CASE STUDY

CAPSEN ROBOTICS

SUBMITTED BY

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Advanced 3D vision and motion planning software
for industrial robot automation

EXECUTIVE SUMMARY

Project Titled: Autonomous Robot Workspace Modeling with an Arm-Mounted 3D Camera

The project addressed three of the underlying causes for slow adoption among Small and Medium Manufacturers (SMMs) by lowering the cost (and time) of robot integration and by making it easier for users to deploy robots in high-mix, low-volume applications and to move the robot around to new work-cell locations in a factory.

KPP	Metric	Objective	Final
Hardware Cost	Total cost of 3D camera and on-arm mount fabrication	< $1,000	$500
Unskilled Integration Time	Time it takes an unskilled worker to perform the mapping task	< 30 mins.	10 mins.
Model Resolution	Smallest feature size able to be modeled by the mapping system	<2 cm	0.5 cm
Model Completeness	Percentage of the operation-relevant surfaces in the robot's workspace that are captured automatically by the mapping process, with no manual post-processing of the model	> 95%	99%
Collision Avoidance	Number of collisions during the autonomous exploration	0	0

CHALLENGES

Small and medium-sized manufacturers (SMMs) comprise a significant percentage of the DoD supply chain. Yet, they often lag behind in the adoption of new technologies such as advanced robotics. This leads to productivity gaps between small and large companies and reduced global competitiveness, which are major strategic risks for the DoD supply chain as well as the U.S. manufacturing sector at large.

There are many reasons for the slow adoption of advanced robotics in SMMs. Among them are:

1. High cost of robot integration

2. Scarcity of high-volume tasks presenting good ROI justification for automation

3. Difficulty repurposing advanced robots for new tasks

3D environment model of a robot work-cell for a bin picking / machine tending task.
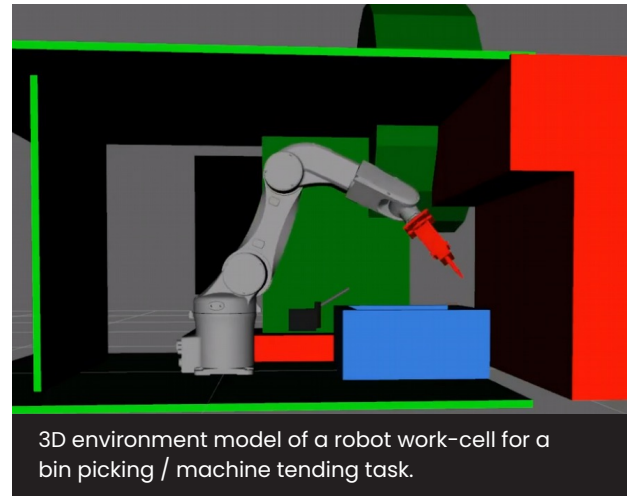
The goal of "Autonomous Robot Workspace Modeling with an Arm-Mounted 3D Camera" was to address all three of these underlying causes for slow adoption among SMMs by lowering the cost (and time) of robot integration by making it easier for users to deploy robots in high-mix, low-volume applications and to move the robot around to new work-cell locations in a factory.

HOW AIM HIGHER CONSORTIUM ASSISTED

Through the ARM Institute Fellows Program, Dr. Jared Glover, CEO of CapSen Robotics was awarded a Fellowship to work on this project. The Fellowship provided the sole funding for Dr. Glover to expand the core intellectual property of the company's CapSen PiC product.

Over a 12-month period, Dr. Glover worked to develop a software package and integrate it into low-cost, OTC components – in this case inexpensive 3D cameras to mount on to small desktop-sized collaborative robots. Existing CapSen clients were surveyed regarding their perceived value and challenges of various robotic factors. Cost to implement and ROI were two of the highest priorities of those considering implementing or at the early phases of their robotic application journeys.

RESULTS, RETURN ON INVESTMENT AND FUTURE PLANS

The project produced a system that can be mounted on smaller robotics arms used for pick-and-place operations and used with software that allows the robot arm to "self-map" it's environment. The project was successful in that it is now a feature to CapSen's existing products. The ability for the robot to move itself through space and map it's environment rather than rely upon a human operator to map-out and test for obstacles and features every time a robot is repositioned is a significant benefit in implementation costs and time.

This lowers the user barrier to robotic adoption for users, allows for "mobile" (eg: on carts) robotic systems to easily reposition, and saves operation time. This feature will continue to be developed and fine-tuned as a feature of part of CapSen's core product line.