Kepros - Wearable posture training diagnostic vest for physical therapy

DESIGN DOCUMENT

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1 Introduction

1.1 PROJECT STATEMENT

This goal of this project is to design a wearable posture training diagnostic vest for physical therapy that is able to monitor back posture through sensor data. This data will be able to be sent to a terminal (computer, phones, etc.) to analyze and interpret the data for users and medical professionals. This device should be able to capture movement of the muscles (including the angles and the strength of muscles being used)on the back, so that data could be understood by the users or doctors.

1.2 PURPOSE

From general medicine aspect, back problems are hard to be diagnosed, because many diagnostic tests have limited value and may even be controversial. Also, many people's discomfort is caused by back pain. However, describing back pain to a doctor and recording levels of back pain throughout the day can be difficult to do accurately. As a result, this diagnostic vest is desired to be able to help medical professionals to better diagnose and treat patients.

This device can have multiple uses in other areas. For example, it can monitor people's seat posture for a time period and help people prevent back problems caused by bad posture. This vest can also give patients better direction for their recovery exercises. Moreover this wearable device can be used in professional sports. By observing the movement and posture a player does, the vest can convert those movements into data and analyze that data to understand how to improve their training regimen.

1.3 GOALS

We would like to have our circuit board and vest built neatly and condensed so that it is convenient to wearers. Collected data

should be more readable by getting rid of noise and unwanted outliers. The vest should be able to detect angles of the back, which means it can give users a clear view of the area of the back that has problems and their current posture and levels of stimulation in their back muscles.

2 Deliverables

Our deliverables for this semester will be a refined vest and hardware component along with software that is able to show data received by the hardware. The semester afterward, the hardware will have a finished design and the software will be easier to use and understand.

3 Design

Include any/all possible methods of approach to solving the problem. Discuss what you have done so far. What have you tried/implemented/tested etc. We want to know what you have done.

We are using the sensors chosen by the previous team. Our main design changes are in reducing the size of the electronics from a large brick to a small package able to be hidden in or near the seams of the finished garment. We have chosen a new board to collect, store, process and distribute the data from the sensor package due to its integrated data handling capabilities and a slightly faster speed along with hardware support for multiple I2C pins as that was a problem encountered by the previous team when they were implementing the gyroscopes in the previous implementation of the project.

3.1 SYSTEM SPECIFICATIONS

Sensor packages which contains biosensor EMG and motion processing unit MPU6000 to get a full set of sensing data to capture the back movement.

I2C, JAVA, C++, Android

3.1.1 Non-functional

1. The vest must not hinder the user's movement. They must be able to perform physical activities close to their normal standards.
2. The vest should be compact. The wearer must be able to go about their daily life without everyone noticing that they are wearing it beneath their shirt.
3. The program must be able to record data over the course of a day.

3.1.2 Functional

1. The vest should be able to obtain accurate and meaningful data pertaining to the wearer's posture and back.
2. The data should be presented in a way that can assist with the correction of bad posture.

3.2 PROPOSED DESIGN/METHOD

Discuss what your team has decided to implement/design/do

Right now, we have a slim fitting cotton vest that the previous team made. The vest has attachments available for 4 gyroscopes and 2 EMGs. The problem with this iteration is that it has a poor appearance and the wires are a mess. We have ordered easier to manage hardware components so that the project becomes more compact and the number of wires decreases.

We have been considering the possible use of the feather line of microcontrollers differing methods of handling data and the future iteration that could be made once we have moved the old

code functionality to the new line of boards. At the moment we are implementing a system to record and save data on board.

3.3 DESIGN ANALYSIS

Discuss what you did so far. Did it work? Did it not work? What are your observations, thoughts, and ideas to modify or continue? If you have key results that may be included here or in section 5 i.e. Results

The testing phase is currently underway. We have not found any results so far indicating that our hardware is faulty or that our changes to the last team's design will not function properly.

4 Testing/Development

4.1 INTERFACE SPECIFICATIONS

Discuss any hardware/software interfacing that you are working on for your project. This section is decided by team advisor/client.

The software program will be able to receive and display data given by the hardware.

4.2 HARDWARE/SOFTWARE

Indicate any hardware and/or software used in the testing phase. Provide brief, simple introductions for each to explain the usefulness of each.

Parts are just arrived in days. We currently have no plans to use other hardware or software to test our project. This may change in the future if we find a program that would be convenient.

