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# Project Gestur

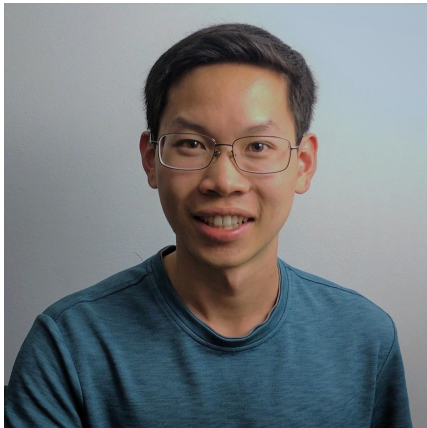
by Reihlo

Kyle Carson, Ryan Kaveh, Jon Young, Ryan Lee, Ryan Tsukomoto



UC SANTA BARBARA  
**engineering**

# Introduction



Jon Young  
4th Year EE



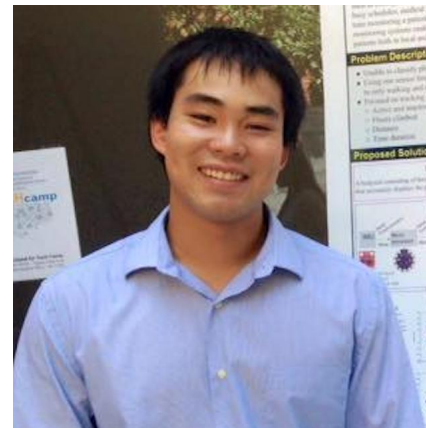
Ryan Kaveh  
4th Year CE



Kyle Carson  
4th Year CE



Ryan Tsukamoto  
3rd Year ME



Ryan Lee  
3rd Year ME

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# Background

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Virtual Reality  
Unintuitive controls for 3D  
Limited haptic devices



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# Background

- Gestur glove as a bridge
- Intuitive virtual control
- Applications outside of VR

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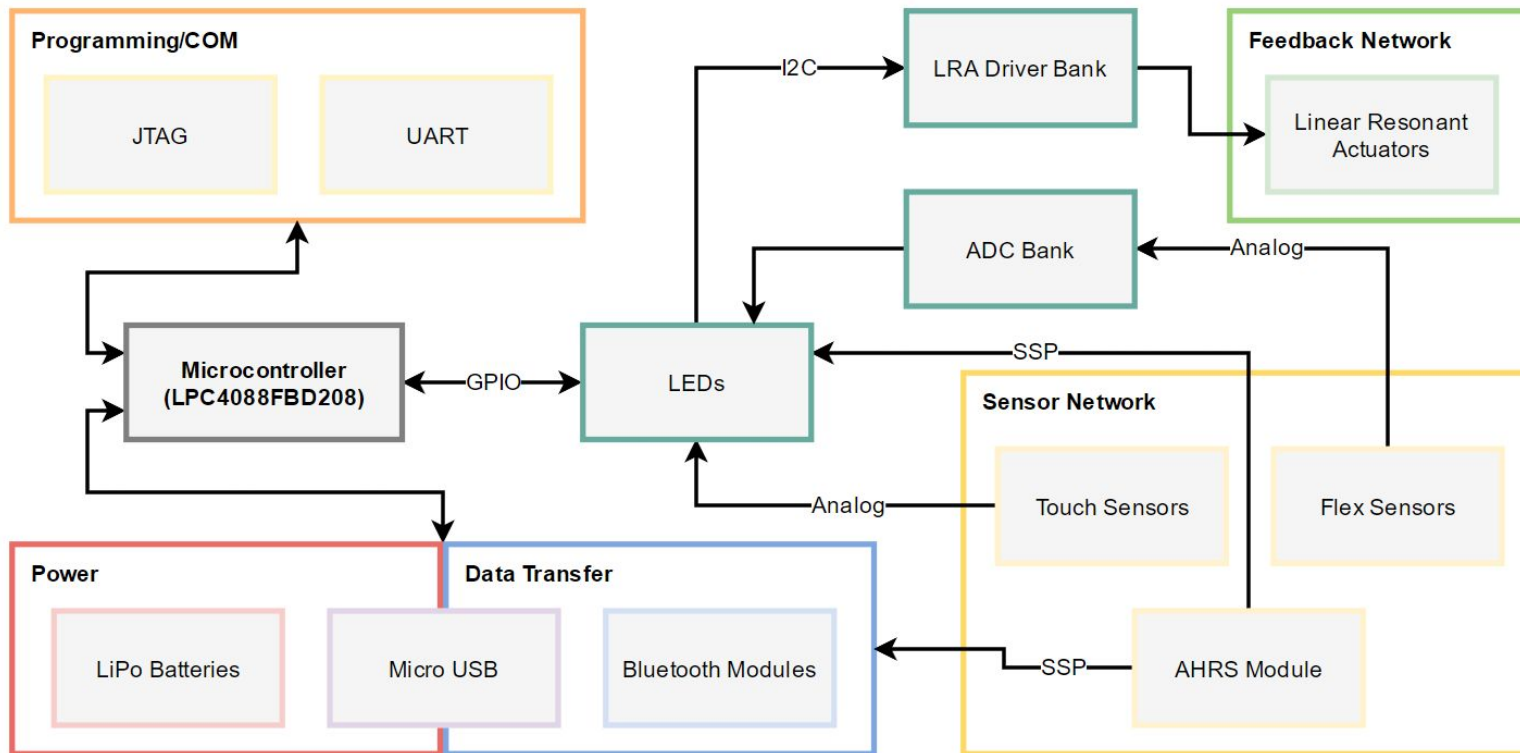
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# Overview

