Developing Natural User Interfaces with Microsoft Kinect to Support Disabled People

Werner Kurschl, Sebastian Pimminger, Philipp Pendelin, Christian Ortner
Upper Austria University of Applied Sciences, Research Center Hagenberg
Softwarepark 11, A-4232 Hagenberg, AUSTRIA

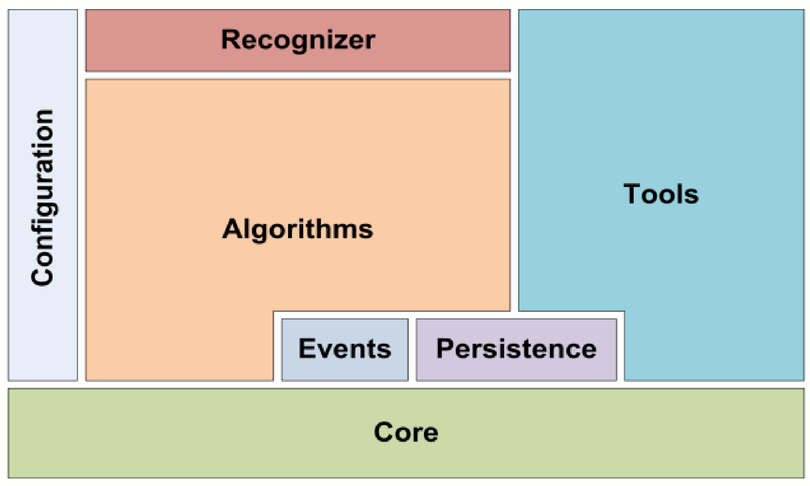
1 Motivation

Microsoft Kinect and its support for skeletal tracking, voice recognition and depth maps make it very attractive for NUI studies and professional applications, but it lacks any kind of gesture and posture recognition. Additionally, **professional NUI design and development requires any kind of support for recording, replaying and exchanging skeletal data and for automatically gesture and posture recognition**. Such features are usually needed for usability evaluations or for computer games for people with disabilities. This work presents a set of frameworks for describing and recognizing gestures and postures, while different kinds of algorithms can be applied. One of the intentions was to **ease the development effort and to support prototyping of NUIs** using Microsoft Kinect as the main input device. But we also kept a focus on **NUI-based applications for people with (especially motor or cognitive) disabilities**, since NUIs have the potential to support these people in their daily activities or in acquiring specific skills.

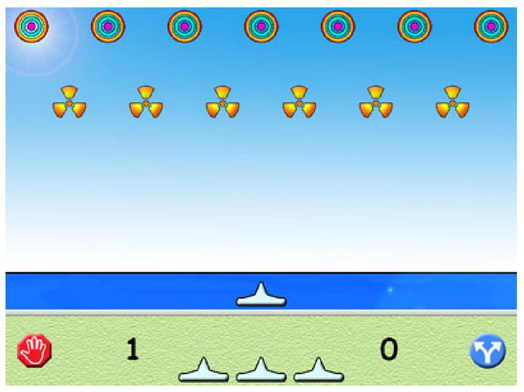
2 Design Considerations

Over the years, a great number of input technologies, e.g. diffused illumination and frustrated total internal reflection, have been introduced by different hardware vendors and research labs. As a result, applications become tightly depended on a particular device. Therefore, a gesture/posture recognition framework needs to be **device independent**.

To guarantee a versatile and easy usage, the framework should be an **integrated platform for creating and managing gestures and recognition algorithms**. Beside standard algorithms (like $1 Recognizer and Dynamic Time Warping), the framework should provide tools for managing gesture/posture sets. This goes along with the need of **user-specific gestures and timings**.



LifeTool KlickTool AAC Literacy

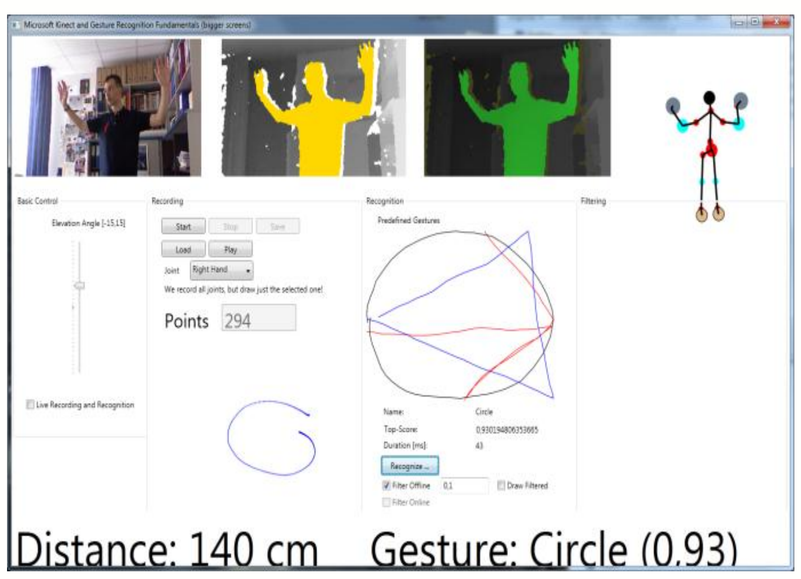


Easy Games Space Invaders

3 Results

Framework/Library has the following features

- Device independent input processing
- Recoding and replaying
- Gesture Recognition with various algorithms
- Posture Recognition
- Filtering (e.g. low-pass) for smoothing signals



4 Evaluation

The evaluation was conducted the following way:

1. from a set of possible postures we have chosen those postures, which where best suited for the individual tester,
2. after a number of tries we have further adapted some relevant parameters (e.g. holding time, lock time) of the posture recognition, so that the tester had a good feeling about the interaction with the applications,
3. the user used each application at least 10 minutes

The results of the evaluation are:

1. **posture and gesture recognition worked reasonable well** (also in seated mode, which was necessary for the those using a wheel chair),
2. **all users were motived to use the application longer,** than it was necessary for the evaluation,
3. some users mentioned, that the interaction paradigm and the applications can be further exploited for a physical training session,
4. some requested **speech recognition as a new input modality**, but they had also problems with the pronunciation,
5. **determining appropriate gestures for specific tasks** requires a sound analysis of existing **constraints stemming from the physiology of the human body of the targeted user**

Acknowledgement

This research was supported by a grant from the Austrian Research Promotion Agency (FFG) under the Research Studios Austria program. Any opinions, findings, and conclusions or recommendations in this paper are those of the authors and do not necessarily represent the views of the research sponsor.