About Universal Robots (UR)

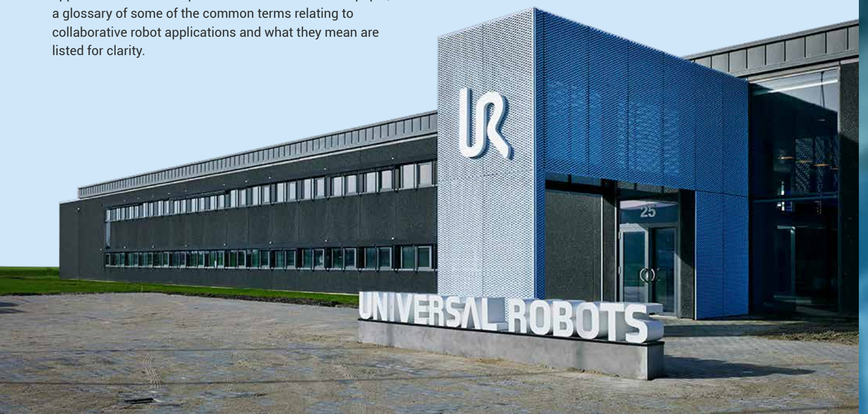
We believe that collaborative robotic technology can be used to benefit all aspects of task-based businesses – no matter what their size. Our robot arms are advanced tools that can be used by all levels of production staff to help increase productivity, reduce injury and boost morale. With a Universal Robots robot arm, you can automate and streamline repetitive or potentially unsafe processes, so staff can be assigned to jobs that provide them with new challenges.

We believe that the latest collaborative robot technology should be available to all businesses. The nominal investment cost is quickly recovered as our robotic arms have an average payback period of just 12 months. We're dedicated to making the world a better place, towards a collaborative future.

We are Universal Robots.

Executive Summary

This document is intended to give an overview of how collaborative robot technology can be integrated into common industrial applications, such as packaging and palletising to improve manufacturing processes. It provides an overview of the packaging and palletising application, how the robot handles the process, plus the common accessories required to be integrated with the robot to successfully complete the task. The benefits of using collaborative robots in the packaging and palletising application will also be presented. At the end of this paper, a glossary of some of the common terms relating to collaborative robot applications and what they mean are listed for clarity.



Introduction to Collaborative Robots

The field of collaborative robotics has expanded significantly over the past ten years and is now by far the fastest growing segment of the global industrial robotics market.

A collaborative robot, also known as a cobot, in its most basic definition is a robot which has the ability to safely work directly alongside human workers to complete a task. At Universal Robots however, we believe the accessibility of the technology through ease of deployment is similarly integral to the cobot definition. A robot that can operate directly alongside and interact with its co-workers does open up a huge number of new possibilities for task automation, but many of these possibilities could go unfulfilled if the robot system is not easy to program, affordable, and flexible enough that it can be re-deployed to different tasks at very short notice.

For this reason, we strive to make Universal Robots safe and collaborative, easy to program and deploy at an affordable price, to make robotic automation technology truly accessible to everyone.

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INTRODUCTION TO COMMON COLLABORATIVE ROBOT APPLICATIONS

PACKAGING & PALLETISING

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Application – Packaging and Palletising

The flexibility of the Universal Robots system has led to UR cobots being deployed in a huge range of applications and industries around the world. Here we will discuss the packaging and palletising application, on how to implement a UR cobot into the application and what accessories would be required.

Before any product leaves a factory, it is highly likely that it needs to undergo some forms of packaging ready to be shipped to its next destination. The ***packaging and palletising*** task could involve packaging a product by placing it into a shrink-wrapping machine, picking packaged products from a conveyor and collating them into boxes, or placing these boxes onto a pallet ready for shipping.

Such tasks are all extremely repetitive and generally, involve small payloads making them ideal for automation with Universal Robots. Rigid products arriving in standard orientation are extremely easy to handle, though a simple vision system may be required to detect the orientation of parts if not uniform. If less rigid products such as sachets are presented and need to be tightly packed into boxes, extra consideration on the handling method is required but still entirely possible.

For business running high mix low volume production, rapid product changeover is key, so the easy programming interface provided by Universal Robots is perfect for this, allowing for reconfiguration of an application within a matter of minutes.

> "Universal Robots provides us with an ideal solution in automating our production lines. UR collaborative robots work safely alongside human operators and increase production volume. UR provides the best return on investment (ROI) attributed to its unique features, such as built-in safety features, small footprint and reliability."
>
> – Worawet Jongmontri, Production Engineer 2 (R&D), DENSO (Thailand) Co., Ltd.

Accessories

End-effector

Packaging and palletising tasks are commonly handled with an array of vacuum cups to pick up and release the products. In the simplest form, these can be attached to a single flat plate, but can also be set up so that their positions are reconfigurable, allowing a range of different sized products to be picked with the same tool.

Conveyer Tracking

Synchronising the movement of the robot with a conveyor to pick products on the fly is simple with the UR conveyor tracking wizard. Simply connect a position sensing encoder to input channels in the controller (or via Modbus fieldbus), configure the direction and speed ratio, and the robot is ready to track the movements of a variable speed conveyor. Note that if this is an end of line conveyor, where the products hit a mechanical stop at the end, it is not necessary to track the movement of the conveyor as the pick position is fixed.

