Video
Hypermedia Applied to Manufacturing Environments

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INTRODUCTION

Many of today's hypermedia systems are designed for single user application domains, such as presentation aides or training applications, but hypermedia technology shows even greater potential to address limitations in today's corporate computing environment. Hypermedia technology allows logical association of information contained within corporate legacy systems while minimally disrupting the application and information environments.

Today's factory information environment is illustrated in Figure 1. Factory personnel must know what information is required, where to find that information, and its access procedure. Information sources are paper-based and electronic, and are often physically dispersed throughout a factory.
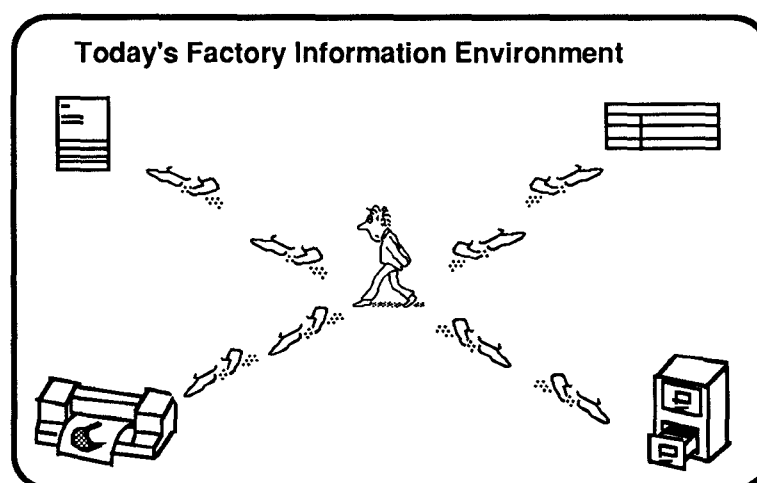

Figure 1

There are currently efforts underway in industry to bring information to the factory user, at his workplace. This is of benefit to the factory user, as he no longer has to physically move from his workplace. However, he still is burdened with needing to know "where to go" to access information (e.g. which software system to invoke), and the specific information access procedure. This is depicted in Figure 2.
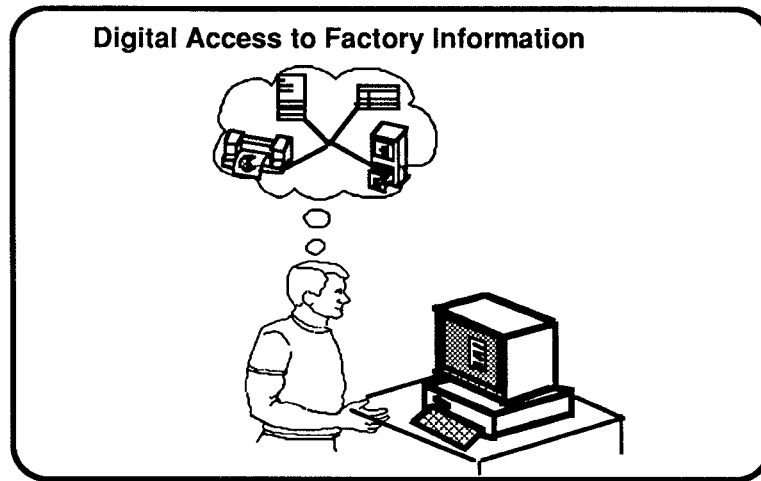
Figure 2

Hypermedia technology can reduce the access and association burden for the user. As depicted in Figure 3, the computer can model the relationships between disparate information systems and model knowing "where to go" and "how to access" information. This frees the user to concentrate on his problem.
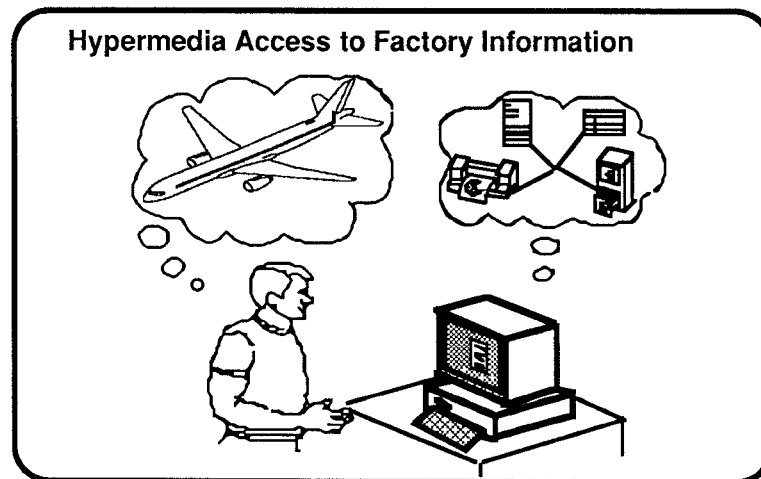

