



# Instrumented Baseball

David Adams | Mathew Brown | Riley Ferrer | Yanni Giannareas | Charles Whitaker

# Meet Team 516



David Adams

*Design  
Engineer*



Mathew Brown

*Mechatronics  
Engineer*



Riley Ferrer

*Manufacturing  
Engineer*



Yanni Giannareas

*Systems  
Engineer*



Charles Whitaker

*Test Engineer*

Charles Whitaker

# Sponsor and Advisor



Dr. William Oates, P.E.

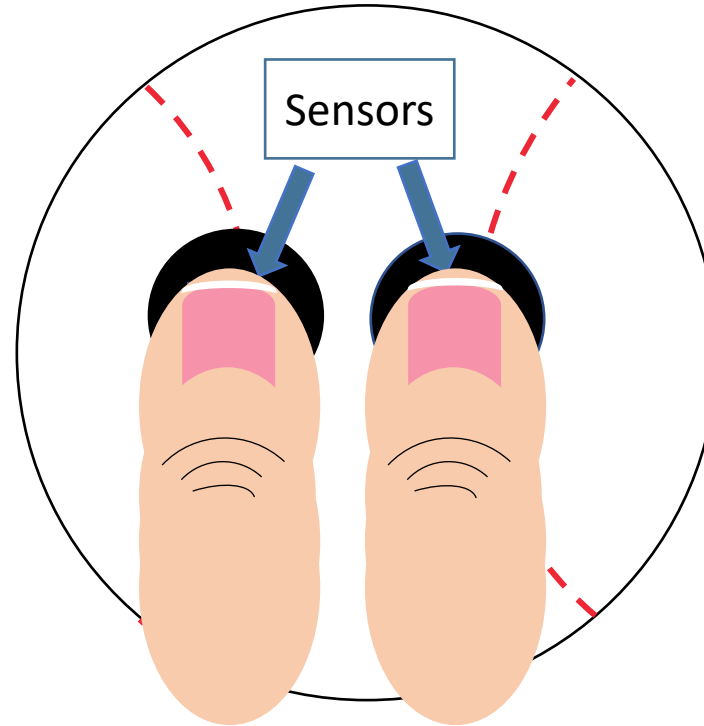
*FAMU-FSU  
College of Engineering*

Charles Whitaker

# Project Objective



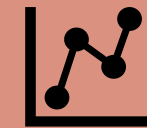
Develop technology to measure dynamic fingertip forces on a baseball



Develop accurate method of measurement



Maintain the original characteristics of a ball



Facilitate access to the gathered data

Charles Whitaker

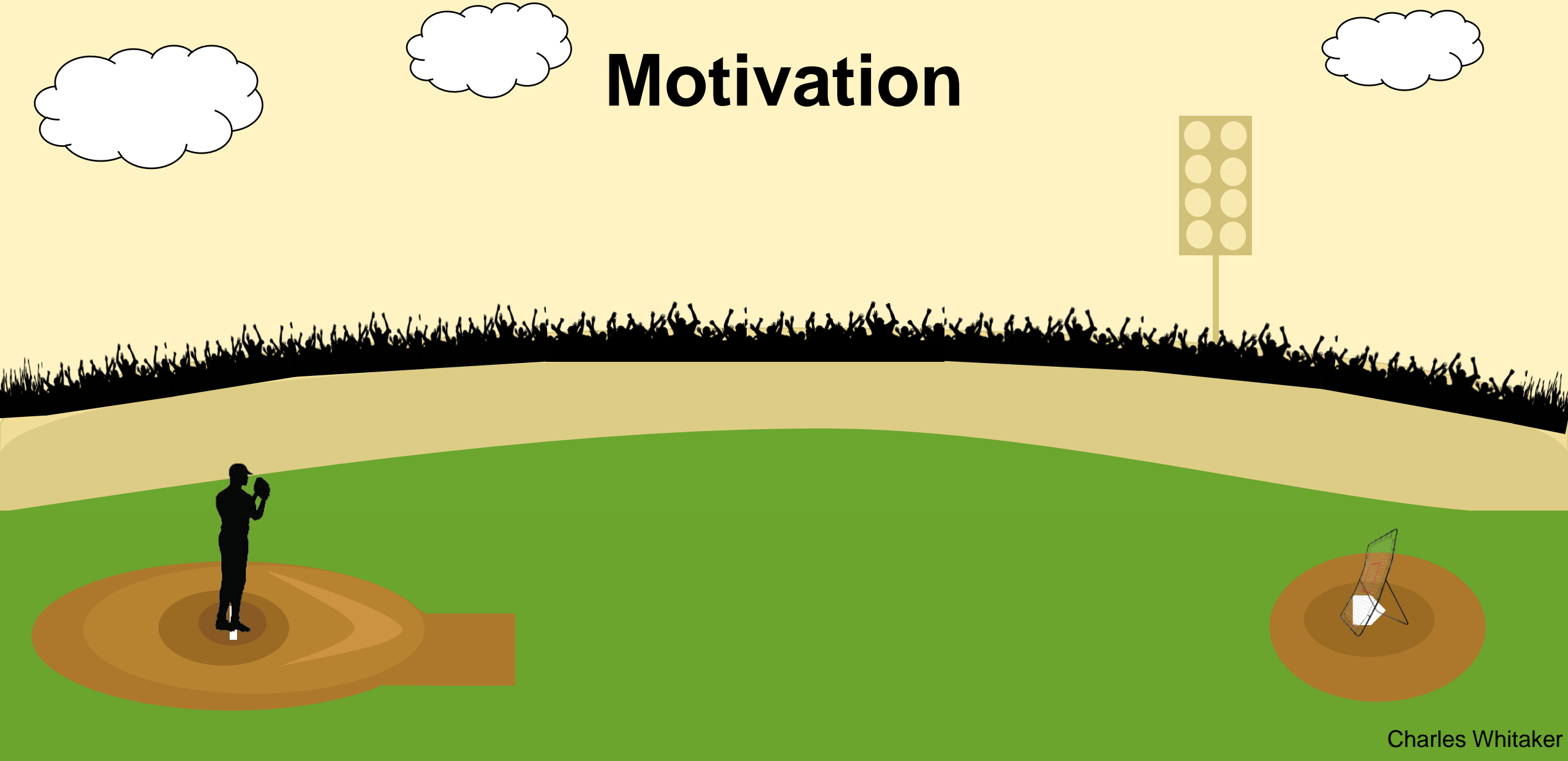
# Background



Your goal shouldn't be to buy players. Your goal should be to buy wins. In order to buy wins, you need to buy runs.  
- Michael Lewis, *Moneyball*

