



Interactive Music Science Collaborative Activities
 Team Teaching for STEAM Education

Deliverable 4.8
Final Version of Pen-enabled multimodal interaction interface

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Executive Summary

In this deliverable we present the final version of the demonstrator for gesture and VR multimodal interaction interface.

We will mainly describe the following interfaces:

- The WIRIS EDITOR allowing to edit mathematical equations. The editor is accessible at <http://www.wiris.com/editor/demo/en/> and has a manual at <http://www.wiris.com/en/editor/docs/manual>
- The WIRIS GRAPH environment which allows drawing and interacting with graphs and functions. It is accessible at <http://www.wiris.net/demo/graph/tests/en/test.html>
- The UNIFRI DrAwME environment allowing to directly draw music and create sound in an innovative way. It is accessible at <https://imuscica-platform.unifr.ch/drawme/first/canvas.html>

Version Log			
Date	Version No.	Author	Change
23-05-2018	0.1	Daniel Martín-Albo (WIRIS)	Initial content
19-06-2018	0.2	Daniel Martín-Albo (WIRIS)	Updated content
19-06-2018	0.3	Manu Bouillon (UNIFRI), Marcus Liwicki (UNIFRI)	Updated content
29-06-2018	0.4	Daniel Martín-Albo (WIRIS)	Ready for review
11-07-2018	0.5	Daniel Martín-Albo (WIRIS)	Revision to address review comments
17-07-2018	1.0	Vassilis Katsouros (ATHENA)	Submission to the EU

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LIST OF ABBREVIATIONS

Abbreviation	Description
WYSIWYG	What You See Is What You Get
GUI	Graphic User Interface
ATHENA	ATHENA RESEARCH AND INNOVATION CENTER IN INFORMATION COMMUNICATION & KNOWLEDGE TECHNOLOGIES
UCLL	UC LIMBURG
EA	ELLINOGERMANIKI AGOGI SCHOLI PANAGEA SAVVA AE
IRCAM	INSTITUT DE RECHERCHE ET DE COORDINATION ACOUSTIQUE MUSIQUE
LEOPOLY	3D FOR ALL SZAMITASTECHNIKAI FEJLESZTO KFT
CABRI	Cabrilog SAS
WIRIS	MATHS FOR MORE SL
UNIFRI	UNIVERSITE DE FRIBOURG

1. Introduction

In this deliverable we describe the different core-enabling technologies related to pen interaction contributed by different iMuSciCA partners.

2. MathType (Old WIRIS EDITOR)

WIRIS EDITOR was renamed as MathType in February 2018.

