Enhancing Social Experiences with Shared Drones

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Abstract
Over the last 10 years, drones have become smaller, more durable, affordable, and easier to fly. Their photo and video-taking capabilities have significantly improved. In fact, the proliferation of drones is already happening, with new no-fly zones being developed in more territories. Given current developments, we envision that everyone will be able to carry a pocket drone with them at all times, just like we do with smartphones today. Drones appeal to users as they offer, among other things, a unique view of landscapes, wildlife, the user, and other people. We conducted a survey in which we asked participants about their video and photo-taking habits and how they could envision using a drone for these purposes. Based on our findings, we envision systems in which nearby drones are available for personal and shared usage. This allows having all the advantages of drones but leaves control over the airspace to regulators, thus enabling safely and respectfully flying over areas such as national parks or zoos. Moreover, we envision shared drones as a means of sparking new social interactions.

Author Keywords
Drone; social; share

CCS Concepts
•**Human-centered computing** → **Human computer interaction (HCI);** User studies;

Introduction

Coin-operated binoculars in national parks and sightseeing spots have a long-standing tradition. However, with the capabilities of today's digital cameras, especially in the form factor of smartphones, coin-operated binocular lost a lot of their original charm as sharing the experience with others around the world, e.g., via direct message or social media, is not possible. We envision that social shared drones can bring back this charm of an outlook over cities and natural parks while enabling to share these impressions. Shared drones can be specifically useful in locations of interest to tourists as these areas are mostly no-fly zones. Here, we argue argue for a vision where social shared drones can be controlled by one entity, ensuring public safety while enabling sharing photos and videos.

Drones are widely available in various form factors and capabilities. Maneuvering them is becoming easier and their photo and video-taking capabilities are improving. Thus, today's research projects already discuss a wide range of scenarios in which drones might be used. For instance, selfie drone [4], flying displays [14], drones in private homes to carry objects or for cleaning tasks [6], navigation support [1, 2], and drones for search and rescue scenarios [8]. Similarly, a number of projects explored how drones can used image capture for the benefit of the users. Here, Romanowski et al. [13] envision that drones can support cheering in sports events such as marathons. Here, the drone can support the runners by visualizing that their supports are watching, while at the same time deliver a video feed to the supports. Additionally, Mueller and Muirhead [9] presented a scenario in which runners used drones as running companions. Further, Mayer et al. [7] purposed using drones to support and enrich backcountry activities such as hiking and rock climbing. These past research results suggest that drones can add a new layer for photo and video-taking. Baytas et al. [3] present how to design drones which can fly in populated areas. However, it is not yet clear how users would appreciate and use a social shared drone.

The manifold use cases of drones and the wide availability of them lead to possible conflicts and safety risks in public space. Already today, drone traffic is restricted in several public areas. DJI's[1] flight zone map provides an overview of various restrictions. In order to minimize drone traffic around public points of interest, we propose a ubicomp approach – providing users access to shared droned located in the environment. These shared drones will enable users to take pictures and videos. This way, users will be able to explore the environment without bringing their own drones.

Shared drones will also enable users to share their experience in the form of pictures and videos with remote people e.g., friends and family. Moreover, the shared access to the drone has the potential to foster the interaction between co-located strangers by negotiating or sharing the interaction with the drone. Moreover, based on related work, we can envision drones enhancing co-located interaction. Here, Paasovaara et al. [11] showed that 28% of Pokémon GO Players are willing to engage in small talk with other players who are strangers to them. Moreover, we can envision to broadcasting the video stream to foster awareness and finally spark conversations with nearby people [5, 12].

In summary, we envision social shared drones overcoming current limitations of handheld photo and video cameras. Simultaneously, drones open possibilities for new human-human interactions. Here, we conceptualize various scenarios such as shared photo and video taking, collaborative observations, and co-pilot scenarios. These interactions can spark conversations between bystanders.

[1] https://www.dji.com/flysafe/geo-map

Survey

To understand how people can use drones for picture and video taking, we conducted an online survey with 50 participants. In it, we introduced three different scenarios in which we asked participants to describe a shared interactive experience involving the usage of a drone. In the first, we asked participants to imagine using a drone while participating in a safari observing wild animals; then we describes using a drone at a zoo, and the last scenario participants imagined to use a drone at a touristic point of interest.

