

# Video Paper: A Paper-Based Interface for Skimming and Watching Video

Jamey Graham and Jonathan J. Hull  
Ricoh California Research Center  
Menlo Park, CA  
{jamey, hull}@crc.ricoh.com

## Abstract

*A paper-based method for browsing, retrieving, and viewing video programs is described. A printed form of the transcript for a TV program is provided that's formatted for easy browsing. The printout is annotated with bar codes that provide links to the corresponding position in the video recording. A remote control device is used for scanning the bar codes and controlling the replay of the video either on the remote control itself or on a video monitor.*

*This paper describes an implementation of this method using a Pocket PC with a bar code reader as the remote control device and an archive of TV programs on the Pocket PC or an external server.*

## 1. Introduction

There are many different kinds of technology available today for capturing, viewing and navigating video recordings. Most of them provide an online graphical user interface (GUI) for search and retrieval. However, there are only a few document-based interfaces for skimming and retrieving multimedia content (e.g., [1]). This is despite the fact that documents have many advantages over GUI's when searching for relevant information. One of these is the efficiency of searching for information in the printed form of a document rather than the online version. This is why many people will print a long document rather than read it online.

Also, paper has many inherent advantages in comparison to an electronic representation such as high resolution, portability and compression. For example, the transcript for a one-hour television news broadcast can be printed on about 10 pages of letter-size paper in a 10 point font. When looking for some specific information, it's much easier to browse such a transcript than to search the video recording.

We propose a paper-based interface (called Video Paper) for interacting with multimedia content such as a

TV broadcast or a recorded video (e.g. a meeting) that includes either closed caption text or a transcript. The goal is to create a very readable paper version of the multimedia content by following formatting guidelines designed for the newspaper industry. For instance, the use of particular fonts, multiple columns and short lines of text along with line spacing, bolding and capitalization techniques all contribute to improving the readability of the text and making the document easier to skim.

We also display key frames extracted from the video at various locations. Figure 1 depicts a sample of the proposed Video Paper interface. Bar codes refer to corresponding points in the recorded video. Swiping a bar code causes the video to begin playing at that time. This allows users to read the paper document and view only those parts of the video that are relevant to their needs.

Given a multi-paged document of this type representing, say, an hour long TV program or recorded meeting, a reader can quickly skim the contents of the program to see if anything relevant might be present in the text.

## 2. Paper-Based Index for Retrieval

We have also implemented a technique for using the Video Paper system as an indexing and retrieval tool for viewing multimedia documents. For instance, let's say you have requested that the TV program *Bloomberg* be recorded for you each day between the hours of 9:00 AM and 11:00 AM when important financial news is broadcast. As part of your profile, you have also specified that a printout of the broadcast be automatically generated in the style described above. This affords you the luxury of skimming such a broadcast whenever you like. With the proposed system, you could watch parts of the program anywhere you happen to be at whatever time is convenient (e.g., on the train, while in a meeting, at home in the evening, etc.).

# CNN News (Channel 203)

12:59 PM, May 30, 2001 • Duration: 00:56:40 hours

Company	Price	Change
Alcatel	25.10	-2.31
Sycamore Networks	5.01	-1.22
JDS Uniphase	16.92	-2.25
Tellabs	33.79	-3.98
Nortel Networks	13.40	-1.22



**GOODYEAR TIRE SAYS IT WILL REPLACE THE WILDERNESS AT TIRES** for Ford Explorers, damage done on the NASDAQ, where severe beating that came after yesterday's after-the-bell bombshell from Sun Microsystems. I had— it washed revenue earnings would disappoint Wall Street closed down more than 2; also, Alcatel more than 2 in New York trading after it warned of second quarter loss of more than 2 1/2 billion dollars, and that came just hours after news that merger talks with Lucent have collapsed. For telecom sector another blow—Morgan Stanley downgraded 4 telecom and fiber optic companies: Sycamore Networks, JDS Uniphase, Trebek, and Nortel Networks closed sharply lower.

For a closer look at what stock analysts are talking about, go to [cnfnfn.com](http://cnfnfn.com) and click on the Street Sweep Shaker section.

Happening in news right now, **SIX CHILDREN AGES 8 TO 16 BELIEVED ARMED ARE HOLED UP IN THEIR HOME AT IDAHO.** Sheriff's deputies dispatched to the house yesterday were kept back by a pack of dogs. The standoff began after authorities arrested the children's mother on charges of injuring a child.

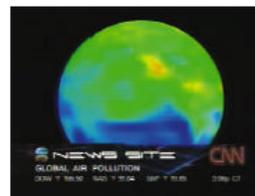


**FLORIDA GOVERNOR JEB BUSH** headed to one of his state's hotspots today to check in on firefighters. The governor took a tour of some of the damage caused by the so-called Mallory Swamp Fire in north Florida. The blaze was stabilized earlier today, and fire crews are now mopping up. The flames have scorched nearly 61,000 acres.



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To help you stay up with the conversation, about :20 past the hour today: enabling the disabled. How new technology is leveling the playing field. And closer to the half hour, freak dancing. The sexually-explicit moves some teens are making and whether they go too far.



Smoke from forest fires and factories, huge clouds of carbon monoxide. All that and more add up to worsening **AIR POLLUTION**, and it's all being captured on film by a NASA's Terra Spacecraft. According to NASA, Terra has produced the most complete view ever of air pollution on planet earth. Joining us with more insight on this, John Gillee of NASA's National Center for Atmospheric Research.

Joie: John, thanks for being with us, and for explaining to us in the best way possible how much this tells us

Figure 1. Example Multimedia Video Paper document,

An example of using Video Paper would be reviewing a two-hour TV program shortly before an important meeting to determine whether any relevant information is mentioned about a client's company or their main competitor. With the proposed paper-based version of the broadcast, you can quickly skim the document for relevant information. When you find one or more sections that are of interest, you can swipe the bar codes in the pertinent sections of the document. This launches the video on the TV in your office. In an alternative configuration, the video is displayed on a PDA either over a wireless link or from content present on the PDA.

This scenario could have included printouts from several different news agencies such as CNBC, CNN/fn and MSNBC. The user's goal in this case would be to skim many hours of video, possibly looking for news reports on the same topic. This can be difficult to do efficiently if the user only has access to video recordings.

### 3. Prototype

A prototype implementation has been developed using a Pocket PC as a remote control. Equipped with a bar code reader and a wireless connection via 802.11b, it communicates with a server that stores an archive of video programs. That archive is automatically built by scheduling software that records selected broadcast TV programs. A user can easily retrieve and watch TV programs with the Pocket PC.

### References

1. B. Shahraray and D. C. Gibbon, "Automated Authoring of Hypermedia Documents of Video Programs", *ACM Multimedia 95*, November 5-9, 1995, San Francisco, CA.