OMEGA KEY

Presented by Breakthrough Innovations Group

For ENSC 305W / 440W

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Outline

- Team Roles
- Background
- Motivation
- System Overview
- Budget
- Market Analysis
- Schedule
- Problems and Challenges
- Future Plan
- Learning & Outcomes
- Acknowledgements
- Conclusion
- References
- Questions and Answers

Team Roles

David Pallmann
- CEO and Lead Designer

Frank Tran
- Software Engineer and Lead QA Engineer

Steven Timotius
- Software Engineer and Software Architect

Chase Kwak
- Systems Engineer and Communications Liaison

Steven Luu
- Systems Engineer and Financial Director

Steven Liu
- Systems Engineer and Machinist

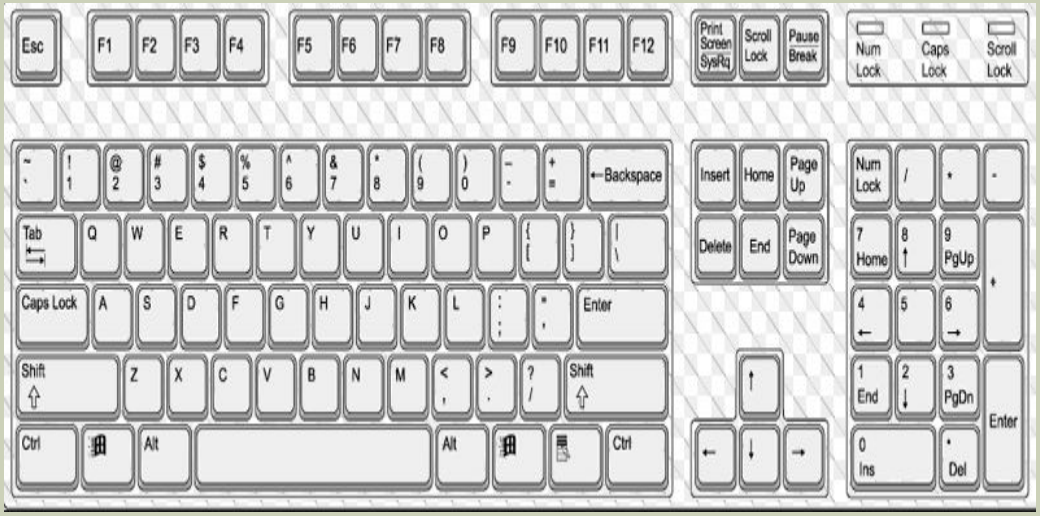
Background

- 2011 Survey from Statistics Canada found that 5.8 million people speaking at least two languages at home (17.5% population)
- People are forced to use the standardized english keyboard when they want to type in their own language
- Over 1 million people are working in the professional, scientific and technical services and 1.7 million students going to universities
- People often need special symbols for their technical report and it is not handy to do that with old QWERTY keyboard

Motivation

Problem

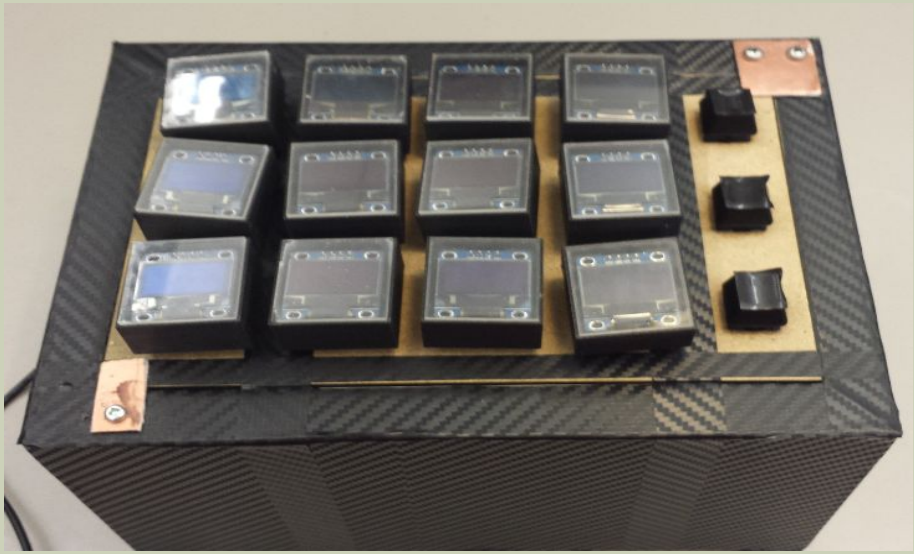
- Existing keyboards have lack of versatility and visual feedback with keyboard inputs
- Touch screens are great examples of customizable keyboards but have poor ergonomics and costly