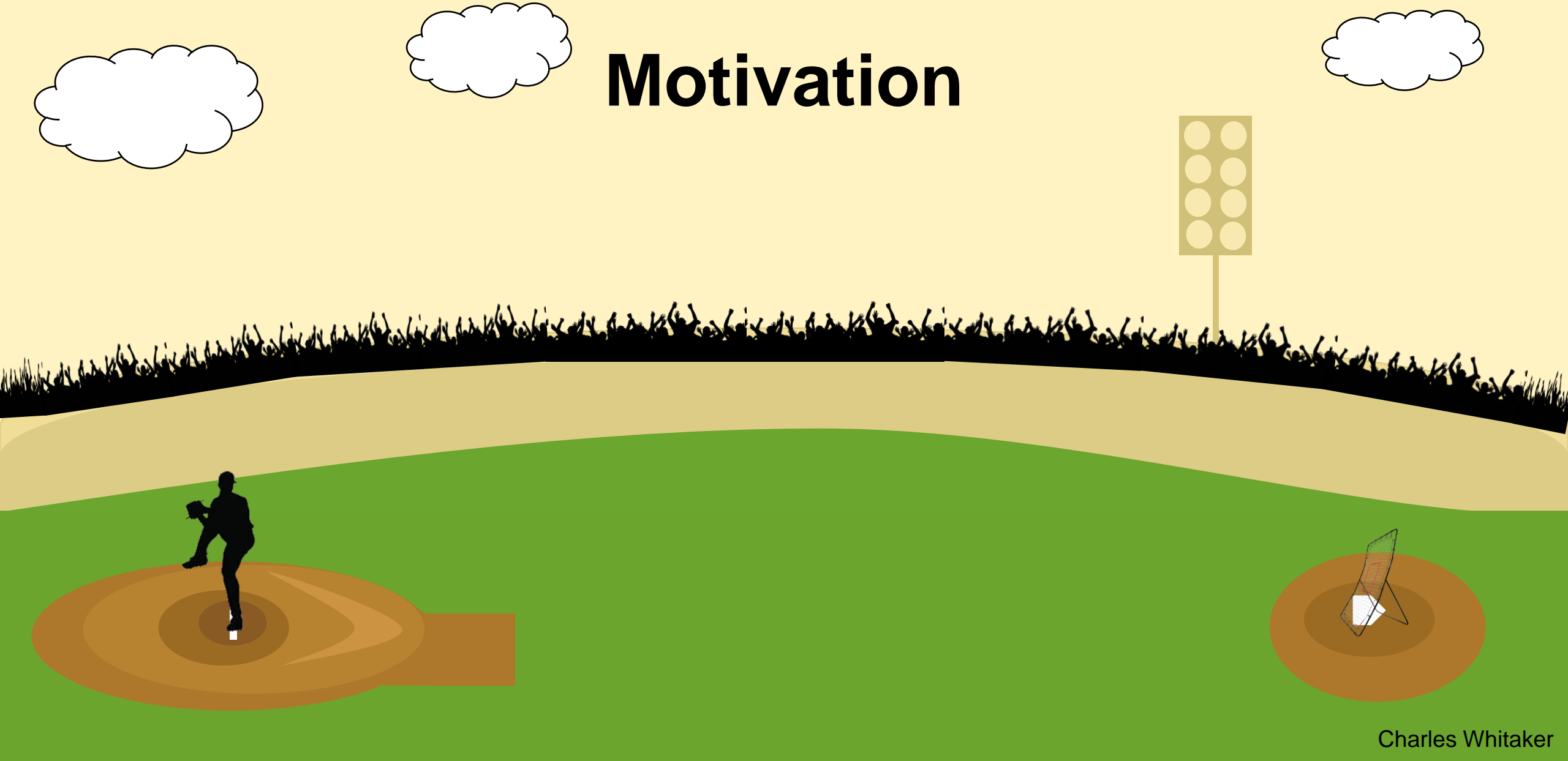
Charles Whitaker

# Motivation



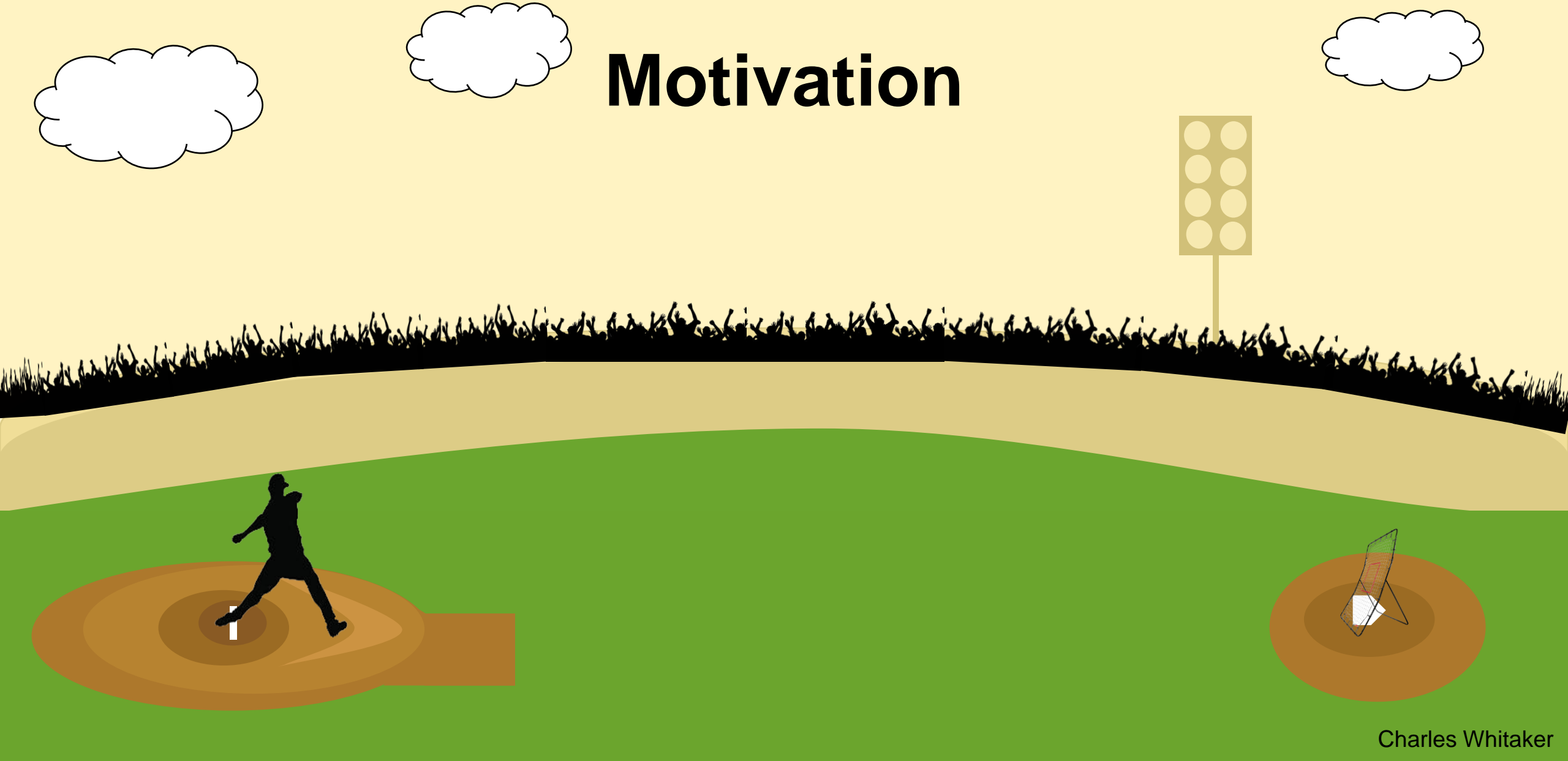
Charles Whitaker

# Motivation



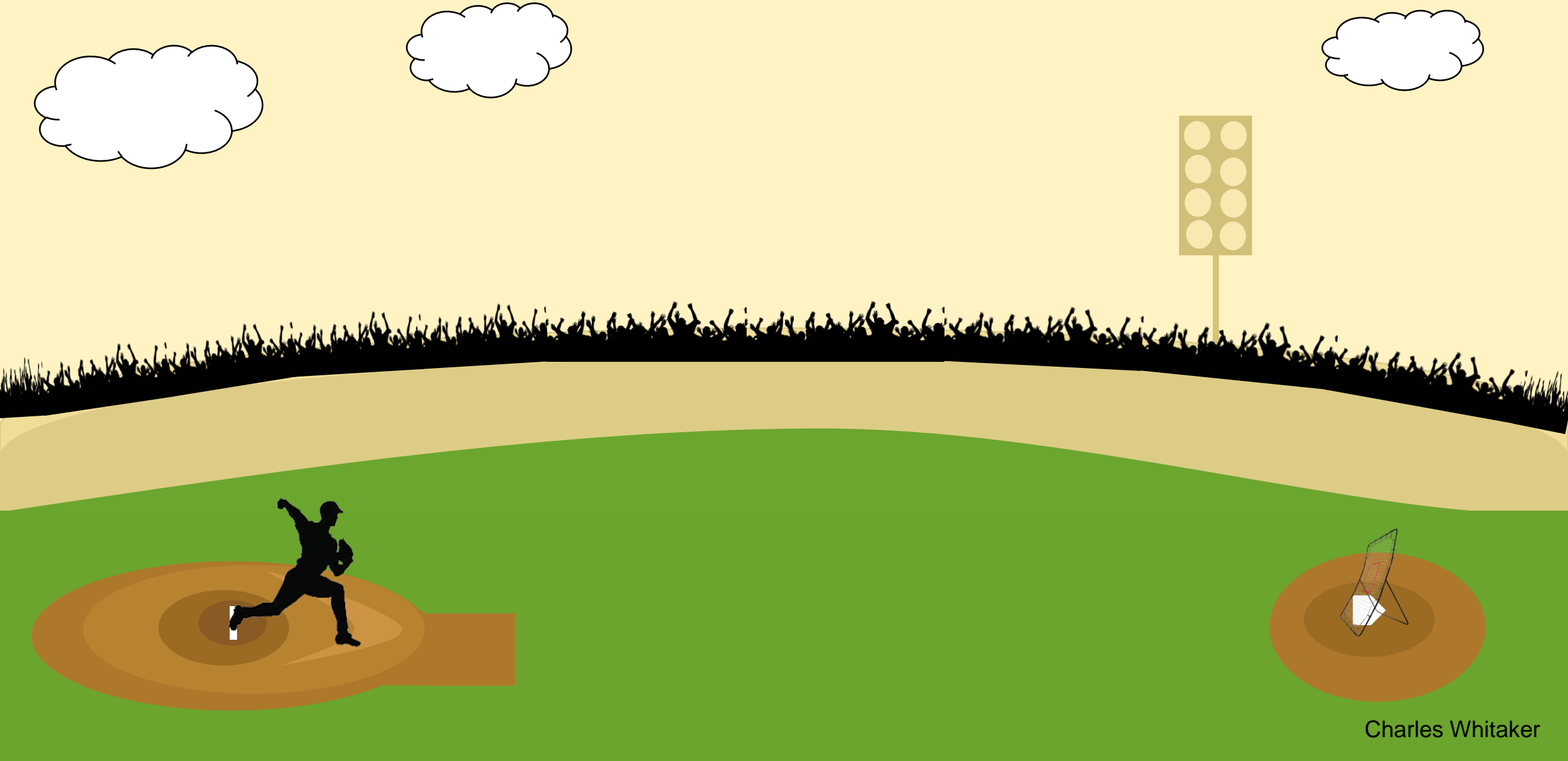
Charles Whitaker

# Motivation



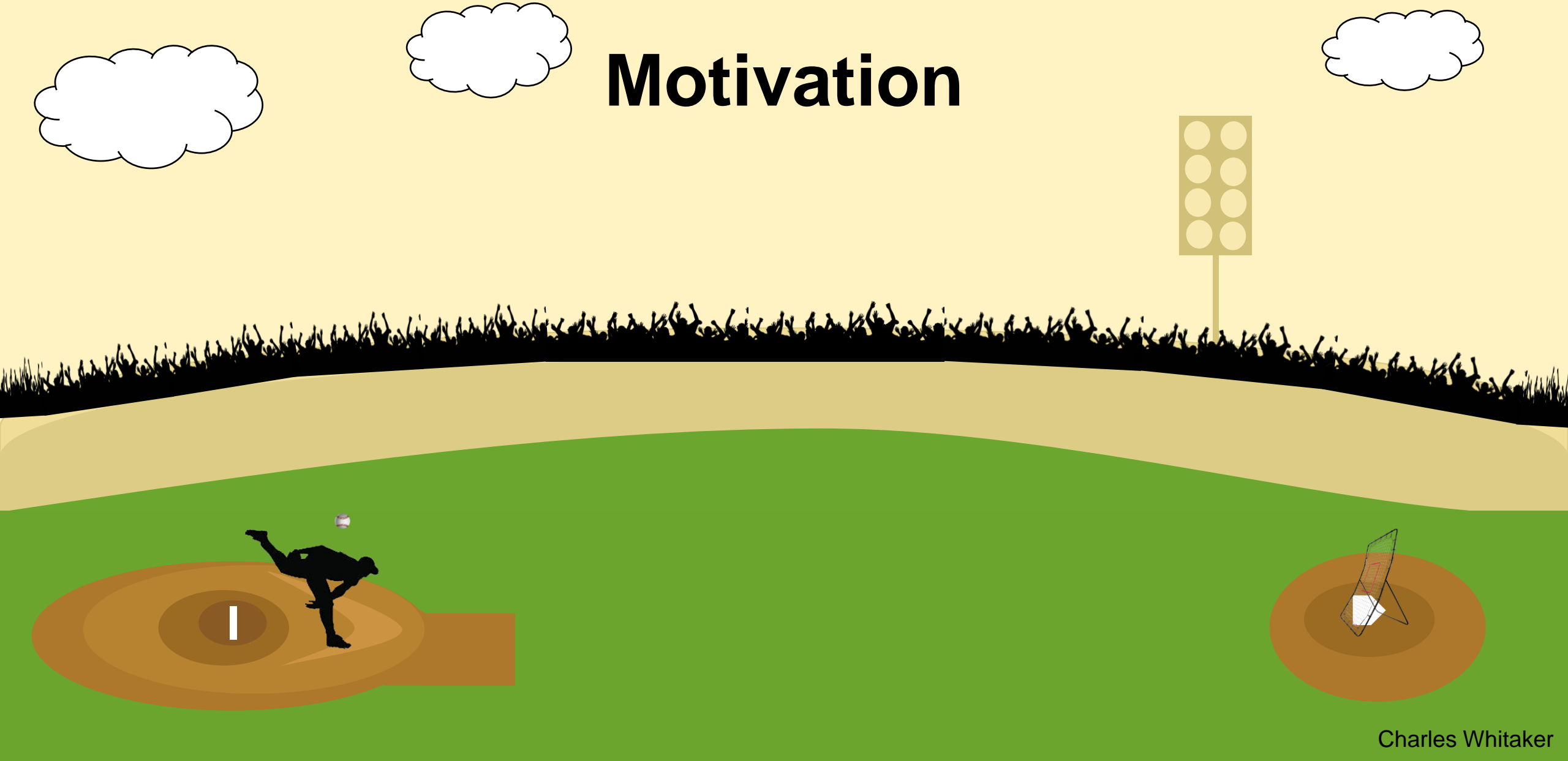
Charles Whitaker





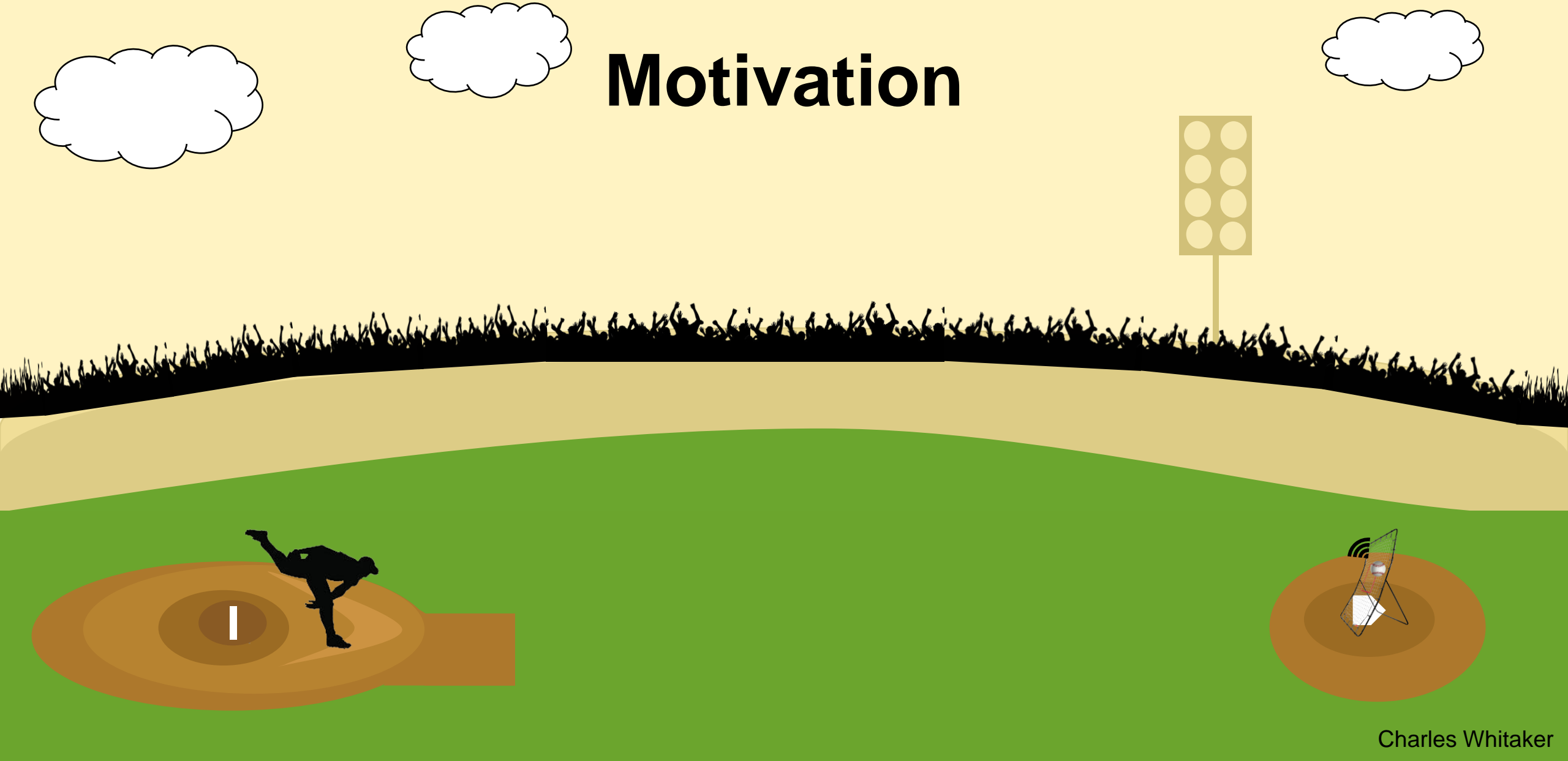
Charles Whitaker

# Motivation



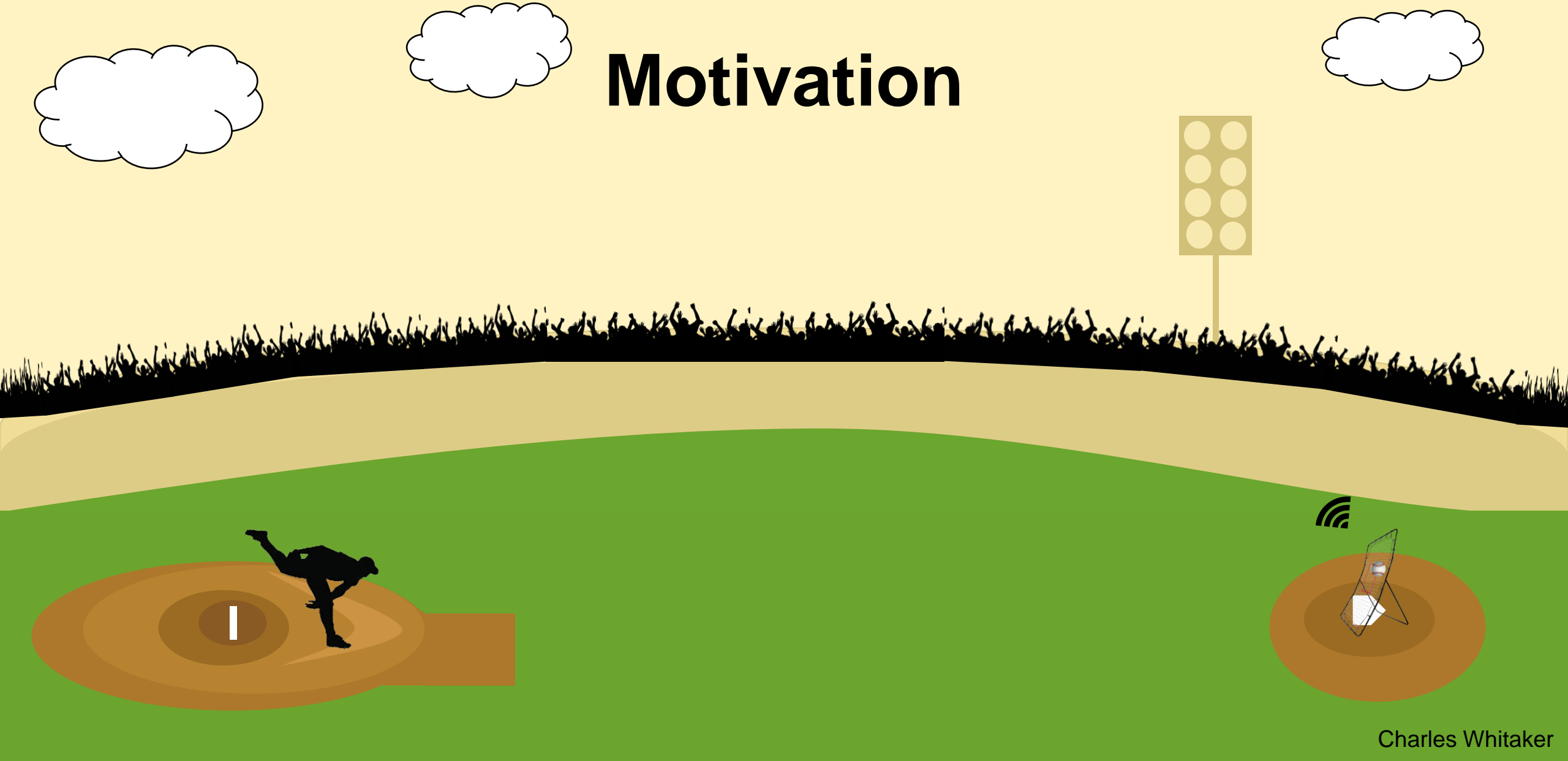
Charles Whitaker

# Motivation



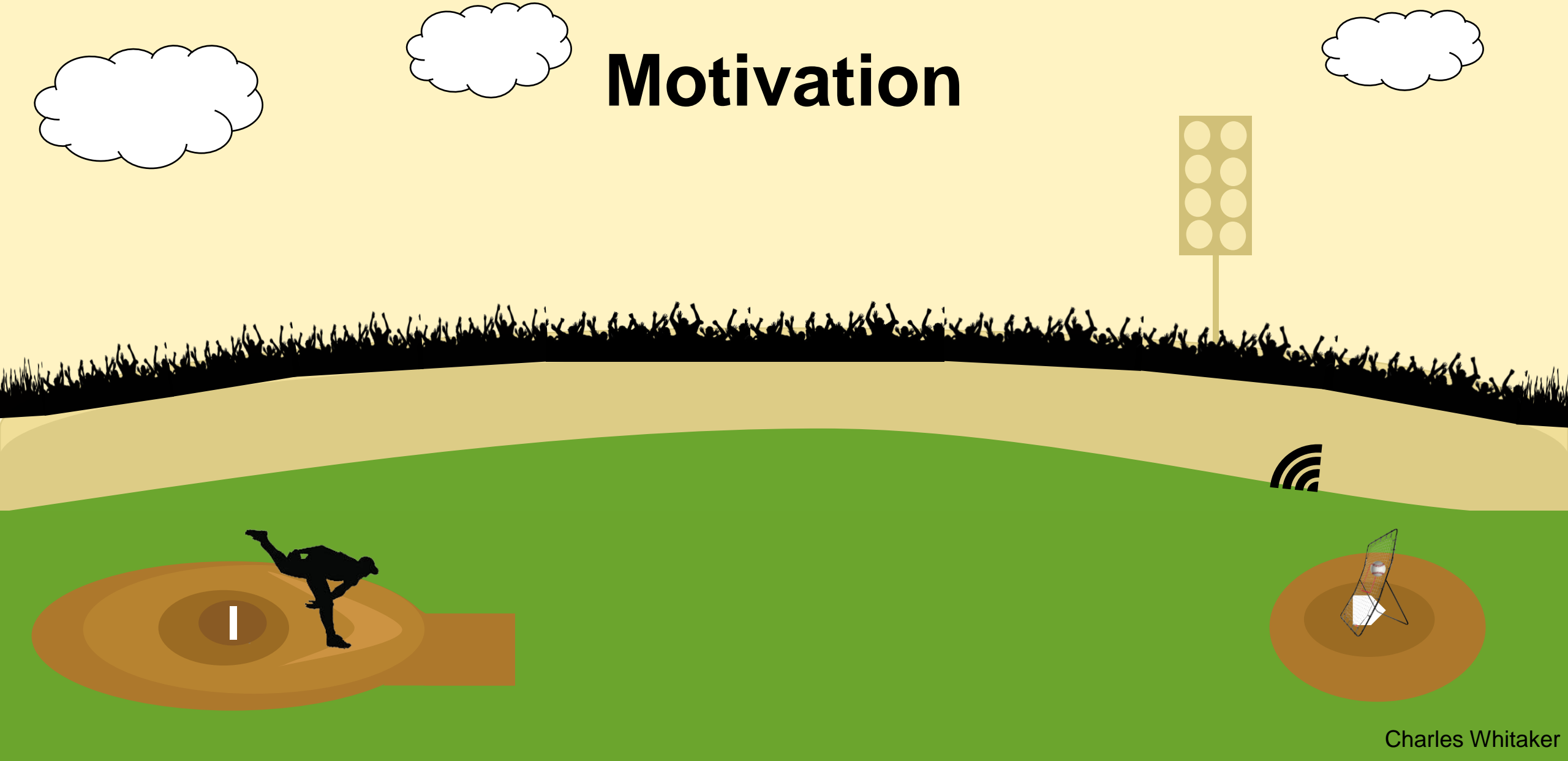
Charles Whitaker

# Motivation



Charles Whitaker

# Motivation



Charles Whitaker

# Motivation



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# Motivation



Charles Whitaker

# Motivation



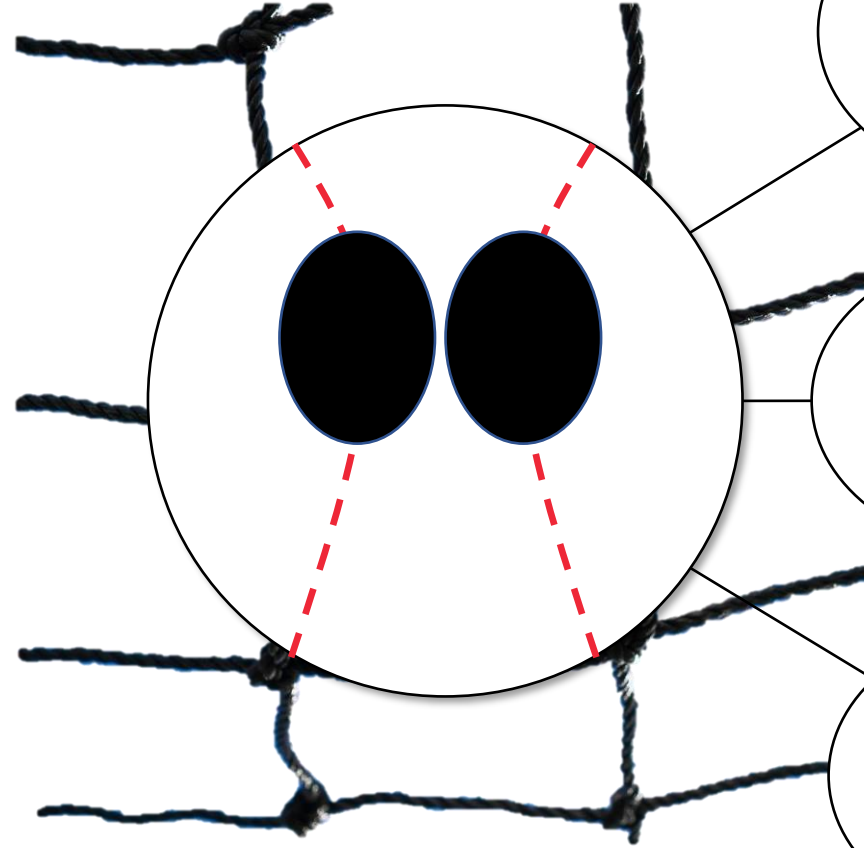
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# Motivation



# Assumptions



Ball is safely caught after the throw by a net.

Ball is thrown in a specific position.

Device can be used to read the data.

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# Customer Needs

The device can be charged repeatedly.

The device doesn't interfere with the pitcher.

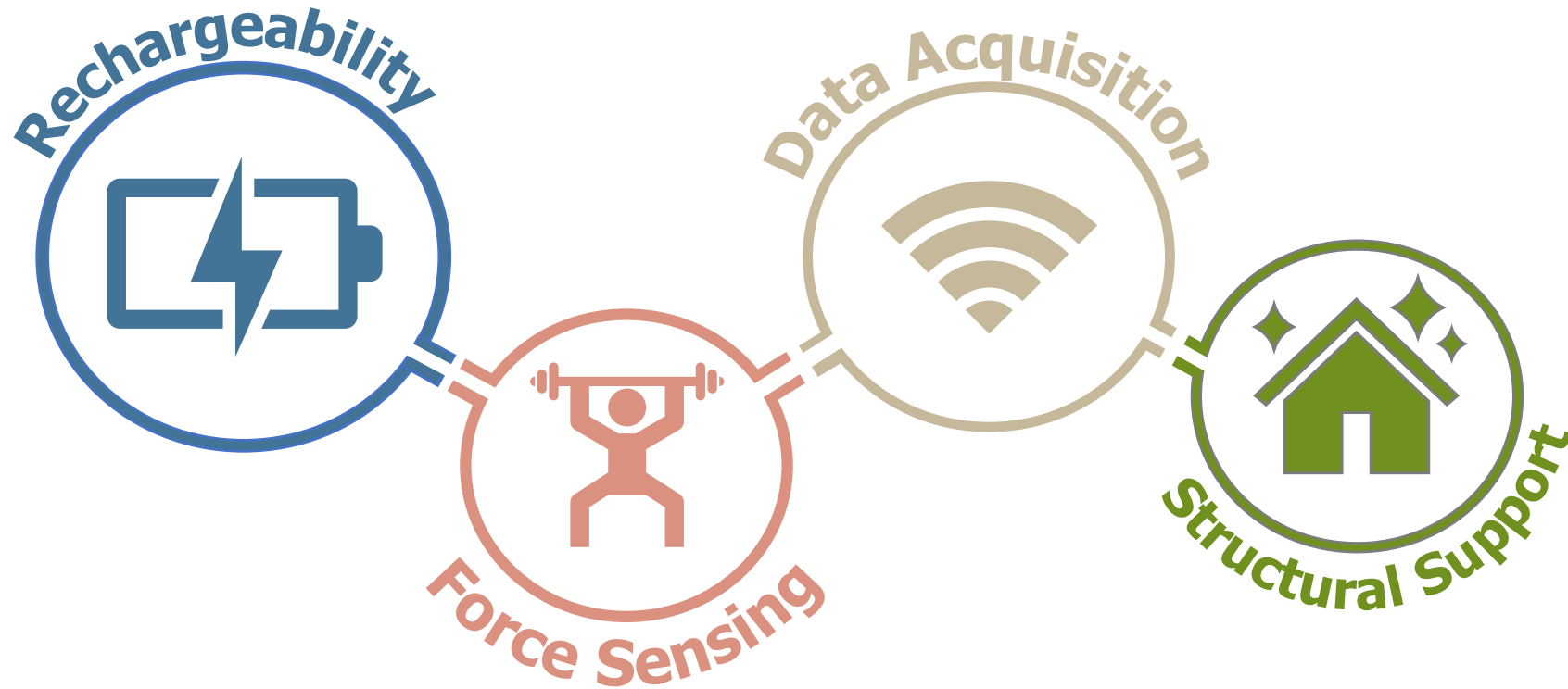
