Idea: Acoustic Infrastructure condition monitoring of bottle packaging lines

Common understanding: If you run a car you surely know that: suddenly there is noise somewhere in the car and every day it becomes more worse. You find not out where it comes, you are not sure if it is really bad, you call not quick enough the garage and suddenly the car stops. Game over.

Industry: Pharmaceutical, continuous production of infusion solutions.

Category of IoT: Condition Monitoring and predictive Maintenance of manufacturing machinery

Production process order: a) Solution-Mixing; b) Filling; c) Sterilization; d) Labelling and Packaging line; e) in-process Quality control

Background: Pharmaceutical production is a highly validated industry segment and thus quick changes to infrastructure and IT-connectivity are not on a "daily" base. Even small changes like exchange of a LAN-Router or a machine logic-controller (PLC) could force a whole re-validation of the whole production line. Therefore a lot of equipment in today pharmaceutical solution production consists of older devices which only grants the control and automation of the production line but not provides any additional data from the motors, pumps and other actors. The regular maintenance depends on written guidelines of the 3rd party manufactures or, if machines were constructed in-house, on the experience of the engineering center (*reactive maintenance*). Specific the packaging lines are highly and complex mechanical machines where its single parts must fit perfectly together in order to work without failure. If a packaging lines stops, the whole producing batch must be stopped. This can endanger the overall production planning and delivery schedule to end customer.

Mechanical problems often start with non-regular noises (vibrations, humming etc.). Areas can be a belt-drive for the bottles, the bottle-grapper or the lifter-motor for the carton-boxes. If the noise is not recognized the mechanical issue can become more severe and suddenly one devices stops working. Now the whole emergency maintenance is running to get the line running again. The availability of highly mechanical packaging lines is more uncertain as for other parts of the production line. With early-alert diagnosis the maintenance could be planned more efficient and non-productive times reduced.

Objectives of idea: Acoustic Infrastructure Monitoring (*trademark of DB Systel GmbH*) uses a microphone (as sensor device) mounted to the most sensitive machine parts of the packaging line.

The microphone is connected to a raspberry-PI based electronic-circuit which converts the acoustic information via Fourier-Transformation to a IT-meaningful data-stream. The regular noise is traced permanently and machine learning capabilities could distinguish more and more between normal run and beginning problems. At a glance the following should be realized with SAP Leonardo:

- Acoustic monitoring with microphone sensors of sensitive packaging-line machinery

- Leonardo Edge to send data to the IoT platform

- Configure Leonardo ready-to-run “SAP predictive maintenance and service “

- Store data and allow applications to read and analyze this data

- App driven Event-processing in case of anomaly and visualization of machinery state (traffic light)

- Creation of maintenance orders in ERP system based on alert events

- Analytics of acoustic data

How does this idea support the Intelligent Enterprise?

Change production-plant maturity from “Digital Silo plant” to “Connected plant”. Introduce vertical integration of automation data (Sensor to ERP). Minimizing production stops by predictive maintenance scenarios.

What is an example of quantifiable business impact as an outcome that could be expected as a result of this idea?

Main production plant KPI (Key performance indicator) is the OEE (Overall equipment effectiveness). It is mainly based on the good count of products and running time of the line. Each unexpected stop or microstop in the production line and also every bad piece reduces the OEE value. A reduction of OEE is an unwanted financial and performance loss for this plant, reported to the management.