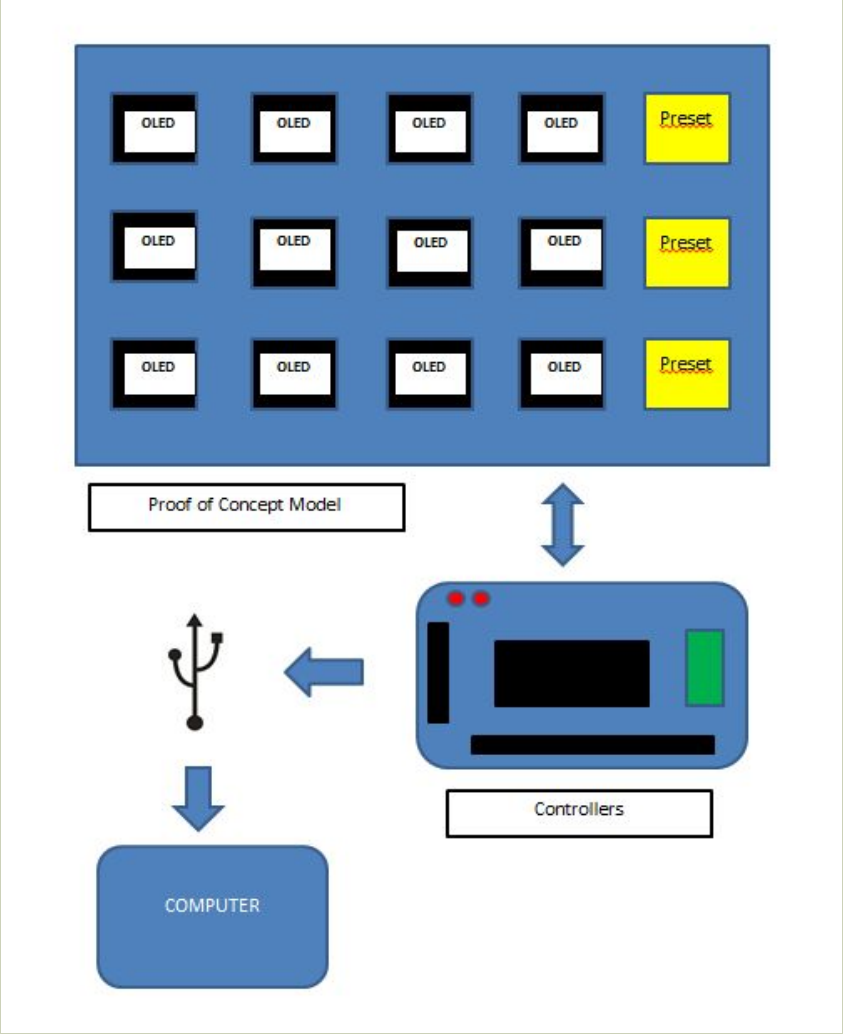
Motivation

Solution

- Create a keyboard which allows users to type in multiple languages and symbols with preset keys
- OLED screens on each key update to show the key's function
- Possible to add software to allow user to customize layouts - Future Plan

