



## 3<sup>rd</sup> trackframe day

### Abstracts

#### **trackframe: Introduction, Overview (Gudrun Klinker)**

After three years of trackframe, significant progress on providing overarching, reusable tracking services across several applications has been achieved. We provide a brief overview of the vision, concepts and tools of the trackframe project, as implemented in the Ubitrack platform.

#### **Indirect Tracking for On-The-Fly Elimination of Occlusion Problems (Reinhard Grandl, Michael Schlegel, Jörn Trilk, Peter Keitler)**

AR Stud welding in experimental vehicle build is in productive use since 2004 and proved to be very beneficial. However, in its current stage, the welding-gun cannot be used in areas hidden to the IR outside-in tracking system that is mounted rigidly to the ceiling.

The proposed solution to this occlusion problem is an indirect tracking setup where the stationary cameras track the mobile cameras which in turn track the target.

Such an indirect tracking setup suffers from large errors if implemented naively. We designed several error correction strategies and evaluated their performance in the laboratory as well as in an industrial environment. For this we used a high precision mechanical tracking system as a reference.

The results show that indirect tracking can achieve almost the accuracy of a classical outside-in tracking setup.

#### **Dealing with Complexity in Industrial Tracking Environments (Peter Keitler)**

In many realistic tracking scenarios, several independent trackers are used at the same time. They have to be registered properly to one another before the environment can be used by VR/AR applications. Furthermore, additional entities such as CAD models might also need to be integrated into the setup. These calibration steps are crucial for overall system performance and have to be performed very accurately. Factors such as outliers or sensor noise, however, make them highly susceptible to errors. The Ubitrack middleware approach decouples VR/AR applications from the underlying tracking infrastructure. Thereby, the infrastructure becomes interchangeable. However, the calibration process can no longer be handled by the applications.

We present a tool that allows the administrator of a tracking infrastructure to perform these calibration and registration steps for almost arbitrary setups in a generic way. We also show how the associated accuracy aspects can be handled robustly.

#### **Integration of odometric sensors for Augmented Reality - Analysis and Application (Michael Schlegel, Manuel Huber)**

Odometric sensors are an inexpensive and reliable way to enhance existing tracking setups. Especially in situations where other tracking modalities are interrupted, odometric tracking proves useful to

bridge these gaps. We present an analysis of the reliability and accuracy of an optical odometric sensor and its fusion with other optical inside-out or outside-in tracking devices as well as inertial sensors. Finally we present an application which demonstrates the integration of an odometric sensor for an indoor navigation task in a large industrial environment.

### **Parasitic radio frequency tracking - Leveraging existing infrastructure for location aware computing (Manuel Huber)**

Most of the time the available tracking quality is a balance between technical requirements, user desires and economic factors, as most of the tracking methodologies require the setup of dedicated infrastructure. As pervasive and ubiquitous computing grow in importance, so does the associated information infrastructure.

Combining these two facts we present strategies to leverage existing information infrastructure and exploit its characteristics to arm users with services to determine their position, without the need for dedicated infrastructure.

### **Using Laser Projectors for Augmented Reality (Björn Schwerdtfeger)**

Augmented Reality (AR) has the potential to provide a competitive advantage in globalizing markets in industrial applications where people have to work efficiently without making errors after minimal training time. Many current industrial AR applications use head-mounted displays (HMDs). Yet, it is currently very hard to bring HMD-based solutions into industrial use due to several fundamental problems (small field of view, limited resolution, swimming effects, multiple focus planes, eye fatigue).

Projectors are increasingly seen as a viable alternative to HMDs. They do not suffer from the problem of multiple focus planes. However they come with their own drawbacks and restrictions. This talk reports on the experiences of setting up laser projectors for industrial Augmented Reality applications. The work focuses on the use of simple but bright laser augmentations rather than using regular projectors. We report on the details when setting up such projective displays including suitable tracking setups.

### **Demonstrations**

- Indirect tracking (Michael Schlegel, Peter Keitler)
- Prototype of an optical odometric sensor platform - Integration and Evaluation (Manuel Huber, Michael Schlegel)

By extracting optical sensors from common off-the-shelf hardware, we were able to construct a cost-efficient and versatile sensor platform for development and evaluation. Using this platform we demonstrate sensor fusion of odometric sensors with different inside-out or outside-in as well as inertial sensors, thereby allowing tracking in large area indoor industrial environments. Furthermore this framework provides an easy evaluation platform for different sensor performance parameters.

- trackman (Peter Keitler)
- Laser projector (Björn Schwerdtfeger)
- (Benjamin Becker)

### **Application oriented integration and benefit analysis of the trackframe platform (Benjamin Becker, Holger Schmidt)**

By adapting and extending the technological results of trackframe to different EADS use cases we are able to assess their impact on various business parameters. Based on various scenarios tested and

validated together with end-users we are able to present an in-depth look on our business case for the usage of Augmented Reality in the field of Design and Engineering activities. Furthermore we plan to give an overview of various applications and scenarios at EADS Innovation Works and other Business Units using results developed within the trackframe project. We will also be able to give a short live demonstration of an Aircraft Cabin Visualisation highlighting different design features.

### **Summary, Outlook (future prospects) (Georg Klinker)**

We summarize the results of the trackframe project and outline further developments / research in the context of future projects.