

Overview

The purpose of this project is to develop an automatically controlled system that will control a shoulder exercise machine for user physical therapy.

There is a big problem with surgeons not knowing if their patients are doing the rehab they have prescribed. Our machine forces the patient to do the exercises correctly – but without some sort of online control – there is no proof that they are doing the prescribed therapy. What all of the therapists and surgeons want is a record that their patients are doing the therapy. The people we interviewed want to be able to prescribe a treatment on our machine online for each of their patients. For example – they could prescribe 4 out of the possible 9 exercises. This would include the weight, reps and range of motion. It would be password protected. Essentially the machine has to be online. Once the patient puts in their password – the nine exercises would appear on the screen (with 5 of them “greyed-out”).

The machine needs to be mechanically and electrically capable of knowing where the weight system is in its total 35 to 40 degree range of motion so we know the range of motion and we also need to know where the mass is on the weight beam so the total weight is correct. The first time the patient goes for their therapy the therapist will have to teach the machine where the start point and finish point is for each of the exercises. Once the machine knows this information then the doctor would be able to specify 75% or 100% etc range of motion. As the patient goes through each exercise the control needs to alert the patient that they have reached the prescribed position (light and or sound) and one rep would be taken away from the total number of reps prescribed. After the patient has finished their therapy – and they logout – a report needs to be automatically sent to the therapist or surgeon.

Tasks

1. System must run off 120 VAC, 15 amp wall outlet
2. Layout Overview (see attachment 1)
 - a. Physician will input client information and exercise information into an online account. This information will be saved into a cloud database.
 - b. When the patient inputs login information, the cloud database for prescribed exercises will be retrieved by the control PC of the system.
 - c. The control PC will then guide the patient through the motions of the exercise, as prescribed.
3. Control system
 - a. A servo unit will control the fly weight of the shoulder exercise system, allowing the amount of weight the patient is activating through the shoulder exercise to be modified.
 - b. A brake solenoid will control the shoulder system so that movement may not occur unless the patient is to begin their exercises.
 - c. An encoder will provide feedback to the system the amount of distance the patient has moved the shoulder machine into.

- d. Proximity sensors will be used to ensure the patient has achieved full movement in each exercise.
- e. A tablet will be used to input the patient information as well as provide feedback to the user of what exercise needs to be performed.
- 4. Online database
 - a. This must be a secure database as it will hold information about patients.
 - b. This database must be accessible by physicians via an internet location, for filling out prescription information regarding the patient exercises.
 - c. This database must be accessible by the machine via a wi-fi connection.

Deliverables

- 1. Enclosure with all pertaining parts of the system.
 - a. PC
 - b. Any connections to devices
- 2. Servo unit
- 3. Brake solenoid
- 4. Encoder
- 5. Proximity sensors
- 6. Tablet
- 7. Online database
- 8. Bill of material for all parts used
- 9. Electrical schematics
- 10. Operator manual

Sponsors

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