BIOROW Real-Time Rowing Monitor

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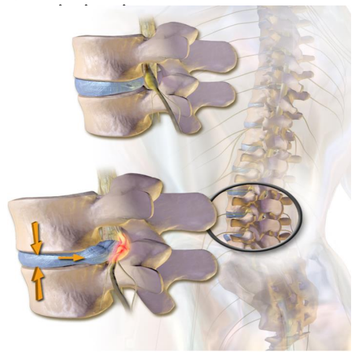
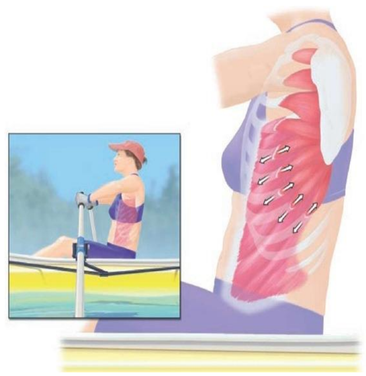
Problem Background

Rowing is a sport that causes stress or fatigue injures due to the repetitive nature of the motions involved. Improper technique in any part of the rower's stroke increases t



In this sport, the two mair injuries are lower-back injuries and stress rib fractures. Another injury is aggravation of the hip area, including hip flexors and psoas.

Uneven forces applied with legs, lifting the body during the drive-phase, instability in the boat, and rushing at the catch are the main causes of these injuries.



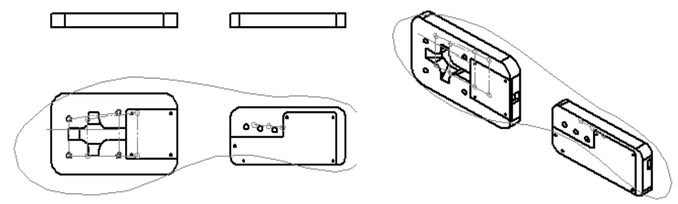
Unfortunately, bone (rib) and cartilage (vertebrae disk) can break easily under high and repetitive shear stress caused by this sport and are more easily broken with improper techniqu

Analysis of the Problem

The rower needs technical feedback that can provide information about the rowers motion. Improving rowing technique can help reduce the injuries acquired in the sport. The BIOROW model is a technique feedback system that can help the rower to improve rowing technique and potentially help reduce the number of lower-back, stress rib fractures and other similar injuries, also helping to improve the speed of the boat.

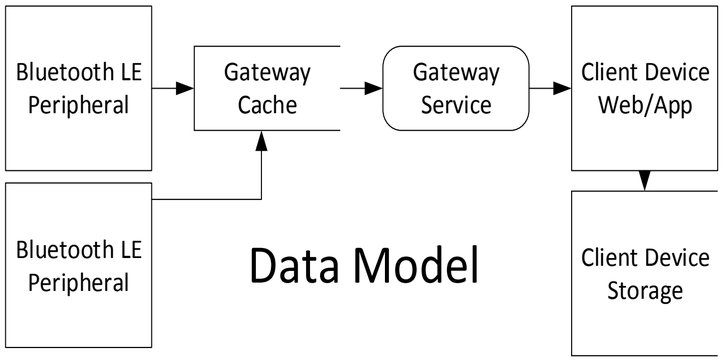
Hardware

This system consists of Bluetooth low energy enabled micro processors communicating data to a central gateway processor device. The gateway is networked to a some consumption device, in this case a HUD, web browser or mobile device over HTTP. This project required simple modifications to existing rowing equipment. The BLE peripherals are housed in the following, which are mounted to rowing equipment:



Software

The software pinnacle of this system consists of the core use of JavaScript. This includes **NodeJS** and **Socket.IO**. Running the core of the system in this programming language allows for the ability of data consumption across many platforms.
Using these technologies, this system becomes expandable and reusable. The following chart shows data flow in BIOROW.



Results

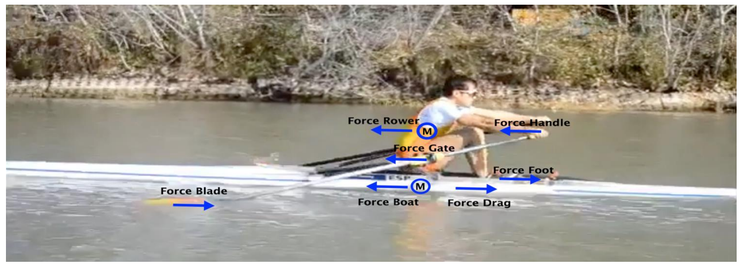
The BIOROW model provides the rower with the following technical feedback:

Even Push: Placing piezo resistive pressure sensors at each foot provides data that can be graphed to display load applied per leg. The objective of the rower is to match left and right forces applied.

Horizontal Strokes: Using the gyro and accelerometer located in the HUD, this system can analyze the motion of the rowers head with respect to the row boat.

Velocity, Acceleration, Stroke rate: A GPS and an accelerometer in our ROWBOX provides speed and acceleration/deceleration data. Using this information, stroke rate of the boat can be calculated and displayed real time.

Boat Balance: Using a gyroscope in the ROWBOX this system will display the roll of the row boat in the HUD. Having balance is essential to spinal alignment and avoiding lower-back injuries.



Conclusion

The BIOROW system can provide the rower with a combination of technical feedbacks that are currently not being implemented. This system can help reduce the most common rowing injures through the improvement of rowing technique.

Perfecting the technique won't only reduce the level of injuries, but it will improve the speed of the boat in the long term by rowing more efficiently.

NORTHROP GRUMMAN

Engineering & Science Student Design Showcase at Florida Institute of Technology