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Technology Transfer Office
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A TACTILE PRESSURE SENSOR AND A METHOD OF SENSING THE POSITION AND MAGNITUDE OF PRESSURE

IITM Technology Available for Licensing

Problem Statement

- Achieving **high spatial resolution** in tactile sensors is **complex and costly** due to the need for a large array of sensors.
- Many sensors are limited to **capturing forces** from **finger-shaped probes**, excluding other objects. Existing tactile sensors require **tedious computational processes for accurate skin deformation estimation.** Optical tactile sensors have limitations in **achieving high resolution** due to material & fiber constraints.
- Current sensors struggle with **accurate pressure estimation and lack consistent multi-dimensional capability**, especially when pressure is non-uniform.
- The present patent application aims to address these problems by proposing a **tactile pressure sensor** with a simpler **construction & processing strategy** that can provide **high-resolution** and accurate results in various uses.

Technology Category/ Market

Applied Mechanics & mechanical Engineering | Virtual Reality (VR) & Augmented Reality (AR)

Technologies: Tactile Sensors, Force Sensing Technology, Multi-Touch Sensors, Optical Tactile Sensors, Human-Machine Interfaces, Waveguide Technology, Imaging and Image Analysis, Computational Algorithms, Materials Engineering, Robotics and Automation.

Applications: Human-Computer Interaction (HCI), Virtual Reality (VR) and Augmented Reality (AR), Robotics, Medical Devices, Automotive Industry, Manufacturing and Quality Control, Gaming, Accessibility Devices.

Market: The global sensor market size was valued at **$166.69 B** in **2019**, and is projected to reach **$345.77 B** by **2028**, to register a **CAGR of 8.9%** from **2021-2028.**

TRL (Technology Readiness Level)

TRL 5;
Component validation in relevant environment

Research Lab

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Technology

The present patent application discloses **A tactile pressure sensor and a method of sensing the position and magnitude of pressure.**

This tactile imaging system **combines optical and mechanical transduction processes** to accurately measure and visualize forces applied to an elastically deformable porous material, enabling **high-resolution, multi-point 3D touch input.**

Refer FIG: 1 and 2.

Figure 1: Illustrates the device's key components and how forces applied to the elastically deformable porous material induce optical transduction.

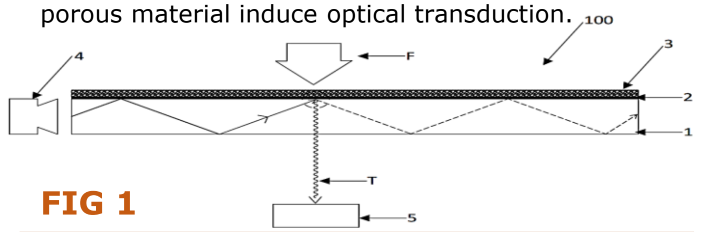

FIG 1

Key Features / Value Proposition

❖ ***User Perspective:***

- **High Precision:** Offers very high spatial resolution for accurate touch input, making it suitable for precise user interactions.
- **Multi-Point 3D Touch:** Enables users to provide simultaneous multi-point 3D touch input, enhancing user experience and interaction possibilities.
- **Realistic Feedback:** Provides realistic tactile feedback in VR, gaming, and touchscreens.

❖ ***Industrial Perspective:***

- **Versatile Applications**
- **Cost-Effective & Durable:** Simpler manufacturing & versatility reduce production costs, making it cost-effective for industrial use. Suitable for long-term use in various environments, including medical & industrial settings.

❖ ***Technology Perspective:***

- **Dual Transduction:** Combines optical and mechanical transduction for accurate force measurement and touch input.
- **High Resolution:** Offers exceptional spatial resolution, surpassing conventional tactile sensors.
- **Adaptability:** Can be implemented in various physical forms & customized for specific technological uses.

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Technology

The present patent describes the invention's objectives and outlines the key components and methods involved in a pressure-sensitive device and its corresponding method for determining force magnitude and position.

❖ Pressure-Sensitive Device:

- **Comprises a first medium.**
- **A third medium, which is an elastically deformable porous material, placed on top of the first medium.**
- **The gaps between the third medium and the first medium are filled with fluid, defining a second medium.**
- **Includes a radiation source that directs radiation through at least one edge of the first medium.**
- **The radiation incident through the first medium undergoes Frustrated Total Internal Reflection (FTIR) at points corresponding to spatial forces applied on the third medium.**
- **A radiation detector is placed facing the bottom side of the first medium to detect the radiation reaching the sensor.**
- **A processing means processes the radiation sensor output to determine at least the magnitude/position of the force.**

Intellectual Property

IITM IDF No: 1569;

IN Patent No. : 405694 (Granted)

❖ Method for Determining Force:

- **Involves providing a first medium.**
- **Providing a third medium, which is an elastically deformable porous material, above the first medium, with the distance between them defining a second medium.**
- **Directing radiation from a radiation source through at least one edge of the first medium.**
- **When force is applied to the third medium, the incident radiation on the first medium undergoes frustrated total internal reflection.**
- **Detecting the radiation using a radiation detector.**
- **Processing the radiation detector output in a processing means to determine at least the magnitude and/or position of the force.**

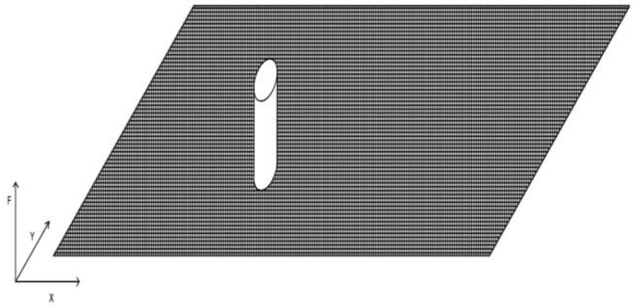

Figure 2: Displays the output of the multi-point force sensing, demonstrating the ability to capture focre intensity and position accurately.

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