## Entire System

### Sensors - Electronics - Host-Side Processing



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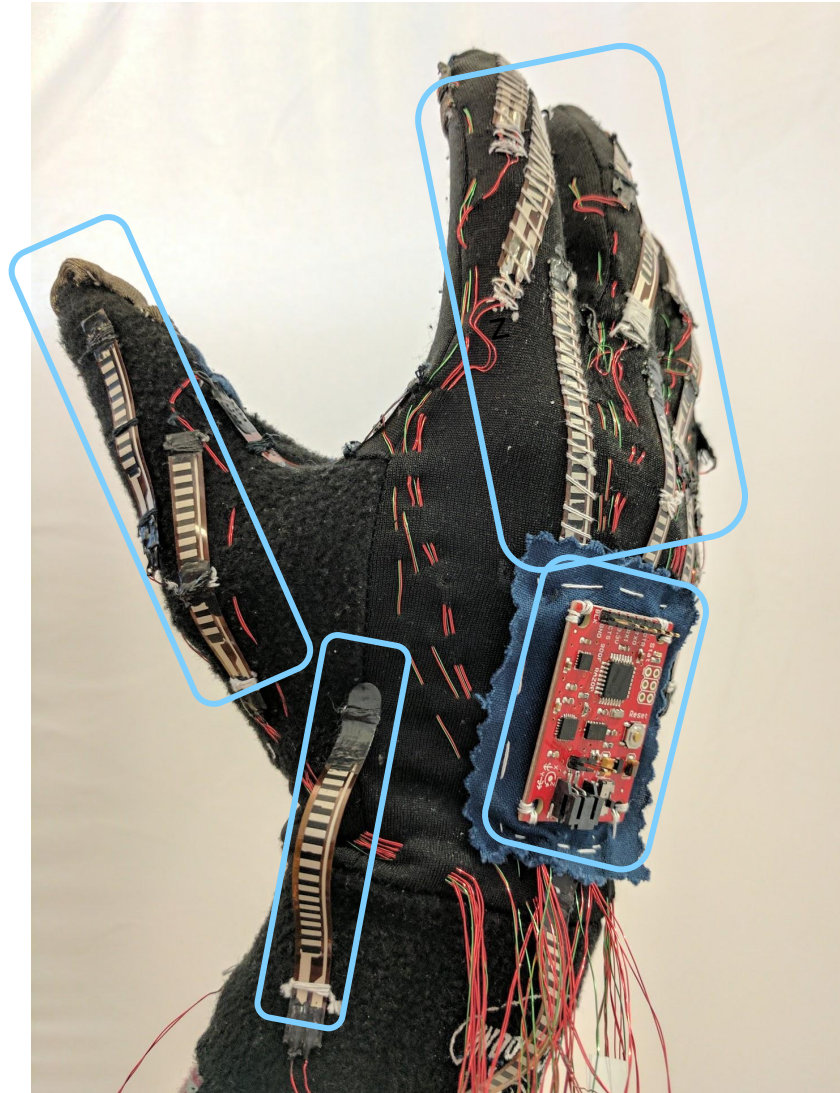
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# Subsystems

