Report Date: 06/24/2022
To: ematson@purdue.edu, ahsmith@purdue.edu, lhiday@purdue.edu and lee3450@purdue.edu

- Dongwhan Lee (Leader) - derick_lee@khu.ac.kr
- Yeeun Heo (Member) - gjdpdms2005@soongsil.ac.kr
- Youngseo Kim (Member) - 201910787@sangmyung.kr
- Juann Kim (Member) - 201920951@sangmyung.kr
- Heeyeon Shin (Member) - 567didi@khu.ac.kr

Summary

Throughout this week, the environment setting is done for the second outdoor test at Mr. Smith's farm. Also, various supplies and requirements needed for the second outdoor test are prepared. For applying an audio-vision multimodal method to this project, various related papers are reviewed during the week.

Continuing next week, the basic theories and codes of the multimodal method to apply to this project will be studied by all team members. Furthermore, the second outdoor test will be done at Mr.Smith's farm at the beginning of the next week.

What K2S3 completed this week:

- Setting environment for the second outdoor test
    - After analyzing the data of the first outdoor test, a new setting has been made. With the projected distance fixed as 10m, the two drones will be flying at different altitudes and vertical ranges. At specific altitudes and vertical ranges, each data will be collected for 3 minutes. The ranges of both altitude and vertical range are fixed as 5m to 25m.

- Reviewing audio-vision multimodal and drone collision avoidance-related papers
    - Papers that are related to this project were searched and reviewed by the team members. The team members summarized the papers and further brought plans to apply the obtained information to this project.

- Preparing requirements and supplies and rehearsing for flying two drones for the outdoor test
    - In the experiment, the iPhone 6 is used to record audio files. As the iPhone should be attached to the detecting drone, EVO 2, several methods to attach the iPhone were tried. To stably attach the iPhone, the best method was to use at least three or four velcro tapes to fix the iPhone on the drone. Also, other supplies that are necessary for collecting data were prepared: a tapeline to measure distance, sticks to indicate a specific location, , charged EVO2, and charged Matrice 300 with extra batteries.

Things to do by next week

- Having the second outdoor test
    - As the first outdoor test is done, the second outdoor test will be done at Mr.Smith's farm at the beginning of next week. From the second outdoor test, the actual data that can be analyzed for the paper will be collected with two drones flying in the air. Both audio and video data will be collected to analyze audio and image-based features.

- Studying audio-vision multimodal method
    - As analyzing audio and image-based features using the multimodal method is unfamiliar, it is planned to study the multimodal methods in detail by learning the basic theories and using codes that can be applied to a real-life situation.

- Having the first indoor test
    - While accumulating the outdoor dataset, the Deep Learning model code will be first tested using the data collected in an indoor test with a similar environment setting. vision and audio-based features will be individually analyzed. Then, using a decision and a feature fusion, the multimodal method will be used to improve detection and classification accuracy. If the results of the two tasks are well analyzed, the position of the drones will be estimated, which is the final goal of this project.

Problems or challenges

- Reallocating the roles of the team members
    - As one of the team members went back to Korea this Friday, the roles were reallocated. Although she is still participating in this project, there were limitations. These limitations include having outdoor tests together and discussing with the team members at any time. These problems were discussed and new roles have been rearranged by other team members.

References

[1] H. Liu, Z. Wei, Y. Chen, J. Pan, L. Lin, and Y. Ren, "Drone Detection Based on an Audio-Assisted Camera Array," *IEEE Xplore*, Apr. 01, 2017. [Accessed Jun. 25, 2022].

[2] Leong, Wai Lun, et al. "Vision-based sense and avoid with monocular vision and real-time object detection for UAVs." *2021 Int. conference on unmanned aircraft systems (ICUAS)*. IEEE, 2021

[3] N. Jiquan, K. Aditya, K Mingyu, N Juhan, L. Honglak, N. Andrew, "Multimodal Deep Learning", *ICML 2011*, 2011 [Accessed June 25, 2022]

[4] S. Al-Emadi, A. Al-Ali, A. Mohammad and A. Al-Ali, "Audio Based Drone Detection and Identification using Deep Learning," *2019 15th Int. Wireless Communications & Mobile Computing Conference (IWCMC),* pp. 459-464, 2019