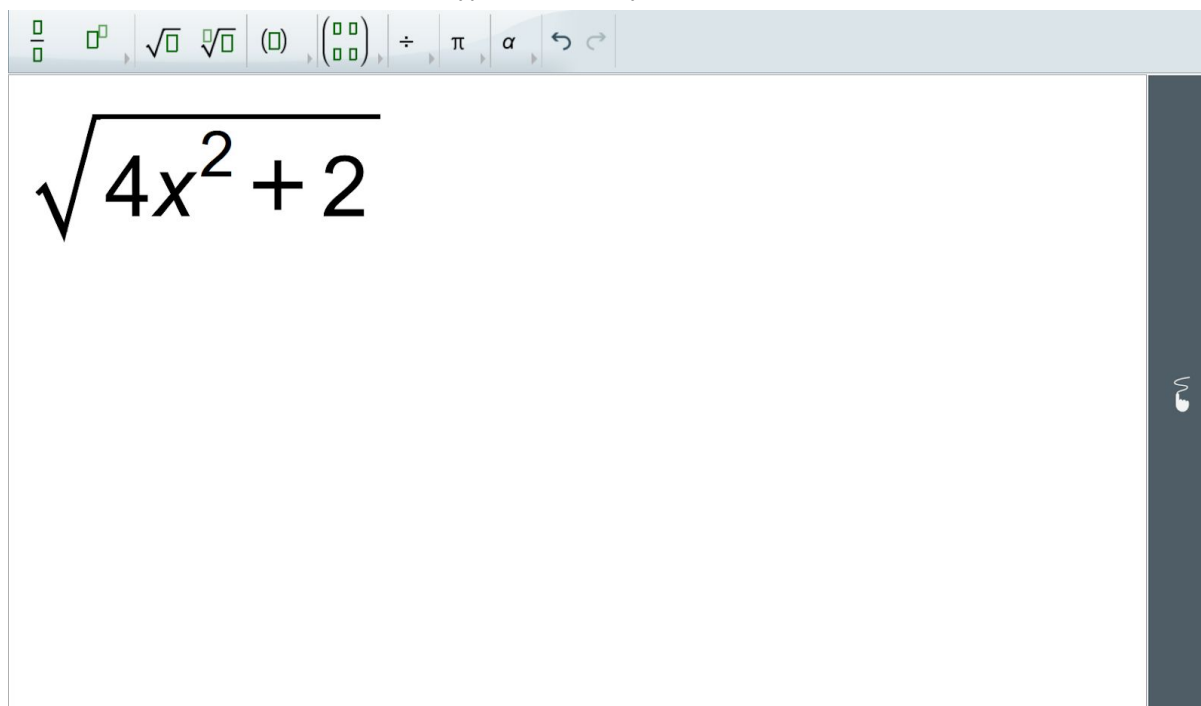


Figure 2-1: MathType with the WYSIWYG GUI. A simple toolbar (upper part) can be used to enter the most common math characters and symbols.

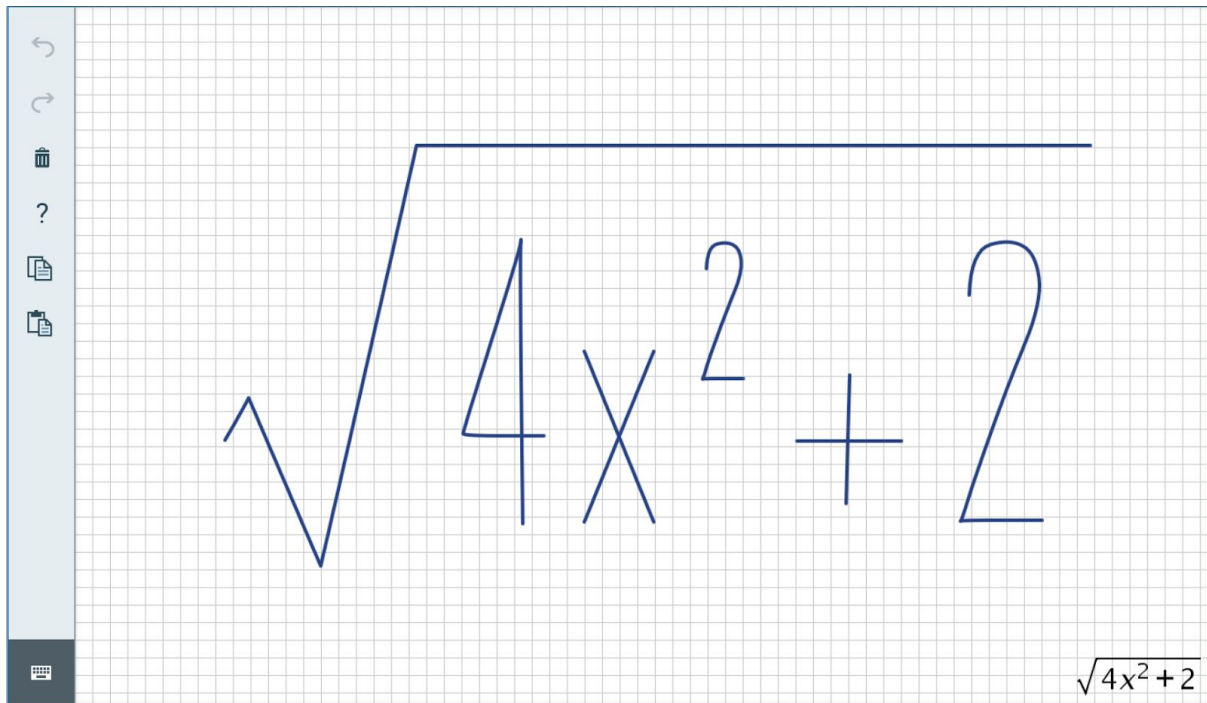


Figure 2-2: MathType with the pen-enabled input interface.

