AsTeRICS Academy Tools
GuidePost

Introducing our
Assistive Technology Collection

The AsTeRICS Academy GuidePost

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The AsTeRICS Academy fosters cross-cultural education in Assistive Technologies, in form of workshops and by providing open source hardware & software and information about affordable assistive solutions for people with disabilities.

This guidepost gives a brief overview of the collection of documents and software which is provided on the USB Stick accompanying our workshop- and summer school programs. Furthermore, this document shows where to find more detailed information and suggests some applications of the various assistive tools in conjunction with other free software – for example for gaming, learning or musical expression.

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For more information please visit: http://asterics-academy.net

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About us

The AsTeRICS Academy team currently consists of 5 people working at the University of Applied Sciences, Technikum Wien: Benjamin Aigner, Veronika David, Martin Deinhofer, Angelina Kratschanova and Chris Veigl. We are an interdisciplinary group with backgrounds in computer science, healthcare- and rehabilitation engineering and internationalization, and we share the enthusiasm for Assisitive Technology supporting abilities of people who are physically or mentally challenged.

The AsTeRICS Academy Team
Martin Deinhofer, Angelina Kratschanova, Chris Veigl, Veronika David, Benjamin Aigner

Our tools

At the UAS Technikum Wien we work at the Department of Embedded Systems, an institute focused on research and teaching utilizing state-of-the art microcontrollers and hardware- / software development methodologies. Since 2010 we established a new focus at our institute: Smart Homes and Assistive Technologies. We develop open source assistive tools (software and DIY-hardware) and collect free or open source software from other sources so that assistive solutions become available also for people with low income or in countries of the Global South.

Our vision

We do not believe that technology is a solution to all problems. It can never replace personal care or friendship, and often low-tech tools prove to be still more practical and capable than high-tech ones. However, in today's digital society - where computers and the internet dramatically changed the way we communicate and how we share our knowledge - assistive tools and information technology have the potential to unlock capabilities and creativity, and to increase personal autonomy and participation in work and life. By developing open source hardware and software for affordable Assistive Technology we would like to contribute to these exciting developments.

the AsTeRICS Academy Team

AsTeRICS

AsTeRICS stands short for "Assistive Technology Rapid Integration & Construction Set". It is a set of software- and hardware building blocks for the creation of end-user ready Assistive Technology applications. AsTeRICS offers a free and Open-Source construction editor which allows the graphical creation of flexible assistive solutions using a large set of sensors and actuators.

AsTeRICS started 2010 as an international research project partly funded by the European Commission. 9 partner organizations worked together for 3 years to establish the software architecture, designed and built the hardware and applied the resulting framework in course of user evaluations. Since 2013, the AsTeRICS framework is further developed and improved by the main partners KI-I (http://www.ki-i.at) and UAS Technikum Wien (http://www.technikum-wien.at).

The main application area for solutions created with the AsTeRICS framework is the support of people with severe motor disabilities. In the recent years we built individual solutions for clients with various conditions including (Dychenne) Muscular Dystrophy, ALS (Lou Gehring's Syndrome), Quadriplegia, Cerebral Palsy and similar motor challenges.

Some possible applications of the AsTeRICS framework are:
- Computer input (mouse-, keyboard-, joystick- replacement and on-screen keyboards)
- Environmental Control (using KNX, FS20, EnOcean, EasyHome or infrared remotes)
- Computer Vision based interfaces (Face- & Eyetracking, TobiiEyeX/EyeTribe/Kinect ..)
- Brain/Neural computer interfaces (Enobio, OpenVIBE, OpenEEG)
- Speech creation and speech recognition in 25 languages
- Toys and game-control (Playstation 3, computer games, RC-toys ...)
- Android phone support (SMS, calls)

What about Asterix ??
Is there any connection between "AsTeRICS" and "Asterix", the famous little gaul who ever prefers a good roasted wild pig over any Italian cuisine ?
Well - sort of - in the sense that Asterix always finds a clever solution to challenges which sometimes seem irresolvable !
By combining the – up to date 160 – individual assistive technology building blocks using the graphical editor, a plethora of solutions can be created very efficiently, allowing rapid AT-prototyping directly at the user's site.

