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## Interfacing the Gryphon Robot with the World Wide Web

Robert T. F. Ah King, Saravanen Mootien, Harry C. S. Rughooputh  
*University of Mauritius*  
*Mauritius*

### 1. Introduction

The field of robotics encloses mechanics, electronics, computer intelligent control and network communication technology. It has application in industry, exploration, public service and medicine. Through supervisory control modes, robotic system can be controlled from remote places and thus preventing the user from direct contact with hazardous and inaccessible environment. Moreover, with the development of computer network and the Internet, connectivity can be achieved to remote devices virtually anywhere in the world. Besides, distance education is becoming a widely used common way of teaching different disciplines (Khan, 1997). Along this line, in addition to introducing the field of robotics through the World Wide Web, this medium can be used as a link to program and control the Gryphon robot remotely. The motivation behind the development of this system was to develop a low cost implementation (You, 2001) to enable students to learn robotics, program and run the robot remotely with existing facilities at the Faculty of Engineering of the University of Mauritius. The proposed system (Mootien, 2003) is based on the client/server model, with a suitable front-end for viewing and interactive sessions with web users and a back-end relational database for storing and retrieving relevant information at the server side. A Web-based interface is also developed to enable online training of students on the programming and control of the robot. This chapter presents a detailed description of the work that has been carried out from the design to the implementation and application (use) of the system. The hardware and software technologies that have been used for implementing the system are Microsoft Internet Explorer, Microsoft Internet Information Services (IIS), VBScript, JavaScript and Hyper Text Markup Language (HTML), Microsoft Active Server Pages (ASP), Microsoft Access, Virtual Network Computing (VNC), Microsoft NetMeeting, WALLI3 for Windows and Creative Web Cam.

### 2. Gryphon Ec Precision Robot

The Gryphon Ec Robot, depicted in Fig. 1, forms part of a family of robots designated by the Walli group of robots, which are the products of the Italtec Company, Italy. Gryphon is a conventional robot emulating the movement of the human arm and hand and having axes for rotation about the shoulder, elbow and wrist in the forward plane. The wrist has two effective axes, for rotation and elevation. There are five axes in all and a gripper. Either a two fingered or a vacuum gripper may be fitted and these may be readily interchanged. The

one actually available is the vacuum gripper. The gripper requires an air supply with a pressure of about 5 to 8 bar. The gripper entry is either 0 or 1, indicating open or closed for the Pneumatic actuated gripper. A control box is supplied together with the robot. Any other compatible devices may be connected to form a workcell via the control box. The articulated arm is under the control of 4 microprocessors and, if properly programmed, will accurately work with components in a workcell. Each axis is powered by a stepper motor with optical encoder feedback to provide closed-loop control. In the controller there is one microprocessor to monitor the positions of the axes, two more to control the motors and another one to supervise the first three and to communicate with the host computer. Programming may be accomplished in a variety of ways. Data for each axis may be directly entered on-screen. Alternatively, the Gryphon EC Robot may be moved by the teach pendant or by hand (lead-by-the-nose).

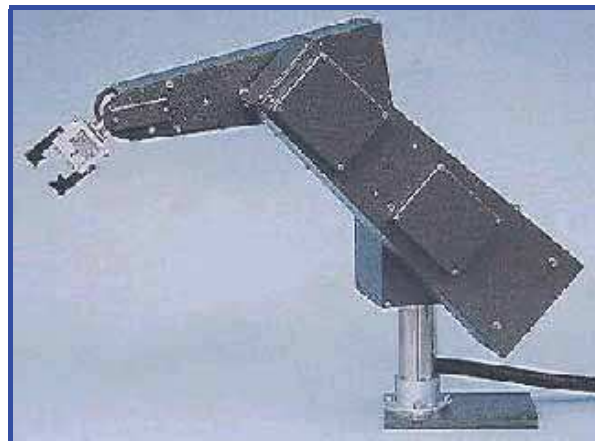


Fig. 1. Gryphon Ec Robot.

### 2.1 Modes of Robot Programming

The following techniques can be used to program and control the robot to complete an assigned task:

Keyboard	~ Direct entry of axis data from keyboard (using WALLI3 Software).
Lead By Nose Pendant	~ Axis data taken from Robot power off. ~ Axis data taken by moving the robot under Push button control.
Simulator	~ Axis data taken from simulator positions.

Keyboard Control is described in the next section as this mode is used for interfacing the robot with the World Wide Web. Lead-By-Nose describes the means of programming a robot by physically moving its end effector, referred to as the nose, through the trajectories which the robot will be required to reproduce automatically. To be totally effective, it is necessary for the forces, that are required to move the robot manually, to be very light. Pendant Control is an alternative physical mode of robot programming comparable to Simulator Control, but on one axis at a time. It is provided for Gryphon since it has digital

positional feedback through encoders. The robot may be moved using push buttons on the Teach Pendant, without the host computer supporting the WALLI3 software being connected. Continuous programming is not possible by this means and it is only a suitable alternative for point-to-point Simulator control. The Gryphon Robot has an additional accessory, called a simulator, which mechanically mimics the robot in a miniature and simplified form. The movement of each of the simulator axis is monitored through potentiometer sensor devices, so that manual movement of the simulator may be reflected through the control system, to move the robot. When a robot is being moved in this remote manner, it is often referred to be in Teledictor control mode.