Device is tailored to detect forces on the index and middle fingers.

The device captures pressure and shear forces.

Device is tailored to a 4-seam style.

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# Functional Decomposition



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# Functional Decomposition



Contains  
supplied  
voltage



Transforms  
signals from  
analog to  
digital

Plot time-  
dependent  
data



Senses  
applied load

Isolates  
region for  
fingertip  
application



Match  
moment of  
inertia close  
to standard

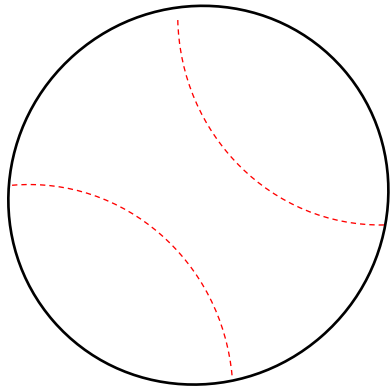
Lock  
components  
in place

Supports  
weight of  
components

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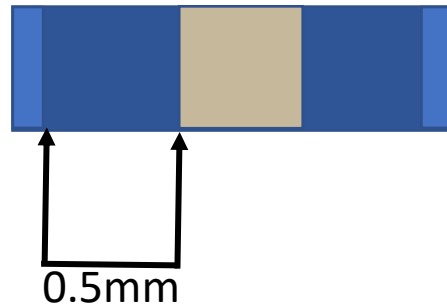
# Targets And Metrics

Standard Moment of Inertia

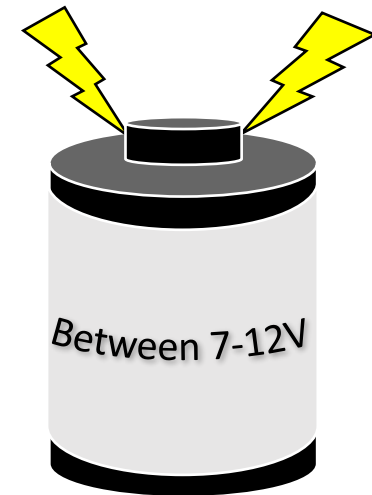


$81.56 \pm 5\% \text{ kg}\cdot\text{mm}^2$

Component Movement



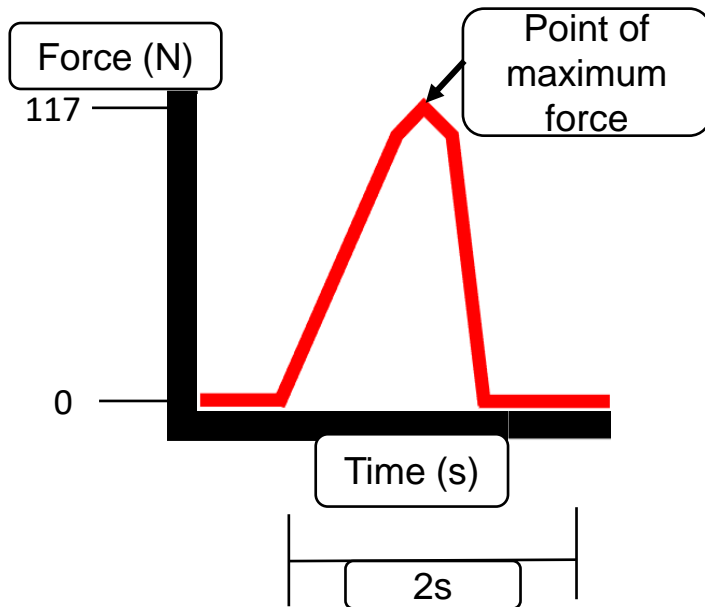
Supplied Voltage



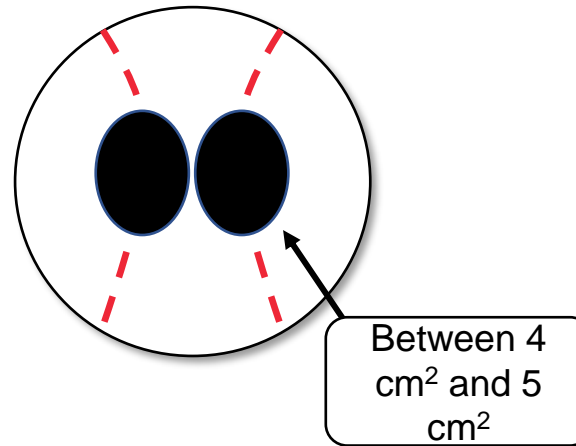
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# Targets And Metrics