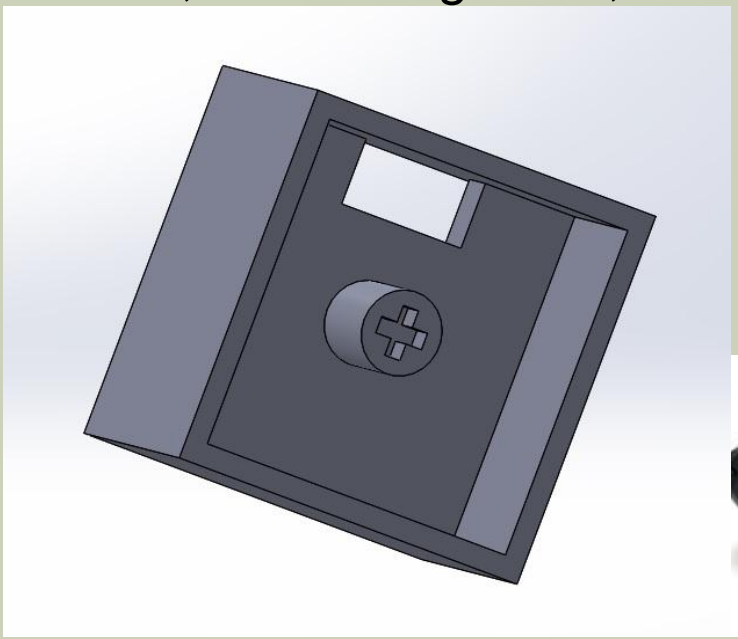


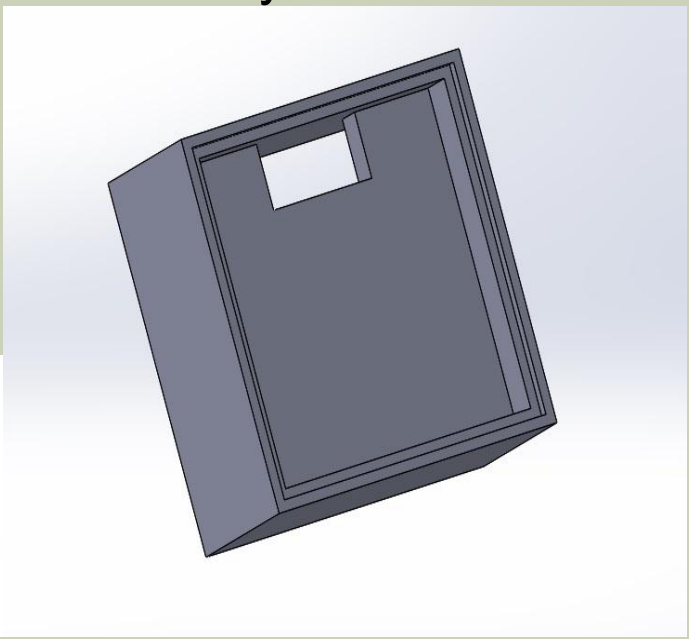
System Overview



Mechanical Design Keycaps

- Key Caps are 3D printed due to the intricate nature of the design which utilizes a cross in the center to connect to the switches to keycaps
- This piece was very challenging to design as it had to integrate the screen, connecting wires, the switches, and the acrylic cover.



