eCraft2Learn

Digital Fabrication and Maker Movement in Education
Making Computer – supported Artefacts from Scratch

Deliverable D4.5

User manual for programming of computer-supported artefacts with integrated debugger and 3d modelling, simulation and printing - the unified user interface approach

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EXECUTIVE SUMMARY

This deliverable (D4.5) is in the format of a sequence of two user manuals (versions 1 and 2). The aim of the deliverable is to provide the learners and teachers with guides and tutorials on using the eCraft2Learn's Unified User Interface for programming computer-supported artefacts, 3D modelling, DIY electronics simulation and printing. The contents of this version compliment D4.3 and D4.4 and can be used to employ the functionalities mentioned in those deliverables.

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1 INTRODUCTION

The 5 stage craft and project-based methodology of eCraft2Learn, requires digital tools that allows the learners to ideate, plan, create, program and share their work in a collaborative way. In this light, the eCraft2Learn team has selected a set of tools (D4.2) and implemented software (D4.3 and D4.4) that together provide a central place for learning and teaching through the 5 stage methodology. In this document we provide a user manual for using this system.

The rest of this document is organized as follows. Section 2 covers the unified user interface briefly and explains how it is accessed. Sections 3 and 4 explain only briefly the tools that are used in the associated stages imagine and plan, since the proposed tools provide their own user manuals. Section 5 explains the steps in the creation and sharing stage, whereas Section 6 explains how to use the tools in the programming stage. The conclusions and the references are found in Section 7 and 8, respectively.

2 USING THE UNIFIED USER INTERFACE

The Unified User Interface (UUI)[1] is the main hub for using the eCraft2Learn ecosystem. Through the UUI it is possible to access all the tools that are used in the five stages of eCraft2Learn environment. Figure 1 shows the layout of the start screen in UUI. Each tile on the page represents a tool. The tiles are grouped in five different groups based on the five stages of eCraft2Learn innovation life cycle.

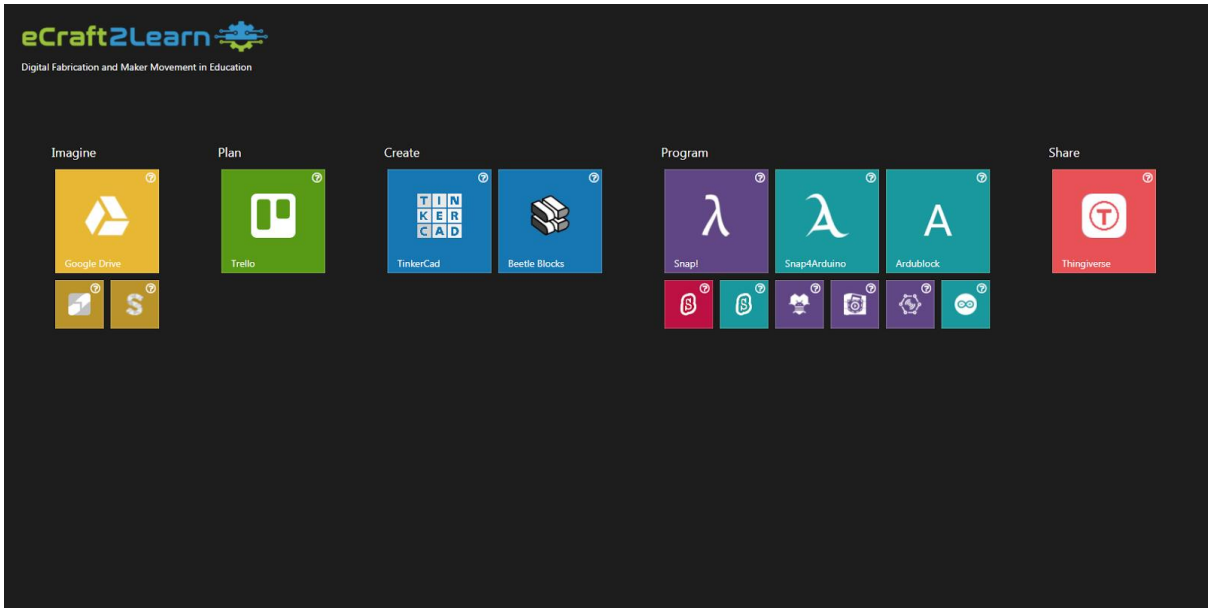

Figure 1 - Layout of the unified user interface. The five different stages of eCraft2Learn environment are presented as five tile groups.

The big tiles on UUI represent the tools that are directly incorporated into eCraft2Learn environment, while the small tiles, although useful for the project works, are not directly part of the system. Note that the content of the Sections 2.1 – 2.4 is also found in the related deliverable D4.4.

[1] *You can find it at: https://afsheenam.github.io/UUI/*

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 2.

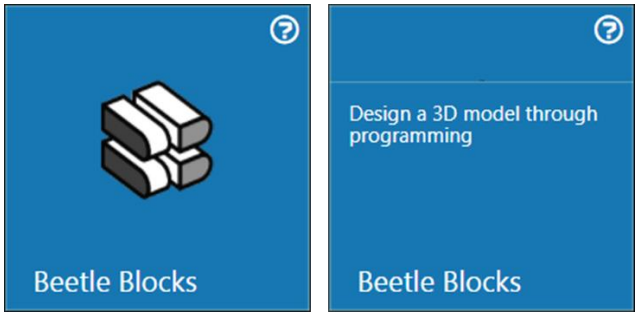

Figure 2 - The two states of a tile. The right one shows the tile while a mouse is hovering on it. This activates a short description text about that tool.

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 3 shows the help dialog for the Snap! Tool on the UUI.

