

An Indian-Australian research partnership

Project Title: **Nanomaterials enabled Palpation device for cancer detection**
Project Number **IMURA0702**
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Research Clusters:
Research Themes:
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 |

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 |

The research problem

Tissue elasticity and palpation are important parameters used by surgeons to assess the quality of soft tissues and to find tumors and arteries in the human body. In clinical practice, doctors often use the hand and palm to assess the condition of organs and tissues. Although this is a useful method of diagnosis, there also exist high probability that doctors miss nodules and small lumps, which may lead to development of cancer. This is particularly important in breast/prostate cancer, where palpation is often used at an early stage. But while these exams have proven to be reliable methods of detection, they are subjective in nature. By capturing and quantifying the sense of touch into reproducible, objective data, however, tactile sensor solutions hold the potential to revolutionize cancer detection. These sensors serve to measure temporal and spatial changes in the stress pattern that is created when a probe is pressed against the organ. These data shed light on the elastic structure of the breast/prostate and generate a digital image of their anatomy in real time to aid in identifying abnormalities in the tissue. Therefore, there is very high requirement to develop flexible tactile sensors but with materials that are also flexible, for example organic based materials. Further to have more efficient/sensitive and comfortable device, it is highly desired that the devices are ultra-flexible/stretchable to conform to the surfaces. As of now, there is real scarcity of such kind of ultra-flexible palpation device, which is due to the fact that either the sensors have been too big or the electronics not sufficiently flexible. In this project therefore, our aim would be to develop a palpation device that is flexible and conformable and is able to detect tissue elasticity useful for breast/prostate cancer detection.

Project aims

- Development of flexible and conformable tactile sensing arrays that can be easily worn and create a digitized image of the organ under subject on palpation
- Process development and material identification
- Integrating electronics and testing in simulated and real conditions

Expected outcomes

- A palpation device useful for early detection of breast/prostate cancer
- Techniques and methods for reliable, reproducible and cost-effective production of tactile sensors
- Manpower training
- Patents, Publications, and PhD thesis

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

The research area in the field of Tactile sensors is highly interdisciplinary and will encompass concepts of Material Science, 'Nanotechnology', and Biotechnology, Sensors and Systems.

Capabilities and Degrees Required

We are looking for 1 Ph.D. student in this project; Candidates with following academic background is desired.

1. M.Tech in Materials Science/Materials Engg/Chemical /Mechanical Engg, Biomedical, Electrical and Instrumentation Engg
2. M.Sc in Chemistry/Physics

Potential Collaborators

Select up to **(4)** keywords from the Academy's approved keyword list (**available at www.iitbmonash.org**) relating to this project to make it easier for the students to apply.

Tactile sensors, Novel functional materials; Nanotechnology/nanoscience; Sensor and Sensor Networks; Materials Chemistry/Science