## Glove

- Flex sensors
- AHRS
- Vibration motors
- Touch controls



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# Subsystems

## Glove

- Flex sensors
- AHRS
- Vibration motors
- Touch controls



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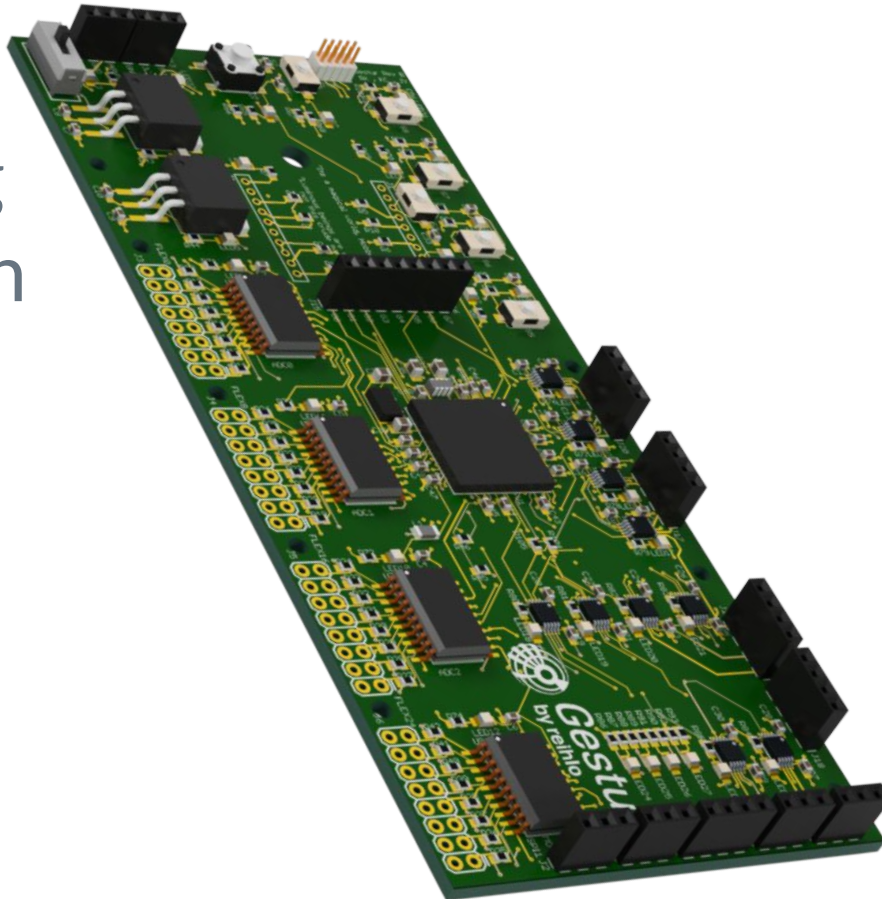
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# Subsystems Board

- LPC 4088 uC
- Sensor sampling
- Low pass filtering
- Com w/ bluetooth
- Battery board



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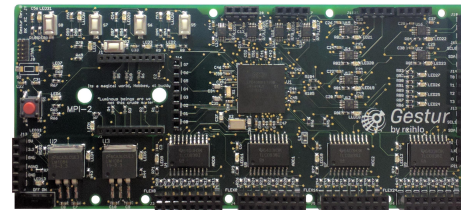
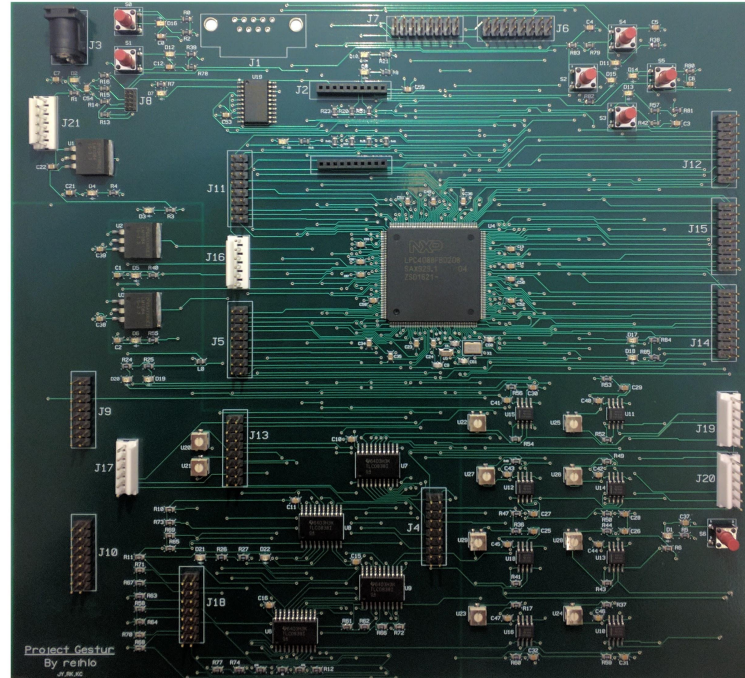
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# Hardware

## Iterative Design

- Two iterations thanks to Laritech
- First Capstone to use a BGA
- 2nd spin is 80% smaller
- Updated design