## 2.2 Keyboard Control: Using WALLI3

**WALLI3** (Workcell Amalgamated Logical Linguistic Instructions, version 3), shown in Fig. 2, is an updated and extended version of WALLI software written for the Windows environment. As the expanded name suggests, the application is concerned with coordinating the activity within an automated or robotic workcell. It is capable of supporting stand-alone robotic devices or a combination of devices and components within a workcell built to demonstrate the organization of automated production. **WALLI3** or **Wali for Windows** is the software (Italtec, 1997) that has been written to provide the overall supervisory control for the WALLI range of robots, CNC machines and peripheral or sub-devices, and to integrate them into an automated workcell. The contents of the workcell is entirely flexible and may include any combination and number of the devices that the user wishes to specify and may be changed at will to accommodate different teaching requirements. Because it is written for the Windows environment or Operating System, the software must be installed into a computer with an INTEL 386 processor as the minimum requirement. The software will run simply as an installed software package, simulating all the machine's actions. But to control any of the robotic hardware, an interface card must be installed into the PC. The interface card is connected into the internal ISA bus of the computer and the card may be driven up to eight hardware devices. Furthermore, a second interface card may co-exist if the required installation becomes extensive.



Fig. 2. WALLI3 Software's Screen..

### 2.3 Working with the Gryphon Robot

Equipped as it is with a gripper as an end effector, the Gryphon is essentially a “pick and place” robot, for picking things up and placing them somewhere else. This is exactly its employment within the workcell, taking model component from the end of a conveyor and placing them into bins, onto another conveyor or Index table. Any use of the robot should be likely some variation of this basic function. The opening and closure is an on/off function, it is not progressive, and jaws travel their full extent. The opening width may be adjusted, but they will always close fully unless they grip on an object. In the Gryphon Robot, the same stepper motors and gearboxes are used on axes 0 (Waist), 1 (Shoulder), 2 (Elbow) and smaller motors and gear boxes for axes 3 (Rotation) and 4 (Elevation). Axes 0, 1 and 2 move at approximately the same rate over large excursions, depending on the speed set, while the combined effect of axes 3 and 4 are more rapid.

### 2.4 Working Environment

For the Gryphon Robot the theoretical outer limit may be readily demonstrated by measuring the full extent of the arm and gripper, in both a horizontal and vertical position, at its limits of travel and from measurement of the shoulder axis height above the workcell surface. Fig. 3 shows the robot outer limit of reach. Referring to the figure, Gryphon has a net offset to the right of the shoulder axis from the plane of the robot arm, and a forward offset. Therefore the Sphere of Influence has a flat pole.

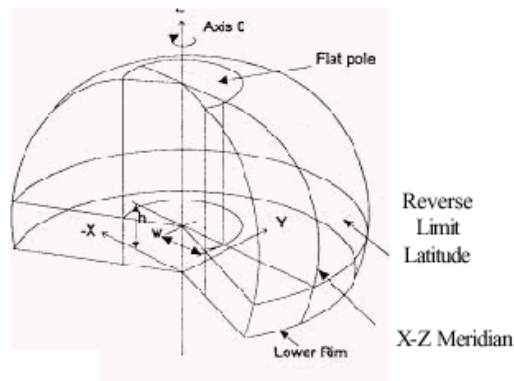


Fig. 3. Sphere of Influence of Gryphon Ec Robot.

## 3. Gryphon Digital Control System

Gryphon has a digital control system using commercially available incremental encoders to feed back position information for each axis. The control circuit uses a master processor and three slave processors and the axes are driven by stepper motors. Two slave processors are used for the five axes motors on Gryphon, one for the waist and wrist control, the other for the shoulder and elbow axes. A third slave processor is dedicated to servicing all five encoders. The Gryphon stepper motors are driven through a matched combination of integrated circuits, the bridge driver and stepper motor controller- one pair for each motor. Instead of pulse modulation, the bridge driver accepts a pulse and direction signal from an up down counter in the motor controller driven by one of the slave processors. The basic scheme is repeated for all axes and the overall schematic is summarized in Fig. 4.

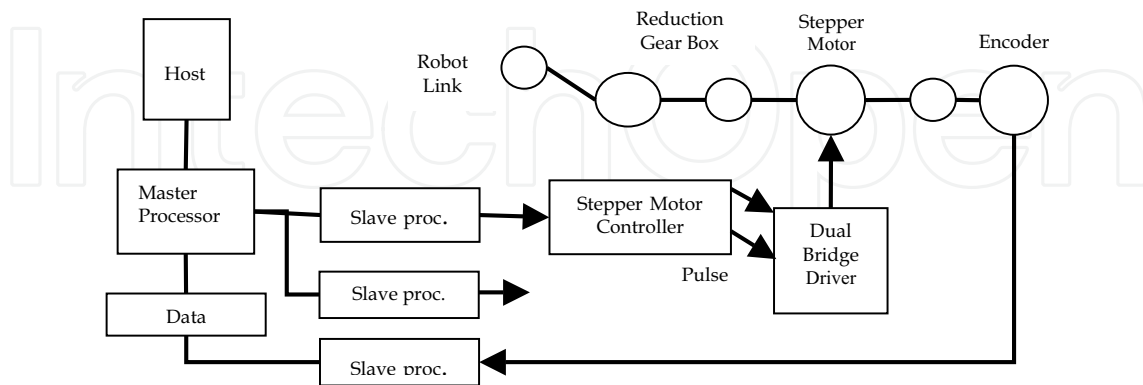


Fig. 4. Gryphon Axis Control System.