Figure 3

Consider an example from a factory user's perspective. Figure 4 illustrates a computing environment where the end user is a factory mechanic. He has access to a number of different applications on his workstation. In Figure 4, the mechanic needs information about a job he is to perform. He determines that the Job Instruction application might have the information needed, so he finds its icon and invokes it. He reads about the Feel and Centering mechanism.
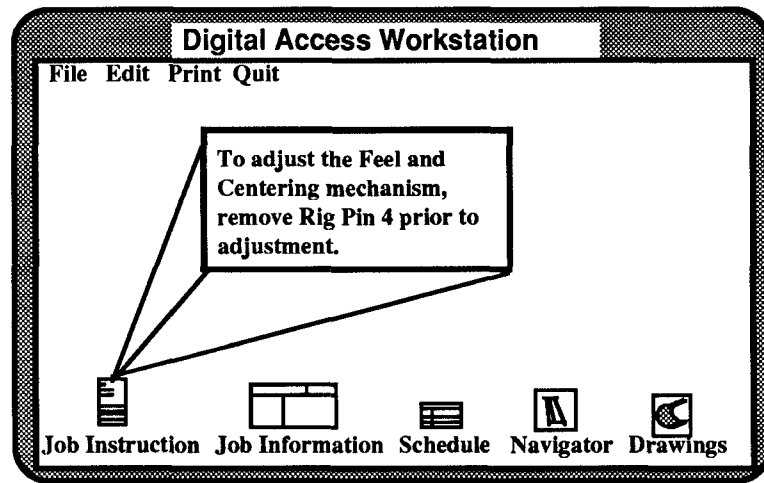
Figure 4

He wants to see a more detailed view of the Feel and Centering mechanism, so, he finds the Drawings Browser and invokes it (as depicted in Figure 5). He has to supply the browser with the drawing number he wants to view (which he probably has to look up or have had written down), and has to know how to identify the pertinent area on the drawing.
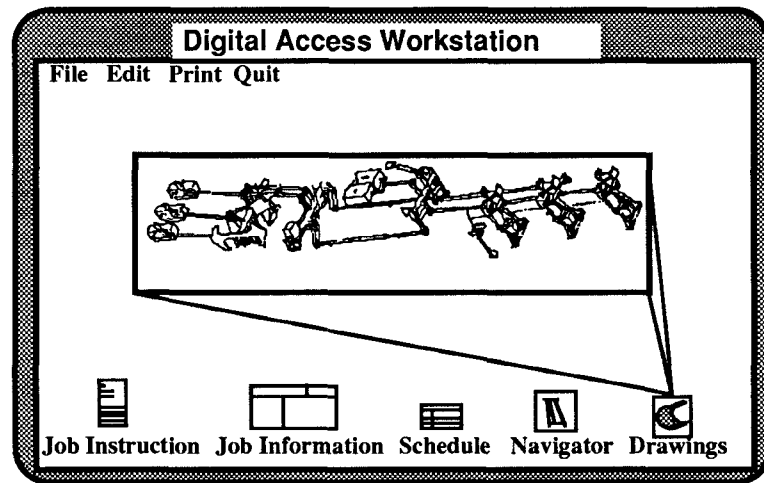