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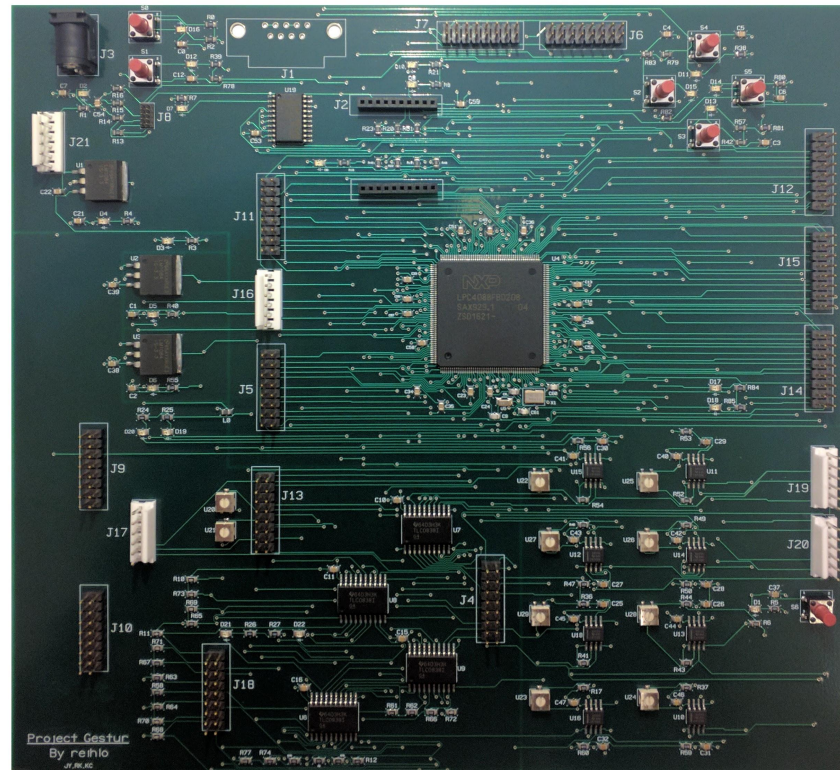
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# Hardware

Rev A

- Dev kit
- Adaptable
- Redundancies
- Reused designs from past groups
- More of a backpack than glove



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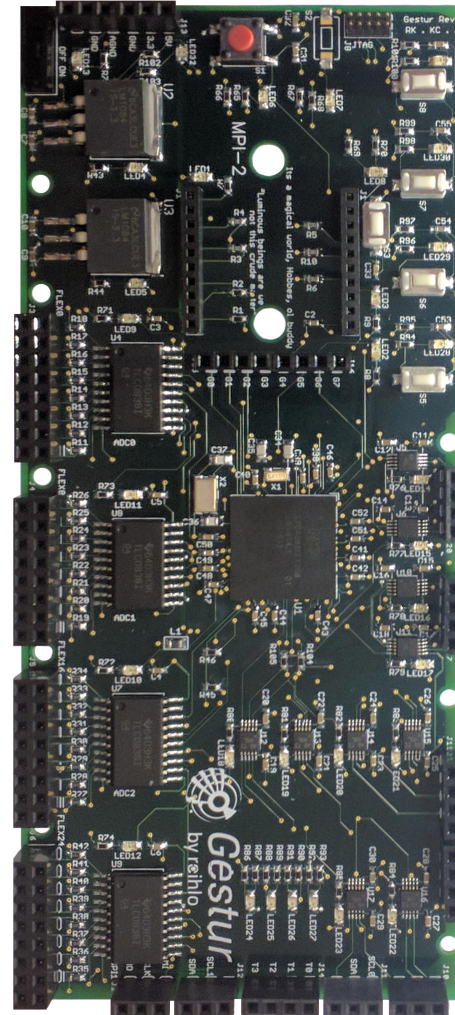
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# Hardware Rev B

- Closer to production model
- Significantly better design
- BGAs & 0603s
- Updated design for vibration motors
- Battery powered
- Fully wireless
- Smaller than a smartphone (2.5" x 5.5")



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# Construction

## Glove

- All parts sewn onto glove/sleeve
- 3D printed wire rack/mount
- Challenges include:
  - Wire management
  - Sensor placement
  - Longevity
  - Durability (strain relief)



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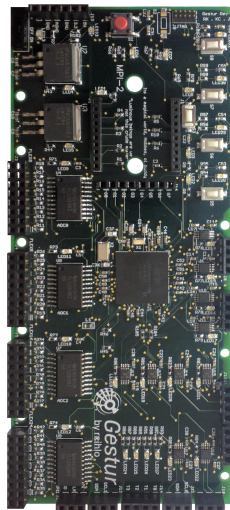
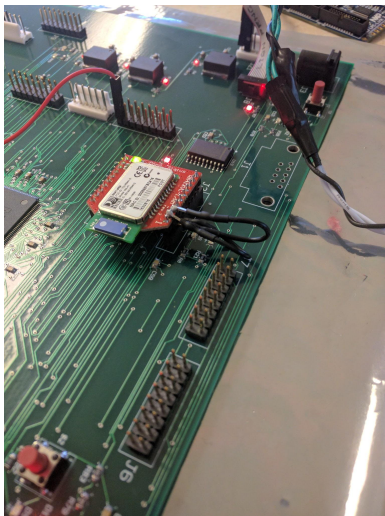
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# Construction