The Gryphon Robot is powered by variable reluctance stepper motors coupled through worm and wheel gearboxes to each of the five axes. The stepper motor resolution and gearbox ratios allow a high degree of mechanical resolution in moving the axes, while the use of geared optical encoders for position feedback, giving resolution of up to 16000 steps per revolution, allows the control system to take full advantage of the drive resolution to ensure precision in positioning the robot axes.

### 3.1 Digital Control Boards

The majority of WALLI devices have digital control systems built from a set of common, notably a master and a slave processor printed circuit board, an eight channel 12 bit ADC to the slave format, and a stepper motor driver. Both the master or CNC processor and the slave processor use the INTEL 80C32 micro-controller, with external RAM and ROM provided for the master that also uses the enhanced 16MHz version of the micro-controller. The CNC processor is in communication with the host processor via a serial link formed from four twisted pairs, to an RJ45 Interface Board in the host computer. This board is the preferred means of communication between the host PC and the control box and is used for all digital control systems. Gryphon uses three slave processors, one to service the encoders used for position feedback on all five axes, the two other to control the stepper motor drives to axes 1 and 2, and to axes 0, 3 and 4, respectively. It also uses individual control boards for each of the stepper motors with load current regulation control to ensure good speed-torque characteristics. For Gryphon, this amounts to a total of five 2A stepper drivers.

### 3.2 12-Bit ADC

The 12-bit ADC circuit board provides the means of connecting the simulator programming devices into the CNC processor used in the Gryphon Robot control box. Together with the Simulator, other hand-manipulated devices have potentiometers mounted at each of the joints, which are representative of the robot axes, and there is a consequent need to transfer the analog signals to digital form. The board is built to the same physical format as the slave processor so that it may be stacked with them in the control cabinet and connected into the 34 way parallel interface between the master CNC processor and the slave processors.



### 3.3 Stepper Driver

The 2A stepper driver board provides an individual circuit to drive the stepper motors for the axes of the robot and the connection is taken from the slave processors output ports. The stepper motor controller provides all the necessary signals to drive the stepper motor in the correct sequence to advance the motor shaft in the required direction by a step.

### 3.4 RJ45 Serial Interface Board

The RJ45 interface is now the preferred means of communication between the compatible host computer and the WALLI robots family. But for the Gryphon Ec Robot it is the only means of communication. The RJ45 interface uses serial transmission over four signal lines, arranged as four twisted pairs to minimize cross-talk and is mapped into the I/O space of the PC. The RJ45 interface is a proprietary design for serial transmission and uses a pre-formed cable with a standard RJ45 plug at each end. The transmission is synchronous with the clock signal carried on one twisted pair and with 8 bits serial information, designated address, control and data, carried on the other three. A clock rate of 2 MHz allows the 8 bit address, control and data information to be transmitted at a rate of 250 Kbytes per second on each of the three lines concurrently, giving an overall maximum transfer rate of 750 Kbytes per second. The clock signal from the PC interface is carried directly to the address, control and data registers in the device interface, there is no requirement for additional protocol and the device address and functionality is derived from the information received.

## 4. System Objectives and Software Development

This section describes the main objectives for setting up the system and the framework considered in developing the software for interfacing the Gryphon robot with the World Wide Web.

### 4.1 System Objectives

The main objectives of the project (Mootien, 2003) are as follows:

- To design a web site to act as an introduction to Robotics.
- To enable the web site to behave as a platform to the control of Gryphon Robot virtually anywhere on the Internet/Intranet.
- To introduce Gryphon Ec Robot, its compatible WALLI3 software and other related technologies in the Web Site.
- To enable any user to send his/her comments about the Web Site.
- To permit restricted number of users to be in command of the robot.
- To obtain a video feedback of the robot and its environment.

### 4.2 Software Process Model

A software process can be defined as a framework for the tasks that are required to build a software system. In order to develop the actual project, solve the related problems and reach the set objectives, a development strategy was adopted. The linear sequential model for software engineering was selected. As the name suggest, the project was started through chronological approach to the software development, that started at the system level and progressed through analysis, design, coding and finally testing.

The following activities were enclosed within the linear sequential model shown in Fig. 5:

- System/Information Engineering:
  - The requirements for the project were established.
  - Information research and background study for different aspects and subsets of the system/project were dealt with accordingly.
  - Interface with other elements such as hardware, people and databases were considered.
  - Initial designs were proposed.
- Analysis:
  - Research was more specifically focused on software and technologies to be used.
  - The software constraints and performance were established and evaluated.
  - Choice of software and other requirements were specified.
  - A reliable proposed solution was maintained.
- Design:
  - The steps towards the implementation were explained explicitly.
  - The configuration of the web site and subsequent pages were set.
  - Flowcharts and state diagrams were used to initialize the coding part.
- Code Generation:
  - The design was coded with selected programming languages.
  - The code generated was mingled with the appropriate information for particular web pages.
  - Interfacing between different programming languages and tools were dealt with accordingly.
- Testing:
  - All functions were tested and proper corrections were made.
  - Interactions between hardware, software and human operator were considered and necessary changes were brought to the system.

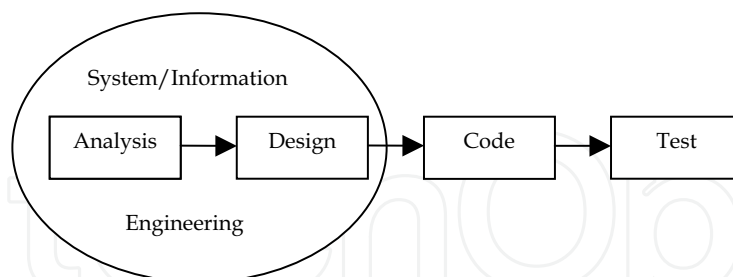


Fig. 5. The Linear Sequential Process Model.

