Bring the Users to the Games by the usage of the Assistive Technology Rapid Integration & Construction Set

Roland Ossmann
Kompetenznetzwerk KI-I
Hafenstrasse 47-51
4020 Linz, Austria
+43 732 9015 5493
ro@ki-i.at

Gerhard Nussbaum
Kompetenznetzwerk KI-I
Hafenstrasse 47-51
4020 Linz, Austria
+43 732 9015 5490
gn@ki-i.at

Stefan Parker
Kompetenznetzwerk KI-I
Hafenstrasse 47-51
4020 Linz, Austria
+43 732 9015 5493
sp@ki-i.at

Dominique Archambault
Team INOVA/UFR 919
Université Pierre et Marie Curie-Paris6
Box 166, 4 place Jussieu,
75252 Paris Cedex 5
+33 1 44 27 26 10
dominique.archambault@upmc.fr

Klaus Miesenberger
Institut Integriert Studieren
Johannes Kepler University Linz
Altenberger Str. 69
4020 Linz, Austria
+43 732 2468 1214
klaus.miesenberger@jku.at

ABSTRACT
In this paper we will present a new, flexible, easy configurable and affordable assistive technology called AsTeRICS. The AsTeRICS (Assistive Technology Rapid Integration & Construction Set) project will be introduced, describing the platform, the hardware and software design and the key features. In a next step, the games accessibility guidelines will be brought back into mind. Based on these guidelines, it will be shown, how the AsTeRICS platform can help making games accessible for persons with mobility disabilities. Therefore, the use of AsTeRICS will make the game automatically follow a substantial subset of these guidelines and it will be shown where the platform will support game developers. Furthermore, the borders, where AT in general and AsTeRICS in particular are not sufficient, so the game developer must manually follow some guidelines, will be presented. This paper shows how to bring the group of disabled gamers closer to (mainstream) games.

Keywords
Games Accessibility, Accessibility Guidelines, Assistive Technology.

1. INTRODUCTION
In the last decades, many efforts have been made towards making games accessible and bringing games accessibility to the mainstream [1]. These approaches were driven by several aspects: beside the fact, that games play a bigger role in society these days [2], games are more and more used for education, training and other aspects of life (see [3][4] and [5]). A lot of interesting work has been done, but without accomplishing a real breakthrough. This paper will show a new approach. The Assistive Technology Rapid Integration & Construction Set (AsTeRICS) will bundle many types of different assistive technologies (AT) and devices and will act as a standard keyboard, mouse and/or joystick. The functionality of the AsTeRICS device will reduce the efforts for game developers to add special accessibility functions to their games. The possible simplifying issues will be shown against the games accessibility guidelines [6].

2. STATE-OF-THE-ART
A lot of papers report case studies that focus on a particular modality and how to render some games interaction with this modality [7] or that focus on specific games and their use by various groups of people with special needs [8, 9].

Over the last years lots of assistive technology devices have been developed. The range reaches from a simple switch up to brain and neuronal computer interfaces. Many of them are alternatives to standard pointing devices (e.g. head trackers like Origin Instruments Headmouse Extreme [10], or eye trackers like Tobii myTobii P10 [11]) and keyboards (e.g. virtual keyboards), developed for persons with severe physical disabilities. Some of these interfaces nowadays are used by non-disabled gamers, too. A good example is the TrackIR from Naturalpoint [12]. Other AT devices and software like screen readers (e.g. Freedom Scientific Jaws [13]), braille displays (e.g. Handy Tech Braille Wave 40 Bluetooth [14]), screen magnifiers (e.g. Ai Squared Zoomtext [15]), etc. are dedicated to people with sensory disabilities.

Many of these AT devices have been optimized for a special application (e.g. computer access) so that they cannot be used in other situations. Furthermore, in most cases AT devices have to be

adapted to and configured for the users to fit their abilities before they can be used. Unfortunately some people cannot be supplied with AT devices due to the limits of adaptability and flexibility of these devices.

This progress allowed starting designed guidelines which allow improving mainstream games accessibility so games can be used by a larger range of players [1, 6]. Nowadays, as various solutions have been found to render different styles of game interaction together with several modalities, the idea of mainstream game accessibility starts to emerge [16].