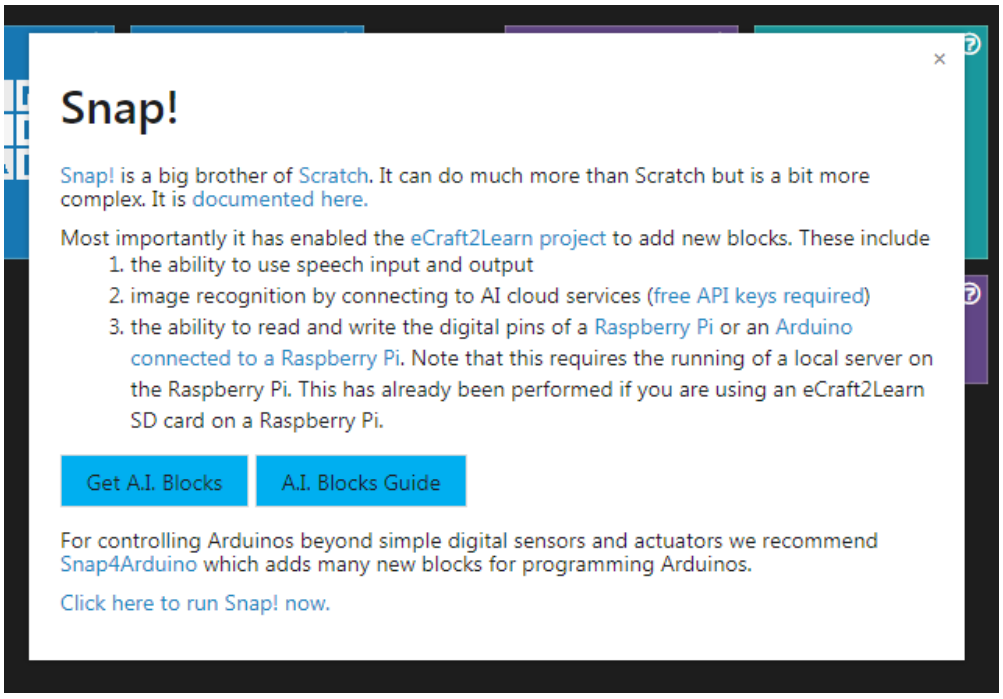

Figure 3 - The help dialog for the Snap! Tool. The help dialogs can be accessed by clicking on the question mark located on the top-right corner of each tile.

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. 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 4 shows TinkerCad launched in a UUI window.

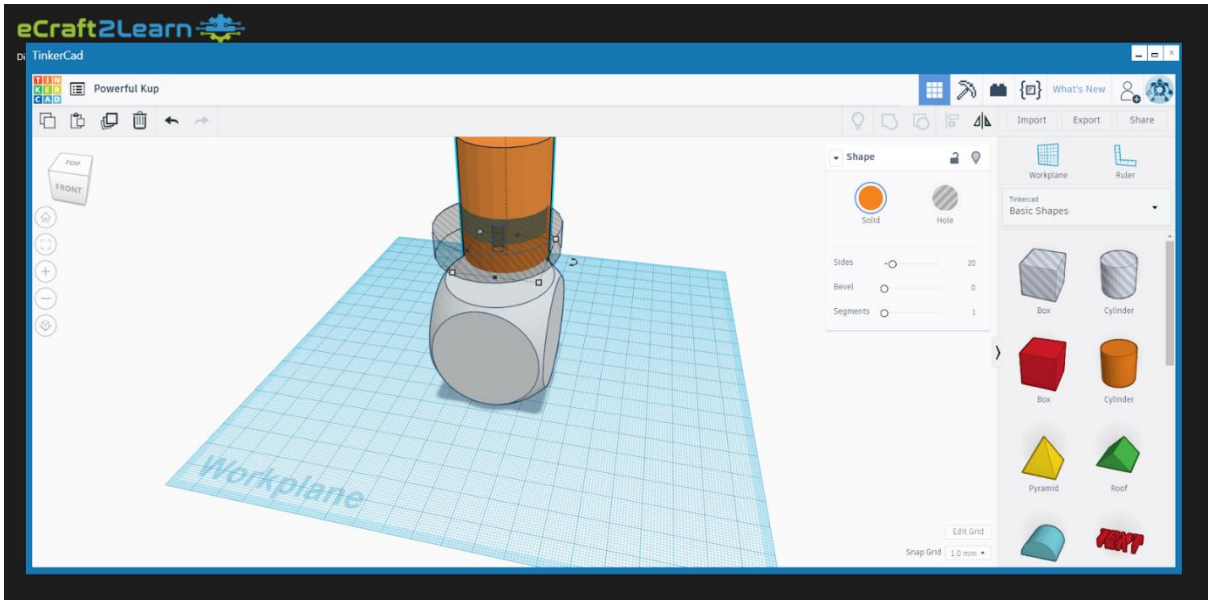

Figure 4 - TinkerCad running in a window inside eCraft2Learn environment.

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 UUI. 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. **Error! Reference source not found.** shows several minimized windows.