## 5. Proposed System

Since the RJ45 Interface Board is a proprietary design for the Gryphon Ec Robot and the WALLI technology, the proposed system should inevitably incorporate the Virtual Network Computing (VNC) technology. VNC is, in essence, a remote display system which allows one to view a computing 'desktop' environment not only on the machine where it is running, but from



anywhere on the Internet and from a wide variety of machine architectures. In addition to this tool, the proposed system must have a video feedback for the robot and its environment. For this to be implemented, the Netmeeting technology developed by Microsoft should be used. Netmeeting delivers an open, extensible platform for real-time communications, offering audio and video. Besides the use of these technologies, it is required to build a web site that would act as the link between these tools and the Gryphon system. Moreover, it is mandatory for the web site to have an introduction to the field of robotics and associated topics. Fig. 6 describes the overall proposed solution.

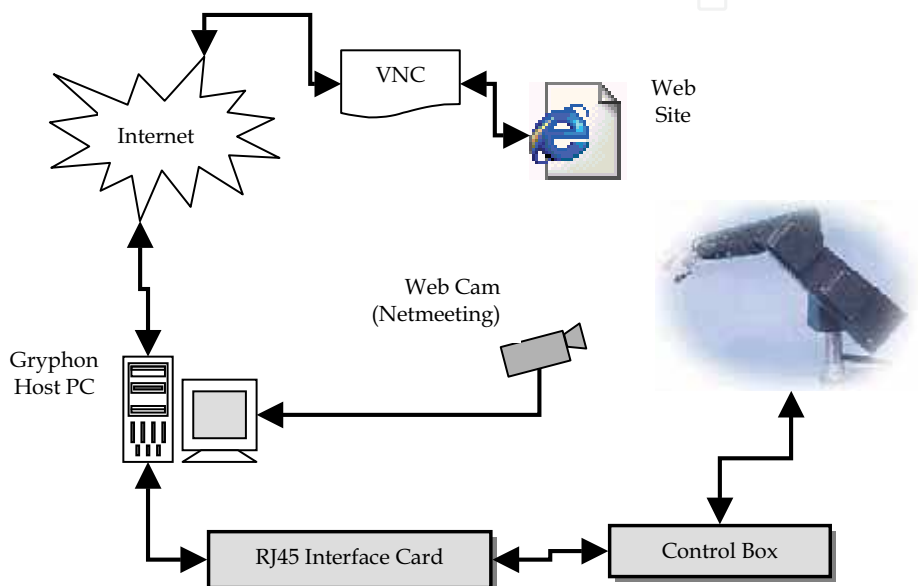


Fig. 6. Proposed System.

The proposed system is developed using the following:

- Microsoft Internet Explorer 5.0 as Front-end browser.
- IIS 4.0 as web server.
- VBScript for server-side scripting and client-side validation.
- JavaScript and HTML for client-side programming.
- Microsoft Active Server Pages (ASP) 3.0 as programming technology.
- Microsoft Access as Back-end for data storage.
- VNC as the connection to the robot
- Microsoft NetMeeting as the software for video transmission

### 5.1 Microsoft Internet Explorer 5.0 as Front-End Browser

Internet technology such as HTML, DHTML and ASP are used for developing the web site and this system has its own particularities, which makes it a must for considering alternative browsers capabilities. Popular browsers for viewing hypertext documents are Microsoft Internet Explorer and Netscape Communicator. Microsoft Internet Explorer is a powerful browser, which runs on all Windows Operating Systems family. It supports multimedia, graphics images and ActiveX components also, and suits the requirements of

ASP. Netscape runs on Windows based platforms, and supports multimedia and graphics images. However, Netscape lacks certain requirements of ASP, as Netscape Communicator does not recognize all syntax of VBScript but instead recognizes JavaScript. The solution is to opt for Internet Explorer 5.0 Browser because it supports efficiently ASP technology and VBScript. Moreover, since the browser is widely used and actually the most common browser on the Internet, the logical solution is Internet Explorer.

### **5.2 Microsoft Internet Information Services (IIS) 4.0 as Web Server**

The pivoting role of processing HTTP requests and sending out static Web pages to the client browser in response is the Web Server. Apart from this, the Web Server can also execute applications that significantly enhance the content of a Web site. Issues governing the choice of a Web server are speed at which the server executes Web-applications; security; whether it supports virtual directories; restricting access with IP addresses. Microsoft Internet Information Services or IIS is a secure server with its security system linked to Windows NT. Together, IIS and Windows NT provide a number of security layers through which a user must pass before gaining access to a site. In brief, it has the depth and breadth of security features required by the most exigent Web site. Personal Web Server (PWS) is a server designed for use with Microsoft Windows 95/98. Whilst PWS supports many but not all the features of IIS, it is more tailored for developing applications off line rather than for functioning as a robust, flexible and secure Web Server. PWS allows for virtual directories and execution can be done for a limited number of clients. Moreover, it lacks hold of security. PWS cannot and has not been intended to compete with IIS. Therefore, the obvious choice for a robust, flexible, secure Web Server is IIS.