Figure 5

Figure 6 illustrates the addition of hypermedia to this environment. The mechanic just has to click his mouse on the link marker located next to the "Feel and Centering" text of the Job Instruction, and the Drawing Browser is invoked which brings up the appropriate drawing with the Feel and Centering mechanism highlighted.
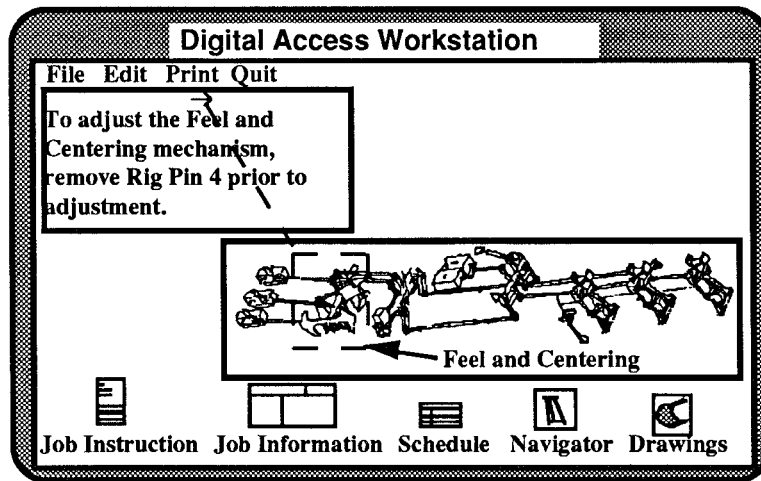
Figure 6

HYPERMEDIA TOOL APPROACH

The vision of being able to "virtually integrate" applications in this manner is very attractive, however, existing hypermedia architectures and tools do not adequately address the requirements of large-scale manufacturing environments, such as those within The Boeing Company.

A large-scale hypermedia architecture is needed which addresses existing hypermedia tool limitations. A large-scale hypermedia architecture is differentiated from typical hypermedia architectures by supporting large production hypermedia networks, which integrate legacy systems. A large-scale hypermedia architecture provides the following:

• Application to application association (linking at various functional levels)

• Robust link management (which ensures that all links are maintained under configuration management).

• Interoperability (heterogeneous platform migration support)

LARGE SCALE HYPERMEDIA MODEL

The hypermedia model logically integrates existing applications by encapsulating the application and trapping the communication between the user and the application. This may be thought of as a "layer of acetate" between the user and the application, as shown in Figure 7. The hypermedia system monitors the user's interactions and determines if actions are to be processed by the hypermedia system.
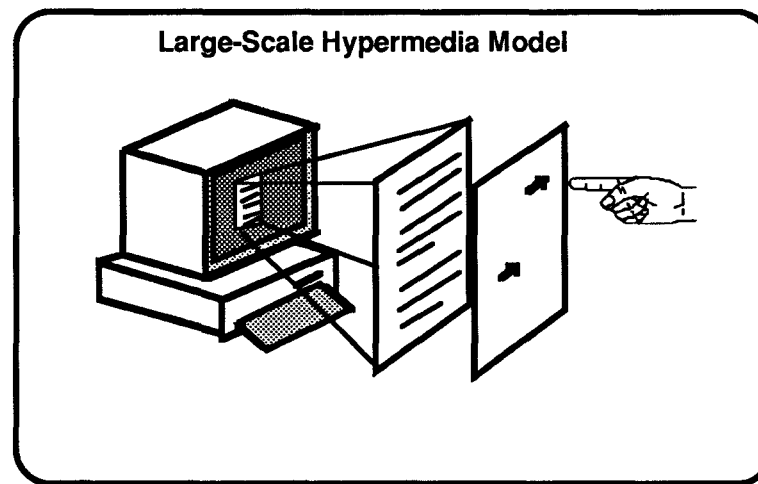
Large-Scale Hypermedia Model

Figure 7

Figure 8 depicts the following example. If a user were to click on a portion of the screen which has an associated link, the hypermedia system would trap the click and determine that it's coordinates were the same as one of it's active links. The hypermedia system would then initiate the action related to the specific link. It does this by identifying the link and searching it's link database for the specific link. Once found, the associated actions, network paths, and/or data are obtained from the hypermedia database. The hypermedia action can be as simple as invoking another application or a complex set of previously authored instructions which updates other databases, begins execution of applications, and informs the user of the current status of the hypermedia network.
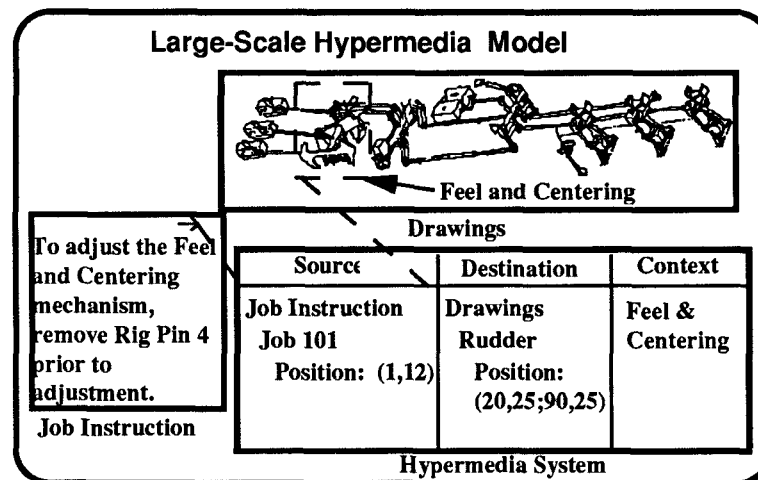