3. THE ASTERICS PROJECT

The goal of the AsTeRICS Project is to develop a construction set for assistive technologies which can be adapted to the motor abilities of end-users. AsTeRICS is intended to allow access to different devices such as PCs, cell phones and smart home devices by simply attaching one single platform to them, which has all the necessary means of input for the specific user already connected to it.

The main objective of the project is to develop a support platform that will facilitate and improve communication resources of people with motor disabilities in their upper limbs. [17]

AsTeRICS will provide a flexible and affordable construction set for developing user driven AT by combining emerging sensor techniques like Brain-Computer Interfaces (BNCI) and computer vision with basic actuators (like switches, sip/puff mouse, special mice/joysticks, etc.). People with reduced motor capabilities will get a flexible and adaptable technology at hand which enables them to access the Human-Machine-Interfaces (HMI) on the standard desktop [17].

3.1 The AsTeRICS Platform

Figure 1 outlines the concept of the AsTeRICS construction set, which contains several modules and a software suite for configuration of the system. The core element of the AsTeRICS system is the AsTeRICS Personal Platform, an embedded computing system which processes data from input modules (sensors) and controls output to actuator modules. Configurations can be designed using a graphical software suite and then downloaded into the AsTeRICS personal platform to perform the desired functions.

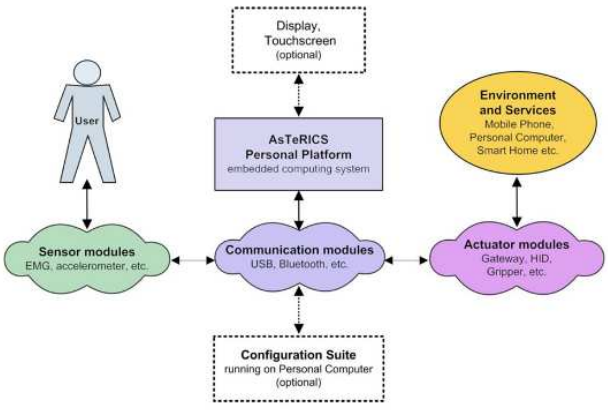

Figure 1: The AsTeRICS Platform

3.2 Hardware and Software Design

In the core of the system (an embedded hardware platform), several modules will be plugged in. These USB-pluggable modules cover a broad range of functionalities, from analog and digital inputs and outputs to smart vision module (eye gaze and eye tracking), BNCI support and many more. Due to the usage of USB, the modules can also be used stand-alone on the PC. Additionally, one module will connect the AsTeRICS platform with the PC, simulating an HID mouse or keyboard or joystick device. Special sensors, like a strain gauge or a sip/puff switch, which deliver analog values, can be used as source for analog input, like an analog joystick movement.

On the embedded platform, a software framework (the AsTeRICS Runtime Environment - ARE) connects the different modules representing sensors, processors and actuators. Due to the usage of OSGi, the modules can easily be changed or new ones can be added. Besides streaming data from one module to the other, modules can fire or receive events to trigger actions.

Another strength of AsTeRICS is the very flexible and extendable architecture. New plugins for sensors, actuators and data processing can be implemented and integrated very easily.

3.3 Configuration

The configuration of this complex hardware and software system should be as easy as possible. This will be accomplished through the AsTeRICS Configuration Suite (ACS). This graphical editor allows the configuration of AsTeRICS by drag and drop of the components (or also keyboard interaction, to fulfill the software accessibility guidelines) and by connecting them via data channels or event channels. Via a network connection, the ARE can be controlled and new models can be uploaded to it. Figure 2 shows a screenshot of the ACS.

4. THE GAMES ACCESSIBILITY GUIDELINES

The "Guidelines[1] for the development of accessible computer games" have been developed to help game developers design their products in a way that assistive technologies can interact with the game interface and the parameters of usage can be adapted to the needs of people with disabilities. [6]

4.1 Structure of the Guidelines

Within these guidelines, four target groups are addressed: people with visual, auditory, mobility and cognitive disabilities. The guidelines are divided in five categories, each of them containing several rules. The categories are a) level/progression, b) input, c) graphics, d) sound and e) installation and settings. Each rule has a prioritization, indicating if it is a must-have, should-have or may-have. This prioritization is connected to the target groups, so finally a rule might be 'must have' for vision impaired persons, but only 'may have' for mobility impaired persons.

