Arm Motion Tracker

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Abstract

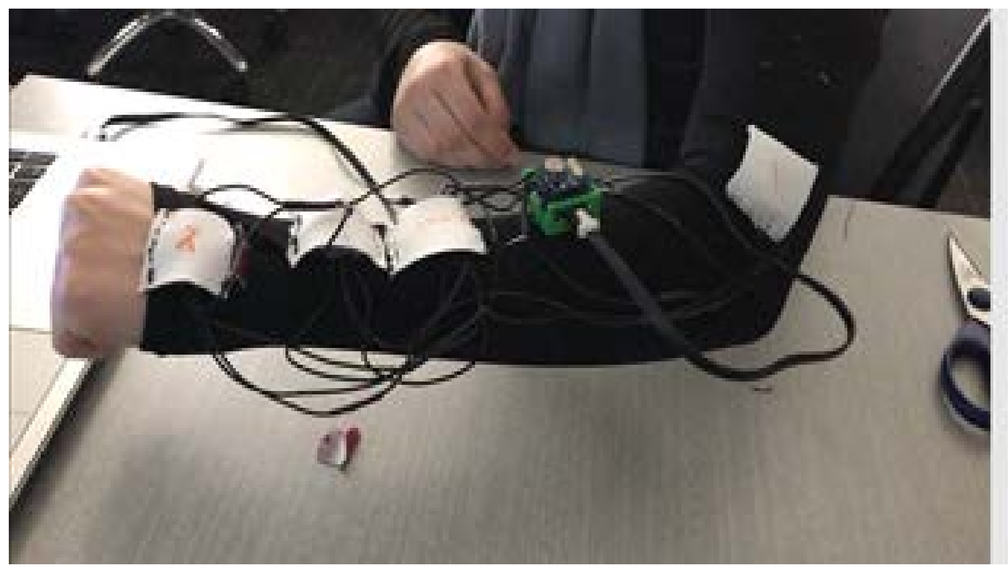
The purpose of this paper is to present the AMT device. AMT is an Arm Motion Tracking device that monitors the arm movement. It does that using IMU sensors and TinyDuino. AMT will be used on patients suffering from Duchenne Muscular Dystrophy. It will monitor their arm movement, and provide necessary data to the FDA to help approve Exondys 51. Exondys 51 is a drug made by Sarepta Therapeutics that slows down the progression of DMD. Exondys 51 has been granted an accelerated approval, however, they must demonstrate the efficiency of the drug through a confirmatory clinical trial and that is where our project comes in play.

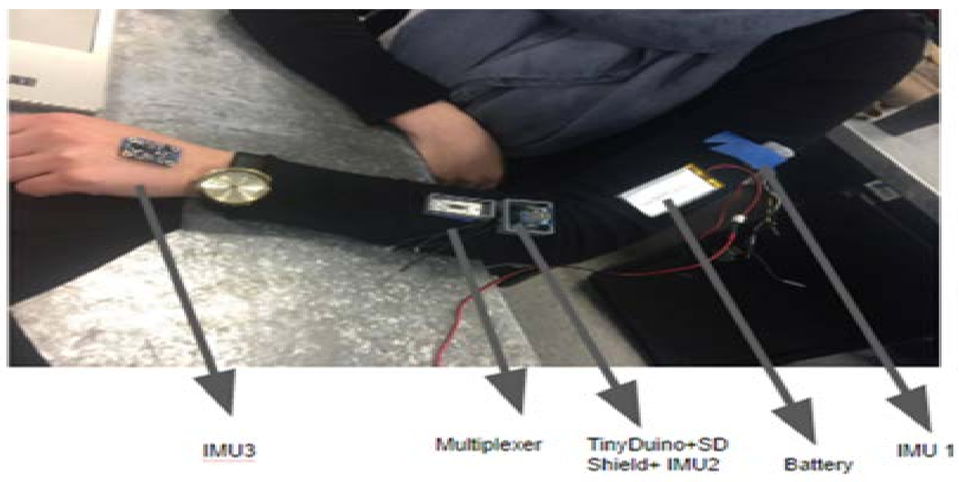
Customer Needs

Our customer has requested a device with a battery that's rechargeable, and lasts at least 12 hours. The device's size has to be adjustable because it needs to be usable for kids between the ages of eight to twenty. The weight of the AMT must be below 3 lbs. It has to be childproof, able to sustain a drop from 6 ft.; water resistant, and it has to take less than two minutes for the parents to put on the patient. In addition, our customer has requested that the device should have easy data acquisition, and must cost less than $250.

Design Concept

The selected design consists of three IMU sensors; one on the wrist (providing three degrees of freedom), one on the elbow (providing one degree of freedom), and one on the shoulder (providing two degrees of freedom). All three sensors are connected to the Tinyduino through a Multiplexer that takes all inputs from the sensors and sends it as one output to the Tinyduino. There will be a tiny screen OLED tiny shield attached on top the tinyduino processor. Which will be programmed to display the time, the battery percentage, and the status of the device (ON/OFF). In addition, in the OLED display there will be a button that is programmed to turn the device ON and OFF. Furthermore, attached to the Tinyduino will be an SD card programmed to save all the collected data throughout the day, and then be transferred to a computer for further analysis. The device is powered by a lithium battery that lasts up to 13 hours and is rechargeable by simply plugging the device into a computer using a USB cable.
The IMU sensors, coated in silicon, the multiplexer, and the battery will be put in elastic pockets in the bottom sleeve. The TinyDuino and its shields will be stacked in a 3D printed box made of ABS plastic. Proceeding, the cases will be placed inside a sleeve made out of a composite material of 90% polyester and 10% spandex which provides comfort and protection to the device and to the user.





Test Plan

Test Case	Direct Requirement	Test
010	REQ010 REQ080	Physical Measurements
020	REQ230	Recharging
030	REQ420	Battery Duration
040	REQ310	Data collection
050	REQ410 REQ440 REQ450	User Procedure
060	REQ620	Drop-Proofness
070		System Test

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