Flexible Cobotic Palletizing

Degree programme: BSc in Micro- and Medical Technology | Specialisation: Robotics
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Pick, place, pick, place, pick, place... A drudge task if carried out daylong by a worker. In this study, a system was developed using a collaborative robot capable of relieving workers of pick and place tasks. Thanks to it, workers will now be responsible of telling the robot what to do and will employ their time more efficiently.

Introduction

In a time when the availability of qualified workforce is scarce, manufacturers must assign their employees to crucial production tasks. Consequently, tedious and repetitive duties prompt manufacturers to pursue automation. However, automating tasks for small lots is often too expensive. Nevertheless, emerging technologies, such as collaborative robots (Cobots), now significantly facilitate the implementation of such tasks. A Rollomatic customer is now interested in automating bulk part placement onto pallets.

Goals

A system shall be developed that reliably picks 8 different parts from bulk and places them on pallets (Figure 1). The pieces come in two distinct shapes and multiple sizes. The system shall use an Omron TM cobot with integrated camera at the end effector and is to be intuitively adaptable to palletize new parts. The cobot shall handle as many manual tasks of the process as possible. The system shall be affordable and thus minimize the use of additional peripherals.

Methods

The pick and place task for the given parts was studied meticulously. Exploring currently used gripping and feeding processes of the industry, an iterative ideation process was followed to arrive at optimal implementation concepts.

Results

Specially designed fingers for a parallel gripper were devised, capable of securely grasping the pallets by clamping sideways onto them, and engaging with the holes in the parts with two pins positioned on the underside. Empty pallets are effortlessly placed by the operator and seamlessly retrieved by the robot in a purpose-built, removable rack. For ease of collecting, filled pallets are stacked next to it. Bulk parts are placed and dispensed from a vibrating hopper onto a flat vibrating surface. The robot captures an image to locate and subsequently retrieve the parts. Its user-friendly graphic programming interface, TMFlow, makes configuration of new parts possible without prior programming knowledge. Together, these components constitute a comprehensive system that accommodates for similarly shaped and sized parts, allowing flexible palletization.

Outlook

Improvements are needed for successful implementation of the system in the industrial setting. The gripper fingers, being made with plastic and aluminium additive manufacturing, exhibit fatigue wear and break after prolonged use. A sturdier gripper, redesigned using FEM analysis, is necessary. Adjustments to the flip mechanism and feeding line are required, to ensure all parts lay flat on the surface. Finally, the software may be extended to palletize similar parts.

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Figure 1: Placing parts by hand.

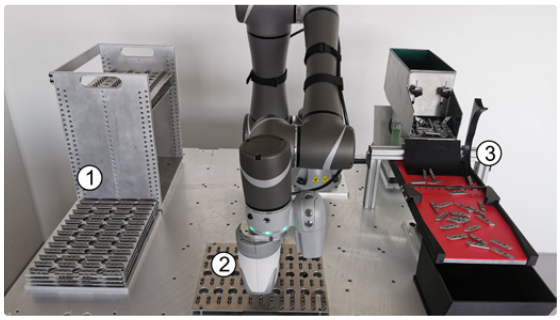

Figure 2: System composed of pallet stacks (1), a robot with gripper palletizing parts (2) taken from the feeding line (3).