This paper will mostly deal with the guidelines focused on people with mobility impairments, as the AsTeRICS project targets this group.

[1] http://gameaccess.medialt.no/guide.php

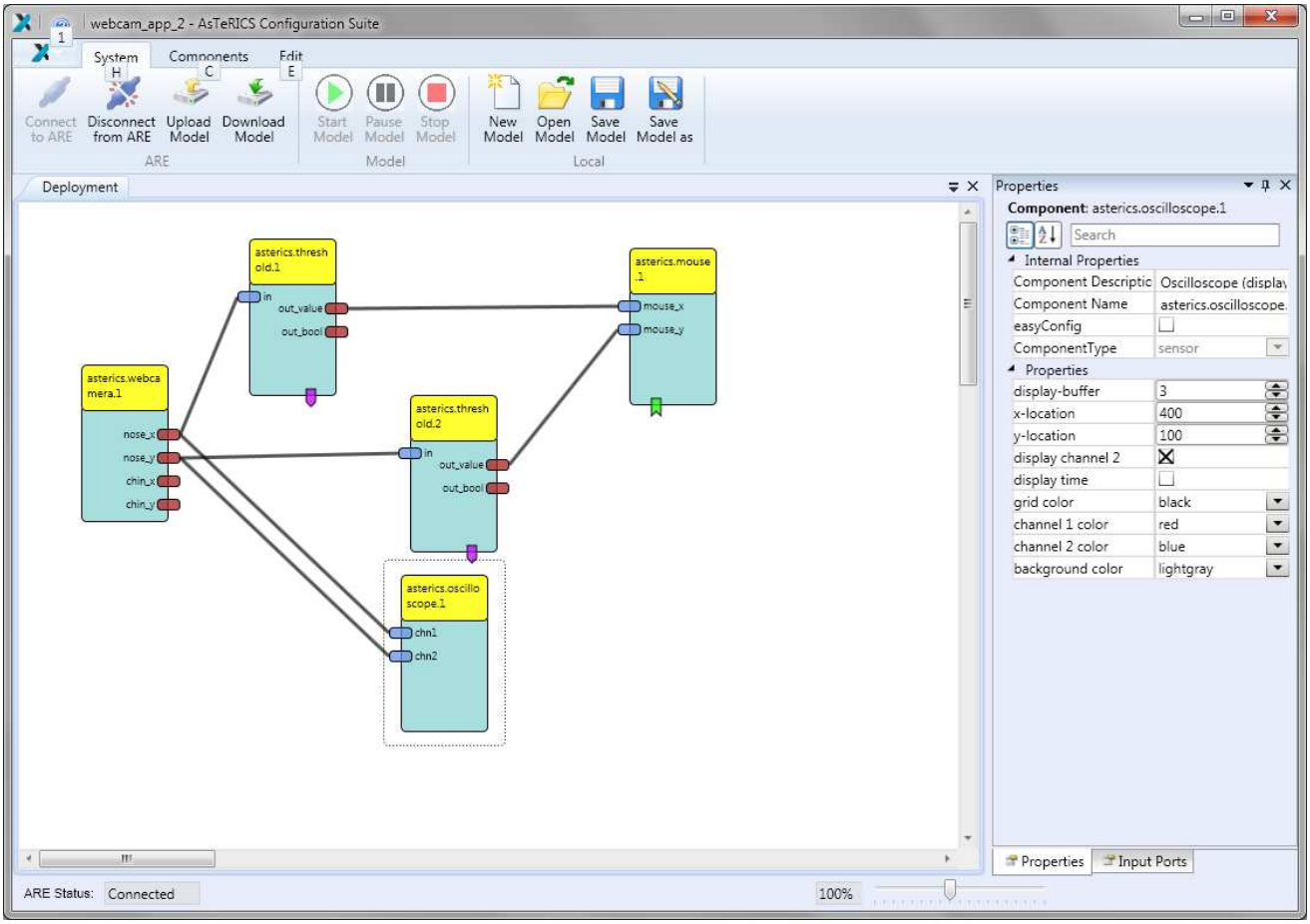

Figure 2: The AsTeRICS Configuration Suite

4.2 Guidelines

Here are a few examples of such guidelines (focusing on guidelines useful for people with mobility impairments).

