Mobile Access to the Físchlár-News Archive

Cathal Gurrin, Alan F. Smeaton, Hyowon Lee, Kieran McDonald, Noel Murphy, Noel O'Connor, Sean Marlow

Centre for Digital Video Processing
Dublin City University
Ireland
{cathal.gurrin}@computing.dcu.ie

Abstract. In this paper, we describe how we support mobile access to Físchlár-News, a large-scale library of digitised news content, which supports browsing and content-based retrieval of news stories. We discuss both the desktop and mobile interfaces to Físchlár-News and contrast how the mobile interface implements a different interaction paradigm from the desktop interface, which is based on constraints of designing systems for mobile interfaces. Finally we describe the technique for automatic news story segmentation developed for Físchlár-News and we chart our progress to date in developing the system.

1 Introduction

The growth in volume of multimedia information, the ease with which it can be produced and distributed and the range of applications which are now using multimedia information is creating a demand for content-based access to this information. At the same time, digitised video content is becoming commonplace through the development of DVD movies, broadcast digital TV, and video on personal computers for both entertainment and educational applications. Besides the growth in volume of multimedia content, we can also observe an increasing and complex range of user scenarios where we require content-based access to such information. Users require access when in a desktop environment, but also, we believe, when using wireless devices in a mobile scenario, each of which will require different access methodologies to be employed. In this paper we discuss mobile access to a video archive of digitised news programs, which can be accessed using desktop devices, PDAs operating on a wireless LAN or XDAs on a GPRS[1] mobile phone network. In this way, and through these different access devices, we support mobile access to a digital video library of broadcast news. Our belief being that mobile users have a demand for wireless access to news content.

[1] GPRS is a packet switching technology for GSM mobile phone networks. A GPRS connection is 'always on' and a single user connection allows 21.4Kbps, but combining connections (time slots) can reach a theoretical speed of 171.2Kbps. However there are a limited number of time slots on a GPRS network.

In addition to simply providing access to digital video archives across a wireless network, we are also working on new methodologies for presenting information to mobile users. In this paper we report on our work on developing an information retrieval system (which supports mobile access) for one type of multimedia information (digital video), of one type of video genre (broadcast TV news) and targeted at one type of user information need, namely a user of Físchlár-News who is not necessarily interested in viewing all the news, but wishes to be kept up-to-date with developing news stories of interest without being restricted to always using a desktop device (i.e. mobile access).

Built on a currently existing system [1], but incorporating mobile access to daily news video, Físchlár-News is based on two new and key underlying technologies:

- Automatic news story segmentation, and;
- Personalisation by means of news story recommendations tailored to user interests of individual users.

In this paper we describe mobile access to the Físchlár-News system and how the fully-automated version of the system operates. We begin in section 2 by describing the desktop version of Físchlár-News (incorporating news story segmentation) which is built upon a news retrieval system that has been operational for last 2 years within the university campus. Section 3 introduces mobile access to Físchlár-News, and discusses the different interaction paradigm that is required for mobile access when compared to Físchlár-News on the desktop. We also discuss how personalised presentation of news stories is being incorporated into the Físchlár-News system to support mobile access. In section 4 we describe how Físchlár-News actually works, and we discuss automatic story segmentation and how recommendation and personalisation is achieved. Finally in section 5, we discuss our progress to date with the development of the system, describe a transitional system that we used during development and finally, we outline our future plans for Físchlár-News.

2 Físchlár-News Video Archive

The Físchlár-News Video archive is one of the results of research in analysis, browsing and searching of digital video content carried out at the Centre for Digital Video Processing in Dublin City University. It is one of four versions of a digital video archive system that we maintain within the centre. Físchlár (all four versions) is an MPEG-7 based digital video content management and retrieval system which supports digital video browsing, searching and on-demand playback using both fixed and mobile devices. The four versions of Físchlár are Físchlár-TV, Físchlár-News, Físchlár-TREC (2002 & 2003) and Físchlár-Nursing. At the time of writing, Físchlár have over 2,500 registered users, of whom about half are “active” and regular users.

The Físchlár-TV system has been in operation on the university campus for over three years and can be accessed via a web browser on a desktop computer. Perceived as a web-based video recorder, registered users have been using the system to record and watch the TV programmes from both the university campus residences and from computer labs [1]. The Físchlár-Nursing system provides access to a closed set of thirty-five educational video programmes on nursing, and is used by staff and

students of the university's nursing school, while the Físchlár-TREC systems were developed for our participation in the interactive search task in the annual activity at the TREC Video Track in both 2002 and 2003[2].

Físchlár-News, the focus of this paper, automatically records the thirty minute, 9pm, main evening news programme every day from the Irish national broadcaster RTÉ1 and thus has only TV news programmes in its collection. With its web-based interface, the system is accessible with any conventional web browser and now is also accessible from mobile devices. Currently several months of recorded daily RTÉ1 news is online within the Físchlár-News archive (with a total of two year's news archived). This archive is made available to university staff and students, and is also conveniently accessible from any computer lab, library or residence from within the campus. We have chosen the Físchlár-News application as our test-bed for providing mobile access to our Físchlár systems.

