Using Wearable AI Smart Sensors for Player Development For Multiple Sports

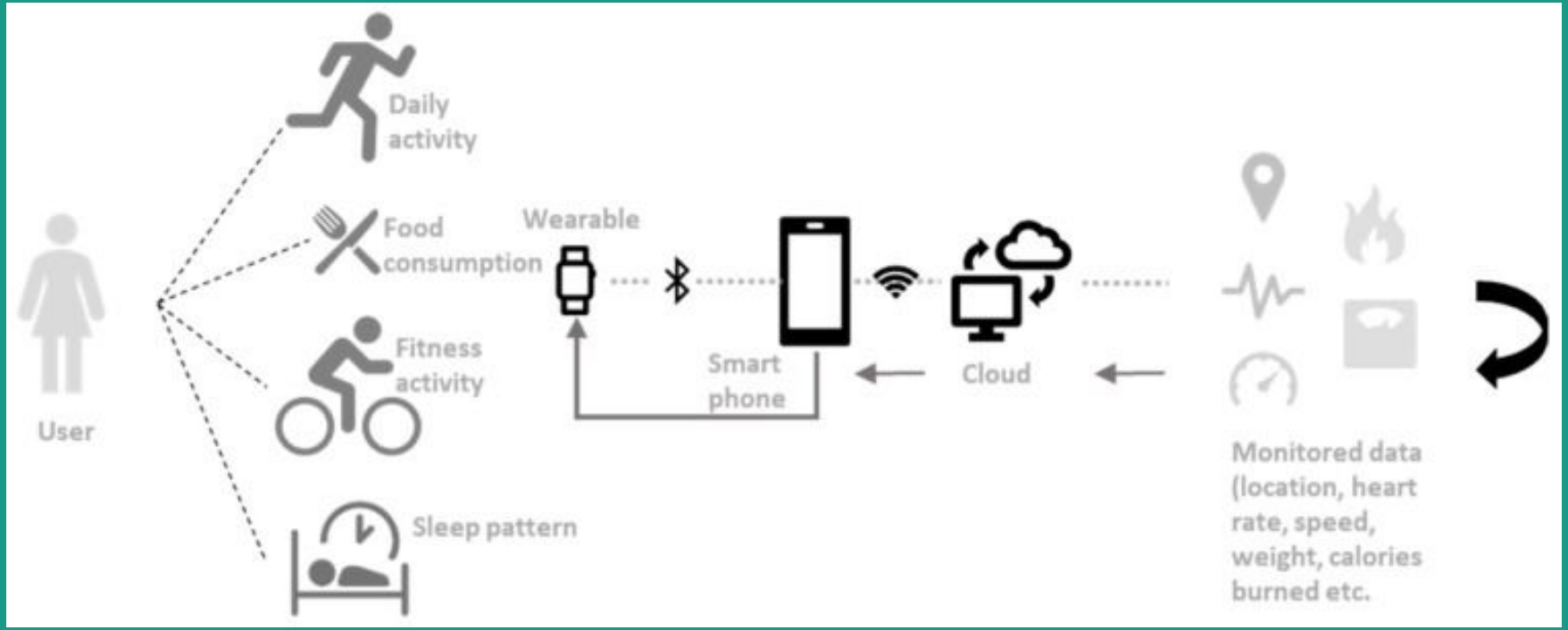
By Hakeem Yatim and Emma Brandes

Goals

- Research about wearable smart sensors technology within the sport of our choosing and explain how it helps its player development.
- Gather different metrics that can be tracked between the two sports (baseball and soccer)
- Figure out how to track them with smart sensors.
- Design a product that could track metrics in both sports.
- Explain how the product can also be implemented in other sports than baseball and soccer.

Wearable AI Smart Sensors

- Wearable devices that acts as accessories to track different metrics of the human using sensors.
- Some examples of different sensors that are used in these devices are accelerometer(tracking movement based on speed and direction), gyroscope (to measure rotation and orientation), temperature sensor (body temperature is connected to intensity of an activity) and heart rate monitor (tracking your pulse).
- Existing products : Fitbit, Smart Watches, Phones.


Daily activity
Food consumption
Fitness activity
Sleep pattern
User
Wearable
Smart phone
Cloud
Monitored data (location, heart rate, speed, weight, calories burned etc.

