Final Project

One-handed guitar game controller

Kennedy Adams & Maija Kinnunen
Ontario Tech University
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Outline

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Justification, Literature review, & Methodology description

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Introduction

Problem statement

The accessibility issue we seek to tackle with our controller design is the issue of limited hand mobility, both due to a lack of full mobility range or because of other hand issues, such as only having a single hand.

Justification

Individuals with these kinds of limitations cannot normally properly use the bulkier guitar controllers present in multiple rhythm games due to their size and shape.

Goal

We want anyone to be able to experience these rhythm games, without any sort of limitations preventing them from enjoying this form of entertainment.

Literature review

Guitar Hero pedal, which is used to replace the strumming and whammy bar functions on the guitar itself.

Guitar Hero Grip for the Nintendo DS, which allowed users to easily play with one hand

Omni Controller, a one handed gaming controller

One handed controller for the Nintendo Wii

Touch-based Configurable Gamepad, designed for gamers with physical disabilities.

Methodology description

The first iteration of the product's design was then created within Blender based on the look of a piano and the size of other similar controllers

The prototype was ported over into Fusion360, where the design was refined in order to account for various electronic components and specific measurements for other components

Finally, the prototype has been refined further to get rid of pieces that were deemed unnecessarily complicated for the design for the physical prototype while the functionality was programmed into a Unity prototype.

Development

Development Tools

Blender - Original model prototype
TinkerCad - Electronics
Fusion360 - Prototype
Unity - Virtual Prototype
Overleaf - Report
ClickUp - Gantt chart