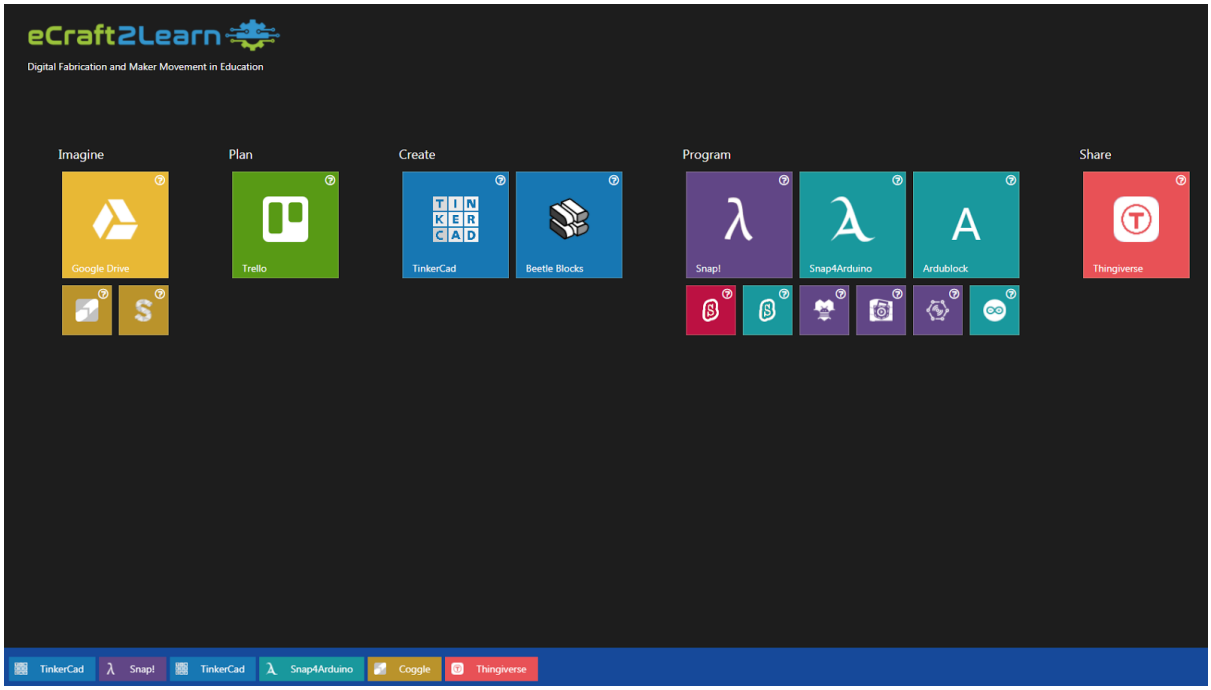

Figure 5 - The The UUI with the Active Tools Panel visible. The panel contains a list of all the minimized tools for easy access by the user. Please note that it is possible to launch a tool several times (for example if the user wants to open two different files in the same tool).

2.3. 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 6 shown the login page.

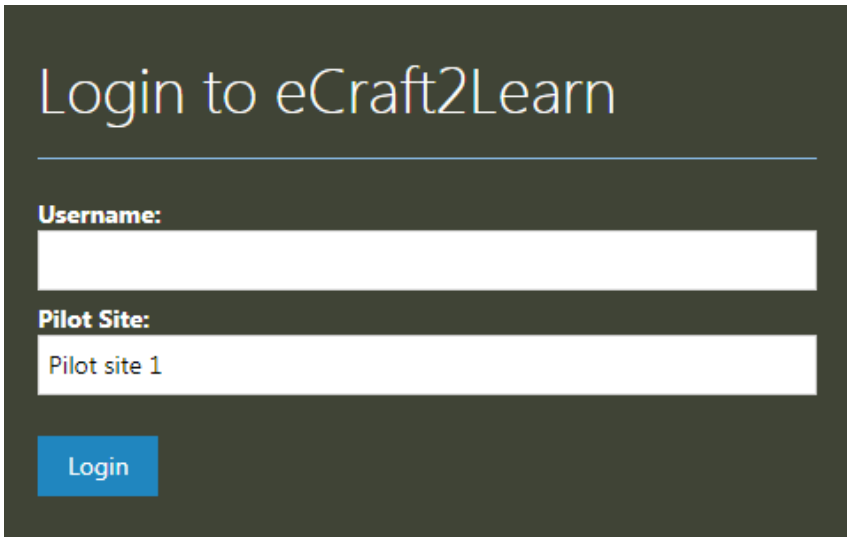

Figure 6 - The Login Page.

2.4. TEACHER NOTES

In the login page make sure that the learners 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.

3 IMAGINE

Coggle is a web application that allows the users to create mind maps-like representations of ideas for visualisation and organising. Creating mind maps is done by (1) adding text, images and (2) links to connect the added information to a mind map. Any group member or the STEAM coach can add, remove or modify the document or comment on specific parts of it. This way the group can collaboratively improve their ideas and prepare them for development. A simple screenshot of a min map in Coggle is presented in Figure 7. This is a tuely intuitive tool, thus the best way to understant how it works is to create an account and test it.

