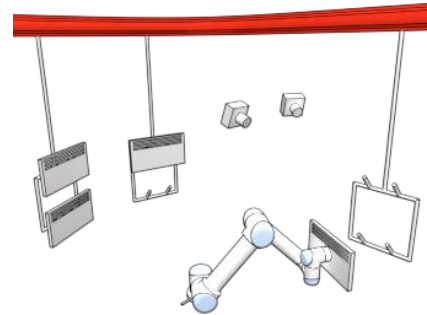# Collision Detection of Conveyor Trolley with Industrial Robot

Background

Roof mounted conveyors are common in a wide range of industries. As shown in the illustration, trolleys carrying the produced goods are suspended from the conveyor. When the trolleys are swinging freely it is difficult to automatically load and unload goods using industrial robots. Currently this task is performed with manual labour. The automation of this task using robots is an ongoing research activity at NTNU and SINTEF. The approach in the NTNU/SINTEF project is to model the swinging motion of the trolley as a pendulum, and then to use a particle filter to estimate the dynamic states. The particle filter uses live video capture of the trolley motion as measurements, taken by several cameras from different angles. The estimated swinging motion of the trolley is then used to compute a trajectory for an industrial robot in real-time. This method has been demonstrated in experiments at NTNU (https://youtu.be/0EAKonCFusg?t=43).

Assignment

For an automated system to run without supervision it is necessary that the tracking algorithm understands when the robot has collided with the swinging trolley, or otherwise fails to perform its task. The assignment is therefore

- Find and study the fault detection methods that are available for particle filters.
- Develop a simplified 1DoF model of the trolley that can simulate collision with external objects.
- Test the methods on the simplified model and compare with the results from the NTNU/SINTEF project.

Access will be given to the existing tracking software and simulator. It will also be possible to test the method on data from experiments.
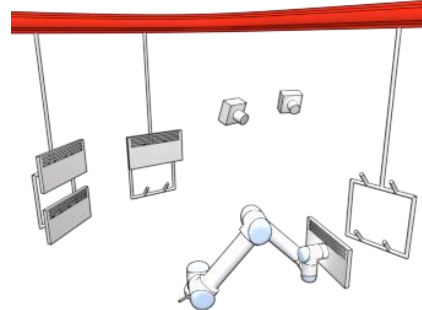
Professor: Tommy Gravdahl

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Estimating Static Parameters for Dynamics and Visual Model of a Swinging Conveyor Trolley

Background

Roof mounted conveyors are common in a wide range of industries. As shown in the illustration, trolleys carrying the produced goods are suspended from the conveyor. When the trolleys are swinging freely it is difficult to automatically load and unload goods using industrial robots. Currently this task is performed with manual labour. The automation of this task using robots is an ongoing research activity at NTNU and SINTEF. The approach in the NTNU/SINTEF project is to model the swinging motion of the trolley as a pendulum, and then to use a particle filter to estimate the dynamic states. The particle filter uses live video capture of the trolley motion as measurements, taken by several cameras from different angles. The estimated swinging motion of the trolley is then used to compute a trajectory for an industrial robot in real-time. This method has been demonstrated in experiments at NTNU (https://youtu.be/0EAKonCFusg?t=43).

Assignment

To reduce the amount of pre-programming necessary the tracking algorithm should automatically estimate the parameters describing the dynamics of the trolley and its visual appearance. The assignment is therefore

- Find and study static parameter estimation methods that are available for particle filters.
- Develop a simplified 1DoF model of the trolley that simulates the dynamic behaviour and the visual appearance of the conveyor trolley.
- Test the parameter estimation methods on the simplified model and compare with the results from the NTNU/SINTEF project.

Access will be given to the existing tracking software and simulator. It will also be possible to test the method on data from experiments.

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