Analysis and Characterization

Rhythm game specific

Guitar Hero DS Grip
2008

Guitar Hero Pedal
2008

Rock Band
Keyboard
2010

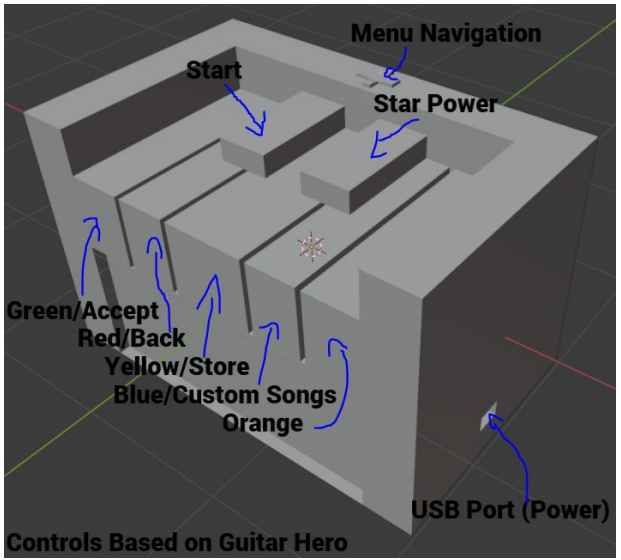
One-handed Controllers

Nintendo Wii
Remote
2005

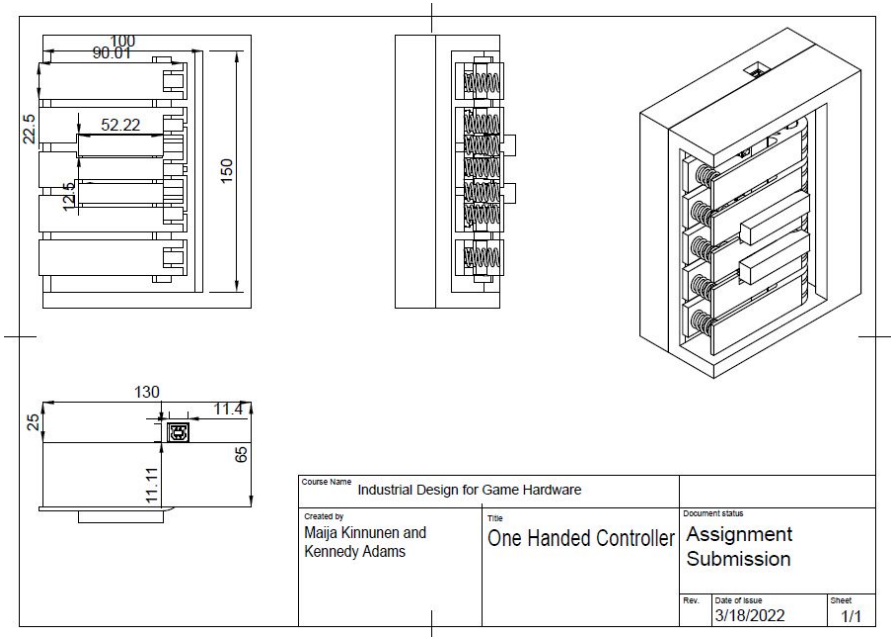
Touch-based
Configurable
Gamepad
2017

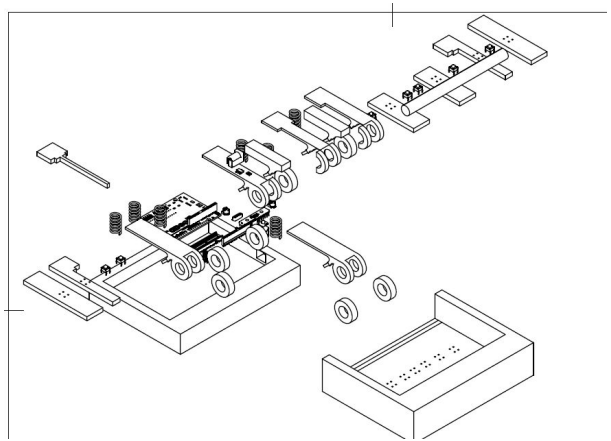
Figure 11: Default interface for 4 fingers.

Omni Controller
2019

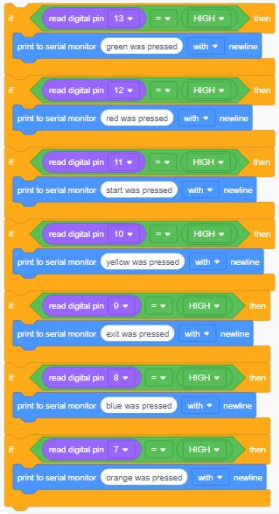


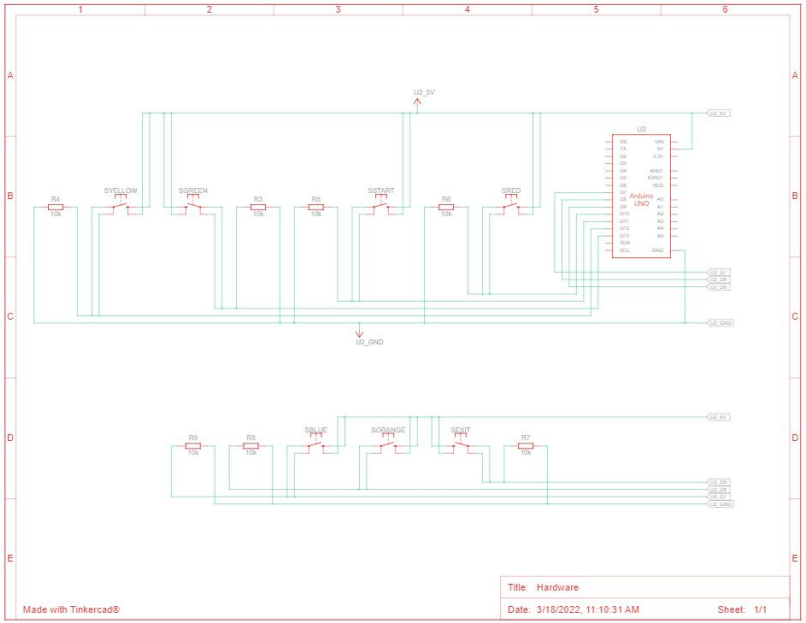
Proposed
System Architecture





Subsystem Development





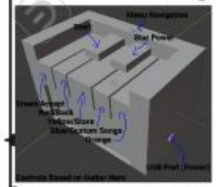
Study Design

INITIAL CONCEPT

Late January: Had idea for creating a one handed piano for use in rhythm games.

