Deliverable E

Design Constraints and Prototype 2

Prepared by Group Z11

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1. **Introduction**

      In order to finalize our design project, a second of three prototyping tests will have to be carried out to evaluate the performance and potential weaknesses of our concept. The prototype will be tested and planned through a pre-developed test plan.

2. **Design constraints**

To carry out the second prototyping, we used the DFX methodology which helped us define two non-functional design constraints :
- **Design for usability** : The controller should have an intuitive and ergonomic design, allowing individuals with reduced physical abilities to comfortably operate the buttons, triggers, and joysticks. It should also consider the placement and accessibility of controls to ensure smooth and accurate gameplay for users. This include :
    - Space between buttons and joysticks to ensure that the customer can reach the desired buttons despite hand tremors.
    - A remote with a pretty decent size (not too small and not too big) to ensure usability.
    - A longer joystick than the regular one to make it easier and more comfortable.
- **Design for accessibility**: The controller should comply with accessibility standards and guidelines to ensure inclusivity for individuals with disabilities. This may include features such as compatibility with assistive technologies, support for alternative input methods (e.g., switches or voice commands), and the ability to customize button mapping and sensitivity to accommodate individual needs. This include:
    - The possibility of buttons remapping.
    - The efficiency of the switch mode between the different systems.

    a. **Updates on the final design**

This allowed us to make the following updates on our design :
- The shell of the controller has been updated for a bigger size with more space between the holes for the buttons and joysticks.
- The joystick has been upgraded from low to high fidelity to assure it is comfortable to use
- The implementation of button functionality and the switch mode.

3. **Client feedback**

After the presentation of the first prototype to our client, we got a positive reaction from him. He also made some good points that we will consider on our third and final prototype :
- The prototype was not sturdy enough.
- We need to cover up the holes on the prototype or leave space between the buttons.
- The shape of the joystick was not adapted to him. He prefers rounder ones.
- He asked about the possibility of keeping the final design to himself.

Overall, we assume that he is pretty satisfied with the outcome of our first prototype.

4. <u>Critical assumptions</u>

We are making critical product assumptions that could affect our ability to implement our design. The first one is that the length of wire we are using for the outer USB cable is 3 m, so we are assuming that the user will not be more than 3 m from the game device. Another assumption is that the user will have at least one available USB input on their game device to connect the controller, since the controller is not wireless. We are also assuming that the current delivery is in the range that the Shift-registers will be able to operate at those current levels. We assume as well that the joystick will be stable and not fall down when played with. Finally, we assume that the box used for the controller will be easy to assemble and that it is sturdy enough to withstand any sudden movements.

5. <u>Second prototype</u>

a. Prototype choice

We chose to make a medium fidelity focused physical prototype. We set out to test 4 things, the rigidity of the case, the operation of the arcade buttons, the fittings of the buttons in the case, the fitment of the joystick covers. To achieve this, we made the prototype pictured below.

It includes 7 arcade buttons, that are fitted to the top of the case, a controller case, and the joystick covers attached to 1 joystick.

b. Test selection

To test these prototype implementations, we decided to conduct qualitative tests to see the validity of our prototype design. First we passed the buttons through the holes in the laser cut case and fitted them by screwing in the supplied fastener. We tested the buttons buy strenuously pressing them and trying to move them to check if there was any give or wobble. Our next test was to see if our 3d-printed joystick covers fit properly on the joysticks without wobble and without any mechanical issues such as the weight being an issue. To test the case, we chose to do tests by playing games and even having our client try it out and see its stability. This also allowed us to test the functionality of the 7 buttons we implemented.

c. Results and analysis

Test	Expected Value	Actual Value
Arcade Button Fitment Test	Snug, No wobble	Snug, No wobble
Joystick Cover Fitment Test	Snug, No wobble	Snug, No wobble
Case Stability Test	Stable, Complete Coverage	Stable, Incomplete Coverage
Arcade Button Function Test	All 7 Buttons Work	All 7 Buttons Work

All the results of our tests went according to plan, except for the case stability test. The arcade buttons and the joystick covers fit snugly, and all 7 buttons worked. However, we had some issues when using the laser cutter to cut the MDF, this led to some structural issues when building the case. We had to remedy this with tape. To fix this, we will lower the cutting speed of the laser cutter, to make sure that the laser goes all the way through the wood. We will also use wood glue to add an extra layer of structural integrity to the case.

