
Joggobot: A Flying Robot as Jogging Companion

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Abstract

Exertion activities, such as jogging, provide many health benefits, but exercising on your own can be considered disengaging. We present our system 'Joggobot', a flying robot accompanying joggers. Our design process revealed preliminary insights into how to design robots for exertion and how to address emerging design challenges. We summarize these insights into the four themes: 'embodiment', 'control', 'personality' and 'communication', which mark initial starting points towards understanding how to design robots for exertion activities. We hope our work guides and inspires designers when facilitating the benefits of exertion through robots.

Keywords

jogging; running; remote controlled Quadrotor; drone; exertion games; exergames; whole-body interaction; sport

ACM Classification Keywords

H.5.2. [Information Interfaces and Presentation]: User Interfaces - Miscellaneous

General Terms

Design, Human Factors

Introduction

Jogging can be an engaging activity and many people find social jogging, i.e. jogging with others, contributes positively to the experience [1]. However, it can be challenging to find people who are available at the same time, run at the same speed and share the same location. Mueller et al. [2] have demonstrated that technology can address these issues through allowing jogging partners to run together even though they are apart. We try to support joggers who do not have any partner available and long for a more engaging experience than jogging alone.

Mobile phone applications such as Nike+ demonstrate that people can embrace technology to enhance the jogging experience through tracking their progress. These systems focus mostly on performance enhancement, whereas we are interested in the engagement a social companion could bring to the experience. Digital companions in the form of 'ghost runners' exist on dedicated sports watches, such as the Garmin Forerunner 610. They display a virtual avatar that indicates how fast one is running compared to previous runs, serving as a target the jogger has to keep up with. In contrast, we focus on a companion that can make the experience more engaging and maybe serve as motivational partner too.

Higuchi et al. [3, 4] already demonstrated that a flying robot could be used for free-space camerawork and capturing external imagery of athletes during exercise, enabling them to detect errors in their performance. While their robot only serves as a monitoring system, our approach will allow the user to engage more socially with a robotic companion.

From human-robot interaction research we know people can tend to apply a social model to robots [5], but so far there is limited knowledge if and how this applies to how a robot is experienced in exertion activities. In consequence, we present Joggobot, a flying robot for joggers. Our aim is to explore how robots should be designed to create engaging jogging experiences in order to increase our understanding of how to design robots for exertion activities.

Joggobot

To realize our concept of Joggobot we opted for the Parrot AR.Drone, a computer-controllable flying Quadrotor. The implementation of Joggobot is based on the AR.Drone open API and makes use of marker tracking software involving the built-in camera. We created jogging T-shirts that contain a visual marker, which allows the AR.Drone to know its relative location and distance to the jogger (Fig.1).



Figure 1. A picture of Joggobot illustrating the concept.

Joggobot takes off from the ground as soon as it sees the marker on the jogger's T-shirt and rises to the same height level as the marker. It then automatically adjusts its position in the air, attempting to maintain a relative position of about 3 meters in front of the jogger. If the jogger is out of sight, the Joggobot lands for safety reasons.

This simple behavior allows for walking and jogging with Joggobot in straight lines, representing an early exploration within the limitations of technology, which we believe might give important early insights in what it might actually feel like to jog accompanied by a flying robot. Although joggers might not always run in straight lines, such routes are not uncommon: jogging paths in parks are often straight and treadmill running follows an 'imaginary' straight line. For now we present preliminary insights with the current system, but we aim to experiment with more complex jogging movements in the future.

Preliminary insights

We now present preliminary insights based on our design process and impressions from visitors to our lab who experienced Joggobot. We also had members from our lab running outside for 20 minutes before engaging with the Joggobot in a gym for about 10 minutes. An indoor environment allowed for more refined control due to the absence of weather influences, such as wind, which can negatively affect the Joggobot. Although we only gained preliminary insights, we hope that they can serve as starting points for explorations into how exertion activities could benefit from robots and what the challenges for designers are. We identified the following themes:

Embodiment – Why does a robot match the activity?

People were positive about the idea of having a flying robot accompanying them while jogging, distracting them from their exhaustion and challenging them to increase their effort. In particular users appreciated that the system had a 'body', which seemed to match the embodied activity of jogging. This becomes particularly evident when compared to virtual jogging support systems such as those available on watches and mobile phones: reading the information during running is often difficult, but with Joggobot, participants thought interactions could be easier to comprehend.

Control - Who is accompanying whom?

With the jogging activity and the robot in front of the jogger it is sometimes hard to tell who is following whom and who is in charge of the activity. We received feedback from people preferring Joggobot to react to their actions, speed up and slow down accordingly, but people also liked the idea of Joggobot taking control and motivating them to reach a certain pace, as they felt compelled to follow it. Designing for this ambivalent sense of control can be an interesting design challenge.

Personality – What is the social relationship?

We mentioned already that people like to approach robots as social beings. Nevertheless, we were surprised at how quickly users attributed social characteristics to Joggobot: they said things such as "it's tired now" when the battery was empty; they felt angry when it was too fast for them. This can be important for designers, as it changes how to prioritize implementation aspects. For example, we did not consider the visual appearance of the robot initially, but this feedback suggests that changing the robot's look, like adding eyes, could enhance the user experiences.

Communication – How to express intentions?

People expressed the need for communicating with Joggobot, which might be difficult due to the jogging activity involved. They pointed out that they want to direct Joggobot around using hand gestures in order to tell it which direction they want to go or to make it avoid obstacles. Alternatively, heart rate monitoring could be used as implicit communication, measuring the jogger's condition in order to speed up and slow down the Joggobot according to health recommendations. Joggobot might be able to communicate intentions as well. We started to test the use of special movements, like a mid-air twitch, signaling the jogger to start off or go faster, but it will take further studies to identify how movements of the robot can communicate certain meanings to affect the user experience.

Limitations

So far we have only presented preliminary findings, as further in-depth studies will reveal more detailed insights, but we believe our initial observations can serve as a valid starting point. In particular, the theme *control* is limited by the fact that we targeted casual joggers; the results might be different for serious runners. Our findings on *communication* and *personality* are both limited by the fact that we have not adapted our design to these themes yet, which could possibly lead to stronger observations if we make the Joggobot respond to gestures or give it an animal-like appearance.

Conclusion

We have introduced Joggobot, a flying robot accompanying joggers, and presented preliminary insights, gained from our design process and limited observations, suggesting that a robot companion can

indeed facilitate an engaging exertion experience. Thereon, we summarized these insights into the four themes *embodiment, control, personality* and *communication*, which mark initial starting points towards understanding how to design robots for exertion activities. We hope Joggobot inspires to consider robots in exertion activities, helping people to profit from the many benefits of exertion.

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