Augmented Reality for Quality Inspection, Assembly, and Remote Assistance in Manufacturing

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Executive Summary

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Abstract

Augmented Reality (AR) is revolutionizing the manufacturing sector by enhancing information delivery. This thesis explores AR's applications in quality inspection, assembly, and remote assistance. The transformative potential of AR in the manufacturing process is evident, offering innovative solutions and improvements across various tasks and challenges.

1 Introduction

Augmented Reality (AR) has emerged as a technology in the manufacturing industry, advancing how information is conveyed to traditional labor. This study presents AR's applications in quality inspection, assembly tasks, and remote assistance. The guiding research question was: *How can AR for quality inspection, assembly, and remote assistance be implemented using custom and commercial tools?*

2 Methods and Findings

2.1 Custom Application for Hand-Held Device (HHD)

A custom application was developed integrating the state-of-the-art You Only Look Once (YOLO) object detection algorithm and AR for quality inspection. This app's functionality depended on the HHD's operating system, software libraries, and the YOLO model version.

Due to hardware limitations, object detection in images was shifted to a python server, requiring a robust wireless connection.

2.2 Assembly Task for Head-Mounted Device (HMD)

Using the Microsoft HoloLens 2, an assembly task application was assessed. The results showed a moderate workload and commendable system usability. Positive feedback from users was 20.93%, while hardware and software challenges were the primary suggested improvements, with 37.28% and 20.93% respectively.

2.3 Remote Assistance

Feedback on remote assistance revealed a reduced workload and an increase in system usability compared to the assembly task. Positive comments accounted for 60.47% of the feedback, indicating a generally favorable user experience.

3 Implications and Recommendations

- Precisely select software and hardware components when designing custom AR applications.

- Clear instructions for assembly tasks and remote assistance lead to lower workloads, improved system usability, and higher user appreciation.

- The hardware and software limitations discovered in this study are primary areas for improvement.

- Enhancing object anchor accuracy for custom apps, refining AR software, and improving HMD hardware specifications need further research.

4 Conclusion

AR is redefining information delivery in the manufacturing sector. Although this thesis provides a comprehensive overview, it only begins to uncover AR's vast potential. AR's applications in quality inspection, assembly, and remote assistance signify just the start of its capabilities in transforming manufacturing and daily life.