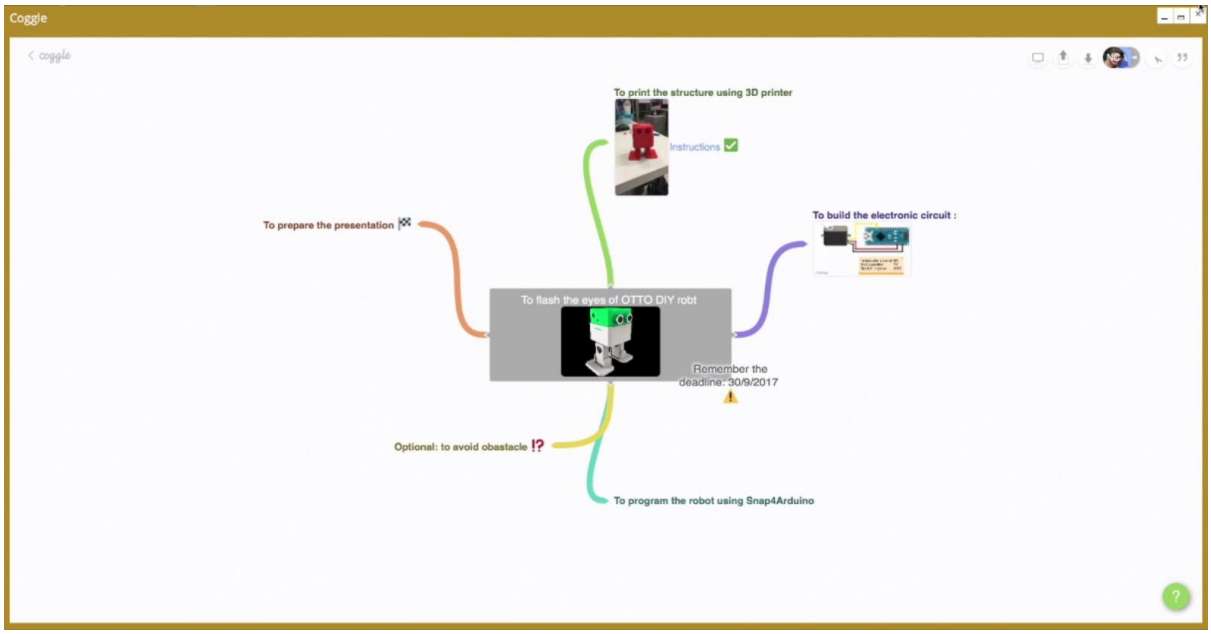

Figure 7 - Ideation in Coggle

4 PLAN

Trillo is an easy to use web application designed for collaborative project management. The work is divided into boards, and each board consists of several lists (or cards) that represent different stages of the work or different tasks, including deadlines. Trello communicates also with Google Drive, so importing and attaching ideation files which are stored in Google Drive in ideation stage is straight forward. As in the case with Coggle the best way to explore Trillo is to try on its own.

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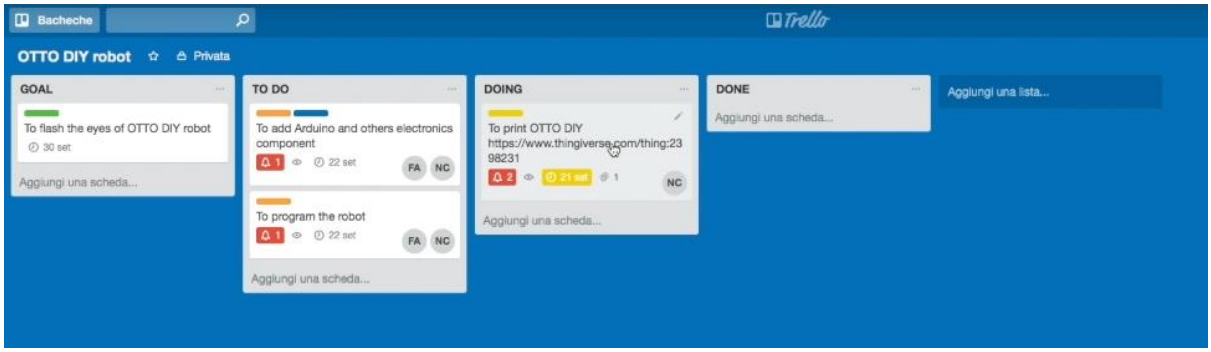

Figure 8 - Project Planning with Trello

5 CREATE AND SHARE

eCraft2Learn uses TinkerCad and Beetle Blocks as 3D modelling software. TinkerCad is a simple 3D modelling tool that uses simple shapes to create 3D objects. In the other hand, in Beetle Blocks you design a 2D/3D shape by developing a program in a block-based programing language.

5.1. TINKERCAD

5.1.1. LAUNCHING TINKERCAD

Click on the TinkerCad tile which is located under the "Create" tile group. This launches TinkerCad inside a window in UUI (Figure 9). If you are already logged in to TinkerCad, you will directly be forwarded to your project space and list of 3D designs.

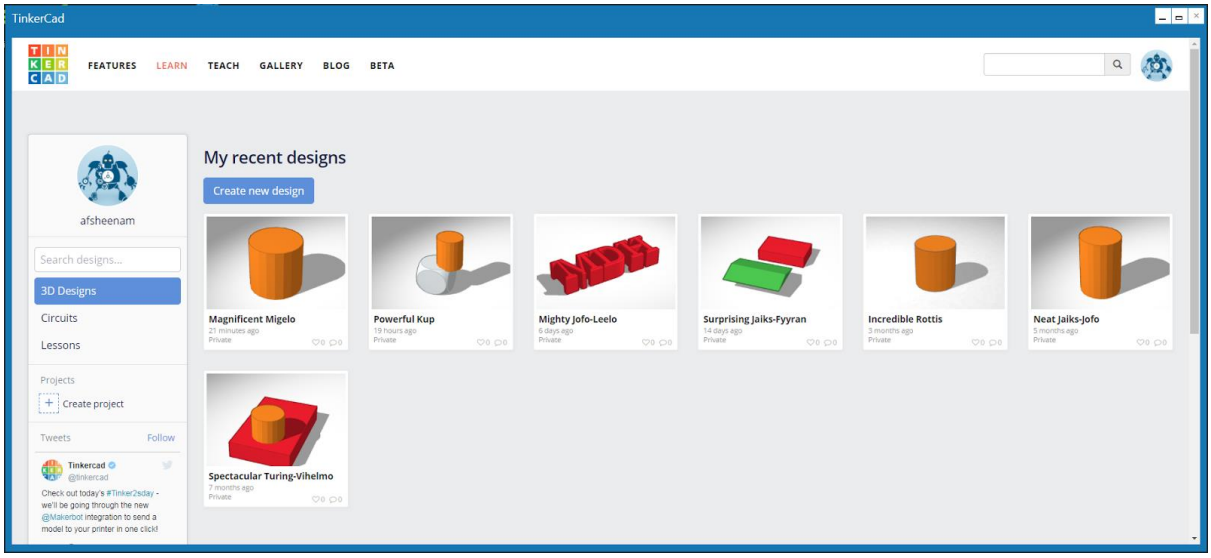

Figure 9 - TinkerCad running in a UUI Window.

