# LASER SPECKLE FIBERSCOPE FOR DETECTION OF EXTENT OF CANCEROUS TISSUE AND METHODS THEREOF
## IITM Technology Available for Licensing

## Problem Statement

- In present era, Cancer has become a major health problem & the main factor during surgical removal as well as biopsy procedures is the **precise sampling** of the tumor areas.
- Laser speckle contrast imaging(LSCI) has been used for analyzing tissue perfusion qualitatively, & the major challenge herein is the **susceptibility** of the LSCI to sample & experimental parameters. A few prior arts techniques have been discussed however **unable to provide solutions** as discussed in the present invention.
- Hence, there is a need to address above challenges in effective manner.

## Technology Category/ Market

**Technology:** Laser Speckle Fiberscope ;
**Industry:** Medical & Surgical Device;
**Applications:** Colonoscopy, Bronchoscopy, Vascular Fibroscopy, etc.;
**Market:** The global fiberscope market size is projected at a **CAGR** of **8.56%** during period of 2022-**2027.**

## Intellectual Property

IITM IDF Ref.:1663 ;
Patent Application No. 201841006754

## TRL (Technology Readiness Level)

**TRL-4**,Proof of Concept, Tested & Validated

## Research Lab

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## Technology

- Present invention describes **a laser fiberscope device** for assessment of **tissue stiffness and tissue blood flow in-vivo.**
- **FIG. 1** depicts **a fiberscope** that includes an illumination **fiber, a lensed image fiber, a ring sensor** and **associated circuitry** in a single conduit.
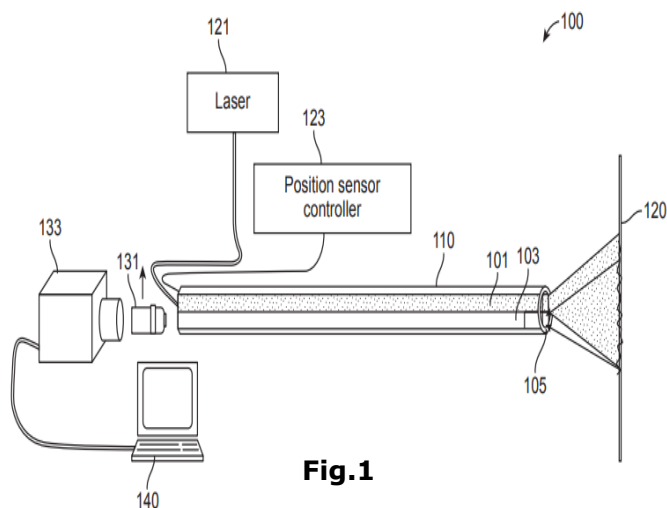
## Technology



**Fig.1**

- The claimed **device** further includes a **laser light source**, a **position sensor controller**, a **microscope objective**, a **charge coupled device (CCD) camera with zoom lens and a personal computer (PC).**

- The computing device comprises a **machine learning algorithm** configured to **perform analysis** on the **acquired speckle image** to assess **tissue stiffness or tissue blood flow or both**.

- Said device is **configured** to be introduced via an **endoscope** & the processing the image using **speckle image analysis.**

- Further, the proposed invention is also described a method of **simultaneously assessing tissue stiffness & tissue blood flow in-vivo.**

- The process is shown in figure 2 in step by step and the **experimental setup** including **results** are shown in Figs. 3 & 4.

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## Flowchart for Demarcating Normal & Cancerous Region

200

- Illuminate a sample tissue by passing laser light through a illumination fiber — 201
- Create a speckle pattern on the tissue surface — 202
- Capture the speckle pattern on a first end of a lensed image fiber bundle — 203
- Transmit the captured image to a second end of the lensed image fiber bundle — 204
- Collect the captured speckle pattern image by a microscopic objective and a CCD camera — 205
- Perform speckle image data analysis to obtain values of tissue stiffness and / or blood flow velocity — 206