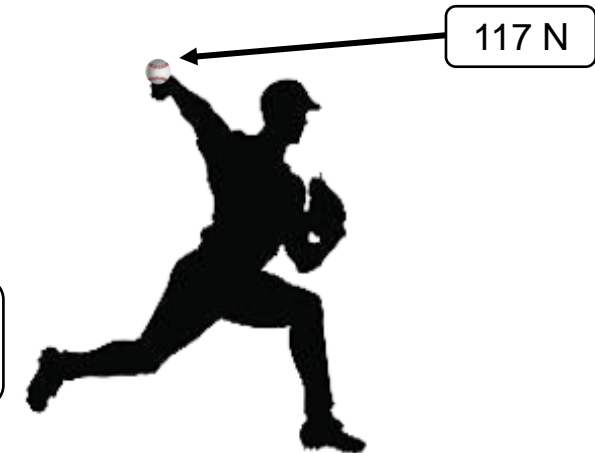
Plot time-dependent data



Region for index and middle finger application



Senses applied load



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Piezo  
Sensors

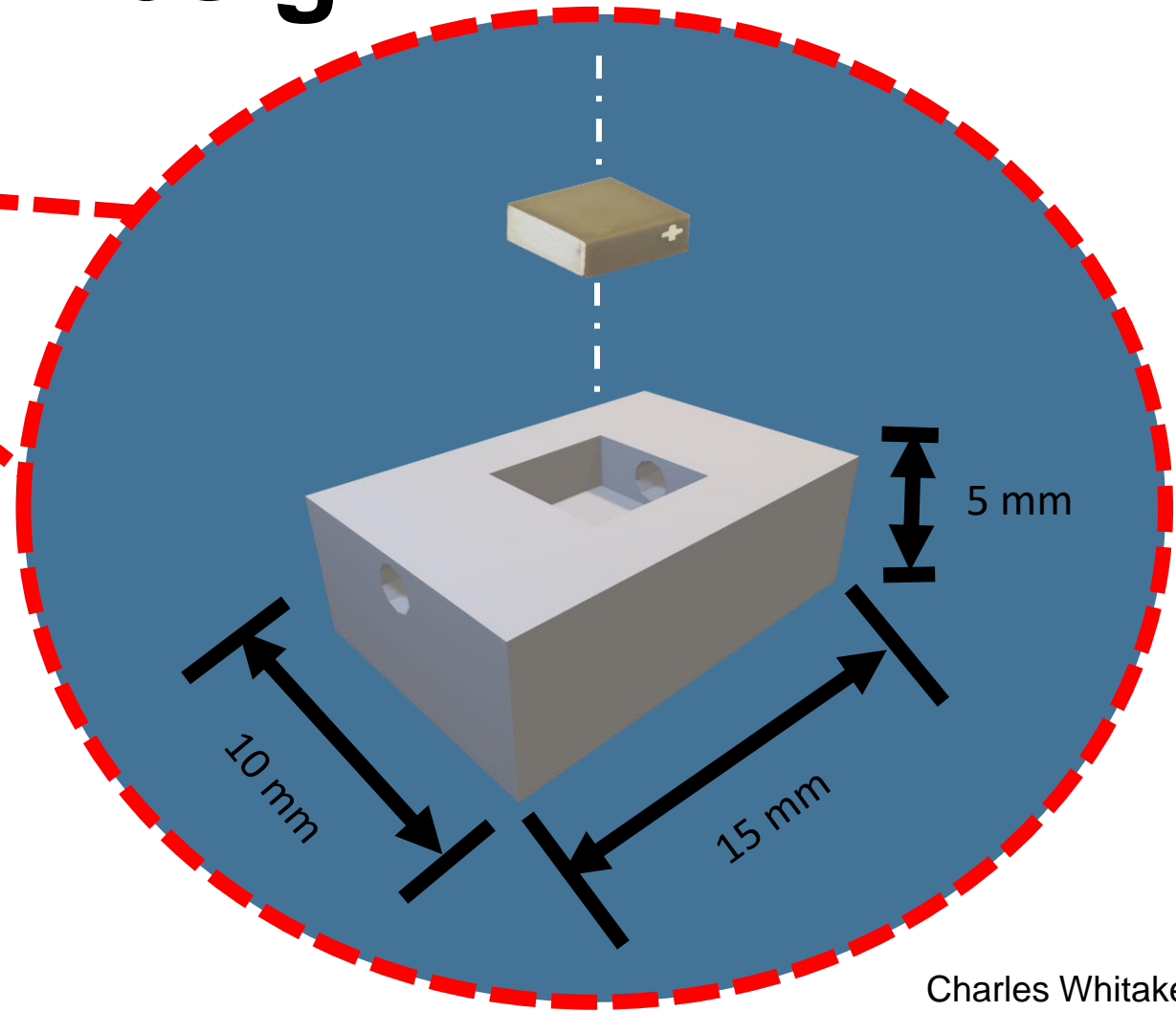
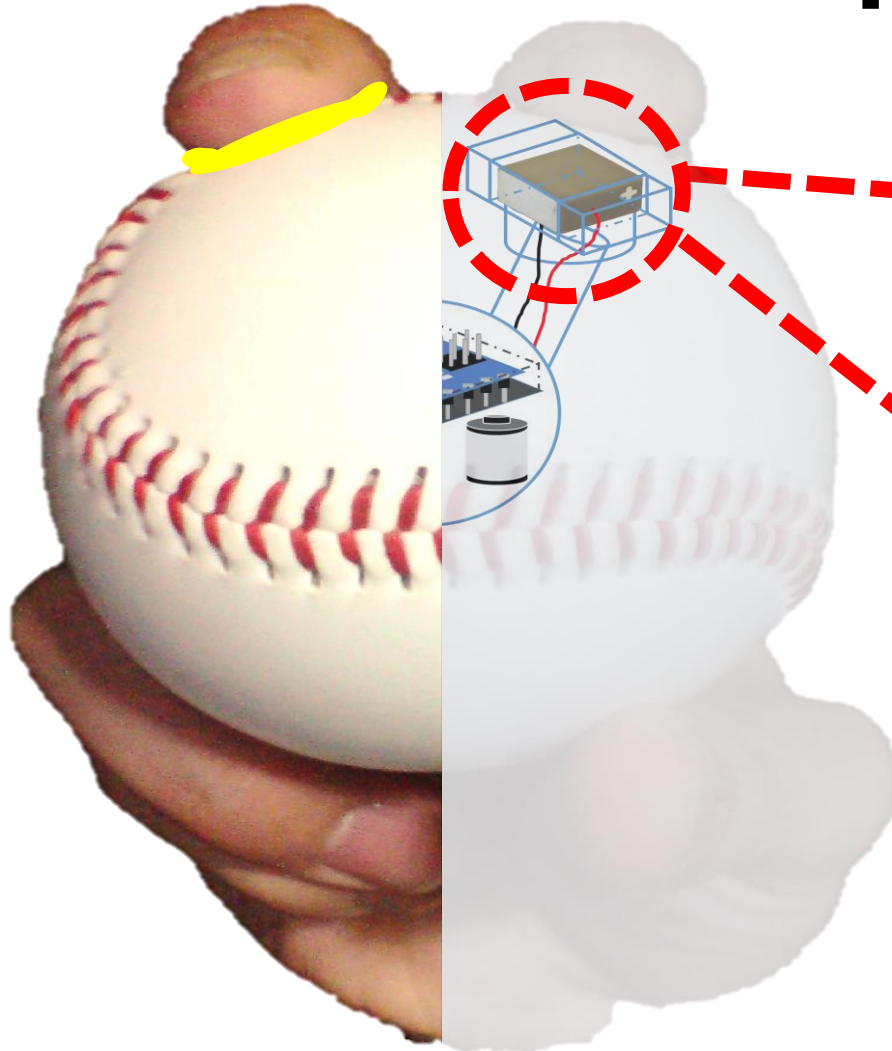
# Concept Design