5.1.2. LOADING A PREVIOUS DESIGN

TinkerCad lists all of your design thumbnails in a tile view. Click on the design that you want to continue working on. This will open up a dialog showing your design (Figure 10). Choose "Tinker this" in the dialog. This will take you to TinkerCad editor (Figure 11).

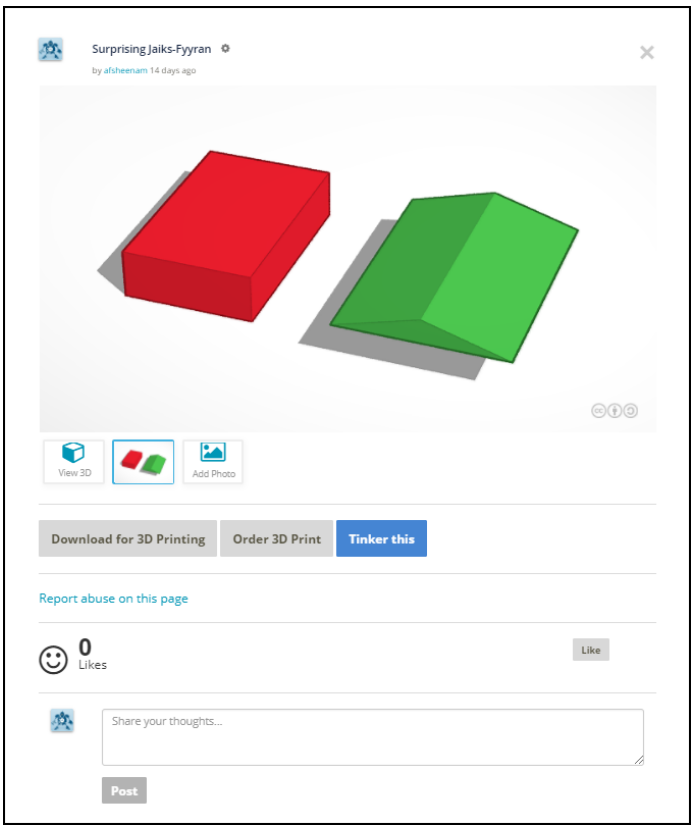

Figure 10 - TinkerCad's item view dialog.

5.1.3. CREATING A NEW 3D MODEL

In the recent designs view (Figure 9) click on the "create new design" button. This will take you to TinkerCad editor (Figure 11).

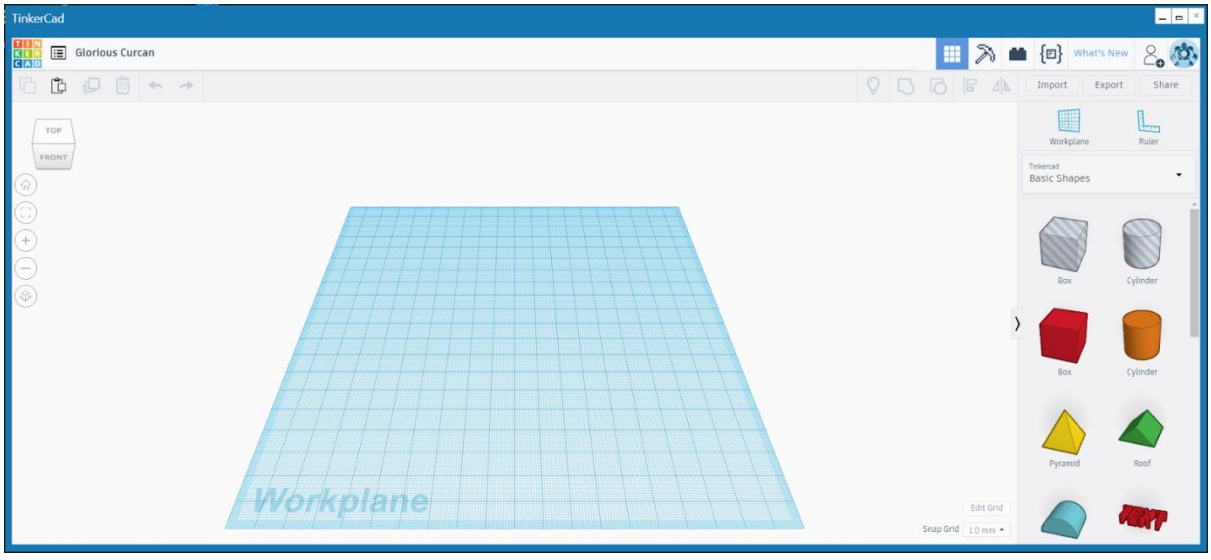

Figure 11 - TinkerCad's editor.

5.1.4. Editing a 3D Model

Using TinkerCad's toolbox (on the left of the editor), you can create/modify different shapes. It is recommended that you learn more about the editor at https://www.tinkercad.com/learn/

5.1.5. Sharing a 3D model

Press the "Share" button on the top-right corner of the TinkerCad window. This allows you to share your design through "Thingiverse" or "My Mini Factory". Thingiverse is integrated to eCraft2Learn environment and is the recommended option.

