CS486C – Senior Capstone Design in Computer Science
Project Description

Project Title: Data-driven Athletic Wellness Management Portal	

Sponsor Information:	
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Project Overview:

College athletes are quite good at what they do. For some, they pick up extremely heavy things and put them back down. Others, like members of the NAU Track & Field team run, and run, and run extremely fast for a very long time.

Training of athletes to succeed at national and international levels of competition has evolved from a vague "gift" that some coaches had while others didn't, into a highly sophisticated, data-driven science. Good coaches still rely on people skills and instinct, but the heart of developing training plans and guiding athletes towards growth and success are now driven by massive streams of data and analysis. On the data side, a wide variety of electronic devices ranging from wearable sensors to heart rate monitors to GPS-enabled sports watches are capable of collecting nearly continuous streams of data, both during a training exercise and during resting periods. The number of potential data streams of this sort is continually growing, to the point that the sheer amount of data is overwhelming for coaches and athletes. In many cases, each of these potential data streams has some way (an app, etc.) to monitor the stream, but putting together a coherent larger picture of athlete wellness, training progress, and data-driven planning has become very difficult. What is needed is a comprehensive "digital wellness platform" that collects, integrates, and displays all of an athlete's training-related data streams in a coherent and easily digestible format. This easy-to-use graphical interface would serve as an informatics cornerstone of the training experience, to optimize efficiency, communication, and athlete wellbeing.

PWR lab has already tackled much of the data stream management and analysis challenge underlying this vision. We are a start-up focused on making the abundance of lived experience data, which most of us collect daily through our wearable devices, useable to coaches, athletes, and their sponsoring companies. Our clients include Sports / Outdoor brands like Brooks, where we've developed a running injury prediction model to develop an automated shoe finder, to Mayo Clinic, where we've provided their data collection platform so they could onboard subjects and study the cardiopulmonary response to endurance sports. We integrate the data from disparate streams, homogenize, and then layer in data science to provide our clients with API's and SaaS software so they can provide product recommendations, and analyze biomechanics for better product development.

Solution Vision: A powerful web-based digital wellness platform

PWR Lab needs you and your team to help design and prototype a comprehensive training program manager – what we call a *digital wellness platform* – that serves as a data-driven cornerstone for analysis of training progress, creation and monitoring of training plans and activities, and communication between athletes and coaches. Although this platform could serve as a model for data-driven athletic training anywhere and in any sport, we will begin by focusing on NCAA college athletes and, even more specifically, NAU's prestigious T&F team.

Let's take closer look at what we envision as this wellness platform and how it would work. In general, the platform will optimize the coach's efficiency in his/her daily review of each athlete's activity and recovery metrics. We already have the data streaming in from NAU T&F which is available via a series of API endpoints, e.g., the separate databases of performance data collected by each device manufacturer. The key function of the web platform is to draw in all of these separate data streams, integrate and analyze them, and display the results in various forms (tables, graphs, exportable data files) to athletes and coaches. Specifically, the mobile-enabled web app will have two distinct account types and perspectives: coaches and athletes. The coach view will be able to review certain metrics coming from the athletes, both quantitative from their GPS watches and qualitative feedback from responses to each athlete's daily wellness prompt, and can then provide feedback and guidance to the athlete. The athlete account will have prompts for daily text input, e.g., a "wellness survey" to see how they are feeling in various regards. They will also have ability to connect/edit a device, and the ability to review key metrics coming from their GPS watch and other connected devices.