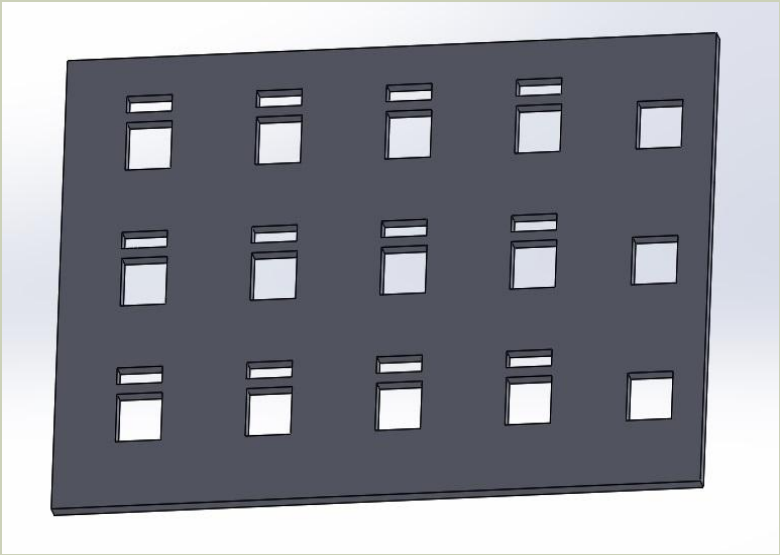


Mechanical Design Switch Bed

- Switch Bed

  This piece was originally going to be 3D printed as well, however once we became more familiar with the rapid prototyping process it became clear that laser cutting was the best option

  The bigger holes are for the switches to rest in and the smaller ones are for wires to go through



Mechanical Design Casing

- **Case**

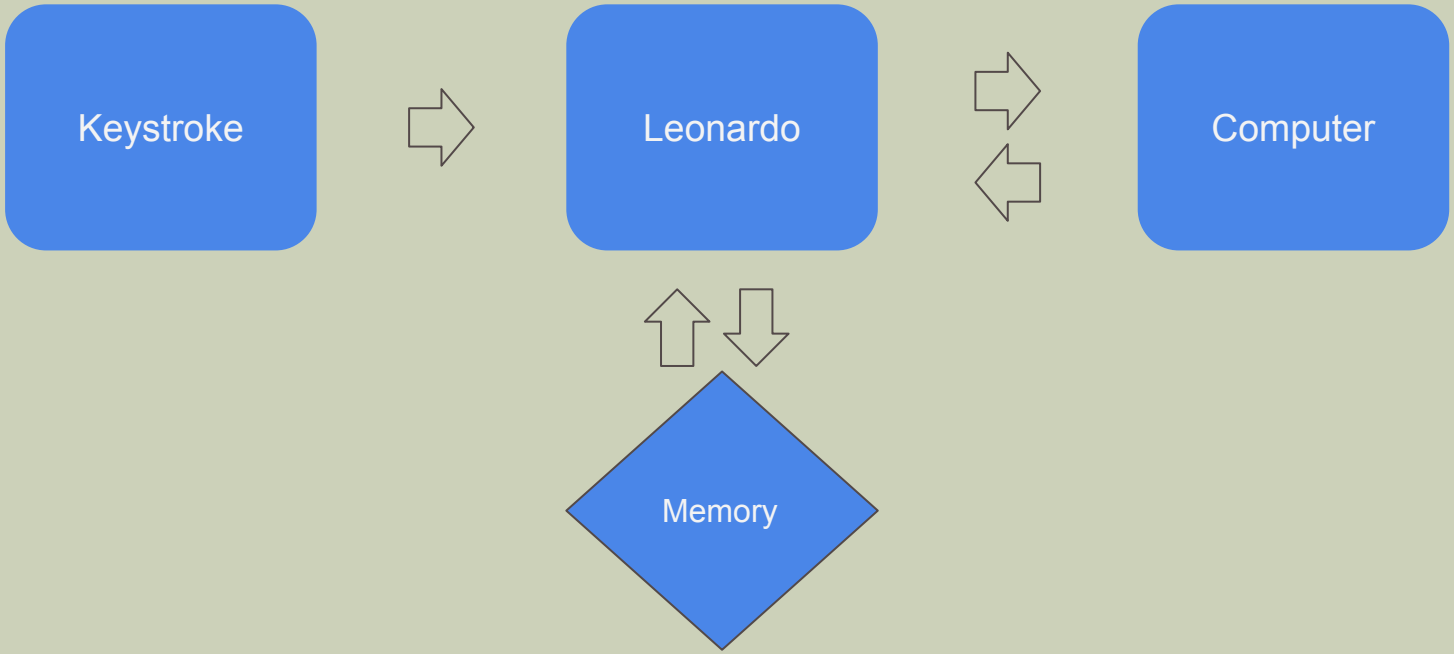
  It had the least amount of specifications to it and as such we crafted our own with wood

