Chapter 11

# Controlling Airplane Crashing Using Multi-Agent Technology (MAT) Using Fuzzy Analytical Technique


**Vikram Singh**
https://orcid.org/0000-0002-8234-7125
*National Institute of Technology, Hamirpur, India*

**Arpit**
https://orcid.org/0009-0009-8773-7403
*National Institute of Technology, Hamirpur, India*

**Najish Asad**
https://orcid.org/0009-0006-2050-6959
*National Institute of Technology, Hamirpur, India*

**Somesh Kumar Sharma**
https://orcid.org/0000-0002-8234-7125
*National Institute of Technology, Hamirpur, India*

**Sahil Puri**
https://orcid.org/0009-0007-4024-4834
*National Institute of Technology, Hamirpur, India*

**Mohammad Al Khaldy**
https://orcid.org/0009-0009-7502-4668
*University of Petra, Amman, Jordan*



## ABSTRACT

*The rapid growth of air transportation has intensified global concerns regarding aviation safety, demanding the integration of advanced and intelligent technologies. This chapter investigates the role of Multi-Agent Technology (MAT) in enhancing safety across critical phases of aviation, including aircraft design, manufacturing, operations, and maintenance. Although prior studies have addressed isolated aspects, comprehensive research on the systemic impact of MAT on aviation safety*



DOI: 10.4018/979-8-3373-3541-4.ch011

*remains limited. Employing the Fuzzy Analytic Hierarchy Process (AHP), the study identifies and ranks the most influential MAT variables that contribute to effective crash prevention. The outcomes provide a structured decision-support model for aviation professionals, enabling targeted investments and strategies that strengthen safety performance both qualitatively and financially. By embedding smart communication technologies within the MAT framework, this research not only advances safety mechanisms but also contributes to building a more sustainable and resilient future for the aviation sector.*

## INTRODUCTION

Aviation is widely considered one of the safest modes of transportation, with significantly fewer accidents and fatalities compared to other forms of travel(Thakur et al., 2024). Aviation Industry has consistently prioritized safety, leading to significant advancements in aircraft design, operational procedures, and technological innovations. This unwavering commitment has resulted in a substantial reduction in accident rates, establishing air travel as one of the safest modes of transportation. However, as air traffic grows, the number of accidents is expected to increase due to airspace congestion. Thus, airplane crash despite being rare continues to be the source of profound concern. The most challenging task is to assign a particular reason for an airplane crash as multiple factors such as human error, equipment malfunctions, manufacturing flaws and adverse weather conditions often cumulate to contribute to airplane crashes, (Cokorilo, 2020). In the past few years, aviation safety has increased due to so many technological innovations as well as using automation in the field. Modern aviation systems are characterized by increasing complexity, driven by the pursuit of greater efficiency, performance, and capacity(Singh et al., 2023a). Contemporary aircraft are equipped with a wide array of advanced technologies, including sophisticated avionics, highly integrated flight management systems, and complex communication networks. Air traffic management systems have also become increasingly intricate, incorporating advanced algorithms for airspace management, dynamic routing, and automated conflict resolution.

This growing complexity presents new challenges for aviation safety. The sheer volume of data generated by these systems can overwhelm human operators, making it difficult to process information and make timely decisions (Bala et al., 2013). The interconnectedness of these systems also creates the potential for cascading failures, where a problem in one area can trigger a series of events leading to a catastrophic outcome. Traditional aircraft control systems, while effective in routine operations, often struggle to handle unforeseen circumstances. These systems typically rely on deterministic algorithms and pre-programmed responses, which