



**KTH Numerical Analysis
and Computer Science**

A Component Framework for Autonomous Mobile Robots

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Abstract

The major problem of robotics research today is the barrier to entry into robotics research. Robot system software is complex and a researcher that wishes to concentrate on one particular problem often needs to learn about details and dependencies of the complete system. This is because a robot system needs several different subsystems that need to communicate and execute in parallel.

Today there is not much controlled comparisons of algorithms and solutions for a given task, which is the standard scientific method of other sciences. There is also very little sharing between groups and projects, requiring code to be written from scratch over and over again.

Component-based Software Engineering (CBSE) is an approach that could solve many of the aforementioned problems. It enforces modularity which helps to manage complexity. Components can be developed in isolation, since algorithms are encapsulated in components where only the interfaces need to be known by other users. A complete system can be created by assembling components from different sources. Comparisons and sharing can greatly benefit from CBSE.

An examination of successful systems and architectures of past and present, yields a number of key characteristics. Some of these are ease of use, modularity, portability and efficiency. By not enforcing a specific architecture, generality is improved. This implies a framework where modules are seen as common peers and not divided into clients and servers or forced into a set layering. Using a standardized middleware, efficient communication can be carried out between different platforms and languages.

A component-based framework called ORCA has been developed with the following properties. All communication is carried out by either of three communication patterns, *query*, *send* and *push*. Communication is done using CORBA, although most of the CORBA code is hidden for the developer and can in the future be replaced by other mechanisms. The framework also includes a component model and a hardware abstraction scheme. This framework has been verified by the implementation of a number of working systems.