WIRIS EDITOR comes with two user input interfaces: a classic visual editor with a palette and icons (see Figure 2-1). The pen-enabled input method integrates a math expression recognition engine. This engine is based on an approach that integrates symbol segmentation and classification and structure recognition. The recognition process is guided by a probabilistic grammar that accounts for the structural probability between symbols and sub-expressions. The engine is completed with specialized modules for specific tasks: spatial relations classification, symbol segmentation and symbol classification. Mathematical symbol classification is performed using neural networks and a combination of several sets of online and offline features. The remaining models are also statistical classifiers such that all probabilistic sources of information are estimated from data.

2.1. Updates

- New user interface.
- Improvements to the recognition engine.

3. WIRIS GRAPH

For visualization and analysis tool we will use WIRIS GRAPH¹. WIRIS GRAPH is a powerful tool that allows drawing geometric primitives or plotting equations with high graphic quality.

3.1. Updates

- Vectors support.

¹ Demo: <http://www.wiris.net/demo/graph/tests/en/test.html>

- Degenerate conic support.
- Geometric primitive labels can now be fixed.
- Line color and width can be changed.
- Improvements to the recognition engine.

4. UNIFRI DrAwME (Drawing cAnvas for Music crEation)

UniFri DrAwME is a powerful tool that allows composing music and exploring sound properties visually.

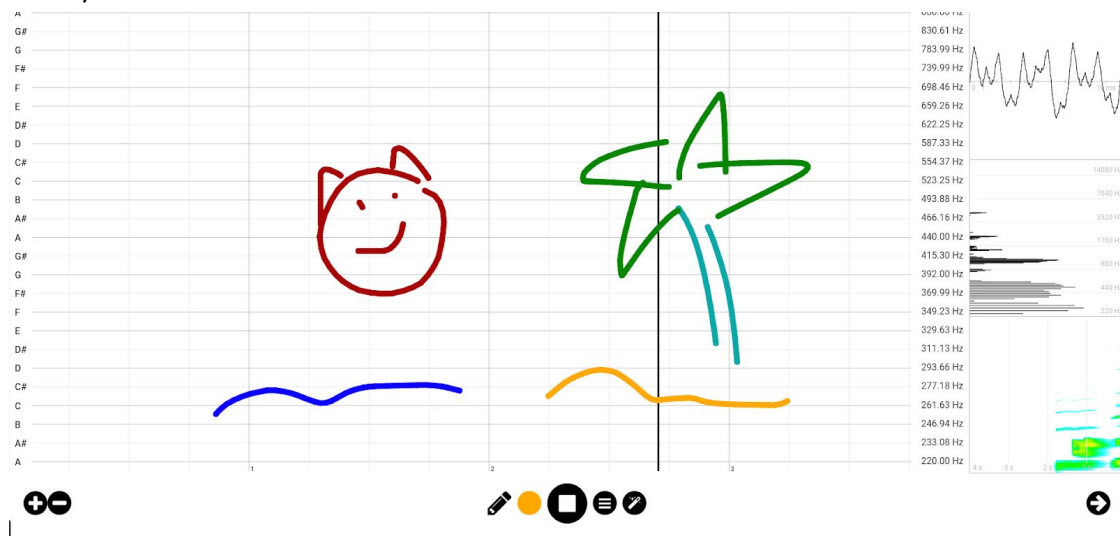


Figure 4-1: UniFri DrAwME with the drawing canvas, the control buttons at the bottom and the three visualization views on the right side

4.1. Installation and technical requirements

UniFri DrAwME is based on JavaScript, so it runs on any modern browser (Chrome, Firefox, Edge, etc.) and operating system (Windows, GNU/Linux, macOS). It is accessible at the following URL: <https://unifri.imuscica.eu/drawme/canvas.html>. You can insert UniFri DrAwME in an iframe with the following code:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html lang=en>
<head>
  <meta charset=utf-8>
  <title>UniFri Dame</title>
</head>
```