Vision System

If the products arriving for the robot to pick are in a non-standard position/ orientation then it may be necessary to integrate a simple vision system to detect the orientation of the part.

I/O Interfacing

A few inexpensive light sensors (photoelectric) connected directly into the controller will allow the robot to detect the presence of arriving products and the box into which they are to be placed.

Programming

For the most part, setting up the program for this type of application is very similar to a pick and place, with the pick usually from a fixed position, triggered by a sensor input. The place positions will likely vary for packing into boxes or palletising, with either a horizontal offset within a layer or a vertical offset between layers, both of which are straightforward to set up within Polyscope. For a more complex palletising pattern, it may make more sense to enter the dimensions and locations of the place positions parametrically instead of teaching/offsetting them manually.

Typical Programming Time – Less than 0.5 days.

Benefits

The benefits of automating a packaging task are similar to generic pick and place – increased productivity over multiple shifts. The Universal Robots system comes fully equipped with interfaces to integrate with existing production lines out of the box, without the need to pay for additional add on features, reducing costs of implementation.

Conclusion

For a newcomer to robotic automation, this paper provides basic insights into how collaborative robots can be implemented in common tasks, such as packaging and palletising and the benefits of doing this. The packaging and palletising task can be rolled out in a very short period, especially when utilising the huge range of plug and play accessories available on the ***Universal Robots+ (or UR+)***[1] showroom.

At Universal Robots, we want to create an ecosystem whereby automation is made accessible for all. Beside content in this white paper, first-time adopters can learn a lot of the required skills for implementing a UR cobot from Universal Robots Academy. Also known as ***UR Academy***[2] , it is an e-learning programme offering a free, interactive online training course aimed specifically at newcomers to robotic automation. To complement this, UR channel partners around the world are also capable of delivering standard UR face-to-face technical training programmes to guide existing technical staff so they can implement robot applications on their own. Affording existing staff the opportunity to operate and even program a collaborative robot system makes for a much more rewarding experience and a more attractive workplace environment for new staff.

By putting automation in the hands of operators, we allow small companies with low volume production to join larger companies in automating their processes without the need for high initial investment and extensive automation experience.

[1] https://www.universal-robots.com/plus/
[2] https://www.universal-robots.com/academy/

Glossary

Workpiace – The object of interest that the robot will manipulate, generally a product or component.

I/O Interface – Inputs and Outputs used by the robot to communicate with its surroundings. Sensors are connected to inputs to detect signals representing things such as a product arriving, or a machine being ready for the next operation. Outputs typically are used to actuate devices such as valves or to tell another machine that an operation is complete.

Polyscope – Universal Robots' touchscreen graphical user interface used to program the robots.

Universal Robots+ (or UR+) – UR+ is a showroom of UR compatible accessories allowing applications to be built with increased speed/ simplicity and reduced cost.

End-effector – The tool mounted on the end of the robot that allows it to interact with the workpiece, this could be anything from a simple gripper to a screwdriver or glue dispenser.

Pneumatic Gripper – A simple gripper powered by compressed air, this is inexpensive but not necessarily good at handling a range of different sized/shaped parts.

Vacuum Tool (or Cup) – Objects with a flat surface on the top can be easily picked up with a vacuum tool (or vacuum cup), but not suitable when the product needs to be rotated from the pick position and placed upside down. A compressed air supply is needed for this method, but many industrial environments have this readily available so it is not necessarily a concern.

Adaptive Gripper – An adaptive gripper, while more expensive than a vacuum cup or pneumatic gripper solution, gives the flexibility of picking assorted sizes of objects and the ability to limit the force of the grasp. This is a convenient choice as often the end-effector will not need to be replaced when redeploying the robot to another application similar task.

TCP – Tool Centre Point. The part of the end-effector that comes into contact with the workpiece, and therefore the point that we are most interested in controlling the position of.

Waypoint – A position in the robot's workspace that it will move the tool to.

Blend Radius – Sometimes the robot does not need to go to the exact position of a waypoint and stop. If the waypoint is just a rough guide as to the path the robot should take, it can get within a certain distance of that point and then start to curve toward the following point, allowing for reduced cycle time and smoother movements.

Vision System – Situations where the workpieces to be picked are presented to the robot in a non-standard position or orientation may require a vision system to tell the robot the precise pick parameters. Vision systems are becoming increasingly affordable and easy to install and add flexibility, but also complexity to a solution. With that in mind, a mechanical guide to force the workpiece into a fixed location where feasible is a valid and usually more cost-effective alternative to using vision.

Photoelectric Sensor – In order for the robot to know when a product is present and ready to be picked, additional sensing is sometimes required. Inexpensive photoelectric or photo-sensors (light-based) can be installed to detect a product arriving on a conveyor or when a tray of products is placed down into a known location, without significantly impacting the overall cost of the project.

External Jig – In applications where the robot is required to place the workpiece into a precise location an external jig may be used, which could either be active or passive. In a passive jig, the workpiece will automatically centre itsewlf when placed due to the mechanical properties of the jig, whereas an active jig can close around the work piece securing it in a fixed location.

Learn More

Please contact ur.sea@universal-robots.com or visit www.universal-robots.com to take the first steps in your collaborative automation journey.