuracy of survivor detection, especially in situations where normal cameras may not perform well.

The system can also be enhanced by implementing more advanced deep learning models. Improved AI models can increase the accuracy of human detection and reduce false detections. As artificial intelligence technology continues to evolve, newer models can be integrated into the system to achieve better performance and faster processing.

In addition, the development of multilingual interfaces can make the application more accessible to users from different regions. Providing support for multiple languages will allow more people to use the system easily during emergency situations, especially in areas with diverse populations.

Another useful improvement would be the addition of offline detection capabilities. In many disaster situations, internet connectivity may be weak or completely unavailable due to damaged communication networks. If the system is able to perform detection locally on the device and store alerts temporarily, the information can be sent automatically once the network connection is restored. This would make the system more reliable in remote or disaster-affected areas.

Overall, these future enhancements can make the proposed system more powerful, reliable, and suitable for large-scale disaster management applications.

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