charles river analytics

# Sensing & Perception

## How well does your platform adapt to the world?

Robotic platforms that cannot autonomously adapt to dynamic surroundings are of limited use when carrying out complex missions—they can jeopardize mission success and endanger your personnel.

Charles River Analytics sensing and perception components use data from a platform's own sensor suite to enhance scene understanding through the use of advanced AI and machine-learning algorithms, including computer vision and natural language processing.


Adding our components to your platform enables true mission-level autonomy, enhancing your robots so they can accurately perceive threats as they are encountered in the operating environment and correctly assess alternative courses of action to sustain mission viability.

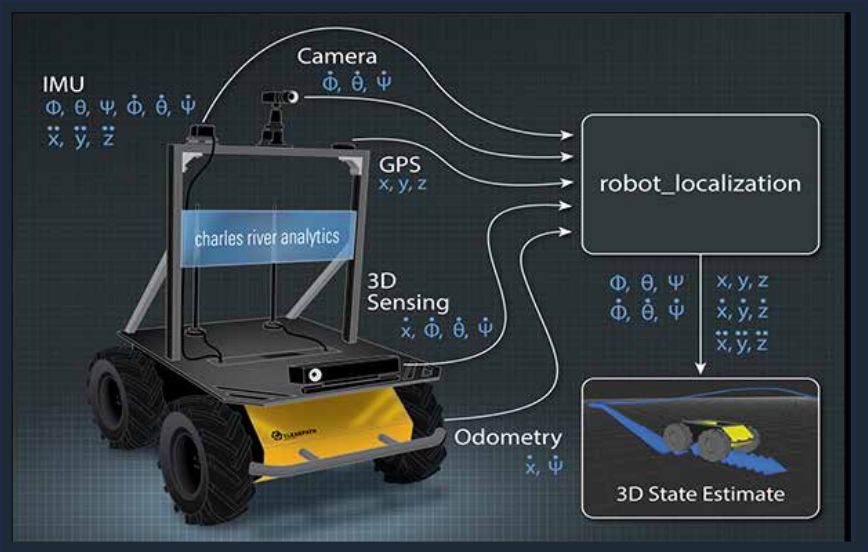
Charles River Analytics transitions robotic perception technology out of the lab and into the field to provide mature and tailored solutions for your needs.

*Are you looking to add perception technology to your AI components? See how we've advanced these capabilities for our customers.*

## Helping Robots Determine Their Position

A key problem for an autonomous mobile robot is determining its position in its environment.

Robotics experts at Charles River Analytics developed the open source robot_localization software package to estimate the 3D position and orientation of autonomous mobile robots using the wide array of sensors onboard each robot. By fusing the data from each of these sensors, the software package enables the robot to determine its location with a high degree of accuracy.




*robot_localization fuses position and orientation information from an unlimited number of sensors to produce an accurate position estimate.*

The Robot Operating System (ROS) is a popular open source robotics framework that has a multitude of high-quality software packages that allow for rapid development of robotic systems. Unfortunately, it lacks a general-purpose solution for fusing data from an unlimited number of sensors.

The robot_localization software package fuses data from multiple sources, such as wheel encoders, inertial measurement units (IMUs), cameras, and global positioning system receivers (GPS). This information is used by higher-level autonomy software packages, such as those that carry out route planning, control, mapping, and other specialized functions.

We developed the software from the ground up to be as widely applicable as possible. In addition to supporting an unlimited number of sensor inputs, robot_localization also offers multiple sensor fusion algorithms. The optimal algorithm can be selected based on context or your specific requirements.

By designing robot_localization to support a multitude of sensors, we ensured it can be immediately integrated with a wide array of mobile robotic platforms in diverse operational domains. Roboticists from around the globe have successfully integrated it into unmanned underwater vehicles (UUVs), unmanned ground vehicles (UGVs), and unmanned aerial vehicles (UAVs).

## Developing Leap-Ahead Capabilities in Mission-Level Autonomy

The US Army, through efforts like the Combat Vehicle Robotics (CoVeR) program, is addressing current robotics challenges by developing technologies that support scalable integration of multi-domain robotic and autonomous systems.

Our contributions in Manned-Unmanned Teaming (MUM-T) enable leap-ahead capabilities in mission-level autonomy for single, tele-operated platforms as well as multi-platform, collaborative robotic teams that self-organize around high-level objectives and commands. We envision a human-machine interface where Commanders can issue instructions to an unmanned robotic system with the same natural communication as they use with human personnel.


Under the CoVeR program, Charles River Analytics is developing a Modular Appliqué Enabling Natural Teaming with Autonomy (MANTA).

MANTA is a platform-independent, natural control and autonomy robot appliqué that enables a user to easily direct one or more host platforms to perform a range of autonomous behaviors.

Robotic and autonomous systems (RAS) equipped with the hardware/software appliqué will be able to execute any behavior supported by platform capabilities, as well as share and access information with any other vehicle equipped with the appliqué. Equipped platforms can be controlled using simple speech and gesture inputs, such as "monitor the back of the red building for activity," "give me a close-up view of that green car," or "search Zone 2 for potential hostiles."

MANTA enables a broad range of MUM-T capabilities on equipped platforms. With MANTA, armed forces can evaluate the feasibility, military utility, and enhanced military personnel mission effectiveness afforded by novel MUM-T technologies, and identify paths forward to requirements generation, technology improvement, and adoption into tactics, training, and procedures (TTP).

This effort was sponsored by the U.S. Government under Other Transaction number W15QKN-17-9-1025 with the National Advanced Mobility Consortium. The U.S. Government is authorized to reproduce and distribute reprints for Governmental purposes notwithstanding any copyright notation herein. The views and conclusions contained herein are those of the authors and should not be interpreted as necessarily representing the official policies or endorsements, either expressed or implied, of the U.S. Government.

## About Charles River Analytics

Charles River Analytics has been at the forefront of human-centered AI R&D, implementation, and deployment for decades. We transform our customer's data into mission-relevant tools and solutions to support autonomy and human decision-making. Charles River continues to grow its technology, customer base, and strategic alliances through programs for the NIH, DoD, DHS, NASA, and the Intelligence Community. We address a broad spectrum of mission areas and functional domains, including sensor and image processing, situation assessment and decision aiding, human systems integration, cyber security, human-robot interaction, and robot localization and autonomy. We take on the most challenging problems in the most difficult environments, and deliver insights that lead to action.

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