Understanding the Design of a Flying Jogging Companion

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ABSTRACT
Jogging can offer many health benefits, and mobile phone apps have recently emerged that aim to support the jogging experience. We believe that jogging is an embodied experience, and therefore present a contrasting approach to these existing systems by arguing that any supporting technology should also take on an embodied approach. In order to exemplify this approach, we detail the technical specifications of a flying quadcopter that has successfully been used with joggers in order to explore the design of embodied systems to support physical exertion activities. Based on interviews with five joggers running with our system, we present preliminary insights about the experience of jogging with a flying robot. With our work, we hope to inspire and guide designers who are interested in developing embodied systems to support exertion activities.

Author Keywords
Jogging; running; quadcopter; multirotor; drone; robot; exertion; sports; whole-body interaction; exergames

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

INTRODUCTION
Jogging has many health benefits and many people find it an engaging experience. In response, mobile phone apps have emerged that aim to support the jogging experience, for example the Nike+ app that reports to joggers how fast they ran. We note that these apps primarily focus on reporting athletic performance achievements and see an opportunity to explore alternative interactive technologies to support the jogging experience. In particular, we believe that jogging is an embodied experience [1] and that in consequence interactive systems aimed to support such activities should be designed with an embodied perspective in mind. In response, we present the technical details of a custom-made quadcopter for jogging as a result of having built and tested six quadcopters. Furthermore, we also present preliminary insights gained from having interviewed five joggers running with our system about their experience.

Figure 1. We built a quadcopter for jogging outdoors

RELATED WORK
Prior work already demonstrated that a quadcopter could be used to support athletes [2], however, the objective of this prior system was to capture athletes' actions with an attached camera rather than investigate the interaction between the robotic system and the athlete (the objective of the study in this paper). The idea to support joggers with a quadcopter is also not new: an AR.Drone has been

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previously used to demonstrate the idea as a design concept [3], however, we found the hardware platform is not suitable for a formal user study. We are aiming to support not only indoor, but outdoor jogging, hence developed our own quadcopter system according to our requirements to suit a study with joggers outdoors [Fig. 1].

TECHNICAL DETAILS

After having custom-built six quadcopters in various configurations and sizes, we found the following system the best compromise between performance, safety, stability and outdoor flight characteristics [Fig. 2]: our current prototypal system consists of a Safeflight Quadcopter 500mm frame, Gemfan Carbon/Nylon 10 inch propellers and Sunnysky x2212 980kv brushless motors. The flight controller is a 3DR Pixhawk/PX4 controller (redundant STM32 microcontrollers) with ST Micro L3GD20 gyroscope, LSM303D accelerometer and magnetometer, Invensense MPU6050 accelerometer/gyroscope and MS5611 barometer. It also includes an off-board uBlox GPS and HMC5883 Magnetometer and has a 915MHz Telemetry link to a laptop running APM Planner 2.

Figure 2. The final design of the custom-built quadcopter.

PRELIMINARY INSIGHTS

We present preliminary insights based on five joggers running with our system for a minimum of 20 min each. Participants were casual joggers (jogging 1-4 times a month) and were given the opportunity to jog with the system beforehand in order to determine a pace that they found suitable. We used this to set up the speed of the quadcopter and laid out a jogging route in the shape of an approximate square over even terrain. We sent the route and speed to the quadcopter beforehand and the participants were free to jog with the quadcopter in any way they wanted and for how long they wanted. Immediately afterwards, while the joggers were still exhausted, we interviewed them about their experience.

We found so far that, firstly, jogging with a flying robot can be an engaging experience. Participants found jogging with the system an intriguing setup that motivated them to keep going. Participants reported that they could see the potential of using such a setup to complement their jogging routine, but also to motivate them to run more often and even faster. They also found their runs to be more "fun" thanks to the quadcopter. Secondly, participants reported how running outdoors with the quadcopter, with the chance of being seen by other people, added to the excitement of running. This was surprising for us, as we expected apprehension of engaging with such a new setup in public, in particular in regards to the often negative connotation of drones in the media. Thirdly, the joggers reported that initially their focus was on the quadcopter, however, the novelty effect wore off quickly once they got tired, as their increasing exhaustion required them to refocus on the act of jogging itself. In particular, participants noted that the quadcopter became simply "a partner in the periphery". Fourthly, participants said that "who is in control" became an important question for them. On the one hand, the jogger is in control of the jogging experience, whilst on the other hand, the quadcopter determines the route (and the user-set speed). However, the jogger can regain control of the pace by cutting corners. Furthermore, because there is a perceived risk of the quadcopter dropping out of the air, the joggers run near, but not under the quadcopter, hence the system is determining where joggers are running explicitly (by means of the route), but also implicitly (by means of flying). As a result, the issue of control emerged for us as an intriguing theme for the design of robotic exertion systems.

DISCUSSION AND CONCLUSION

We presented a flying quadcopter aimed at supporting the jogging experience together with preliminary insights from casual joggers running with the system outdoors. This case study serves to exemplify our approach of investigating embodied systems to support exertion activities. Our contribution is two-fold: firstly, we provided the technical details about our system that successfully worked as jogging companion outdoors, which demonstrates the feasibility of our approach. Secondly, we presented preliminary feedback from joggers in order to construct an understanding of how such robots should be designed. Ultimately, with our work, we hope to inspire and guide designers who are interested in developing embodied systems to support exertion activities.

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REFERENCES

1. Dourish, P. *Where the Action Is: The Foundations of Embodied Interaction*. Boston, USA: MIT Press, 2001.
2. Higuchi, K., Shimada, T. & Rekimoto, J. Flying sports assistant: external visual imagery representation for sports training. In *Augmented Human*, 2011, ACM, 1-4.
3. Mueller, F., Graether, E. & Toprak, C., Joggobot: jogging with a flying robot. In *CHI'13 Extended Abstracts*, ACM, 2845-28