**Fig.2**

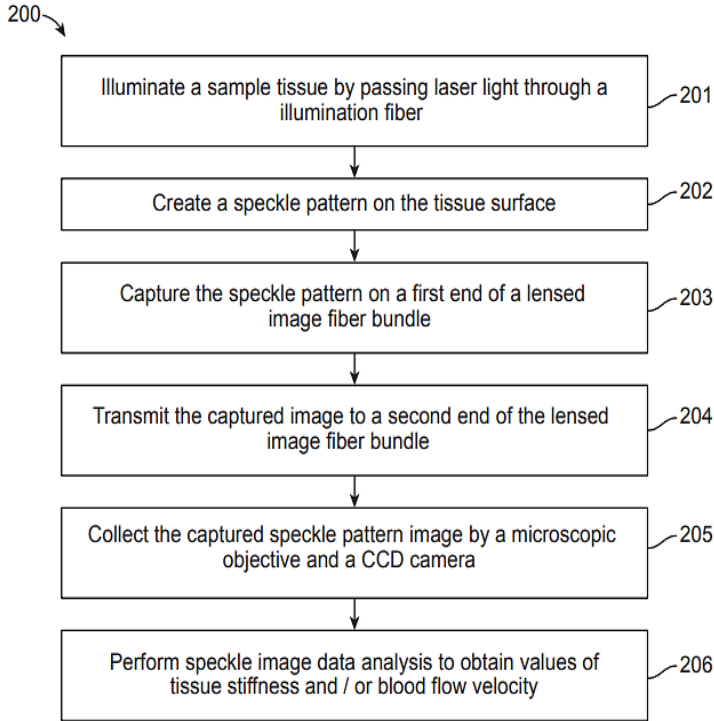## Key Features / Value Proposition
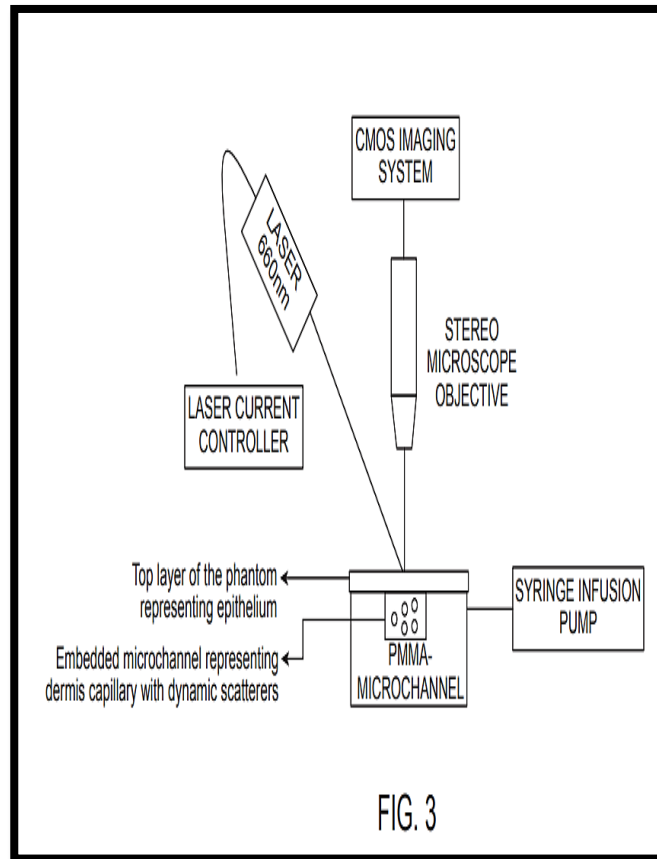
### ❖ Technical Perspective:

1. A static scattering coefficient of tissues is estimated independent of flow velocities using a machine learning model.
2. The **tissue blood flow rate** is calculated using **dynamic scattering**.

### ❖ Industrial Perspective:

1. The device and system is the integration of illumination with **lensed image fiber** that makes the entire system **cost effective &** may **open up avenues** for **integration of other optical modalities for better tissue discrimination.**

## Experimental Setup

**Fig.3 : Illustrates an experimental set up with open space optics having similar FOV as the system;**



CMOS IMAGING SYSTEM
LASER 660nm
LASER CURRENT CONTROLLER
STEREO MICROSCOPE OBJECTIVE
Top layer of the phantom representing epithelium
Embedded microchannel representing dermis capillary with dynamic scatterers
PMMA-MICROCHANNEL
SYRINGE INFUSION PUMP

FIG. 3