Lakeside View Global Vision

CEGEP JOHN ABBOTT COLLEGE

ENGINEERING TECHNOLOGIES DEPARTMENT

244-686-AB – Technical Report for Project 2

Title:

Tetris GameBoy

Students' name:

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Date:

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Problem Description

For my Project 2 I wanted to combine my three favorite aspects I learned in this program: programming, PCB design and Solidworks design.

I also wanted to incorporate a Raspberry Pi Zero W that I have obtained recently. Its usage would allow me for more flexibility if ever my project would change.

Proposed Solution

The original idea was to design a VR headset, however it proved to be too complicated for a project of this size and thus I decided to keep in a similar theme and design a small portable console to play Tetris on. Tetris was selected as it is relatively easy to program and does not require a lot of controls.

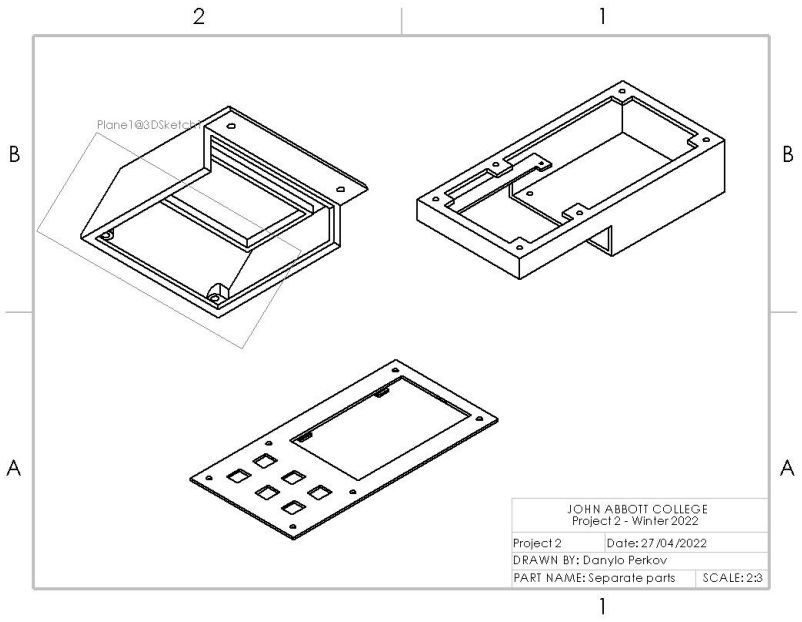
The usage of a smaller microcontroller instead of the Raspberry Pi would make the process a lot easier & faster, however having this option allows for all sorts of customization, since at its basis, it's a small computer. Thus, later on any game/program can be run on it as long as it only needs 6 inputs. This open-source base allows for more flexibility, so I've included all the designs with the PCB, this way every detail can be recreated or added upon. (See GitHub link: https://github.com/DanyloPerkov/RPi-Tetris.git).

As for the analysis done in the design process, the console was fully assembled in Solidworks. It provided a picture of errors to fix in order to obtain the right dimensions. It however failed to assist in the practical design evaluation process (see lessons learned).

The programming language Python3 was chosen because I felt most comfortable using it and already had experience using the PyGame library: the most popular library for designing small scale games with Python.

Technical Product Description

The Tetris Pi consists of three printed parts, one PCB and a screen. The printed parts and all the electronics can be assembled with screws and solder.


2
1
B
A
Plane1@3DSketch1
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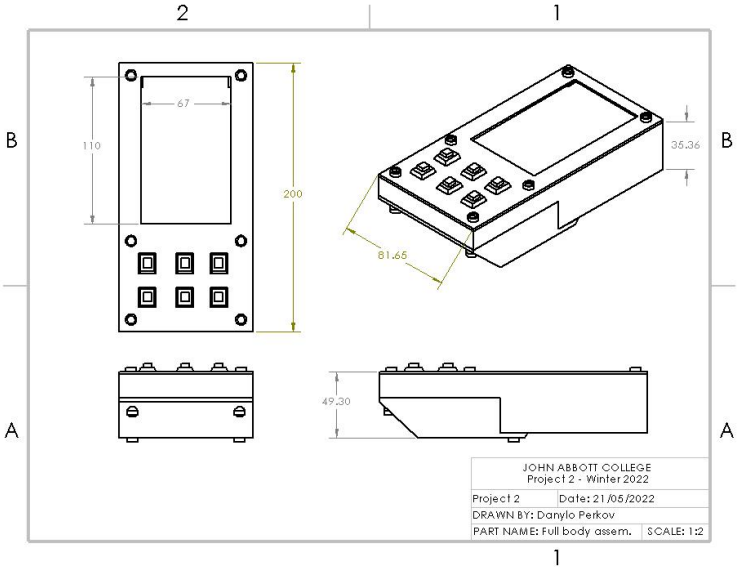
Project 2 - Winter 2022
Project 2
Date: 27/04/2022
DRAWN BY: Danylo Perkov
PART NAME: Separate parts
SCALE: 2:3


2
1
B
A
67
110
200
81.65
35.36
49.30
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Project 2 - Winter 2022
Project 2
Date: 21/05/2022
DRAWN BY: Danylo Perkov
PART NAME: Full body assem.
SCALE: 1:2

Operation

Safety.