In order to facilitate accessing Físchlár-News from a number of different devices (both desktop and mobile based), the entire Físchlár system is based on XML technologies, which by incorporating XSL transformations for each new device required, can easily be extended to incorporate new access methodologies, devices and standards. Fig. 1 shows the basic architecture of the Físchlár-News system which illustrates both desktop and mobile access and the process by which automatic news story segmentation takes place.

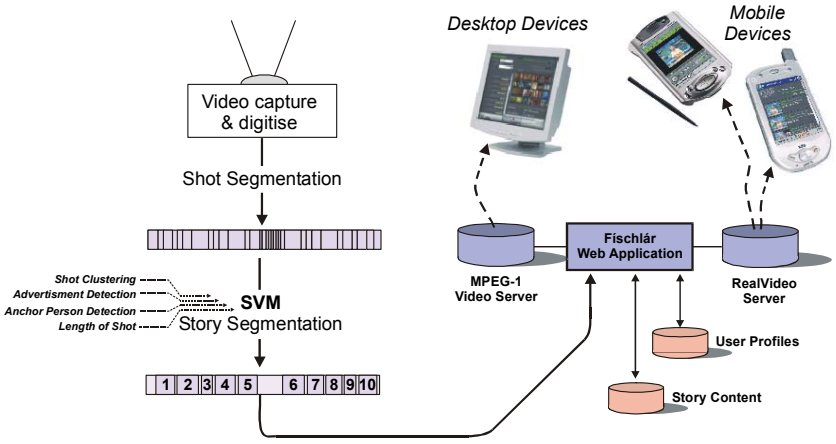

Fig. 1. Architecture of Físchlár-News

In Físchlár-News, mobile access to the news archive is supported for both PDAs (Compaq iPAQ on a wireless LAN) and XDAs, each of which plays RealVideo encoded content, which has been encoded at 20Kbps in order to support streaming across a mobile phone network to an XDA. In a desktop environment, a user can use a conventional web browser (using MPEG-1 video streaming) as shown in Fig. 1. The inclusion of XDA support (using a GPRS connection) allows us to prototype a version of our Físchlár-News system in a truly mobile environment, where access is dependent only on the availability of a GPRS connection.

In realising such mobile device interaction for Físchlár-News, two essential technologies are required, namely the segmentation of news programs into a collection of news stories and a facility to automatically recommend these news stories to individual users based on their preferences. We will discuss these aspects of the system in later sections of this paper. Previous versions of Físchlár News have focussed on providing browsing and search support at the shot level by automatically segmenting captured video content into its constituent shots and presenting video to the user as a collection of these shots. However, our current system (discussed in this paper) incorporates search and retrieval of content at the news story level which we feel is more intuitive to a user than at the shot level because a news story is a self-contained and logical unit of data and is more likely to be of benefit to a user than a full news program or a single camera shot from a news program.

2.1 Content Access to the Físchlár-News Archive

When using Físchlár-News on a desktop device, there are a number of ways of accessing news stories, described in the next sections.

2.1.1 Browsing News by News Program

This is the basic level of access in Físchlár-News and is shown in Fig. 2. As can be seen, a listing of news programs grouped by month is displayed on screen.

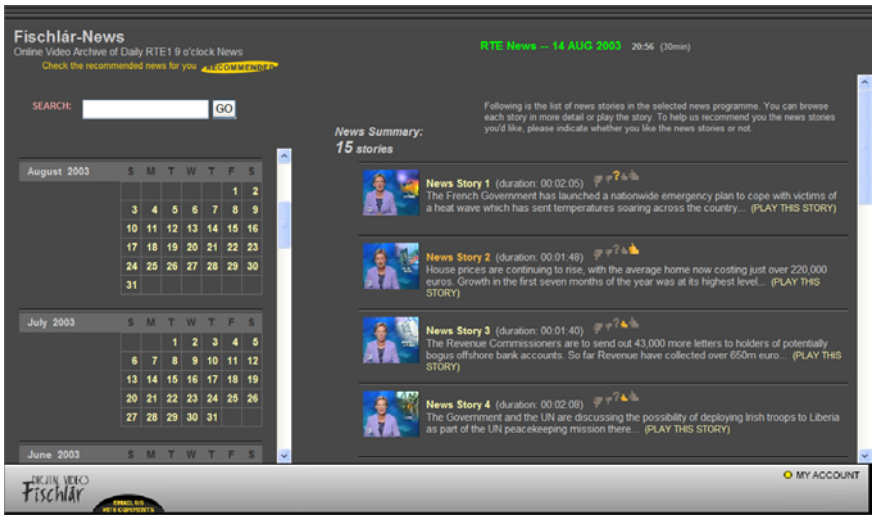

Fig. 2. Físchlár-News (with stories from one program)

Currently this list extends to include news content from April 2003. Selecting any news program will display a list of the news stories from that program (Fig. 2). Each news story is represented by a keyframe (chosen so as to contain the anchorperson

and if possible an image in the background associated with the story) and a textual description of the story.

