Cervical Trainer

A Physiotherapy Product

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Introduction

* Nearly 85 % of the people over 60 years live with cervial pain.
* People using laptops and computers for longer period of time are prone to cervical problems
* Visiting different doctors and interviewing them helped us understand the problems that doctors were facing during this treatment and the need for this technology.
* We propose to design a system which is cheap , wireless, and more efficient in calculating the movement of the human head by using harmless systems.

Objective

* Our device is
  - Low Cost
  - Accurate and Sensitive readings
  - Ease of use for the patients with simple UI
  - Different types of modes
  - Database system.
* Help doctors and patients to have enhance and better experience
* Our device will ensure that the patient does exercise on regular basis and is self motivated, which will help doctors save time.
* Also the doctors can treat patient more efficiently and easily assess their patients'.
* The device can be spread via doctors of that field,online, conventions and social drives.

Literature Survey

Recent practices that are performed by doctors have a laser pivoted at the center of the head, and the patient has to target at given board as shown in figure below

* In above practise method, doctors face various problems of calculating angles by taking readings from chart and then substitute that in mathematical equation(tan^{-1}).
* For this type of treatment, the patient has to sit at a fix position and also the height of the chart has to vary.
* At present there has been development in new system which has a 9 DOF sensor which helps in finding the inclination of the human head in different directions(YAW,PITCH,ROLL).
* This values are sent over Bluetooth communication to android app which will process the data and will be used in further modes(activities).
* This project will have an analyses mode which helps doctor understand the initial stage of patient, when the patient first arrives at the clinic.
* The analyses mode will analysis the shift in head position from original position after exercise.

Hardware and Software Requirements

Hardware requirements:

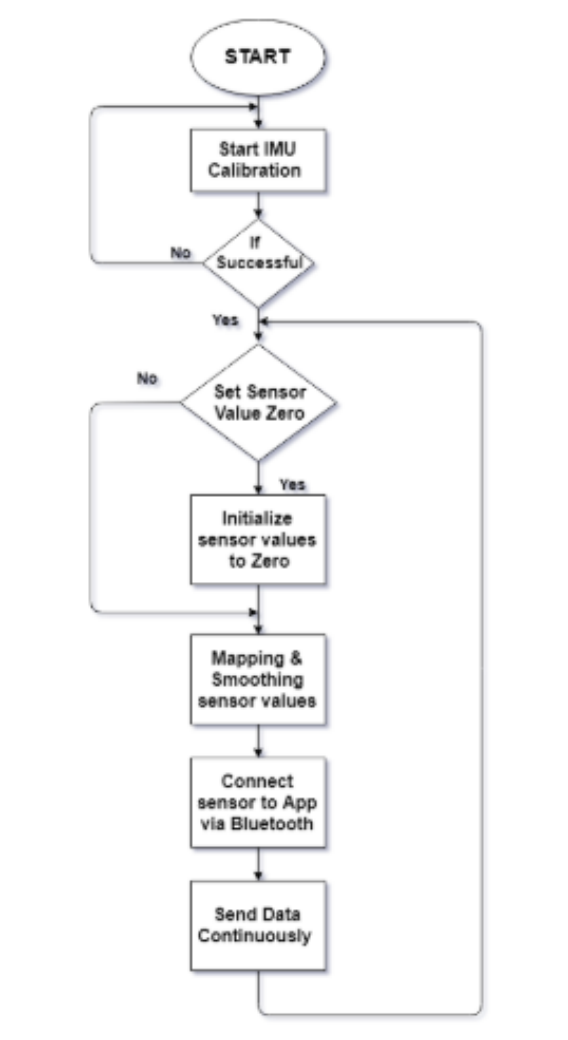
* 9-DOF IMU sensor
* Arduino Nano/SAMD21
* Bluetooth Module HC-05/BLE
* LIPO batteries 3.7V
* Battery charger

Software requirements:

