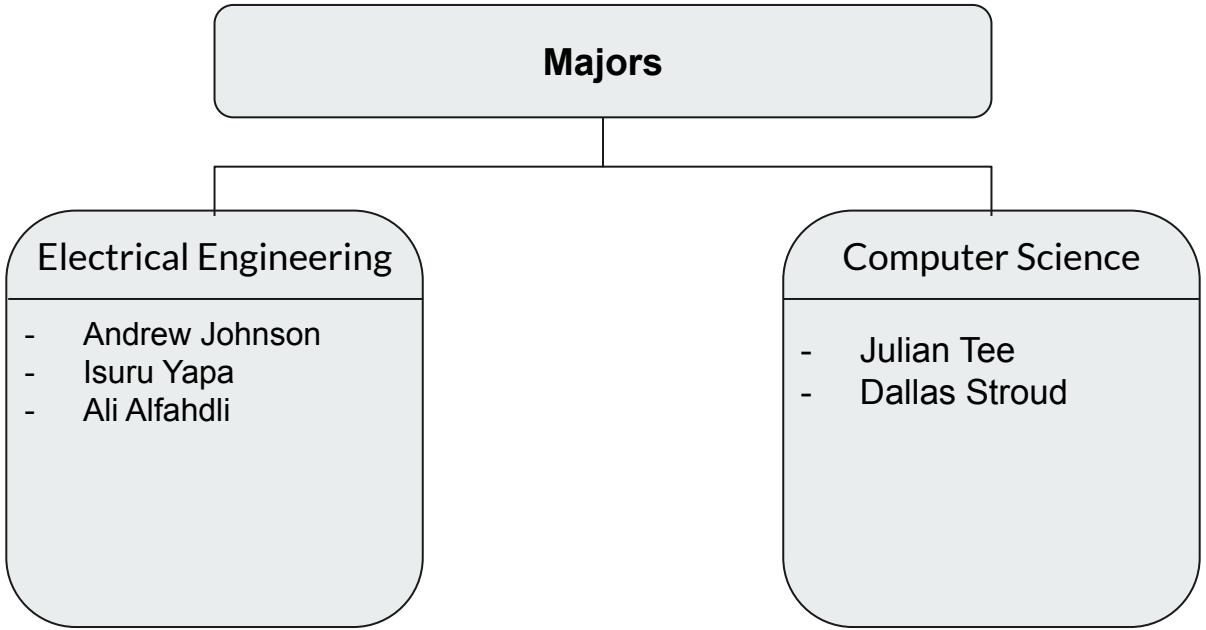
CS598-Senior Design 1

Midterm Presentation

The Raiders

Wichita State University

Team Composition



Project:

Collision Detection Football Helmet

Ali Alfadhli

Why did we choose a helmet?

- According to Vox.com “80% of football concussion goes unreported.”

How will the helmet benefit players?

- Act as an effective safety system
- Insure longer career life for athletes
- High quality designed helmet that will be based on a smart tech

Ali Alfadhli

Market Analysis

Ali Alfadhli

Difference between our project and Shockbox

Our project	Shockbox
• Lower cost • Built into the helmet • Utilizes Lorawan • Range of 2-3 km	• High price • Separate device • Utilizes Bluetooth • Range of 325 ft

What is a concussion?

Concussion Symptoms

Physical Symptoms	Other-related symptoms
- Headaches - Nausea - Vomiting - Fatigue - Blurry Vision	- Confusion or feeling amnesia surrounding the traumatic event - Dizziness

Problem Analysis

Julian Tee

Concussive Impact

- **High School Football Athletes:**
  - Average concussive head impact = 95 g
  - Lowest acceleration resulting in concussive impact = 74 g (Broglio et al, 2012)
- **Youth athletes (aged 9-14):**
  - Average concussive head impact = 62.4 g
  - Lowest acceleration resulting in concussive impact = 25.9 g (Campolettano et al, 2019)

