DECISION SUPPORT SYSTEM FOR VIRTUAL FACTORY SIMULATION

Team Members Ahmad Hatziq B Mohamad, Chong Yong Xiang, Ling Zhi Wei, Ng Jing Hui Darrell
SDP Supervisor A/P Chen Nan
Infineon Supervisor Pamela Lin
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Department of Industrial Systems Engineering and Management (ISEM)

BACKGROUND

Infineon Technologies is one of the world's leading manufacturers of semiconductor solutions.
Infineon Technologies Asia Pacific Pte. Ltd. (IFAP) in Singapore focuses on the Testing and Mark, Scan, Pack (MSP) phases in the manufacturing process.
This project focuses on the **burn-in** process of the Testing phase.

PROBLEM DESCRIPTION

Infineon has a lack of an adequate optimisation system. Currently, they have a *FlexSim* simulation model but it is too **computationally tedious and complex** to run many iterations for the purposes of optimisation. The current process flow remains suboptimal.

PROJECT OBJECTIVE

To develop an **optimised, automated decision support system** with the aid of a discrete event simulation model. This helps users easily determine the **optimal batch size** and **lot sequencing** for the burn-in process - Intelligent Burn-In System (IBIS).

PROBLEM IMPACTS

Loss of capacity for incoming chips when current chips spend longer time in factory.

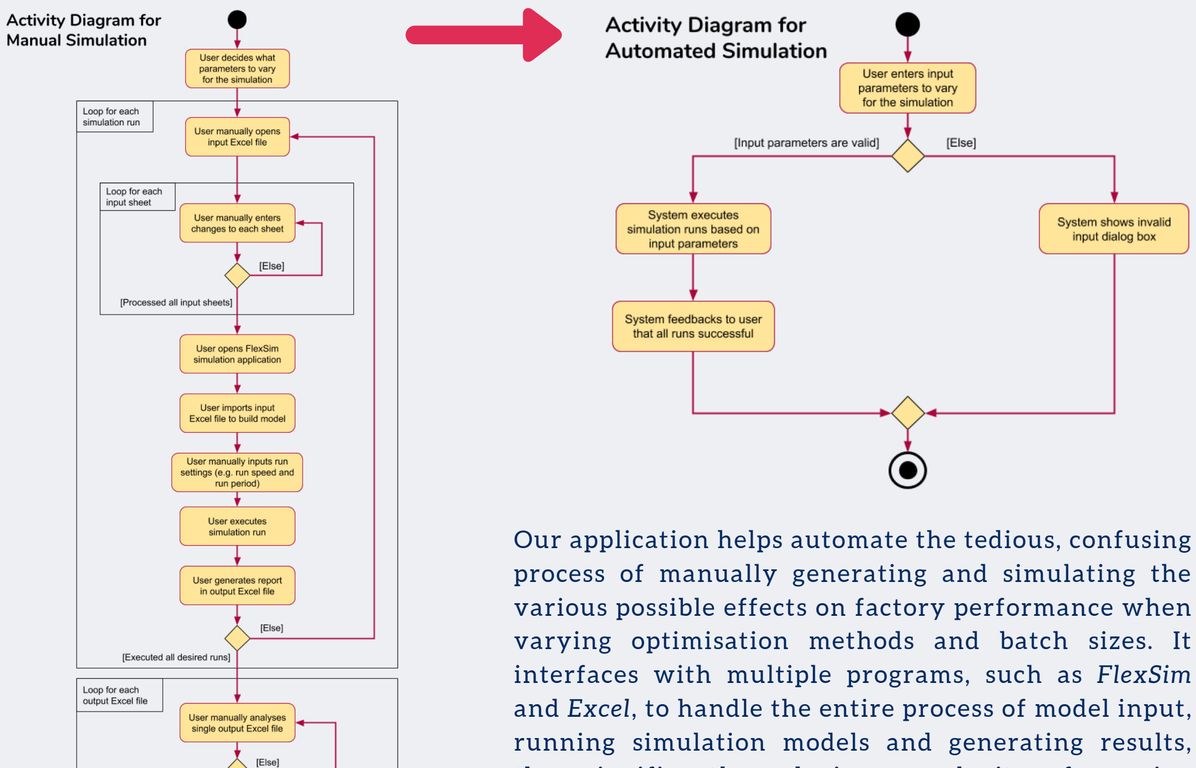
Longer processing times could lead to overdue orders, resulting in loss in reputation.

Loss in revenue due to storage, potential delay, and increased processing times.

