DETAILED REPORT: Examiner A

Candidate Name: Binh Nguyen

Thesis Title: EFFICIENT MEMORYLESS LOCAL PLANNING FOR QUADROTOR NAVIGATION

General

This thesis presents research focused on the development of novel memoryless local planning frameworks that operate directly on raw sensor observations, without relying on global maps or fusion systems. The outcomes make significant contributions to the field of quadrotors and similar mobile systems by enhancing computational efficiency while preserving robust navigation capabilities. The thesis consists of eight chapters and a bibliography. It is well-structured and offers original and innovative contributions to the field.

Methodology and approach

The thesis explicitly formulates three key research questions that address existing gaps and advance the field of autonomous aerial navigation. The solutions and approaches developed in response to these questions led to five major contributions, each thoroughly discussed in the main technical chapters of the thesis. The candidate effectively distilled these contributions into concise technical keywords: computational efficiency, planning completeness, flight time optimization, collision checking, sensor noise handling, and dynamic environment navigation, demonstrating an impressive ability to summarize complex findings. The significance and novelty of the work are further evidenced by five top-tier publications authored by the candidate, representing an outstanding achievement.

Significance

The approaches and findings presented in this thesis make significant contributions to the field of autonomous aerial navigation. The five interconnected research topics are addressed through clearly articulated and innovative algorithmic solutions that are reproducible by both academic researchers and practitioners. Moreover, the results have the potential to be extended to a broad range of mobile physical systems where efficiency, reliability, and lightweight design are critical. This opens numerous new opportunities for future research.

Findings

The results in each technical chapter are clearly presented and demonstrate strong coherence with prior findings. Both simulations and experiments are conducted to validate the developed approaches, and the outcomes are convincing. Furthermore, the results are critically analysed, highlighting key improvements as well as remaining limitations. This reflects a commendable and humble research attitude.

Presentation

I would like to highly commend the literary quality of the thesis. The candidate demonstrates a professional and sophisticated writing style throughout. The overall structure is logically organized and clearly articulated. Figures and tables are appropriately placed to support and enhance the narrative. I found no errors in grammar, spelling, or punctuation. The thesis is not only clear and easy to understand, but also engaging and enjoyable to read.

Reference list

The references cited in the thesis are both adequate and accurate, and they are thoroughly discussed throughout the document. Chapter 2 provides a clear and well-structured classification of the literature, effectively aligning it with the research objectives. It also identifies specific research gaps associated with each method or technique reviewed.

Comments

I have only a few minor comments, listed below, which the candidate may consider addressing in the final revision. These suggestions are optional to address.

1) Line space in the tables may be a bit larger, e.g. page 20, Table 1.
2) Page 53, Algorithm 3, could the upper bound of error (i.e. 1m) be set as a configurable variable for more generalization?
3) Fig. 45, Fig. 53 and Fig. 61 seem to describe the same experiment platform. You may consider removing the repeated ones.

Conclusion

Overall, the research has been well-executed in both its presentation and outcomes. This PhD project is both intellectually stimulating and technically challenging. The candidate has successfully disseminated the research findings through reputable publication channels and clearly identified well-defined research questions, demonstrated substantial evidence of independent investigation, and developed solutions with strong potential for real-world applications. I recommend the award of the degree of Doctor of Philosophy without the need for further revisions and this thesis be considered for a Dean's Award for Excellence.