- "3.1 Allow for Alternative Controls": Handicapped persons have very different assumptions for controlling computers. There are many different aids, for example: mouse, switches, pointer screens, control panels, keyboards and scanners
- "3.2 Allow for the use of several different input and output devices simultaneously": A handicapped user may not necessarily be able to use all the functions in a program (even allowing for keyboard control etc.). But if several control systems can be used at the same time, then a group of handicapped users can work together. This can be fun, instructive and increase the user range for the product. Furthermore a single user should be able to use the same input configuration (of different devices), he/she uses outside the game.
- "3.3 Adjustable sensitivity/error tolerance": Properties for the keyboard and other input devices should be adjustable. Examples from the keyboard might be: repetition delay, repetition speed, marker blinking, slow keys, filter keys, switch keys, etc.
- "3.4 Adjustable speed and size of pointers and markers": It should be possible to adjust the size and speed of the pointers and markers. Color and contrast are also important properties and should also be adjustable. Increasing the size of pointers and markers also means, decreasing the accuracy needed by the gamer.
- "3.7 No simultaneously button pressing": It should be possible to play a game by not pressing more than one button simultaneously. This means e.g. instead of drag and drop an object, it should be possible to pic it up and release it by pressing a button.
- "3.8 Reduce the number of different inputs to a minimum": It should be possible to reduce the number of different inputs to a minimum. This means that there should be the option that the game makes some inputs automatically. E.g. a racing game accelerate and break automatically, the gamer just control left of right. Another example: at a Tic-Tac-Toe game, the game preselect the fields automatically, the gamer just need one button to confirm the selection (input scanning).

5. AUTOMATICALLY MEET ACCESSIBILITY RULES WITH ASTERICS

Using the AsTeRICS platform allows to meet automatically some of the Accessibility rules, and to make it easier to meet some other. The following section will show several rules which can be handled or simplified by AsTeRICS (most of them located in the guidelines section *inputs*).

The best example for the usefulness of AsTeRICS for the game developers is rule "3.1 Allow for Alternative Controls". Using the AsTeRICS platform, the developers need not care about any alternative controls, as alternative controls will act as standard controls. One pluggable component will allow connecting the platform via USB to the PC, where AsTeRICS will act as a standard HID device (mouse, keyboard or joystick). The game will not know whether a standard joystick or a complex system, using a camera and switches, is used as control.

The effort for fulfilling rule "3.2 Allow for the use of several different input and output devices simultaneously" will also be decreased with AsTeRICS. Several input devices can be combined and work in parallel and once again deliver all inputs as a standard HID device.

"3.3 Adjustable sensitivity/error tolerance" can also be handled by the AsTeRICS platform. The game developers need not develop a configuration setting for AT, this functionality will be handled by AsTeRICS. AsTeRICS will allow to configure the attached AT very extensively.

Within rule "3.4 Adjustable speed and size of pointers and markers", AsTeRICS can also support the developers. AsTeRICS cannot change the size of pointers or markers, but components like tremor reduction can make it easier for the users to select an object by mouse.

Obviously AsTeRICS cannot follow automatically all of the accessibility rules. This concerns especially the need for alternative or adapted graphic output, which induces significant effort for game programmers. Also guidelines of the *inputs* section, like rules "3.7 No simultaneously button pressing" and "3.8 Reduce the number of different inputs to a minimum" cannot meet automatically. Other sections of the guidelines like *level/progression* or *sounds*, with less effort for the developers, are also not handled by AsTeRICS.

6. CONCLUSION

Accessible games are far away from a state to reach the mainstream. There are a few games, guidelines, ideas, but no real breakthrough. As long as the effort (and therefore the costs) for making games accessible is considerably high, accessibility will hardly or not at all reach the games mainstream market. One step forward are assistive technologies, which support the end users in a way that makes games (and of course applications) need less adaptation and support. AsTeRICS is such a kind of AT, bringing users with special needs closer to games and applications. Additionally, the flexibility of AsTeRICS enables the development of components, being tailored supporting game interaction and game control.

7. ACKNOWLEDGMENTS

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