Wearable AI Smart Sensors in Baseball

- An example of a wearable smart sensor in baseball would be a Blast Sensor.
- Comes with a little sensor, attachment for the sensor to the knob, and a charger.
- Would track the speed of a player's hands and bat when making contact with the ball and also map out the bat path and angles.
- Uses some sort of combination of gyroscope, accelerometer, and magnetometer sensors that creates a microelectromechanical system (MEMS)
- The company also made sensors for softball and golf (swing based sport).


BLAST
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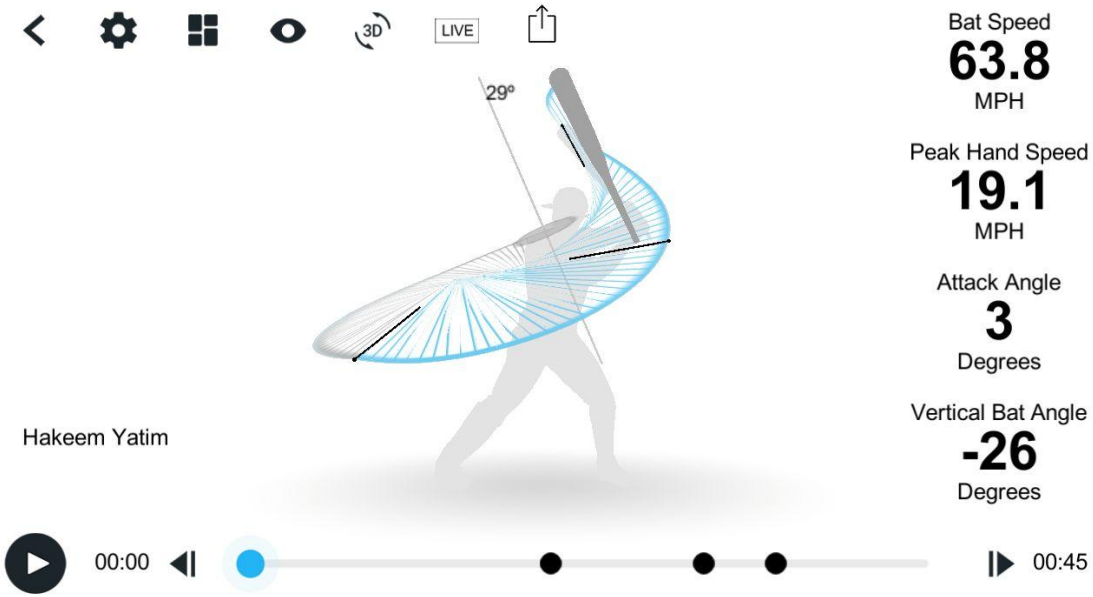
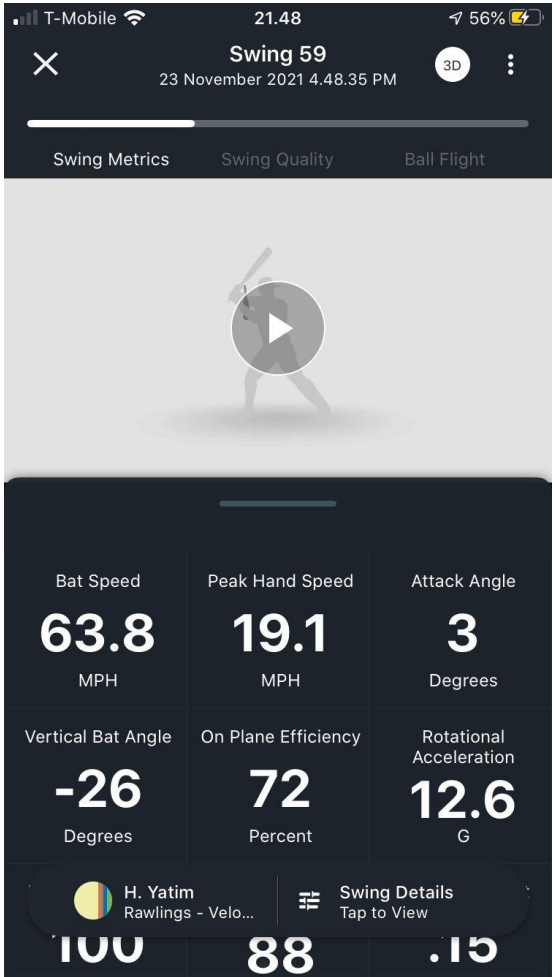
#1 SWING ANALYZER
IN THE BOX
SWING ANALYZER
BAT MOUNT
CHARGING PAD


