1st Faculty Science Day
of the Faculty of Mechanical and Industrial Engineering
Vienna, February 21st 2024

Development of HoloLase MD: Integrating AR Technology with Laser Protection for Healthcare 4.0

Osman Bodur, Clemens Hohensulz, Christoph Einspieler, Günther Poszvek, Friedrich Bleicher
TU Wien, Institute of Production Engineering and Photonic Technologies, Getreidemarkt 9, 1060 Vienna, Austria.

Abstract

Healthcare 4.0 demands innovative solutions to enhance medical procedures. In response, Innotonix, in collaboration with TU WIEN, presents HoloLase MD, a groundbreaking medical laser protection eyewear. This device integrates augmented reality (AR) technology with laser protection, aiming to visualize hazardous laser radiation, enable digital workflows, and elevate work efficiency in dental and laser surgical applications.

Objective

The HoloLase MD development project encompasses diverse objectives, focusing on key aspects of design, manufacturing, and application in healthcare. Primary goals include achieving an **ergonomic design** to ensure comfort for users with varying head sizes, utilizing cutting-edge **additive manufacturing** techniques for functionality and durability, and prioritizing compliance with stringent quality assurance and ISO standards.

The project aims to enhance overall process efficiency in healthcare, particularly in dental and laser surgical applications, by integrating **augmented reality technology** with **laser protection**. Through these objectives, Innotonix envisions HoloLase MD as an innovative solution aligned with the principles of Healthcare 4.0, providing enhanced safety and efficiency in medical workflows.

Methods

- **Face Model Scanning:** Employ laser scanning techniques on various face models to accurately determine dimensions for an elliptical face shape.
- **CAD Construction:** Develop a comprehensive Computer-Aided Design (CAD) model based on 3D printing tests and user trials to optimize the design.
- **SLA Printing:** Utilize Stereolithography (SLA) printing for the frame, optimizing assembly, and enlarging frame seams for improved comfort.
- **Lens Positioning:** Determine precise positions for lenses and 3D print curved lenses using Fused Deposition Modeling (FDM) and SLA.
- **AR Glasses Integration:** Design inner covers for AR glasses integration, incorporating features to prevent scratching during improper usage.
- **Headband Construction:** Construct robust headband connections with a key mechanism for easy and secure adjustment.
- **Clip-on System:** Develop a clip-on system for frame interchangeability, allowing users to customize the frame for comfort.
- **Component Mounting:** Create a mounting area on the frame for additional components such as cameras or magnifiers.

Results

The implemented methods resulted in a highly successful HoloLase MD prototype. The ergonomic design not only achieved a visually appealing form but also facilitated an efficient weight distribution for enhanced comfort during prolonged use. The integration of curved lenses effectively optimized laser safety by reducing aberrations. Streamlined inner covers provided a polished and professional appearance while preventing scratching of the AR glasses during incorrect usage. The clip-on system for frame interchangeability proved to be a practical feature, allowing users to customize the frame according to their preferences.

Overall, the results showcase the successful translation of the project's objectives into tangible outcomes, marking a significant advancement in the design and manufacturing of laser protection eyewear for healthcare applications.

Discussion and Conclusion

HoloLase MD represents a significant leap forward in laser protection eyewear, effectively addressing ergonomic challenges, and ensuring optimal safety and comfort in healthcare settings. The collaboration with TU WIEN has been instrumental in integrating additive manufacturing techniques and adhering to ISO standards, further solidifying the device's position in the future of AR/VR eyewear with stringent safety requirements.

The collaborative effort between Innotonix and TU WIEN has resulted in a successful innovation in the design and manufacturing of laser protection eyewear. HoloLase MD not only meets individual customer needs but also aligns with European safety standards, laying the groundwork for future advancements in AR/VR eyewear with high safety requirements.

Figure 1. The prototype of HoloLase MD

Acknowledgements

A highly innovative smart medical laser safety glasses - HoloLase - has been successfully developed and designed as a cooperation project between Innotonix GmbH and Research Group for Production Metrology and Adaptronic Systems at IFT, TU Wien within the scope of FFG Innovationsscheck funding program.

Contact Information

Dr. techn. Osman Bodur, MSc.
Tel: +436765760023, E-Mail: osman.bodur@tuwien.ac.at