

Simulation Model for Surgical Instruments Flow During Surgeries

IE3100M System Design Project | Group 15

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COMPANY BACKGROUND

SingHealth is Singapore's largest healthcare group with the vision of **transforming care and improving health**. SingHealth strives to provide consistent quality care, nurturing generations of healthcare professionals, and pursue innovation that will transform and advance care for patients.

MOTIVATION

- The movement of surgical instruments during surgeries is a critical supporting activity for a surgical procedure.
- The problem arises when the requested surgical instrument is not readily available and has to be transported from the storage areas to the operation theatres by the nurses during a surgery.



Nurses to carry out these additional requests

- Productive Time Wasted



Nurses are not fully utilised during a surgery

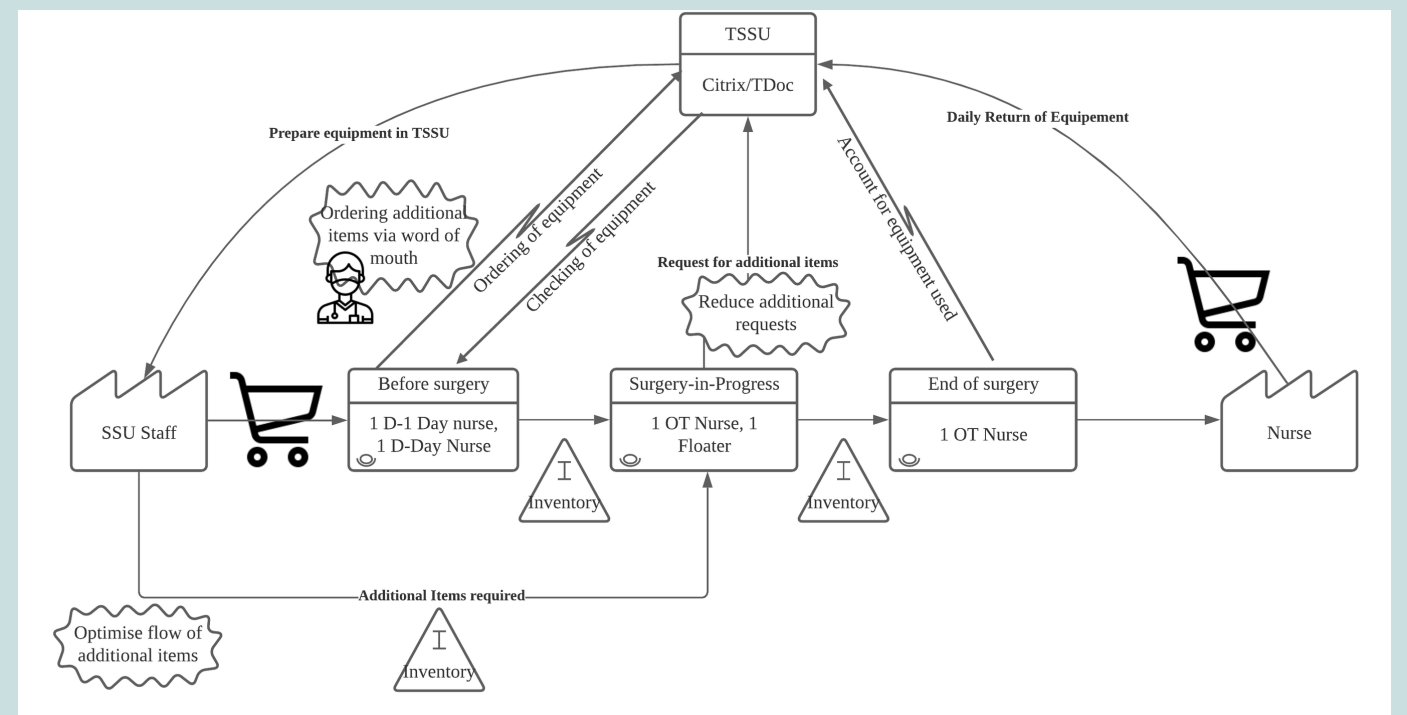
- Additional Labor cost

OBJECTIVE

To assess the effectiveness of the use of Autonomous Guided Vehicles (AGVs) on the surgical floor as a replacement for nurses to pick up the additional surgical instruments required in an ad-hoc request.