LIVE
29°
Bat Speed
63.8
MPH
Peak Hand Speed
19.1
MPH
Attack Angle
3
Degrees
Vertical Bat Angle
-26
Degrees
Hakeem Yatim
00:00
00:45


T-Mobile
21.48
56%
Swing 59
23 November 2021 4.48.35 PM
3D
Swing Metrics
Swing Quality
Ball Flight
Bat Speed
63.8
MPH
Peak Hand Speed
19.1
MPH
Attack Angle
3
Degrees
Vertical Bat Angle
-26
Degrees
On Plane Efficiency
72
Percent
Rotational Acceleration
12.6
G
H. Yatim
Rawlings - Velo...
Swing Details
Tap to View

Metrics tracked by the Blast Sensor

- Some examples would be Bat Speed, Attack angle, Peak Hand Speed, Power, and Swing Qualities
- The sensor collects data for all the metrics with every swing
- We can also obtain a graph of multiple swings and find out the average of each metric.
- With all the data recorded by the smart sensor, I would be able to set goals on improving on certain metrics, which would help with my performance in games.

Player Report

Nov 23, 2021 - Nov 23, 2 | All Environments | More Filters

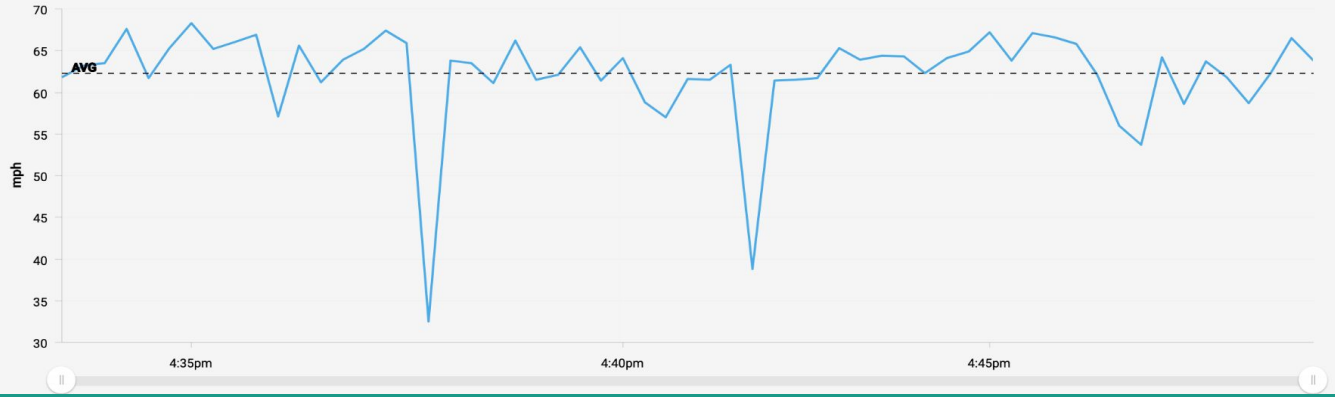
Swing Quality (Avg)

Plane	Connection	Rotation
60	61	52

Swing Metrics (Avg)

Bat Speed	Rotational Acceleration	On Plane Efficiency	Attack Angle	Early Connection	Connection at Impact	Vertical Bat Angle	F
62.3 mph	13.7 g	77%	-2°	90°	80°	-28°	3

Low	High	Variance
32.5 mph	68.3 mph	35.8 mph



Player Report

Nov 23, 2021 - Nov 23, 2 | All Environments | More Filters

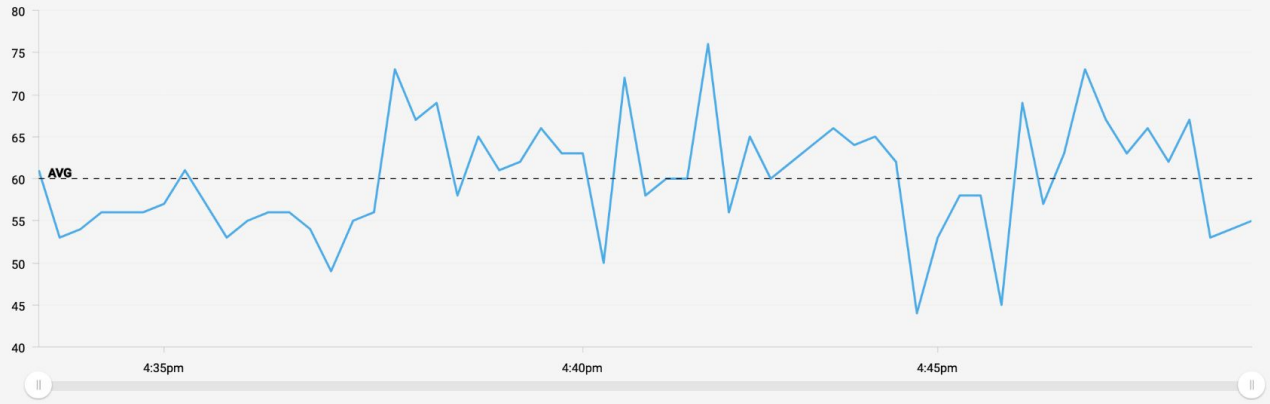
Swing Quality (Avg)