### **5.3 VBScript for Server-Side Scripting and Client-Side Validation**

VBScript is a scripting language that allows functions to be written be embedded in HTML documents. With VBScript, creation of rich, dynamic, interactive Web content is possible. VBScript has a rich feature set that provides a very good environment for developing client and server applications. Many tasks that once required processing on the server can be done on the client. This reduces both the number of requests to the server and the workload placed on the server. However, because VBScript is interpreted, the host environment must have the correct software to execute the code. In the case of client-side script, the Web browser must be aware of VBScript. Microsoft Internet Explorer has this ability built-in, but many other browsers require a plug-in to interpret VBScript.

### **5.4 JavaScript and HTML for Client-Side Programming**

JavaScript is an object-based language developed by Netscape. Syntactically, it is very similar to Java but is not a subset of it. JavaScript is well suited for quick development and easy maintenance of relatively small programs. JavaScript is a scripting language that allows programs to be written that resides inside HTML documents. It is an interpreted language, so the host environment or Web browser, must have a JavaScript engine to execute the code. Both Microsoft's Internet Explorer and Netscape's Navigator support JavaScript.

### 5.5 Microsoft Active Server Pages (ASP) 3.0 as Programming Technology

Up to now, with the help of Client-side programming, pages are published with some degree of interactivity due to client-side scripting. However, some applications may need to access databases to execute queries. ASP can be described as a server-side scripting environment that can be used to create and run dynamic, interactive, high-performance Web Server applications (Jones, 2000). ASP files combine HTML, scripts, and ASP code to enable a much higher degree of interactivity than is possible with plain HTML. ASP can be used to include executable scripts directly into HTML files. Microsoft Active Server Pages is a server-side scripting environment that allows programmers to create and run dynamic high-performance Web server applications. ASP scripts run on the server, instead of the client, and the Web server sends the output as an HTML page to the client-browsers. There is no need to worry whether the browser is compatible with the scripting language. The browser only view the end-result of the server-side processed HTML page. ASP encourages browser independence. Other benefits of ASP applications are as follows:

- Completely integrated with HTML files.
- Easy to create, with no manual compiling or linking of programs required.
- ASP enables programmers to use any scripting language provided ASP support the language or script. ASP supplies scripting engines for Microsoft Visual Basic Scripting Edition (VBScript) and Jscript. For this project, VBScript is the language used.
- Flexible and secure: With ASP, developers can choose whether to run their scripts at the client or server to meet their specific needs. Furthermore, since scripts and server components are executed at the server, they remain hidden to the user.

### 5.6 Microsoft Access as Back-End for Data Storage

The performance of the system highly relies upon the back-end to be included in the system. The primary goal of SQL Server is to allow data to exist in multiple formats and be accessed using many different methods. With SQL Server, Microsoft wanted to provide not only a more powerful relational database management system, but also a mechanism for gathering contrasting information stores and for presenting data in a consistent and useful manner. It is as well used when databases are involved in replication. The SQL Server replication technology copies data, moves these copies to different locations, and synchronizes the data so that all copies have the same data values. Access can make a good back-end package, compared to other desktop database packages. Access has one huge advantage in that it is most likely that users are running Windows as operating system and using Microsoft Office as their application base. Access integrates well with these packages and data transfer between Access and the other office components is relatively easy. In addition to this, Access is very easy to use, almost for anyone of any level. Active Server Pages supports Microsoft Access as a valid data source. A great benefit is certainly that Access offers portability, meaning that it can be moved from server systems to another without altering its functionality and configuration. Microsoft Access is the appropriate solution because all the characteristics that are required for the system are observed in it. Moreover, Access is used since the proposed design does not require large and complex database utilities.

### 5.7 VNC as the Connection to the Robot

The Virtual Network Computing (VNC) technology (Richardson et al., 1998; AT&T, 1999) developed for ATM Network Computers by AT&T is a remote display system which allows one to view a computing



## 6.2 Web Pages

The Homepage introduces the project and provides an overview of the content of the entire site. All the other web pages are redirected to the Homepage. The Homepage is illustrated in Fig. 8 and the image has been embedded using the HTML codes.

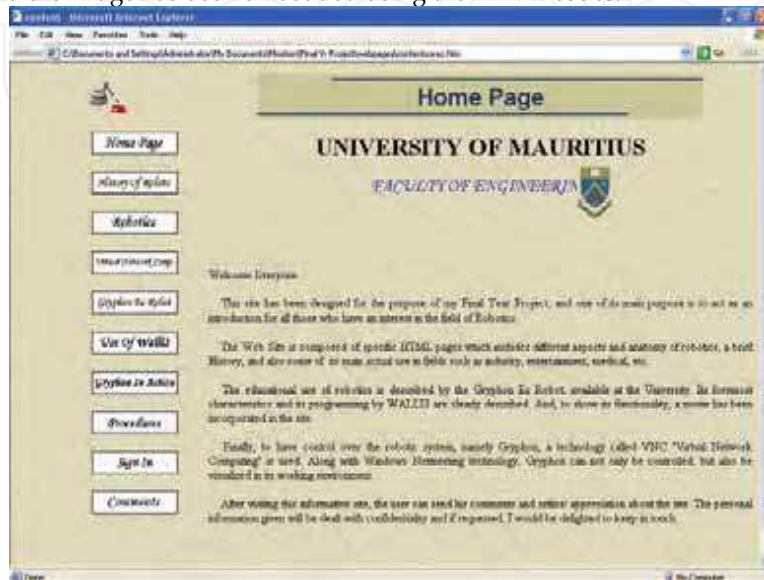


Fig. 8. Homepage

The web page on the History of Robots shown in Fig. 9 illustrates the existence of robots and milestones in the robotic industry.



