Art project: using brain interface to draw a hexagon flower

Robert Modic

Univerza v Ljubljani, Fakulteta za računalništvo in informatiko
Večna pot 113
Ljubljana, Slovenija

Abstract. In the following work we describe our solution to support digital arts project that will use brain interface to input data into computer and visualise it. The main goal is for the user to select colour and input its EMŠO by using this brain interface. Next the said user thinks about something and we record his/hers brainwaves. Next we use all this data to visualise a hexagonal flower that is built from several equilateral triangles. This flower is built as a group effort from multiple users that decide to interact the art installation and help colour it.

Keywords: Brain interface · Unicorn hybrid black · Brain waves · P5

1 Introduction

In this work we will present the digital art project that lets people interact with the art installation via brain interface. User puts on a brain interface cap and then by looking at symbols on the screen inputs some information. The goal is for the user to input his/her EMŠO and then selects the colour. This input is then processed and appropriate equilateral triangle that the visual part of the installation is built from gets coloured in one of three colours (red, green or blue).

This is interactive art, users or viewers of this installation are expected to interact with it and help build the end result. In terms of visualisation pipe line users provide data trough brain interface. Through it they interact with the board on computer screen as seen in Figure 3. This data is then processed and transformed into final product in shape of hexagonal flower as seen in Figure 7, that the user can then see and look at. If we divide the interaction int three levels we can say that, on physical level user interacts with this installation by putting on the brain interface and calibrates it. On control level user selects the desired symbols by looking at them on screen and in the end confirms the selection in the same way. The conceptual level is similar to the control one, only that user can play with different inputs like selecting different colour to see the end result.

If we were to classify this art installation according to Edmonds it would fall under dynamic-interactive. Observers can assume or even are expected to assume active role in influencing the changes of this art piece. At first the flower

is completely void of colour and as such pretty uninteresting, only observers turned into users are able to change that by actively interacting with the art piece.

Some time should also be allocated to finding a solution for preserving this piece of art. Because it is purely digital we cannot expect it to last as long some other more traditional pieces of art. There are some aspects of this installation we simply cannot control, like the brain interface in terms of software and hardware. If the support for hardware drops we will have the current piece for as long as it works. Same goes for the software part, but here there is a solution. We can make a Docker image or in other words a snapshot of current machine, so that even if supporting software like drivers and operating system ceases to exist (is no longer supported) we still have a working versions of them all and can deploy it on any hardware that support virtualisation. We can however influence the longevity of visualisation part of this installation (the hexagonal flower). With this in mind we decided upon using P5, which is JavaScript implementation of graphical interface design programming language Processing. By doing so we ensured that visualisation can be served on http server and viewed in any internet browser, both being robust technologies that are not going anywhere anytime soon.

2 Proposed solution

The solution consists of Unicorn brain interface and its corresponding software that we use to record data that we need to interpret. In our case that is EMŠO number and one of three colours (red, green or blue). This data is recorded and sent over UDP protocol to C# program that reads it and prepares the input for visualisation. This input is then sent to http server that does the parsing of data and colours the appropriate triangle in our hexagonal flower.

2.1 Hardware

The art installation is meant to consist of brain interface, personal computer and two monitors, one for showing the board and one for showing the result of user interaction ie. hexagonal flower that gets coloured over time.

Unicorn hybrid black is wearable EEG headset that delivers high-quality EEG data from 8 Unicorn Hybrid EEG Electrodes, sampled with 24 Bit and 250 Hz per channel. These electrodes are positioned relative to human brain as seen in Figure 2. After putting on the cap it is also advisable to use ECG gel (ultrasound gel) that can be easily applied by using a syringe trough a hole that each electrode has. Doing so we ensure the best possible signal.

2.2 Software

To build a final solution we use and develop different kinds of software. To build a board, show it on screen and capture the desired symbols we use a piece of

Fig. 1. Brain interface in action

software called Unicorn speller that the brain interface comes with. To parse data and send it onward we develop a C# program and then to visualise the result on screen we use P5 programming language in JavaScript that runs on http server. we decide to use this last instead of developing in pure Processing mainly because of portability and ease of setup, since only thing it requires to run is any kind of http server.

