SUPPLEMENT REPORT: THE DATA ACQUISITION FOR BONUS TASK

 # 26188 LEADS UAV [1,2,]: Xinyuan Wang, Yifei Shen, Chuan Zhang, et al.*

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1. INTRODUCTION

In the open competition, we are asked to send our audio recordings which meet the relevant requirements to complete the bonus task. The audio files and experimental data in this report are recorded in the *outdoor* environment, using a UAV that can hover stably in the air. Only one microphone is used to record the sound. For this task, ten single channel audio recordings with sampling frequency of 44.1 kHz, each lasting approximately 10 seconds and in the form of `wav` files, named 1.wav to 10.wav. Besides, we also provide a 10-second audio file to record the ego-noise of UAV in hover, which was named `motor_recording.wav`. All of the above can be found in the `data.zip` file.

2. UAV AND MICROPHONE

A quadrotor UAV Phantom 3 Advanced from SZ DJI Technology Co., Ltd.[1] was employed. This professional aerial drone is equipped with four 2312A motors. Fig. 1 shows the architecture of the drone and the position of the microphone.

The remote control device that matches the drone is equipped with a Micro USB interface that connects to the mobile phone control platform, allowing the DJI GO APP to interact with the drone using data networks, including low-level flight operation and data collection work (hover height, vertical and horizontal flight speed, angular velocity, etc.). For the sound recordings, a single-channel audio signal acquisition microphone with a sampling frequency of 44.1 kHz is installed 0.12 m below the bottom of the drone. This height could avoid the influence of wind on the microphone to some extent. The detailed structure of the drone model can be referred in the attached `plot_structure.m`. The total weight of the equipped quadrotor is 1.28 kg. The wheelbase of the symmetrical rotor is 0.35 m. The vertical hover accuracy of the drone is ± 0.1 m, and the horizontal hover accuracy is ± 1.5 m. The speed of the propeller at start-up is 30 turns/s while the rate at the time of hovering is up to 130 turns/s. The position of the microphone in the coordinate system is the center of gravity of the cube formed by the bottom bracket of the drone. Fig. 2 shows the relative positions of the four propellers in the coordinate system. We stipulate that the forward direction of the drone is the x-axis and establish a left-hand coordinate system and the z-axis points above the ground . The angle between the x-axis and the line of the person's standing point and the vertical drop point of the drone is azimuth, which is a positive direction from the clockwise direction of the x-axis. The elevation is the angle between the x-y plane and the line of the sound source and the drone, which is positive when the sound source is higher than the drone. It is worth mentioning that the body of the drone is utterly symmetrical concerning the coordinate system, except for the effect of the size of the battery on the model structure.

Fig. 1. Phantom 3 Advanced quadrotor aerial drone for data acquisition with a microphone on the bottom, red circle highlights the position of the microphone.

3. EXPERIMENTAL ENVIRONMENT

The experiment was carried out in a spacious outdoor lawn environment. Fig. 3 shows the experiment place, where weather and terrain are both suitable to avoid the disturbance

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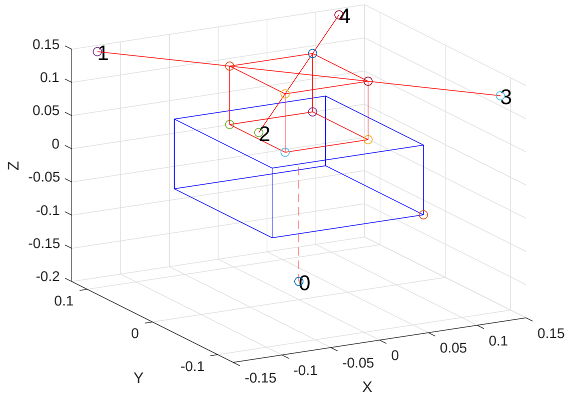

Fig. 2. The relative position of the drone and microphone in the coordinate system.

Fig. 3. The environment in which audio files are recorded during the experiment.

of external factors to the experimental data recording. During the experiment, there was no interference from other noises except the drones noise or wind, which accorded with the condition of sound source recording.

4. EXPERIMENTAL PROCESS AND DATA

Ten experimental recordings of a single static source were performed on open space, and elevation and azimuth data are recorded in `datasets.docx`. The drone is remotely controlled by a team member through App and steadily hovering in the air through program control. Fig. 4 shows that another member remained stationary on the lawn, and the variant speech emitted through him are the sound sources. The built-in GPS positioning system is used to obtain the hovering height and deflection angle of the drone and allows to observe the almost invisible horizontal and vertical speeds during hovering. By measuring the distance from the vertical drop point of the microphone to the single static sound source, the specific geometric coordinates could be obtained to calculate the position of the UAV relative to the ground. To analyze the ego-noise of drone, an individual recording was performed without the sound source.

Fig. 4. Experimental process of recording audio, the person in the picture is stationary relative to the drone.

5. CONCLUSION

This report describes the experimental process of acquiring dataset using DJI Phantom 3 Advanced and a single-channel microphone to promote the UAV SSL methods. The dataset consists of noise-only and in-flight audio recordings of a target source emitting speech. The position of all target sound sources is measured using accurate measuring instruments. In this task, we present ten single channel audio recordings and a noise-only audio recording, which are expected to be available to the research community.