Fig. 9. History of Robots Screen Shot.



Applications and uses of robots in different sectors: Material Handling (Fig. 10), Automobile Industry, Agriculture, Medical, Space Exploration, Emergency Response, Robotic Toys are emphasized.



Fig. 10. Notes on Robotics/Material Handling Screen Shot.

The web page on Virtual Network Computing depicted in Fig. 11 includes its origin, use and other features in relation to the project. This web page provides a link to the official VNC web site and additionally a proper downloadable format of this technology is freely supplied.

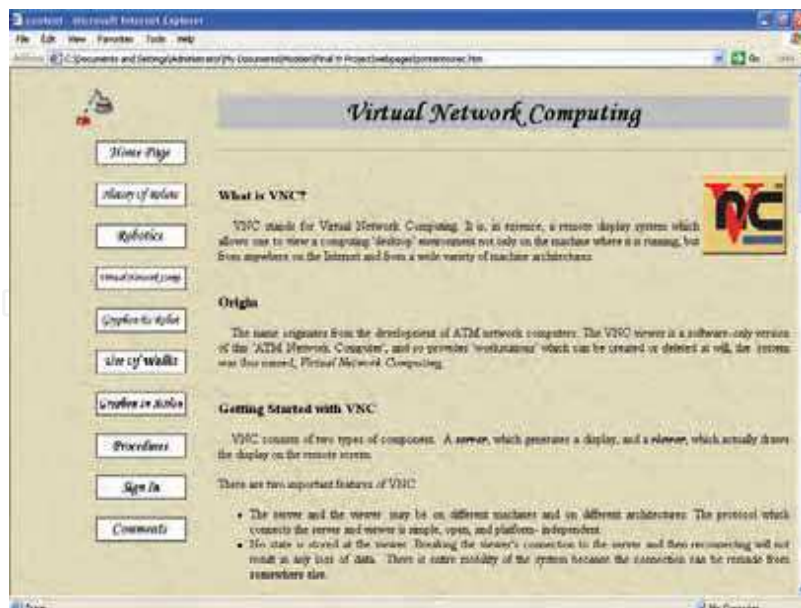


Fig. 11. Virtual Network Computing.



The web page shown in Fig. 12 dedicated to the Gryphon robot describes its specification, modes of programming and digital control system.



Fig. 12. About Gryphon.

Since the mode of programming the robot adopted is keyboard control, WALL3 software is described in the web page shown in Fig. 13 where the main keys to successful programming are also presented.

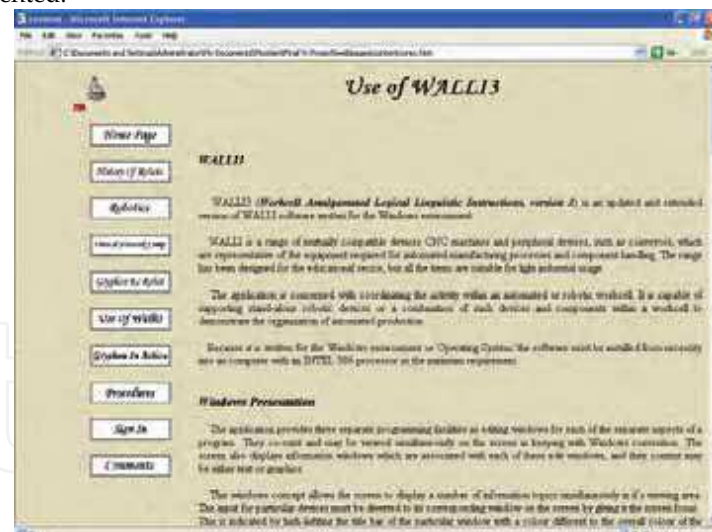


Fig. 13. Use of WALL3.

Now that the robot and its supporting control system have been explained to the user, there is a need to demonstrate the capabilities of the robot. A simple robot program has been implemented and this program is explained to the user on the web page presented in Fig. 14. The user is instructed to follow the steps to program and run the robot by calling WALL3

through the remote interface. Details regarding the connection procedures are described in the next paragraph. The performance of the robot is demonstrated using an embedded video clip in the web page and this clip is downloadable. The user can compare the robot action with the clip to check if he has correctly programmed the robot. Moreover, a more elaborate program is also available and this involves the robot in picking and placing objects on a conveyor.



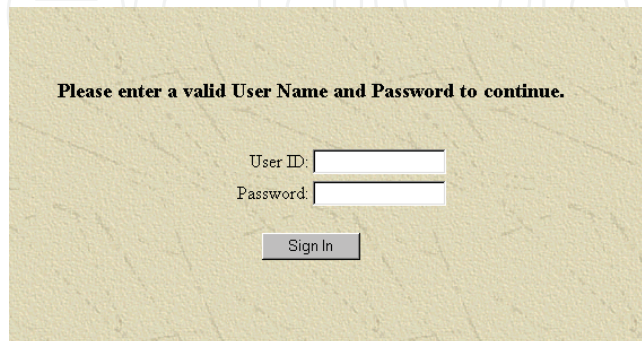
Fig. 14. Gryphon In Action.

The requirements for proper connection to the Gryphon Host PC are described and integration of VNC and Windows NetMeeting are appropriately highlighted as shown in Fig. 15. Also, Windows NetMeeting 3.0 Setup is provided as download.



Fig. 15. Procedures For Connection.