Plane	Connection	Rotation
60	61	52

Swing Metrics (Avg)

Bat Speed	Rotational Acceleration	On Plane Efficiency	Attack Angle	Early Connection	Connection at Impact	Vertical Bat Angle
62.3 mph	13.7 g	77%	-2°	90°	80°	-28°

Low	High	Variance
44	76	32



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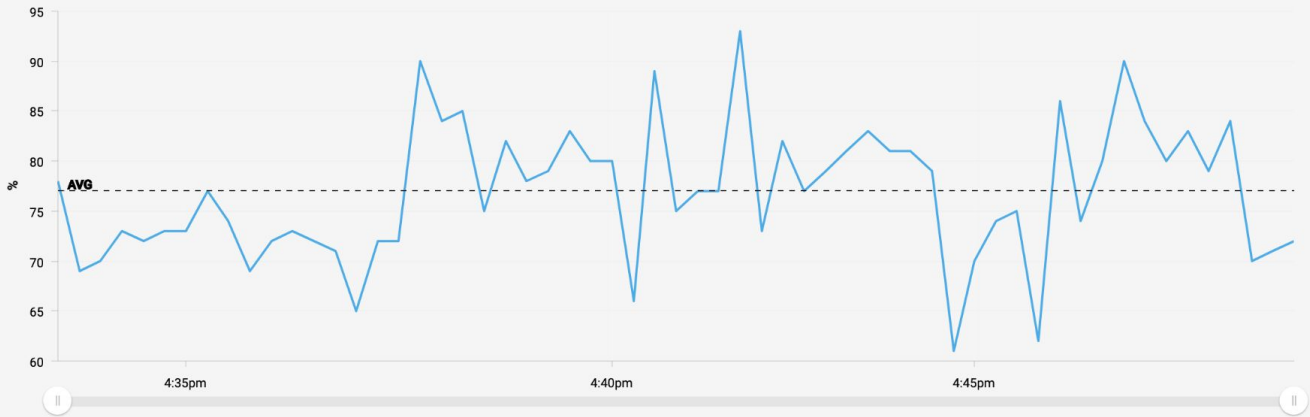
62.3 mph	13.7 g	77%	-2°	90°	80°	-28°