## Integration

- Flex sensor testing & improvements
- AHRS testing
- Board reworking



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# Construction

## Integration



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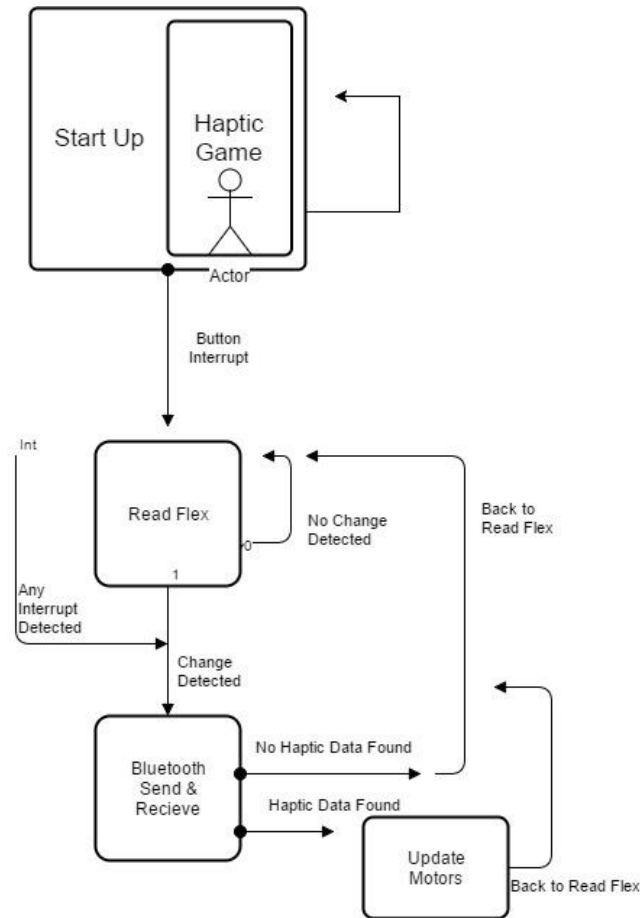
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# Software Embedded Software

- FSM on LPC4088
- Communicates with host
- Poll & interrupt based state transitions
- Low power idle mode
- Will ensure board is always doing something useful



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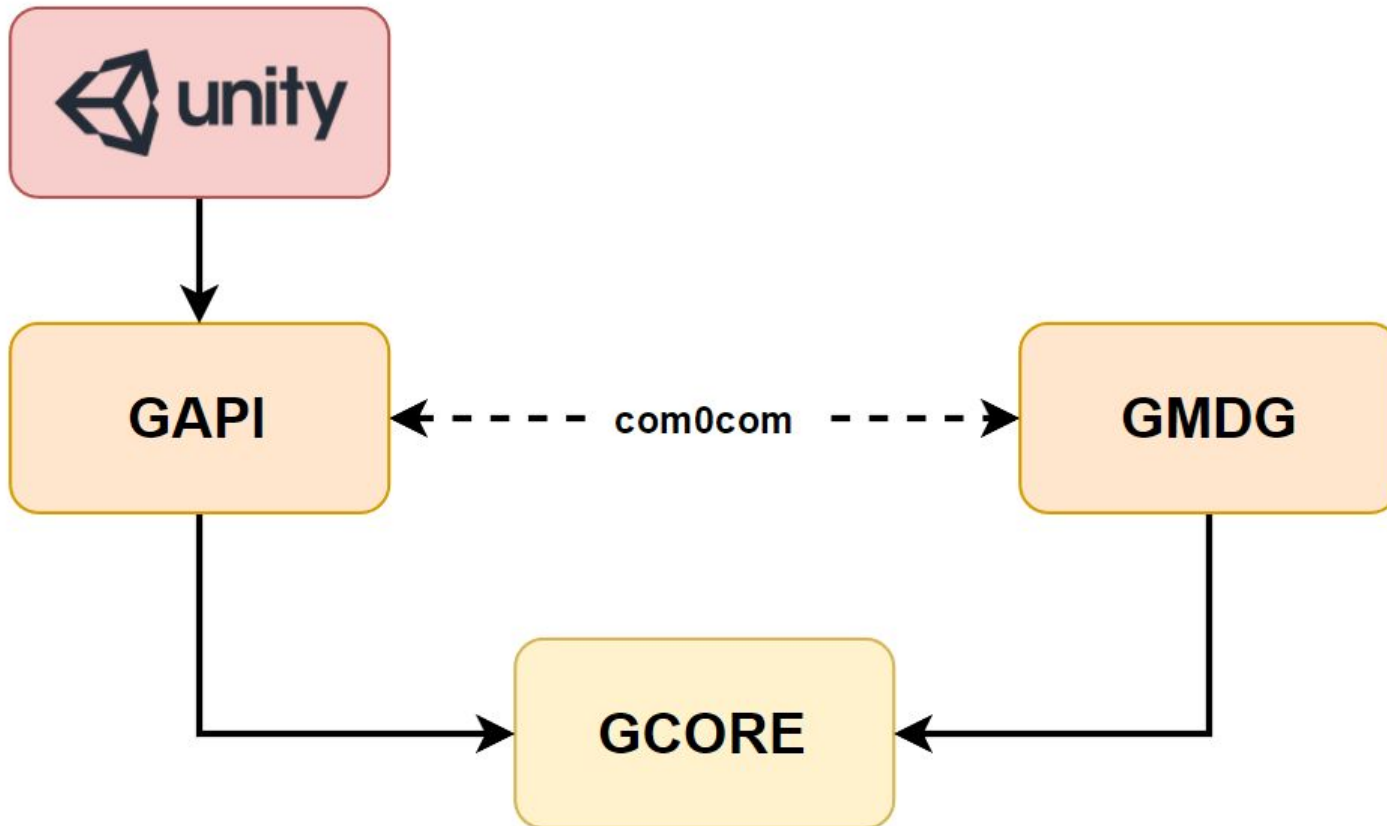
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# Software

