Case Study

Development tools selected for multi-robot collaboration

Distrix was selected by Integrated Consultants Inc. to provide a software platform for multi-robot collaboration in a dynamic environment.

Integrated Consultants, Inc. (ICI) specializes in unique technical process engineering services for Government and Industry. ICI designs, builds, and integrates evolutionary prototype devices and systems for complex applications.

ICI's largest customer, the US Navy, operates many unmanned vehicles, sourced from many different manufacturers. Each type of vehicle performs different missions and uses different sensors, effectors and control software to achieve their goals. The US Navy needs these vehicles to collaborate on more sophisticated missions. The US Navy also needs to deal with the logistics problems of having appropriately configured vehicles on hand to support those missions. These requirements led the US Navy to look for tools that enable effective collaboration between unmanned vehicles with a variety of sensory capabilities in a dynamic environment. ICI was selected to build a system that would demonstrate how these requirements could be fulfilled by leveraging COTS software and hardware where possible.

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>
> Dave Aberizk, P.E.
> President
> Integrated Consultants, Inc.

ICI needed a reliable software platform to deal with information exchange across programming languages, operating systems, hardware components, and communication protocols. ICI's engineers needed to focus on the information content to be exchanged, not the implementation details of how information is exchanged. ICI also needed to be able to repurpose hardware and software resources dynamically to show how vehicles could be reconfigured in the field.

ICI chose Distrix from Spark Integration Technologies Inc. to resolve these issues. Distrix isolates and manages the environmental issues that complicate interoperability. As a platform for loosely-coupled systems, Distrix enables components to be added or replaced during operation or prototype configurations to be developed without directly impacting adjacent systems in a plug and play manner.

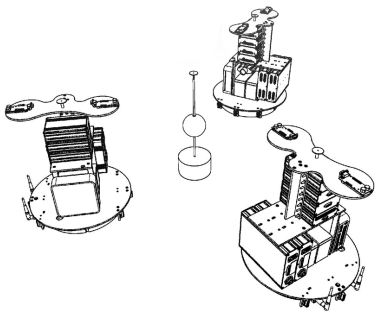
Dave Aberizk, ICI's President said, "One of the most complex technical challenges was dealing with integrating a variety of sensors and platforms into a dynamically configurable system. Distrix provided my team with the tools to deliver that capability very quickly so we could focus on the US Navy's needs."

ICI worked with Spark to demonstrate the concept of fused sensor de-coupling - the ability to combine sensor information from multiple heterogeneous unmanned vehicles without each needing a full complement of sensors in order to complete a task – to the US Navy. The dynamically configurable system used three robots with different sensory capabilities: two searcher robots used IR sensors for detecting the target and a

single target acquisition robot used a video sensor. All robots had IR rangers for collision avoidance and used Cricket sensors and odometry for positioning.

The project goals addressed three key areas: integration simplicity - to provide time savings versus other methods, project predictability, programming language and operating system independence; post-integration flexibility - to easily add new robots or change the device configuration per robot without requiring a restart; and collaboration - for the two searcher robots to generally locate a target using IR sensors and the third to accurately locate the target using a video sensor.

A complex aspect of any unmanned vehicle collaboration scenario is in determining the accurate location of each of the vehicles. By using Distrix to provide the information exchange infrastructure ICI could focus on the development of a particle filter algorithm using odometry and sensor data.



Distrix's distributed architecture allowed concurrent development of different aspects of the project that reduced the project timeline significantly. A shared Information Model, described in Distrix System Builder, ensured consistent interfaces between components.

The Information Model, Agents and Information Objects were developed using Distrix System Builder and debugged in simulation substantially reducing the amount of field testing required. Distrix hardware and operating system abstractions allowed the same code to be used in the simulated and physical hardware environments.

Spark provided ICI with the solution to quickly implement a distributed information exchange architecture that supports the complex requirements of unmanned vehicle collaboration. Distrix enabled ICI's system designers and engineers to focus on the core design issues and the needs of the US Navy by handling the complex details of robot-to-hardware and robot-to-robot communication.

Dave Aberizk said, "Distrix provides us with a clear competitive advantage in dealing with these issues for us."

About Spark Integration Technologies

Spark Integration Technologies provides award-winning system software, development tools and technologies for developers and integrators of electronic systems.

Combined with straightforward development and system management tools Distrix, Spark's secure, platform-independent information exchange software, substantially simplifies the development, integration and deployment of complex, dynamic electronic systems.

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