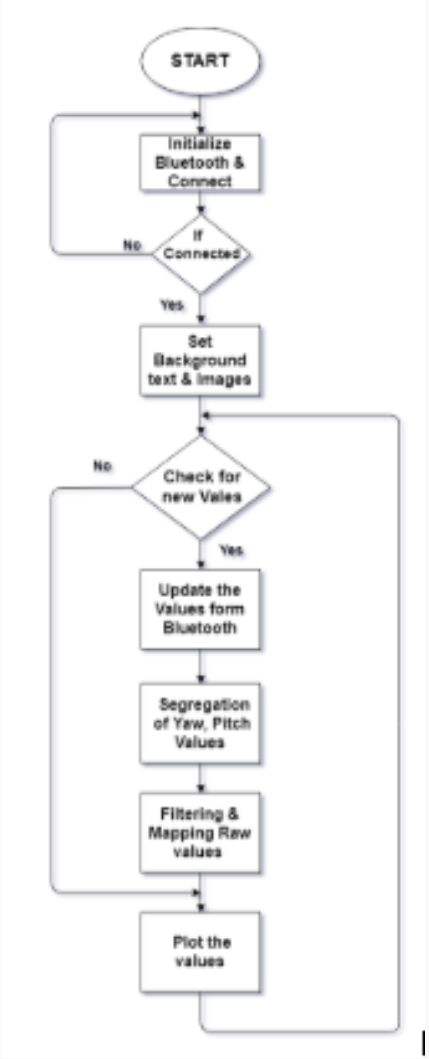
* Arduino IDE/Atmel Studio
* Android Studio(App development)

Methodolgy

Hardware



Software



Market Research

* For neck pain in the general population, the lifetime prevalence has been reported to be greater than 70%, 67%, and 80%, respectively.
* The one-year prevalence of neck pain among adults ranges from 12.1% to 71.5%.
* The point prevalence of neck pain is reported to be between 12 and 34%.
* The weekly prevalence of neck and shoulder pain in adolescents rose from 17 to 28% in the years 1989 through 1996 in one study; the authors opine that this was related to the increasingly sedentary nature of adolescents, including increased computer use.
* An increased prevalence of musculoskeletal illness for users of computers and video display units has been observed Cagnie et al reported a 12-month prevalence of neck pain in office workers of 45.5%.
* Cote et al more recently reported the one-year prevalence of neck pain in office workers to range from 17.7% to 63%. (Source-Canadian Chiropractic Association)

Challenges and Conclusion

Challenges

Every required feature had to be subsumed into the app which was a challenge . Moreover, the age group is not specific and hence the data is very versatile. Involving users from all age group is a challenge.

Conclusion

Having a talk with a plethora of doctors and at the same time reading various subjective and practical papers helped us in knowing the growing problems in the cervical, which has indeed caused a myriad of problems in the mundane routine of human beings. Looking into this we conclude with a solution that is lightweight, less power consuming, interactive and which will be easy for the doctors to track the records and improvements of the respective patients.

Future Works

- 3D gamification for a real-world interaction experience.
- Use of Augmented Reality.
- Transfer from static to dynamic database.
- Reducing the overall size of device by using Nano 3BLE device.

Reference

1. "Arduino Software Release Notes". Arduino Project. Retrieved September 25, 2019.
2. https://www.androidcode.ninja/android-bluetooth-tutorial/
3. Simple neck pain questions used in surveys, evaluated in relation to health outcomes: a cohort study. Authors-Anna Grimby-Ekman & Mats Hagberg. doi: 10.1186/1756-0500-5-587
4. Viikari-Juntura E. et al.Longitudinal study on work related and individual risk factors affecting radiating neck pain. Occup Environ Med. 2001;58(5):345–352. doi: 10.1136/oem.58.5.3.
5. Murphy S, Buckle P, Stubbs D. A cross-sectional study of self-reported back and neck pain among English schoolchildren and associated physical and psychological risk factors. Appl Ergon. 2007;38(6):797–804. doi: 10.1016/j.apergo.2006.09.003.
6. Andersen JH. et al.Physical, psychosocial, and individual risk factors for neck/shoulder pain with pressure tenderness in the muscles among workers performing monotonous, repetitive work. Spine. 2002;27(6):660–667. doi: 10.1097/00007632-200203150-00017.
7. Assessment of patients with neck pains: a review of definitions, selection criteria, and measurement tools. Victoria Misailidou, Paraskevi Malliou, Anastasia Beneka, Alexandros Karagiannidis, andGeorgios Godolias. doi: 10.1016/j.jcm.2010.03.002.