3D Printed  
Housing

Arduino  
Blue  
Nano

Lithium-  
ion Battery

Indications



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# Concept Design

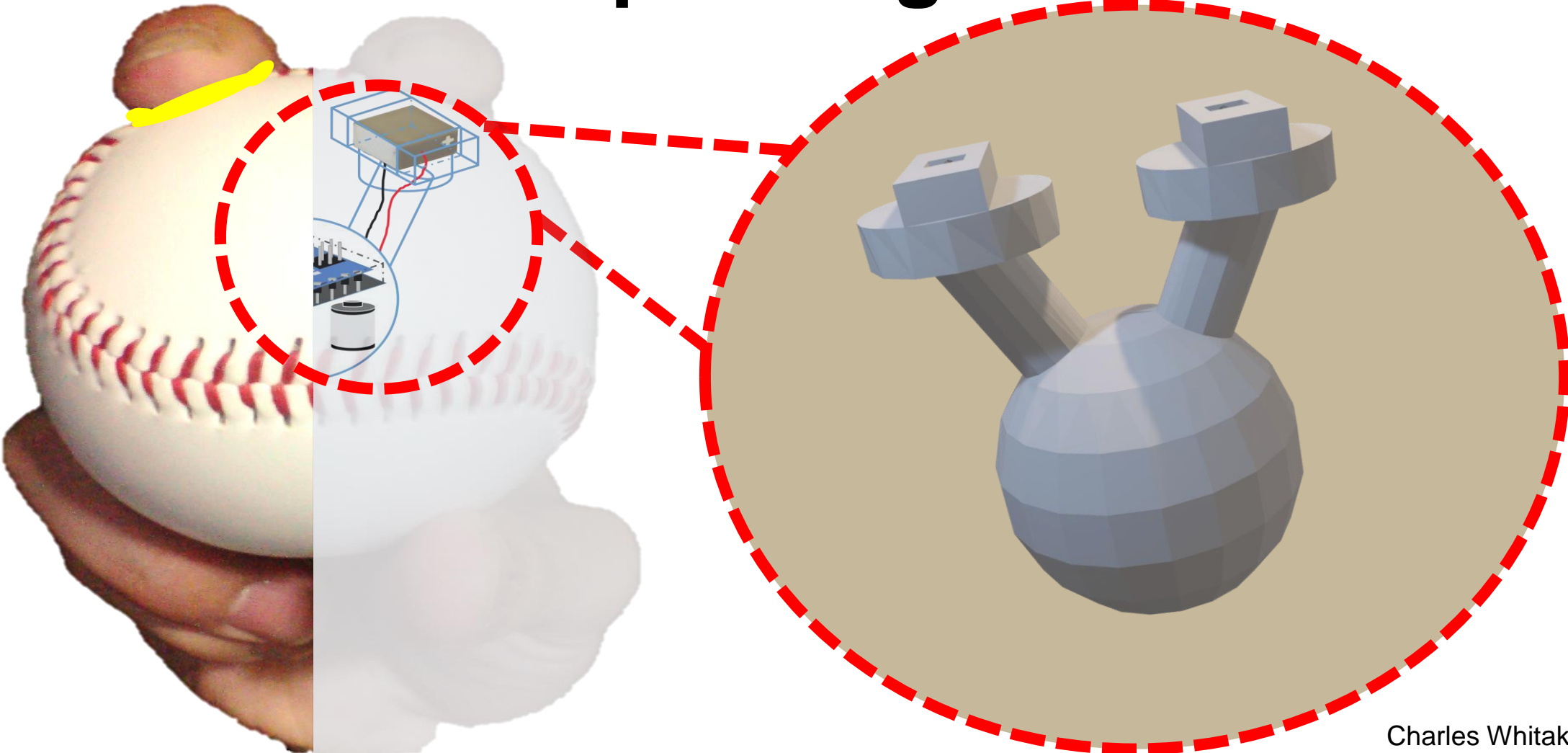
Piezo  
Sensors

3D Printed  
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Blue  
Nano

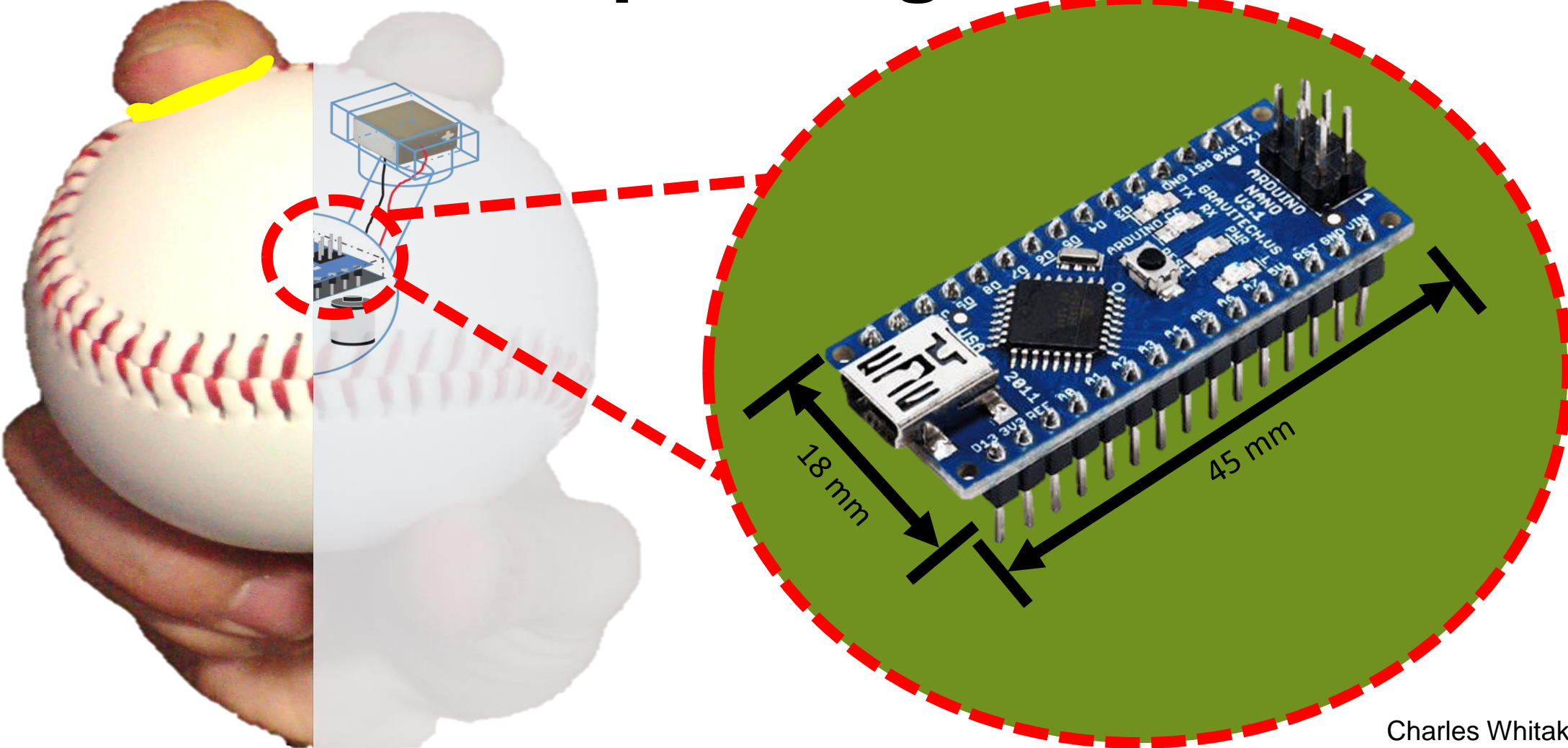
Lithium-  
ion Battery

Indications



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# Concept Design



Piezo Sensors

3D Printed Housing

Arduino Blue Nano

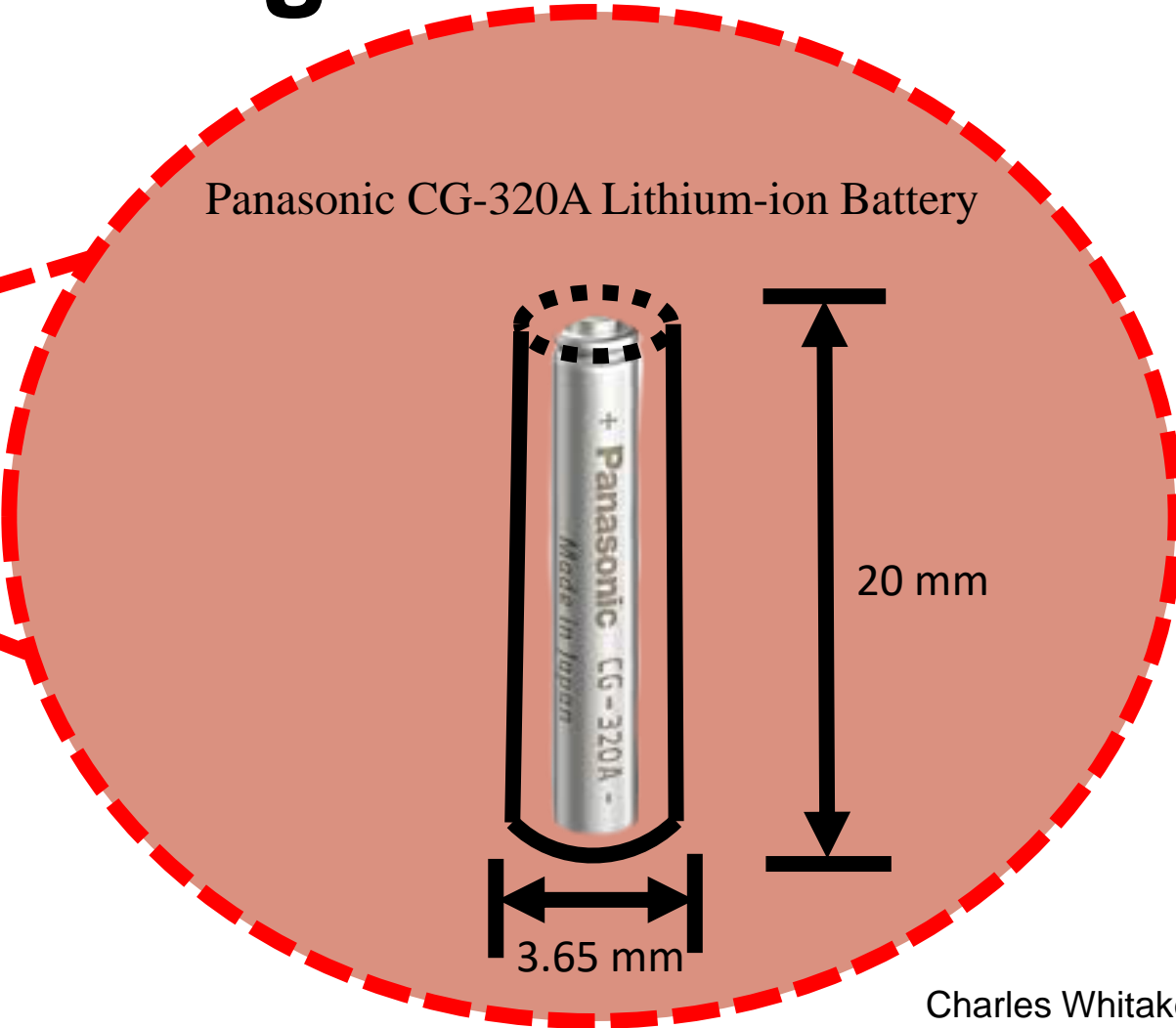
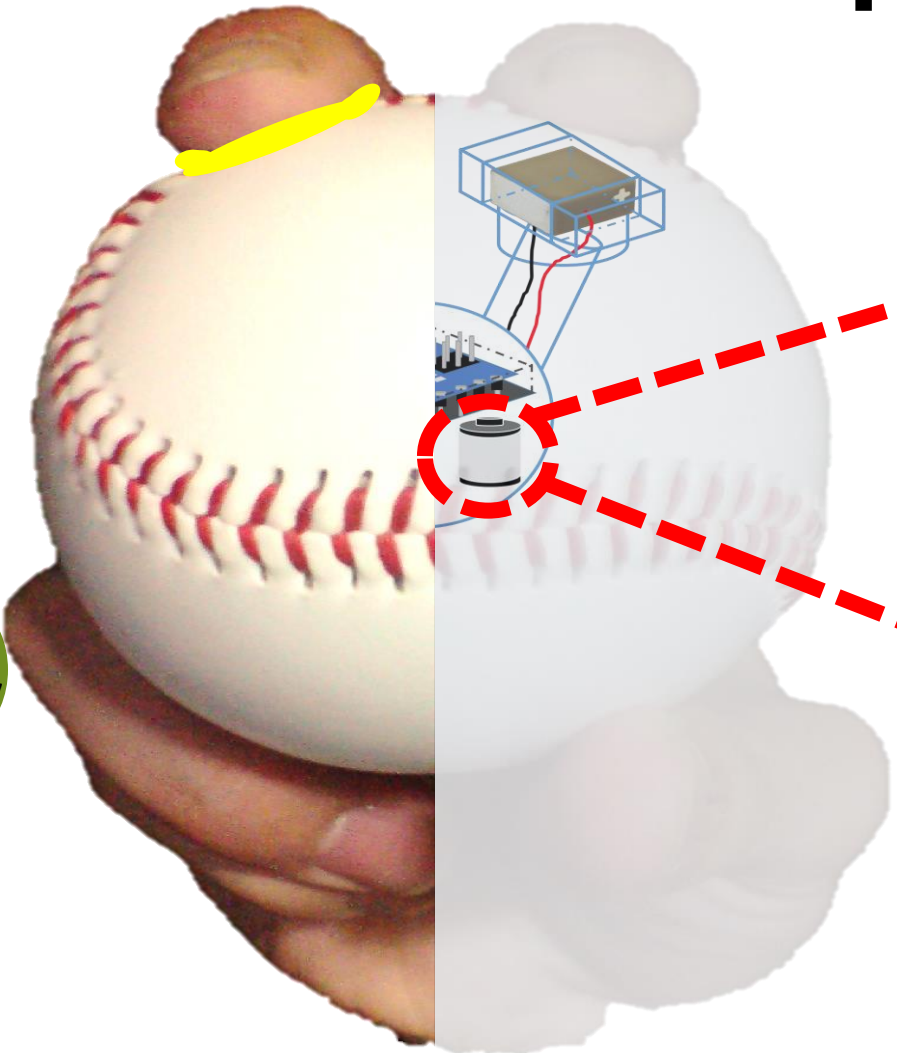
Lithium-ion Battery

Indications

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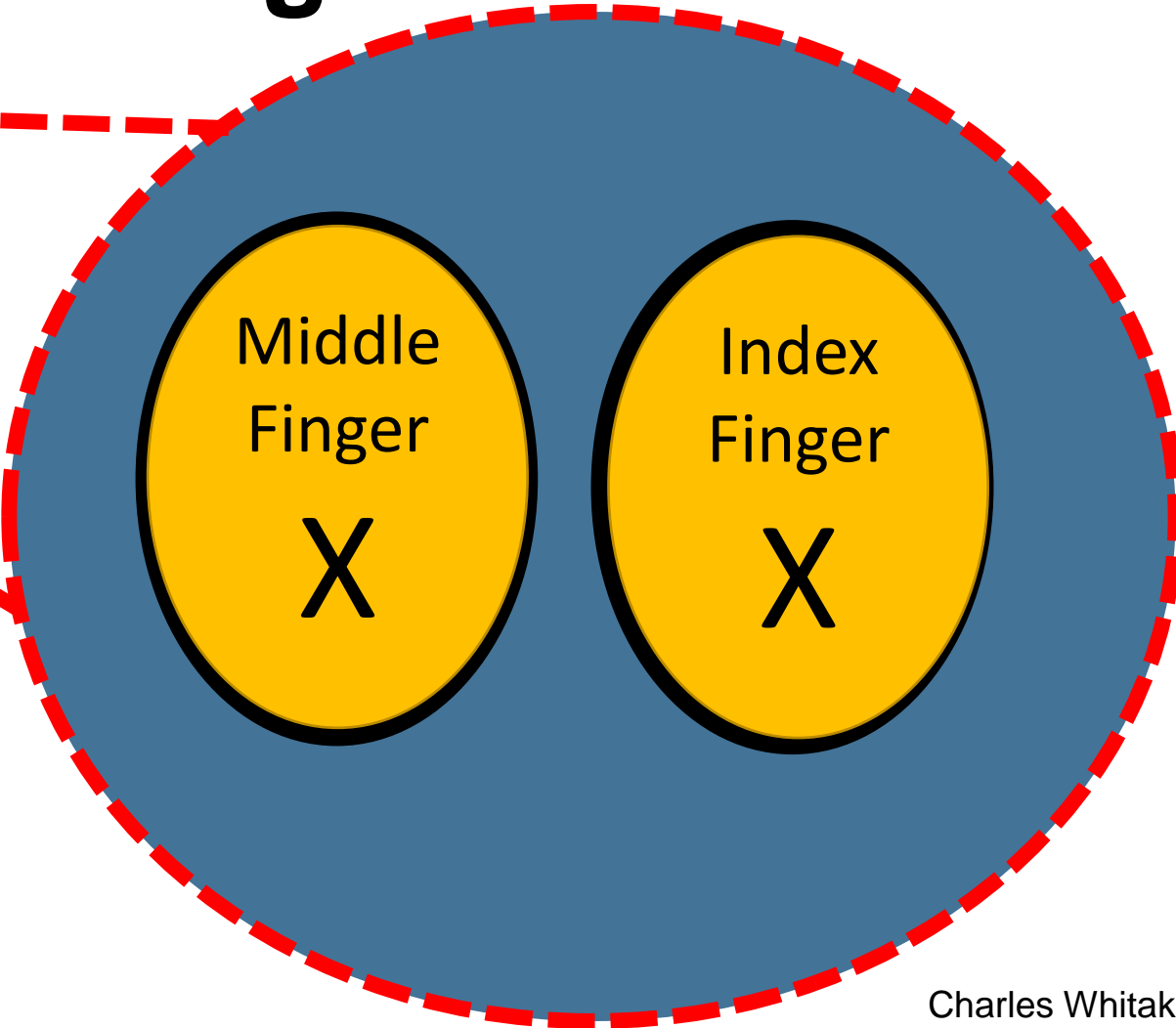
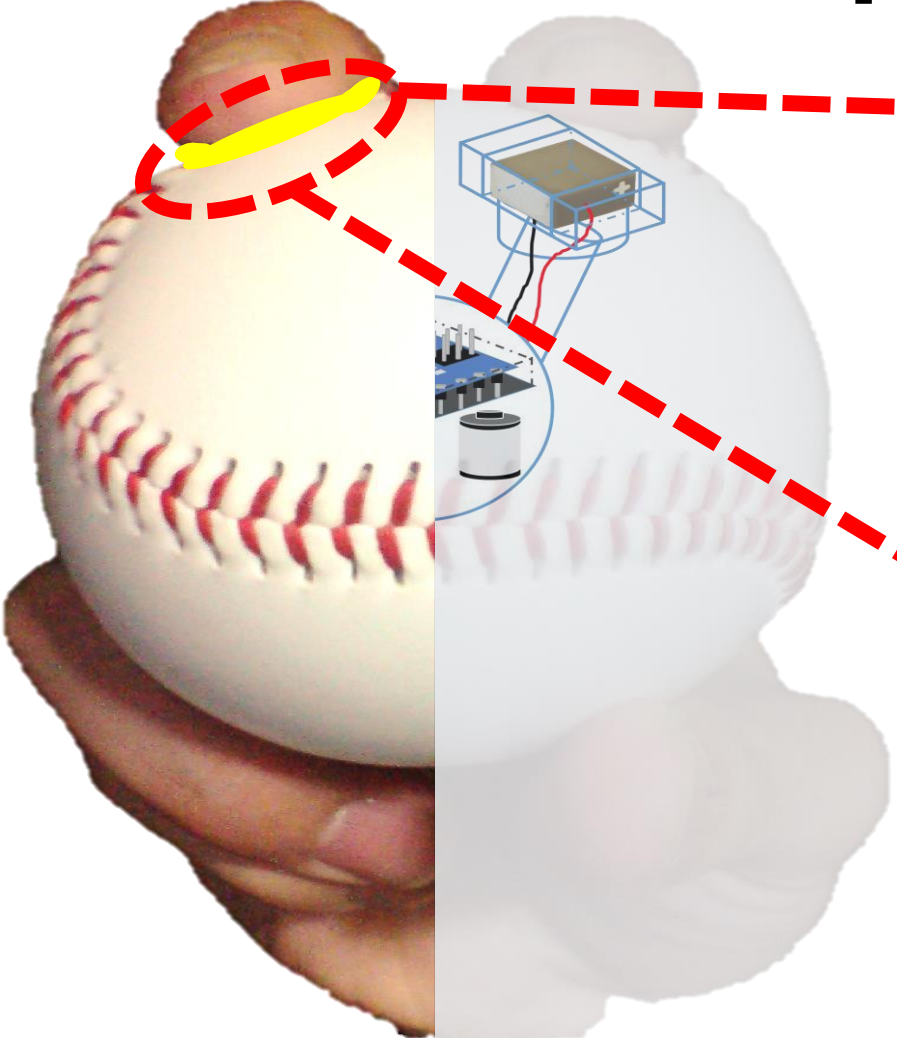
# Concept Design

- Piezo Sensors
- 3D Printed Housing
- Arduino Blue Nano
- Lithium-ion Battery
- Indications



