Project Title:	**Development of a Robotic Platform for Paediatric Surgery**	
Project Number	IMURA0817	
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Research Clusters:

Highlight which of the Academy's CLUSTERS this project will address?
*(Please nominate JUST **one.** For more information, see www.iitbmonash.org)*

1	*Material Science/Engineering (including Nano, Metallurgy)*
2	*Energy, Green Chem, Chemistry, Catalysis, Reaction Eng*
3	*Math, CFD, Modelling, Manufacturing*
4	*CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control*
5	*Earth Sciences and Civil Engineering (Geo, Water, Climate)*
6	*Bio, Stem Cells, Bio Chem, Pharma, Food*
7	*Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng*
8	*HSS, Design, Management*

Research Themes:

Highlight which of the Academy's Theme(s) this project will address?
(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1	*Advanced computational engineering, simulation and manufacture*
2	*Infrastructure Engineering*
3	*Clean Energy*
4	*Water*
5	*Nanotechnology*
6	*Biotechnology and Stem Cell Research*
7	*Humanities and social sciences*
8	Design

The research problem

The first robotic surgery was conducted about two decades ago and it has gained more and more popularity in the past few years. In this type of surgery the surgeon performs the surgery at the master console, while their movements are replicated by the slave robot on the patient. Currently, the robotic surgical platforms are mainly developed for adults with instruments that are 7 to 10 mm thick and robotic device handlers that exert forces up to about 15 N. While this design meets the requirements of abdominal surgery in adult patients, it is not largely suitable for patients with smaller body parts, children and specially newborns. Laparoscopic tools designed for babies have a thickness of 3 to 5 mm and have shorter length compared to common tools. The existing robotic instrument holders are not suitable for handling these smaller tools neither in the mechanical design nor in the actuation and sensing. Using the existing platforms for conducting surgery on children may put their safety at risk and is impossible in newborns.

Project aims

In this project we aim to develop a robotic surgical instrument holder suitable for manipulating the smaller tools developed for children and newborns. Our development will cover the mechanical design of the robot as well as its actuation and sensing. The robotic arm will be designed to meet the requirements of handling a 3 to 5 mm surgical tool. The design of the actuation system and the selection of actuators and sensors will be optimised to meet the size limitations and safety factors.

Expected outcomes

By the end of this project a slave robotic instrument holder for paediatric surgery will be developed. This robotic arm will be specially designed for manipulation of paediatric surgical tools. Considering the existing gap in the market of dedicated robotic surgical platforms for children, we envision a high potential for further developments and commercialisation of our final product.

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.
Our project falls under "Advanced computational engineering, simulation and manufacture". The PhD student is required to first design the hardware and develop it using latest technology. The project involves designing robotic arm, using sensors and actuators and microcontrollers to control the arm. There will be software/ programing use in order to run the microcontroller. Hence there will be simulations carried out, computational engineering algorithms in this project.
This project will be conducted between IITB and Monash University. The successful candidate will spend the first six months of their PhD at IITB and the rest of their PhD duration at Monash University. The first six months will be dedicated to study of the background and the existing literature in the domain, development of the ideas and project plan. The remaining of the studies will be focused on development of the first prototype of the device including the mechanical design, and integration of sensors and actuators.

Capabilities and Degrees Required

We seek an enthusiastic and hands-on PhD student with high level of creativity and the ability of thinking out of the box. The ideal candidate must have a Master in Mechatronics or Mechanical Engineering with a strong background in mechanical design. Only candidates with the following skill set will be considered: familiarity with programming of microprocessors, actuators and sensors, familiarity with SolidWorks, MATLAB and C++ programming language.

Potential Collaborators

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

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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.