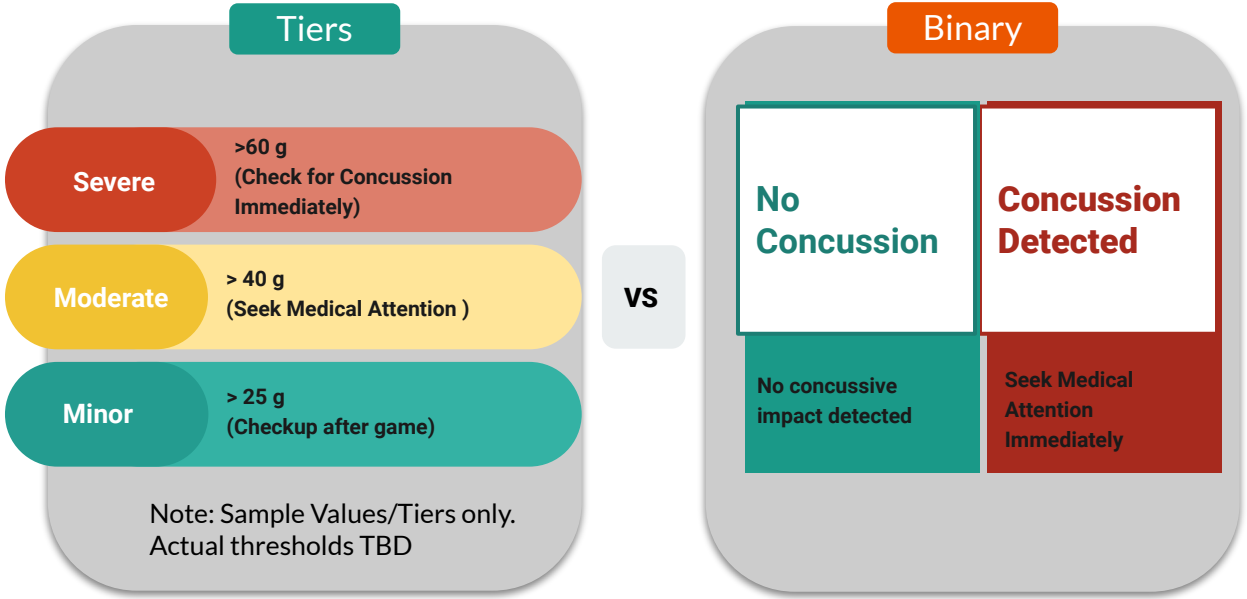
Problem:

How can we differentiate severity of concussive impact?

Julian Tee

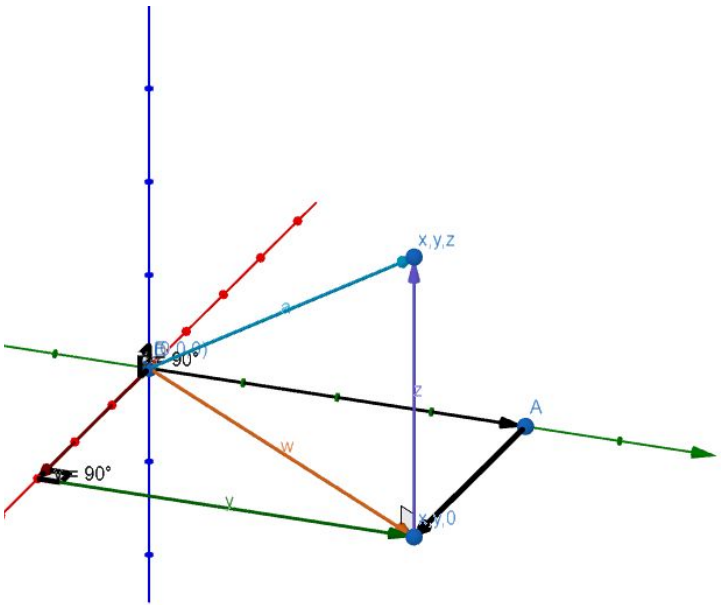
Solution: Creating ‘tiers’ and tier thresholds

- By separating the magnitude into different tiers, we can more effectively gauge the severity of impact instead of having a binary of ‘concussion or no concussion’



Julian Tee

Calculating magnitude of acceleration



From the accelerometer, we obtain x, y, z in terms of m/s^2

To obtain the magnitude of a, the pythagorean theorem is used to obtain g-force as a directionless measurement as proven below:

$x^2+y^2=w^2$

$w^2+z^2=a^2$

$|a|=\sqrt{(x^2+y^2+z^2)}$

$|a|/9.81\ (m/s^2)$ = magnitude of acceleration in g's

Julian Tee

Sensor/Legal/Regulations

Legal Analysis

RF Frequency

- There are set frequency plans
- There are no regulatory document

Liability/Patent

- Lorawan accelerometer patent
- Energy consumption

Andrew
Johnson

Goals

- Creating a sensor that accurately records acceleration and brain waves.
- Connecting the device to a LoraWan gateway.
- Recording the data and giving to it to medical professionals.
- Integrating the device into a helmet.

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Bill of material

- ADXL335 will be able to be finding the dynamic force of a football hit.
- An EEG sensor that measure the humans brain waves after then it can detect for a concussion.
- Arduino uno wich connect the device to the LoraWan bridge.