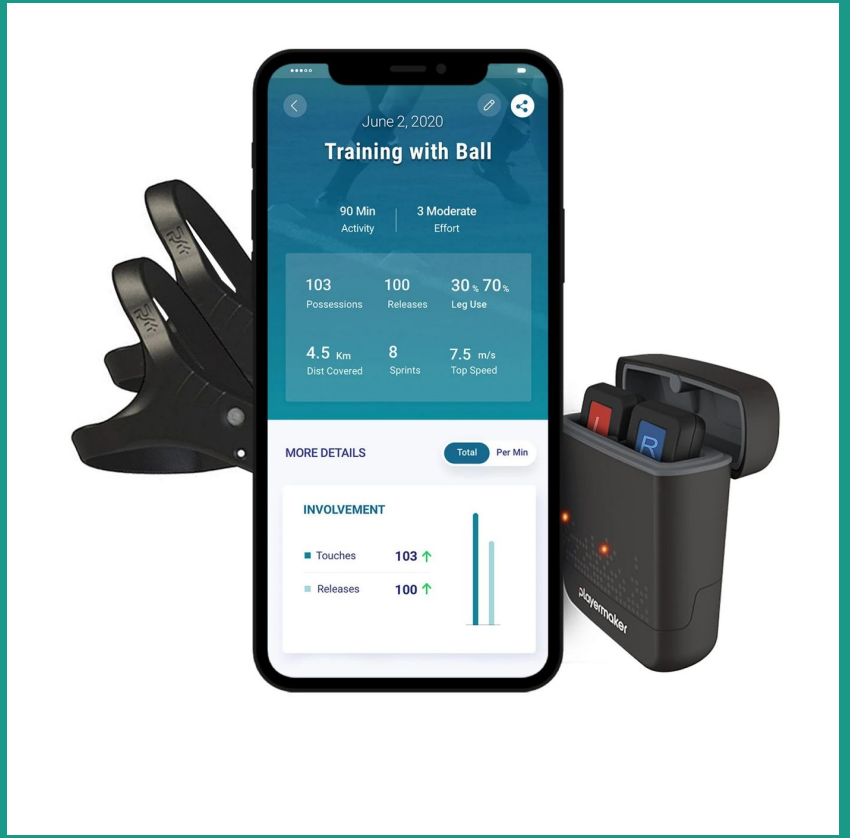
Low	High	Variance
61 %	93 %	32 %



Wearable AI Smart Sensors in Soccer

- The Playermaker is a soccer specific wearable smart sensor that measures any movement of the foot, including rotations of the ankle or contact with the ground.
- It comes with: 1 sensor, 1 charger, and 2 wearable straps that go around each foot. There is also an app that you download to track the data collected after each game or practice.
- The sensors can be used on any type of field indoors or outdoors. They can also be used in any type of weather.
- The overall design was for comfort and to have the least about of impact on a players performance.


playermaker


June 2, 2020
Training with Ball
90 Min
Activity
3 Moderate
Effort
103
Possessions
100
Releases
30 % 70 %
Leg Use
4.5 Km
Dist Covered
8
Sprints
7.5 m/s
Top Speed
MORE DETAILS
Total
Per Min
INVOLVEMENT
Touches
103
Releases
100
playermaker

Metrics tracked by Playermaker

- Examples of what it tracks: distance covered, sprints, acceleration, deceleration, top speed, ball releases/ possessions, short/ long and one touch passing, touches per foot and ball received by each foot.
- The data that is recorded is then able to be used find the users averages of each category and can help the user set personal goals that they want to achieve.
- The playermaker uses a 6-axis motion smart sensor that allows the measurement of every micro-movement. The sensor is built with a gyroscope and accelerometer that examine movement as fast as 1000 times per second.

TECHNICAL ABILITY

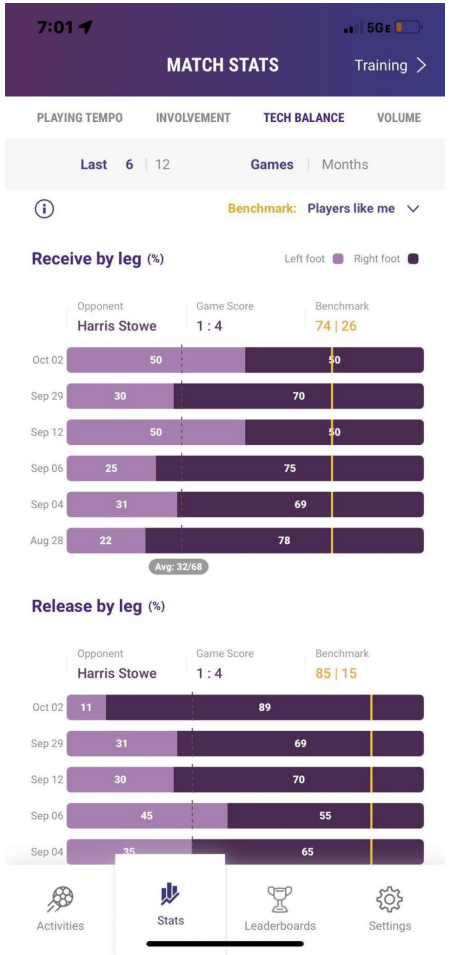
Allowing coaches to develop technical aspects to players through dual-foot usage, ball-striking speed/velocity and position specific first touches.

