In the production of real-time simulation code, math model development and testing of logic and control network systems can be very time consuming. GSE Systems has developed JControl as an enhanced graphical control logic software tool for modeling plant control systems. Included in JControl is an extensive set of objects for Boolean (e.g., “And” and “Or” gates), analog (e.g., “Add”, “Multiply”, “Select”), and control (e.g., “PID”) functions.

The JControl software package is designed to minimize engineering effort and enhance productivity, while producing high quality real-time simulation software with consistent documentation. As a part of GSE’s JADE environment, JControl shares our single graphical user interface and offers the portability of a truly platform independent software tool.

GSE Systems has developed an extensive object library of code segments and subroutines modeling the control algorithms typically used by the various control system vendors. More complicated components such as vendor specific “Function Blocks” are modeled through the use of generic code segments or subroutines, but these too may be easily developed as exact user-defined icons where desired. For ease of use, JControl will produce standard FORTRAN code.

**Benefits**

JControl supports useful and rigorous engineering development and evaluation of simulated plant control network systems by:

- Producing high quality real-time simulation software
- Minimizing simulation engineering effort
- Providing the flexibility to create a user library for new icons and templates
- Enhancing model developer productivity
- Using JADE’s single GUI allows system drawings to be viewed on any instructor, trainee, or engineer’s JStation
- Allowing portability across Microsoft, Linux, and UNIX operating systems

**Functionality**

JControl brings a fundamental change to the traditional simulation methodology for control network systems. JControl has two modes of operation: Edit and Test mode. In Edit mode, JControl provides all the editing tools necessary to create and maintain the logic and control network configuration.

- The Edit Mode includes:
  - Standard Windows® toolbar icons (File, Edit, View, etc.)
  - Menu bar drop down list like those found in Windows type programs
  - Icon shortcut menus which are accessed directly from the drawing window
  - JControl toolbar icons for predefined logical Boolean, analog, mathematical, plant component, and controller functions
  - JControl groups of icons for user-defined modules and subroutines
The Test Mode allows the user to:

- Monitor and debug the created logic network configuration
- Dynamically update all display fields with their calculated values
- Update all icon objects with appropriate colors to automatically indicate their current status
- Manipulate external variable values
- Monitor the status of the logic icon
- Modify parameter values and observe design value changes

The JControl modeling tool provides the capability of grouping various components together. Individual control circuits can be grouped together to represent a complete system or subsystem from a software perspective. This allows the user to copy and paste and control the number of discrete software modules generated to represent the plant control system.

**Implementation**

JControl is an auto code generator which is integrated with a drag and drop graphical user interface. All the modeling code, database definitions, constant values, and initial conditions are created by the tool on the graphic design screen.

Icon libraries are provided to allow the creation of logic network configuration diagrams. These icons are the typical building blocks of control systems. Specific plant data can then be entered via the pop-up windows associated with the icons. Pre-defined icons can be combined with user-created icons for maximum flexibility in simulation modeling.

It is now possible for the user to quickly produce simulation code with minimum errors even for very complex control systems. The useful life of the training program and simulator model will be extended due to the auto code generation and documentation features that allow for easier modification and maintenance.

**Summary**

Within the JADE environment, high-fidelity simulation of plant control network systems is achieved through the use of JControl. The application of JControl to nuclear BOP and fossil power plant control systems guarantees consistent engineering and the highest quality models.