Case #1 – Conveying - Control of the pulley's bearing lubrication

Background: the pulley lubrication interval is dependent on the pulley load, belt speed, and the temperature. The insufficient lubrication is the main reason for bearing damage in conveyor pulleys.

Solution: the pulley gets following signals:

- Belt speed from belt scale
- Mass Flow Rate from the scale
- Belt tension from the tension station
- Ambient temperature from the weather stations.
- Bearings' temperatures from itself (sensors installed in the pulley's bearing housings)

From the signals, the pulley controller calculates the grease service life and triggers the lubrication by the automatic lubrication system. The controller finds the optimal time for the lubrication, when the bearing is hot and rotating. From the difference between the ambient temperature and the bearing temperature, the controller can estimate if the bearing is full with grease.
If there is no automatic lubrication, system the controller can send the message "lubrication necessary" to SCADA.
The digital twin can overtake the function of the controller.

Case #2 – Conveying - Pulley utilization time

Background: The pulley utilization time is important information for the customer, till now there is no tool showing it. The pulley utilization can be calculated knowing the load, speed, cleanliness level and the state of the belt.

Solution: the pulley gets following signals:

- Belt speed from belt scale
- Capacity from the scale
- Cleanliness level of the belt from the scraper
- The wear rate of the belt from the belt sensors
- Belt tension from the tension station

From the signals, the pulley controller calculates the utilization time of the pulley, the bearing service life and the wear of the lagging.
The digital twin can overtake the function of the controller

Case #3 – Conveying - Control of the brakes
This is the state of the art and no new case. However, it shows how different equipment communicates with each other.

Description: In the uphill conveyors, the brakes have the function of backstops. In the running conveyor, the controller gets the actual torque of each drive. During stopping, the last drive torque is saved and the motors are switched off, conveyor stops and the brakes are closed when the belt speed reaches about 5% of the nominal speed. During start up, the motors are switched on the brakes stay closed. When the torque reaches the last saved value the brakes are opened and the conveyor starts.

Case #4 – Conveying - Misalignment detection

Background: The misalignment of the belt can lead to huge damages and to material spillage. Usually there are misalignment switches located in the head and in the tail of the conveyor, but in case of long conveyors the critical misalignment and the spillage can take place in the middle.

Solution: the controller gets following information:

- Idler temperatures left and right side from idlers
- Wind direction from weather station
- Belt capacity from scale
- Signals from misalignment sensors – warning / alarm or temperature in case of temperature based sensors.
- In case of the load detection on the pulleys the load left/right for each pulley

In case of significant belt misalignment, the temperature on one side of the conveyor will be higher than on the other side. A controller can send a signal “warning misalignment in conveyor part X”. Comparing the wind speed, the capacity and misalignment rate, the reason of misalignment can be analyzed: When the misalignment increases with the increase of the capacity it can be stated, that the transfer point gives the material not in the middle, this information can be send to SCADA.