Oil Thickness Measurement Device

Lead American University of Beirut Inventors

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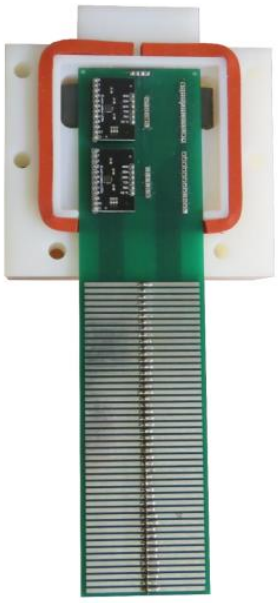
Background and Unmet Need



Techniques to estimate or detect oil spills in open water may be divided into two categories: remote measurement or contact-based measurements. Current remote measurement techniques comprise visual methods that include estimation depending upon the color of the oil from aerial vehicles or satellites. Such a method only estimates thickness measurements; is greatly influenced by lighting conditions; and cannot be performed continuously. In comparison, contact-based measurements enable localized and continuous thickness measurements. However, neither current detection method provides the functionality required to measure oil thickness in open water conditions. There are very few commercially available sensors that are used for continuous measurement of oil in non-stationary open water. And most existing methods are limited by multiple factors, including environmental conditions.

As a result, there is a clear need for new technology that provides accurate, continuous, and cost-effective solutions for oil thickness measurement.

Opportunity

The American University of Beirut investigators have developed a novel capacitive array sensor device to measure a liquid continuously, with persistent measurement, between at least two mediums (i.e., water, oil, and air). By measuring the change in capacitance between strips of the array, the floating liquid thickness measurement device identifies the air / oil interface and the oil / water interface. Once calibrated, the floating liquid thickness measurement device calculates the thickness of the floating fluid and reports the results wirelessly.

This device is designed to be mounted to skimmers, buoys, or in an oil spill boom apex, to provide thickness data in field operations. It is not limited solely to mounted long term and continuous oil thickness monitoring and can be deployed as a handheld device for instantaneous sensing. Further, while originally designed for oil skimming operations in the open ocean, this technology may also be extended to measure any layered media, such as the thickness of the humid layer of soil.

The Elhajj-Asmar technology was developed under a research contract from the United States Department of the Interior, Bureau of Safety and Environmental Enforcement. Its performance was further demonstrated through tests that simulated real-world conditions including during skimming operations, where the sensor was tested in both static and dynamic conditions. The sensor displayed appropriate functionality in dynamic environments, including fresh and saltwater conditions, varying lighting, temperature, and humidity. Its knife-like design improves performance in open-water applications by minimizing fouling effects commonly experienced in open-water operations.

The oil spill management market was valued at $125.6 Billion in 2022 and is expected to grow at a CAGR of 3.5%. As increasing safety and environmental concerns drive market demand, this technology will play a crucial role in providing much-needed information to inform oil spill remediation.

Unique Attributes

- AI powered to eliminate the need for calibration per oil type. Functions with crude and processed oil, fresh and salt water.
- Knife-like design to mitigate oil fouling.
- Deployable in dynamic environmental conditions, including open ocean applications.
- Real-time and continuous assessment of oil thickness during skimming, and other oil mitigation operations.
- May be extended to measure any layered media, such as the thickness of the humid layer of soil.

Stage of Development

Technology Readiness Level (TRL) 5, Prototype tested in simulated environment.

Intellectual Property

United States Patent US 10,976,147 B2, issued April, 2021.

Collaboration Opportunity

Seeking licensee for commercialization or for collaboration to advance development.

References and Publications

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- Mahdi Saleh*, Ghassan Oueidat*, Imad H. Elhajj, and Daniel Asmar, “In-situ Measurement of Oil Slick Thickness,” IEEE Transactions on Instrumentation and Measurement, Vol. 68, No. 7, pp. 2635-2647, July 2019. DOI: 10.1109/TIM.2018.2866745

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