

## Article

# Real-Time Survivor Detection System in SaR Missions Using Robots

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**Abstract:** This paper considers the issue of the search and rescue operation of humans after natural or man-made disasters. This problem arises after several calamities, such as earthquakes, hurricanes, and explosions. It usually takes hours to locate the survivors in the debris. In most cases, it is dangerous for the rescue workers to visit and explore the whole area by themselves. Hence, there is a need for speeding up the whole process of locating survivors accurately and with less damage to human life. To tackle this challenge, we present a scalable solution. We plan to introduce the usage of robots for the initial exploration of the calamity site. The robots will explore the site and identify the location of human survivors by examining the video feed (with audio) captured by them. They will then stream the detected location of the survivor to a centralized cloud server. It will also monitor the associated air quality of the selected area to determine whether it is safe for rescue workers to enter the region or not. The human detection model for images that we have used has a mAP (mean average precision) of 70.2%. The proposed approach uses a speech detection technique which has an F1 score of 0.9186 and the overall accuracy of the architecture is 95.83%. To improve the detection accuracy, we have combined audio detection and image detection techniques.

**Keywords:** SaR missions; rescue robot; human detection; F1 score; DARP algorithm; mCPP



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## 1. Introduction

Natural catastrophes such as earthquakes, landslides, and other natural disasters have caused substantial damage to people's lives and property in recent years. Victims are frequently trapped in collapsing structures. As per studies, when there is a natural or man-made disaster such as an earthquake, building destruction happens. Then, after the first half-hour, the survival rate percentage is 91, and after one day, the survival rate percentage decreases from 91 to 81. By the next day (2nd day), it decreases to 36.7%. And again, after the fourth day, it decreases to 19% [1]. As a result, there is a great deal of contemporary interest and demand for the creation and comprehension of modern disaster relief approaches.

In such cases, in order to remediate the situation, a search and rescue operation is carried out. The aim of a search and rescue operation is to provide aid and medical attention to the victim as soon as possible. The person is first of all "searched" for, if his whereabouts are unknown to the rescue team. Once the location of the injured person is determined, the next task is to "rescue" them. The term "rescue operation" refers to a circumstance in which it is known that intervening and organizing a person's rescue is necessary [2]. This usually involves taking them to the medical team.

Manually scouting the disaster-affected area is a tricky task. It needs to be conducted fast enough. For rescue team members, it is very risky for their lives to go inside the disaster-affected areas. All these activities are mainly carried out by humans and trained