Authentication is an important process for this project. The control part of the web site is not freely available to any visitor. For this sensitive part, ASP technology is extensively used and right of entry is only possible after user name and password be validated. After acceptance of user ID and password (Fig. 16), a web page is available to provide necessary information, e.g. IP address, to establish connection to the remote Gryphon host PC (Fig. 17).

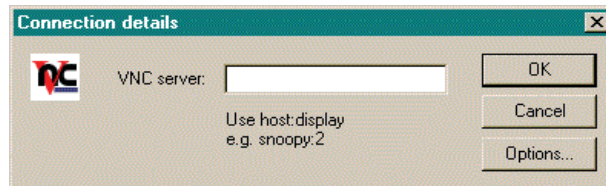


**Please enter a valid User Name and Password to continue.**


User ID:

Password:

Fig. 16. Login Page.



**Connection details** [X]

 VNC server:

Use host:display  
e.g. snoopy:2

Fig. 17. VNCviewer.

To make the web site interactive with the user and developer, the final stage of the web site includes a Contact and Comment Form represented in Fig. 18. The form supplies sufficient fields so as to facilitate any user to enter his/her personal details, contact points and any comments/suggestions. After correct entry of the required data, the system validates the said entries at the client side. Upon submission of the form to the database, a reply is offered to the user to confirm receipt of the form in the database.



**If you have any queries concerning the content of this site, please fill in the form below.**

**All of your comments and suggestions will be the most welcome.**

Name:

Other Names:

Email:

Phone:

Address:

City:

Country:

Enter your comments in the space provided below:

Fig. 18. Comments Form.

## 7. Using the Web-Based Interface System

For the time being, the web site is only accessible on the University network and hence can only be viewed by any user who logs in the University intranet. The client's browser will generate the Homepage and then the user may travel along the site as any other one. The various pages mentioned before will always be available and the user may select the existing links and the program generates the request for each task. Whenever a user selects the Sign In page, the user is prompted to enter a valid user ID and a password. The server then processes the query of the user and if the ID and the password are missing in the database, logging is unsuccessful and the user is redirected to the initial login page. Now, if the ID and password are valid, another web page is displayed. In this page, the user is given the instruction on how to connect to the server where the Gryphon Robot is connected. An IP address, together with the associated password for the VNC is then given to the visitor. To use the VNC technology the user requires a VNCviewer, offered as download, and after running the application, it requires the given IP address and password for proper connection to the server. In addition to this tool, the new web page gives a direct connection for the video transmission. By simply clicking the link, video images of the robot environment will be readily available. After connection, the user may then view and control the movements of the Gryphon Robot remotely as shown in Fig. 19.



Fig. 19. Remote Access.

### 7.1 Sample Program for Remote Control

A sample program with axis data entered remotely using WALLI3 are given in Fig. 20 and Table 1 respectively. This program demonstrates how the Gryphon robot can be operated using keyboard control mode. The program and table describe the Robot program which coordinates various devices and a sub-device. The overall system consists of a conveyor belt (Conveyor 1), an index table (Index table 1), a digital sensor (Sensor 1) and finally the Gryphon robot itself. The various axes are positioned in an orderly manner whereby the robot can smoothly perform a scenario.



```

MAIN PROGRAM - EXECUTING ONLINE
1 START CONVEYOR 1
2 IF DIGITAL SENSOR 1 IS ON THEN GOTO 3
3 HALT CONVEYOR 1
4 WAIT 5 SECONDS
5 MOVE GRYPHON THROUGH POSITION Pickup 1
6 INCREMENT INDEX TABLE 1 THROUGH 90 DEG
7 MOVE GRYPHON THROUGH POSITION Pickup 2
OK

```

Fig. 20. Sample Program.

	<i>Axis 0</i>	<i>Axis 1</i>	<i>Axis 2</i>	<i>Axis 3</i>	<i>Axis 4</i>	<i>Axis 5</i>			
<b>Line</b>	<b>Waist</b>	<b>Shldr</b>	<b>Elbow</b>	<b>Wrist</b>	<b>Wrist</b>	<b>Grip</b>	<b>(Elev)</b>	<b>(Rot)</b>	<b>Spd</b>
<u>Start</u>	4500	4950	790	790	790	1	790	800	3
<u>Pickup 1</u>	6500	240	5100	1410	370	0	890	1320	3
	6500	240	5100	1410	370	1	890	1320	3
	6500	1665	3950	1375	345	1	860	1315	3
	5000	3120	1900	1460	430	1	945	1315	3
	5000	850	3550	1550	500	1	1025	1325	3
	5000	850	3550	1550	500	0	1025	1325	3
	5000	2375	3500	1375	325	0	850	1325	3
	5000	3280	2015	1125	75	0	600	1325	3
<u>Pickup 2</u>	4400	1790	2480	1180	140	0	660	1320	3
	4400	1790	2480	1180	140	1	660	1320	3
	4400	2800	2500	1180	140	1	660	1320	3
	3200	2800	2500	1180	140	1	660	1320	3
	3200	1600	1450	1320	280	1	800	1320	3
	3200	1600	1450	1320	280	0	800	1320	1
<u>End</u>	3200	5500	0	1320	280	0	800	1320	1

Table 1. Keyboard Control Data.

