

A Knowledge-Based Middleware and Visualization Framework for the Virtual Soldier Program

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A Presentation will be made describing the Oak Ridge National Laboratory proposal to the Defense Advanced Research Projects Agency (DARPA) in response to BAA 03-02, addendum 4 - The Virtual Soldier. For the Virtual Soldier Program, the Oak Ridge National Laboratory proposes to develop a middleware framework for integrating multi-level, structured, and heterogeneous information based on the anatomy of heart, lungs, great vessels, aorta, and chest of the Virtual Soldier and present a portable, lightweight graphical interface capturing critical medical information with easy-to-use features for use by medical personnel. The proposed framework is meant as a component of the “Holographic Medical Electronic Representation” or holomer concept and will integrate datasets produced by other teams involved in the project. Our effort will focus on developing the middleware framework and display mechanisms for the infrastructure supporting this vision.

We will also design mechanisms for mapping user and application queries to relevant ontologies and models that may be provided by other areas of the Virtual Soldier solicitation. Since the structured knowledge described in ontologies is extensible, concepts can be added and modified as medicine advances. Simulation models also produce dynamic data. The data middleware framework is based on an architecture that will accommodate dynamic data and changes over time. This middleware will complement the ontology infrastructure described under the Global Architecture (part 1) of the solicitation, not replace it. Our approach is to provide mechanisms for integrating information at the storage, retrieval, display, and query level. Our system will also gather datasets produced by simulation in a Heart Database with access and retrieval mechanisms.

Our proposal contributes to several efforts toward the goal of a demonstration in the DARPA Virtual Soldier Program by initiating the development of:

- 1) A middleware component that integrates data and information from various sources, gathers information from the other models, mediates between areas of expert knowledge contained in ontologies for the holomer, and allows integration with other components of the Virtual Soldier Program.
- 2) A visual interface that will provide a high-fidelity resemblance to the real soldier data where all the organ systems look exactly like the actual organs. It will be linked to the global ontology architecture via the proposed middleware, and provide query, and alert and query interrogation modes, and display results provided in other parts of the Virtual Soldier Program.

The proposed framework supports the vision of the holomer by connecting the Holomer Display and Interface (part 5) and the Holomer Storage, Retrieval and Interoperability (part 6) of the DARPA proposal call. Our team brings extensive experience in design and implementation of middleware and visualization frameworks for complex scientific applications.