Unicorn speller is a piece of software that enables us to interpret the raw data that brain interface sends to the computer. It enables us to design a custom board trough a rather simple interface. In Figure 3 we can see how the board for our project looks like, the important part here is the Rows/Columns section where we define the grid of out board. In Figure 4 we can see the configuration for the text design portion of the board, and in Figure 5 we can see the position, symbol and other design parts of our board. For each key we set the following parameters:

- Name
- Displayed Text - the text visible on board
- OutputText - text that software outputs upon selection
- Flash Image - image that flashes on screen when the selection part of interaction is in progress
- Dark Image - image that represents the symbol we wish to show on the board

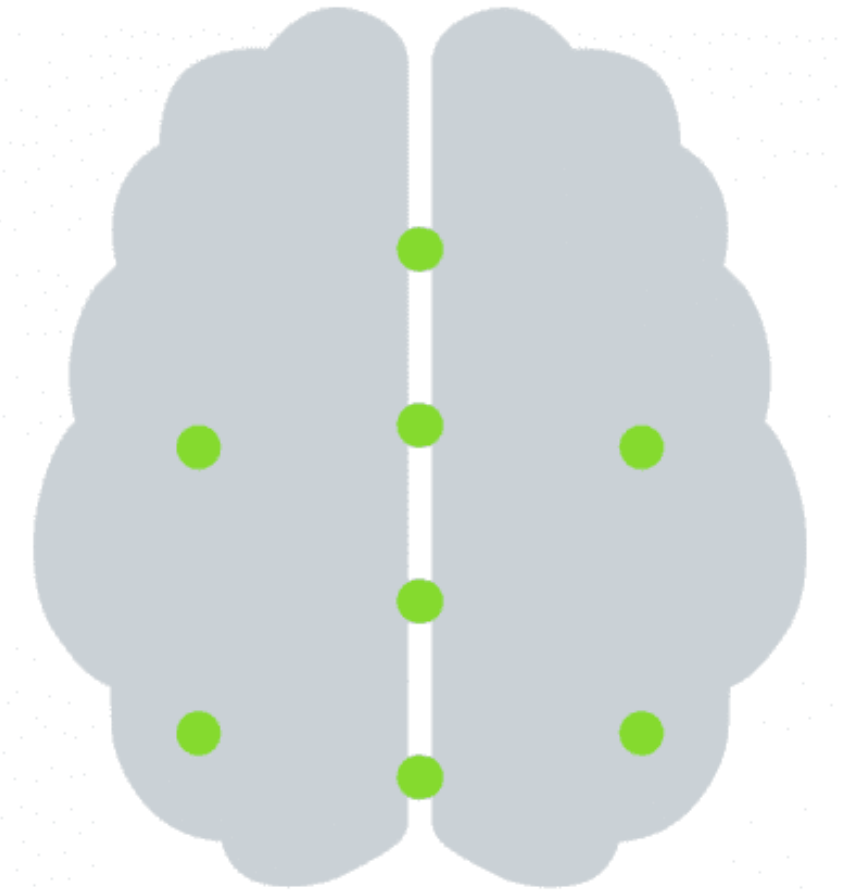

Fig. 2. Electrode positions

In the section Board Items we define the position of elements (keys). These are drawn from left to right in order depending on the grid we previously defined.

In Figure 6 we can see the network configuration, where we define where to the UDP packets with data (key selected) are to be sent. We define this under Network Settings section. Here we can also test the connection under Test Settings section, prior to running in production environment to test the receiver part of our solution.

