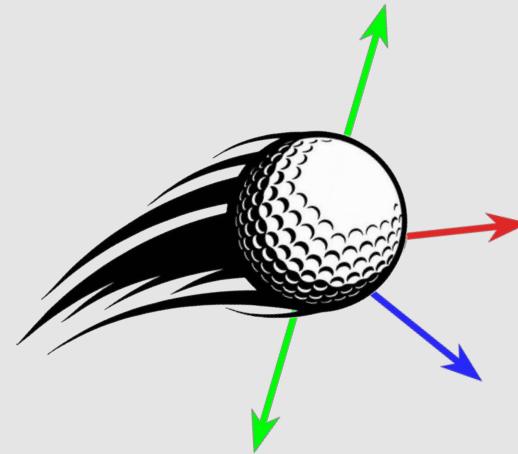
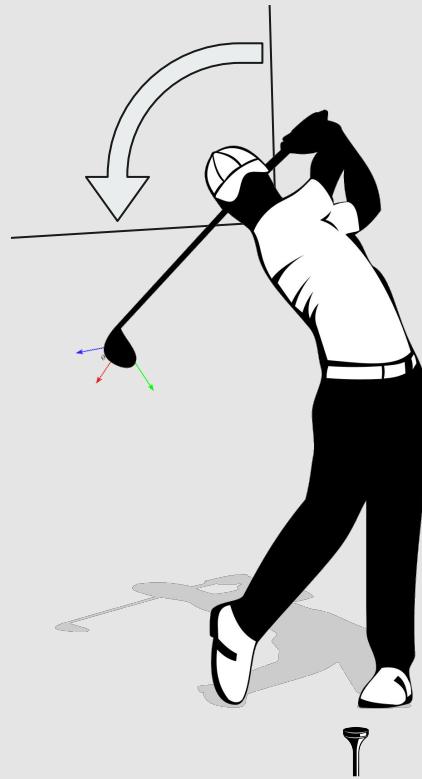




MISSISSIPPI STATE
UNIVERSITY™

Golf Glove



Team



Christian Bush
Computer Engineering
Software



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Firmware



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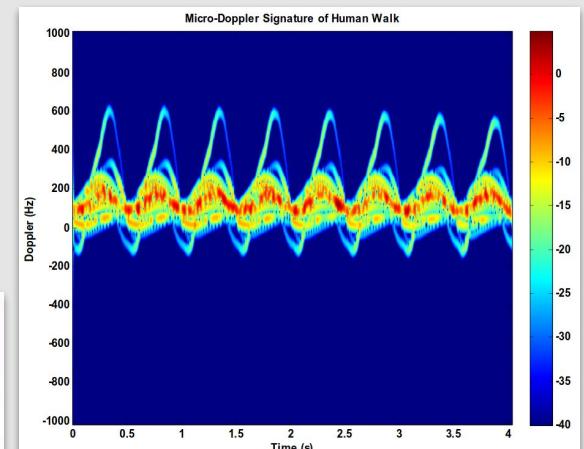
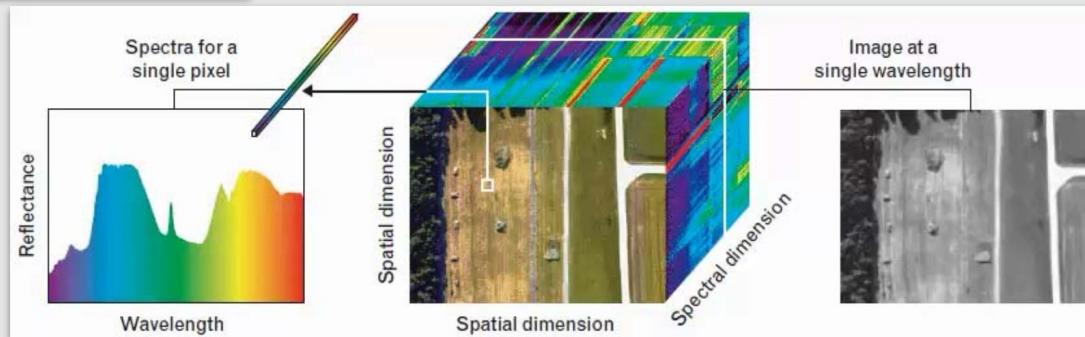
Advisor