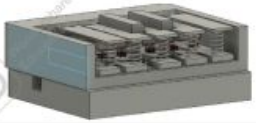
ITERATION 1

Early February: Initial design for prototype. Includes 7 keys, 5 white and 2 black, as well as a DPad for menu navigation.



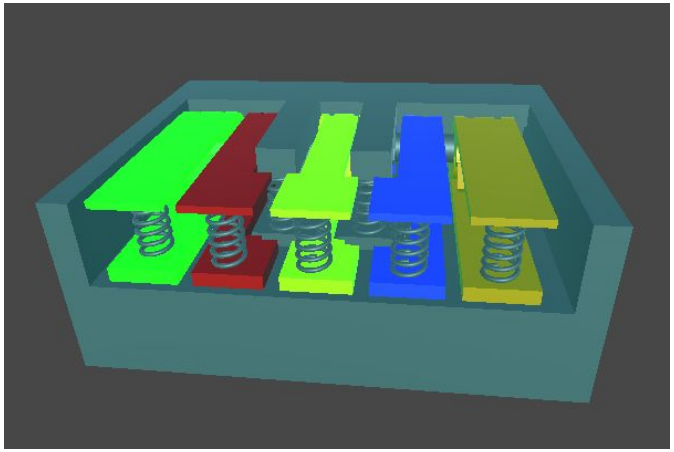
ITERATION 2

March: Refined prototype design in Fusion 360. Removed DPad to simplify design, provided specific measurements for parts, moved USB location



FINAL PROTOTYPE

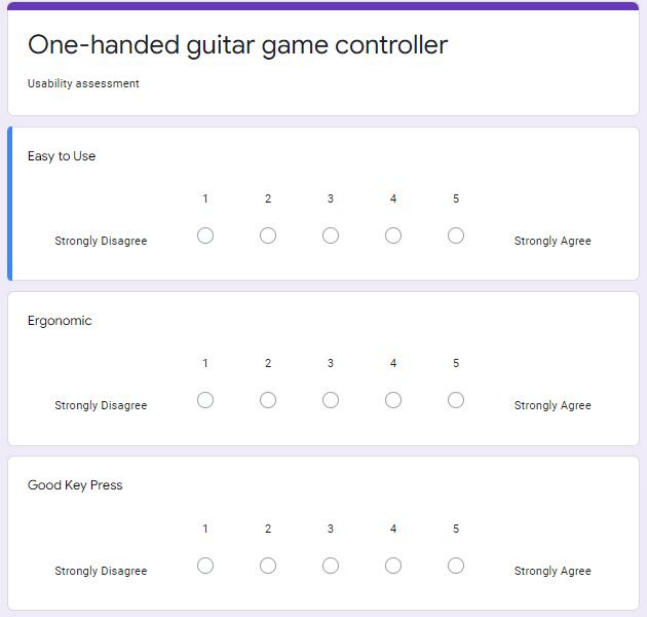
Early April: Finalized version of controller prototype made out of cardboard. Removed unnecessary pieces to simplify spring mechanism.



