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Method and devices for detection of suspended nanoparticles

An image detection approach that can detect suspended particles much smaller than the wavelength of visible light, or far below the microscope resolution or the diffraction limit of light, using an image sensor.

IP Status: PCT Application Filed

Applications

- Sensors used for indoor air quality detection
- Sensors in Gasoline and Diesel Engines
- Detection of contaminants in drinking water, vaccines
- Detection of water droplets in Diesel Fuel which can adversely affect the engine performance
- Sensors to detect airborne aerosols such as biological agents

Key Benefits & Differentiators

- **Simpler:** No need for particle size growth mechanism
- **Widely applicable:** Due to the absence of a particle growth mechanism, the application is no longer limited
- **Cost-effective**

Technology Overview

Conventional laser optical methods without using a particle size growth mechanism can reliably detect particles larger than about 100 nm. This is typically addressed by introducing a growth mechanism to increase the particle size. The particle size growth mechanism has its own limitations. It increases the complexity of the detection system and limits its applications. After the growth of the particles for detection, the original particle size information is lost. Researchers at the University of Minnesota have developed an image detection approach and a device that can detect suspended particles much smaller than the wavelength of visible light, or far below the microscope resolution or the diffraction limit of light, using an image sensor. The method comprises a technique to detect the particles under the condition that light scattering of the medium is sufficiently intensified to be clearly distinguishable from the background of the image sensor. The enhancement is achieved by using a laser with sufficient power and an image sensor with sufficiently high sensitivity. This method addresses the problem by detecting both the particle and the surrounding molecule light scattering. Using this new method, the limitations can be surpassed while maintaining simplicity and cost-effectiveness.

Phase of Development

TRL:4-5
Prototype developed and tested

Desired Partnerships

This technology is now available for:

Technology ID
2022-143

Category
Engineering & Physical Sciences/Instrumentation, Sensors & Controls
Engineering & Physical Sciences/Nanotechnology
Engineering & Physical Sciences/Photonics

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Researchers

- **David Y.H. Pui, Ph.D.** Professor, Department of Mechanical Engineering

References

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2. Ye, Yan, Qisheng Ou, Weiqi Chen, Qingfeng Cao, Dong-Bin Kwak, Thomas Kuehn, and David YH Pui.(5 March 2022) , https://www.mdpi.com/1424-8220/22/5/2038, Sensors