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## Progress Report

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*for*

# OptiFit: A Powerlifting Monitor & Warning System

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## Introduction

Powerlifting has seen an explosion of research in the past decade as more and more North Americans are prioritizing their health, fitness, and performance. Unfortunately, the tools used to measure the performance of athletes are lacking twofold: Research and education tools are broad in terms of raw data, but narrow in terms of analysis and user feedback while consumers products are overpriced, bulky and usually only give the user one biometric piece of data.

OptiFit will give users a large array of data in addition to automated analysis that can warn the user should their form be incorrect. To give analysis during a user's lift, our software package will take advantage of three sensors: an electromyograph (EMG) to measure muscle activity, a force pad to calculate force delivered to a barbell, and a Microsoft Kinect to track body mechanics.

## Schedule

The project had lofty goals as far as the amount of work that was required per team member; however, there has been success in hardware and steady progress throughout the rest of the product. As shown in Table 1, the electromyography (EMG) is complete and fully functioning on a custom printed circuit board (PCB). The mechanical portion of the force pad on the other hand, was just recently completed after it had been behind schedule for two weeks. The rest of the mechanical construction, namely the case for the EMG, is on schedule and nearing completion.

**Table 1: Summary of OptiFit's schedule and current status.**

Component	Target Date	On Schedule?
Kinect SW	Feb. 2	✓
Wireless SW	Feb. 19	-4 weeks
EMG	Feb. 19	✓
GUI	Feb. 23	✓
Force Pad	Mar. 8	✓
EMG Case	Apr. 1	on schedule
Test/Debug	Apr. 5	-1 week
Final Product	Apr. 18	on schedule

Software meanwhile, has been hindered on finishing the wireless transmission, which is behind four weeks now. Consistent progress has been made elsewhere despite this hiccup, as the GUI/analysis programs are nearing completion. Once the wireless is functioning, additional progress on these programs can take place so that we can begin initial calibration. At our current pace, we will meet our deadline of the April 18<sup>th</sup> demo.



## Financial

Omaro secured \$600 from the Engineering Science Student Endowment Fund (ESSEF), which was our anticipated budget upon starting the project. As shown below in Table 2, a majority of our finances were aimed at electronic components and the Microsoft Kinect itself. The Kinect, although expensive, was a fixed cost whereas we have gone 60% over estimated electronic costs.

Table 2: Summary of OptiFit's cash flow compared to amount budgeted.

Source	Amount	$\Delta$ from Budget
ESSEF	\$600	\$0
WDF/IEEE	TBD	TBD
Electronics	- \$285.02	- \$105.02
Wireless	\$0	\$0
Mechanical	- \$109.22	\$10.78
Kinect	- \$236.14	- \$0.96
<b>Total Net</b>	<b>-\$30.38</b>	<b>- \$95.20</b>

The mechanical components meanwhile were very close to our budget. These purchases included the acrylic for the EMG case, plywood for the force pad, and misc. parts for construction. Money wise, we are currently ~\$30 into our own pockets after exhausting the ESSEF grants. Taking a look into our

## Progress

As a team, Omaro has done a thorough job researching the design, planning for potential issues, meeting weekly, and progressing through development consistently. Currently, the hardware and mechanical components for OptiFit are completed and waiting on software integration.

The EMG's components were purchased quickly and prototyped on a breadboard early so that the final design could be determined quickly. A PCB was sent off early and has already been soldered and tested on an oscilloscope. The second electronic system, the strain gauges for the force pad, has been soldered and is waiting strain testing and calibration.

Mechanically, OptiFit has seen a lot of progress as well. The plate for the force pad has already been fabricated and is waiting for its laser-cut feet and electronics to be installed. The case for the EMG has also been laser-cut, bent and is undergoing testing before the circuitry can be installed. Particularly, we are worried about potential electrostatic discharge (ESD) issues with the acrylic and ESD sensitive wireless mote. Before we proceed, we're going to consult with peers and install a metal ground plate for safety.



Unlike the other sections, software has seen some delays and is currently the critical path of the system. The wireless software is currently half of the team's effort as getting data from software to the PC is a significant part of the product. Other pieces of software like the GUI and analysis program are as complete as they can be without the sensor data. One fortune is that the system has all necessary parts and materials for completion, as software can be worked on up until near the deadline. We do need to leave some room for testing however, as many of the functions will require trial-and-error during integration.

Omaro's in-depth consideration of design and attention to detail has helped the group create professional quality documents. All three major deliverables (Proposal, Functional Specification, Design Specification) have scored near perfect scores. These results are also the side effect of the company's strong cultural identity that each member has thrived in.

## Remediation

There are two major areas we would like to adjust moving forward with the project: purchasing habits and the distribution of our manpower.

One side of effect of our early prototyping was the uncoordinated purchasing of electronic components for the EMG. Many of the components we could only locate online, which includes exorbitant shipping prices with respect to the price of the parts. Not only that, but we purchased components that ended up not being the most optimal one for our needs. Moving forward, we will be consolidating our purchasing to reduce shipping costs.

Secondly, we underestimated the amount of development time for the wireless software. We had initially split the team into two groups of two, one on each of hardware and software. As it stands now, we have moved one of the members from the hardware team to assist with software – a total of 75% of our manpower dedicated to accommodate for this scheduling slip. The remaining member in hardware will take care of documentation and keynote preparation as well to allow the rest of the team to focus on software.

## Summary

OptiFit, a unique product aimed to bridge the gap found in physiological monitors, is progressing well. Estimated finances and scheduling are near our anticipated expectations. The hardware and mechanical components of the system are complete and awaiting further testing, whereas the software side is noticeably behind. To make up for this, we are shifting a majority of our efforts to speed up software development to have the proof-of-concept product finished for the April 18<sup>th</sup> demo.