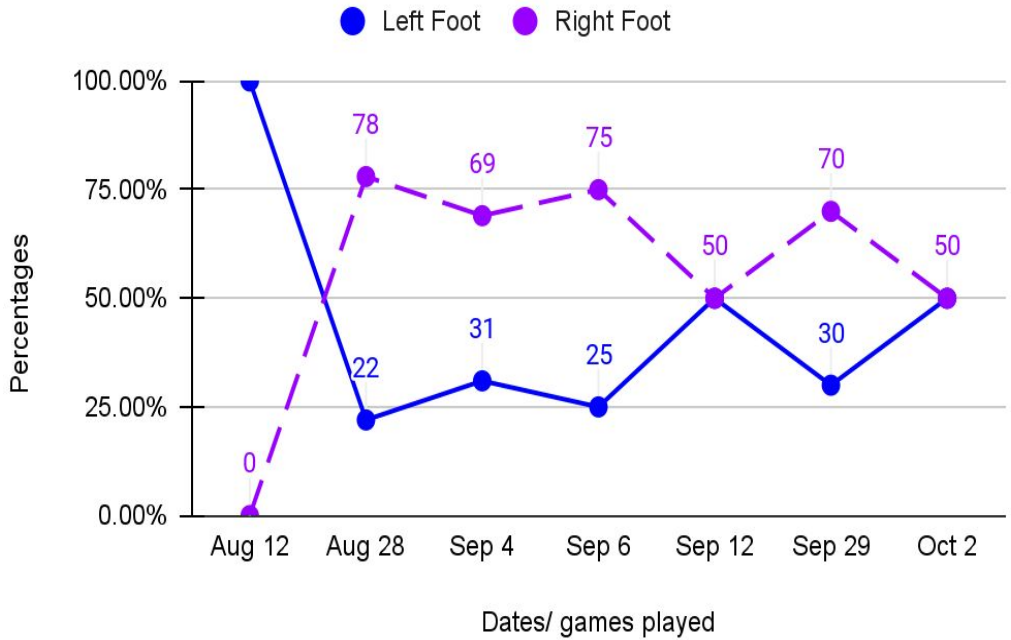
TEAM BENCHMARKING

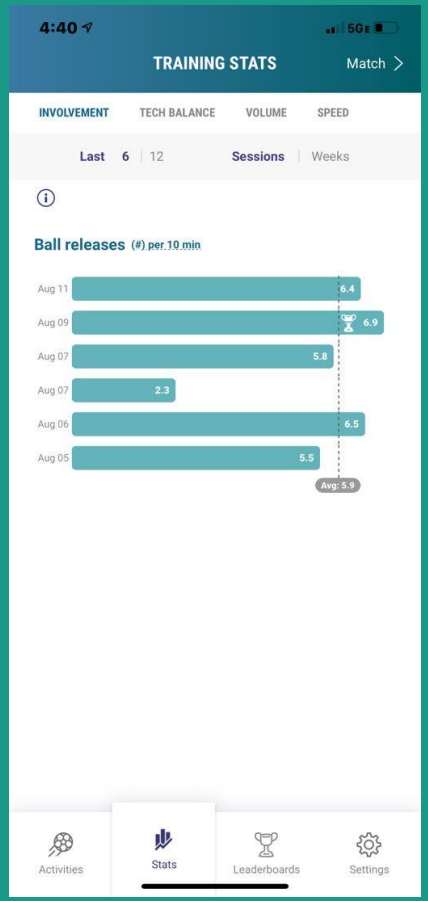
The ability to compare player performances to drive selection decisions, formations, tactics and development targets for individual players.

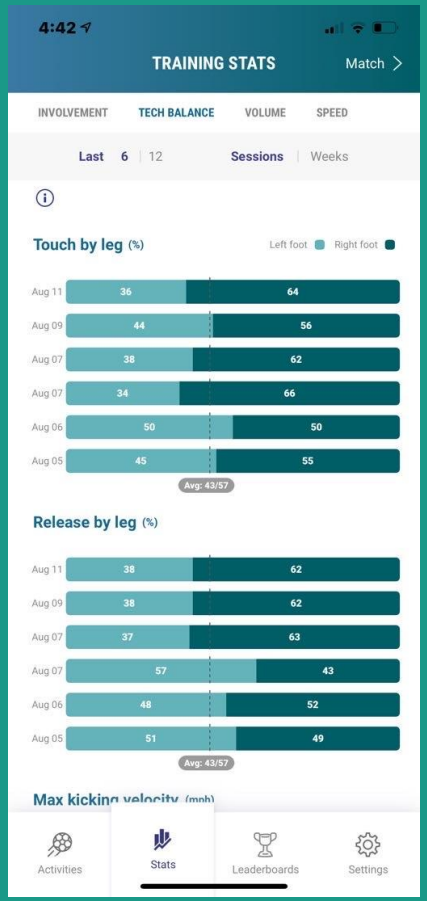
REDUCE INJURY RISK

Advanced Gait analysis to protect players from fatigue leg injuries, impact injuries from over ball retention and injuries from unbalanced running patterns.


