Deliverable D4.4

The unified user interface - A software solution for 3D design, programming and making computer-supported artefacts

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EXECUTIVE SUMMARY

This report (D4.4) describes the work that is carried out in order to design and implement the first version (version 1) of the unified user interface (UUI), which plays a central role in the eCraft2Learn project. This interface will address interaction with 3D technologies (modelling, visualisation, simulation, and printing) as well as DIY electronics (wiring, programming, debugging), thus provides feedback on design and design conditions of the project to the learner. The same interface will also be used by the teachers to monitor and guide the learner. By designing one multi-purpose interface, for all users, the intention is to provide a holistic view of the process to the users as well as facilitate the involvement of the teachers in the learning process.
1 INTRODUCTION

The UUI plays a central role in the eCraft2Learn project. It is the prime tool for letting the learners and the coaches/teachers to access the technological solutions that are offered. This interface is flexible enough to address needs in both formal and informal settings, although the rest of this document primarily describes issues associated with the former.

All of the digital tools that are required in the 5 stage craft and project-based methodology of eCraft2Learn are accessed by the UUI. These steps include ideation, planning, creation, program and sharing.

1.1. eCRAFT2LEARN LEARNING METHODOLOGY

eCraft2Learn is an ecosystem which is based on craft and project based teaching methods. This methodology includes 5 stages, which together guide the learner from an idea to developing and showcasing, through sharing, the final solution (Figure 1).

![Figure 1 - eCraft2Learn craft and project-based methodology (the 5 stages)](image)

- **Ideation**: The learners explore the world to find challenges. This exploration can be in the physical or virtual world (i.e. online communities).
- **Planning**: The learners collect information and material. They also start making project plans.
- **Creation**: Through a co-design and co-creation process, the learners start creating their solutions. This stage might involve many different technologies such as do-it-yourself (DIY) electronics, visualization, simulation and 3D printing.
- **Programming**: Learners add functionality to their crafted artefacts through high-level programming languages.
- **Sharing**: By sharing the solutions on online communities, the learners can learn from other projects, while receiving feedback from designers, engineers and programmers.

Each of the aforementioned stages requires a different set of tools and materials. Developing a central place (software) for managing these stages is the aim of the educational extension in eCraft2Learn. Such a solution will make it easier to manage the learners’ co-creation project work and also can provide then additional tools to improve their projects even further.

The UUI plays a central role in this context since its aim is to allow the users to go between different tools smoothly. Another important future of this interface is to collect information about the activities...
of the users. This information will be used in the learning analytics part. The learning analytics solution will collect data from technical parts of the eCraft2Learn framework, such as 3D printers and programming environment, as well as from learners’ and teachers’ interactions with the (UUI).

2 Unified User Interface (version 1)

The UUI is a portal to a wide range of tools that covers the eCraft2Learn five pedagogic stages. The majority of these tools are integrated in that they appear as elements of the UUI that can be treated as sub-windows. The integration also includes data gathering for learning analytics and file sharing. The educational extension which hosts abovementioned tools, and its integration with the UUI is described in detailed in D4.3 and a user manual for its use and a video demo are included in D4.5. As can be seen below (Figure 2), in this first version, the most evident feature is the clusters of set of tools for each of the 5 stages (Ideation/Imagine, Plan, Create, Program, Share) of the eCraft2Learn craft- and project-based learning methodology. As can be seen all tool are visible and available, at the same time the 5 stages of the methodology is evident.

![Figure 2 - The UUI is a 2D space.](image)

2.1. User Interface Approach and Design

The first version of the UUI can be found at https://afsheenam.github.io/UUI/. As can be seen in the website page the Metro style (https://en.wikipedia.org/wiki/Metro_(design_language)) familiar from Windows 10 and elsewhere was used. It is structured around the five pedagogic stages of eCraft2Learn. Each tool provides both tool tips and a more detailed help page. It was decided to highlight those tools that are tightly integrated and recommended by making their icons much bigger than other tools. When possible, tools are launched as sub-windows of the interface. These can be minimised, maximised, and closed. When there is no web-based version of a tool the UUI launches a sub-window describing with images and videos how to launch the desired tool. The UUI updates logs of user actions on one of our servers to facilitate learning analytics.

The UUI is hosted on github.io to facilitate collaboration and versioning. Github.com is the free open source code repository that is used in the project. The HTML, CSS, and JavaScript files are automatically
copied from github.com to github.io where they are served as web pages. It is highly robust and reliable. Being free means the site will remain after the project and its funding has ended.

The UUI website only serves static files and hence requires no maintenance on our part. Updates and security is handled by Github. In order to collect data for learning analytics JavaScript code was added to make AJAX calls to a project server in Finland that stores the user logs in a database.