Asterix cartoon character,
© Les Editions Albert René, France

AsTeRICS basics: ARE and ACS

AsTeRICS consists of two main software applications: the AsTeRICS Runtime Environment (ARE) and the AsTeRICS Configuration Suite (ACS). The ARE is the part which actually contains all functions elements and where a concrete assistive solutions runs. The ACS is the graphical editors where you can connect, combine and adjust all the individual building blocks, thereby defining the intended fuction of the assistive solution. ACS and ARE are connected via the network so that finished solutions can be transferred from ACS to ARE and vice versa.
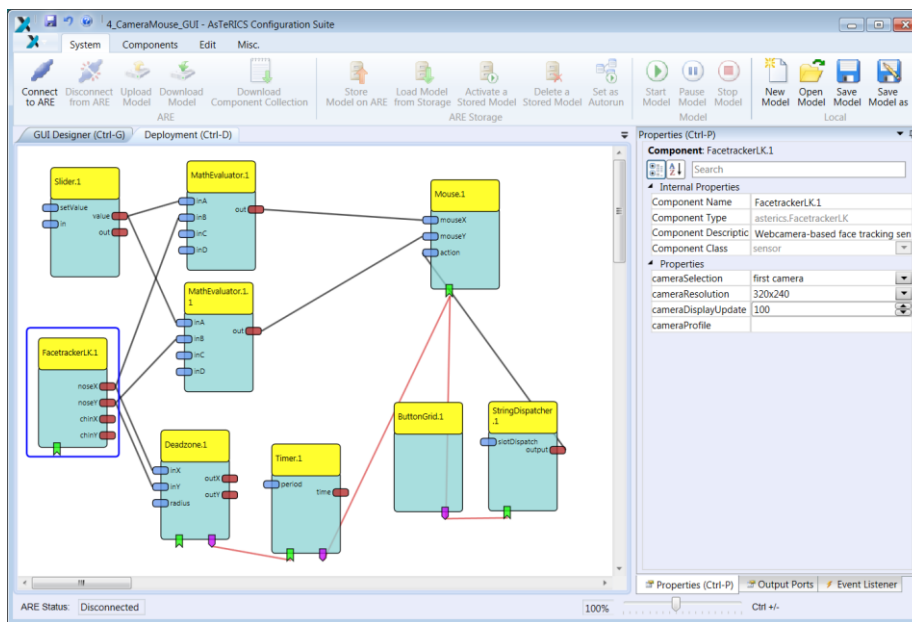
The graphical ACS editor, here showing a functional model for a facetracker-based mouse cursor control

Installation and use

The AsTeRICS project offers a setup installer (.exe) for Microsoft Windows which contains all necessary parts and prerequisites to run the software. It also contains extensive documentation for users and developers. All necessary files are provided on the AsTeRICS Academy USB stick in the folder **/Software/AsTeRICS**

Strengths and weaknesses

The huge amount of possible solutions and the effectivity how these solutions can be created, adapted and tested together with users is where AsTeRICS shines. However, all this flexibility has also some downsides: There is a steep learning curve because so many plugins and options exist, which makes AsTeRICS a nice tool for AT-researchers, computer scientists or engaged care persons with some affinity to technology – but it is not an easy task for newcomers or people without any computer background to reveal the full potential of the framework. That was the reason why we decided to create some stand-alone modules for alternative computer input which can be easily used and still provide a lot of flexibility: The FLipMouse and the FABI button interface.

