Development of an Enhanced Palletizing Cell

Degree programme: BSc in Mechatronics and Systems Engineering (Medical technology | Robotics)
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Robotic palletizing cells modernize logistic processes by replacing repetitive and tedious tasks with robots, increasing efficiency, and reducing worker fatigue. These flexible and reliable systems can be easily integrated into production lines and reconfigured for a variety of tasks, offering an ideal solution in contexts where skilled labor is in short supply. The aim of this work is to optimize an existing robotized palletizing cell to increase its reliability and speed.

Context

Rollomatic has developed a robotic cell equipped with an Omron TM5-900 collaborative robot (cobot), which incorporates a camera on its end effector. The cell includes an automatic part feeding system and a dedicated pallet storage area. The purpose of the cell is to pick up parts from bulk and place them on pallets. The system is capable of handling eight different parts with similar geometries.

System Highlights

Fig. 1 shows the realized system, the on-board camera of the robot is used to detect the parts to be palletized. The part feeding system ensures continuous cell operation. It includes a hopper to store the parts and a vibration plate for their distribution. Information from sensors on the plate combined with the part detection are used to limit the number of parts on the vibration plate. The gripper fingers, robust and easy to manufacture, handle pallets, parts, and the overflow container. The fingers work in pairs and, with the help of pins, allow the parts to be manipulated through their holes. Flipped parts that cannot be palletized fall into the overflow container. The robot can pick the container and empty it into the hopper. This solution can handle all types of parts.

Part Quality Control

A visual inspection has been added to identify major defects on the cutting edges of the parts (Fig. 2). This check is performed using a new external camera directly connected to the robot controller.

Results

Verification tests show an improved process, with a 30% time reduction to fill a pallet. The system can stock ten pallets reliably and autonomously, after which it must be replenished manually with parts and pallets. Quality control has proved reliable in identifying parts with defects. The program, implemented on TMFlow, can be easily modified to teach the cell new types of parts.

Outlook

A few improvements are still necessary to obtain an industrialized cell. In the future, 3D printed plastic parts, such as the overflow container, can be replaced by metal ones to increase durability. Some mechanical parts, like the storage space for pallets, could have their tolerances adjusted to make the system easier to use. The cell's safety concept must be assessed.

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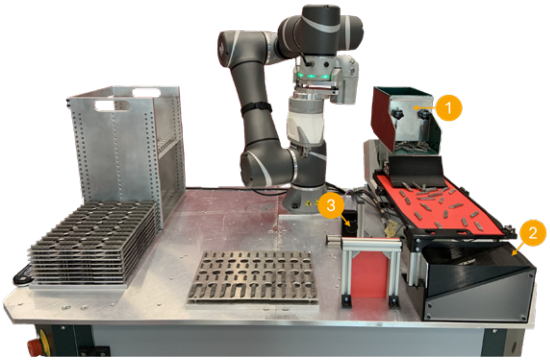

Figure 1: Modified cell. (1) Parts feeding system, (2) overflow container, (3) parts inspection camera.

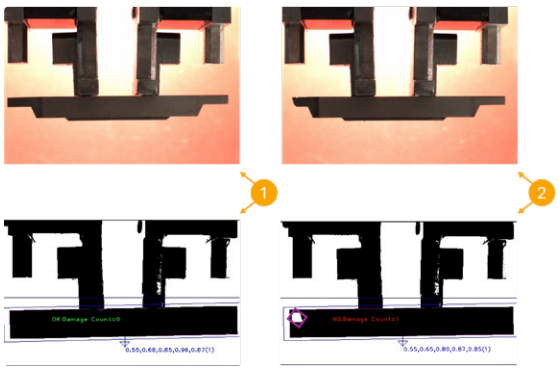

Figure 2: Images from the external camera. Top: Raw image. Below: Inspection results, (1) good part, (2) defective part.