METHODOLOGY

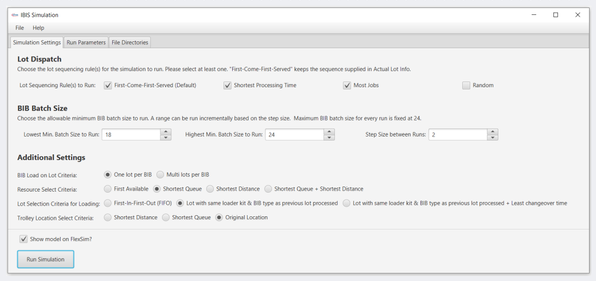
Automate the data extraction for the simulation input. → **Generate simulation runs** with different inputs via GUI-based application. → **Analyse results** to determine optimal batch size and lot sequence.

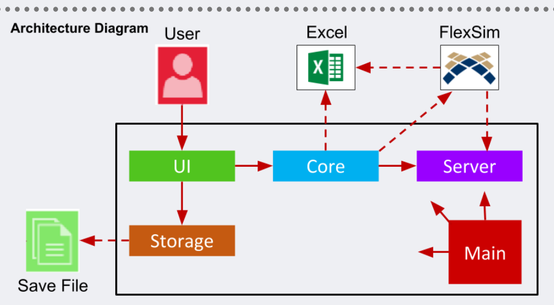
GENERATE SIMULATION RUNS



Our application helps automate the tedious, confusing process of manually generating and simulating the various possible effects on factory performance when varying optimisation methods and batch sizes. It interfaces with multiple programs, such as *FlexSim* and *Excel*, to handle the entire process of model input, running simulation models and generating results, thus significantly reducing complexity of running simulation models.

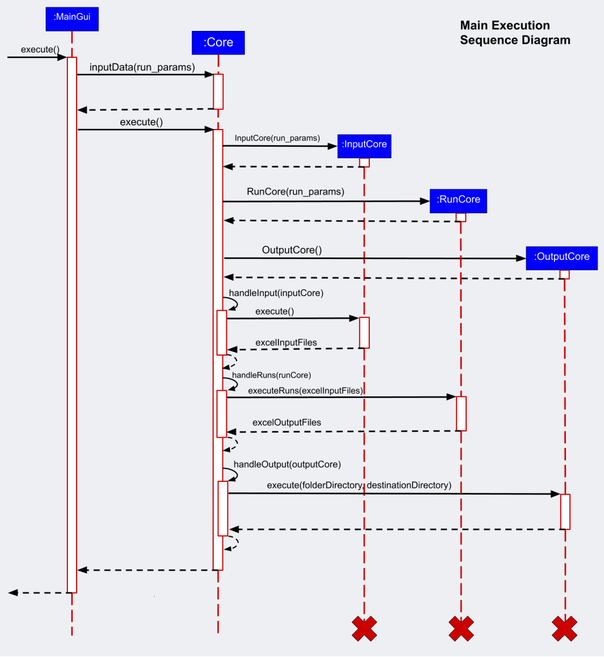
A simple and intuitive GUI interface allows any user with or without prior experience in simulation to test various theories and scenarios easily, thus significantly reducing the previous workflow process and increasing productivity and efficiency.





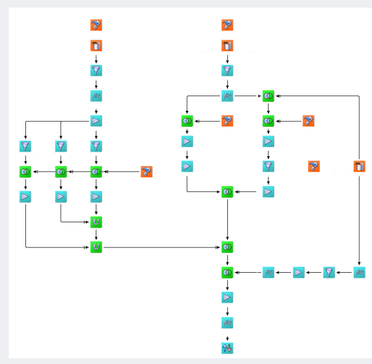
The diagram on the left shows the architecture diagram that explains the high-level design of our program. Our program adopts a multi-layered architecture that provides a user interface (UI) around the core component that processes *Excel* files and interacts with *FlexSim* software to facilitate the simulation runs. A simple storage component has been implemented to save and load the input fields provided by the user.

The diagram on the right shows a high-level sequence diagram. Once the user clicks "Run Simulation" and confirms the execution, the MainGUI component will pass all the input fields to the Core component and call the execute function to kick off the operations.
All the core components, InputCore, RunCore and OutputCore, are first initialised with the user-defined input parameters and the input *Excel* file extracted from the database. InputCore will then generate the input *Excel* file required for each run and pass them to RunCore. RunCore will execute the *FlexSim* simulation, which builds the model based on the given input file, then runs the model and generates the output *Excel* report. All the output files will be compiled and summarised analytically in OutputCore to generate an *Excel* file required for data visualisation on the designed *Tableau* dashboard.