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# Concept Design



Piezo Sensors

3D Printed Housing

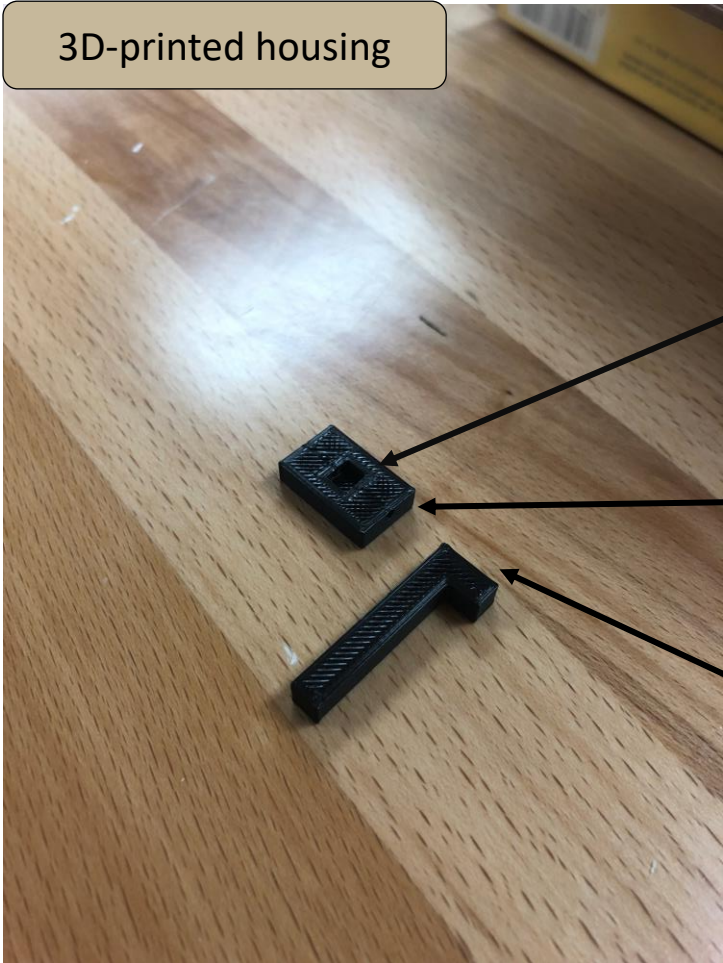
Arduino Blue Nano

Lithium-ion Battery

Indications

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# Initial Prototyping

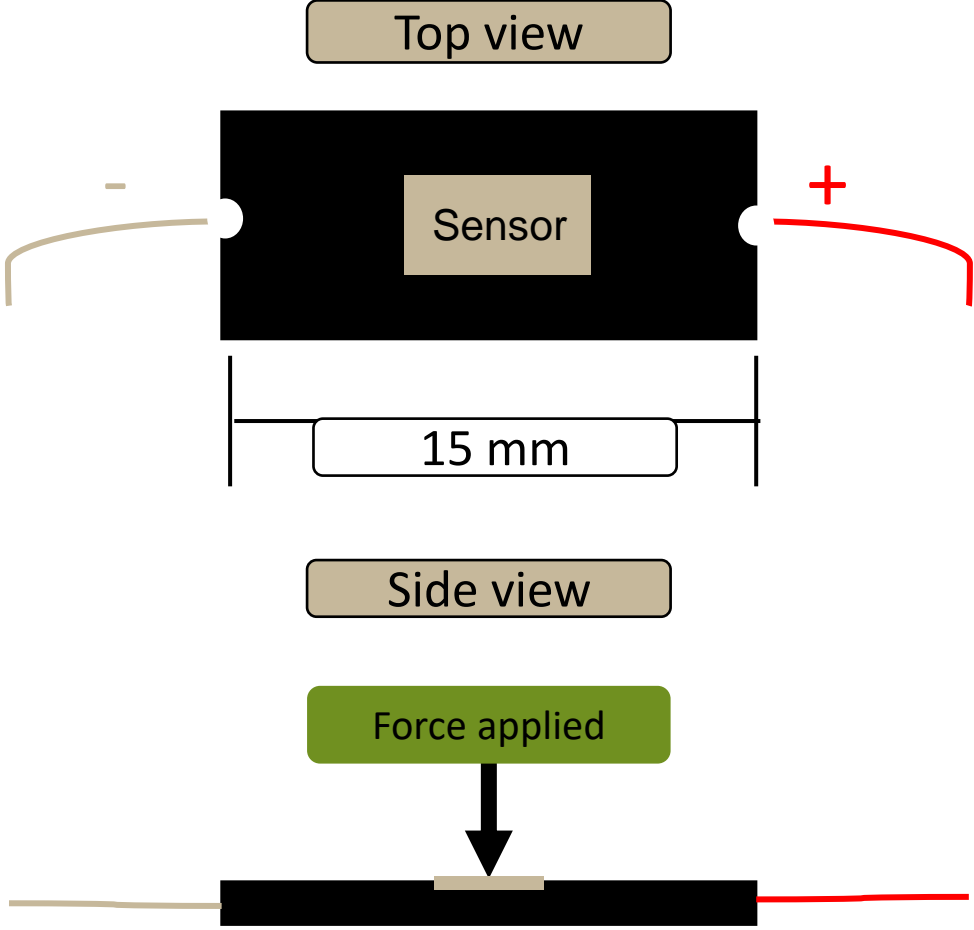


3D-printed housing

Gap for sensor

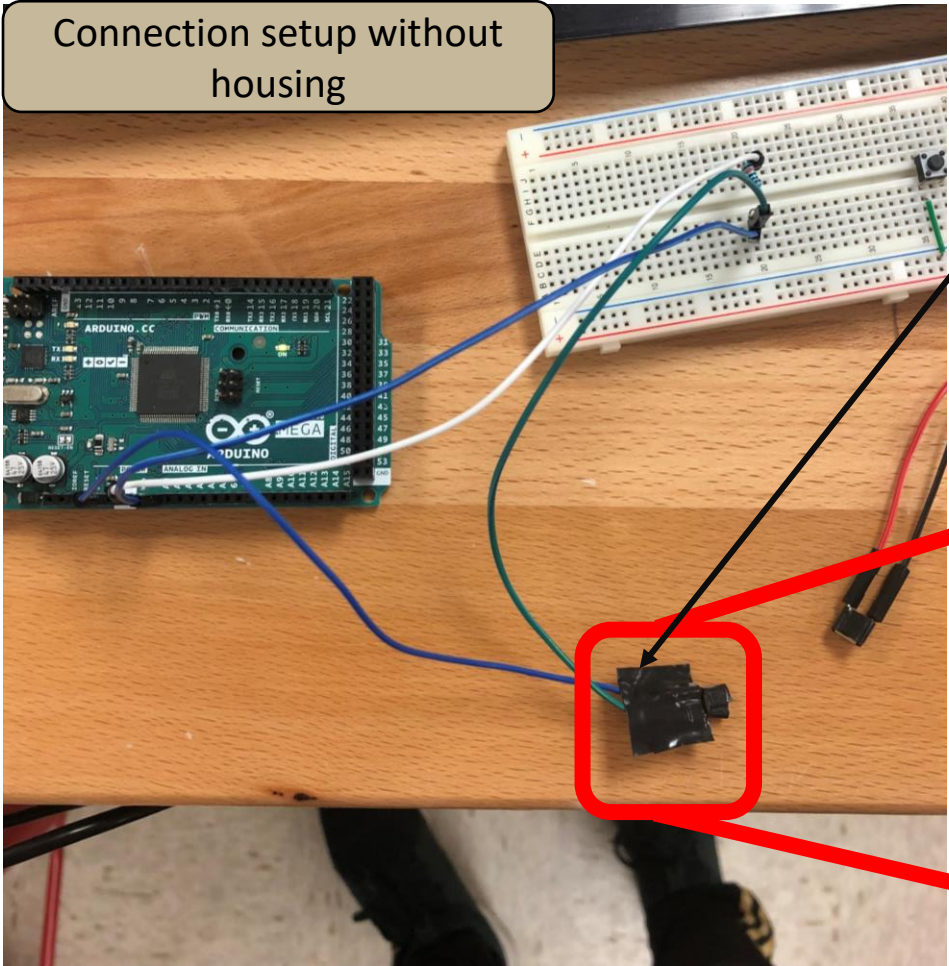
Opening for cable connection

Bracket for force application



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# Initial Testing

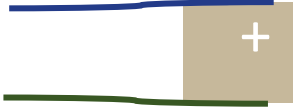


Connection setup without housing

Insulating tape

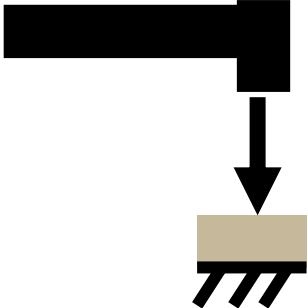


Connected to 5V



Connected to GND

Testing pressure force

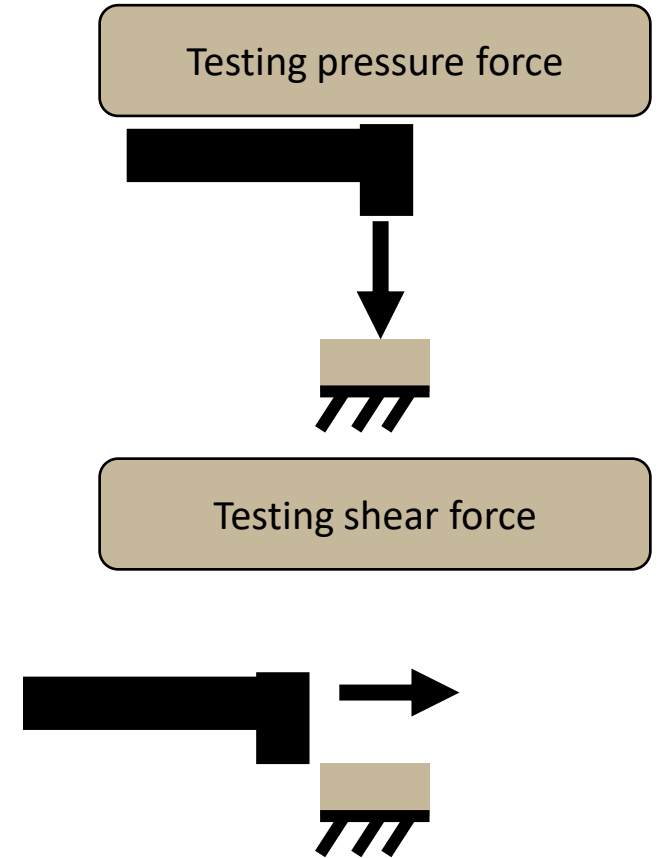
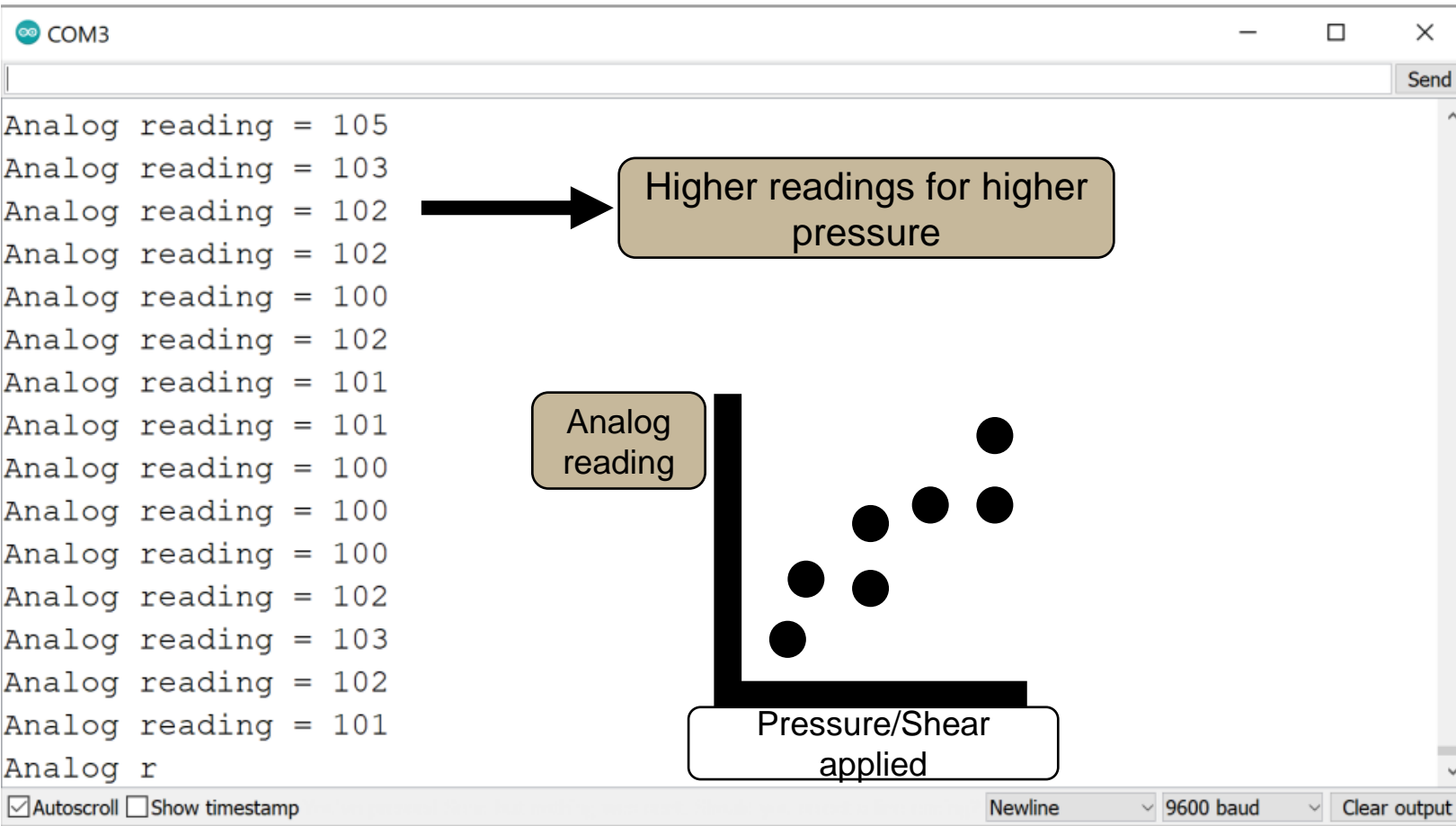