Demo

Results

Analysis of Usability


One-handed guitar game controller

Usability assessment

Easy to Use

1 2 3 4 5

Strongly Disagree Strongly Agree

Ergonomic

1 2 3 4 5

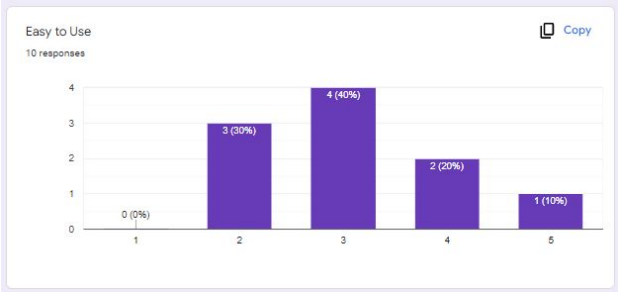
Strongly Disagree Strongly Agree

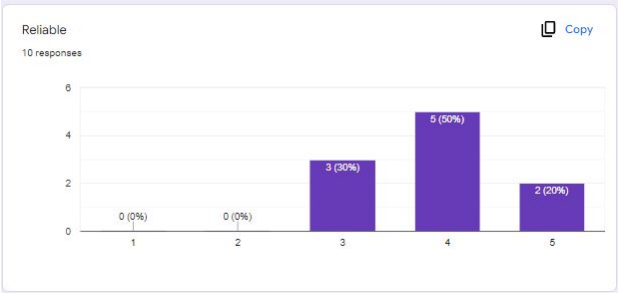
Good Key Press

1 2 3 4 5

Strongly Disagree Strongly Agree

Easy to use
Ergonomic
Good key press
Good feedback
Aesthetically pleasing
Lightweight
Cheap
Reliable



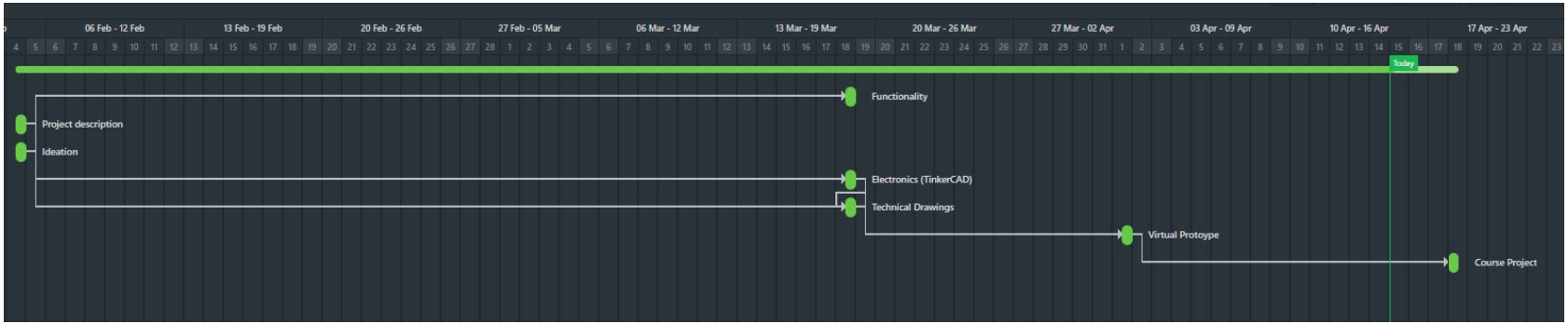


Correlation matrix	
++	Strong Positive
+	Positive
-	Negative
--	Strong Negative
	Not correlated

Relationship matrix		
◉	Strong	9
○	Medium	3
□	Weak	1
	No assignment	0

	Customer importance traing (1 = low, 5 = high)	Percent of customer importance rating	Weight	Cost of Production	Expected Life	Keys	Casing	LED Lights
			Low	Low	High	High	High	High
Easy to Use	3	12%	○			◉	□	
Ergonomic	5	20%	○			◉	◉	□
Good Key Press	5	20%			○	◉	□	
Good Feedback	2	8%			○	◉	□	◉
Aesthetically Pleasing	1	4%				○	◉	◉
Lightweight	2	8%	◉			□	◉	○
Cheap	3	12%		◉	◉	○	○	□
Reliable	4	16%			◉	◉	◉	◉
Importance rating			1.7	1.04	2.76	6	4.8	3.7
Percent of importance			8.6%	5.2%	13.8%	29.9%	24.1%	18.4%

Task Completion Metrics



Conclusion

Conclusion

Making a prototype of an instrument was harder than we had initially planned

In the future, we would:

account for more research time and delve further into research topics.

prioritize having a sleeker, simpler design over something fancy or eye catching.

make future prototypes slightly larger to account for more hand sizes.

add the LED lights to the designs and/or the physical prototype.