```

<body style="margin:0px;padding:0px;overflow:hidden">
  <!-- DAME iframe -->
  <iframe id="tool" src="https://unifri.imuscica.eu/drawme/canvas.html"
frameborder="0" height="100%" width="100%"></iframe>
</body>
</html>

```

4.2. Description of demonstrator and user manual

UniFri DrAwME is composed of three parts, the drawing canvas in the middle, the control buttons at the bottom and the visualization views on the right.

4.2.1. Drawing canvas

The user can draw on the canvas and hear the corresponding sound at the same time. Multiple colors, corresponding to different pitches, are available for drawing.



Figure 4-2: The drawing canvas, where the user can pen- or hand-draw with different colors. Two scales are displayed: a note scale on the left and and frequency scale on the right

4.2.2. Control buttons and settings

Below the drawing canvas, the control buttons makes it possible to “play” the whole drawing by clicking on the “play” button, and to edit different settings (see Figure 4-4). A color picker allows to change the drawing colors, which correspond to different pitches. The menu button gives access to different options:

- Activate hand gesture interactions
- Activate stick to line option (to force drawing on the note/frequency lines)
- Clear the canvas
- Open settings window

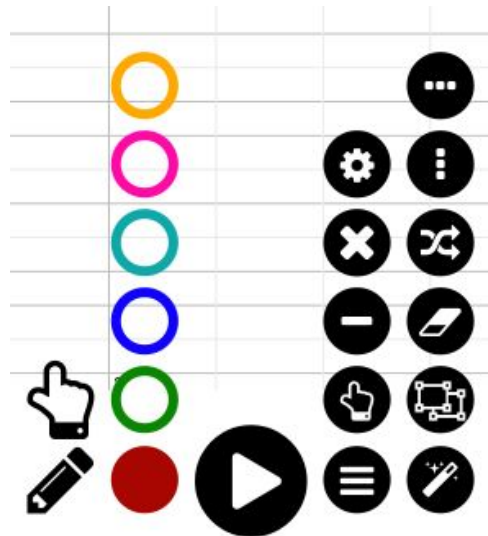


Figure 4-3: The control buttons with the edition/drawing mode button and the color picker on the left, the play/stop button in the middle and the option and edition menu on the right. The option menu allows to activate the hand gesture interactions (zoom, etc.), to activate the stick to line feature, to clear the canvas and to open the settings window. The edition menu allows to duplicate, erase, linearize and mirror (vertically and horizontally) currently selected strokes.

The settings window enables to:

- Adjust volume
- Adjust playback speed
- Enable/disable loop playback
- Smoothen strokes
- Display debug information
- Export/import drawing in JSON format

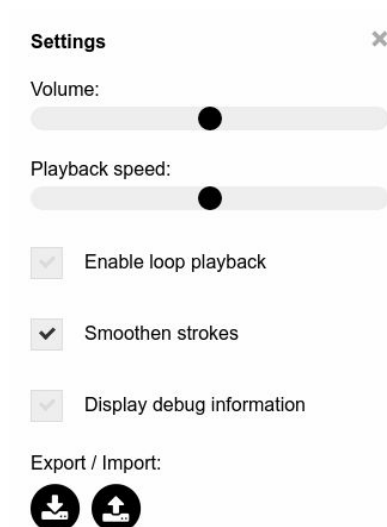


Figure 4-4: The setting menu allows to adjust the volume and playback speed, to enable/disable loop playback, to (de-)activate stroke smoothing, to display debug information and to import/export the drawing in JSON format

4.2.3. Visualization panel

Anytime sound is produced, it can be visualized in the visualization panel on the right. The visualization panel includes three views:

- A waveform view
- A Fourier transform view
- A spectrogram view

The visualization panel can be hidden by clicking on the arrow at the bottom right, and can be opened in an external window by clicking on them.

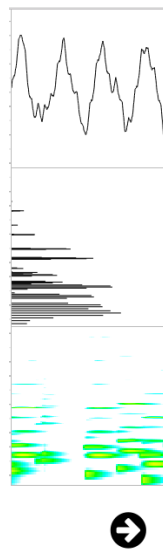


Figure 4-5: The visualization panel include three different views: a waveform, a Fourier transform and a spectrogram. The visualization panel can be hidden by clicking on the arrow on the bottom right, and can be opened in an external window by clicking directly on the views