Research Proposal Master Graduation:

A Data Acquisition Architecture

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Problem: Prodrive Technologies is a manufacturer company, they develop and manufacture products for customers. To be able to manufacture these products, machines are used. Currently there is no monitoring on these machines and thus Prodrive has to react retroactively in case something goes wrong. This can result in downtime or broken products, which costs money. Also, some of Prodrive its customers have started to require a process control to be in place. They want to be able to view the collected data that is related to their bought products.

Importance: This project is a first step for Prodrive. Once the production data has been collected, additional functionality can be added in the future such as determining anomalies on the manufacturing process, predicting required maintenance, etc. All of this will increase the uptime and the amount of products produced with the high quality standard.

Project: Prodrive bought sensors from the company EpiSensor[1] which are planned to be placed around the production environment. Initially there will only be a few sensors, but this is expected to grow quickly. Therefore, scalability must be kept in mind. The data of these sensors, along with the sensors that are already present in some of the machines, must be collected. Each sensor is to be configured (manually) in the equipment application of Prodrive. This makes it possible to define a location on the production environment for each sensor.

For this project the sensors from EpiSensor are most important, the ones already embedded in some of the machines are left out-of-scope. The sensors from EpiSensor must be connected to one of their gateways. Each gateway can be configured to export its data using either the FTP, HTTP, or MQTT protocol. This means that a gateway hides the complexity of communicating with a sensor. All sensors send their data to their connected gateway, the gateway sends it to a configurable third party.

The 'raw' data that is collected must be enhanced with production data extracted from Prodrive its MES (Manufacturing Execution System), to give the raw data context. This production data is a stream of data that contains 'start operation' and 'stop operation' events. This means that the stream of

[1] `http://episensor.com/`

raw data must be merged with the production data stream. This can be done based on the location of the sensor and the location on which the operation is being executed.

The data must be collected as quickly as possible. It is desired that this happens within 1 second of the data being produced. All this data must be stored in a storage system that keeps this data for at least 5 years. After the 5 years have passed, the data may be removed.

All of this data must be extractable by an user based on filter criteria. So, for example the user must be able to retrieve all data that is related to a certain production order. This can be determined based on the data context. Besides the manual extraction of data, the data must also be depicted in real-time using a graph.

An architecture has to be designed to facilitate the collection, enhancement, storage, extraction, and real-time depiction of the data. In addition, a prototype/implementation of this architecture should be made to show that it works in practice. With this architecture it must be kept in mind that it must be extendable. This way adding functionality such as anomaly detection can be done relatively easy.

An example for which it should work, that can be used for testing, is a Fujitrax Pick-and-Place machine production line. This production line automatically solders multiple components on a circuit board.

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