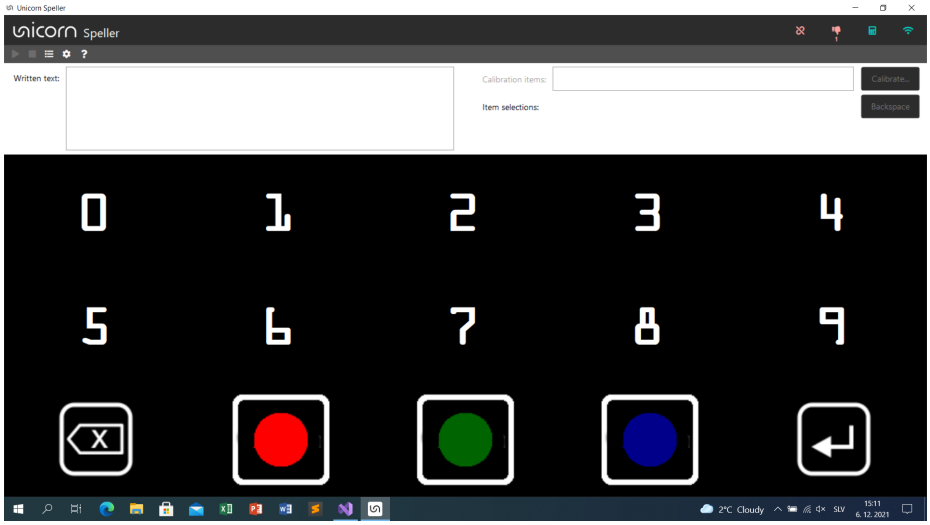

Fig. 3. On screen keyboard - board

2.3 Pipeline

In Figure 8 we can see the sketch of our proposed solution pipeline. Raw data is captured via brain interface and fed into two pieces of software, Unicorn speller program and a program using python API for signal processing. The Unicorn speller processes this data and for each selection on board prepares UDP package that is then sent to our next piece of software written in C# that then extracts relevant information from it and sends it onward to http server (as a POST request) that is running our visualisation. Raw data that is sent to the program using Python API is processed, and then also sent as a POST request to our http server running the visualisation. The P5 JavaScript program running on this server then takes both requests and then colours appropriate equilateral triangles on our hexagonal flower.

