Module name: Robot trajectory generation based on digital design content

- **Main functionalities**:

This module has two functionalities first one is utilizing digital design information for robot simulation, online or offline programming online and offline. The target of this functionality is to speed up robot simulation and programming by using data from digital design data, such as BIM (Building Information Model).

Secondary functionality is to utilize design data to create AVR (Augmented or Virtual Reality) models. The target is to speed up the creation of AVR models or virtual twin models by using data from digital design.

- **Technical specifications:**

The overall description of this module is shown in figure 7. We can utilize information from digital design data to create either, AVR-experience or robot trajectories. In first case, digital design data and simulation data is imported and processed with Unity, Blender and Vuforia to create AVR-experience. Hardware here is HTC Vive. In second case, input data is used to create robot trajectories for manufacturing software used here are Solidworks and RoboDK. Hardware is industrial robot.
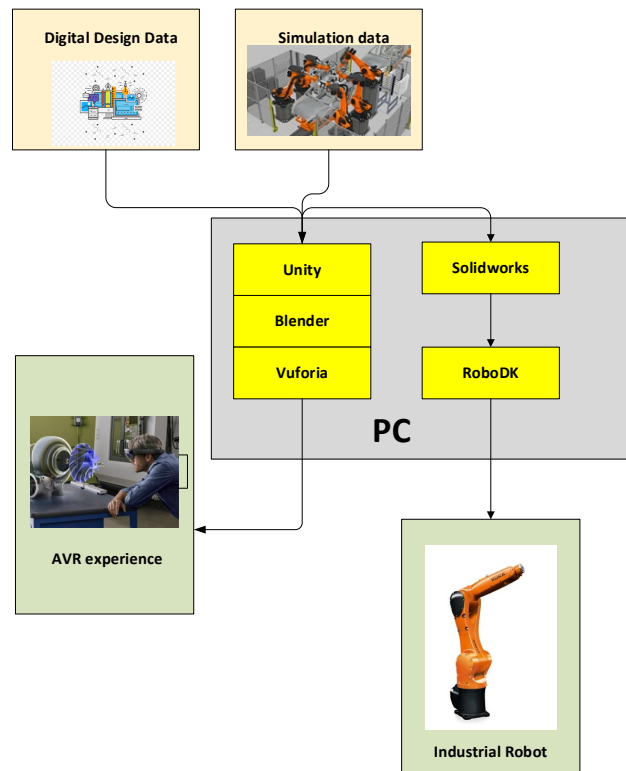

Fig 7. Module components and connections

- **Inputs:**

  Inputs here are digital design data and simulation model of the production environment

- **Outputs**

  Outputs are digital twin of production environment and AVR-experience or robot TCP locations and trajectories for different work tasks such as material handling, nailing and spraying.

- **Interface specification:**

  Interfaces here are user interfaces of Unity, Vuforia, Blender, RoboDK, Solidworks and controls of AVR-environment.

- **Formats and standards used**:

  ISO 10303-STEP, ISO 19650-BIM, ISO 10218

Availability:

This module is currently under development. First version is available at the beginning of year 2020.

- **Application scenarios:**

This module has applications within many manufacturing processes, e.g. in material handling of large objects or in the production process of wall and floor elements for buildings And also users who need virtual twin or AVR-environment of their production for education, presentation or production planning purposes

- **Offered for internal / external use**

This module as a concept will be available for internal and external use.