## API Hierarchy



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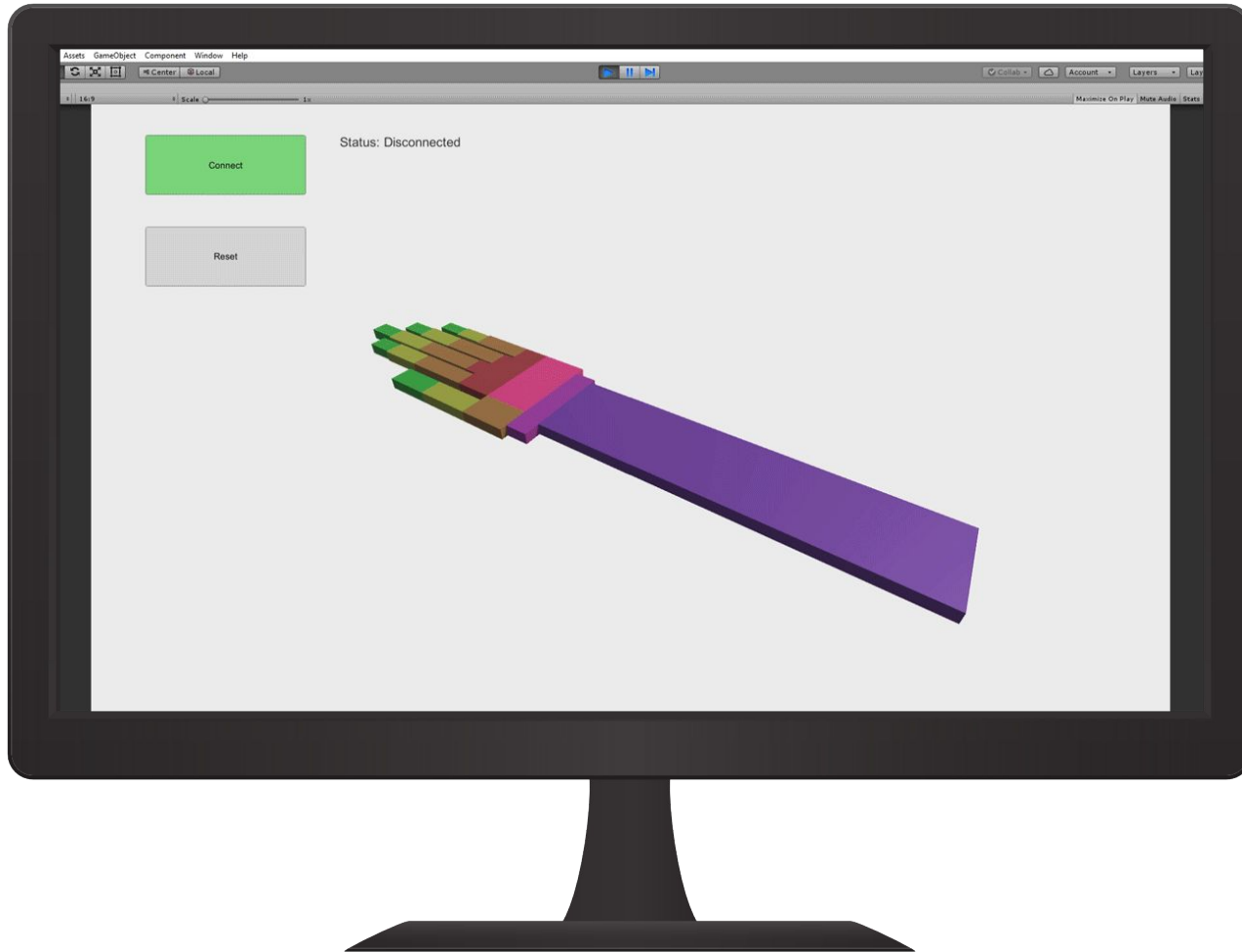