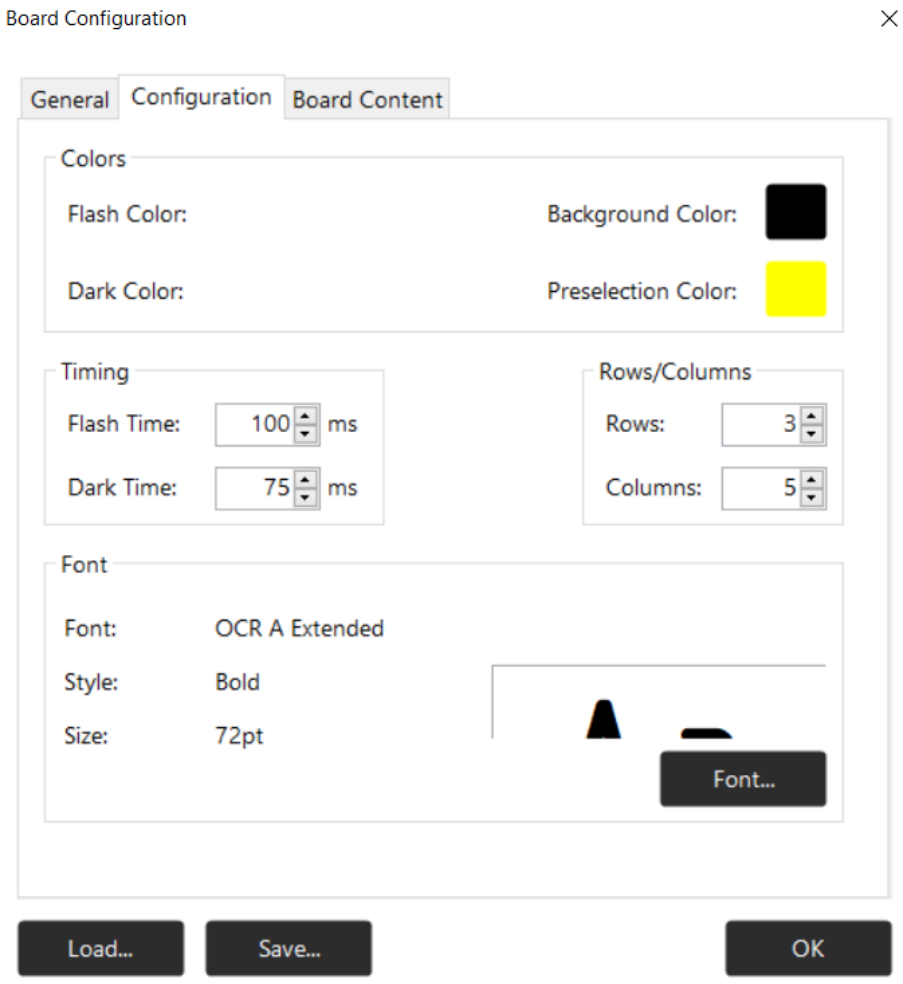

Fig. 4. Board text label configuration

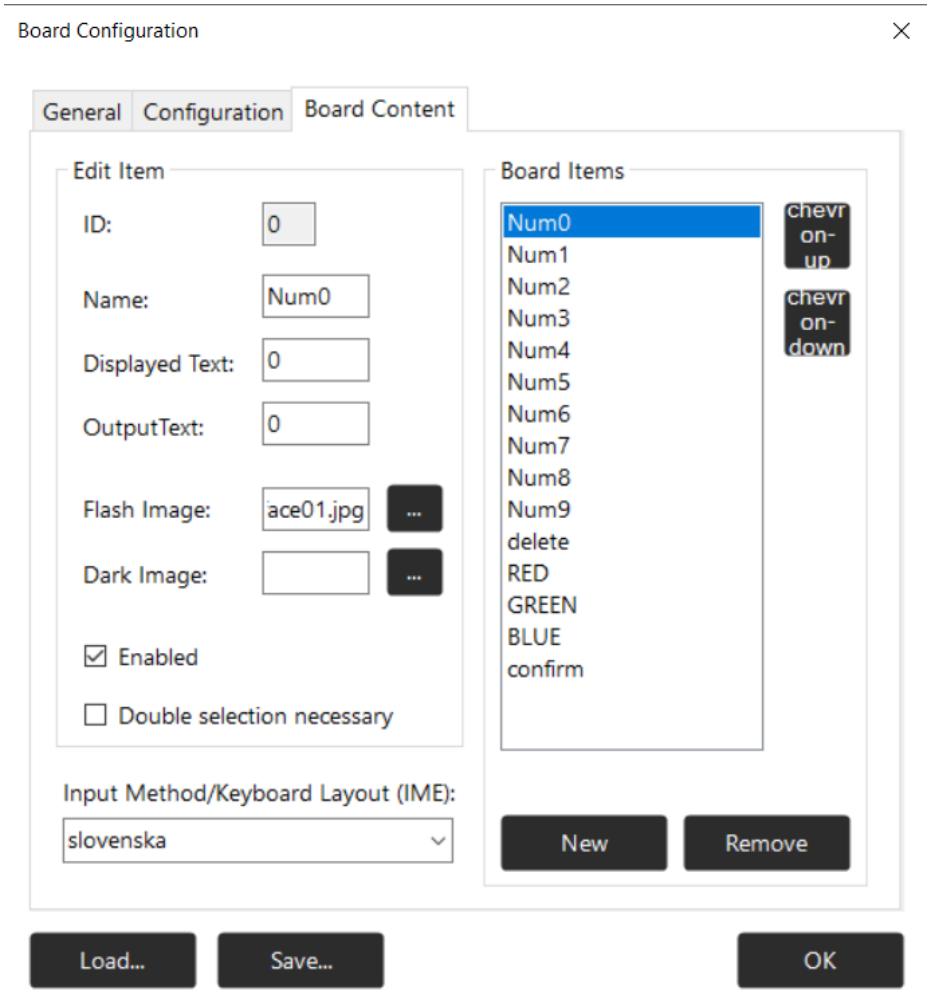

Fig. 5. Board key configuration.

