ACCELERATING DEPLOYMENT OF
MULTI-ROBOT WORKCELLS

There is a great opportunity to have multiple robots work together in many application domains, including manufacturing and logistics. The potential performance advantage of being able to use multiple robots is similar to the benefits of being able to use multiple people to complete a task.

realtime robotics

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DEPLOYMENT PROCESS

While many of us have seen multi-robot workcells, we do *not* see the vast amount of time required to deploy them and the performance opportunities that they miss. Once the number of robots has been chosen, there are several challenging problems that must be solved, and they all involve choreographing the work. This work can be divided up into tasks (e.g., pick up object X or weld at location Y), and each task requires a robot to reach a target pose and spend some amount of time there performing an action. Engineers must solve the following interrelated challenges to achieve the best possible performance, often referred to as cycle time, without collisions:

Allocating

Every robot has a different set of capabilities (reach, function, tool-tip, etc.). Engineers determine which robot will accomplish which set of tasks, while understanding the limitations and complexities of each choice.

Sequencing

This is the order and priority of each robot allocated to complete the given tasks.

Robot Programming

Once tasks have been allocated and sequenced, a program is written to instruct each robot where, when and which way to go.

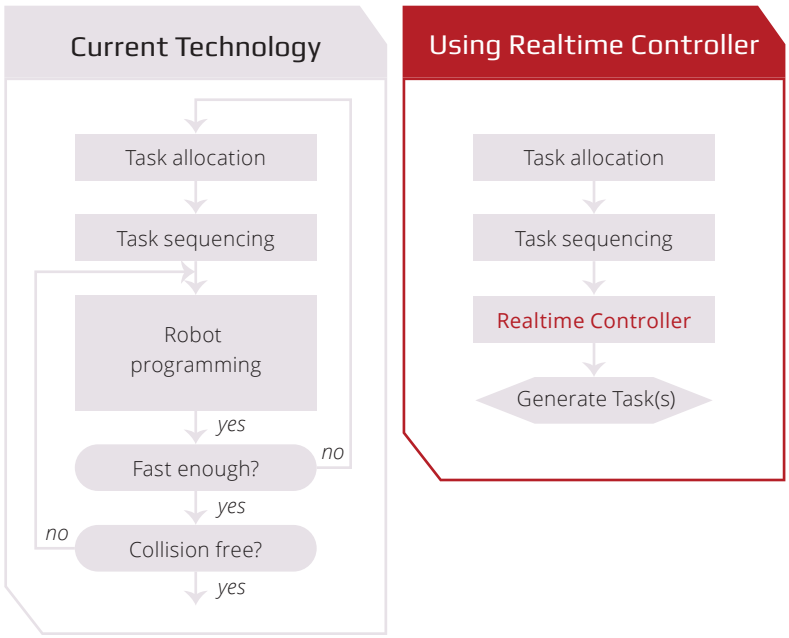
Avoiding Collisions

Programmers need to guarantee that robots avoid collisions while performing various tasks. Detecting and rerouting a robot to avoid collisions during a task has been computationally difficult and slow. Due to the complexity, programmers use conservative practices, such as pauses, interlocks and interference zones as a way to avoid collisions. Rather than using these tedious and performance hindering solutions, developers now have the option of using Realtime Robotics' technology.

REAL PROGRESS

The bottleneck for deploying multi-robot cells—and the reason it takes many engineer-weeks of effort—is writing robot programs that provide collision-free motion plans. Due to the complexity of where multiple robots will be at any time, it is very difficult to produce collision-free plans. If there is a collision during testing (or worse during runtime), then an engineer modifies the robot program by either adding interlocks, pauses or changing the waypoints between targets. This time-consuming process continues until the robots pass all tests to be deployed.

The current technology process (shown below) of modifying the software with iterative changes can degrade performance beyond what is acceptable, forcing the entire process to begin again from allocation and sequencing. It can require many weeks to produce even a viable collision-free solution; improving performance beyond the minimum viable has been prohibitively slow, and results have still been far from optimal.



The Realtime Controller was developed to eliminate the main bottleneck in multi-robot workcells. Realtime's technology includes a proprietary processor, which is tailor-made for producing collision-free motion plans. This processor removes manual iterative programming as shown in the flowchart. Realtime Robotics provides a toolkit that allows users to intuitively work with the Realtime Controller to autonomously provide collision-free plans.

REAL APPLICATION

75%+ reduction in programming time/costs:

A global automotive manufacturer had a 4-robot workcell in which the robots needed to reach 22 targets and spend a half-second at each target to perform the desired task. Their skilled automation engineer spent 13 weeks developing and iterating to achieve the desired 25-second cycle time. Realtime's technology took less than 3 weeks to achieve a more desirable result. The most time-consuming task during Realtime's process was to create a model of the robot and workspace to build a configuration file, which is a standard requirement. The Realtime Controller could get the workcell online and in production 10 weeks earlier and save 10 weeks of engineering effort.

REAL SOLUTION

Realtime Robotics has developed a proprietary way to empower and streamline multi-robot workcells to be far more productive. The Realtime Controller and toolkit produce multi-robot deployments that are far faster than those that can be created manually. When adding a second robot to a workcell, Realtime can provide throughput increases of 70% or better, which is far greater than manually developed solutions. The Realtime Controller and toolkit automate the optimization of task allocation, sequencing, and collision avoidance—and completely remove the need to program interlocks and interference zones. Additionally, this automation saves weeks or even months of engineering effort to complete all aspects of deploying a robot workcell.

REAL BENEFITS

+ **Increased throughput** with interlock-free multi-robot workcells
+ **Faster, easier robot programming** with accelerated offline motion planning
+ **Flexible workcells** with collision-free planning in real-time
+ **Safely deploy industrial robots** in shared workspaces for collaborative solutions

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