# Software Gestur Model Data Generator

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# Software TouchBox



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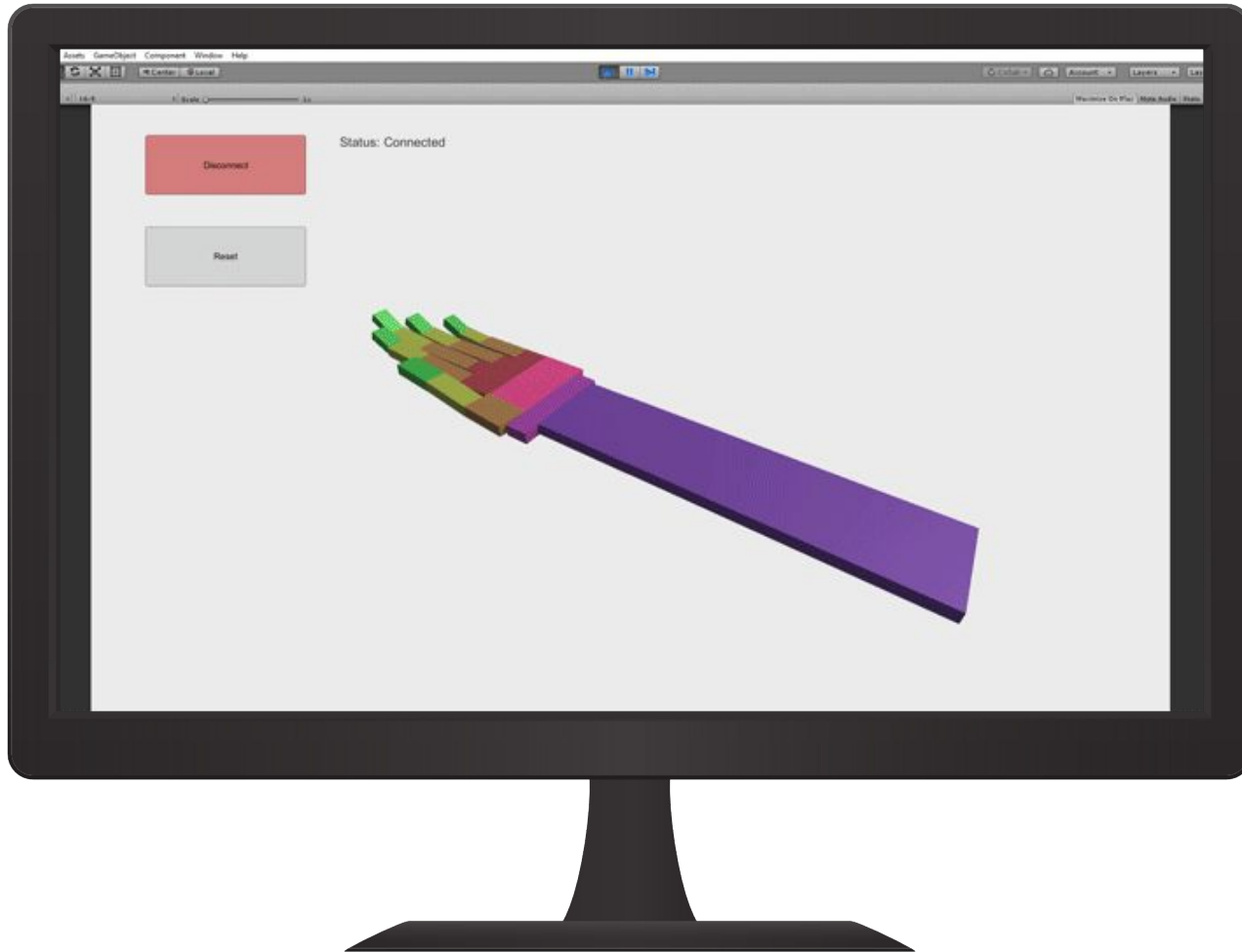
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# Demo

