Productivity Improvements in Construction Site Operations through Lean Thinking and Wireless Real-Time Control

David Rylander
Licentiate Thesis, December 16 2014
Biography

David Rylander is a researcher currently working at AB Volvo, Gothenburg Sweden. In 2006 he received a MSc. degree in Electrical Engineering at Chalmers Technical University, Gothenburg Sweden. He joined Volvo 2005, starting with his master thesis in dynamical geofencing. He is currently appointed connectivity specialist and R&AE Program Manager on Connectivity and Connected Services at Global Trucks Technology – Advanced Technology and Research.

In the end of 2011, David started as a Industrial PhD student at the ITS-EASY Industrial Research School at Mälardalen University Sweden. His research is focused on operational improvements in safety and productivity for quarry and aggregate and road construction by Lean thinking utilizing wireless communication and embedded real-time control.

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Abstract

The purpose of a quarry is to extract rock material to deliver gravels, cement and asphalt to its customers. These products are important input to the construction and maintenance of road infrastructure, buildings and more.

The operation of quarry and road work sites is similar to factory production, since it contains sequential production processes, tasks and activities to produce the output product. Compared to the factory, the quarry and road work processes are generally not synchronized and controlled towards the overall throughput in real-time. Some sites control parts of the production but do generally not utilize real-time technologies for the whole site and all its activities. This fact indicates a general improvement potential in increased productivity, but also unsolved challenges for the same reason.

This thesis investigate how Lean thinking utilizing real-time control and wireless communication can be used to improve productivity and safety in the operation of quarry and road construction. The main overall contribution is the identified operational improvements, its use cases, the system design constraints and challenges as well as assessed impact in productivity, energy efficiency and safety if introducing wireless real-time control to the site operation.

The results include the presentation and demonstration of a developed method based on Lean value stream mapping, for identifying wastes in sequential processes and activities including mobile machines. Further it investigates the performance and evaluates how the latest developments of wireless communication and vehicular ad-hoc networks (VANET) can be utilized within the quarry and road construction operation. The main system requirements and constraints are identified and the tradeoffs and gains in terms of system design, communication coverage, energy consumption and safety for the identified use cases are presented.
List of Publications

Publications Included in the Licentiate Thesis


Main value flow for Quarry to Road Construction operation.

Industrial Software Engineering Research Group

The research group Industrial Software Engineering, led by associate professor Jan Carlson, is focusing on engineering of complex software-intensive embedded systems, covering the entire lifecycle and including technologies, methods and processes. Particular emphasis on component-based software engineering and component-models for embedded systems.
The ITS-EASY post graduate school for Embedded Software and Systems

ITS-EASY is an industrial research school in Embedded Software and Systems, affiliated with the School of Innovation, Design and Engineering (IDT) at Mälardalen University (MDH) as an integrated part of the MDH strategic research area Embedded Systems (ES).

ITS-EASY is funded by the Knowledge Foundation (KKS), and the eleven participating companies. ITS-EASY started October 1st 2011, and will continue until September 30th 2020. During that period the PhD students will complete their studies and obtain the doctoral degree in Computer Science.

ITS-EASY is a large organization: it counts 22 PhD students, 14 main advisors from IDT, 18 co-advisors from IDT and the partner companies, and more than 25 associated members; senior researchers and industrial specialists. The board, led by Helena Malmqvist, ABB, has six members, and the industrial committee where all participating companies are represented, has 11 members. The management team of the research school consists of four members. All in all, about 85 persons are directly engaged in ITS-EASY.

www.mrtc.mdh.se/projects/itseasy

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