The starting position (Start) of the robot may be defined by the user. The coordinates used may be as per the user's discretion and should eventually be the starting position of the robot. As soon as the program is run, the Main Program is executed. The first line of code clearly directs the conveyor to move. Then, as soon as an object hits the digital sensor, the conveyor automatically stops since the sensor should read ON. The main program is then redirected to the third line of codes, which is stopping the conveyor. The program continues running and the system now receives the order to wait for 5 seconds. All the mnemonics for the main program are built in the WALLI3 software. The user has just to feed in appropriate data in order to execute a program. After 5 seconds delay, the main program directs the system to the subroutine which includes the coordinates and movement of the Gryphon robot. The first movement or task that the Gryphon robot should perform is picking the object from the conveyor belt. The subroutine PICKUP 1 describes this task. The robot's arm moves towards the chosen object and grips it. Then, the arm moves away and put down the object on the index table. As soon as the PICKUP 1 subroutine is completed, the system is

forwarded to the main program. The next instruction from the software is moving the index table through 90 degrees. This table can continuously rotate and digital sensors may be used as for the conveyor belt. However, in this context, the index table has been ordered to move through only 90 degrees. As soon as the index table has completed its task, the program is again redirected to the Gryphon subroutine PICKUP 2. Its function is to pick up the object on the index table and place it in a safe position as required by the user. Speeds varying between 1-3 may be used to move the robot, and 3 is the fastest. The robot has been programmed to dispose of the object slowly in a safe position. As the task of the subroutine is completed, the program executes the final line of codes and hence the robot moves to a safe position as determined by the user.

The remote user has the flexibility of changing the robot parameters and experiment with the program again to view how the robot can be effectively controlled and in the process learn the basics of robot programming. To end the session, the remote user simply closes the VNC and signs out. The user will be then directed to the login page, after which it can be linked to the rest of the site. At the closing stage of the site, a Comments Form has been included in order to enable further interaction with any user. The form is available upon request and the user has to fill all the available fields. On clicking the Submit button, all the fields are validated on the client side itself. If there are any missing or incorrect formats of information, the user will be prompted accordingly. If now, all the fields are correctly filled, connection is opened to the database and the data is stored. To confirm acceptance of the records by the database, a feedback is supplied to the user. All the records are stored on the same server as the mechanical device.

## 8. Conclusions

An introductory web site on robotics, with remote control of the Gryphon robot via the World Wide Web, has been successfully designed and implemented. This chapter has described the development of the web-based interface using the tools and technologies currently available. The web site gives concise and up-to-date facts about robots and genuine industries which employs them and it acts as a teaching tool for all those who have a particular interest in robotics. Moreover, by including the control of a mechanical device in the system, a remote user can easily make the link between the theoretical approach and real life systems. The user can change the robot parameters remotely and experiment with them to learn its control. However, at this instance, the remote control of the robot is restricted to a single user, but priorities may be set for either a local or a remote control. Part of the system is suitable for Engineering courses such as Robotics Technology, which is being newly added in the Mechatronics course at the University of Mauritius. Further works and programs may be developed for other courses in the future, where the World Wide Web can help students enhance their knowledge about other disciplines.

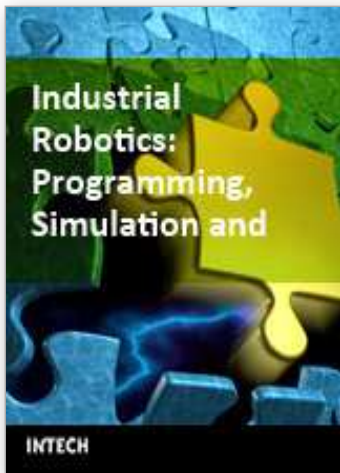
## 9. References

- AT&T (1999). <http://www.uk.research.att.com/vnc/index.html>
- Italtec (1997). *WALLI for Windows*. Italtec Company, Italy, revised 10/03/1997.
- Jones, A. R. (2000). *Mastering Active Server Pages 3*. BPB Publications, Delhi.
- Khan, B. H. (1997). *Web-Based Instruction*. Educational Technology Publications, Englewood Cliffs.



- Microsoft (2000). <http://www.microsoft.com/windows/netmeeting/default.asp>
- Mootien, S. (2003). *A Web-based Interface for the Gryphon Ec Robot*. Final Year Project, B. Eng. (Hons.) Mechatronics, University of Mauritius, Mauritius.
- Richardson, T.; Stafford-Fraser, Q.; Wood K. R. & Hopper A. (1998). Virtual network computing. *IEEE Internet Computing*, Vol. 2, No. 1, pp. 33-38.
- You, S. (2001). A low-cost internet-based telerobotic system for access to remote laboratories. *Artificial Intelligence in Engineering*, Vol. 15, No. 3, pp. 265-279.

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This book covers a wide range of topics relating to advanced industrial robotics, sensors and automation technologies. Although being highly technical and complex in nature, the papers presented in this book represent some of the latest cutting edge technologies and advancements in industrial robotics technology. This book covers topics such as networking, properties of manipulators, forward and inverse robot arm kinematics, motion path-planning, machine vision and many other practical topics too numerous to list here. The authors and editor of this book wish to inspire people, especially young ones, to get involved with robotic and mechatronic engineering technology and to develop new and exciting practical applications, perhaps using the ideas and concepts presented herein.

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University Campus STeP Ri  
Slavka Krautzeka 83/A  
51000 Rijeka, Croatia  
Phone: +385 (51) 770 447  
Fax: +385 (51) 686 166  
[www.intechopen.com](http://www.intechopen.com)

### **InTech China**

Unit 405, Office Block, Hotel Equatorial Shanghai  
No.65, Yan An Road (West), Shanghai, 200040, China  
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元  
Phone: +86-21-62489820  
Fax: +86-21-62489821

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