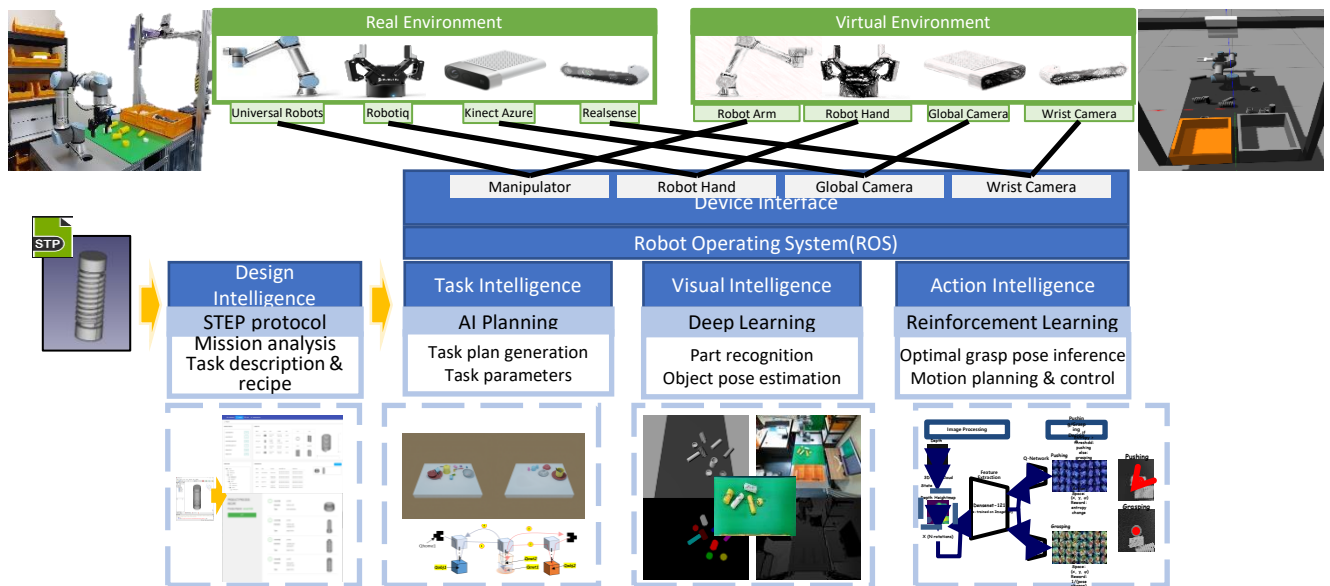# Autonomous Manufacturing Collaborative Robot Framework

Introduction

- SW framework for collaborative robots to assemble products autonomously
- Performs intelligent environment recognition, task & motion planning, actions

Framework components for autonomous manufacturing

Real Environment: Universal Robots | Robotiq | Kinect Azure | Realsense

Virtual Environment: Robot Arm | Robot Hand | Global Camera | Wrist Camera

Device Interface: Manipulator | Robot Hand | Global Camera | Wrist Camera

Robot Operating System(ROS)

Design Intelligence
STEP protocol
Mission analysis
Task description & recipe

Task Intelligence
AI Planning
Task plan generation
Task parameters

Visual Intelligence
Deep Learning
Part recognition
Object pose estimation

Action Intelligence
Reinforcement Learning
Optimal grasp pose inference
Motion planning & control

Main technologies and outstanding characteristics

- Design Intelligence: Automated mission & task analysis using product CAD model
- Task Intelligence: Task sequence & parameter generation based on reasoning
- Visual Intelligence: Occluded object recognition and pose estimation using images
- Action Intelligence: Optimal object grasp pose inference and autonomous action

Application areas and expected effects

- Bin-picking/piece-picking/palletizing for very diverse parts/products
- Autonomous manufacturing by jig-free product assembly using co-robots

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