When presented with a listing of news stories there are two options available to the user, the first of these being to playback the news story by clicking on the "PLAY THIS STORY" link which will commence playback (in a new window) from this point onwards (Fig. 3).

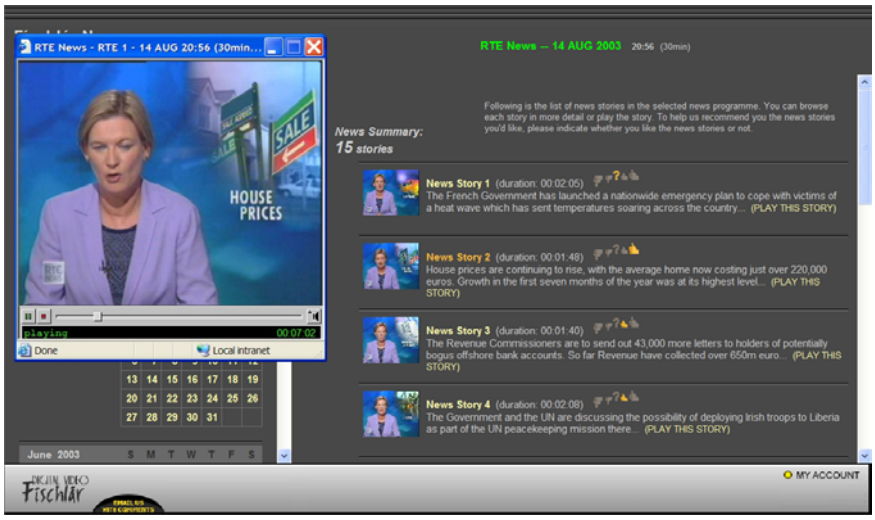

Fig. 3. Playing back a news story

Alternatively, when presented with a listing of news stories the user may examine the news story at the shot level by clicking on either the keyframe or the numbered news story title. If this option is taken the user is presented with a detailed listing of all the camera shots, which have been automatically extracted from that story, as well as the closed caption[2] text that is associated with that story, as shown in Fig. 4. In this way the user can browse through the content of a given story. Clicking on any of the keyframes will commence playback from that point.

[2] Closed caption text (or teletext) is a textual description of the spoken content of a programme that accompanies certain programmes when broadcast. Most programs now transmitted on TV now have associated closed-caption text.

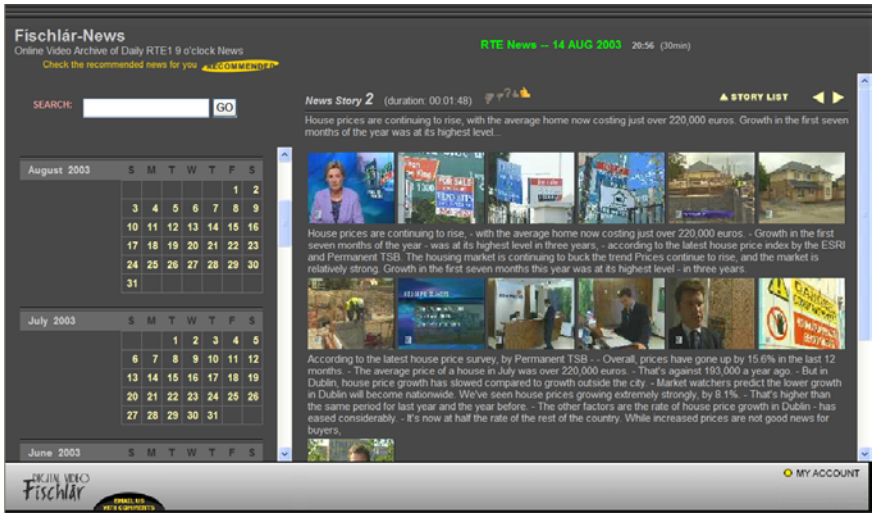

Fig. 4. Shot-level browsing of a news story

However, given that the Físchlár-News archive extends to include several months of news programs, with an additional two years archived, and is growing daily, supporting user navigation throughout this archive of many thousands of stories is essential. The desktop version of Físchlár-News supports a user searching through news stories based on textual content and browsing through the news story archive by following automatically generated links between news stories. We discuss both search and linkage now.

2.1.2 Content Searching for News Stories

Given that there are a large number of stories in the Físchlár-News system, one of our support measures is content based search and retrieval of news stories. This is achieved by representing each news story by a textual description, which has been automatically extracted from the closed caption text and allowing user queries against these textual descriptions of each story. This facilitates content-based retrieval of news stories based on textual queries. For example, in Fig. 5, a query "house prices" has been presented to the Físchlár-News system.