Dr. John E. Ball

PhD, Electrical Engineering, Mississippi State University, 2007
MS, Electrical Engineering, Georgia Institute of Technology, 1993

- Radar Systems
- Digital Signal Processing
- Digital Image Processing
- Remote Sensing
- Automated Target Detection



[1]



Presentation Outline

Problem Statement

System Overview

Design Constraints

Approach

Progress

Timeline

Problem Statement



Amateur Golf
failures [2]



Modern golf coaching
technology [3]



Next-generation
coaching application [4]

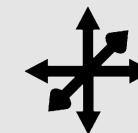


Product Specs

Controlled by app



Wireless
Communication



Accelerometer
Magnetometer



Gyroscope

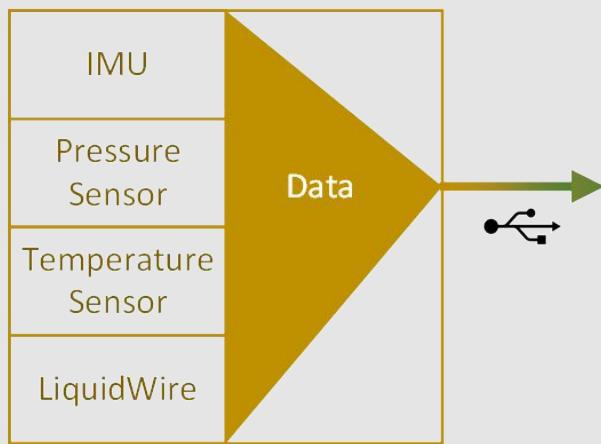


5-Hour Battery Life
Rechargeable

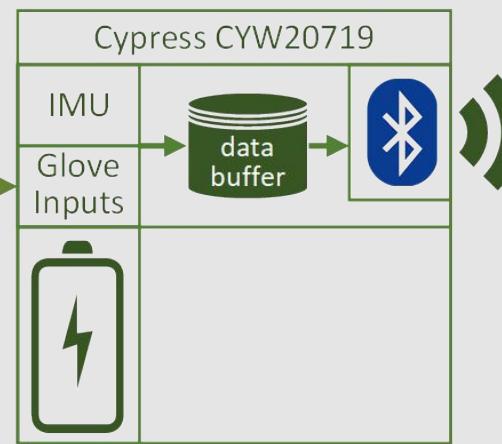
[5]

System Overview

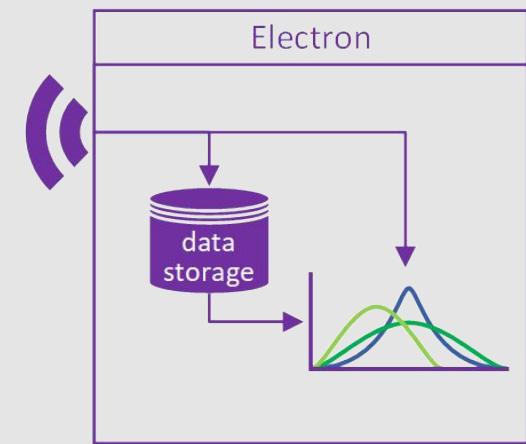
Glove



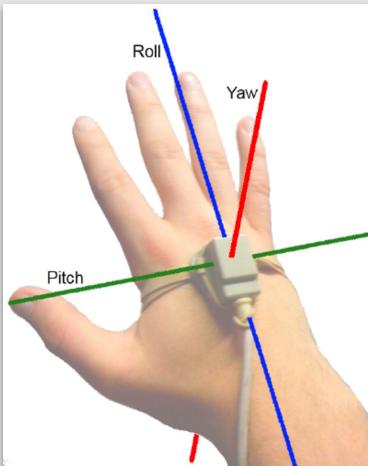
Wrist Controller



Coaching Application



Design Constraints - Technical



Accurate Orientation [6]

