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ABSTRACT

Interactive kiosks are becoming very popular in industries, educational institutions and public facilities. This paper discusses the design and development of a multimedia kiosk (Project iTOWER) by the University of Texas at Austin using the state-of-the-art technology and reports the results of the use of this system by students. The kiosk provides various types of information online through the media of text, color graphics, animation, audio, and video. New segments are being added on a continual basis. The ultimate objective of Project iTOWER is to use advanced computer technology to create a single point of access for the widest possible array of official University services, and enable people to conduct official business with the University electronically and at their convenience. To evaluate how students feel about using these multimedia kiosks, 69 undergraduate and graduate students were asked fill out a questionnaire after the use of the Project iTOWER system. Questions focused on how the kiosks are used; what information and what types of media users are interested in; and preference of using multimedia kiosks to other forms of delivery systems. Results indicated: the average time for using the system was 19.25 minutes; the overall impression of the system was 3.97 on a 5-point Likert scale; the most frequently accessed information by the students includes campus maps, maps of shuttle bus routes, stories about the University through videos and animation, and financial aid information; ratings by first-time users were consistently higher than those by non first-time users; the undergraduate students gave consistently higher ratings than the graduate students; and female students rated the usefulness of the system higher than the males. (Contains 10 references.) (AEF)

Designing Effective Multimedia Kiosks

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Abstract: Interactive kiosks are becoming very popular in industries, educational institutions and public facilities. This paper discusses the design and development of a multimedia kiosk by the University of Texas at Austin using the state-of-art technology. The results of the field evaluation of this system are also reported and discussed.

1 Introduction

This paper is (a) to discuss the design and development of a multimedia kiosk system for university use using the state-of-art technology; and (b) to report the results of the use of this system by the students.

2 Theoretical Framework

One of the most recent technological advances in computers is the hypermedia and interactive multimedia technology. Hypermedia/interactive multimedia technology (the two terms are used interchangeably here) refers to an associative, nonlinear information presentation and representation system built around a network of multimedia materials such as text, graphics, audio and video. The excitement about this new technology is centered on several issues. First, this technology has multimedia capabilities. Instead of dealing with just text, we are now facing a wealth of much richer information. Second, this technology is perceived in many ways as being parallel to the human memory system (Conklin, 1987; Jonassen, 1989). Like those in human memory, concepts and ideas in an interactive multimedia environment do not exist in isolation, but rather in association with other concepts and ideas. They are often packaged as nodes as represented by the screens, cards or files. These nodes are connected with and among each other through links. Associative and nonlinear characteristics of this technology allow a learner to make meaningful connections between logically and semantically related information, and present the knowledge in a more efficient way. Third, because of its flexibility, interactive multimedia technology holds the promise of accommodating learners with different needs. Learners can access text, audio and/or video information depending on their interests and needs.

With large amount of information in the form of text, graphics, audio and video, and with highly interactive and associative nature of this interactive multimedia technology, the teaching and learning process is transformed. Computer-based learning becomes less linear, more flexible and closer to the reality. Complex concepts can be explored through three-dimensional visual presentation that should contribute to a better comprehension of the subject matter. Learners have much more control of what information to retrieve, when and how to retrieve it. Students can deliver presentations and reports developed from a multimedia database that can be updated frequently, no longer limited to reference books and the written page. Teachers have become less like information transmitters, but more like facilitators of the learning process and managers of these technological possibilities (Wellburn, Francis, Riecken, & Farragher, 1993). In other words, the interactive multimedia technology offers new possibilities and opportunities that affects how we learn and how we live.

The interactive multimedia technology is becoming more and more popular in the educational settings. The number of electronic instructional programs created using this technology is increasing at a rapid rate. With more and more instructional, and educational entertainment software being produced targeting at learners of all ages both at schools and at home, how to design effective instruction becomes a very critical issue. In order to realize various potentials of this technology as discussed above and ensure for this technology to have positive effect on learning,

e need well-designed multimedia based applications. Sound design principles grounded in well-defined theories and empirical research are the basis for such well-designed applications.

Currently the research on interactive multimedia design centers on four major areas: (1) instructional dealing with instructional strategies used in the programs, (2) branching as to how to navigate through a program easily and how much learner control should be provided, (3) affective dealing with learning styles and mouvation factor, and (4) media as to different types of media used such as interactive videodisc, CD-ROM, digital video interactive and CD-interactive (Litchfield, 1993). These issues are essential to good designs of multimedia programs. Instructional strategies are the basis for the approaches used and philosophies reflected in the programs. Navigation and learner control provide branching options for learners. Learners' learning styles and motivation are critical perceptual aspects of their educational environment (Litchfield, 1993). Learners' different learning needs require programs incorporating multiple means for searching, accessing, retrieving and presenting information. How much learner control is optimal for learning to occur and which media is most preferred by learners with various learning styles are some of the research questions that need to be answered.