4.2 PROCESS

Explain how each method indicated in the design section was tested. It might be a good idea to insert a flow diagram of the process.

Testing has not begun.

5 Results

List and explain any and all results obtained so far during the testing phase. Include failures and successes. Explain what you learned and how you are planning to change it as you progress with your project.

Testing has not begun.

6 Conclusions

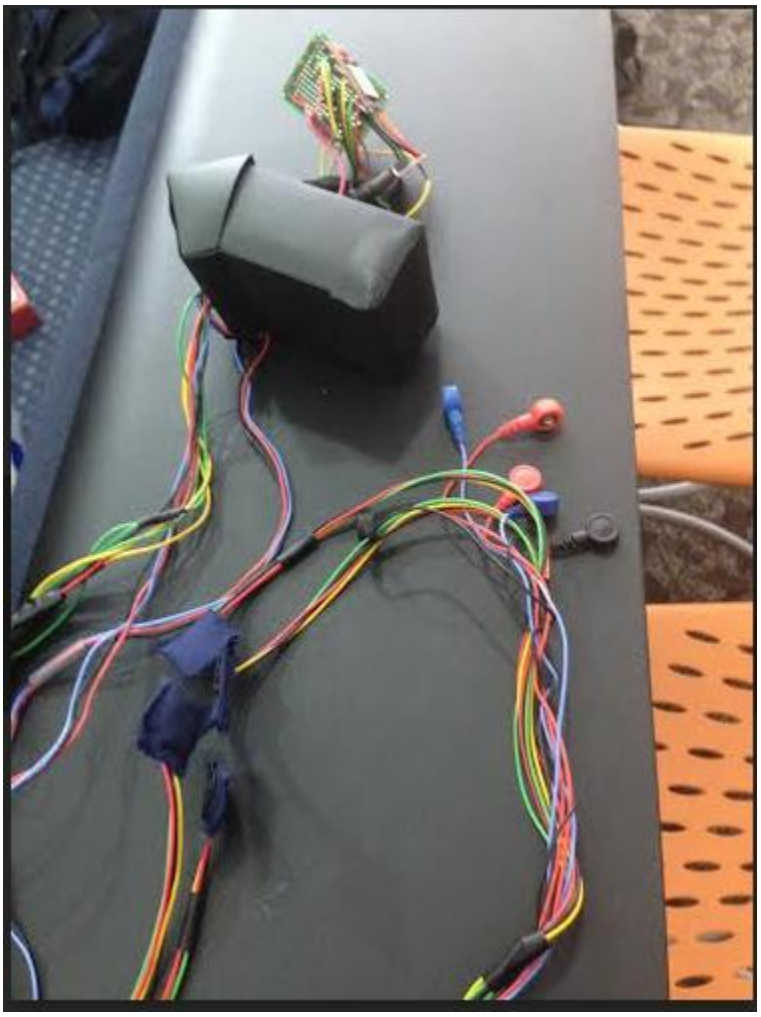
Summarize the work you have done so far. Briefly re-iterate your goals. Then, re-iterate the best plan of action (or solution) to achieving your goals and indicate why this surpasses all other possible solutions tested.

We have begun making desired changes to last year's project in order to make the vest more compact and usable. By the end, this vest will be able to help wearer's solve their back pain issues. By observing data from the vest, we will be able to record problematic positions and tell the wearers when their posture matches these positions. Observing the data will be necessary, because we need to know the kind of information that can be outputted for every twist and turn the user makes.