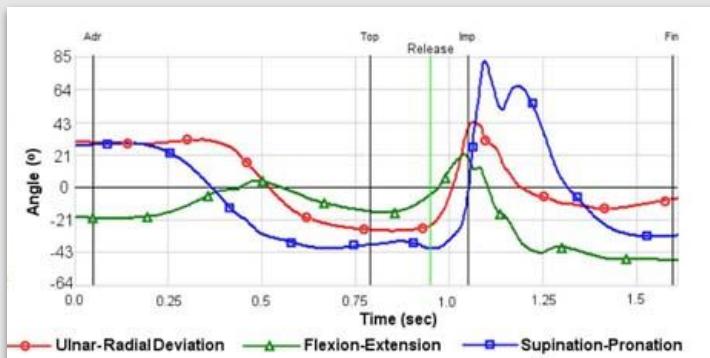


Wireless Communication [7]



Comfortable and Unobtrusive [8]

Design Constraints - Technical



Intuitive Display [9]



Portable [10]

Design Constraints - Practical



Cost [11]



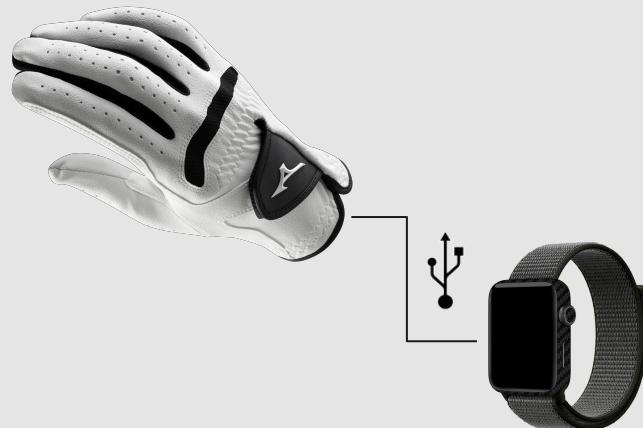
Swing Form



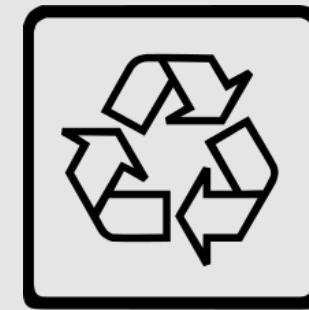
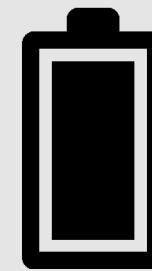
Weather-resistant
[12]



Design Constraints - Practical



Modular/Replaceable parts [13]



5 Hour Battery Life, Rechargeable

Design Constraints - Engineering Standards



Ingress Protection
Level 54 [14]



ICNIRP RF
Emissions [15]



Reduction of Hazardous
Substances [16]

Approach: Hardware



LiquidWire Linear Soft Robotic Sensors [17]

Approach: Linear Pressure Sensor

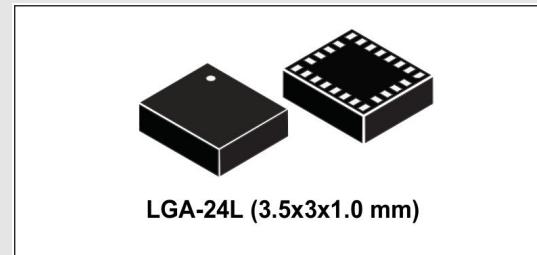
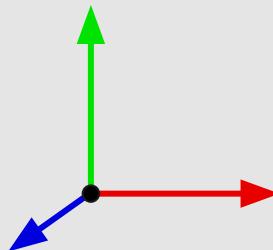


[18]

Name	Diameter (mm) ★	Price (USD)	Resistance Range (Ohms)	Interface/Communication
Interlink 40X	<15	7	Infinite-250	Analog
Velostat Conductive Sheet	Custom	3.95	Variable	Analog

Approach: Inertial Measurement Unit (IMU)

IMU	Cost (USD) ★	Power Draw (mA)	Accelerometer/Gyroscope ★	Magnetometer	Interface ★
STM LSM9DS1 [21]	\$ 6.14	4.6	±16g linear acceleration, ±2000dps angular rate	±16 gauss	I ² C / SPI
Bosch BMX055 [22]	\$ 7.02	0.13	±16g linear acceleration, ±2000dps angular rate	±2500 uT	I ² C / SPI



[23]

Approach: Microcontroller



CYW920719Q40EVB-01
Evaluation Board [19]

