Memo

To: Eric Walstra
From: Calvin College Engineering Senior Design Group 10:
      Nick VanDam, Jessica Par, Brad Kunz, Carl Cooper
Date: March 2, 2015
Re: Project Brief

Team Member Introduction:

BioBit, Team 10, of the Senior Engineering Design course, is comprised of four members, all of whom are of the electrical/computer discipline. The four team members are Brad Kunz, Nick VanDam, Jessica Par, and Carl Cooper as seen below. To understand the project proposed and the high-level concepts, please refer to the content herein.

![Figure 1. Team members - Brad Kunz, Nick VanDam, Jessica Par, Carl Cooper (left to right)](image1)

Project Description:

The concept of BioBit’s project is a smart, wearable device intended for coaches, sporting teams, and workout groups who need a better way to gauge intensity and effectiveness of workouts and practices.
This concept is a wearable device that tracks and displays data via a partnering Android app. The device will provide coaches with real time analysis of workout, goal tracking, and team performance. Unlike personal fitness trackers that focus on daily routine tasks, our product will provide a unique workout tracking network of multiple devices that help improve team and individual workouts and achieve fitness goals with a partnering analysis application.

**Figure 2. Block Diagram of the System**

**Summary of the Requirements:**

Below is a breakdown of the requirements for the system. A full list of the technical requirements can be seen in the team's Project Proposal and Feasibility Study document.

For the device:

- Must not hinder the athletes’ movement or performance.
- Must be battery powered and last a minimum of 2 hours and be rechargeable.
- Must be rugged and able to withstand environment of weather and sweat.

For the central hub:

- Must be able to host its own network and database.
- Must operate under moderate weather conditions (any condition that an outdoor practice would take place in)

For the app:

- Must have an intuitive and easy to use interface
- Must be able to view data as a team or individually

**Major Design Decisions:**

- Communication protocol for the devices is Wi-Fi because it meets the distance requirements, is able to interface with smartphones/tablets, and is an easy to work with protocol.
- The microprocessor used for the tracker will be an Arduino Pro Mini. This was chosen as the alternative as opposed to the Intel Edison due to factors such as price, size, and ease of use.
- A Raspberry Pi was picked to be the central hub within the system. This will host a database that will receive all the trackers’ data, organize, and sort the data within the database, and then transmit the data to the app when requested.
- The fitness tracker will include a heart rate sensor and an accelerometer that will track step data.

**Significant Issues:**

- Creating an algorithm to decipher step tracking data if the device is placed on the wrist
  - Involves using a six axis accelerometer and gyroscope to detect when a step has occurred. This presents an issue because the arm has a much greater degree of freedom and more individual movement from the body than the waist or leg where a pedometer is often located.
- Housing all the components for the wearable device in a suitable case that will hold the heart rate monitor firmly to the skin to provide a good reading but also remain a reasonable size to wear.

**Current Status:**

As the project currently stands the team has split up the work between the members with one designated person working on the heart rate sensor, the accelerometer/pedometer, the server on the Raspberry Pi, and the Android App. The team has set goals to establish communication and start recording data in the coming weeks along with developing the app.

As of 3/2/15:

- The heart rate sensor is transmitting BPM data to an Arduino Uno (Uno is used for development purposes, and will not be a part of the final prototype).
- The accelerometer is outputting raw x, y, z values to the Arduino Mini Pro.
- A basic Android app has been created and displays test data coming from a database.
- The Raspberry Pi is capable of hosting its own network and the peripheral Wi-Fi chips for the Arduino Mini Pros can connect to the network.

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