

Scientific Methods

Report Plan

Fahim Shahria, Hampus Fink Gärdström, Henrik Prüß
Henrik Schwarz, Tom Bourjala, Tomas Soucek

University of Southern Denmark, SDU Software Engineering, Odense, Denmark

Email: {fasha23,hgard20,hepru23,hschw17,tobou23,tosou23}@student.sdu.dk

October 19, 2023

Contents

1	Introduction	1
2	Problem area and research questions	1
3	Research Methods	2
4	Expected Outcome	2
5	Project Plan	2
6	References	3

1 Introduction

Unmanned Aerial Vehicles (UAVs), also commonly called drones, are aircraft without an onboard human pilot [1]. A multi-drone mission refers to a coordinated operation involving multiple drones that work in tandem to achieve a specific objective. These missions can vary in complexity, from simple tasks like aerial photography to more advanced operations such as search and rescue, surveillance, data collection and more [3].

Multi-drone missions can cover larger areas and handle more complex tasks. However effective communication between drones is crucial for the success of these missions, as sharing important data and coordinating actions in real-time is vital for achieving the mission goals [3] [2]. Other studies have categorized some parts related to the communication patterns, data and structure of multi-drone missions, however they have not focused on all aspects nor provided a perspective of what should be included in a high-level communication layer between agents in a multi-drone mission [3] [2] [5].

This systematic literature review aims to explore the communication patterns, types of data exchanged, and the structure in multi-drone missions. By categorizing and analysing current communication patterns based on these aspects, this review seeks to provide insights into what a high-level communication layer should include to ensure effective communication in multi-drone missions.

Understanding and improving communication in multi-drone systems is crucial for unlocking their full potential and ensuring the success of missions in real-world scenarios.

2 Problem area and research questions

Previous studies either focus on a specific point of interest or a specific mission in communication between agents, or conduct a survey to compare techniques. We believe that conducting a systematic literature review could offer a more comprehensive understanding of communication patterns and their relationship to missions. Specifically, there is a lack of research that provides a holistic view of a high-level communication layer, including the data sent, received, and the methods of communication used.

The specific research questions we address in this paper is:

- RQ1: *How can the communication patterns in multi-drone missions be categorized based on the type of data sent and received, mission context and types of agent involved?*
- RQ2: *What should be included in a high-level communication layer between agents in a multi-drone mission based on the categorization of communication patterns?*

3 Research Methods

In this process, we followed the guidelines for conducting a systematic literature review proposed by Kitchenham [4]. A systematic literature review is an empirical study that involves collecting and aggregating evidence from multiple primary studies through a systematic search and data extraction process.

We first combined and synthesized findings from various studies related to the research topic. Relevant studies were gathered from electronic databases using specific search strings.

Only studies published in peer-reviewed journals or conference proceedings were included. Specific criteria related to the research topic were used to determine which studies to include and assess their quality. The data extracted from these studies was then organized into relevant identified categories. The categorized data was further compiled and analyzed.

Overall, the systematic literature review process involved a rigorous and comprehensive approach to gather, analyze, and synthesize data, providing valuable insights and supporting evidence-based conclusions related to the research topic.

4 Expected Outcome

The expected outcome of this study is a systematic literature review that offers a more comprehensive understanding of communication patterns and their relationship to multi-drone missions. This study will classify data types transferred, agent-types, outline mission contexts like search and rescue or goods transport, architecture layer, and define the communication mode between agents. It aims to provide a holistic perspective of what should be included in a high-level communication layer in a multi-drone mission between agents.

5 Project Plan

We have formulated a project plan that can be seen in table 1.

Activity	Start	End	Group member(s)
Keyword Identification	2023/10/24	2023/10/28	Fahim, Tom
Database Search	2023/10/29	2023/11/05	Tomas, Schwarz
Study Selection	2023/11/03	2023/11/08	Prüß, Hampus
Quality Assessment	2023/11/08	2023/11/12	Fahim, Tomas, Prüß
Data Extraction	2023/11/12	2023/11/16	Tom, Schwarz, Hampus
Categorization	2023/11/16	2023/11/19	Fahim, Schwarz
Synthesis	2023/11/19	2023/11/23	Tom, Tomas, Prüß

Table 1: Project Activity Plan

6 References

- [1] Roger Clarke. Understanding the drone epidemic. *Computer Law Security Review*, 30(3):230–246, 2014.
- [2] Lav Gupta, Raj Jain, and Gabor Vaszkun. Survey of important issues in uav communication networks. *IEEE Communications Surveys Tutorials*, 18(2):1123–1152, Secondquarter 2016.
- [3] Samira Hayat, Evşen Yanmaz, and Raheeb Muzaffar. Survey on unmanned aerial vehicle networks for civil applications: A communications viewpoint. *IEEE Communications Surveys Tutorials*, 18(4):2624–2661, Fourthquarter 2016.
- [4] Barbara Kitchenham and Stuart Charters. Guidelines for performing systematic literature reviews in software engineering. *EBSE*, 2, 01 2007.
- [5] Evşen Yanmaz, Saeed Yahyanejad, Bernhard Rinner, Hermann Hellwagner, and Christian Bettstetter. Drone networks: Communications, coordination, and sensing. *Ad Hoc Networks*, 68:1–15, 2018. Advances in Wireless Communication and Networking for Cooperating Autonomous Systems.