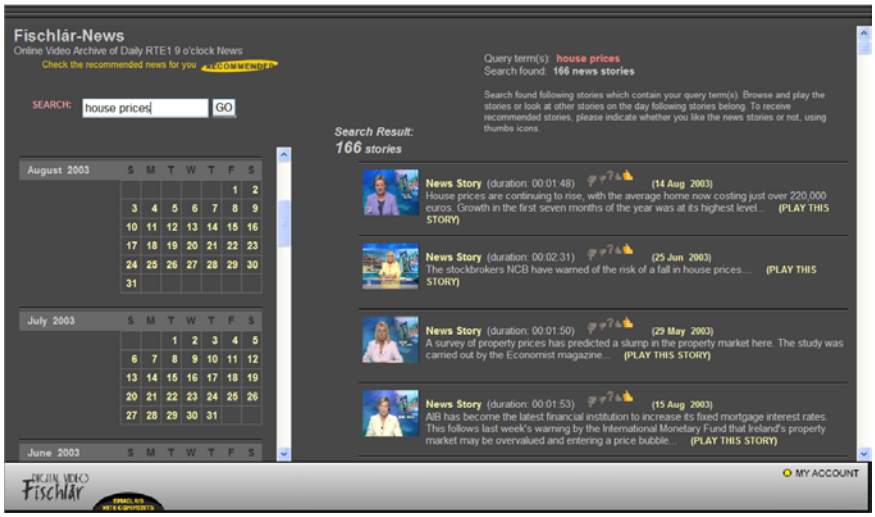

Fig. 5. Content searching the news archive

The results of the search (166 news stories) are presented on the right side of the screen in decreasing estimated order of relevance. Once again, clicking on 'PLAY THIS STORY' commences playback and clicking on the story title or keyframe takes the user to a shot listing. However, when a list of relevant news stories is presented to the user, another option exists which is to view the story in the context of that day's news by following the date link which displays a listing of news stories from the news program recorded on that date.

The third access methodology employed in Físchlár-News is in following automatically generated links between related stories.

2.1.3 Following Automatically Generated Links between News Stories

Using the closed caption transcripts for a given news story it is possible not only to provide for text based search and retrieval of news content at the story level (as just described), but also to identify similar stories to any one given story, and to provide the facility for content-based linkage of news stories using only the closed caption transcripts. Therefore, on a desktop device, for any story that a user is currently accessing, Físchlár-News automatically generates a ranked list of story-links to the ten most similar news stories, which we refer to as 'Related Stories' (see Fig. 6 which shows a listing of related stories to a story about house prices).

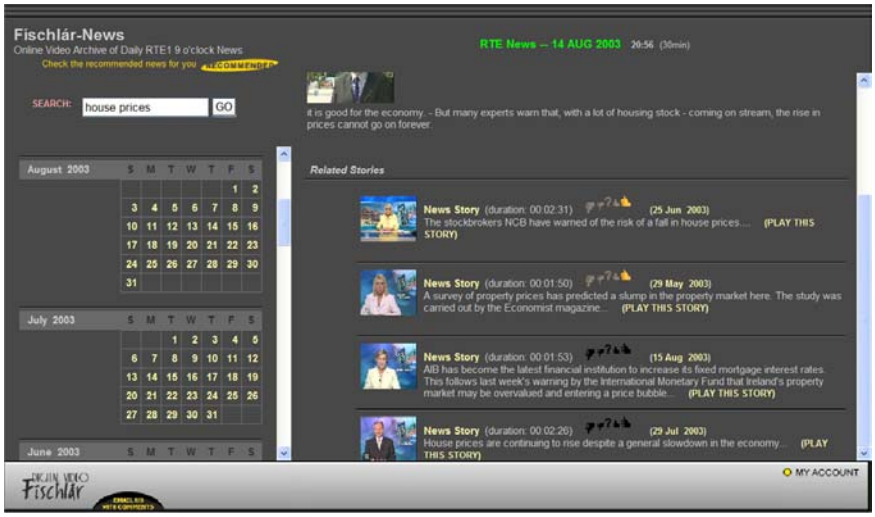

Fig. 6. Illustrating related stories

2.2 Gathering User Feedback

In order to provide personalisation and recommendation to users accessing the system using mobile devices, we gather user feedback and preferences when the user accessed Físchlár-News from the desktop environment. At any point while browsing either the archive or a particular news story (on a desktop device), the user is presented with the opportunity to rate a particular story on a five point scale from "do not like" (thumbs down) to "like very much" (thumbs up). This can be seen in Fig. 7 where a user has rated a news story as being one that the user likes very much (a large thumbs up). In this way we explicitly capture a user's preferences for news topics that they are interested in. This will allow us to match individual users together based on complementary preferences and to recommend news stories for a user based on this collaboration graph.

