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# MACHINE LEARNING OPTIMIZED PROCESS CONTROL AND YIELD OF ARTIFICIAL RETINA IN-SPACE MANUFACTURING

**Abstract**

LambdaVision developed an artificial retina (AR) to restore vision to millions of people blinded by retinal degenerative diseases. Artificial retinas are manufactured via a layer-by-layer technique subject to the effects of gravity. Nine missions to the ISS have qualified LambdaVision's manufacturing hardware and demonstrated proof of concept to produce thin films in low earth orbit. To improve the reliability of thin film manufacturing and meet the FDA standards of safety, efficacy, and quality of the implant, LambdaVision partnered with G-SPACE to develop a highly innovative artificial intelligence/machine learning (AI/ML) system that provides real-time analytics, monitoring, and optimization of the manufacturing process to improve implant production. This work will allow LambdaVision to streamline the manufacturing process and ensure better quality control, thereby increasing efficiency and productivity of the AR manufacturing in microgravity, reducing costs, and accelerating commercialization. The advancement of a layer-by-layer manufacturing technique enhances uniformity, alignment, and durability of multilayer thin films, making it suitable for a wide range of applications. These applications include retinal implants, solar cells, chemical detectors, pharmaceutical delivery mechanisms, and development of biological tissues. The integration of real-time process controls into this manufacturing method promises to refine the production workflow, achieving higher levels of accuracy and operational efficiency. The possibility of fabricating AR in a Low Earth Orbit (LEO) environment offers unprecedented prospects in the commercial aerospace sector. The wide-ranging applications of this technology extend to fields like retinal implants, solar energy, chemical sensing, drug administration, and tissue engineering, marking a significant intersection of health and space-based technological advancements. On-orbit production of the artificial retina for patients with retinal degenerative diseases aligns with NASA's long-term strategy for commercial LEO development, particularly in supporting terrestrial applications. AI/ML improvements to process control will reduce costs and development times for future payloads. This trailblazing work has the potential to catalyze broader commercial demand for drug and therapy development in space, paving the way for future space-based medical innovations.