  The case had to be large enough to hold all the wires and have a supporting shelf to hold the switch bed

  It also has an access port in the back to allow two microcontrollers to plug in

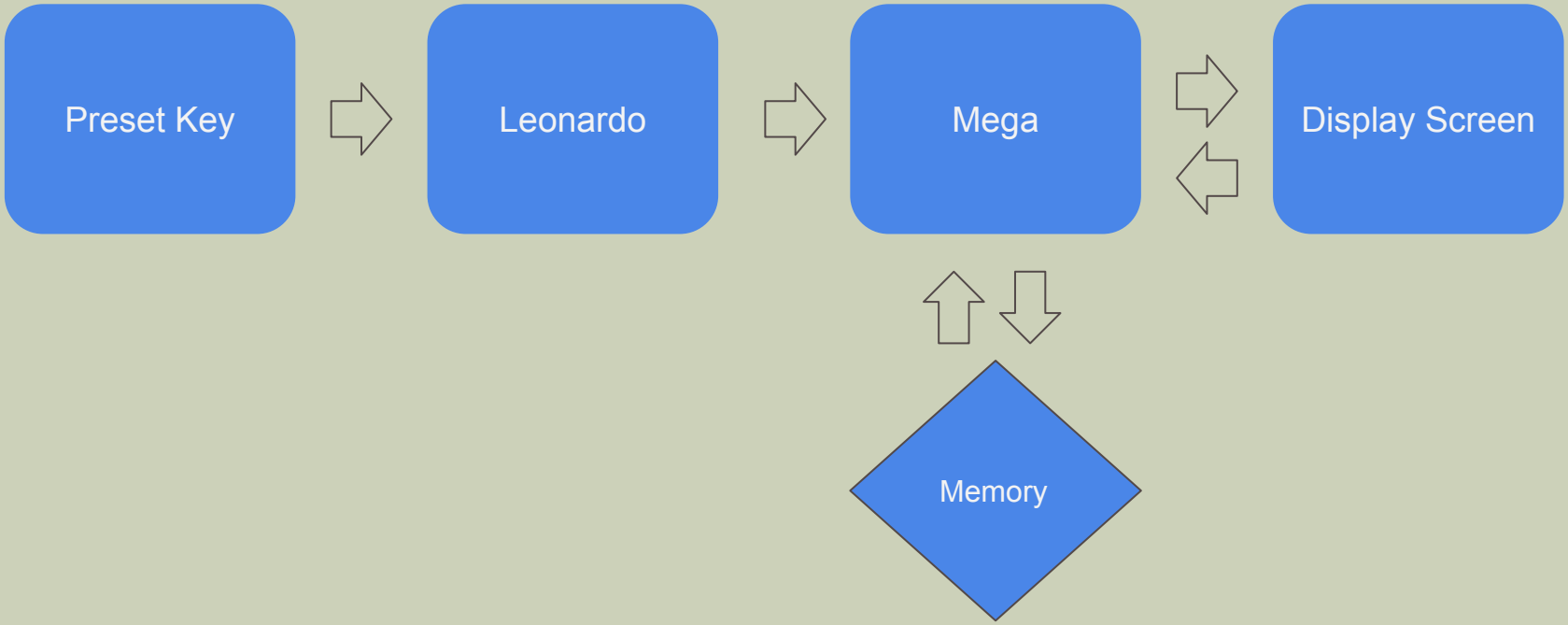
Microcontroller

- Arduino Leonardo board
  - Recognizes the key strokes and retrieve corresponding key code from its memory unit
  - Communicates with computer to send keyboard input data