The FLipMouse

The FLipMouse is a DIY-construction kit for an alternative input device for people who prefer (or need) other input variants for computer usage than a standard PC-keyboard or mouse. Using the FLipmouse, mouse- and keyboard activities can be created via slightest finger- or lip/mouth interaction. A zero-way joystick (which can also be used as a mouthpiece) allows detection of subtle movements, allowing a precise control of mouse/key activities with low forces. Click activities can be created via sip and puff or by attaching external switches to the FLipMouse device via standard 3.5mm jack plug connectors.
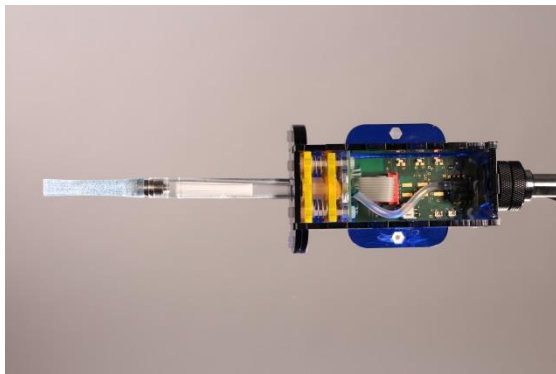
The FLipMouse module with its printed circuit board and sensors; demonstration of a possible usage scenario

Using the provided FLipMouseGUI application, every function and the sensitivity of the FLipMouse can be freely configured. Multiple memory slots are available on the device to store different configurations – so that users can switch e.g. from mouse control to keyboard key creation, activate different acceleration profiles etc.

All FLipMouse design files and source code files are available as open source. These files are part of the AsTeRICS distribution and will be separately distributed from the AsTeRICS Academy homepage. We are currently working on a construction set and accompanying build instructions so that the FLipMouse becomes available for an affordable price - targeting users who cannot benefit from expensive AT modules.

Assembly, Installation and use

The assembly and installation processes for the FLipMouseGUI software and the needed drivers are explained in the FLipMouse manuals. All necessary files are provided on the AsTeRICS Academy USB stick in the folder **/Software/FlipMouse**

The FABI interface

Simple switches can be a powerful input method for people with physical disabilities. Many assistive software applications support switch-based input, ranging from on-screen keyboards to communicators (offering speech synthesis) and tablet/smartphone control tools. For attaching one or multiple switches to a computer, usually a special hardware interface is required which must be supported by the desired software applications and/or by the operating system.

Microcontrollers are affordable programmable electronic components which often can be connected to a computer via an USB cable and can behave as a standard computer mouse or keyboard if programmed accordingly. The Flexible Assistive Button Interface (FABI) is a microcontroller where up to 9 momentary switches can be attached. It works on any computer with a major operating system (Windows, Linux or Mac). With the provided FabiGUI software application, the function of each switch can be defined, so that pressing the switch will create mouse movement, mouse clicks or key presses on the computer.
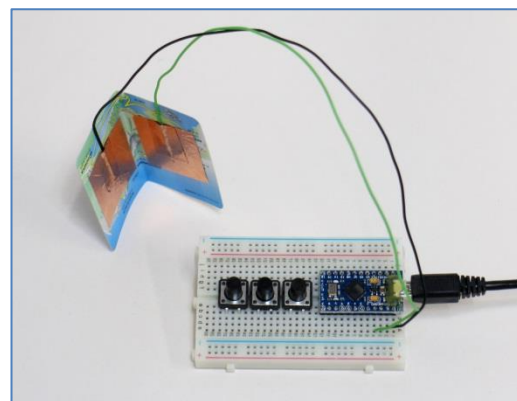
Multiple memory slots are available on the FABI device to store different configurations – so that users can switch e.g. from mouse control to keyboard key creation, activate different acceleration profiles etc. Thus, FABI can be used for generic computer input, internet browsing or creative software.

FABI uses the most affordable components which are available on today's market and a full DIY-construction guide is available, showing how you can prepare the hardware and assemble your own creative switch solutions. For about 15$ of hardware cost, a complete set can be made!