We distributed the survey via social media and mailing lists. Our 50 participants (32 male, 16 female, 1 non-binary, and 1 preferred not to disclose their gender) were between 18 and 51 years old ($M = 25.4$, $SD = 5.6$). Forty-six participants stated that they were from Europe and the remaining from North America. Of our participants, 12 reported owning a drone, and 5 stated that they were photographers.

Photo and Video Taking

We first investigated the needs for photo-taking; here, we asked where and why participants took photos. The majority of the comments (24.0%) stated they took shots as they go; this was followed by landscape shots (23.2%). Further, as a general reason to take photos/videos was vacation. Other reasons were: cities/tourist spots (12.8%), people/selfies (11.2%), events (4.8%), animals (3.2%), and food (3.2%). These results illustrate diverse needs in taking photos, which often require different perspectives.

Photo and Video Sharing

To understand the social aspect of taking photos, we asked users about their current sharing behavior. We found that 31.6% commented that they used instant messages (e.g., WhatsApp) for media sharing, which was closely followed by second-most comments (30.4%) by cloud services such as Google Drive (30.4%). Next, 24.1% reported sharing via social media, indicating a high willingness to share photos and videos openly. This was followed by “in-person sharing” with friends and family (7.6%). Last, was other sharing possibilities e.g., USB stick or print with only (6.3%). Finally, one participant stated that they did not share images, and five did share videos at all. We can observe that while the majority of users in the survey did engage in sharing, their sharing habits were heterogenic.

Issues when Taking Photos and Videos

When asked about struggles when taking photos and videos, users contributed a total of 90 comments. Half of the comments (50%) addressed technical problems (e.g., low light, reflections, poor quality, or low battery). Interestingly, 38.9% of the comments concerning restricted positioning of the camera – “[object is] too far away for a smartphone camer” P9. Similarly, users also struggled with taking selfies (5.6%). Finally, both 3.3%, participants stated that they always needed to carry the phone with them, and on the other hand, participants who owned a drone commented on legal restrictions in flying drones.

Future Drone Use Cases

Before introducing participants into our scenarios, we wanted to inquire how they could envision using drones in the future. Most comments addressed the opportunity of positioning the camera using a drone (52.0%), e.g. “Shots from a great heigh” P42. Here, another 6.0% were dedicated to landscape shots. Another 24.0% were about taking great selfies, group pictures, and pictures of events – “[it would be] essentially an ultra-long selfie-stick” P18.

Positive and Problematic Aspects of Using Drones

By asking our participants about the three scenarios (safari, zoo, point of interest) , we received various positive (114 quotes) and negative (22 quotes) statements on the use of drones. The negative comments concerned the af-

fecting animals (9), noise pollution (8), the involvement of people (3), and air space pollution (2). On the other hand, 100 statements described an improved photo and video taking experience. In detail, users expected that drones would enable better and novel positions (57), closeup views (41), and better selfie-taking capabilities (2). Moreover, participants commented on better recording for video (9), and object tracking (5).

Social Aspects of Using Drones

We received only 35 comments which addressed the social experience of using drones. Twenty-two participants remarked that drones can be closer to the areas of interest, and thus people can stay further away. This would make it more pleasant to enjoy areas of interest as "[today] usually top touristic spots are extremely crowded" (P4). In five comments, participants envisioned sharing their drone video feed live to a nearby screen so that bystanders could take part in the experience. Only two participants envisioned sharing the video feed with remote people. One participant would stream a virtual reality experience to remote attendees. Also, one participant envisioned remote users directly collaborating with the pilot. Two participants commented on the possibility of the drone to overcome the distance and open a communication channel to let people at the drone side interact with the pilot. Lastly, one participant saw opportunities for group pictures, and one other participant argued that drones were particularly suited for taking selfies.

