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COS-231-300

Professor Wu.

2 December 2024

Research Project: *Profusa, Inc's Tissue Integrated Biosensors*

Throughout the 21st century there has been a plethora of new and emerging technologies that have arrived leading to drastic changes in the way we live life. One of the most groundbreaking technologies being developed is the Lumee Tissue Integrated Biosensor that the digital health and biotech company Profusa has just invented and released to the public. We will further explore the technology; detailing the core concept of the biosensor as well as its key features and hardware implementations. The field of biotech is not new but has recently been growing more popular and research is being developed now more than ever thanks to innovations such as Profusa's new Biosensor.

Foremost, Profusa is a biotech company founded in Emeryville, California based on the principles of health and wellness. Their mission is to make the human body more accessible in an effort to improve the human body's limitations. Profusa is extremely dedicated to developing and researching biosensors that will provide major insight into overall health of an individual and other medical discoveries. Their invention, the Lumee as it is called, is a tissue integrated biosensor centered around the concept of continuous monitoring of the body's vital signs through a minimally invasive device that

is placed underneath the skin. The biosensor is designed to detect specific biomarkers (ie. glucose) in the body and then transmit the data received remotely for live and real-time analysis. The core idea behind the biosensor is Profusa's mission to provide healthcare providers and their patients with data that can be used to inform them of needed treatments or health decisions to come, thus improving patient health outcomes and quality of life.

Furthermore, Profusa's biosensor is packed with features that prove the core concept accurate. For starters the biosensor is minimally invasive and can be injected under the skin with only a single dose. This eliminates the need for frequent blood draws, tests, and other time consuming, expensive, and oftentimes invasive procedures. The biosensor itself is made from safe materials that have undergone long-term studies for use on the human body. This significantly reduces the risk of adverse reactions in the body as the biosensor is not rejected by the body and is seen as tissue itself by the body. The biosensor is made of nanotechnology and is bioluminescent which enables the device worn on the skin to collect messages from the biosensor using blue light wavelengths. The biosensor also typically is only 3-5 millimeters in length and 500 microns in diameter. Among the most innovative features is that the biosensor can collect and transmit data in real time to an external device on the body via wireless communication. This grants immediate access to health data by both the patient and their provider. Once the information is collected, it can then be sent to a digital health platform that one's hospital or clinic uses for better health monitoring and management. Lastly, the data can be trusted to be highly accurate and can detect

low concentrations of target biomarkers that most other devices cannot. All of this can be achieved by the Lumee while also being a cost effective and reliable device as well, lasting up to seven years without need for replacement.

As a result of the reliability and effectiveness of the Lumee device the hardware used has to be top notch quality both technically speaking and medically. The hardware of the device includes a sensor chip, microcontroller unit, power management circuitry, wireless module, enclosure materials, calibration mechanisms, data storage components, and a user interface component. It all starts with the sensor which contains a chip coated in microelectrodes that is capable of biorecognition of elements specifically binded to the target biomarkers (ie. glucose). The microcontroller unit or MCU for short, is what manages the biosensor operations including processing signals and conveying communication procedures. The power management circuitry ensures efficient power supply and battery life running to the unit. In order for the MCU to convey data to health platforms or the user a wireless module is needed that uses bluetooth enabling the user to communicate with external devices either on the skin or elsewhere. In order for the user to interact with the device there is also a User Interface Component that uses LED indicators. The data is stored on a memory device locally before transmission occurs of the data to an external device. Among those components is also a calibration mechanism designed to read user input and/or adjust health readings to new or preferred standards depending on the patient or their provider. To keep all of these important components safe, the enclosure material is made from biocompatible materials that allow the device to sit on the skin while also allowing air to pass through

as well as bodily fluids such as sweat so that the device does not cause irritation or rashes around the site it is placed on.

In conclusion, Profusa's new Biosensor Lumee is an incredibly exciting and groundbreaking invention in the field of medicine and technology and should be approached with praise as well as caution so that the technology can be safe and effective. Not only is the Lumee loaded with features to enable it to perform its functions but the hardware it contains allows it to perform flawlessly for the user. During the research and development phase of the biosensor it is clear that Profusa was dedicated to achieving the core concept that they originally had in mind and then some. Profusa's biosensor tech is far from over and will lead to a wide range of biosensors and innovative products for people to use, including soldiers considering that Profusa recently was given funding for $7.5 million by DARPA (Defense Advanced Research Project Agency). Overall, this technology is never before seen and is guaranteed to lead to drastic changes in our lives and will in turn change the way we look at the human body as well as its limitations.

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