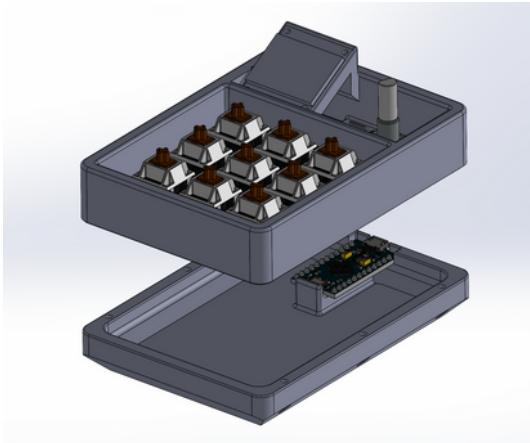


# Alec Chen

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## 3x3 Custom Keyboard - Personal Project



### What?

- Designed a custom keyboard for optimizing my workflow in **SolidWorks**.
- The objective was to **increase efficiency** while maintaining an intuitive and visually appealing design.

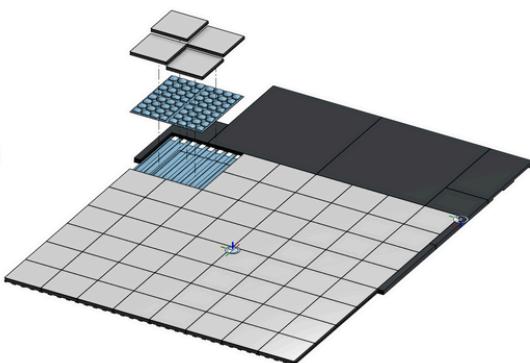
### How?

- Designed a 3D-printed enclosure with heat inserts to mount a **microcontroller, rotary encoder, and OLED screen**.
- Designed and ordered a **custom PCB** for the switches using **KiCAD**.
- Developed **custom firmware** for communication between components.

### Outcomes

- Created a custom macropod with **39+ programmable functions**.
- Gained a **end-to-end product design** experience, from CAD modelling to **electronics integration** and **firmware development**.

## Custom LED Embedded Chess Board - Spark!



### What?

- Designed an LED-embedded chessboard for my design team's Smart Chess project.
- The objective was to **optimize the board thickness**, ensuring **structural strength** while maintaining a **thin profile** for **reliable magnetic attraction** on opposite sides of the board.
- Light from LEDs also had to diffuse minimally between board pieces.

### How?

- Designed a system with three layers: a topper that connected to other toppers and prevented light bleed to other positions, a diffusion layer and a layer for holding LED strips.
- Used **OnShape** to **prototype** and test **10+ iterations** during the design process.
- Tested light diffusion using the **FastLED Arduino library**.

### Outcomes

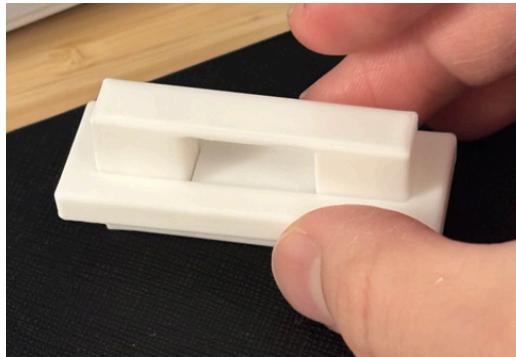
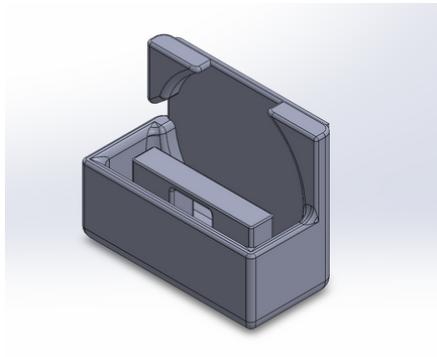
- Designed and manufactured a LED-embedded chessboard with a thickness of **7.7mm** and a deflection of less than **2mm**.
- Chessboard contains **1024+ LEDs** with little to no light diffusing between the grids.

