Technische Hochschule Ingolstadt

Faculty of Computer Science

The Future of AI in Air Traffic Management: Coordinating Autonomous Airliners and UAM within Busy Airspaces using AI

Seminar Paper

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Affidavit

I certify that I have completed the work without outside help and without using sources other than those specified and that the work has not yet been submitted in the same or a similar form to any other examination authority and has been accepted by them as part of an examination. All statements that have been adopted literally or analogously are marked as such.

Ingolstadt, 5 May 2025

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Abstract

The summary gives the reader a rough overview of the content (brief problem definition, approach, solution approaches and possibly key findings). The scope should be about half a page. This chapter is not mandatory and should only be considered optional.

Contents

1 Introduction

Air traffic management (ATM) refers to the systems and services that ensure the safe anf efficient movement of aircrafts during all phases of operations, through controlled airspaces and on the ground [2]. Traditionally, this has been a highly human-centered system, relying on air traffic controllers, pilots, and pre-defined procedures. However, as global air traffic continues to rise and with emerging aerial technologies such as urban air mobility (UAM) and autonomous airliners, the complexity of managing airspace is set to increase dramatically [1].

UAM, which includes electric vertical take-off and landing (eVTOL) aircrafts, such as helicopters, operating in densely populated urban areas, introduces a new dimension of aerial activity. These vehicles are expected to operated at lower altitudes and with higher frequencies compared to traditional aircraft, leading to increased airspace density, especially near cities [1]. Simultaneously, advances in autonomous flight systems are enabling a shift towards single pilot operated aircraft or even pilotless airliners in the future [4].

artificial intelligence (AI), machine learning and deep learning, branches of AI, have emerged as fundamental tools in addressing the challenges of this evolving landscape. From predictive analytics to real-time decision-making and autonomous coordination, AI has the potential to transform how we manage air traffic. The increase in air traffic density and increasing volume of information sending through the system, it is necessitating more efficient optimization algorithms to maintain safety and efficiency in the airspace [3].

This report explores the roles of AI in shaping the future of ATM, focusing particularly on its application to autonomous airliners and UAM integration.

2 Background

Acronyms

ATM air traffic management. 1

eVTOL electric vertical take-off and landing. 1

UAM urban air mobility. 1

VTOL vertical take-off and landing. 1, 2

References

[1] Bianca I. Schuchardt et al. "Air Traffic Management as a vital part of Urban Air Mobility—a review of DLR's research work from 1995 to 2022". In: *Aerospace* 10.1 (Jan. 2023), p. 81. DOI: 10.3390/aerospace10010081.

[2] SKYbrary Aviation Safety. *Air Traffic Management (ATM)*. Accessed: 2025-05-04. 2023. URL: https://skybrary.aero/articles/air-traffic-management-atm.

[3] Cristian Lozano Tafur et al. "Applications of artificial intelligence in air operations: A systematic review". In: *Results in Engineering* 25 (Mar. 2025), p. 103742. DOI: 10.1016/j.rineng.2024.103742.

[4] Samuel M. Vance, Evan C. Bird, and Daniel J. Tiffin. "Autonomous airliners anytime soon?" In: *International Journal of Aviation, Aeronautics, and Aerospace* 6.4 (2019). DOI: 10.15394/ijaaa.2019.1402.