Large-Scale Hypermedia Model

To adjust the Feel and Centering mechanism, remove Rig Pin 4 prior to adjustment.

Job Instruction

Feel and Centering

Drawings

Source	Destination	Context
Job Instruction Job 101 Position: (1,12)	Drawings Rudder Position: (20,25;90,25)	Feel & Centering

Hypermedia System

Figure 8

LARGE SCALE HYPERMEDIA ARCHITECTURE

Most commercial products are implemented at the application layer, while the large-scale hypermedia architecture strategy is to incorporate hypermedia functionality into the operating system. Figure 9 shows the application layer removed and exposes a high-level view of the large-scale hypermedia architecture.

Large-Scale Hypermedia Architecture

Hypermedia Workbench
(Navigator, Link Mgr, Web Mgr...)

Hypermedia Manager
(Search Eng.,Event Mgr...)

Hyperbase Management System
(Hypermedia Object Schema)

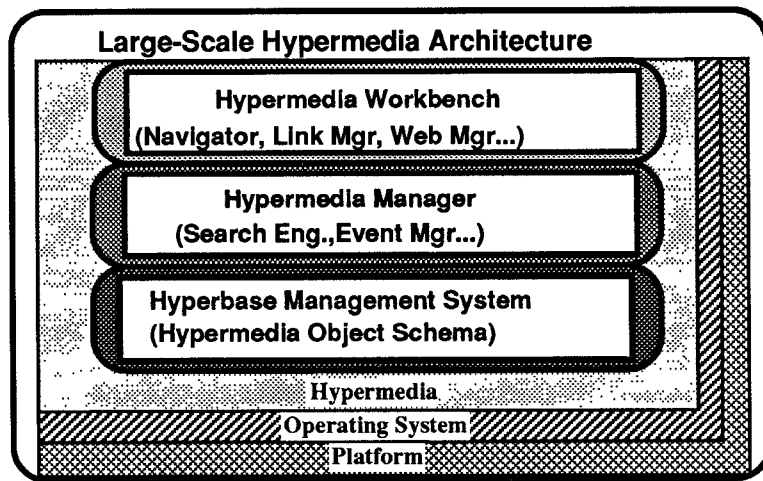Hypermedia
Operating System
Platform

Figure 9

The Workbench is the author and browser interface component. The manner in which it is designed determines the behavior and functionality available to authors and browsers. It provides such functions as the ability to define a link and associated semantics, navigate through information networks, and manage information networks.

The Hypermedia Manager is the kernel of the hypermedia system. It coordinates all hypermedia activity. It monitors all application events, contextual restrictions, requests searches of the hyperbase, and responds to events triggered by the Hyperbase Management System.

The Hyperbase Management System is the central link repository. It provides connectivity to commercially available DBMSs for link management. It defines the schema for the hypermedia paradigm, configuration control rules, information network administration, and monitors events within the hyperbase which must be communicated to the Hypermedia Manager.

CONCLUSION

There are many business and manufacturing systems in today's factory. Factory personnel depend on these legacy systems to provide accurate and timely information. Hypermedia technology can allow users to logically associate information contained within these systems while minimally disrupting the application and information environments. The integration of hypermedia into a manufacturing environment requires an architecture designed to provide production quality link management, utilization of traditional technology, easy incorporation of new technology, heterogeneous platform migration support, and tools to integrate hypermedia with legacy systems.

ACKNOWLEDGEMENTS