Assembly, Installation and use

The build instructions and installation process for the FABI software and the needed drivers is explained in the FABI manuals. All necessary files are provided on the AsTeRICS Academy USB stick in the folder **/Software/FABI**

Provided 3rd-party software

Additionally to our own developments, the AsTeRICS Academy USB stick contains a lot of free assistive software applications, tools, games and educational software. In the following, these applications will be very briefly described. (The list is not complete! You will find more useful software in the "3rdParty" subfolder! Documentation on these tools is available on the internet!)

On-Screen-Keyboards, typing & communication
**/Software/3rdParty/On-Screen-Keyboards**

- *Click'n'Type*: a virtual keyboard with many functions (including macros, language packs etc.)
  http://cnt.lakefolks.com/
- *Dasher*: text-entry interface driven by continuous pointing gestures
  http://www.inference.phy.cam.ac.uk/dasher/Download.html
- *DynamicKeyboard*: an on-screen keyboard optimized for eye/gaze control
  http://www.canassist.ca/EN/main/programs/free-downloads/dynamic-keyboard.html?sredir=1
- *Special Access to Windows (SAW)*: on-screen-keyboard with comprehensive editor, scanning, scripting and word prediction features
  http://www.oatsoft.org/Software/SpecialAccessToWindows
- *Symbols&Pictograms* by Sclera.be: a huge collection of icons for your own keyboard creations: http://www.sclera.be/en/vzw/home
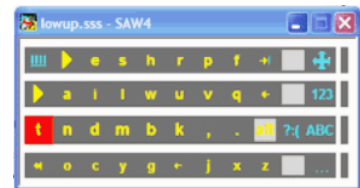
MouseUtilities, clicking & mouse-control
/Software/3rdParty/MouseUtilities&Control

- *CameraMouse*: webcam-based (head-controlled) mouse replacement by Boston college
  http://www.cameramouse.org/
- *CrossHair*: utility which displays a crosshair instead of the mouse cursor
  http://crosshair.software.informer.com/download/
- *eViaCam*: webcam-based (head-controlled) mouse replacement software
  http://eviacam.sourceforge.net/
- *Point'n'Click*: small tool that can send mouse clicks and special keys to other running programs: http://www.polital.com/pnc/
- *XMouseButtonControl*: tool for reconfiguration and expansion of the mouse/button functions (different mappings for individual running applications are possible)
  http://www.highrez.co.uk/downloads/XMouseButtonControl.htm
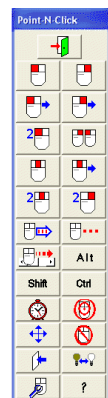
Musical expression
/Software/3rdParty/Music&Sound

- *MouseHarp/EyeHarp*: an eye-tracking based musical instrument: http://theeyeharp.blogspot.co.at/
- *PureData* (Pd): open source visual programming language for musical applications: https://puredata.info/
- *SoundPlant*: trigger sound samples via keyboard keys ! http://soundplant.org/
- *ZynAddSubFx*: open source synthesizer with many instruments and effects http://zynaddsubfx.sourceforge.net/
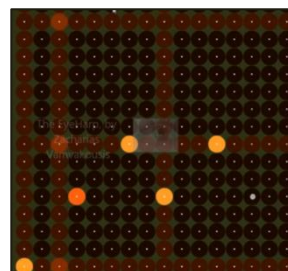
Speech creation and screen readers
/Software/3rdParty/SpeechCreation

- *NVDA (Non-Visual-Desktop-Access*) for Windows: a free screen reader application for people with visual disabilities: http://www.nvaccess.org/
- *ETrioquist*: Augmentative communication aid software with speech synthesizer and customizable speech templates: http://www.etriloquist.com/