5.1.6. Downloading a Printable 3D Model

There are two ways to achieve this in TinkerCad:

1 From the item view dialog (Figure 10) click the "Download for 3D Printing" button. In the next dialog choose ".STL" as the file format.

2 From the TinkerCad editor (Figure 9) click the "Export" button (top-right corner). In the new dialog (Figure 12) choose the "Download" tab and then ".STL" as file type.

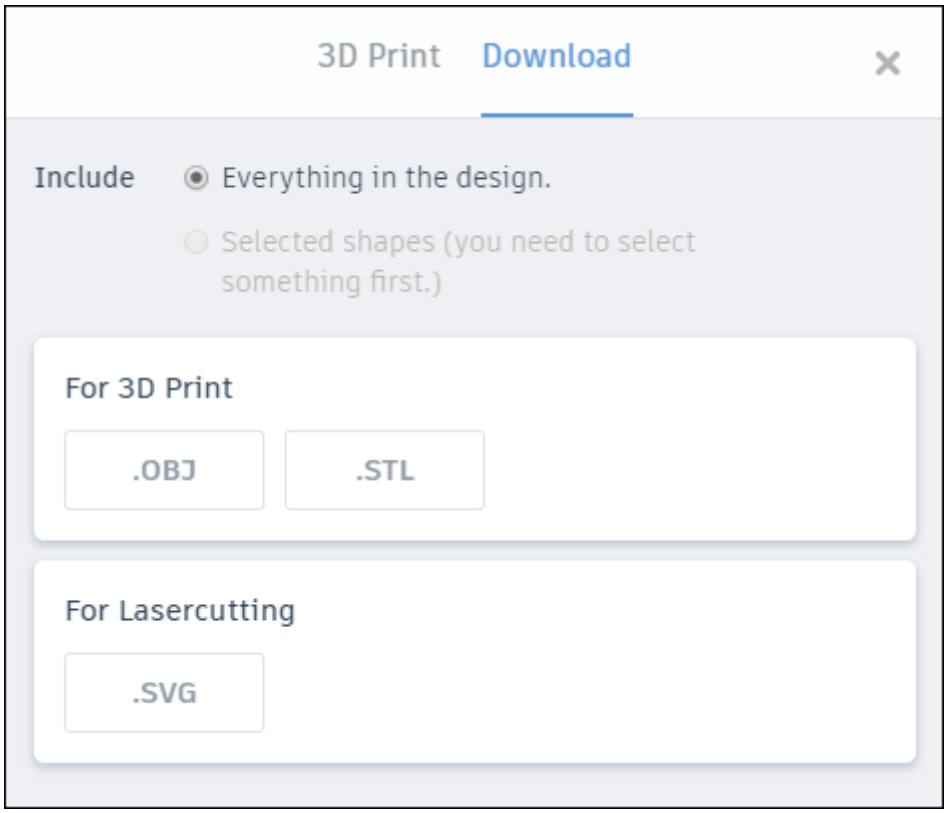

Figure 12 - TinkerCad's Export dialog.

5.1.7. Teacher Notes

For version 1, it is recommended that the learners login to TinkerCad before they launch the application.

5.2. HARDWARE SIMULATION

5.2.1. TINKERCAD CIRCUITS

Apart from designing 3D models, TinkerCad can also be used for simulating different electronical elements and microcontrollers (Arduino Uno R3 and ATtiny).

5.2.1.1. LAUNCHING TINKERCAD CIRCUITS

Since “circuits” is part of the TinkerCad application, you will need to launch the TinkerCad application, using the “TinkerCad” tile in eCraft2Learn UUI. When TinkerCad’s start page appears, click ”Circuits” in the left panel. This takes you to “TinkerCad Circuits” project list page (Figure 13).

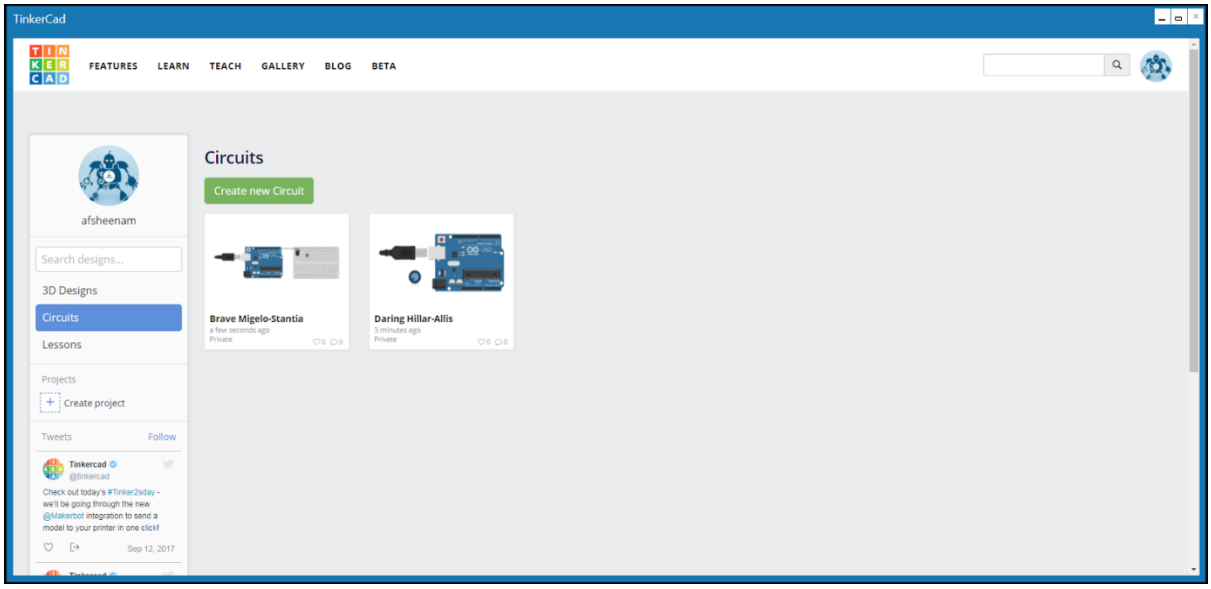

Figure 13 - TinkerCad Circuits.

