SUMMARY

This thesis is dedicated to understanding the importance of designing an optimized 3D simulation for a flexible manufacturing system (FMS) to improve its efficiency, effectiveness, and overall performance. The thesis focuses on exploring the development and simulation of an FMS integrated with visual components. The main goal is to investigate the potential benefits and improvements that can be attained by utilizing 3D simulation in industrial operations, specifically within the context of an FMS. The study begins by providing a thorough overview of the key concepts and principles of FMS and virtual models, establishing a solid foundation for the subsequent research. It highlights the significance of FMS in modern manufacturing environments and the role of virtual models in improving operational efficiency, productivity, and decision-making processes.

3D Simulation plays a crucial role in this study's main body chapter, where it helps evaluate how well the Flexible Manufacturing System (FMS) performs. By using simulations, researchers can make changes and adjust different components and parameters visually to modify the system before putting it into practice. It's important to carefully analyze these changes to ensure that the designs work effectively in real-world applications. Detailed simulations in the 4th chapter were conducted to analyse the system's response to assess cycle time, throughput, and utilization, and identify potential areas for optimization and improvement.

In this study, two simulations were compared to evaluate how well they performed. The findings show that the second simulation was better than the first one in terms of machine and robot efficiency. It also had higher throughput and completed cycles more quickly. Additionally, the second simulation was more cost-effective, saved more energy, and made better use of space by using one less component.

The first simulation faced challenges, including delays in part arrival to the lathing machine and queues on conveyors due to their short length and slow mobile robot speed. Lower utilization rates for the milling machine and CMM were also attributed to inefficient workflows and production bottlenecks.

Proposed strategies include optimizing conveyor speed and length, reducing feeder intervals, improving workflow efficiency, and conducting regular maintenance. Addressing these factors can enhance operational performance, productivity, and machine utilization in simulated manufacturing environments.