SKILLSETS ACQUIRED

Simulation Modelling | Data Analysis | System Design



SIMULATION

Input Analysis

Current Real-life Data Utilised

- Time-motion study
- Validation of key assumptions
- Determining delay distribution of AGV as a result of interaction with the dynamic environment (M/M/1 Queueing system)

Key Parameters and Assumptions:

Average number of surgeries conducted in a day | Average duration of surgery | Capacity of AGV | Speed of AGV | Average Walking speed of Nurses | Arrival Rate of Nurses | Probability of ad-hoc surgeries

Model Overview

AutoMod Simulation Software

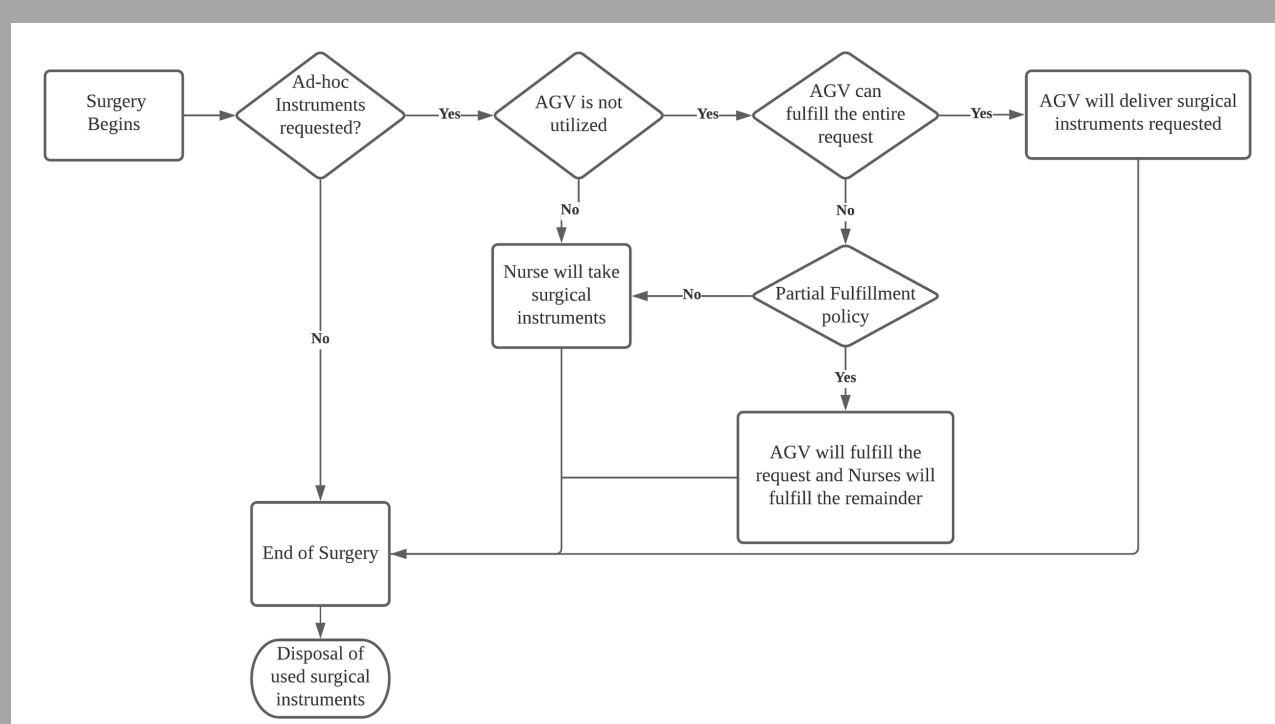
- Truncated layout of actual floor plan
- Consideration of the dynamic environment

Sensitivity Analysis:

Speed of AGV | Ad-hoc request probabilities | Number of Instruments on AGV | Restocking policy | Payload of instruments on AGV

Key Performance Measures:

Average Response Time | Average Time Savings for nurses | Utilisation of nurses for ad-hoc requests



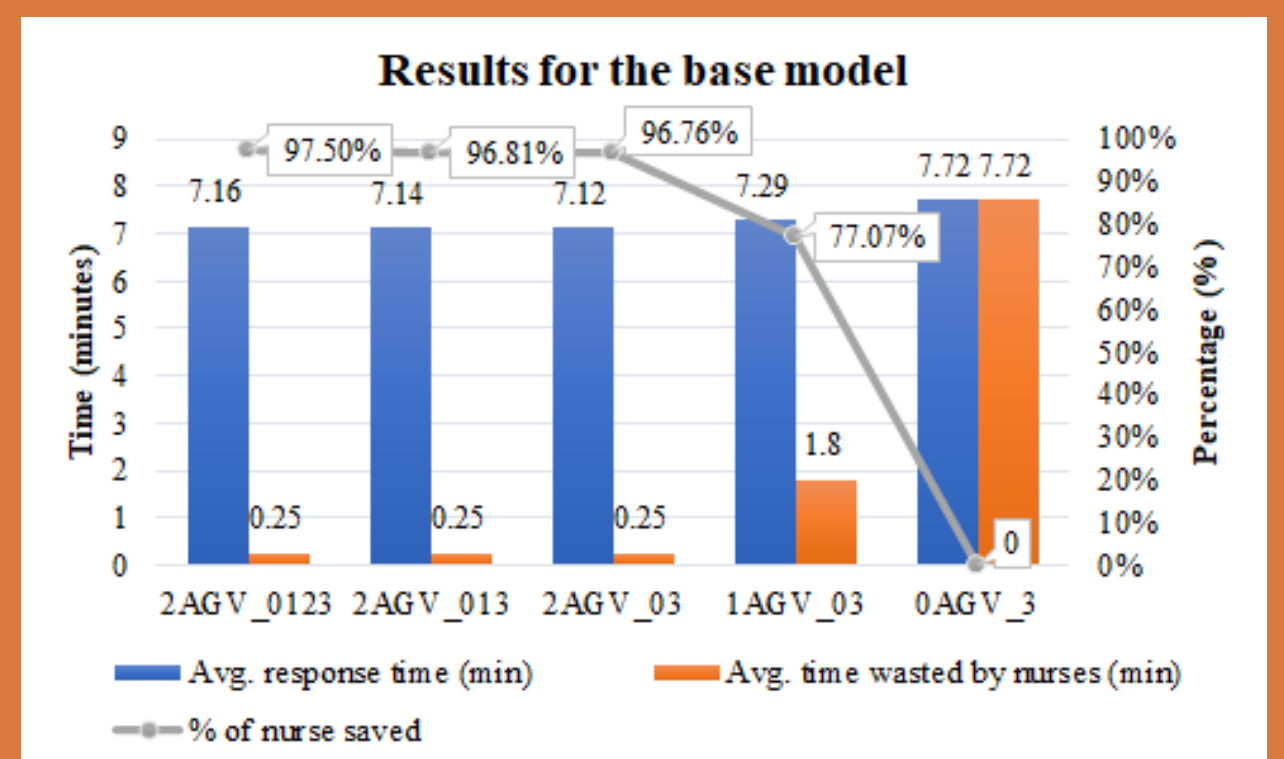
INSIGHTS

Shorter Waiting Time for Surgical Instruments

- Surgical Instruments are pre-loaded onto the AGV
- ↓ the waiting time for instruments upon each request

Productive Time Savings for Nurses

- AGV is able to effectively replace the nurses in the delivery of surgical instruments
- ↓ wasted time in transportation and motion of surgical instruments
- Nurses are able to focus their tasks in the OT
- ↑ productive time savings for nurses as nurses are not needed to fulfill ad-hoc requests



RECOMMENDATIONS

- Optimal Number of AGV → 2 AGVs
- Optimal Docking area → Central location
- Optimal Speed of AGV → 0.9 m/s
- Optimal Payload of instruments on AGV → 6 surgical instruments
- Optimal Restocking policy → Once a day