A Virtual Reality study on the acceptance of UAM from the viewpoint of pedestrians

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Figure 1: Air taxi landing scenario as it can be seen in the VR simulation.

Motivation

Visual and acoustic pollution is a crucial aspect that needs to be considered when talking about Urban Air Mobility (UAM). Unmanned Aircraft Systems (UAS) might become part of urban traffic within the next years and also fly overhead people. Thus, it must be ensured that citizens on ground will not be disturbed by the visual presence and noises caused by UAS. A Virtual Reality study within the HorizonUAM project made a contribution to this topic by investigating how people perceive UAS flights in an inner city environment.

Procedure

The experiment took place outside the office building of DLR's Institute of Flight Guidance due to the restrictions from the COVID-19 pandemic that were present to that time. Participants wore a VR helmet-mounted display and headphones to see and hear the simulated environment. As an inner city environment a 360-degree video taken from the central station of Braunschweig was presented. UAS were added to the environment using the game engine Unity. The study explored the effect of flight altitude, visual density (amount of UAS visible), and noise. Additionally, the participants experienced a nearby landing of an air taxi.

The experiment consisted of 18 scenarios that were presented in randomized order varying the aforementioned research parameters systematically. Eight question items measured the acceptance of each scenario with a seven-point scale. Some of the items were taken from the Technology Acceptance Questionnaire and others were formulated by the researchers. For example, participants were asked whether they felt comfortable, safe or nervous in the different scenarios.

Findings

With respect to the factor flight altitude, significant effects were found in three of eight acceptance items: All indicate a lower acceptance for lower flight heights. Regarding visual density significant effects were observed on all items. Responses were more negative as more drones were visible. For both the flight altitude and visual density condition there is no evidence that UAS noise has a significant impact on acceptance. A possible explanation for this is provided by the participant's rating, whether UAS noises were recognized in the scenarios. The majority of the participants constantly stated that they did not hear UAS in the various scenarios. Reasons might be the noise from other traffic covering the sound from UAS and the great distance between UAS and the observer's point of view (at least 45 m). With respect to the air taxi scenario this study revealed that responses to all items are significantly more negative compared to the baseline measurement.

It was further observed that attitudes towards UAS mostly stayed the same or turned more positive after the participants took part in the simulation experiment. Lastly, after the simulation experiment participants had significantly less concerns related to privacy and noise than before. The findings related to attitude and concerns suggest that more experiences with UAS might increase their acceptability.

Figure 2: Exemplary picture showing a test run during the experiment.

For more details see: Stolz, M., & Laudien, T. (2022, September). Assessing Social Acceptance of Urban Air Mobility using Virtual Reality. In 2022 IEEE/AIAA 41st Digital Avionics Systems Conference (DASC) (pp. 1-9). IEEE.

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