

SUMMARY

This thesis work is about Starship Technologies OÜ company that offers delivery services using delivery robots manufactured by the company's manufacturing factory and whose assembly operations are purely manual assembly with humans as the resources being used. The company's goal was to determine the cycle time for one robot due to the changes made in their manufacturing processes and to know factors for improvement of the system. To achieve this, data were collected from the factory's representatives. The current system layout was modelled in Visual Component software to visualize the design better while the simulation of the manual assembly processes was constructed using Arena simulation.

The simulation model constructed was run with 55 replications at an 8hrs shift per day with a terminating condition. The results were obtained and analyzed based on some KPIs (total time and resource utilization) at a 95% confidence interval. The cycle time for one robot was also obtained. To obtain other KPI results such as throughput, the simulation model was run for a month and the results were obtained and analyzed.

To improve the system, various suggestions were investigated, such as changing the schedule rules for resources and different scenarios were created, which were the wait schedule, ignore schedule and mixed schedule scenarios. In addition, based on the result of the resource utilization, a scenario based on set of workers to work at different locations was also added, and these were analysed with Arena Process Analyser and compared with the base scenario.

The result showed that on average, when compared to the based scenario, the throughput increased by 30%, 70% and 60%, 30% for the wait, ignore, mixed and set of workers scenarios respectively, the total time increased by 1.34% for wait scenario, decreased by 0.17% for the ignore scenario, decreased by 2.16% for mixed scenario and decreased by 0.63% for the set of workers scenarios. The resource utilization for the wait and mixed scenarios showed that the maximum utilization was three times the based scenario which is due to waiting on processes to complete and loss of breaks, while the ignore and set of workers improved as compared to the base scenario.

Overall, most of the suggestions made can be adopted as improvements depending on the KPIs to be focused on. Also, further improvements can be made in future by including costs, simulating the whole operation on a 3D modelling software if the 3D components model can be made available so that the effects of layout rearrangement can also be investigated.

The analysis of the processes and determination of various KPIs has shown that with simulation technique using modern software, the operations of manufacturing factories or production lines can be assessed and improved to increase productivity. The author has been able to acquire appreciable knowledge on process analysis, production improvement and optimization of systems. He has also learnt about operations management, and this will help him in his future career path.