Games and learning
/Software/3rdParty/Games&Learning

- Drawing&Creativity
    - *1-2-3 Paint, Splodge, FunPaint, AlphabetPaint*….
      A suite of free games for kids with disabilities including switch input support, simple drawing / coloring games, funny sound effects.
      Thanks to ClaroSoftware for providing these!
      http://www.clarosoftware.com/
    - *CrayonPhysics*: 2D-physics puzzle / sandbox game http://www.crayonphysics.com/
    - Physion: physics simulation software: http://physion.net/

Games and learning (continued)
/Software/3rdParty/Games&Learning

- Freeware Games and Game machine emulators
    - *CCS64:* C64 emulator + 10 retro games
      http://www.ccs64.com/
    - *ProjectN64* (Nintendo64 emulator + MarioKart)
      http://www.pj64-emu.com/
      Be aware of the malware "Swift" and "Youtube Accelerator" included in the setup program. Just "Skip" the optional installations.
    - *SpaceCadet* 3d-Pinball game:
      http://www.chip.de/downloads/Microsoft-3D-Pinball_60864018.html

- Reading, writing and math practice
    - *EffectiveEnglish*: basic English words training
      http://effective-english.soft112.com/
    - *MathBear:* funny games and math training !
      http://www.shifz.org/rechenbert/
    - *KlexDemo*: reading / writing practices (german)
      http://www.legasthenie-software.de/download/download.htm

- Programming
    - *Scratch*: free graphical programming language with many examples and game programming tutorials: https://scratch.mit.edu/

Please note that the provided 3rd-party applications are distributed under their respective licenses, see the internet links above for more information.

The AsTeRICS Academy is by no way responsible for their content, the collection of these software applications and tools on our workshop USB-flash-drive serves the purpose of making the content available in regions or situations where no stable internet connection is present.

Some of the provided applications are a universe of their own and can only be briefly introduced in course of our workshop (for example Pure Data or the Scratch programming language). However, we offer a separate Scratch workshop for kids who are interested in computer programming. Find more information on our webpage http://www.asterics-academy.net

Suggested applications

This section suggests several assistive use cases which could be implemented via the hardware and software tools provided in course of the AsTeRICS Academy workshop. There are many more! – it's just a glimpse of what is possible with some resources and a lot of creativity ☺

Please note: To accomplish the following tasks you need to work with the provided frameworks and user manuals – not every step is explained here. In our workshop we will build these examples together in a step-by-step manner !

A) Use FABI for triggering sound samples

1. Connect several more switches or pushbuttons to your FABI interface (see A)
2. Start the *Soundplant* sample triggering application and select appropriate
3. Play around with different keys (using *FabiGUI.exe*) and sample configurations !

B) Use FABI for controlling a communicator with speech synthesizer

1. Use the FABI DIY manual to build yourself a FABI interface (microcontrollers will be provided in course of the workshop) with two switches (or pushbuttons)
2. Use the *FabiGUI.exe* configuration software to assign the keyboard keys "Enter" and "Space" to your two switches.
3. Install the SAW on-screen keyboard creator, choose the options "user scan with 2 switches" and configure the switch interface for "Enter" and "Space" keys. Try the provided keyboard layouts (selection sets).
4. Start the *ETrioquist* speech synthesizer software. Try to compose several words or sentences just by using the two FABI switches and the scanning process of the on-screen-keyboard. Pretty tempting, isn't it?

C) Use FABI for playing your favorite retro computer game

1. For this it will be helpful to attach at least 3 switches / pushbuttons to your FABI interface (better are 5..)
2. Start the game computer emulator of your choice (C64 or N64) and load a game. Our suggestions: "Bubble Bobble" or "Super Mario Kart" – you can play together with FABI + keyboard or 2 FABI sets !
3. Check the input configuration settings in the menu (input keys for game control)
4. Use FabiGUI.exe to assign the these keys to your switches
5. Have fun !