AUTOMATE DATA EXTRACTION

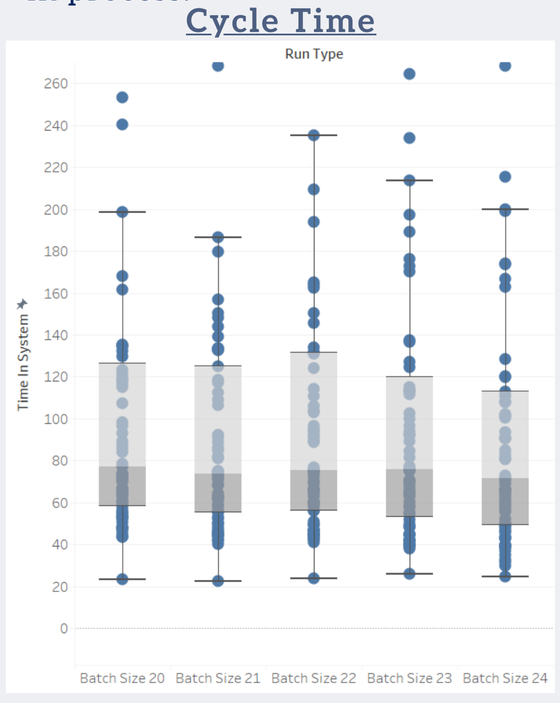
Infineon uses an **Extract-Transform-Load (ETL)** tool called *APF RTD*. *APF RTD* creates and dispatches reports based on real-time data from the company's raw database. Using the *APF*'s built-in formatter and activity manager, the raw data can be transformed into the format required for the simulation input and exported as a *Microsoft Excel* file.



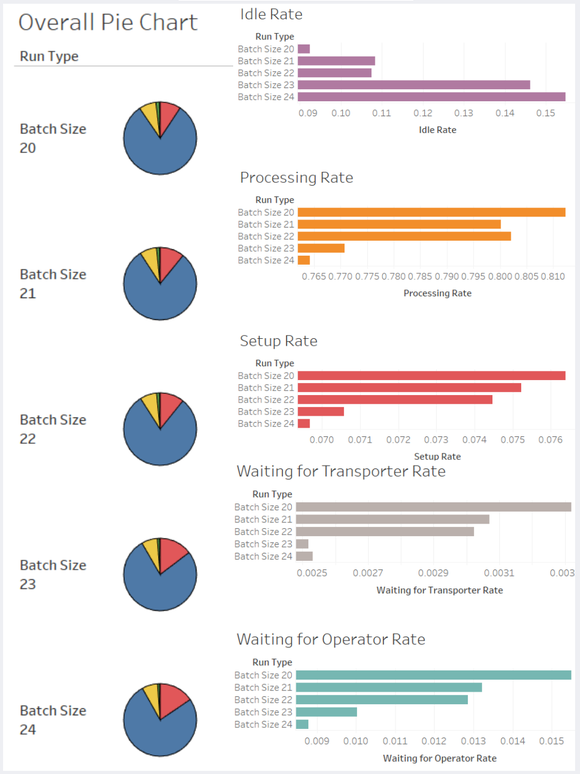
RESULTS

These are examples of results generated from the simulation via **data visualisation** tools on *Tableau*. The main measures of performance of the best solution are **IBIS oven** overall equipment effectiveness (**OEE**), **product throughput/cycle time** and **worth**. The simulation user can monitor these measures to determine the optimal batch size and lot sequence for the incoming lots that are about to undergo the burn-in process.

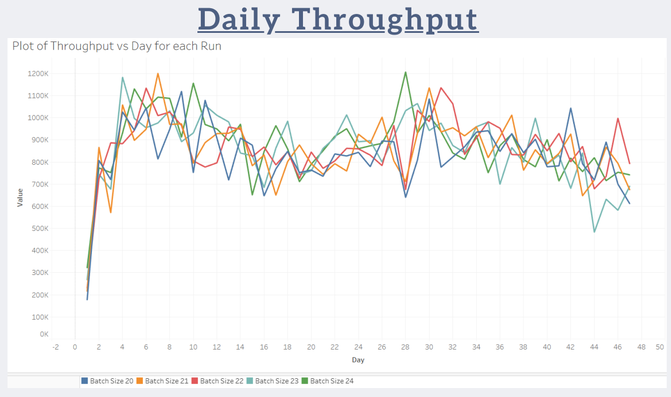
Cycle Time



IBIS Oven OEE



Daily Throughput



SKILLSETS

Manufacturing Logistics
- Cycle Time, Throughput, OEE
- WIP Analysis
- Batch Sizing
- Lot Sequencing

Data Analysis
- Sensitivity Analysis
- Data Visualisation

Data Management
- Extract, Transform, Load

Discrete Event Simulation
- Optimal Solution Analysis

Software Engineering and Design
- Object-Oriented Programming
- Multi-Layered Architecture
- UX Design