Microcontroller

- Arduino Mega board
  - Communicates with Leonardo
  - Retrieves corresponding display layout from its memory and updates each display screen with corresponding image



3 Pre-Defined Layouts

Numpad

Math

Polish

Budget

Proposed Costs

Parts	Total Cost (CAD)
Microcontrollers	150
LCD graphic displays	40
Blue Cherry MX Switches	50
Mechanical Keyboard	150
3D printing	60
Total	550

Actual Cost

Parts	Total Cost (CAD)
Arduino Mega	68.04
Blue Cherry MX Switches	27.20
Test Display	15.99
Old OLED Displays	88.00
New OLED Displays	164.89
Solderable Breadboard	11.99
MCP23017 Chip	1.82
3D Printing	43.00
Jumper Wires	11.00
Protective screen for Keycap	7.60
Wood (Pine)	3.83
Shipping & Tax	35
Total	476.32

Market Analysis

- Potential Clients

  Anyone wants to customize layouts (Arabic, Hiragana, Special Symbols)

  Students / Professionals who need faster access to technical symbols

- Estimated Manufacturing Cost

  If we have facility to mass produce the product, it will cost approximately $85/unit

- Estimated Retail cost

  $200/unit

Market Analysis

Competitors

Company Name	**Razer**	**Sonder Design**	**Art. Lebedev Studio**
Model Name	Razer Orbweaver	Sonder Keyboard	Optimus Maximus
Cost (USD)	130	300	1600
Features	Programmable Keys, Adjustable hand module	78 Customizable E-ink display	Customizable Layout, HTML codes, math functions

Market Analysis

- Razer Orbweaver: Targeting customer is narrow; mostly for gamers

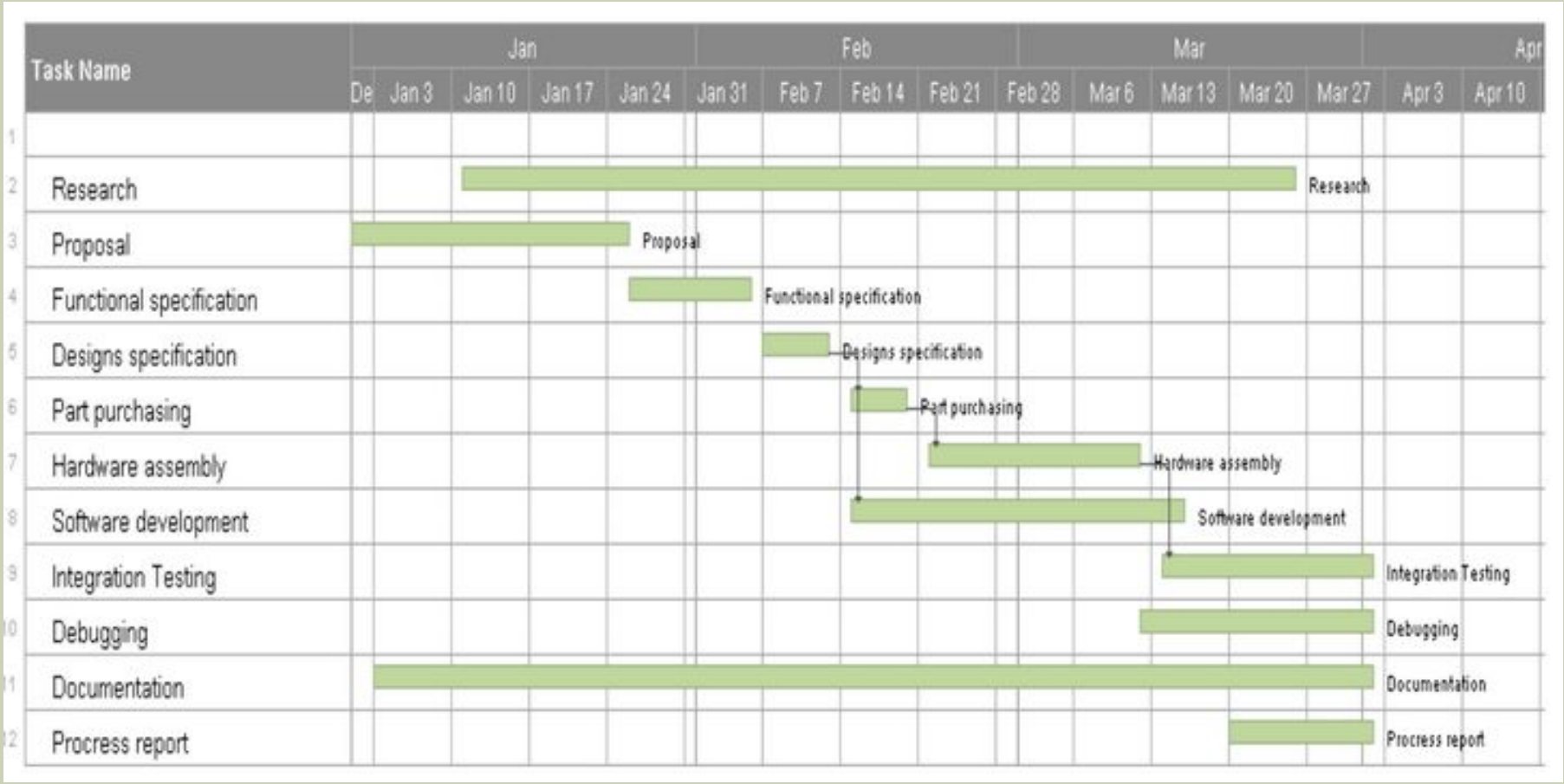
  Gaming keyboard have excess of feature that go unused for most consumers