D) Use AsTeRICS and FABI to control the mouse cursor via head movements

1. Install the AsTeRICS software, check if the demo menu comes up when you start the ARE
2. Connect a webcam (in case you do not have a built-in laptop webcam) and select the "CameraMouse" demo model from the menu
3. Try to move the mouse cursor via head movements! – A left mouse click is automatically done when you stop moving for a short time.
4. Start the ACS and connect to the ARE, download the running model
5. Try to replace the automatic clicking via a keyboard input which is created with your switch / FABI interface. You can use the "keycapture" plugin for this purpose.

E) Use AsTeRICS to control an electric light via speech commands

1. For this scenario you will need a 230V power switch which is supported by the AsTeRICS framework, and the Microsoft Speech Platform 11 must be installed on the computer. We provide an FS20 light actuator in our workshop. If this hardware is not available you could simulate the light for example by using a "DotMeter"- or a "TextDisplay" plugin.
2. Create a new model in the ACS, insert the SpeechProcessor plugin and configure it to detect phrases like "switch on light" and "switch off light" by adding them into the property fields of the SpeechProcessor plugin.
3. Connect the "recognized" events to the FS20 light actuator plugin, select a desired housecode and device address (you can also leave the default values if just one actuator is connected)
4. Attach an electric light to the FS20 actuator and activate the address-learning function (by pressing the button on the FS20 actuator until the led blinks)
5. Start the AsTeRICS model and try the speech-activated light
6. It works ?? – cheers and congratulations !!
   It does not work ?? – you could write us an email to office@asterics-academy.net ☺

Additional information how to prepare these use cases is provided in the workshop sildes !

One final tip: As usual when working with computers and digging into the mysterious riddles of IT: Patience, strong nerves and a lot of motivation are essential prerequisites ! Providing these, you will finally solve the technical problems and come to a working solution !

Contact Information

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Disclaimer

The University of Applied Sciences Technikum Wien and the AsTeRICS Academy project team do not assume any warranty and liability for the functionality of the set of Assistive Technology and the correctness of the documents handed over.

Additionally, the UAS TW is not liable for any damages to health due to the use of the Assistive Technology provided. The provided software applications and hardware modules are used at own risk !

Acknowledgement

Links and Resources

Related organizations and friends:

- KI-I: Competence Network Information Technology for Supporting Integration of People with Disabilities: http://www.ki-i.at
- HARPO: Cutting edge flexible solutions for people with visual impairments http://int.harpo.com.pl/
- Platus communicates: Alternative Augmented Communication solutions and more http://www.platus.at/en/platus.html
- LifeTool: Assisitve technology competence centers in Austria and the developers of the IntegraMouse: http://www.lifetool.at
- Therese Willkomm, PhD, the "MacGyver" of Assistive Technology, Author of the books "Assisitive Technology in Minutes": http://chhs.unh.edu/faculty-member/therese-willkomm
- The QuadJoy-Team: Bill and Debra Street – thanks for letting us use your mouthpiece !! https://quadjoy.com/
- Center of Applied Assisitive Technologies, TU Vienna (FORTEC) http://www.aat.tuwien.ac.at/index_en.html
- OpenDirective: dedicated to facilitating open innovation in accessibility and assistive technology: http://www.opendirective.com/
- Institute for Integrated Study, Johannes Kepler University Linz http://www.jku.at/iis/content

Other useful resources

- WebAIM: Web Accessibility, with a lot of interesting articles on accessibility in general http://webaim.org
- RJ Cooper & Associates, Inc: cooles iPad AT-utilities, mounts and much more ! http://www.rjcooper.com#
- Robobraille: great online service to convert text and non-accessible file formats into speech, braille etc ! – very helpful for people with dyslexia or visual impairments http://www.robobraille.org/
- Broadened Horizons: lots of AT there, flexible mounts, accessible game controls etc http://www.broadenedhorizons.com/
- OneSwitch.org: game accessibility portal with man resources http://www.oneswitch.org.uk
- Sensory Software: developers of the "Grid" AAC software and other useful tools http://sensorysoftware.com/