

Quad Theatre: Cirque du Soleil's flying lampshades (w/ Video)

September 27 2014, by Nancy Owano



Dance of the Quadcopters? Cirque du Soleil, ETH Zurich, and Verity Studios have partnered to develop a film that shows 10 quadcopters in performance. What would one expect with the name-brand Cirque du Soleil. Humans and drones move in sync. ETH Zurich comes into the mix with precise computer control for the performance of human and machine movements. The technology team would be tasked with

achieving seamless coordination of multiple vehicles, designing suitable trajectories and high-reliability infrastructure to pull off a successful film shoot.

Called SPARKED, this performance was fundamentally an exploration to see how state of-the-art technology can be used in the realm of entertainment. The result was a human actor placed with quadcopters in a symbiotic, choreographed performance. In achieving the magical visual effects, no CGI or wires, slow-mo or fast-forwards were used, said the creators.

Raffaello D'Andrea, professor at ETH Zurich, said he and his team have been doing research with flying machines and using algorithms they developed in order to dynamically control the machines with precision. The ETH Zurich researchers have explored quad control and state estimation, trajectory generation, increased autonomy, adaptation and learning, high-precision flight maneuvers, aerial construction and cooperation among multiple vehicles.

At the start of this collaborative project, the creators thought about what types of interactions they would have. Imaginations ran a wide course for potential effects. Welby Altidor, Executive Creative Director of Creations, Cirque du Soleil, said it was fun to imagine and ask what else we could put on them? Is it possible to make them disappear? "We came up with all kinds of ideas. We even had flying heads." They talked about lights on the quadcopters and then "at some point, almost by accident," he said, some colleagues joked about lampshades, and that made him stop in his tracks. "I said, wait a minute, did you say lampshades?" The concept sparked a workshop of flying lampshades.

The film shoot took place in the Flying Machine Arena at ETH Zurich, a space for work in autonomous flight. Along with flying machines at this space, there is a high-precision motion capture system, wireless

communication network and custom software at play for algorithms providing estimation and control. According to the arena website, "The motion capture system can locate multiple objects in the space at rates exceeding 200 frames per second. While this may seem extremely fast, the objects in the space can move at speeds in excess of 10 m/s, resulting in displacements of over 5 cm between successive snapshots. This information is fused with other data and models of the system dynamics to predict the state of the objects into the future."

The system uses the knowledge to determine what commands the [vehicles](#) should execute to achieve moves such as high-speed flips, balancing objects, or playing paddle-ball. Via wireless links, the system sends the commands to the vehicles, executing them with on-board computers and sensors such as rate gyros and accelerometers.

Prof. D'Andrea posed and answered the broader question: "Is there a future for this in performing arts? Absolutely. We're just getting started."

More information: flyingmachinearena.org/sparked/

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Citation: Quad Theatre: Cirque du Soleil's flying lampshades (w/ Video) (2014, September 27) retrieved 2 May 2024 from <https://techxplore.com/news/2014-09-quad-theatre-cirque-du-soleil.html>

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