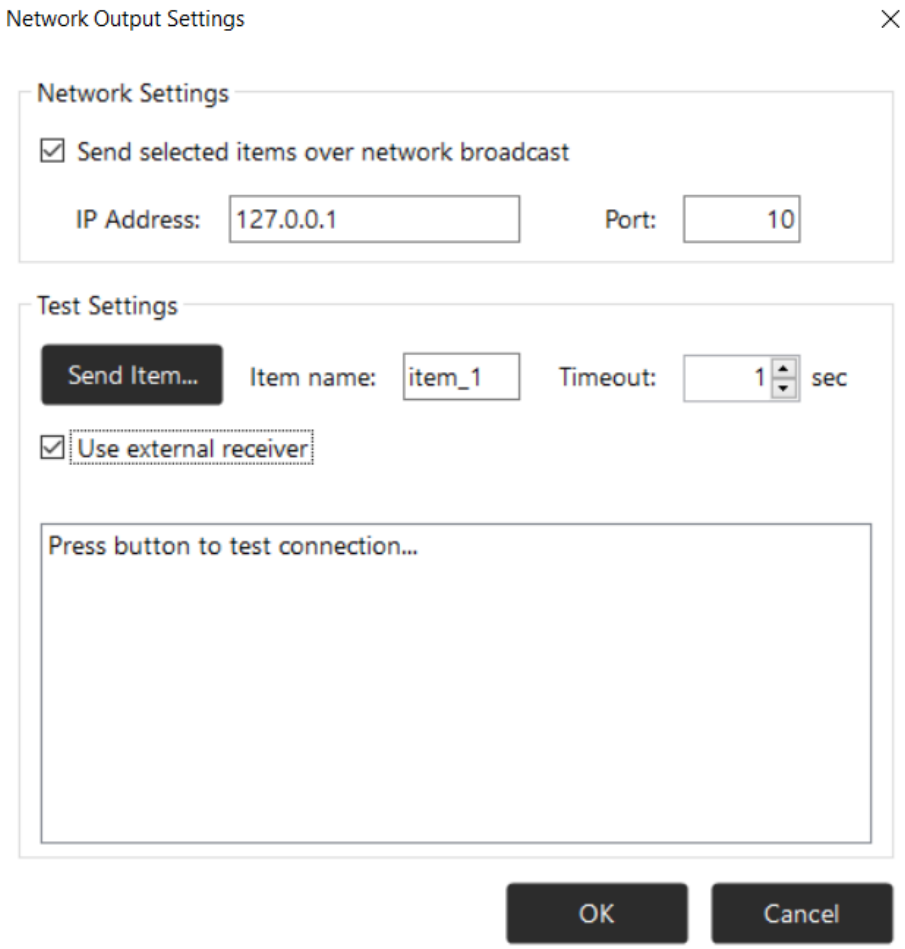

Fig. 6. Configuration for sending data

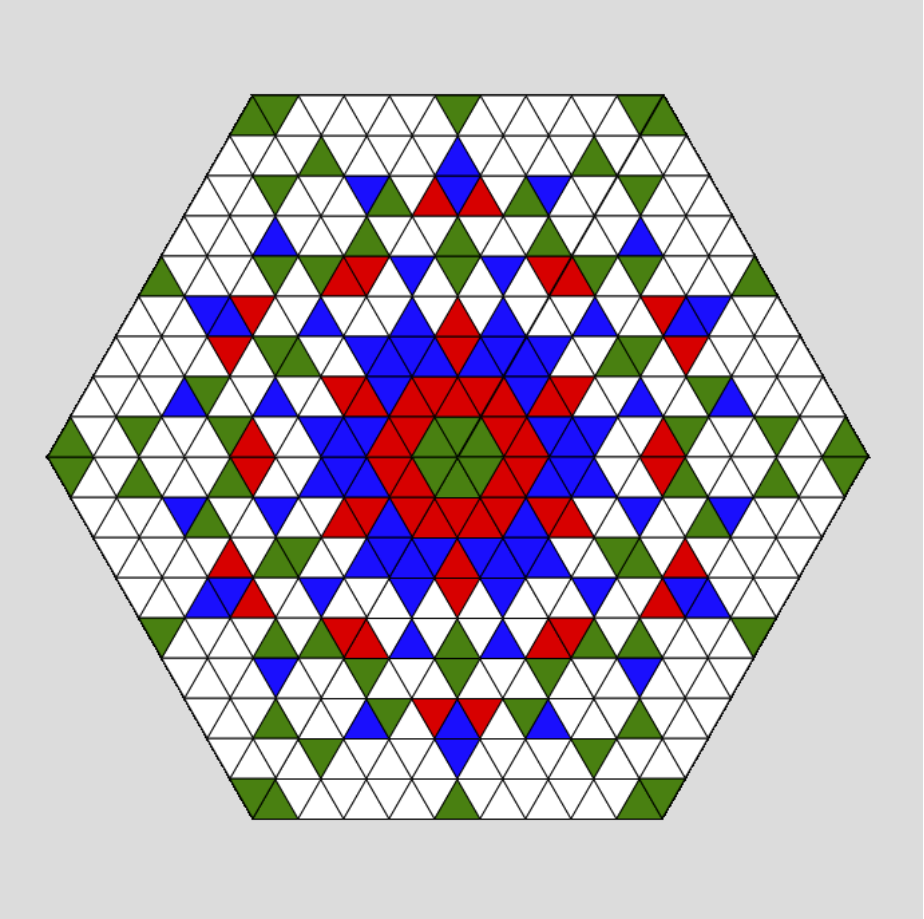

Fig. 7. Output art

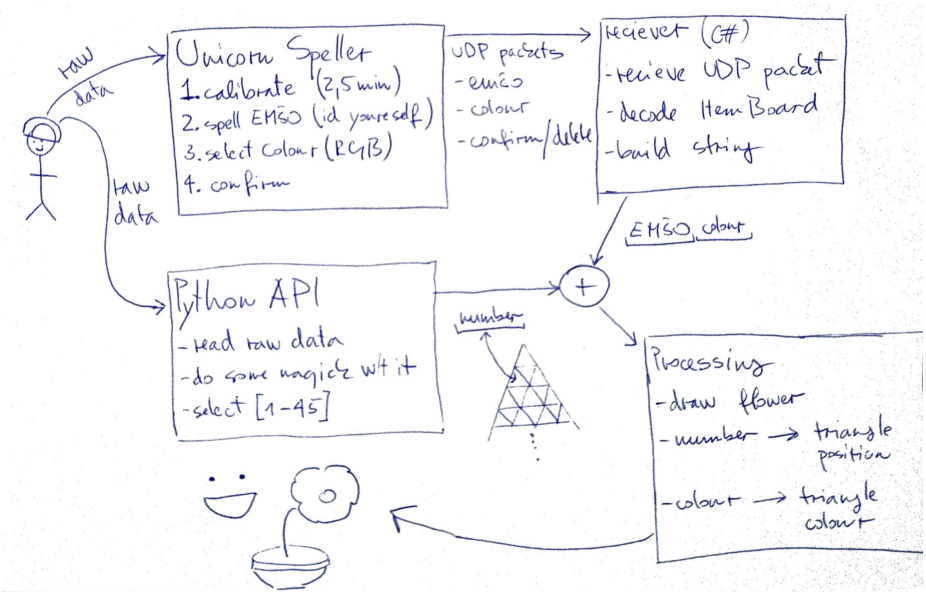

Fig. 8. Solution pipeline

2.4 User perspective

The nature of this art installation demands that someone is there to help potential users to interact with it. First user needs to be seated in-front of computer screen showing the board. Next he/she needs to put on the cap (brainwave interface) and someone needs to help with ultrasound gel application to each of eight electrodes. If this is the first interaction the setup also needs to be calibrated, this takes approximately two minutes to ensure the best result. If user already interacted with the art installation only appropriate configuration file needs to be loaded. At this point the user can begin with proper interaction ie. symbol selection. By looking at symbol on board screen first the numbers are selected (user inputs EMŠO one number at a time) and then the desired colour is selected. If user makes a mistake or wishes to change the input, this can also be achieved by selecting appropriate key on board. When satisfied with input user confirms it again by selecting appropriate symbol on board and can view his contribution to the art piece on a separate screen.

3 Conclusion

In this work we presented the new media art, where main attraction of installation is the brain interface. The visual part of this installation consists of hexagonal flower built from equilateral triangles. At the beginning the flower is void of colour and users help colour it over time. They do this by interacting

with installation via brain interface by looking at (selecting) desired symbols on board computer screen.

At this point it is appropriate to say a word or two about some problems and challenges that this project poses. The first one being that the installation needs to be supervised. Users cannot simply walk up to it and begin interacting with it. Another person is needed to help the user with putting on the brain interface cap and with applying ultrasound gel to the electrodes. After this the helper needs to run the calibration or load the appropriate calibration file and only after this the interaction with the art piece can begin.

Another problem that arose was the fact that brain interface cannot be simultaneously connected to both Unicorn speller and our python script for brainwave capture, meaning that again helper would need to intervene and switch the programs. User would also have a rather poor experience during this brain capture and as a final note more research into raw signal data would be needed to make better sense and utilisation of the data.

To conclude we built an interesting solution, that will defiantly attract technology enthusiasts and if execution and promotion is done in interesting enough way even wider audience.

References

1. Unicorn The brain interface https://www.unicorn-bi.com/ (online), accessed: 10.1.2022