Towards sustainable mineral processing via plantwide eMPC (SUMIPRO)

Aalto University, University of Pretoria

Summary

Over last thirty years, process industries have made much progress in real time control and optimization. Close to 10 000 Model Predictive Controls (MPCs) have been implemented in different industries, mainly in oil refining, petrochemical and pulp & paper, and the estimated benefits delivered is 10 billion $. However, only a few MPC implementations have been reported in mining industry and none of them with combination of economic optimization.

The connection between mineralogy and metallurgical performance in a mine plays a key role for economic and sustainable processing of the ore body. An exciting research task is to develop the methodology which provides an integrated approach for linking information between the various unit processes, mineralogical composition, sustainability and to combine this "big mine data" via Industrial Internet to the plant real-time optimization.

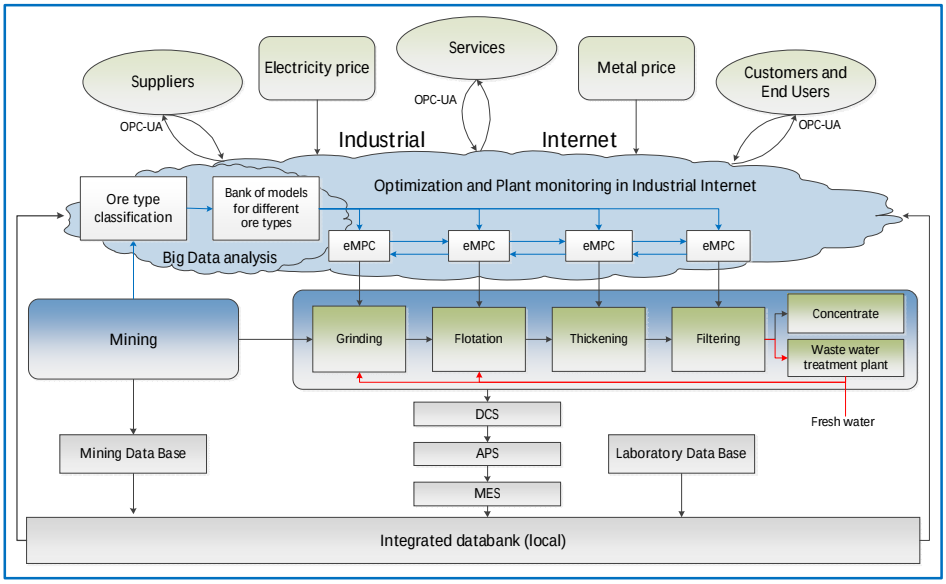
Project aims

The strategic objective of the SUMIPRO project is to explore new methodologies, methods and technologies, to maximize economic and energy efficiency in mineral processing plants. Optimization of concentrator operations needs to be considered at the plantwide level and to be integrated to the smart mining data, thus making optimization a complex large-scale task that needs to be solved. Smart mining concept, information and communication technology including industrial internet solutions should be used to optimally integrate the mineral processing chain in the form of distributed network of advanced process controllers and plant mineralogical data. The specific objective of the project is to:

Objective 1: develop a framework for plantwide eMPC based on the mine big data

The limitations of existing theory to easily encompass the complexity of large-scale systems for mineral processing plants and the lack of suitable design tools for addressing such systems are the main factors influencing the direction of the research work:

Objective 2: create models, control strategies and an innovative engineering toolkit for plantwide eMPC to operate safely and economically in large-scale, complex, distributed and dynamic environments

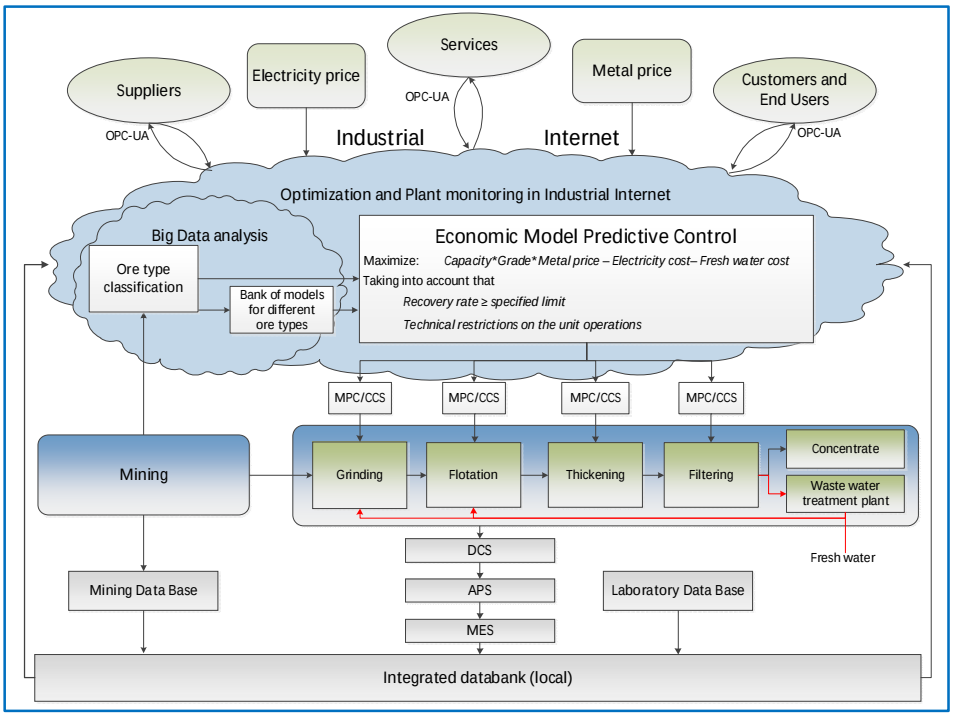


Distributed eMPC based on big data analysis (ore type) for concentrator control

Project significance

Achieving the objectives of this proposal will take the field significantly beyond the state-of-the-art, since it will enable, for the first time, i) formulate eMPC in the field of mineral processing; ii) combine mine big data with eMPC; iii) finally if successful the case studies with the industrial data.

It should be mentioned that the project focuses on the processing and enrichment of mineral resources, which is among the targeted themes defined by the call. Being successful, the project will boost the development and enhance the material and energy efficiency of the process. This will support the sustainable growth of Finnish and South African economies through sufficient supply of the necessary mineral and metal resources. Moreover, the expanded operation strategies will require the development and utilization of advanced process automation methods. Thus, novel products and technology business areas will be created.



eMPC based on big data analysis (ore type) for concentrator control (CCS: conventional control strategy)

The project team

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- ✓ Prof. Ian Craig, consortium PI
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