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Software Layout

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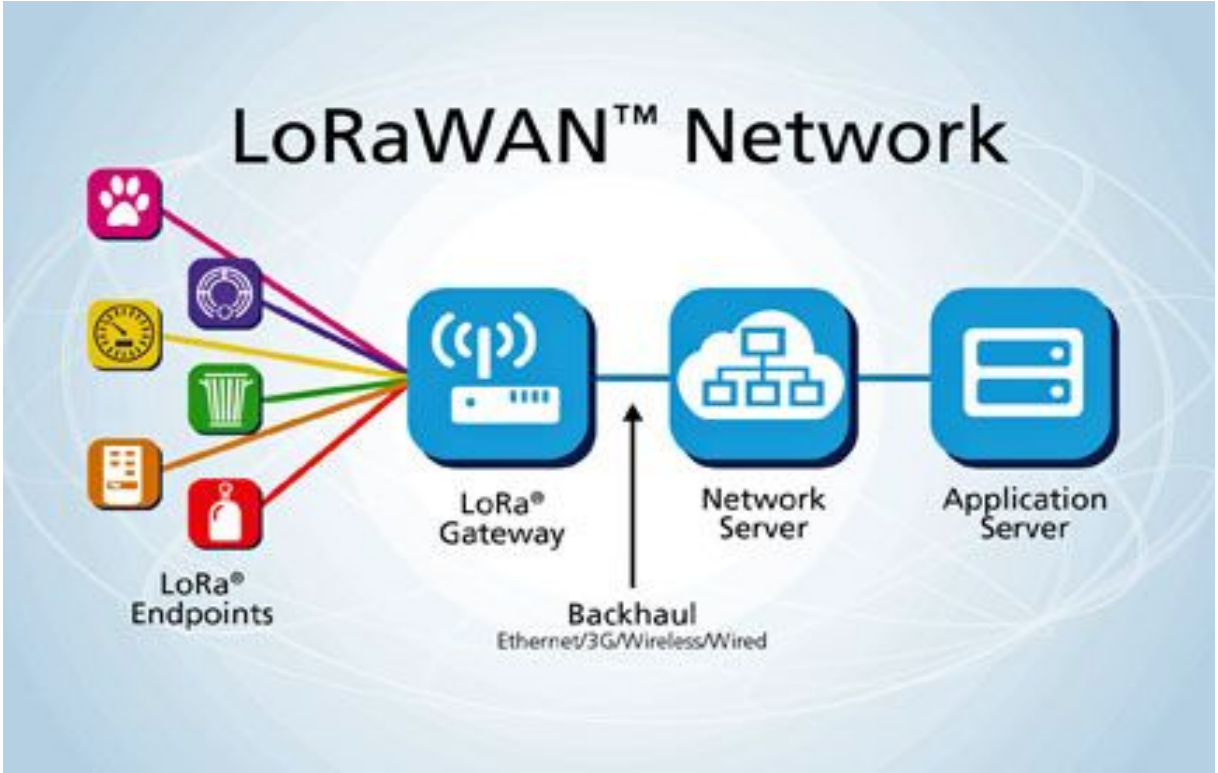
LoRaWan

- Low power use
- Low data bandwidth
- High Connection Range
- Wireless



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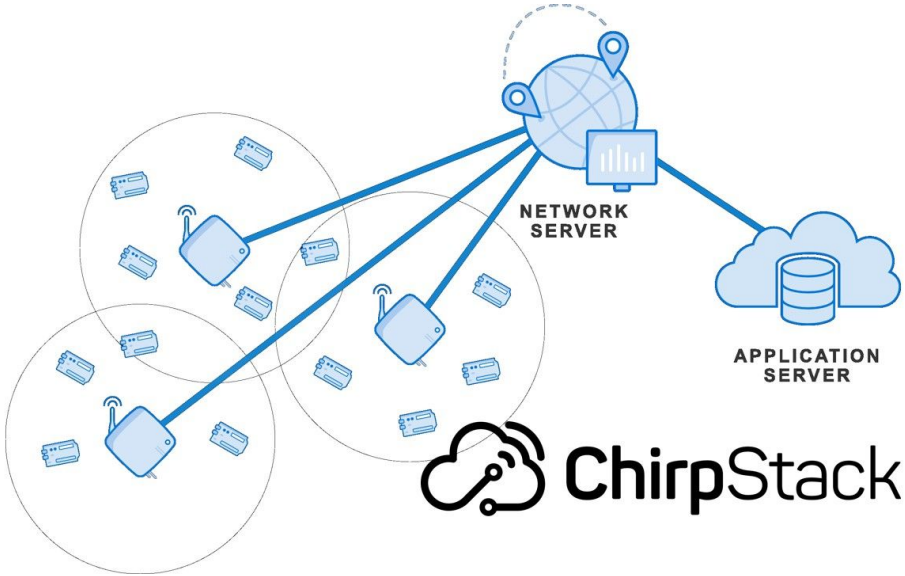
ChirpStack

- Formerly known as LoRa Server
- Open-Source
- User Friendly
- ABP vs OTAA



Dallas Stroud

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