- Sonder Keyboard: Not yet released, no publicized working models

- Optimus Maximus: Too expensive, ~$1600

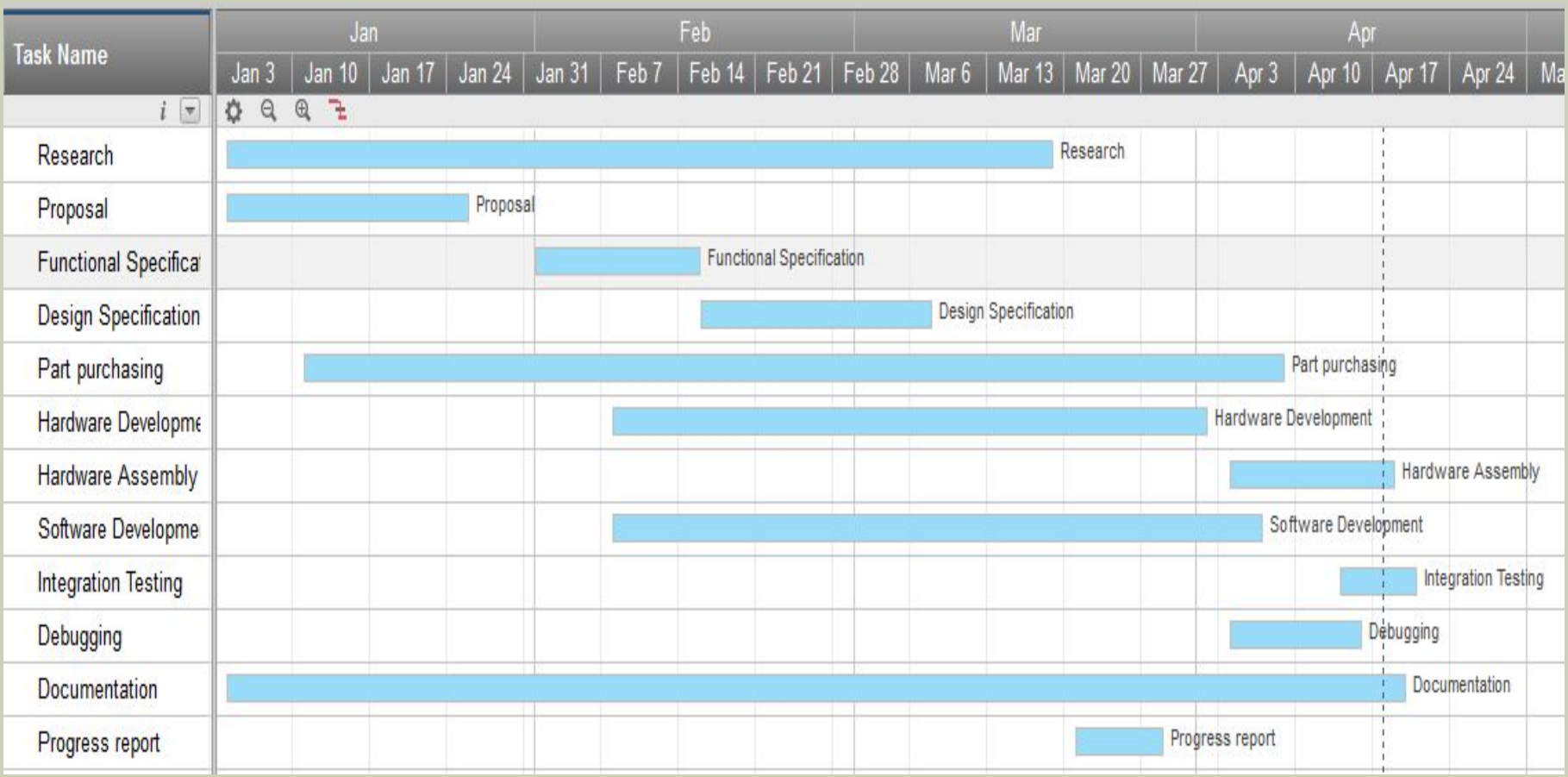
Schedule

Proposed Schedule



Schedule

Actual Schedule



Problems and Challenges

- First major design challenge was connecting all the display screens and switches.
  - Not enough GPIO ports on a single board for all the peripherals
  - Initially, wanted to use a GPIO expander, but unsure if enough power. Also makes software more complicated
  - Later decided to use 2 Arduino boards instead of just 1

- Second problem was connected to the OLED display
  - Did not have the machine soldering facilities to connect the first set of display screens we bought
  - Had to return them and purchase another kind of display screen
  - Had to redesign other parts to fit the larger screen
  - Setback in budget and schedule (2 weeks)

Problems and Challenges

- Another major problem was finding suitable facilities to construct our casing for the keyboard
  - We had difficulties find an appropriate facility with the tools we required

- Significant issue throughout the project was time management
  - Hardware assembly process stalled due to time for parts to arrive
  - Further aggravated by display screen issue
  - Longer than anticipated time taken to design manufactured parts
  - Resulted in reduced time for system testing

Future Plan

- Create a user interface that allows users to customize individual characters and layouts
- Evaluate the cost to benefit analysis of creating multiple screens to just one large one with see through screens
- Evaluate the cost to benefit analysis of a smaller ‘helper’ keyboard to a full keyboard

Learning and Outcomes

- Teamwork skills
- Time Management
- Budget Management
- Project Management
- Technical Writing Skill
- Arduino Programming
- Circuitry Design
- Hardware Integration
- Mechanical Design
- Machining skills

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  Mona Rahbar
  Soroush Haeri

- Special thanks to **Gary Shum** for providing knowledge and expertise in rapid prototyping

Conclusion

- Omega Key is a proof of concept model
- Improvements shall be made for production purpose
- Can be competitive in the market because of its simplified functionality and cheap retail price
- We learned both soft and technical skills during this project

References

[1] Statistics Canada 2011 Census (2016, Jan 21). Retrieved from https://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-314-x/98-314-x2011001-eng.cfm

[2] Students going to university (2016, Jan 21). Retrieved from http://www.univcan.ca/universities/facts-and-stats/

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Questions?