By relying only upon static web pages the UUI can easily be run using the local file system or local web server in situations where there isn’t reliable Internet access. The project also provides local copies of those web-based tools that are open source. The plan is to store user log data locally to be uploaded subsequently to our server when there is no Internet access.

To implement the popular Metro style interface, the project group decided to build upon Metro UI CSS (https://metroui.org.ua/). It was developed with the advice of Microsoft (the original designers of this UI style) and includes general styles, grid, layouts, typography, over twenty components, and over three hundred built-in icons. Metro UI CSS uses the MIT open source licensing model.

2.2. Interacting with Unified User Interface

2.2.1. Interacting with Tiles

There are 3 different ways to interact with a tile: hovering the mouse over a tile, clicking a tile and clicking the question mark on top of the tile. Hovering a mouse over a tile shows a short description of that tile on it. This can be seen in Figure 3.

![Figure 3 - The two states of a tile. The right one shows the tile while a mouse is hovering on it. This activates a short description text about that tool.](image)

Clicking the question mark on top-right corner of a tile, opens a small dialog which explains that tool in more detail. The text might contain links that you can follow to learn more about a tool. As an example, Figure 4 shows the help dialog for the Snap! Tool on the UUI.
Clicking a tile will do one of the following:

- Opens the tool in a new window inside eCraft2Learn UUI.
- Opens the tool in a new browser window/tab.
- Shows a short video and description on how to launch the tool from the main operating system.

2.2.2. LAUNCHING A TOOL IN A UUI WINDOW

At the moment only some tools are launched in this way. They are: Coggle, TinkerCad, Snap!, Snap4Arduino and Thingiverse. Launching a tool inside a UUI window allows you to access other tools directly from the UUI without the need to move between different operating system windows or browser tabs. Figure 5 shows TinkerCad launched in a UUI window.
Figure 5 - TinkerCad running in a window inside eCraft2Learn environment

It is possible to close, maximize and minimize the window, using the three command buttons on the top right corner of the window.

Maximizing a window: Click on the middle button on the top-right corner of the window. By using this option, you allow the tool window to use all the screen space possible. Clicking on this button again bring the window back to its original size.

Closing a window: Click on the X mark on the top right corner of the window. Remember that closing a window ends the session with that tool and the next time that you open that tool you may need to reload/reopen your project. If you want to keep your workspace open in the tool and temporarily use another tool, then use the minimize option.

Minimizing a window: Click on the third button from right on the top-right corner of the window. This hides the window from your view, giving you access to full interface of the UI. The contents of the window and your project stay active and a small icon representing that tool is added to the active tools panel at the bottom of the page.
The active tools panel contains a list of all the minimized tools for easy access by the user. Please note that it is possible to launch a tool several times (for example if the user wants to open two different files in the same tool).

2.2.3. USER LOGIN TO UUI

The login page is automatically shown on the first access to the interface. Simply input your username and choose your pilot site from the list. Make sure to always use the same username. Figure 7 shown the login page.

![Login page](image)
2.2.4. **Teacher Notes**

In the login page make sure that the students understand the importance of using the same user name for subsequent logins. This helps the data analytics and debugging systems to give a better feedback to the user. In next version of UUI, this will be replaced by a user authentication system.

2.3. **The Unified User Interface (Version 2)**

Many changes will be determined by participatory design with teachers and learners who will use version 1. The suggestions will be discussed within the consortium and prioritised based on the objectives of the T4.4 as well as rest of the project. In addition, some planned changes are:

1. User and group identity will be provided. This will be done via Basic LTI ([https://www.imsglobal.org/basic-overview-how-lti-works](https://www.imsglobal.org/basic-overview-how-lti-works)) or other services (such as Google, Twitter, and Facebook authentication)
2. Enhance the repository for learner project files to facilitate sharing and versioning
3. Tools will be launched with the up-to-date state from the current project
4. Customisation of the interface and list of tools by teachers (and possibly also learners). This is important also from the perspective of learning analytics.
5. Work around technical limitations imposed by some websites that prevent them running as sub-windows (technically an iframe)
6. Customisation of help messages for learners using PCs (instead of the Raspberry Pis used in the pilots)
7. Integration of translated pages with a fall back to Google Translate when translations aren’t available
8. Integration of additional tools including a discussion tool, a searchable repository of shared eCraft2Learn projects, project status, and generic help information (perhaps also link to social media sites (e.g. Facebook and Twitter) where learners are sharing projects)
9. Provide more support for users without a reliable Internet connection to run locally
10. A search facility

3 **Conclusion**

This document and accompanying videos demonstrated the first version of the unified user interface. This version demonstrates integration with the educational extension, thus the tools to support the 5 stages of eCraft2Learn methodology. Although this is the first version, it already evident how a fully developed and integrated system will work. This set of functionalities for version 1 are selected to provide the basics for the first round of pilot tests. The results of the pilot studies will provide useful insight into the next versions in the development of the UUI as well as the rest of the system.