Fig. 7. The five-point story rating scale

In addition to this process of explicitly gathering data from a user, usage data is automatically gathered (on the desktop device) as the user plays back news stories or browses news stories. This information is then used (along with the explicitly gathered data) for recommending news stories to users. So, for example, if a particular user liked news stories on a given topic, and watched these stories, then additional news stories could be recommended to the user based on the viewing

habits, or user ratings, of similar users. These recommendations are used as one of the two primary access mechanisms for the mobile version of the Físchlár-News system.

3 Mobile Access to Físchlár-News

Small display size, awkward methods of data input and distractive environments have been noted as major constraints in designing systems for mobile platforms [3, 4, 5]. For example, a typical mobile device, the Compaq iPAQ has a 3.8" TFT screen which operates at a resolution of 240 x 320 (portrait orientation) in 16-bit colour. Compare this to a conventional desktop device, besides having larger storage and memory, faster processors, the supported resolution on any such device (in recent years) is at least 1024 x 768 (800 x 600 as a standard safe-resolution for design), with 24-bit colour and a 15" diagonal display with a landscape orientation.

In order to stream video to such mobile devices taking into account resolution issues and bandwidth (we accommodate GPRS 21.4Kbps as a minimum), the entire video must be downsized from the MPEG-1 (352 x 288) resolution at 25fps used for Físchlár-News on the desktop to RealVideo format (156 x 128) at 30 fps. This equates to 13.5Kbps for the video and 6.5Kbps for the audio data. MPEG-1 streaming for the desktop requires about 1Mbps.

Consequently, there have been suggestions on devising different interaction paradigms suitable for the mobile environment rather than simply following the conventional direct manipulation interfaces successfully used in desktop platforms [6], [7], [8]. More and more qualitative studies are appearing which help us better understand how people use and interact with mobile devices, and the kinds of context they experience when doing so [9], [10], [11]. The general consensus is that a mobile interface should require a different interaction style from that of the GUI desktop interface, and that attempts to replicate all the functionality of desktop system into a mobile device are a mistake [12], [7], [6], [3].

Though the current literature alerts to the fact that we do not have any established or known methodology on which to base an interface design for a mobile platform, a number of rough design guidelines have been suggested based on experiences of individual researchers. These include the following:

- minimise user input where applicable, provide simple user selections such as yes/no options, simple hyperlinking by tapping, etc. instead of asking the user to articulate query formulation or use visually demanding browsing that requires careful inspection of the screen,
- filter out information so that only a small amount of the most important information can be quickly and readily accessed via the mobile device (e.g. use of automatic recommendation as provided in the Físchlár TV system [21]),
- Proactively search and collect potentially useful pieces of information for a user and point these out, rather than trying to provide full coverage of all information via an elaborate searching/browsing interface.

In terms of developing any system for a mobile device which is to support searching and information retrieval tasks, all these guidelines point to more pre-processing on the system's side in order to determine what information a particular user will most likely want to see. This encourages the development of systems that proactively recommend a particular piece of information (or pointers) to the user, and consequently demand less interaction on the user's part. This aspect is even more important in the case of information retrieval from a video archive where browsing is such an important component of video access. What all this means is that in the development of search systems to be accessed from mobile platforms, the information retrieval functionality should be hidden as much from the user as is possible, and should form part of the data pre-processing. In supporting mobile access to the Físchlár-News archive, our approach has been in line with these guidelines by incorporating the personalised list of news stories as the primary access point for mobile users and providing a personalised window on these news stories based on each user's individual preferences. Secondary access points include archive browsing.

Fig. 8 illustrates the logical breakdown of news programs into stories and associated shots based on keyframes. It is our belief that story based presentation can be supported using both mobile and desktop devices, however, if finer granularity of retrieval is required (shot level browsing with stories) then desktop devices are essential due to interaction design methodologies for mobile devices [13] as well as the bandwidth limited nature of some such devices, e.g. the XDA we use to prototype our mobile access.

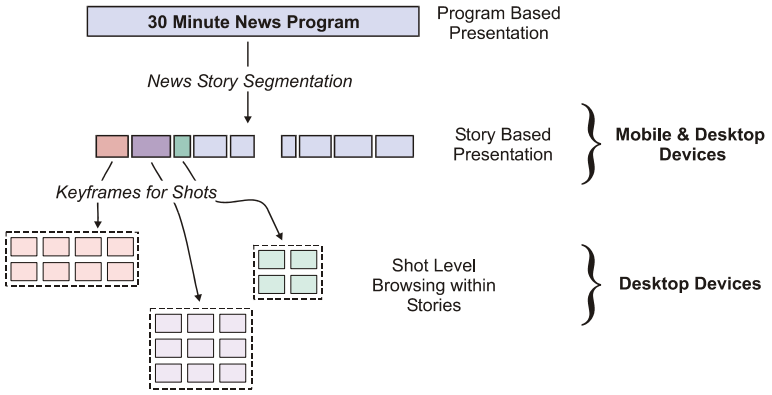

Fig. 8. A logical breakdown of news programs

Given that user interaction with a mobile device should be limited to a subset of the functionality of the desktop version for reasons outlined in the previous section, the functionality of the mobile device is to support two methods of using Físchlár-News:

– providing personalised access to the news archive by presenting the user with a listing of news stories of interest to the user (Section 3.1), or;

– supporting the user access news stories in the archive by browsing the reverse chronologically ordered listing of news programmes (i.e. Programme Browsing in section 3.2).