Discussion

Our survey shows that drones offer the potential to enhance picture, and video taking, especially in areas that are hard to access. However, the participants of the survey also see risks and disadvantages of using drones. Participants were concerned about disturbing animals or other humans by the drone itself or the noise of the drone. Also, they were concerned with the risk of accidents with drones. Even though we asked participants to imagine shared experiences, most social interaction was limited to taking group photos. Shared control of the flying drone played only a minor role in the scenarios described by participants. This is surprising as simultaneously piloting aircraft and taking photographs is not a common combination of activities.

To minimize these negative effects of drones, and to maximize their accessibility, we propose the concept of "Drones as a Service". We postulate that drones could be provided at points of interest and visitors could request access to the drone control. Thereby, the drone would be a shared resource, which could be maintained by a professional provider. Hence, visitors would not be required to bring their own devices and the provider could guarantee a higher level of safety. Such limited access to drones scenario opens a novel design space for designing collaborative drone interaction. Further, understanding and designing drones as shared resources might contribute to social cohesion [10]. In the following, we will sketch the opportunities for exploring this design space.

We anticipate that enabling live steaming in affordable drone models will open a new dimension in drone interaction. Live streaming can foster engagement right with the person who gives instructions to the drone as this person will have the means to adjust the instructions. On a distant level (far), the drone stream can be conveyed to friends and family, but also to strangers online. The live stream feature of platforms like Facebook or YouTube can serve to distribute the stream. Additional, ephemeral messages services, like Instagram Stories, Snapchat, and TikTok, may arise from using drones to serve as means of distribution. This way, the lived practice of sharing drone resources can become a trigger for new social experiences.

Beyond live streaming, we believe collaboration is the next dimension to explore for drones in social sharing scenarios. In the control dimension, we can reflect on the same abstractions in terms of distance as in the streaming dimension: local, around, far, and with the world. On each level, we can have different types of collaboration. The simplest one would be asking the person in control to manouver the drone to a certain spot; here, one person is still in full control. In contrast, we can also, especially for autonomous drones, envision a concept in which users vote for certain targets. Here, more users get the chance to see the specific object of interest while keeping the drone number low and thus reducing pollution, noise and resources consumed.

Our survey also shows that users have an inherent need to better understand the risks associated with drones and how to eliminate them. Building this understanding can help designers overcome today's problems with drones, which are often related to user not being familiar with flying objects. While current research already focuses on this, our work shows that the participants were more concerned about the animals than humans in sightseeing spots. Thus, avoiding disruptions to the natural environments emerges as a key design consideration for future social drones.

Scenarios
In the following, we illustrate our vision with three scenarios on how socially drones can work in the real world.

Remote Exploration Using live streaming and collaboration, we can envision that remote participants, such as friends but also strangers, will be able to join into the experience the on-site people have. This will help broaden the audience of events by people who do not have the means to join on site. Additionally, it enables obtaining a preliminary view of an area or attraction before deciding for a physical visit.

Shared drone control to explore wild-life In today's world plagued with environmantal issues, exploring wild-life can be an important aspect of educating about environmental challenges and biodiversity. Shared drone control could create a collaborative experience, which will enhance the understanding of wild-life through building engagement. Here, the design challenge is to provide a deep experiences beyond watching a video for all users.

A digital coin-operated binocular Similar to coin-operated binoculars, a drone with a public interface could be located on such spots. This would allow viewers to collaboratively explore the environment from a wide range of perspectives. Depending on the design of the controls, multiple people could navigate the drone and then observe live video captured by the drone. In contrast to classical coin-operated binoculars, drone-based coin-operated binoculars have the advantage of being independent from the topography of the environment.

A Selfie-Button-Drone In this scenario drones would act as an unlimited, virtual selfie stick, capable of taking pictures even at normally impossible angles and locations outside of the range of any physical arrangement.

Conclusion

In this work, we explored the concept "Drone as a service". In areas of public interest, professionals could provide and maintain drones for shared public use. The drones can fly in restricted areas and could be accessed by visitors. Having obtained access, visitors could control the drone for personal or shared experiences. This would also open the design space for collaborative drone interactions between remote and co-located strangers. Our future plan is to investigate the different concepts presented in this work and study the design space further.

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