Hydrocyclone Roping Detector and Predictor

Description

The Hydrocyclone Roping Detector and Predictor (DPR) measures the underflow discharge angle using a specialized camera (Figure 1) and vibration data from different points on the housing, including the body, discharge, and feed areas (Figure 2).

The DPR is an artificial intelligence innovation. It first uses computer vision to label different discharge-angle states against the measured vibrations and then trains deep learning algorithms to predict roping.



Figure 1: Spray shape and angle detector



Figure 2: Normal and roping operating angles

Solution benefits

The system supports the operation in the following areas:

1 - Prevent risks and improve personnel and equipment safety.

2 - Increase hydrocyclone availability and service life.

3 - Increase MTBF.

4 - Reduce emergencies associated with unexpected failures.

5 - Reduce maintenance costs.

6 - Improve production quality.

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Operation

The system operates in three stages: detection, diagnosis, and prediction. During detection, the shape of the underflow discharge spray is observed and labeled (Figure 3), making it possible to identify when roping occurs. In the second stage, the captured images are processed and spray angles are calculated to obtain a numerical value representing the roping condition (Figure 4).



Figure 3: Spray shape

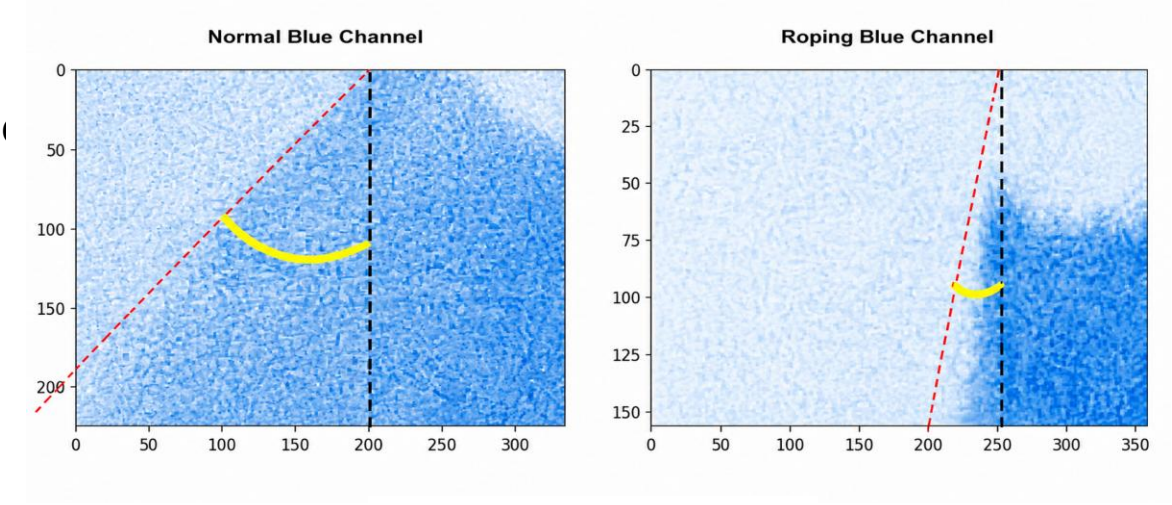


Figure 4: Normal operation and roping

Operation

In the third stage, spray-angle values are combined with data from accelerometers mounted on the hydrocyclone structure (body, feed piping, and discharge piping). The data are sent to an intelligent system that learns and then predicts when roping will occur (Figure 5).

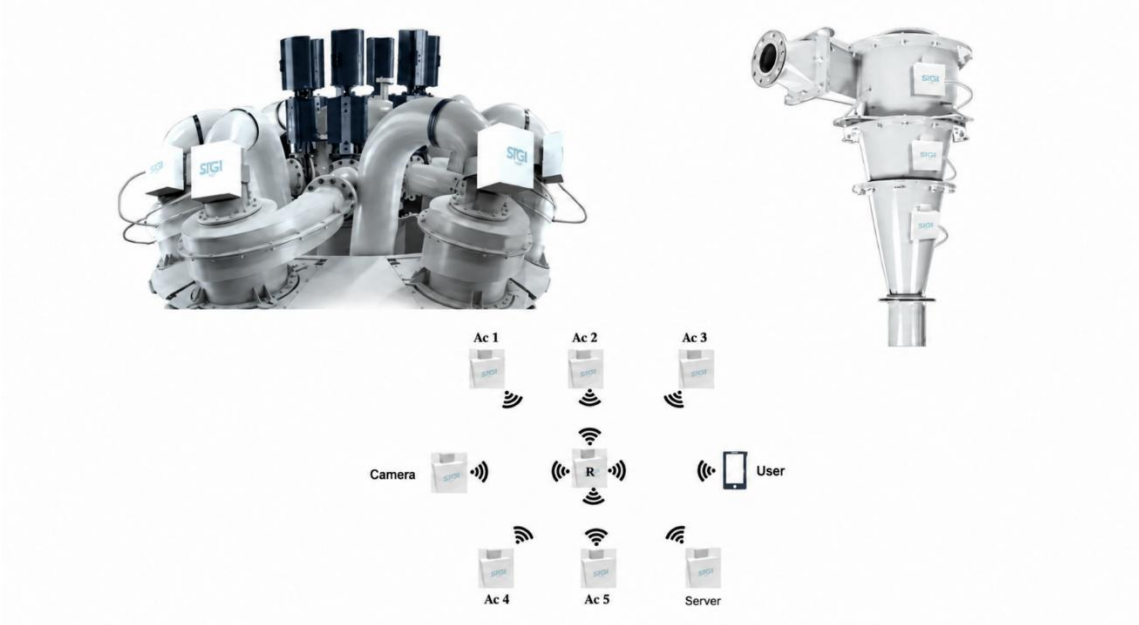


Figure 5: Sensor communication for roping prediction

Decision support

1 - Prioritize systems for maintenance.
2 - Implement improvements to the maintenance plan.
3 - Predict failures.
4 - Increase MTBF.
5 - Improve equipment availability and reliability.

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