3.1 Personalised Presentation of News Stories

The primary access mechanism for the mobile device is based on personalisation of news stories tailored to individual user preferences. Each user's personalised view of the news archive is based on similarity of program content to previously rated programs and also to the concept of collaborative filtering. Collaborative filtering, in what is perhaps its most famous form, is employed by Amazon.com when making user recommendations based on a users previous purchases or recently viewed items. In the case of Físchlár-News collaborative filtering is employed based primarily on previously gathered user ratings of any given news stories as well as news story usage histories. We will outline our collaborative filtering mechanism in greater detail in section 4.

Upon accessing Físchlár-News using a mobile device, a user has the option of being presented with a personalised listing of recent news stories (see Fig. 9), that it is hoped will be of interest to that user, based on program content and the output of the collaborative filtering process. Each story in this list will be represented by a short description (similar to the desktop device), generated from the closed caption text, and a keyframe. The only user input that is required from a user's perspective is to select a news story to playback (Fig. 10), which causes the story to be streamed in RealVideo format.

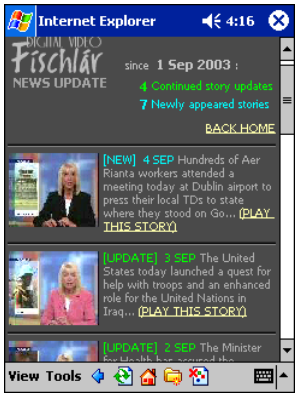

Fig. 9. Personalised story recommendations

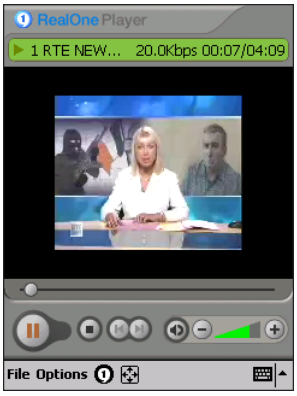

Fig. 10. Playback on a mobile device

By incorporating this personalisation aspect of Físchlár-News on a mobile device we are minimising user input by filtering out content that the user may not be interested in, where this filtering is based on news story rating data and content similarity from the desktop device. For more complete rationale on the interaction

design approach taken and the detailed consideration for this particular interface for a PDA, see [13].

3.2 Programme Browsing

An alternative to personalised news story presentation is provided, to enable a user to access news programmes regardless of their presence or absence in the personalised list. In this way, a user is not limited to only viewing stories that the system chooses, but is presented with a reverse chronological listing of recorded news programmes (not unlike the desktop interface in Section 2) so that the user may browse the entire news story archive (Fig. 11). Upon selecting a news programme, the user is presented with a listing of news stories from within that programme (Fig. 12), in a similar manner to the listing of personalised stories, with each news story represented by the keyframe and the textual description of the story.

Fig. 11. Reverse chronological daily news listing on a mobile device

Fig. 12. Story listing on a specific date

4 Físchlár-News, How It Works

In realising such mobile device interaction for Físchlár-News, two essential technologies are required, namely the segmentation of news programs into a group of news stories and a facility to automatically recommend these news stories to individual users based on their previously gathered preferences and the preferences of others. In the following sections we describe automatic story-based news video retrieval and the mechanisms we employ for automatic recommendation.

4.1 Automatic Story Segmentation

As we have stated, Físchlár-News operates over news stories as the primary unit of retrieval, which is especially important in the mobile environment, but this requires a method of segmenting an entire news programme into a listing of its constituent news stories. If done manually this is a time-consuming task and if done automatically, which is essential for any large-scale archive of story-based news content (such as Físchlár-News) is an extremely difficult task. However, given that news programs from one broadcaster (RTE in our case) represents a very constrained domain this makes automatic story segmentation somewhat easier to accomplish. For example, there are a lot of features (sources of evidence) that can be extracted automatically from the video stream to aid the segmentation process, if it is known in advance what to look for (i.e. in a constrained domain). We have tested and integrated into Físchlár-News an automatic news story segmentation system that is based on a combination of a number of different sources of evidence automatically extracted from the digitised news video.

There has been previous research in this area (Table 1), upon which we now report.