The only risk is caused by the two 18650 batteries. They are properly wired and do not cause any danger for everyday usage. If left in for too long might leak and cause damage. If shortened might cause fire.

Use.

The device must be turned ON with the switch on the back. Once the Raspberry Pi has booted up the Python script will run. In order to edit it the memory card can be removed and edited manually. A different program can be added to the boot command using crontab (https://serverfault.com/questions/352835/crontab-running-as-a-specific-user).

Maintenance

The product must not be exposed to extreme weather and moisture. This might damage it beyond repair.

Troubleshooting

Refer to the GitHub repository for references (https://github.com/DanyloPerkov/RPi-Tetris.git).

Lifespan

If kept in good condition and looked after the product is designed to last as long as the plastic it's made out of does not break. The batteries hold the charge for about an hour of constant usage. Once battery power begins to go down, the screen will shut down first.

Final Timeline

See Appendix for “1952564_DANYLO_Timeline.xlsx”

Lessons Learned.

Write the product development story OR reflect on the learning Experience of your stage.
Question prompts:
What worked and what didn’t? What would you do differently in the future?
Projects: If this project is to be completed by other students in the future, what valuable information would be needed for them to continue this project? What do you suggest for future students that will take on projects?
Stage: If students were to do a stage similar to you, what would suggest to them? Do you feel your stage would be beneficial for you in your career endeavor?

The coding part of the project did not cause any major problems: figuring out the right GPIO pins and how to access them through PyGame caused a small delay but apart from that everything went smooth.
The installation caused a bit more problems because all the libraries were installed to the user instead of rot, thus crontab was used to solve the issue instead of editing the nano file.
The major lessons learned were wit the Soplidworks design. Even though pre-assembling the parts helped see the right dimensions, I did not calculate for comfort of using. Thus the best steps for the future would be to obtain different physical prototypes, to be held by hand and inspected. This will help understanding the comforts to adjust in the design:
For example, the current prototype is too securely closed. It would take too long to simply open it and change the batteries. An easier way to change them must be added.
The ON/OFF switch is installed in a bad place and can be easily pressed by accident.

Acknowledgments and Credits

Two major parties were of great contribution to this project:
- Project 2 supervisors provided valuable feedback on design upon our meetings
- My dad helped me figure out the different crontab commands and to properly run them.

Appendix:
A1. Bill of Materials (BOM)

#	Name of Product	Part #	Quantity	Unit Cost ($)	Cost ($)	Source	Manufacturer/Datasheet
1	HDMI 4 Pi 5" Display not Touchscreen 800x480 - HDMI/VGA/NTSC/PAL	1678	1	64.95	64.95	Adafruit Industries	https://www.adafruit.com/product/1678
2	18650 batteries	-	2	4.99	10	Pre-Owned	https://www.18650batterystore.com/collections/18650-batteries
3	Raspberry Pi Zero W	-	1	10	10	Pre-Owned	https://www.raspberrypi.com/products/raspberry-pi-zero-w/
4	Battery holder	-	1	2	2	Amazon	QTEATAK 8 Pack 18650 Battery Holder Bundle with Wire 1 18650 Battery Holder 3.7V, 2 Pcs, 2 Battery Holder 7.4V, 2 Pcs, 3 Battery Holder 11.1V, 2 Pcs, 4 Battery Holder 14.8V, 2 Pcs
5	Mini DC-DC Buck Step Down Module 4-24V 12V/24V to 5V 3A Power Module QS-1205CME-3A	-	1	1.2	1.2	Pre-Owned	https://www.satistronics.com/shop/product/1941621-mini-dc-dc-buck-step-down-module-4-24v-12v-24v-to-5v-3a-power-module-qs-1205cme-3a-79148
6	Push-buttons	-	6	2.6	15.6	DigiKey	https://www.digikey.ca/en/products/detail/e-switch/PS1057ABLK/46305
7	PCB	-	1	6.11	6.11	Jlcpcb	See PCB design file
8	Printed parts	-	3	0.3	1	Printed at the College	See Solidworks files
9	Nuts & bolts	-	20	-	4	ABRA Electronics	-

	Total amount of parts	36	Total $	114.86	

A3. Engineering documentation.

Reference Letter	Link to File	Description
A	tetris3.py	Code for the Tetris game
B	1952564_DANYLO_Timeline.xlsx	Final project timeline
C	batteries.SLDPRT	Battery holder printed part
D	body.SLDPRT	Main printed body
E	button.SLDPRT	test button filler
F	front_panel.SLDPRT	top printed panel of the body
G	full body assem.SLDDRW	technical drawing of the full assembly
H	TPi_Tetris_v2.6.dip	DIPTRACE file for the PCB
I	schematic_project_2_danylo.dch	DCH file for the PCB
J	screen.SLDPRT	test screen filler
K	screw.SLDPRT	test screw filler
L	separate parts.SPDDRW	technical drawing of the three main parts of the body