5.2.1.2. LOADING A PREVIOUS CIRCUIT

In the recent designs view (Figure 9) in “Circuits” mode, click on the “create new circuit” button. This will take you to TinkerCad’s circuit editor (Figure 14).

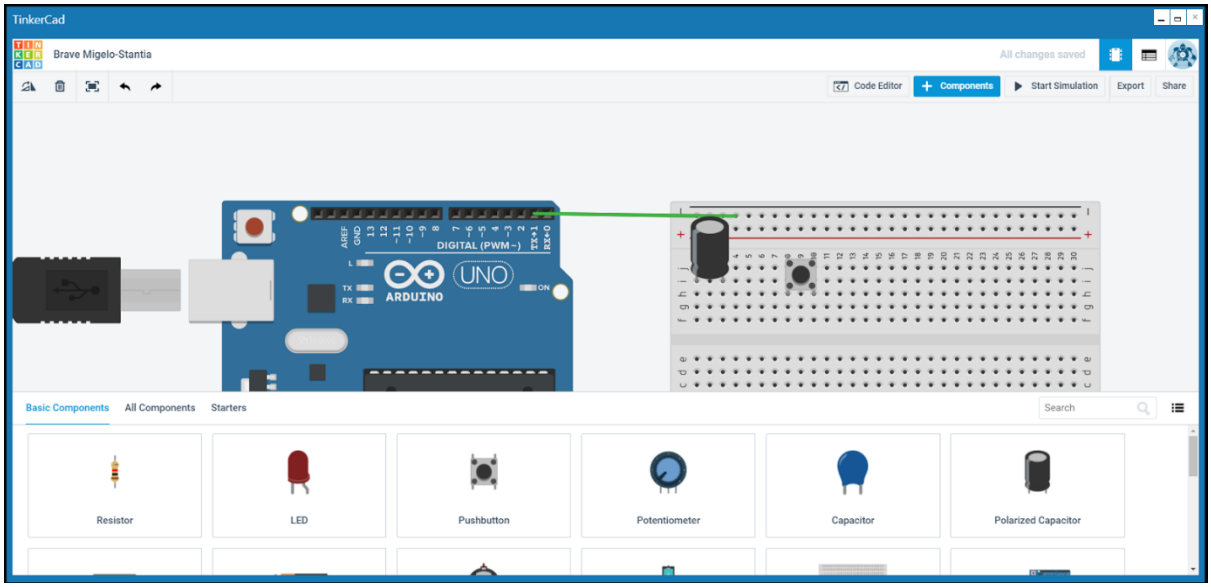

Figure 14 - TinkerCad Circuit's editor.

5.2.1.3. CREATING A NEW CIRCUIT

In the recent designs view (Figure 9) in “Circuits” mode, click on the “create new circuit” button. This will take you to TinkerCad circuit editor (Figure 14).

5.2.1.4. USING THE CIRCUIT EDITOR

Click on the “+ Components” button on the top-right corner. This will show a list of available electronical components that “Circuits” can simulate. Add them to the project by dragging and dropping them to the main panel. Connect different elements by dragging and dropping simple lines between them. When the circuit is ready press on the “Start Simulation” button on the top-right corner.

For more detailed information on using circuits, it is recommended that you read more about it here: https://www.tinkercad.com/learn/

5.2.1.5. SHARING CIRCUIT DESIGNS

Similar to TinkerCad 3D Design, you can use the share button on the top-right corner to share your circuit design with your group members. Sharing circuit designs is done over email or popular instant messaging systems. The share dialog is presented in Figure 15.

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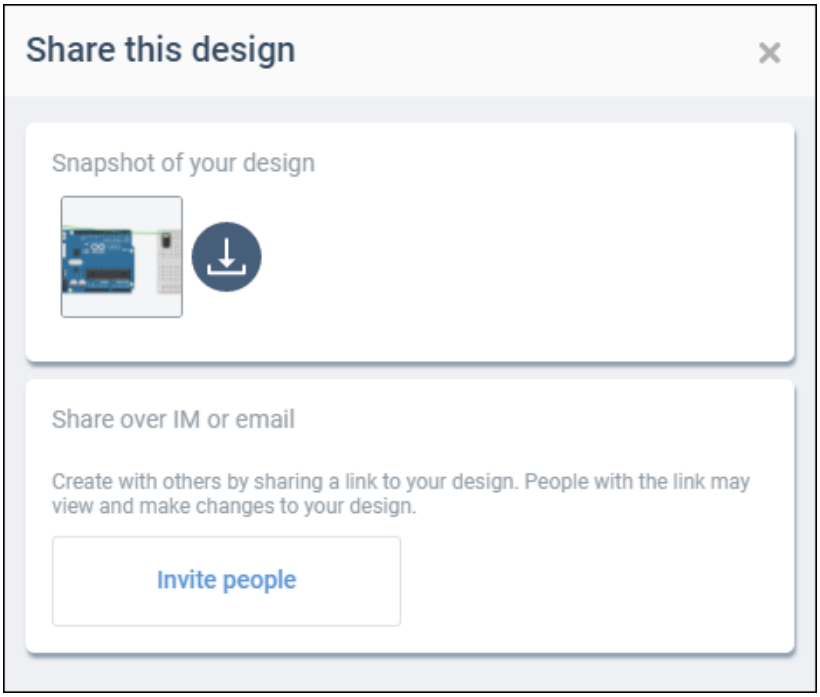

Figure 15 - Sharing circuits in TinkerCad.