Table 1. Comparison of Approaches to Automatic Segmentation of News Stories

Evidence System	Visual	Audio	Closed Caption	Combination Method
Informedia [14]	Shot boundary detection; face detection; OCR; black frame	Speech recognition; silence detection; acoustic environment change; signal-to-noise ratio	">>>", ">>", absence of text	Step-by-step (ad-hoc)
VISION [15]	Shot boundary detection	Audio energy-based shot merging	">>>", ">>", absence of text, word identification for topic distance calculation	Step-by-step (shot boundary detection followed by audio-based merging followed by closed caption-based adjustment)
BNE & BNN [16]	Black frame; logo detection; anchor booth & reporter scene detection	Silence	Named entity heuristics in captions, ">>>", ">>"	Finite State Automation enhanced with time transitions
Topic Browser [17]	No	No	Morphological analysis	(only Closed Caption used)
ANSES [18]	Shot boundary detection	No	Lexical chaining	Step-by-step (shot boundary detection followed by Lexical chaining-based merging)
Físchlár-NEWS	Shot boundary detection; face detection	No	No	Support Vector Machine

4.1.1 Previous Research

Many of the current studies in news story segmentation make use of multiple evidences for segmentation from visual content, audio content and closed caption text associated with a particular news programme. Visual evidences currently studied and used include shot boundaries (helping to identify possible story boundaries), blank frames (indicating story boundaries), anchorperson (indicating start/end of stories). Audio evidences studied include existence of speech/music, silence (indicating story boundaries) and audio energy level. Use of closed caption text, often used as the primary source of evidence, has been more extensively studied with linguistic analysis to detect news story boundaries. Evidences in closed caption text includes simple clues such as complete absence of the closed caption (an indication of a commercial break), welcome phrases such as "hello and welcome" (indicating the start of the news), "back to you in <location>" (indicating reporter to anchorperson), etc. and manual marking[3] ">>" (indicating speaker change) or ">>>" (indicating story change), as well as sophisticated topic change detection by lexical chaining analysis. Using only closed caption analysis for news story segmentation also gives acceptable results [18]. Combining individual evidences into more reliable story segmentation is conducted in different ways, but most often follows sequential processing in which visual analysis (shot boundary detection) followed by audio analysis (merging back related shots) as done in [14, 15, 17], or the use of a state transition map to classify different states of scene changes in news programmes [16]. In the Físchlár-News system, we use an SVM (Support Vector Machine) to combine various evidences automatically extracted from the video content. Table 1 (above) shows a summary of analysis methods and combination methods used in six news video retrieval systems, including Físchlár-News.

4.1.2 Automatic Story Segmentation in Físchlár-News

For automatic news story segmentation, we analyse various visual features in the news programmes to automatically determine story boundaries. We utilise algorithms for anchorperson detection using shot clustering [19], which detects when an anchor person is on screen, as well as advertisement detection [20], which determines when advertisements occur and face detection which detects human faces in the video content [21]. In addition we are considering the use of speech/music discrimination [22, 23].

All of the analysis techniques mentioned above for automatic story segmentation take place at the shot level (recall Fig. 1) and have been combined to create an automatic story segmentation system. The output from the advertisement break detection algorithm is used to pre-process the shots, discarding as candidates for story boundaries any shots which are part of an advertisement break.

The combination of the other analysis outputs is being supported through the use of Support Vector Machines [24] and initial results suggest that this technique can

[3] Unfortunately not all closed caption broadcasts contain such manual markings, RTÉ1 news is one such example. Even if such manual markings were available, most closed caption text is not perfectly aligned with the video content and must be realigned in order to produce accurate story segmentation results.

effectively and efficiently combine these diverse analyses. Each shot that comprises a news programme is described by a feature vector made up of the outputs from the various analysis tools, and the Support Vector Machine is trained to classify shots into those which signal the start of a new story and those which do not, hence we are then able to detect story boundaries in a TV news programme.

In order for an SVM to operate, it must undergo a training process. This we have done using a training set consisting of 435 example shots, 86 of which are positive examples of news story boundaries and 349 of these are negative examples. Following from this we tested the performance of our SVM, with very promising results, on a small test set of six news programmes with precision and recall figures of 1.0 and .859 respectively. We appreciate that this test set is small and we are currently testing the SVM for story bound segmentation on a larger test set of news programs as part of the TREC Video Track 2003, which will give us a better indication of SVM performance. The automatic segmentation system is operational since October 2003, when it replaced a temporary system which utilised manual story segmentation.

For each automatically segmented news story, a textual description will be extracted from the closed-caption text as well as a keyframe automatically extracted for each story. Our belief is that the (single) keyframe chosen to represent each news story should (where available) contain the anchorperson as well as a background image, which represents the story. In order to automatically achieve this we will incorporate both temporal and anchorperson detection knowledge.

4.2 Físchlár-News Story Recommendation and Personalisation

Given that we have developed the Físchlár-News system with a mobile user in mind, the most important news stories that a mobile user requires should be presented to the user with the minimal user intervention or required data input. In order to facilitate this we have put great emphasis on supporting news story recommendation and personalisation. In a desktop environment Físchlár-News supports these features along with story-based retrieval using textual queries and story linkage. However, in a mobile environment, personalisation and recommendation is a central aspect of user interaction with Físchlár-News, which helps to address some of the major constraints in designing systems for mobile platforms [3, 4, 5]. One highly important aspect of this personalisation and recommendation is Collaborative Filtering.