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## Airpods Dock/Charger - Personal Project



### What?

- Designed and modelled a custom dock and charger for my AirPod Pros to encourage myself to charge my AirPods more.
- The objective was to **maximize access speed, intuitivity and simplicity**.

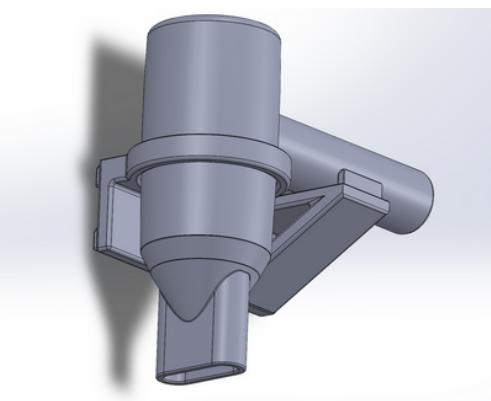
### How?

- Researched and developed a **print-in-place mechanism** so that the entire part can be printed without assembly, despite containing two separate parts.
- Designed, and modelled 2 prototypes to **ensure perfect fit** for Magsafe Charger and Airpods.

### Outcomes

- AirPods have never been uncharged when leaving the house in the **last 6 months**.
- All relevant files and print instructions are **open-source on Thingiverse**.
- Link to project:  
<https://www.thingiverse.com/thing:7143822>

## Hair Dryer Holder - Personal Project



### What?

- Designed a hair dryer holder so that I can hide my hair dryer within my bathroom closet.
- The objective was to design something with **sufficient support** while remaining **simple and fast to print**.

### How?

- Measured and modelled hair dryer to test fitting within a **SolidWorks Assembly**.
- Strategically designed model to ensure **no supports** were needed, thus **saving filament** and keeping **print times low**.

### Outcomes

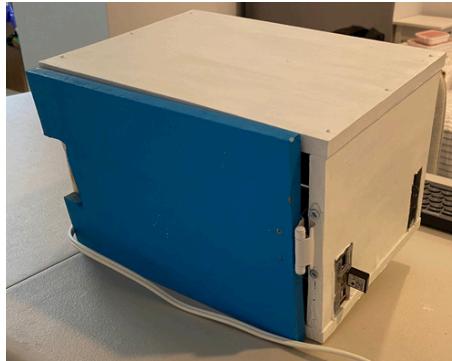
- Space beside bathroom sink is now **50% less cluttered**.
- Project received positive feedback, with **47 likes and 8 saves** on **Thingiverse**.
- Link to project:  
<https://www.thingiverse.com/thing:7116034>

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## Smart Digital Photo Frame/Second Monitor - Personal Project



### What?

- Designed a **smartphone-controllable** digital photo frame that can double as an external monitor.
- The objective was to **maximize utility** while keeping the **design simple** and unobtrusive on the desk.

### How?

- Researched and learnt how to **woodwork** with **hand drills** and **saws** to create the enclosure.
- Learnt **Python** to adapt and **debug** scripts from **GitHub**.

### Outcomes

- Digital photo frame with 32GB of expandable storage using USB ports.
- Created an enclosure that integrated a **Raspberry Pi**, cooling fan, 11" monitor, HDMI switcher, and monitor control board.
- Photo frame features can be controlled by connecting the phone to the local network.

## IR Camera Holder - LEMAM



### What?

- Designed an adjustable lens mount and fixture for a \$27000 IR camera.
- The objective was to create a **stable** fixture that had **smooth motion** and **fast print times**.

### How?

- Designed a cap with **standardized** Sony threads to mount lens filter onto IR Camera.
- Measured mounting hole dimensions on DED machine for design.
- Created fixture to combine IR camera with linear guide which was mounted to the DED machine.