To further illustrate how the platform will work, let's assume we have Coach Mike, and Athlete Susie. At the start of the season, Mike sends Susie an invitation to join the team's wellness platform. Susie accepts, creates an account on the platform, and connects her Apple Watch as one (of potentially multiple) sensors. Now Susie can see her recent workouts and key metrics. She also can enter in text into a templated "daily diary" that corresponds to the activities for that day and asks subjective questions about how the training day went. Mike logs in and can see a "dashboard" showing all 85 athletes, with some basic summary of their status and training-related data being collected via the PWR Lab APIs. When he clicks on Susie, a more detailed page for this athlete is shown, where he can see her activities and her daily diary responses. To give feedback, guidance, and encouragement, Mike can "comment" on entries in the diary, with his text appearing below/with her response; Susie could optionally respond to those responses, essentially starting a "chat" surrounding that topic.

Features and implementation: a mobile-friendly web application

We envision a secure, web2.0 web application as the basis of this portal, allowing both coaches and athletes to access the tool from any web browser. It is important to design the key interfaces (especially ones used heavily by athletes) to be "mobile-friendly" however, because the majority of athletes (often as well as the coaches) use will be via a mobile phone, i.e., a mobile phone browser. The two key user groups are obviously coaches and athletes; each of these user groups will have different priorities in terms of data access and viewing, and thus one would expect a customized UX design for each. From the coach's perspective, the wellbeing log will optimize their efficiency to review each of the athlete's individual wellbeing and journal (health & wellness) data to easily provide feedback and adjust the upcoming coaching plan based on the evaluation. For the athlete, this will minimize their data submission time and effort by automating the data flow from their wearable device to the shared wellness management platform. It also provides the athlete with real time updates when the coach provides feedback and allows the athlete to follow-up with the coach immediately if clarification is needed. As there is no standard for the best way to coach an athlete, the final solution must be dynamic and flexible to allow coaches to determine what information is most important to them as they evaluate athlete performance, and provide multiple time windows for evaluating each athlete, i.e., daily, weekly, monthly, etc.

At the backend, the web app accesses data streams via PWR Lab's established API pipeline, and can either pull those data into an integrated backend database; both web app and associated data could be stored in cloud infrastructure. We leave these design details to be explored by the team and will look forward to developing a detailed functional specification and selecting specific technologies. Detailed function will be developed and specified by the team, but some key features will include:

1. Easily set up new coaches in the environment
2. Allow coaches to customize their dashboard rows & columns as they see fit (i.e. do they want to see elevation gain and loss as two different columns or just a generic vertical column counting increase in elevation?)
3. Allow coaches to create a template of what each individual athlete's wellbeing log will look like.
4. Allow coaches to easily onboard new athletes

5. Allow athletes to easily sync their wearable device with PWR Lab to provide automatic data submission.
6. Create a daily form/survey system for athletes to submit additional data, i.e. injuries, food/nutrition info, menstrual data, journal/diary entry, etc. Also customizable by the coach.
7. Have data feed into a coach's dashboard to be easily reviewed in real time. Have the dashboard sort athletes by priority, i.e., athlete is injured or having a mental health crisis, allow coach to reach out to athlete sooner when help is needed.
8. Once athlete's data has been reviewed by the coach, provide feedback real time to the athlete.
9. Create a notification and reminder system to ensure that athletes are diligent about submitting their form/survey data.
10. Fully secure with OAuth via API
11. Coach has global access to coaches dashboard and also each athlete's individual dashboard. Athletes only have access to their own dashboard.

Knowledge, skills, and expertise required for this project:

- Modern Web2.0 web application design, including various related frameworks and concepts.
- Knowledge of API access and integration
- Understanding of applied DB technologies and systems.
- Web-based GUI design and implementation, including mobile-ready web design.

Equipment Requirements:

- Access to cloud-based development platforms will be provided as needed.
- There should be no equipment or software required other than a development platform and software/tools freely available online.

Software and other Deliverables:

- The wellness platform product, as described above, deployed on a server infrastructure of the client's choice, and demonstrated in one or more realistic use case scenarios.
- A User Manual or integrated help system for end-users, i.e., faculty and students. Backstop for when clear and obvious GUI design falls short.
- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally documented codebase delivered both as a repository in GitHub, BitBucket, or some other version control repository.