7:01
5GE
MATCH STATS
Training
PLAYING TEMPO
INVOLVEMENT
TECH BALANCE
VOLUME
Last 6 | 12
Games | Months
Benchmark: Players like me
Receive by leg (%)
Left foot
Right foot
Opponent
Harris Stowe
Game Score
1 : 4
Benchmark
74 | 26
Oct 02 50 50
Sep 29 30 70
Sep 12 50 50
Sep 06 25 75
Sep 04 31 69
Aug 28 22 78
Avg: 32/68
Release by leg (%)
Opponent
Harris Stowe
Game Score
1 : 4
Benchmark
85 | 15
Oct 02 11 89
Sep 29 31 69
Sep 12 30 70
Sep 06 45 55
Sep 04 35 65
Activities
Stats
Leaderboards
Settings


Passes per feet
Left Foot
Right Foot
100.00%
75.00%
50.00%
25.00%
0.00%
Percentages
78
69
75
70
50
50
22
31
25
30
0
Aug 12
Aug 28
Sep 4
Sep 6
Sep 12
Sep 29
Oct 2
Dates/ games played


4:40
TRAINING STATS
Match
INVOLVEMENT
TECH BALANCE
VOLUME
SPEED
Last 6 | 12 Sessions | Weeks
Ball releases (#) per 10 min
Aug 11 6.4
Aug 09 6.9
Aug 07 5.8
Aug 07 2.3
Aug 06 6.5
Aug 05 5.5
Avg: 5.9
Activities
Stats
Leaderboards
Settings

