

Lean Manufacturing Analysis Supported by Process Mining

Extension of the "Fab Analytic Miner" application with features for lean manufacturing

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Result: This project's goal is to enhance the capabilities of an existing application named Fab Analytic Miner. Originally designed for process mining tasks, the application is now being extended to provide more insights that support Lean Manufacturing practices. This objective was accomplished with the support of log file data supplied by Intellion, the industry partner collaborating on this thesis. Specifically, the Fab Analytic Miner is designed to analyze log files generated by Intellion's DisTag server application. These log files are retrieved through a REST API from an Elasticsearch cluster hosted by Intellion. The enhancements to the Fab Analytic Miner encompassed the incorporation of data aggregation, cleaning, transformation, and visualization functionalities. These enhancements aimed to analyze the complex production workflows of Intellion's customers. To achieve this objective, a visualization library called Plotly.js was employed. This library is integrated into the frontend of the application, denoted as Fab Analytics Server, which is developed using the Blazor Server framework. The frontend interacts with the backend server, referred to as Fab Analytics Engine, to display aggregated and transformed data extracted from Elasticsearch. A gRPC API, offered by the Fab Analytics Engine, serves as the connection between the backend and frontend. This work elaborates on the process of improving the initial application and presents the outcomes achieved.

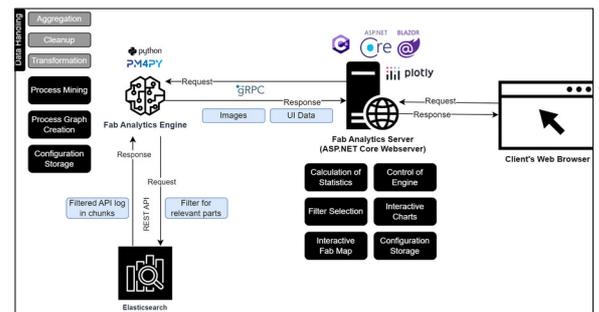
Introduction: Intellion designs, develops and implements individual solutions for control and assistance of manual processes in the production of semiconductors. Using technologies such as Radio Frequency Identification (RFID), sensors and displays enables innovative tracking and assistance solutions. The production of semiconductors is very complex. The planning of employees and machines is very challenging, as several lots take different paths through the production process at the same time. It is not assembly line manufacturing. Instead, the lots are processed in loops of about 400 production steps. It can take up to three months for a product to be finished. The lots are moved manually by operators or by an Automated Material Handling System (AMHS) from one production step to the next. The processes used are very difficult or even impossible to track, and their efficiency cannot be measured. Customers have only a limited view of their production and cannot see the whole picture of a production process and its impact on other parts of a factory.

Approach: In semiconductor fabrication plants (fabs) using the Intellion solution LotTrack, workflow information about the global processes in production is contained in the log files of the LotTrack system. Based on this data, a process analysis can be

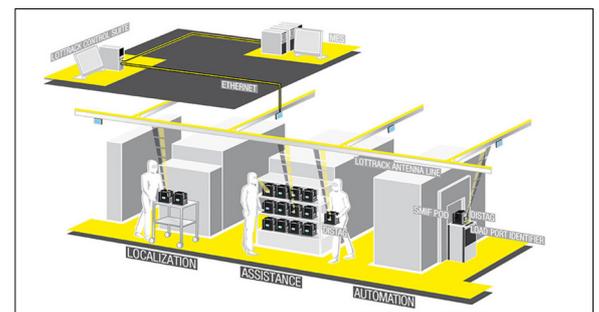
performed. Using process mining techniques, workflow models can be extracted. Subsequently, their performance and conformance can be measured.

Beyond process models, it is possible to extract metrics that enable Lean Manufacturing analysis concerning resources and similar aspects directly from the log files. This information can prove highly valuable in gaining insights into the intricacies of semiconductor fabrication processes.

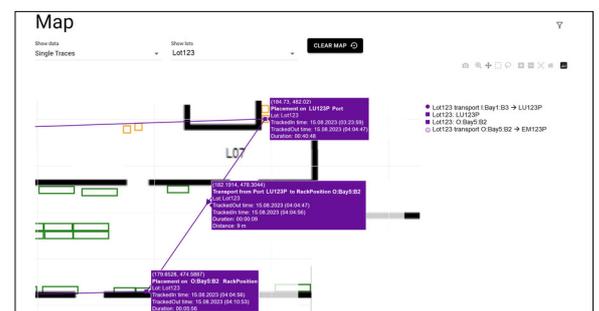
Fab Analytic Miner V2 architecture Own presentation



LotTrack system architecture intellion.com (2023)



Single Lot Trace on Fab Map Own presentation



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Subject Area
Computer Science,
Data Science

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