As a final step, click on the invite people button, to receive a link that you can then send to your team members through email.

6 PROGRAM

6.1. SNAP!

Snap! Is programming language which is well integrated with eCraft2Learn environment. In eCraft2Learn UUI, Snap! Comes in two slightly different flavours: Snap! And Snap4Arduino. Because of the similarities between these two environments, we discuss them both here as Snap!

It should also be noted that the AI services which are integrated in eCraft2Learn environment, are easily accessible through Snap! Programming language.

6.1.1. LAUNCHING SNAP!

Click on “Snap!” tile in start page of the UUI. Snap! Editor will open in a new UUI window (Figure 16).

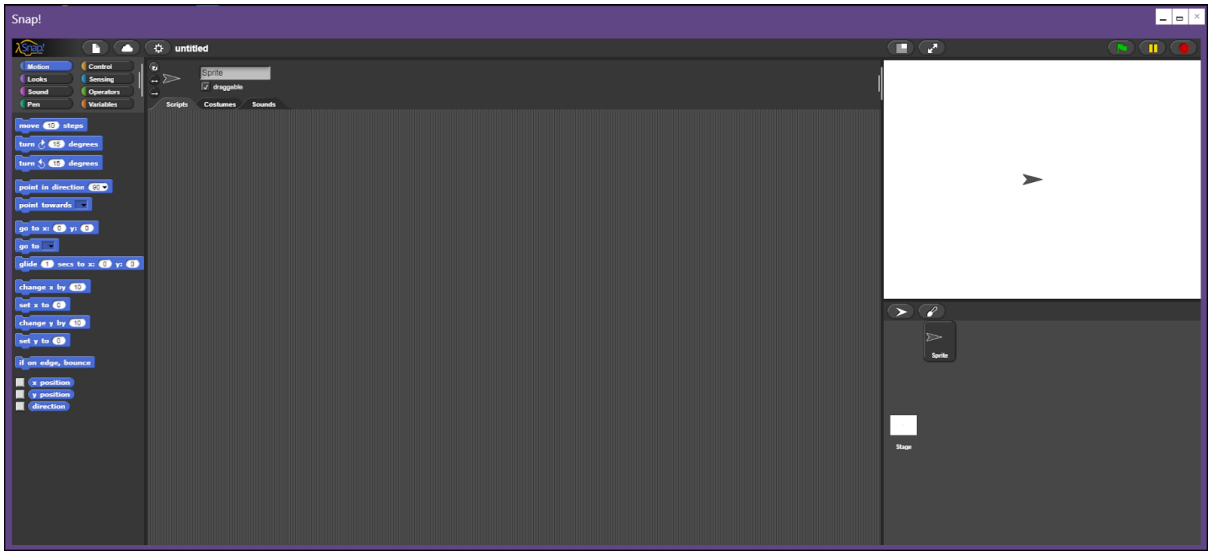

Figure 16 - Snap!'s editor running in a UUI window.

6.1.2. PROGRAMMING WITH SNAP!

Snap! is a block-based programming language. Different sets of blocks are arranged in different groups in the panel to the left of the editor. You can create your program by dragging and dropping the blocks to the centre of the editor to create your program.

In order to learn more about the blocks and their role it is recommended that you refer to Snap! User manual at http://snap.berkeley.edu/SnapManual.pdf. eCraft2Learn adds new blocks to Snap! that provide you with cloud-based AI services. This topic is covered in this document.

6.1.3. SNAP! BLOCKS FOR ARTIFICIAL INTELLIGENCE (AI)

6.1.3.1. Importing AI Blocks to Snap!

You can import the AI blocks to Snap! with following steps:

- Click on the question mark icon on Snap!'s tile to open Snap!'s help dialog (Figure 3).
- Click the "Get AI Blocks Button". This opens a new page.
- In the new page click on the button. You will end up in a Snap! Program that contains all the AI blocks.
- Go to file menu and choose "Export blocks".
- Choose the blocks that you want to use in your project.
- These blocks will be saved on a file and downloaded to your computer.
- Open Snap! on your computer.
- Go to file menu, choose "Import ..." and load the saved file.

6.1.3.2. Programming with AI Blocks

AI Blocks can be used for speech and image recognition through different service providers (Google, Microsoft and IBM). In order to read about them and see some demo examples click on the "AI Blocks Guide" in the Snap!'s help dialog.

6.1.4. TEACHER GUIDE

6.1.4.1. Obtaining API Keys for AI Services

The AI cloud service providers require you to have an API Key before using the service. Before using the service make sure that you obtain API Keys from the providers. A short guide can be found here: https://github.com/ToonTalk/ai-cloud/wiki

6.1.4.2. Setting the API Keys

In the Snap! editor's variables section there are blocks for reporting the API keys (Figure 17). Right click on one, select 'edit', and then paste your key into the definition.

Figure 17 - AI cloud service provider API keys in Snap!

7 CONCLUSION

This document presented the user manual for the unified user interface. It offers information on how to employ the unified user interface to access the tools for the 5 stages of eCraft2Learn methodology and perform projects using ideation, planning, creation, programming and sharing tools. Information on 3D design, circuit simulation and AI cloud services is also provided.

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8 REFERENCES

Websites:

https://afsheenam.github.io/UUI

https://coggle.it

https://trello.com

https://www.tinkercad.com

https://toontalk.github.io/slide-show/listen-and-speak.html

https://www.thingiverse.com