Testing shear force



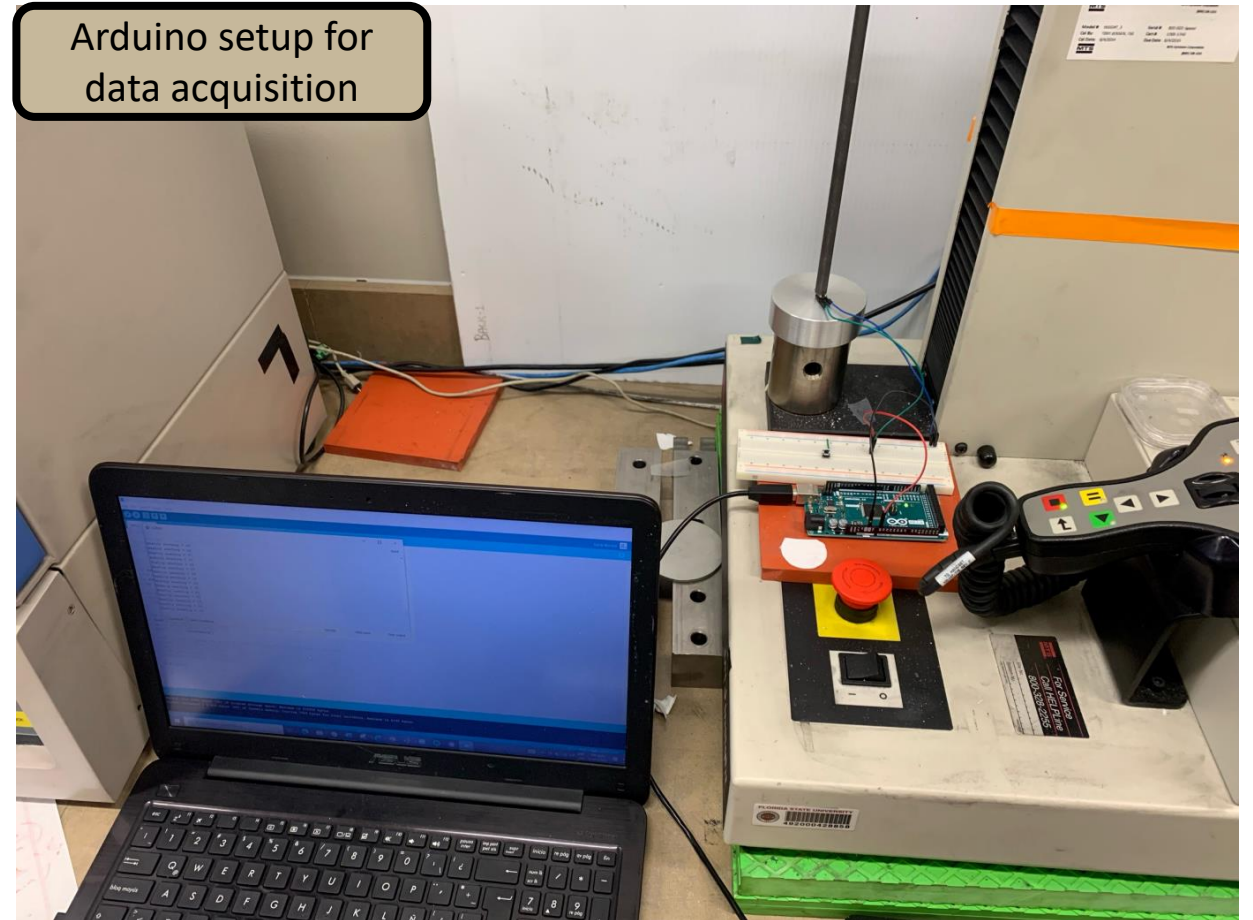
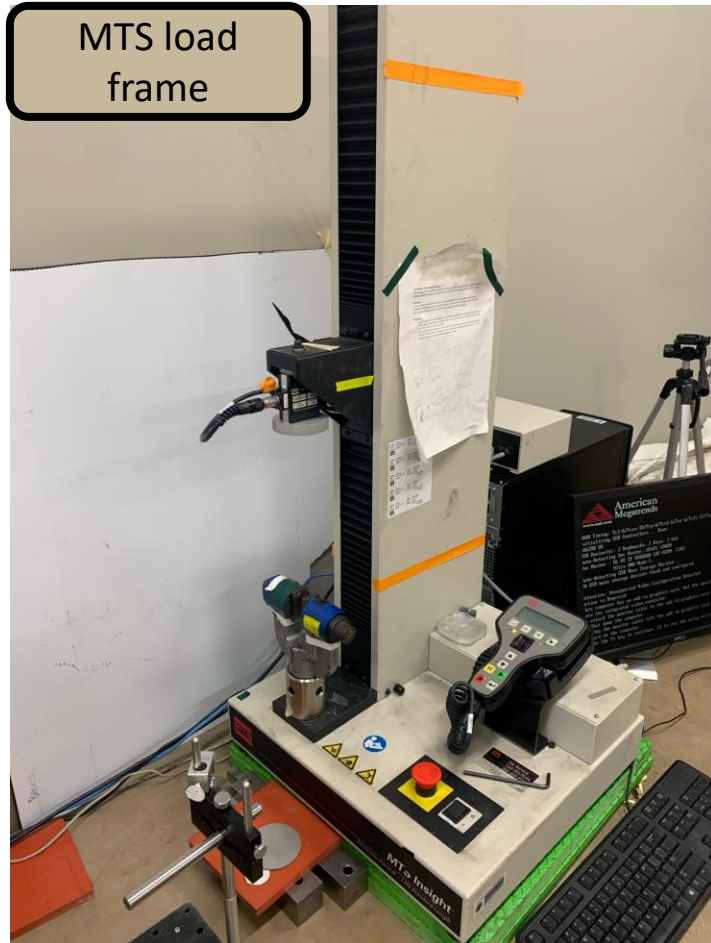
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# Initial Testing



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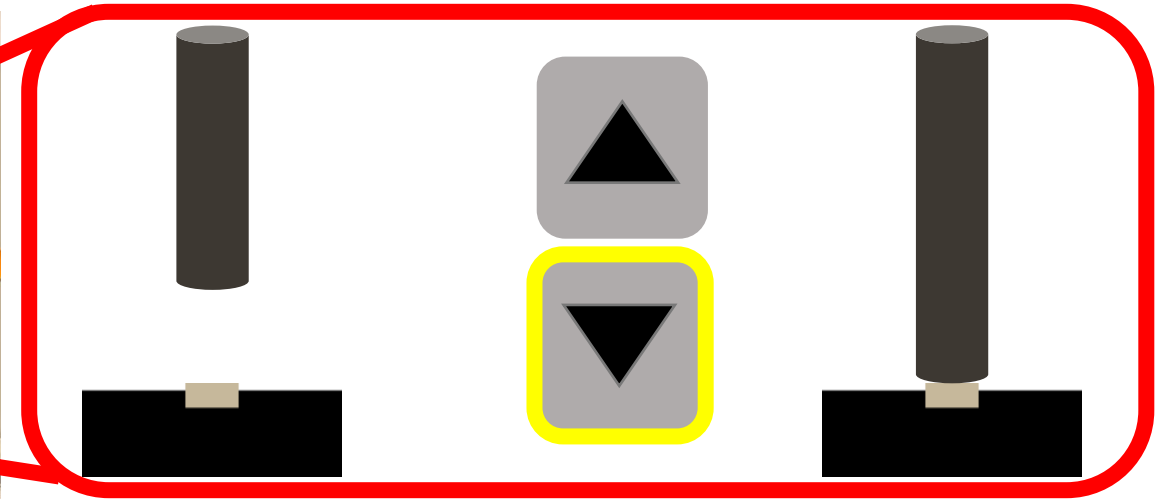
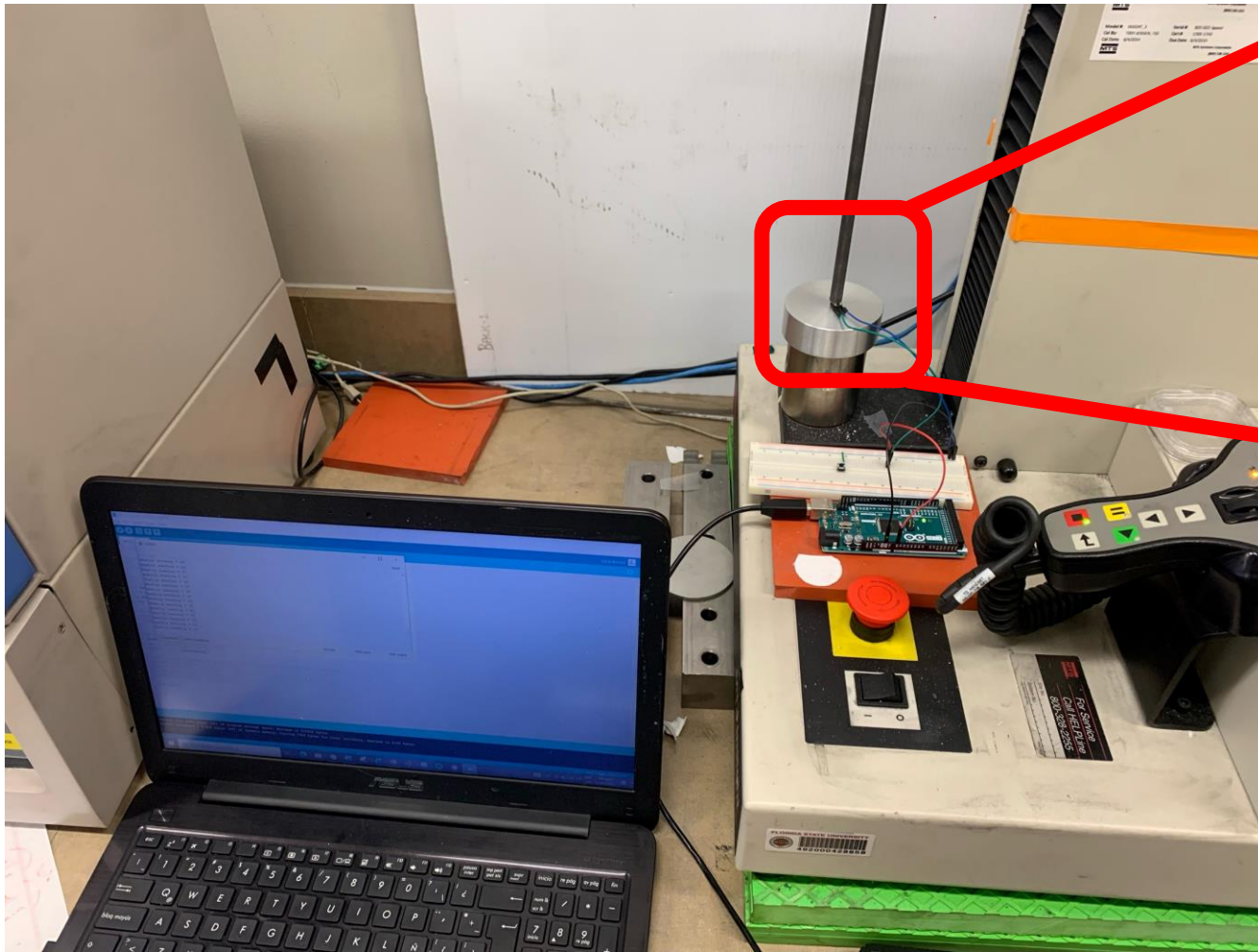
# Continued Testing



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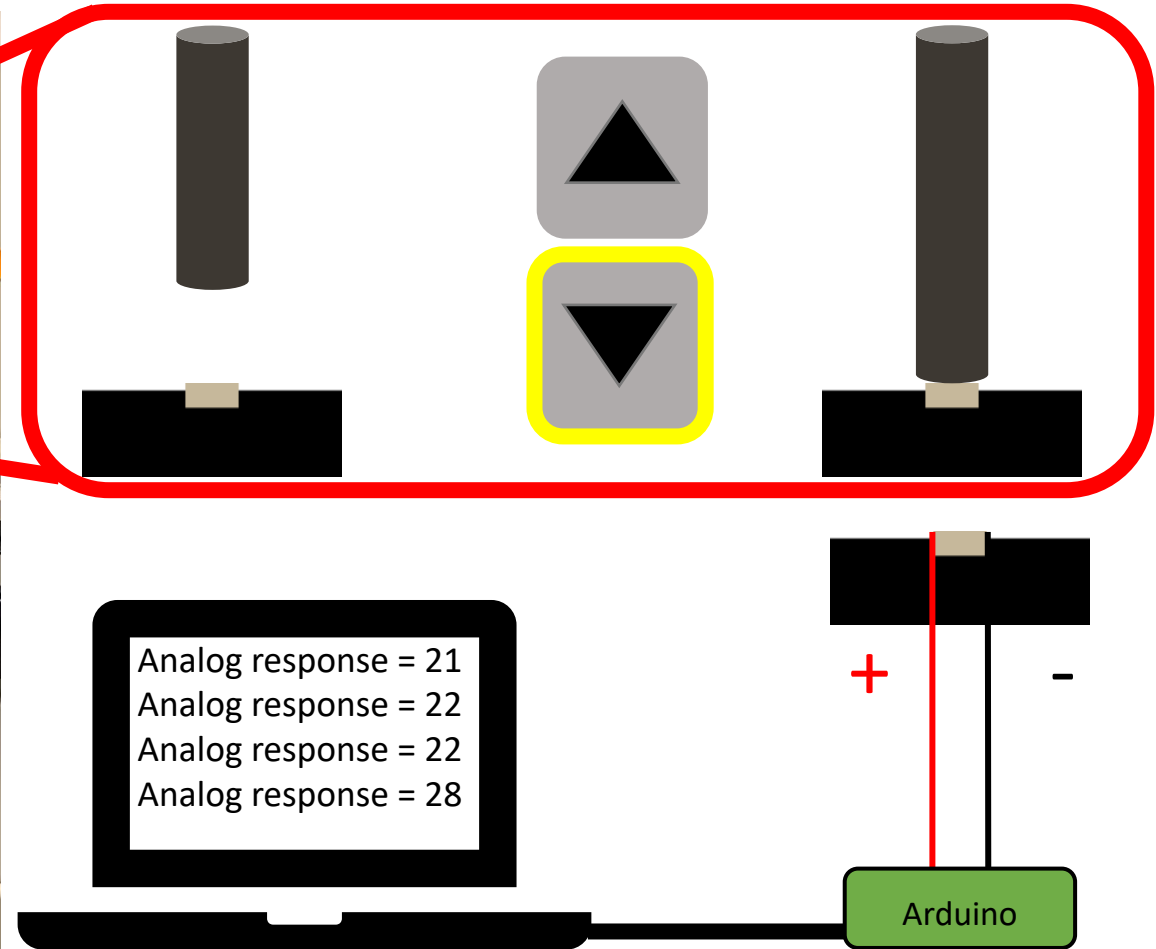
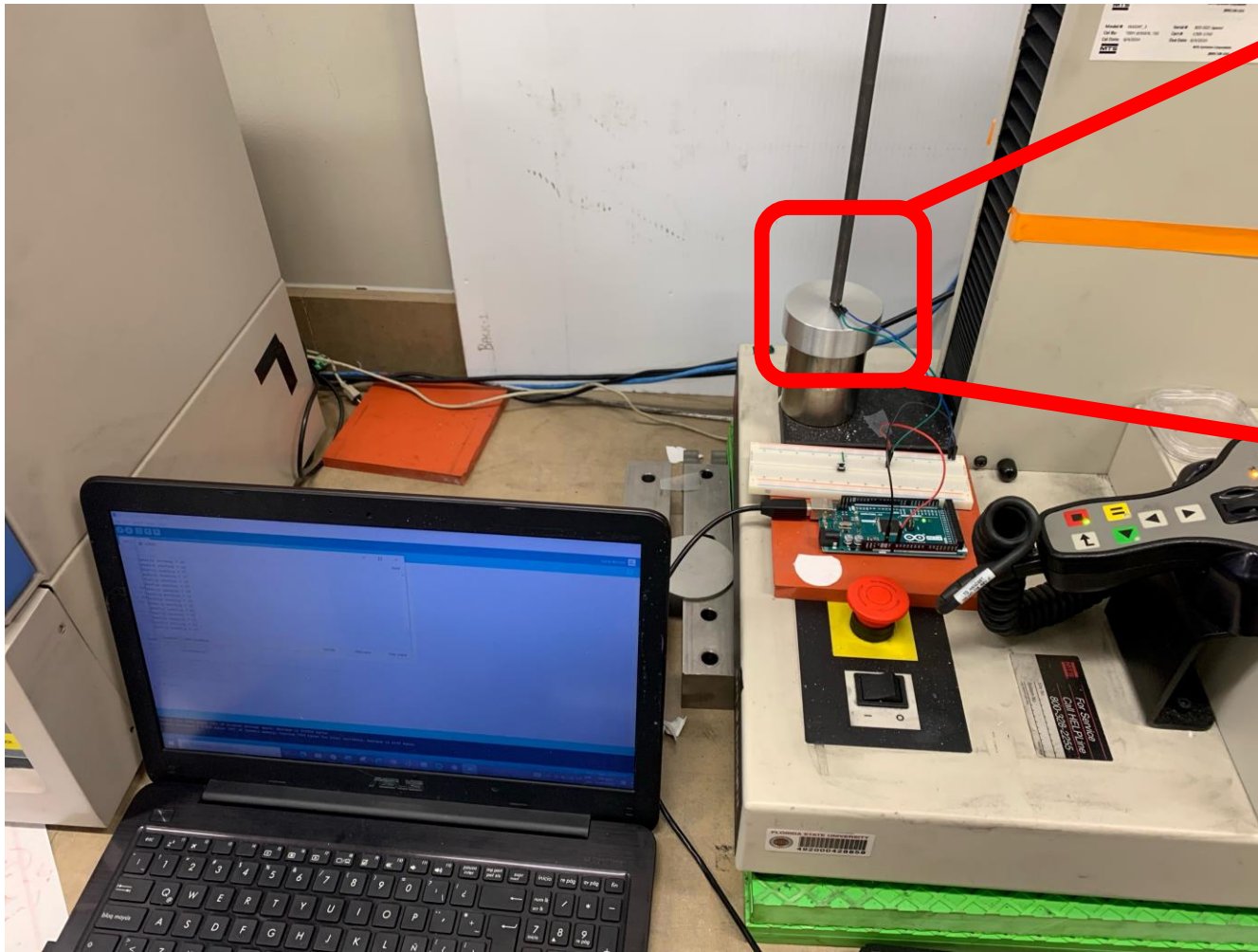


