

# Development of Remote Inspection Systems with the Java Applet

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## 1. Introduction

The world wide web and java are powerful networking technologies on the internet.

An applet is a program written in the java programming language that can be included in an HTML page, much in the same way as an image is included. When we use a Java technology-enabled browser to view a page that contains an applet, the applet code is transferred to a client's system and executed by the browser's Java Virtual Machine (JVM).<sup>[1]</sup>

We have developed two remote inspection systems for a reactor wall inspection and guide tube spilt pin inspection based on the java and traditional programming language. The java is used on a GUI(graphic user interface) and the traditional visual C++ programming language is used to control the inspection equipments.

## 2. System Concept

We adapted the client/server model for the remote inspection systems. The server systems connected to the internet consist of a web server, an inspection equipments control server and database server. A client could access the server systems with the client's web browser.

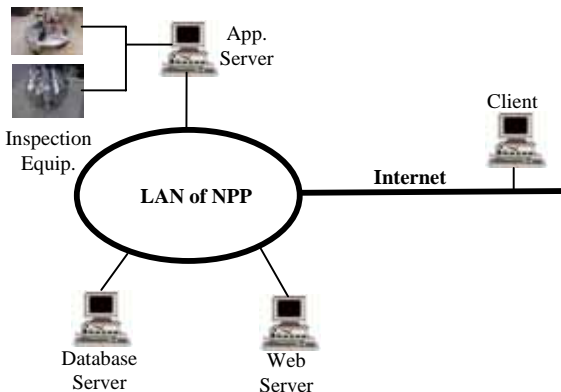


Figure 1. System Concept

The application server shown in figure1 is an inspection equipments control server that controls a mobile robot, a data acquisition and an analysis system, and so on.

The most critical problem for a remote inspection system is the interface. The Java is used to develop client's interface and communicate with the control server and a client's web browser. The java program is

maintained on a web server and all the clients can use the same java code regardless of their computer operating system.

An inspection must be achieved in a timing-restriction environment. Since java is an interpreting language it is not compatible for a machine control field and a timing-restriction environment, therefore we have used visual C++ for the control server. But the java itself is a network language and the java applet is executed on the client's computer, the data transfer capability of it is similar to a traditional programming language.

## 3. Development

### 3.1 System Architecture

The system architecture of the two remote inspection systems we have developed is shown in the figure 2.

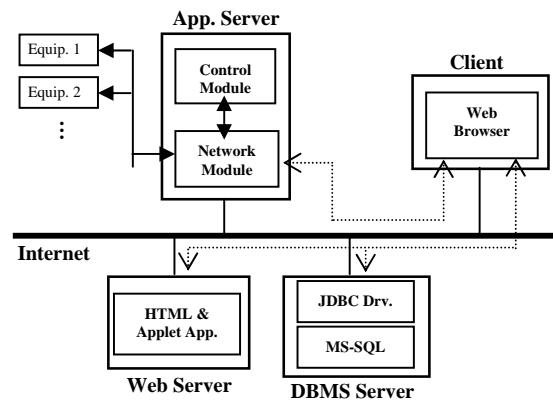


Figure 2. System Architecture

The application server consists of a control module and a network module. The network module communicates with a remote client's web browser interface that is downloaded from the web server and with the inspection equipments simultaneously. The commands transferred from a client's web browser are passed to the control module. The control module interprets the commands and passes a set of inspection commands to the network module.

The web server has an apache engine and the applet applications for the remote inspection system and the remote DBMS. The DBMS server has a MS-SQL DBMS engine and provides a JDBC driver for the java based remote DBMS connection..

We use the apache 1.3.19 for a web server, JDK 1.3.0 for the java programming and the MS-SQL server 2000 and the WebLogic's JDBC driver for the DBMS. All the systems are constructed on IBM PC.

### 3.2 RWIS(A Reactor Wall Inspection System)

RWIS consists of an UT inspection robot, LPS(a Laser Position Indicator), a DAS(a data Acquisition and Analysis System), a main control server, several web cameras, a web camera server, and a web server.

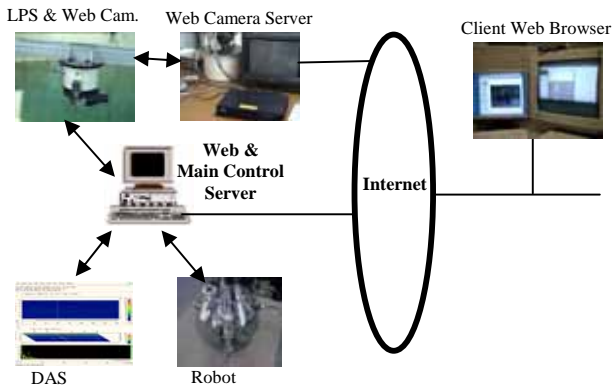


Figure 3. RWIS Structure

RWIS is derived from RISYS.<sup>[2]</sup> RISYS doesn't provide any remote inspection facility. We changed RISYS to a remote inspection system. We adopted the java applet and TCP/IP network technologies to the inspection robot, the LPS and the main control server.

### 3.3 GIS(Guide tube split pin Inspection System)

GIS consists of a split pin inspection robot, an image processing server, a robot control server, a main control server, several web cameras, a web camera server, and a web server.



Figure 4. GTS-PIS Interface

The image processing server finds the center of a guide tube and the pin holes across the guide tube. The robot control server makes the robot move to the inspection

area and sets the precise robot position to inspect the pins. The position information is reported to the image processing server and passed to the robot server. The inspection robot reports the pin images and UT inspection data. Remote clients could control the robot and inspection procedures with real camera images on their web browsers.

### 3.4 Remote DBMS Application

The remote DBMS access is an important factor in a remote inspection system. It makes it possible to share the NPP related inspection data through the internet. On-line inspection data sharing could cause a reduction in the NPP safety accidents. We have developed some applet interfaces to access a remote database.

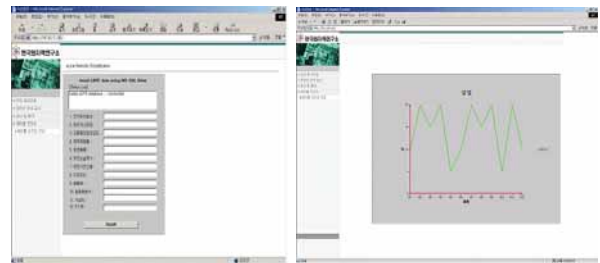


Figure 3. Remote Database Access Interface

## 4. Conclusion

We have developed two remote inspection systems and remote DBMS access interfaces with the java applet and a traditional programming language.

The java based graphic user interfaces are maintained in the web server and the applet code is transferred to a client's system and executed by the browser's JVM.

The control program written in a traditional language controls the inspection equipments and the java applet communicates with it.

The interface problem of a remote inspection system and a remote DBMS access system could be solved with the java applet. This technique will be applied to the NSSS inspection systems.

## REFERENCES

- [1] J. M. Lee, about Advanced JAVA Programming, Youngjin.com, 2001.
- [2] J. H. Kim, J. C. Lee, Y. R. Choi, Development of a remote inspection system for NSSS components, KAERI/TR-2711/2004, 2004.