### Outcomes

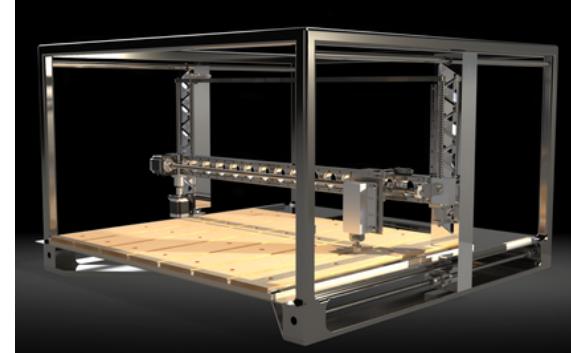
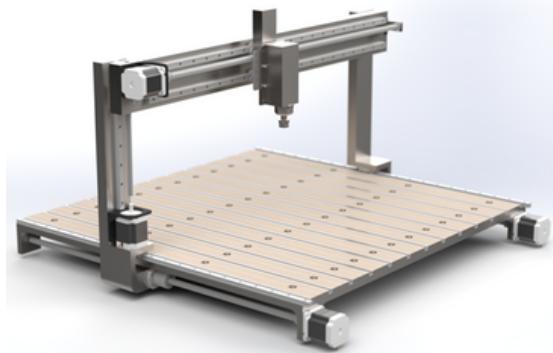
- IR camera now has **50+mm** of travel along the Z-axis for focusing.
- IR camera is stable, with less than **2mm** of wobble when secured.
- Net print time of under **2 hours** on the Prusa i3 mk3s+.

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## Custom CNC Machine - University of Toronto



### What?

- Designed and modelled a large-format three-axis CNC router with a combination of **custom-designed parts** and **McMaster-Carr components**.
- The objective was to **maximize utility, modularity and repairability** while **keeping costs low**.

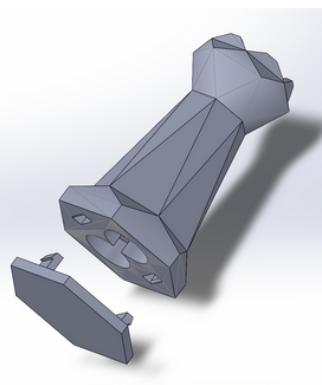
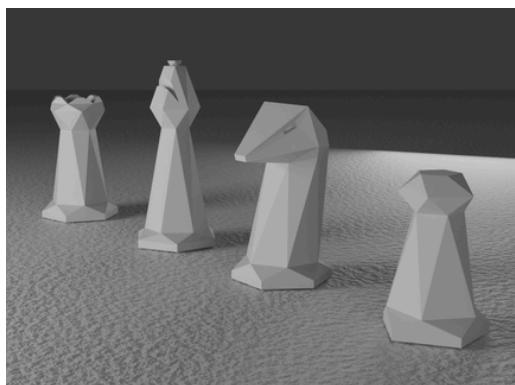
### How?

- Researched components to **optimize for cost-efficiency** and performance based on **design specifications**.
- Developed and delivered Google Slides to communicate **key design features and trade-offs**, effectively securing approval during **engineering design briefing**.

### Outcomes

- Designed and modelled a custom CNC router with **229 parts** and **400+ mates** in **SolidWorks**.
- Created a **comprehensive design report**, including **engineering specifications**, component justification and a **bill of materials** outlining all components required to assemble the router.

## Custom Chess Pieces with Magnets - Spark!



### What?

- Designed four unique chess pieces with **internal magnets** for my team's Smart Chess project.
- The objective was to design something with a **low-poly aesthetic** that could house internal magnets.

### How?

- Designed and modelled the chess pieces in **Blender**.
- Created renders of the design in **Blender** for marketing purposes.
- Created a **Blender to SolidWorks workflow** to utilize both organic modelling and technical refinement in both software.
- Designed a **3D printable clip-on cover** and magnet slots within **SolidWorks**.