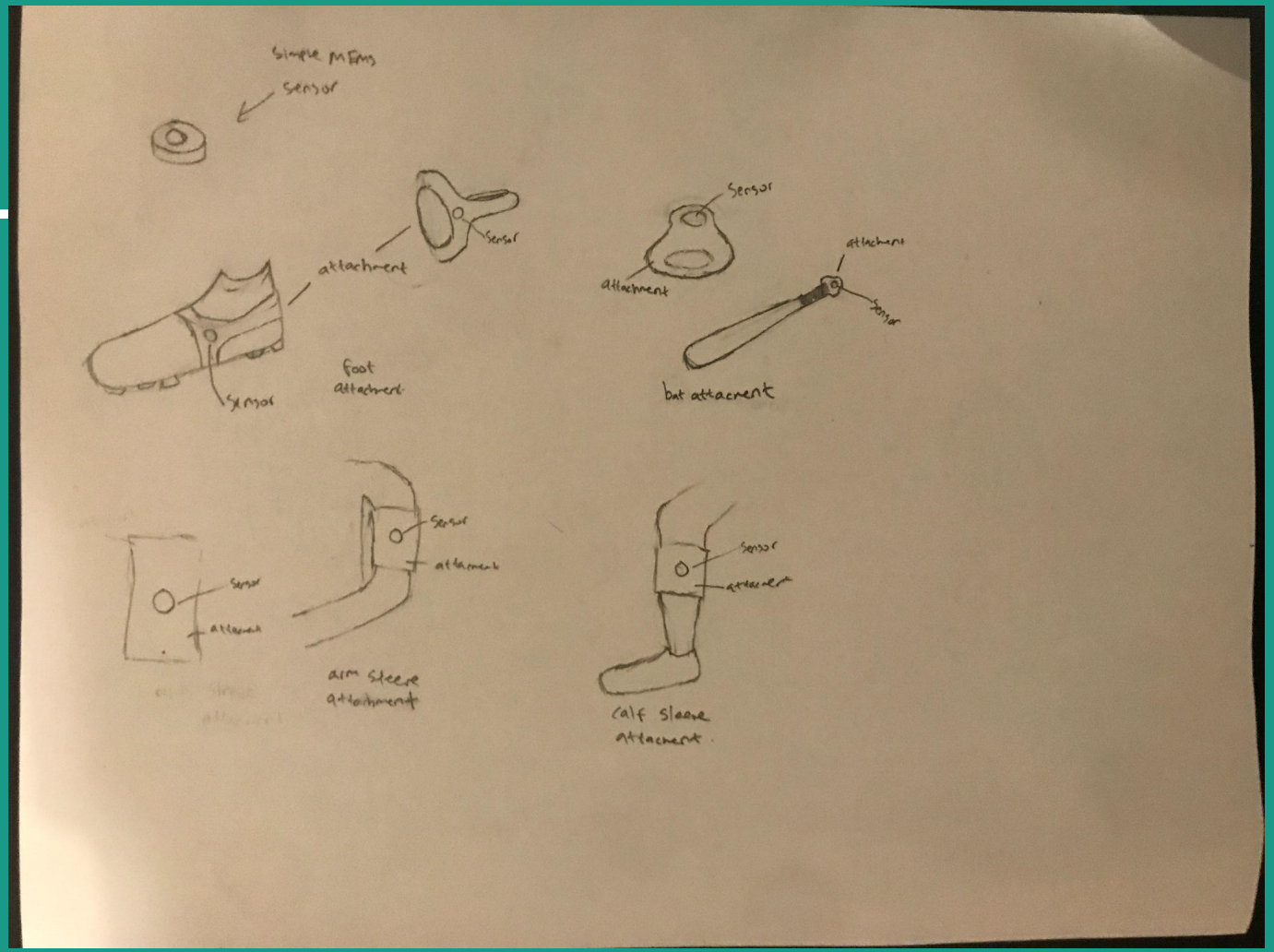

4:42
TRAINING STATS
Match
INVOLVEMENT
TECH BALANCE
VOLUME
SPEED
Last 6 | 12 Sessions | Weeks
Touch by leg (%)
Left foot
Right foot
Aug 11 36 64
Aug 09 44 56
Aug 07 38 62
Aug 07 34 66
Aug 06 50 50
Aug 05 45 55
Avg: 43/57
Release by leg (%)
Aug 11 38 62
Aug 09 38 62
Aug 07 37 63
Aug 07 57 43
Aug 06 48 52
Aug 05 51 49
Avg: 43/57
Max kicking velocity (mph)
Activities
Stats
Leaderboards
Settings


4:42
TRAINING STATS
Match
INVOLVEMENT
TECH BALANCE
VOLUME
SPEED
Last 6 | 12 Sessions | Weeks
Top speed (mph)
Aug 22 15.9
Aug 11 13.6
Aug 09 12.8
Aug 07 13.4
Aug 07 11.6
Aug 06 13
Avg: 13.4
Sprints (#) per 10 min
Aug 22 1.1
Aug 11 0.4
Aug 09 0.2
Aug 07 0.2
Aug 07 0
Aug 06 0.1
Avg: 0.4
Accl/Decl (#) per 10 min
Activities
Stats
Leaderboards
Settings


4:42
TRAINING STATS
Match
INVOLVEMENT
TECH BALANCE
VOLUME
SPEED
Last 6 | 12 Sessions | Weeks
Avg: 13.4
Sprints (#) per 10 min
Aug 22 1.1
Aug 11 0.4
Aug 09 0.2
Aug 07 0.2
Aug 07 0
Aug 06 0.1
Avg: 0.4
Accl/Decl (#) per 10 min
Aug 22 2.6
Aug 11 4.2
Aug 09 2.1
Aug 07 3.5
Aug 07 2
Aug 06 2.4
Avg: 2.8
Activities
Stats
Leaderboards
Settings

Our Product

- We were thinking of designing a product that is similar to the ones we reviewed.
- The difference would be that we would have our own little MEMS sensor and make different attachments/accessories that can support the sensor to capture different metrics. (Blast has a detachable sensor while Playermaker does not).
- Ex: leg sleeve, arm sleeve, bat attachment, foot attachment.
- For the application that would show the metrics, it would be similar to both the Blast and Playermaker but it would be combined to one app (the user can choose which sport to focus on when they open the app).


Simple MEMS
Sensor
attachment
Sensor
Sensor
foot attachment
Sensor
attachment
Sensor
bat attachment
Sensor
attachment
Sensor
arm sleeve attachment
Sensor
attachment
calf sleeve attachment

Further Development of the Product

- What we discovered during research and development stage is that as long as you have data and metrics that are in demand to be tracked in a particular sport, we can develop a product that does that with the use of machine learning algorithms and smart sensors.
- By being able to track metrics, athletes in any sport can use the data acquired to see trends and try to set goals on achieving better results on a specific metric.
- Athletes can also design specific workouts and practices to improve on their metric goals.
- With this concept, we can build more accessories and interfaces for different sports other than baseball and soccer for our product.

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