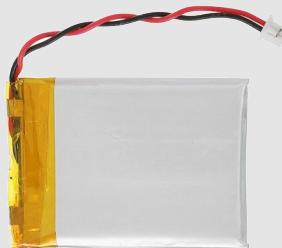
Microcontroller	Cost (USD)	Wireless Connectivity	Power Draw (mA)	Flash Memory (kB)	ADC
Cypress CYW20719	\$ 9.63	BR/EDR/BLE Bluetooth 5.0 @ 2 Mbps	10 mA	1024	1x28-channel, 10-bit, 3.6 kspS
Microchip IS1871	\$ 2.98	BLE Bluetooth 5.0	8 mA	256	1x6-channel



[20]

Approach: Battery

Component (Battery)	Price (USD)	Capacity (mAh) 	Output Voltage (V) 	Form Factor 	Chemical Composition	Rechargeable 
LP503035	1.00	500	3.7	Pouch Cell	Li-Ion Polymer	Yes
UxCell AAA	1.64	500	1.2	AAA Cylinder	Ni-MH	Yes
Duracell AAA	0.55	541	1.5	AAA Cylinder	Alkaline	No
Panasonic CR3032	2.45	500	3.0	Coin Cell	Lithium	No



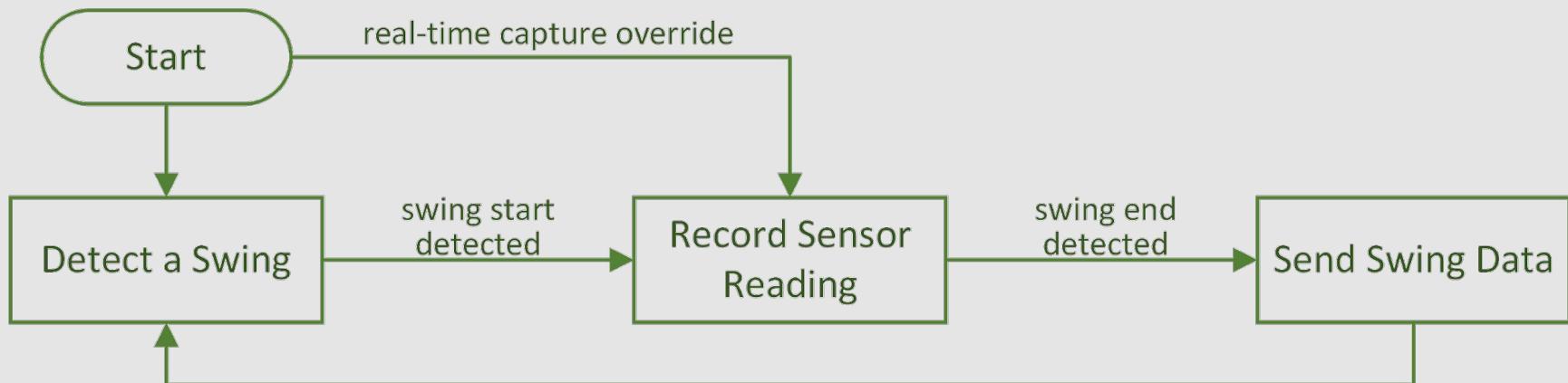
500mAh 3.7V
Li-Po Cell [24]

Total Power Usage:

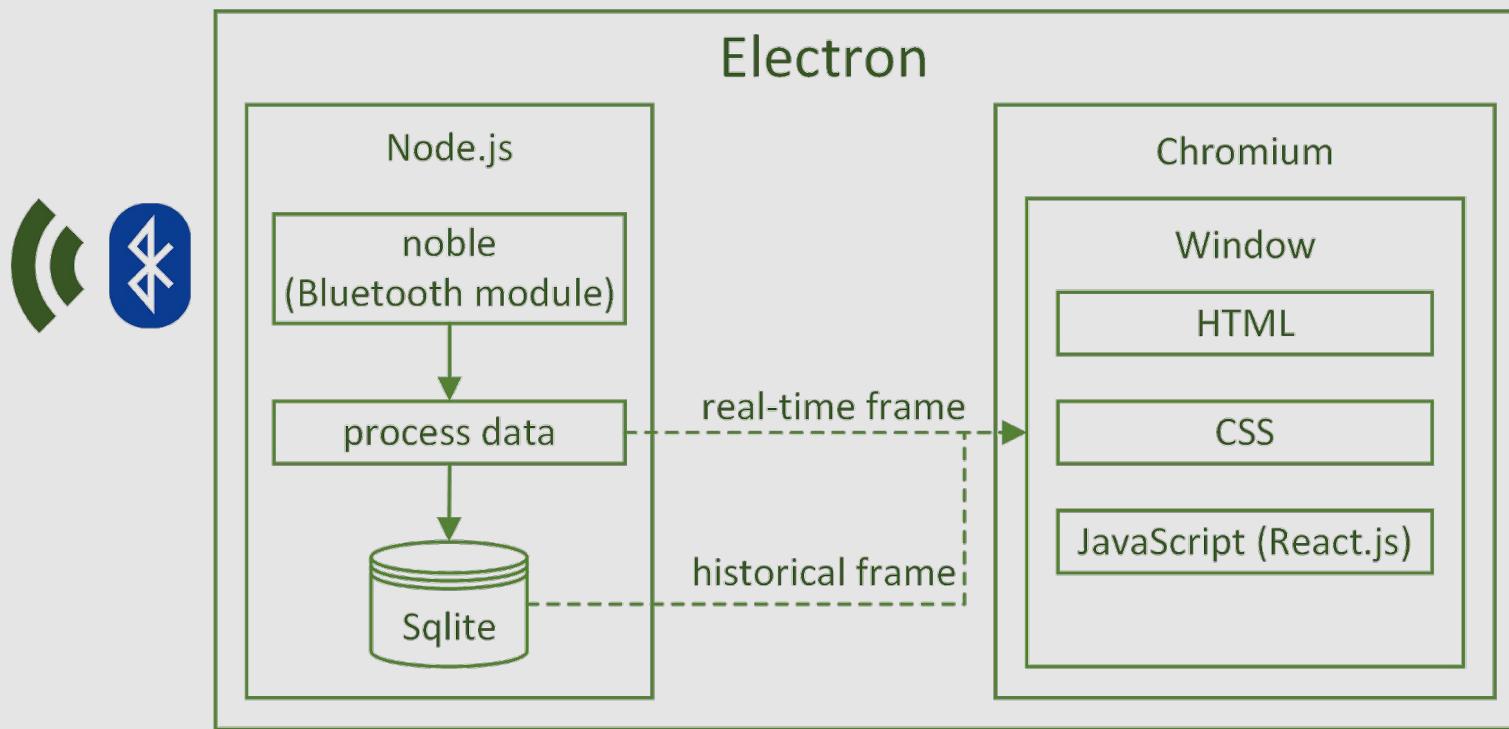
$$(I/O \text{ pins}) + (\text{Radio}) + (\text{IMUs}) =$$

$$320\text{mAh} + 57.5\text{mAh} + 46\text{mAh} + .03\text{mAh} = 423.53\text{mAh}$$

