xPPU Mini-scenario:
Small step changes for the evolution from modified scenario 9 to 11

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Mini scenario overview

- **Idea**
  - To facilitate researches on evolution by providing incremental changing scenario with mini changes

- **Basic scenario**
  - These mini scenarios are based on the evolution from scenario 9 (modified) to 11 in [1]
  - This evolution has been divided into 5 small step changes (10a-10b-10c-10d-11)
  - Two different basis timing is considered regarding the working timing of the pusher
    - Pusher works after the time of traveling from the end of the conveyor to the pusher (10a, 10b, 10c)
    - Pusher works after the time of traveling from the sensor near the pusher to the pusher (10a', 10b', 10c')
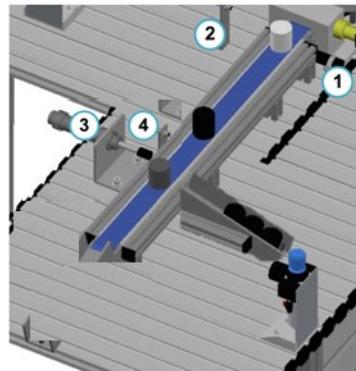
- **Overview of the evolution**

Scenario 9 (original)
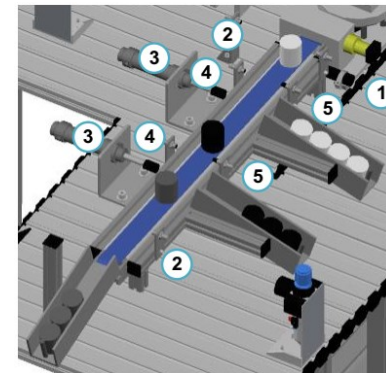PPU has a conveyor with one ramp at the end
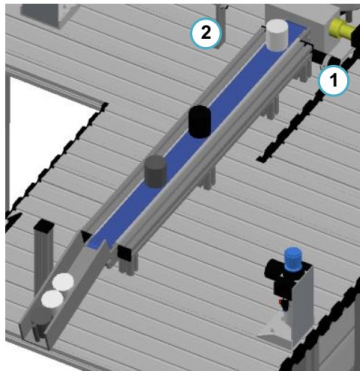
**Scenario 10a
(modified version of Sc 9)**
PPU has a conveyor with one ramp and its corresponding pusher

Scenario 11
PPU has a conveyor with three ramps and two pushers with sorting function

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Mini scenarios description (based on end point of the conveyor for all scenarios)

Scenario	Objective	Structure	Behavior
10a	To move the WP from the edge of the conveyor to the Ramp 1	There is a conveyor part which consists of conveyor belt, a ramp (Ramp 1), and a pusher (Pusher 1).	Once the WP is placed on the conveyor belt, the conveyor moves the WP for a certain time (t_1) and then Pusher 1 pushes the WP. All the WPs are going to the Ramp 1.
10b	To move the WP from the edge of the conveyor to the Ramp 2 – WP storing location is changed.	Based on the scenario a, we add a ramp (Ramp 2), a pusher (Pusher 2).	Once the WP is placed on the conveyor belt, the conveyor moves the WP for a certain time (t_1) and then Pusher 1 pushes the WP. All the WPs are going to the Ramp 1.
10c	To achieve doubled capacity.	Hardware structure is same to Scenario b.	Once the WP is placed on the conveyor belt, it moves the WP to the pusher location. Pusher 1 and Pusher 2 push the WPs alternatively. Controller knows the order so the conveyor working time is also by spells (t_1, t_2) and the pushers are actuated alternatively with different timing.
10d	To separate the black WPs from others and gather them in Ramp 1 with others in Ramp 2.	Based on Scenario c, light sensor added.	Once the WP is placed, the conveyor works for a certain time (t_s) to move the WP to the sensor location. If the WP is black, i.e. light sensor returns FALSE, conveyor move this WP from the sensor to the Pusher 1 (for $t_{1'}$) and this pusher pushes the WP.
11	To separate the black WPs and white WPs from others and gather black ones in Ramp 1 and metal ones in Ramp 2.	Based on Scenario d, inductive sensor added.	Once the WP is placed, the conveyor works for a certain time (t_s) to move the WP to the sensor location. - If the light sensor == F, regardless of the inductive sensor value, then the conveyor moves this WP from the sensor to the Pusher 1 (for $t_{1'}$) and this pusher pushes the WP to the Ramp 1. - If the light sensor == T and the inductive sensor == F, then the conveyor moves this WP from the sensor to the Pusher 2 (for $t_{2'}$) and this pusher pushes the WP to the Rampt 2. - If the light sensor == T and the inductive sensor == T, then the conveyor moves this WP to the end of the conveyor belt.

Mini scenarios description (based on sensor location for all scenarios)

Scenario		Objective	Structure	Behavior
10a'		To move the WP from the edge of the conveyor to the Ramp 1	There is a conveyor part which consists of conveyor belt, a ramp (Ramp 1), and a pusher (Pusher 1).	Once the WP is placed on the conveyor belt, the conveyor moves the WP to a certain place which the sensor will be placed at. After stopping here for a certain time, the conveyor moves the WP to the Pusher 1 for a certain time ($t_{1'}$) and Pusher 1 pushes the WP. All the WPs are going to the Ramp 1.
10b'		To move the WP from the edge of the conveyor to the Ramp 2 – WP storing location is changed.	Based on the scenario a', we add a ramp (Ramp 2), a pusher (Pusher 2).	Once the WP is placed on the conveyor belt, it moves the WP to a certain place which the sensor will be placed at. After stopping here for a certain time, the conveyor moves the WP to the Pusher 2 for a certain time ($t_{2'}$) and Pusher 2 pushes the WP. All the WPs are going to the Ramp 2.
10c'		To achieve doubled capacity.	Hardware structure is same to Scenario b'.	Once the WP is placed on the conveyor belt, it moves the WP to a certain place which the sensor will be placed at. After stopping here for a certain time, the conveyor moves the WP to the pusher location. Pusher 1 and Pusher 2 push the WPs alternatively. Controller knows the order so the conveyor working time is also by spells ($t_{1'}$, $t_{2'}$) and the pushers are actuated alternatively with different timing.
10d		Same as previous slide		
11		Same as previous slide		

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