## Unity



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# Finances

Description	Manufacturer	Manufacturer Part Number	Vendor	Vendor Part Number	Type	Units/Board	Unit Price	Price
Bluetooth Header	4UCON Technology Inc	-	Sparkfun	PRT-08272	Through Hole	2	\$1.00	\$2.00
1X03	GCT	SP-140520-03-001	Sparkfun	PRT-13875	Through Hole	6	\$0.50	\$3.00
1X04	Sullins Connector Solutions	PPTC041LFBN-RC	Digi-key	S7002-ND	Through Hole	7	\$0.43	\$3.01
2X8	Sullins Connector Solutions	PPTC082LFBN-RC	Digi-key	S7076-ND	Through Hole	4	\$1.02	\$4.08
JTAG	Harwin	M50-3500542	Mouser	855-M50-3500542	Through Hole	1	\$1.18	\$1.18
3V3 Voltage Regulator	Texas Instruments	LM1084ISX-3.3/NOPB	Digi-Key	296-35390-1-ND	Through Hole	2	\$2.73	\$5.46
uController	NXP Semiconductors	LPC4088FET208,551	Digi-Key	568-9832-ND	BGA	1	\$11.49	\$11.49
20 MHz Crystal	TXC Corporation	7B-20.000MEEQ-T	Digi-Key	887-1303-1-ND	SMT	1	\$1.14	\$1.14
32.768 kHz Crystal	Citizen Finedevice Co Ltd	CM315D32768EZFT	Digi-Key	300-8816-1-ND	SMT	1	\$0.80	\$0.80
8 channel - 8 bit ADC	Texas Instruments	TLC0838IDW	Digi-Key	296-2867-5-ND	SMT	4	\$3.15	\$12.60
Reset Button	C&K	PTS645SK43SMTR92 LFS	Digi-Key	CKN9084CT-ND	SMT	1	\$0.25	\$0.25
Other Buttons	sparkfun	COM-08229	Sparkfun	COM-08229	SMT	6	\$0.10	\$0.60
On/Off Switch	sparkfun	COM-00102	Sparkfun	COM-00102	SMT	1	\$1.50	\$1.50
RED LED	Kingbright	APT2012SURCK	Digi-Key	754-1133-1-ND	SMT	31	\$0.16	\$4.96
RG LED	Lite-On Inc.	LTST-C195KGJRKT	Digi-Key	160-1452-1-ND	SMT	1	\$0.50	\$0.50
Motor Controller	Texas Instruments	DRV2605LDGST	Digi-Key	296-38481-1-ND	SMT	10	\$4.30	\$43.00
Flex Sensors	Spectra Symbol		Digi-Key			18	\$7.95	\$143.10
PCB	Sunstone					1	\$300	\$300.00
Assembly	Laritech					1	\$300	\$300.00
Misc (wires, gloves, thread)						1	\$50	\$50.00
<b>Total Price</b>								<b>\$888.67</b>

Prototype cost per glove: \$888.67

Mass Production cost per glove: <\$80.14

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# Conclusion

- Future Direction
  - New 3D-printed board rails
  - Different physical materials
  - More sensors
    - Optical
    - Heart rate
  - Integrate physical tracking with commercial VR headsets
  - Medical applications
- Reihlo
  - Datasheet
  - Website
  - Github
  - Open Source



[github.com/reihlo](https://github.com/reihlo)  
[reihlo.com](https://reihlo.com)

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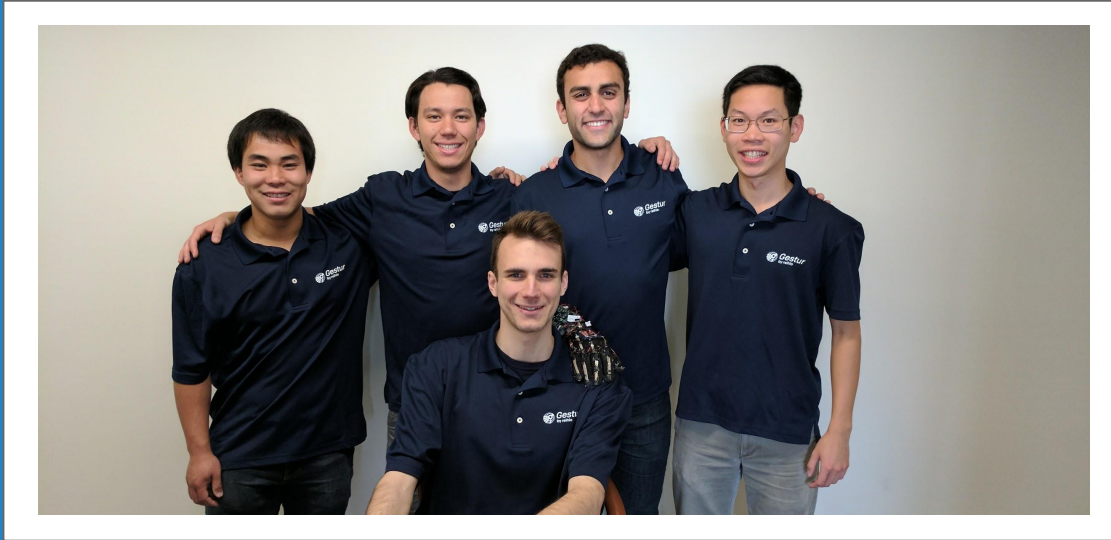
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# Thank you!

John Johnson & Yoga Isukapalli  
Caio Motta, Celeste Bean, Will Miller, Forrest Brewer & Yon Visell  
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