6. <u>Conclusion</u>

Our second prototyping test has produced good results, but much work remains to be done. Fortunately, our concept is in its completion phase and will soon be fully functional, thanks to the positive feedback received from our second iteration. These results will be used in the third and final prototyping test.
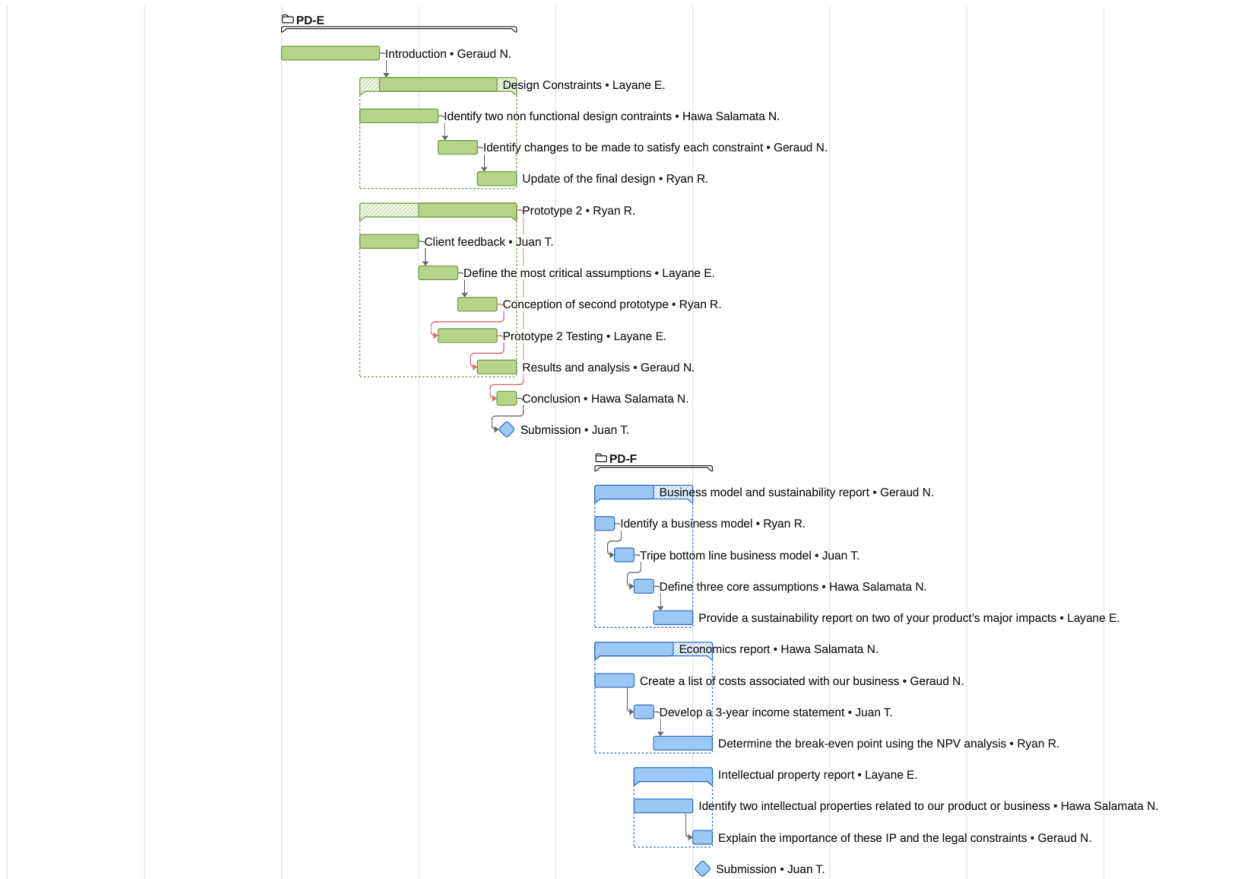
<u>B.1 References</u>

[1] Input test portable   (*visited on 20/06/2023*)

[2] https://canasstech.com/products/ultra-joystick (*visited on 22/06/2023*)
[3] https://assets.nexperia.com/documents/data-sheet/74HC_HCT166.pdf (*visited on 24/06/2023*)

B.2 Project Plan Update

Snapshot :
https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=aWoKnBx7mkXtZospzGRmvPokW1YyBTEV%7CIE2DSNZVHA2DELSTGIYA