4.2.1 Collaborative Filtering

In another application, Físchlár-TV, we have been using the ClixSmart engine [25] to provide collaborative filtering based recommendations of TV programs for recording and for playback from those recorded and available in the Físchlár-TV library. The ClixSmart engine is a collaborative filtering system that recommends items based on the actions of equivalent users. For additional information on how collaborative filtering works within the Físchlár system in general see [26].

In Físchlár-News, personalisation is employed based on a combination of content similarity of news stories and collaborative filtering. As stated, Físchlár-News on a mobile device will filter out news stories that will not be of interest to the user based

on past history, in addition to supporting temporal based browsing of stories from within the news archive. In order for collaborative filtering aspect of personalisation to be effective, all required data must be gathered by the system from the desktop interface. The data gathered is as follows:

- explicit user ratings as described previously in section 2.2,
- usage data on a per-user basis from story playback logs,
- usage data on a per-user basis from story access logs

This data is automatically gathered while a user uses the desktop interface and is used to populate a story-by-user matrix, which is used in the collaborative filtering process. Therefore, we can see that the mobile interface is supported and works in parallel with the desktop interface, by the desktop interface collecting and processing user data to support the personalisation process in the mobile environment.

5 Conclusion

In this paper we have described our efforts at supporting mobile access to a large-scale library of digital video news content. Our efforts have focused on incorporating story segmentation and personalisation into the Físchlár News system in order to support access using mobile devices. This mobile access is made possible by careful development of the Físchlár-News system, its interface and browsing and retrieval methodologies to support the bandwidth limited, screen size limited, mobile user using mobile devices, such as XDAs on a GPRS mobile network.

These mobile devices have a number of key features which limit how we interact with them, These include small display size, awkward methods of data input and in some cases (such as the XDA) limited bandwidth. Conventional wisdom suggests that different interaction paradigms should be devised for the mobile environment rather than simply following the conventional direct manipulation interfaces successfully used in desktop platforms. Mobile access should require, minimal user input and filtered information presentation based on background data collection so that only a small amount of the most important information can be quickly and readily accessed via the mobile device. Table 2 shows a summary of the interaction mechanisms on the mobile and desktop devices for Físchlár-News.

Table 2. Summary of Desktop v.s. Mobile Device Interaction

	Desktop Device	Mobile Device
Programme Browsing	Y	Y
Story Browsing	Y	Y
Shot Browsing	Y	N
Text Querying	Y	N
Related Stories	Y	N
Personalisation	N	Y

In Físchlár-News, the mobile interface is supported and works in parallel with the desktop interface, in that the background data collection to support personalisation and recommendation is mined from observing user activities in a desktop environment and used to support personalisation in the mobile environment.

5.1 Our Progress to Date

In realising the underlying technology required for story-based and recommendation-based mobile access to the news story archive, we built and for a number of months, used a manually segmented version of Físchlár-News to kick-start the fully-automated system that is in operation since October 2003. From April 2003 until October 2003, recorded daily news programmes were manually segmented into stories (in XML format) to generate an initial library of news stories. The manually marked XML files are uploaded into the system, which then incorporates them into the archive. Manual segmentation is a time consuming process in which each news story identified from a given programme is represented in XML format by the following information; a start-time and end-time, a representative keyframe and representative text to describe the story, which had been extracted from the closed captions.

This initial manual segmentation just described served to start collection of initial user ratings of news stories required for collaborative filtering while the automatic segmentation mechanism was being prototyped.

Collaborative filtering is only of benefit if users of the system access or watch news stories (mined from user logs) and/or rate news stories using the thumbs-up and –down indication (as discussed in section 2.2). In order to collect data to support the collaborative filtering process, a core group of regular users of the Físchlár-News system have been encouraged to rate news stories since the end of April, 2003. To date (mid-October 2003) we have received over 22,000 individual story recommendations from these users. The reason for doing this was that in October 2003, when the fully automated Físchlár-News system went live, it was immediately able to generate recommendations of stories for all users based on collaborative filtering using the judgements of this core group of users.

5.2 Future Plans

Given that the Físchlár-News system outlined in this paper is a live system based on research being carried out within the Centre for Digital Video Processing, it will be subject to modification and improvement. Our future plans include identifying what other functionality (from the desktop) can be included in the mobile version that fits in with the design guidelines for mobile devices.

Currently a daily reminder email is sent out to each user of the Físchlár-News system reminding them that the latest news programme has been processed and available for browsing and searching. This email is currently identical for all users, however, the facility exists for us to tailor or personalise each daily reminder email based on the users previous preferences for news story content.

Finally, it is possible using SVMs to incorporate additional sources of evidence into the automatic segmentation process if this is deemed necessary. The results of our larger test of the performance of the SVM will dictate whether this is required.

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