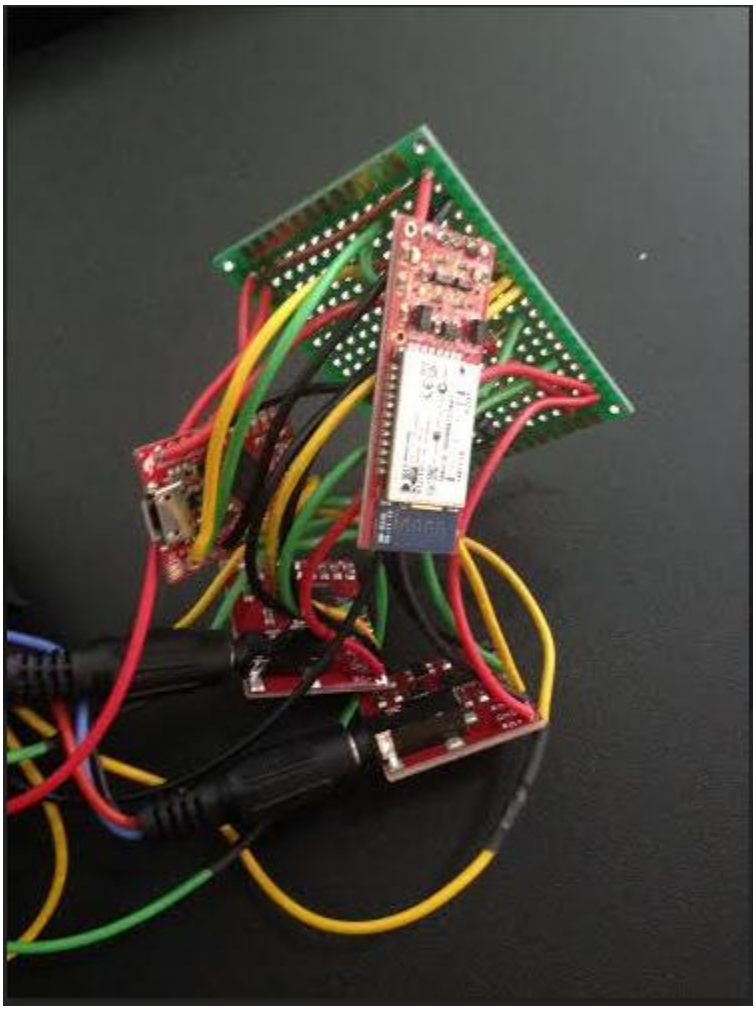
7 References

Ted Kepros, Client.

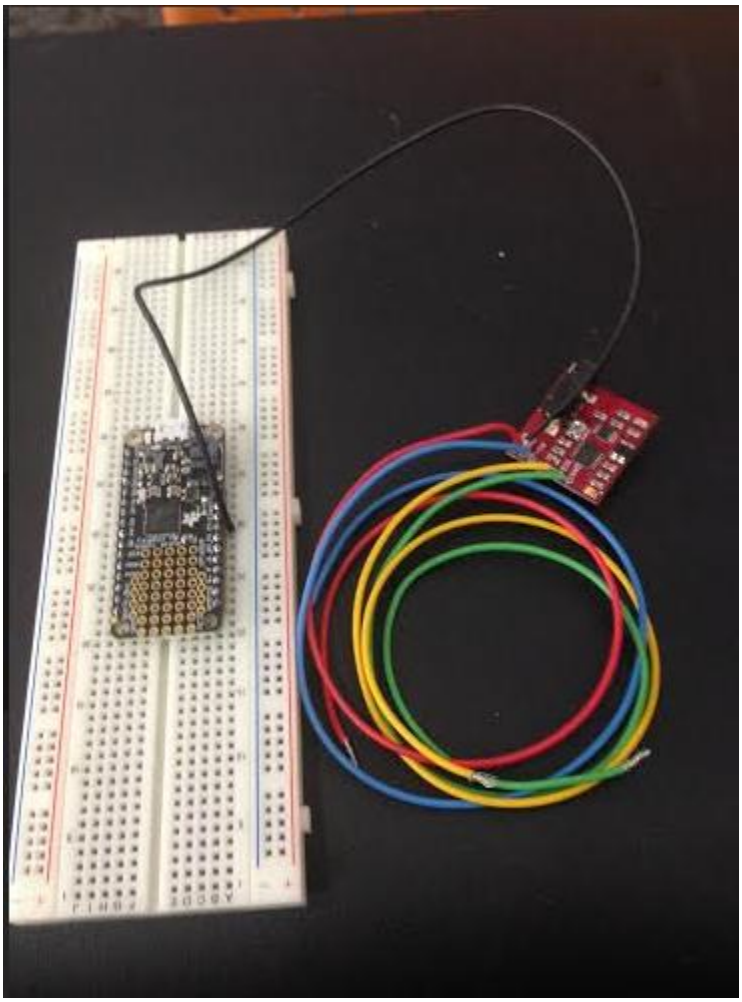
Current vest with hardware disconnected



Current hardware and the box that stores the board



Closeup of the board



An EMG connected to the new hardware