

Masters Project Proposal

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1) Osteoarthritis Rehabilitation:

Knee lubrication, massage, and support

Medical Problem:

I have a hereditary problem called Osteoarthritis which is passed on to me from my father. For each step I take, my knee makes popping and cracking noises. In addition to noises, my father faces severe pain as his problem is quite old and persistent. It occurs when the protective cartilage that cushions the ends of your bones wears down over time.

Proposed Solution:

Doctors recommend lubricating the knee frequently. The lubrication is required in proportion to the amount of movement the knee has to make. Patients with severe Osteoarthritis needs to massage the knee with oil and some patients have to wear a support brace. Therefore, I am proposing all time wearable device which will detect the knee motion and constantly provide the lube proportionally, massage the knee when required and will have a supportive effect like any other knee exoskeleton.

2) Lymphedema Rehabilitation (After diagnosis):

Complete decongestive therapy using a soft silicone based robot

Medical Problem and Decongestive therapy:

As you may know the patients with Lymphedema have swollen arms or legs and the therapy consists of lymphatic drainage and compression. The therapies are done manually by a therapist by hands using compression strips.

Proposed Solution:

I am proposing a device which will have multiple pneumatic silicone based cylindrical actuators in a row. Let's assume we are giving therapy to the arm, then the device will be a wearable sleeve consisting if those silicone rings around the arm. The different rings will be actuated at different time from lower arm towards upper arm. This will create compression effect and pressure the fluid from lower arm to upper body.



3) Sleep Apnea Monitor

Chest Breathe monitor

Medical Problem:

Obstructive sleep apnea is a common and serious sleep disorder that causes you to stop breathing during sleep. About two percent of young children have obstructive sleep apnea.

<https://www.mayoclinic.org/diseases-conditions/sleep-apnea/symptoms-causes/syc->

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[20377631#:~:text=Sleep%20apnea%20is%20a%20potentially,occurs%20when%20throat%20muscles%20relax](#)

Proposed Solution:

A device which will be on a person's chest that can detect the Breathing pattern of the user. The device will mainly use strain sensor. The idea came from <https://www.uprightpose.com/> this product. Similar sensors can be used to monitor breathing pattern.

4) Soft robotic surgery navigator

Medical Solution:

A soft robotic silicone based snake which will have a camera on its head. The snake will have twist and multidirectional actuation.

- For idea reference, here's one of the projects that I worked for:

<https://www.youtube.com/watch?v=5M-x9bpsxns&t=113s>

5) Finger stroke Rehabilitation

Medical Solution:

A soft robotic silicone glove with flex sensors for feedback. Each finger will have different pressure input and will be actuated differently to support each finger. The project will also make a use of Time Domain Passivity Control.