Approach: Firmware

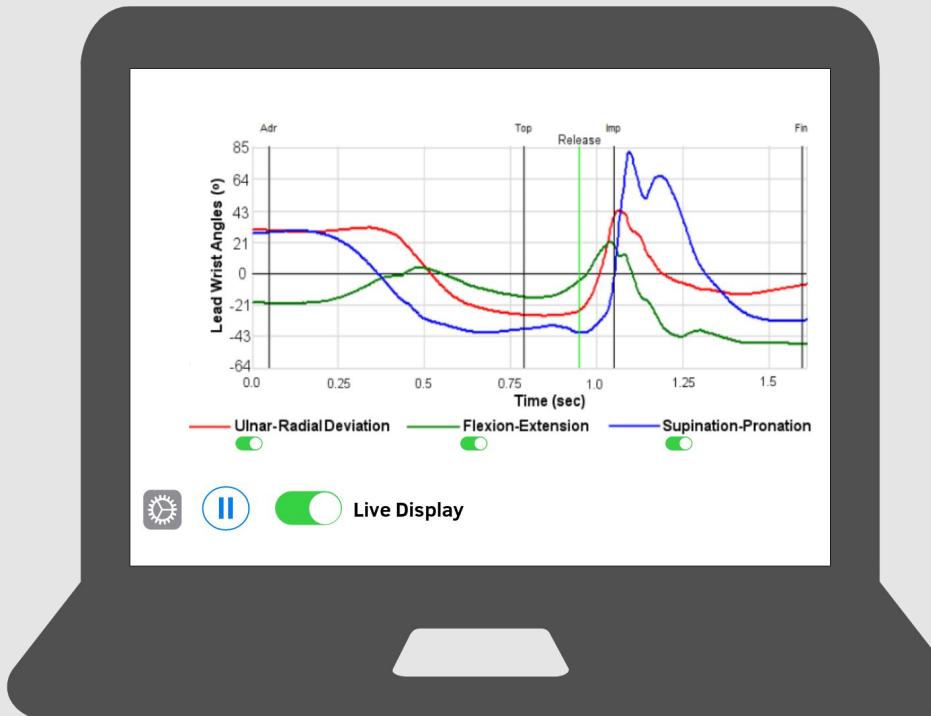


Approach: Coaching Software





Approach: Front End



Progress

status acquired

Garment

status acquired

Pressure Sensor, IMU, Microcontroller

status acquired

LiquidWire Sensors

status in progress

Firmware Development

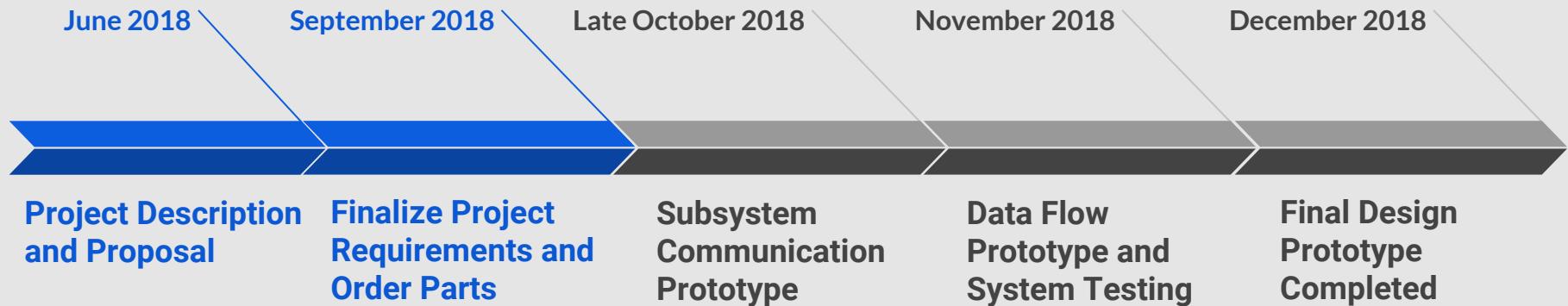
status in progress

Software Development





Timeline



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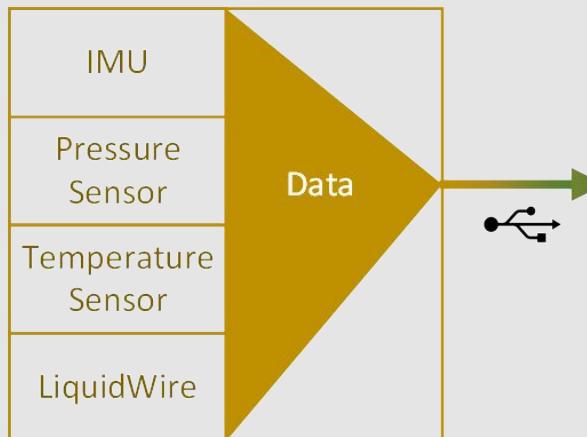


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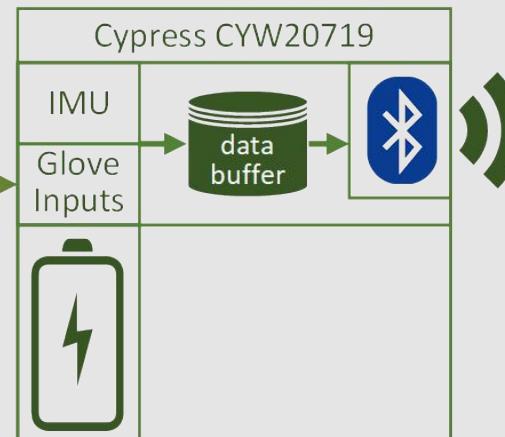
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System Overview

Glove



Wrist Controller



Coaching Application

