

An Indian-Australian research partnership

<b>Project Title:</b>	<b>Physiotherapy-Assisting Technology</b>	
<b>Project Number</b>	IMURA0893	
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### Research Clusters:

### Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? <i>(Please nominate JUST <u>one</u>. For more information, see <a href="http://www.iitbmonash.org">www.iitbmonash.org</a>)</i>		Highlight which of the Academy's Theme(s) this project will address? <i>(Feel free to nominate more than one. For more information, see <a href="http://www.iitbmonash.org">www.iitbmonash.org</a>)</i>	
1	Material Science/Engineering (including Nano, Metallurgy)	1	<b>Advanced computational engineering, simulation and manufacture</b>
2	Energy, Green Chem, Chemistry, Catalysis, Reaction Eng	2	Infrastructure Engineering
3	Math, CFD, Modelling, Manufacturing	3	Clean Energy
4	<b>CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control</b>	4	Water
5	Earth Sciences and Civil Engineering (Geo, Water, Climate)	5	Nanotechnology
6	Bio, Stem Cells, Bio Chem, Pharma, Food	6	Biotechnology and Stem Cell Research
7	Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng	7	Humanities and social sciences
8	HSS, Design, Management	8	<b>Design</b>

### The research problem

*Define the problem*

For many paralyzed and injured patients, body movements are restricted due to effect of paralysis and/or accidents. After injury or paralysis recovers, doctors refer the patient to a physiotherapist in order to achieve muscle correction and strength. The physiotherapist provides the patient with a set of movements and exercises to rebuild the muscle and regain strength.

The existing methods include mechanical help from a caregiver, a physiotherapist, and/or a tool to provide

a guided movement of the patient. However, the physiotherapist cannot continuously monitor the patient, and the tools cannot monitor the progress of individual muscles and limbs. This increases the recovery time of a patient. This problem can be solved with an innovative technology incorporated in a smart wearable device. This smart wearable device with embedded sensors and actuators will monitor and control the movements. A mobile App will be embedded in the 2<sup>nd</sup> part of the smart device to send the data to the physiotherapist and a doctor to monitor the rehabilitation of the patient remotely.

## Project aims

*Define the aims of the project*

This project aims at monitoring the prescribed muscular activities and movements for specific exercises recommended by a physiotherapist. The proposed smart wearable device is a bi-directional corrective actuation and sensing that allows the patient to do correct exercises and also monitors the gradual improvement of the patient. The wearable device will be lightweight, compact and conformal to the wearer's paralyzed limb to ensure comfort. The design and development of the wireless communication link between the wearable device and its coupled part, called base monitoring and control system, the embedded signal and data processing algorithms and analysis would augment the telemedicine and provide added advantage for the healthcare professionals.

## Expected outcomes

*Highlight the expected outcomes of the project including likelihood of patents*

This research would lead to the following outcomes:

1. Design of a network of sensors and actuators to sense the movements.
2. Design of an optimal bi-directional wireless communication link between transceivers and the base monitoring system.
3. Development of algorithms for processing and denoising sensors data as well as providing specific guided movements.
4. Design, develop and demonstration of all the modules as defined in (1) to (3).

## How will the project address the Goals of the above Themes?

*Describe how the project will address the goals of one or more of the 6 Themes listed above.*

The project is defined based on the current needs of the paralyzed and injured patients in the rehabilitation centers, and the complementary expertise of IIT-Bombay and Monash supervisors. The project has well defined modules with adequate flexibility to meet the required detailed specifications of the sub-systems. The supervisors would consult with physiotherapists in the choice of movements. Appropriate ethical clearance will be obtained from both institutions to conduct the research.

## Capabilities and Degrees Required

*List the ideal set of capabilities that a student should have for this project. Be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.*

- Background in Sensor-System Design, Implementation and Test
- Background in Embedded System Design
- Background in Signal Denoising, Signal Processing and Preferably Machine Learning
- Background in Integration of Wireless Transmitter and Receivers

## Potential Collaborators

*Please visit the IITB website [www.iitb.ac.in](http://www.iitb.ac.in) OR Monash Website [www.monash.edu](http://www.monash.edu) to highlight some potential collaborators that would be best suited for the area of research you are intending to float.*

Select up to **(4)** keywords from the Academy's approved keyword list (**available at <http://www.iitbmonash.org/becoming-a-research-supervisor/>**) relating to this project to make it easier for the students to apply.

BioScience, Bio Medical Engineering  
Sensor and Sensor Networks  
Signal Processing  
Antennas and Microwave/mm-wave Engineering  
Modelling and Simulation