

Group Report Template

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Abstract—

***Index Terms*—Keyword1, Keyword2, Keyword3, Keyword4,
Keyword5**

I. INTRODUCTION AND MOTIVATION

The structure of the paper is as follows. Section II outlines the research question and the research approach. Section III describes similar work in the field and how our contribution fits the field. Section IV presents a production reconfiguration use case. The use case serves as input to specify a reconfigurability QA requirement in Section V. Section ?? introduces the proposed reconfigurable middleware software architecture design. Section VIII evaluates the proposed middleware on realistic equipment in the I4.0 lab and analyzes the results against the stated QA requirement.

II. PROBLEM AND APPROACH

Problem. In todays society, there is a heavy focus on the automation and digitalization of complex systems. The complex systems are used in many areas, such as industry, healthcare, public transport and so on. These systems are described as complex, because of the many parts involved, the intricate ways in which those parts communicate, and the overall behavior of the system - how do all these parts work together to complete the systems' goals? To ensure the correctness and reliability of such systems, it is of outmost importance that thought is put into the design. After all, failure in a system can lead to negative consequences ranging from minor inconveniences to death[SOURCE].

The Industry 4.0 production (I4.0) domain [... need to define]. In this domain there exist many complex production systems, one of which is the production of cars. Cars are sold not only for their functionality as a vehicle of transport, but often offer the customers a range of options for customization. These range from functional (...example) to cosmetic (paintjob, materials and colors for the interior).

Research questions:

- 1) not sure wtf they're expecting here. Smth like, How can we design a industry 4.0 production system for cars?
- 2) ...smth how effective is our architecture in ensuring the desired quality attributes?

Approach. The following steps are taken to answer this paper's research questions:

1)

III. RELATED WORK

This Section addresses existing contributions by examining xxx in the I4.0 domain. In total, x papers are investigated.

In [1], experiences are elaborated on a three-layer architecture of a reconfigurable smart factory for drug packing in healthcare I4.0.

The paper [2] proposes an ontology agent-based architecture for inferring new configurations to adapt to changes in manufacturing requirements and/or environment.

In [3], [4] an architecture for a reconfigurable production system is specified. Two objectives for reconfiguration and how they can be reached are described.

Several papers [5]–[7] describe reconfigurable manufacturing systems that are cost-effective and responsive to market changes.

All contributions provide valuable knowledge about reconfiguration but lack a study of the software architecture perspective that specifies a quantifiable reconfigurability architectural requirement, a software architecture that adopts the architectural requirements, and evaluates the architectural requirement.

IV. USE CASE

This Section introduces the use cases, of which there are XX.

A. Customer places an order

Actors: Customer, Website, Production Scheduler
Preconditions: Available cars and customization options have been defined in database.
Steps:

- Customer accesses company website
- Customer chooses preferred car
- Website fetches available customization options for chosen car
- Customer chooses preferred customizations
- Customer places the order
- Website sends order details to the Scheduler
- Production Scheduler receives order details from website
- Production Scheduler breaks down the order into a JSON production recipe, which is then stored in the database
- Production Scheduler stores the order in the database, marked as 'ready'

Postconditions: A customer order is stored and marked as 'ready' for production.

B. Execute production run

Actors: Production Orchestrator, Production Scheduler, Production Floor Components
Preconditions: The recipe for a customer order has been created and stored, and the order has been marked as ready for production. Production Floor components are all available to work.
Steps:

- Orchestrator contacts the Scheduler for next ready order
- Scheduler queries the oldest order that is marked as ready in database
- Scheduler fetches the relevant recipe from database, and sends it to the Orchestrator
- Scheduler updates the order's status from 'ready' to 'inProgress'
- Orchestrator delegates the steps in the recipe to production floor components and starts production

Postconditions: Order status is 'inProgress' and production run has started.

C. Check status of production floor components

Actors: Production Manager, Production Orchestrator
Preconditions: Production is running, a component on the production floor is not acting as expected
Steps: Production Manager signs into the production software and selects the "Check status". Production Orchestrator fetches logs and real-time status information from each component on the production floor. After reviewing the logs and the current status of the faulty component, the Production manager pauses the component to allow for maintenance. When the component is fixed, the production manager resumes the component operation.
Postconditions: Affected component is acting as expected.

D. Abort production run

Actors: Production Manager, Production Scheduler
Preconditions: Production is running
Steps: Production Manager logs into the production software and navigates the "Manage Production Run" option. Production Scheduler retrieves and displays current production overview. When the Production Manager selects the "Stop Production Run" option the Production Scheduler confirms the abort, and notifies related components. Each active components abort their current tasks, and return to default operational state.
Postconditions: Production run is aborted, and all affected components return to default state.

E. Schedule hardware maintenance

Actors: Production Manager, Production Scheduler
Preconditions: Production is running
Steps: Production Manager logs into the production software and selects the "Manage Production Run" option. Production Scheduler fetches an overview of production. Production Manager selects the "Schedule Maintenance" option. Production Scheduler confirms the date and notifies related components.
Postconditions: Components continue running, until the scheduled maintenance date.

F. Schedule software update

Actors: Production Manager, Production Scheduler
Preconditions: Production is running
Steps: Production Manager signs into the production software and selects the "Manage Production Run" option. The Production Scheduler retrieves the current overview of production. Production Manager then selects the "Schedule software update", after which the Production Scheduler confirms the date and notifies all related components.
Postconditions: Components continue running, until the scheduled maintenance date.

V. QUALITY ATTRIBUTE SCENARIO

This Section introduces the specified x QASes. The QASes are developed based on the use case.

VI. DESIGN AND ANALYSIS MODELLING

Design and analysis modelling.

VII. FORMAL VERIFICATION AND VALIDATION

Formal verification and validation of system(s).

VIII. EVALUATION

This Section describes the evaluation of the proposed design. Section VIII-A introduces the design of the experiment to evaluate the system. Section VIII-B identifies the measurements in the system for the experiment. Section VIII-C describes the pilot test used to compute the number of replication in the actual evaluation. Section VIII-D presents the analysis of the results from the experiment.

A. Experiment design

B. Measurements

C. Pilot test

D. Analysis

IX. CONCLUSION

Conclusion of the report, discussion and relevant future work.

A. Discussion

B. Future work

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CONTRIBUTIONS	
Name	Contribution
Anne-Marie	Scheduler, Use cases