# Continued Testing



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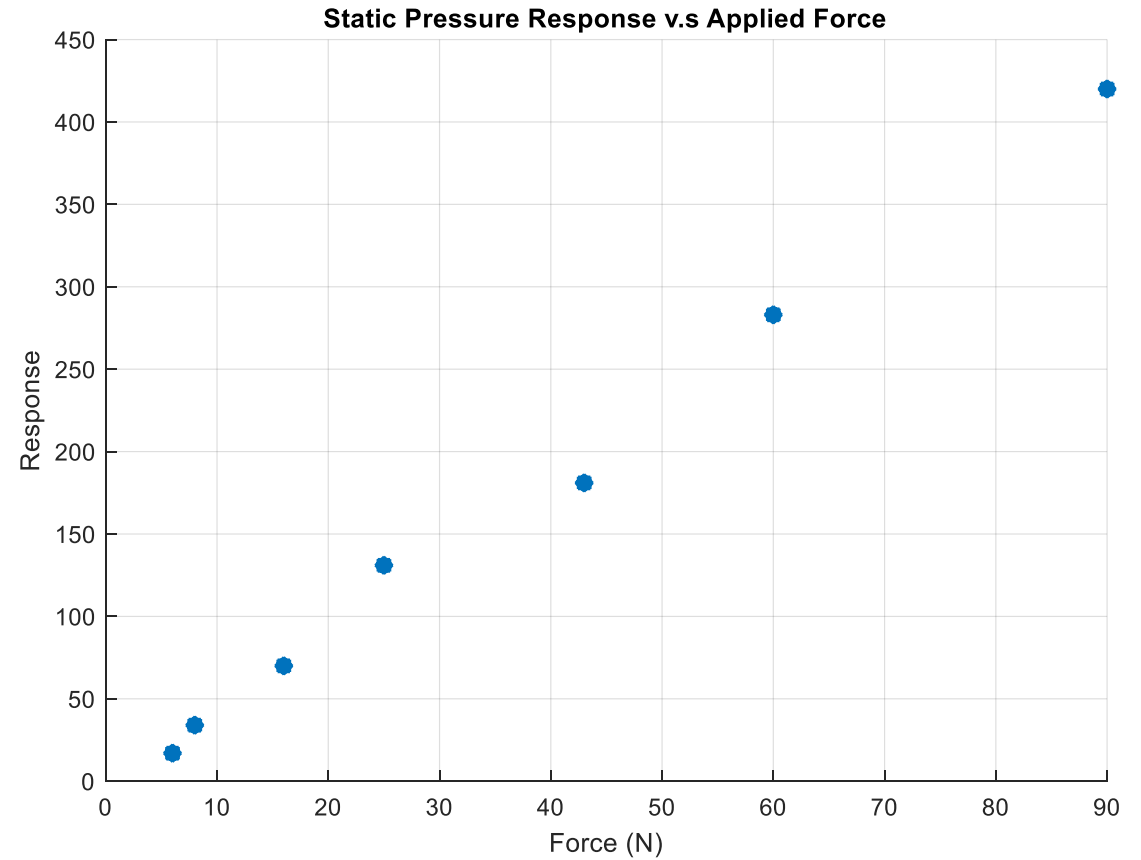
# Continued Testing



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# Continued Testing

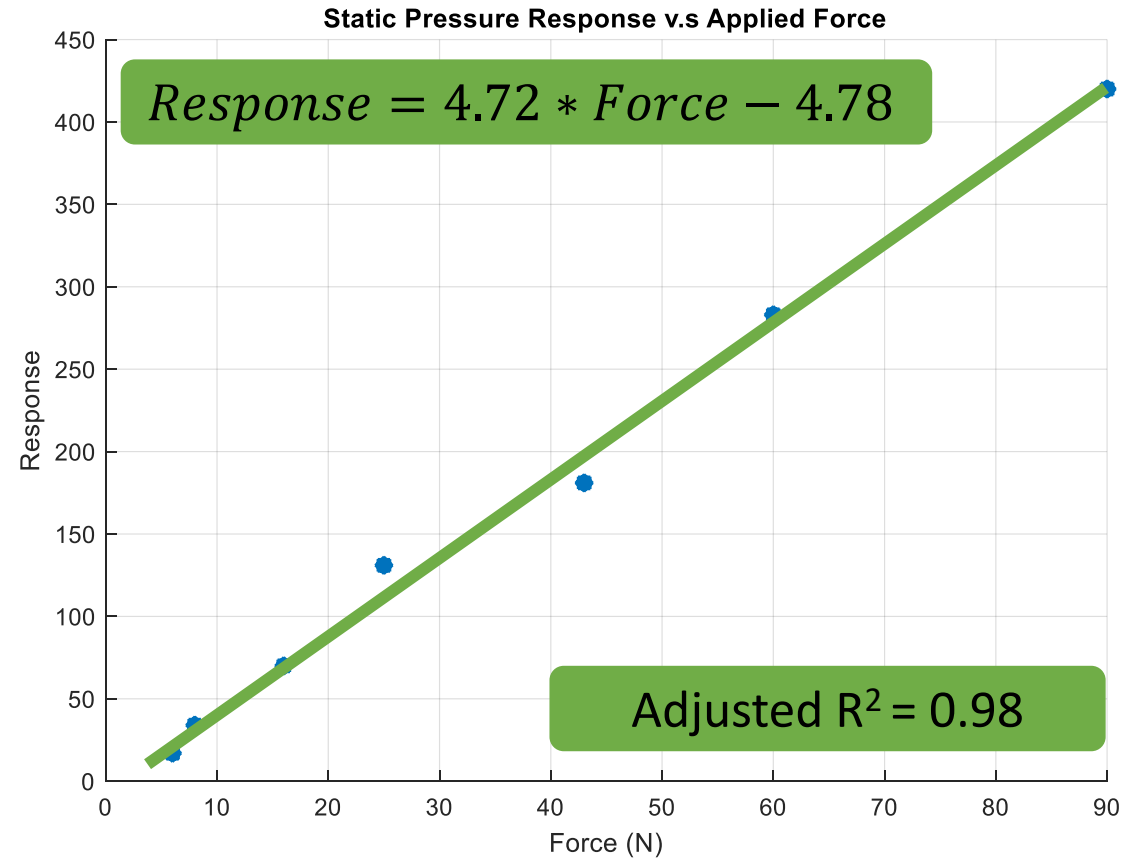
Force (N)	Response
6	17
8	34
16	70
25	131
43	181
60	283
90	420



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# Continued Testing

Force (N)	Response
6	17
8	34
16	70
25	131
43	181
60	283
90	420



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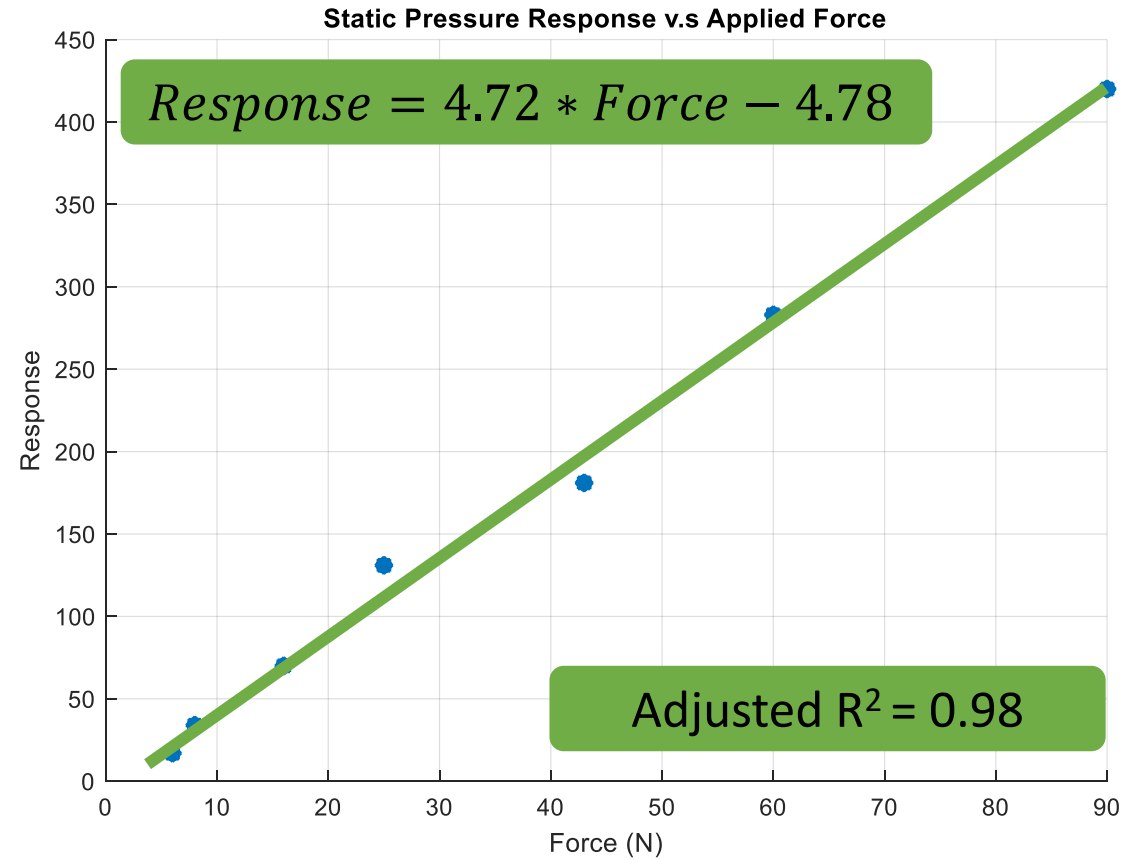
# Continued Testing

Before

Analog response = 21  
Analog response = 22  
Analog response = 22  
Analog response = 28

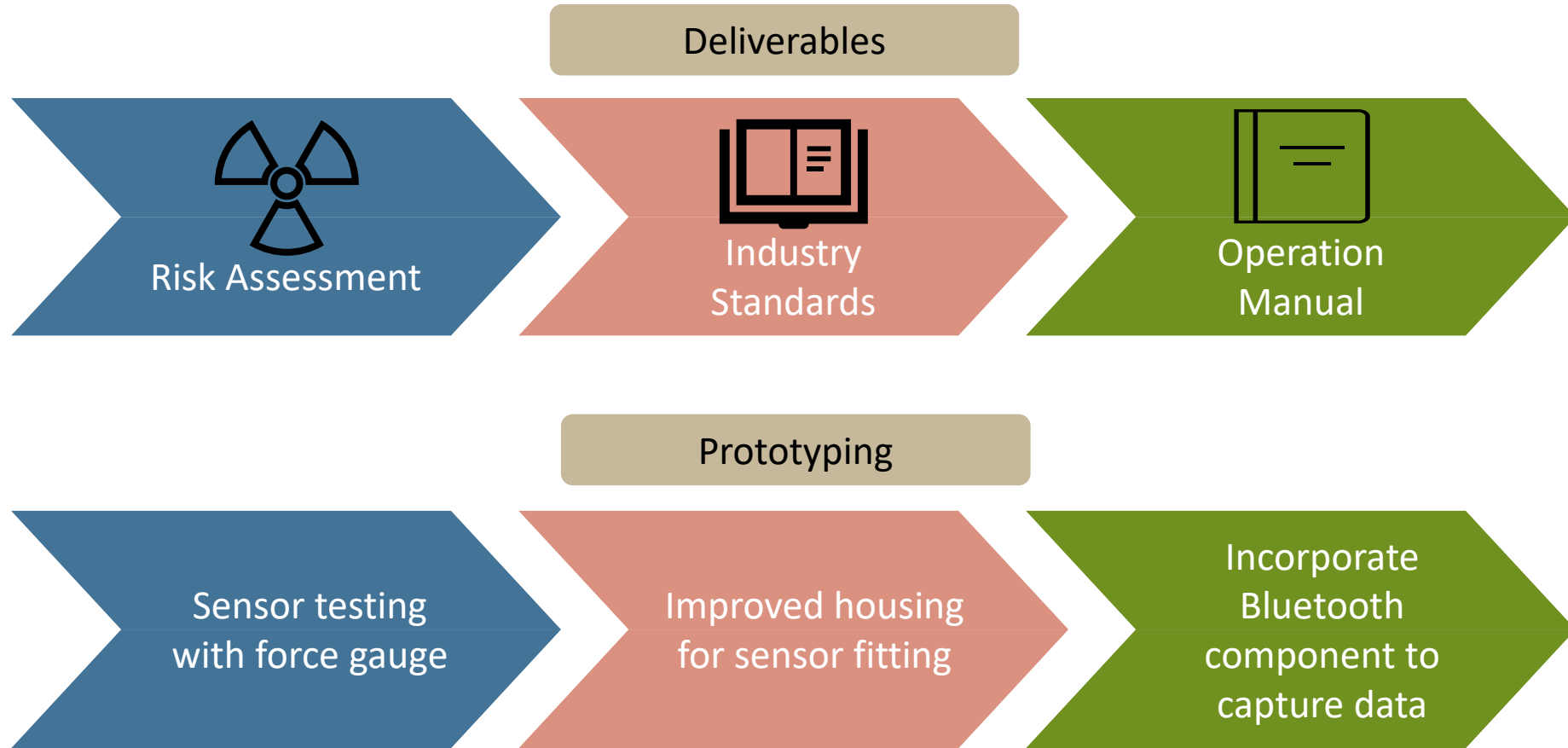
After

Force = 5.46 N  
Force = 5.67 N  
Force = 5.67 N  
Force = 6.94 N



David Adams

# Future Work



David Adams



# Instrumented Baseball

David Adams | Mathew Brown | Riley Ferrer | Yanni Giannareas | Charles Whitaker