



**AUDI**  
KONFUZIUS-INSTITUT  
INGOLSTADT



Technische Hochschule  
Ingolstadt

**AKII Microlab**

Bachelor/Master Thesis

## **Multimodal Avatar Augmentation using Event-based and Depth Cameras**

### Problem description

Remote VR has enormous potential to allow physically separated users to collaborate in an immersive virtual environment. These users and their actions are represented by avatars in the virtual environment. It has been shown that the appearance of those avatars influences interaction. Moreover, a one-to-one mapping of the user's movements to the avatar's movements might have advantages compared to pre-defined avatar animations. In this context, the project proposes a multimodal augmentation of typical avatars (i.e. built using head and hand controller tracking). Using new modalities (i.e. event based vision and depth sensors) the avatar augmentation can be two fold: motion can be improved by having faster motion detection and estimates from the event-based camera; localization can be improved by calculating distance to objects using depth information. The event-based camera (Dynamic Vision Sensor - DVS) is a novel technology in which each pixel individually and asynchronously detects changes in the perceived illumination and fires pixel location events when the change exceeds a certain threshold. Thus events are mainly generated at salient image features like edges which are for example due to geometry or texture edges. The depth information is obtained from an active depth-sensing camera sensor (e.g. Kinect, ASUS Xtion, Primesense). The combination of the two results in a sparse stream of 3D point events in camera coordinates which directly give the 3D position of salient edges in the 3D scene. The combination of DVS and depth sensors is a promising opportunity for a new type of visual processing by using a sparse stream of 3D points events which captures only dynamic and salient information invaluable for having precise avatar construction.

### Tasks

- Get familiar with the DVS and depth sensor.
- Investigate depth sensor technologies (i.e. resolution, detection, interfacing).
- Program an interface to acquire data from DVS and depth sensor.
- Program a fusion mechanism for data from DVS and depth sensor.
- Program an interface from DVS and depth sensor to VR system.

### Technology

- <https://inilabs.com/products/dynamic-vision-sensors/>
- <http://xtionprolive.com/primesense-carmin-1.09>

### Required skills

Strong programming experience, computer vision and algorithms.

### Preferred field of study

BA/MA Mechatronics(Robotics), BA/MA Computer Science

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