Kiosk development is one of the multimedia applications. Kiosks refer to publicly accessed information systems. The design of effective multimedia kiosks is one of the important factors in the field of multimedia design. Most recently the interest in developing a multimedia-based kiosk is growing in industry, public facilities as well as educational institutions due to the breakthroughs in storage, graphics and video technologies. Chadwick (1992) reported the use of a multimedia based kiosk in the New Mexico Museum of Natural History that assisted the exhibition on the topic of "Arid Lands, Sacred Waters." According to Christensen, Giamo, Jones and Simpson (1993), an electronic yearbook was developed by Drexel University to celebrate the university's 100th birthday and to provide instruction in and about multimedia. Many computer companies such as IBM and Dell are using multimedia kiosks for their customers to order products. IBM has developed "retail marketing assistants" -- multimedia kiosks that incorporate full-color.images, stereo audio, full-motion video and a touch-screen interface. Such kiosks have been welcomed by the customers and make the catalog-ordering system a delight to use (Robo-shop!, 1993). Department stores such as KMart are using kiosks for displaying their products. There are also many do-it-yourself kiosks ranging from making your own greeting cards to making your own gifts. During the summer 1994, approximately fifty universities and colleges nationwide gathered at the University of Texas-Austin for its first National Kiosk Developers' Conference. Many universities are in the process of developing a campus multimedia kiosk and many others have the intention of developing one in the near future. The interest in multimedia kiosks is high in education, museums and industry, and the need is growing.

There are generally four different types of kiosks: (a) a promotional kiosk which entertains such questions as "What is the special for this week"; (b) an informational kiosk which answers a wide range of questions such as "Where is..." and "How do I find..."; (c) a transactional kiosk where a customer completes a sale using a credit card; and (d) an interactive vending kiosk where a customer not only completes a sale but also picks up the product from the kiosk directly (Strothman, 1992). The primary function of a kiosk is to provide information at a time and location that is convenient to its users. Kiosks are different from other multimedia programs in that they are public and available to a variety of audiences across various age groups and learning needs. Because they are accessible twenty-four hours a day, they can meet a user's needs directly and conveniently. They must not only provide useful information, but also be easy-to-use and entertaining enough so that a user will use it. The issues of how to satisfy learners with different needs through various media, how to present information so that learners will find it interesting and motivating enough to use, how to develop a navigation strategy so that learners of all ages can use, and how to ensure learners not to get lost in hyperspace while given total learner control of the kiosk environment are important research issues that need to be investigated.

The purpose of this paper is to look at a multimedia kiosk designed and developed by the University of Texas-Austin. We intend to discuss its use on campus and the results of the field evaluation of this system among students. We hope that the information presented here will help to address some of the research issues mentioned above.

3 The Multimedia Kiosk: Project iTOWER

The University of Texas at Austin (UT) has made an effort to provide electronic information services to its students and faculty. As part of the effort, the University has developed a UT kiosk, Project iTOWER, which has been made available on campus recently. This kiosk provides various types of information on-line through the media of text, graphics, audio and video. Students, faculty, staff and visitors can access such information at their leisure, at

their convenience and at the location of their choice. The following information is currently available from the kiosk:

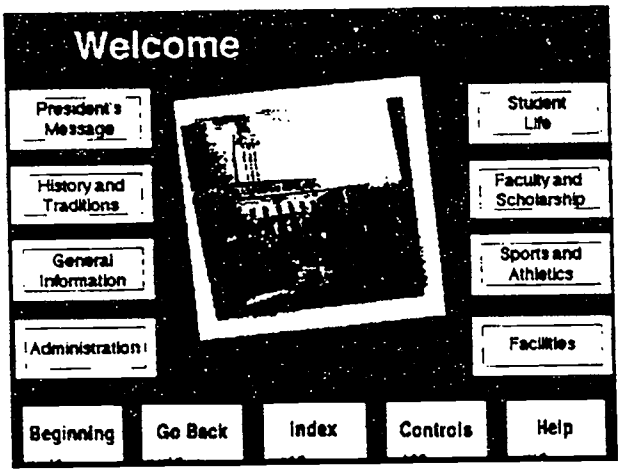
- A multimedia introduction to UT Austin;
- A campus-wide events calendar;
- Interactive campus maps;
- Maps of shuttle bus routes to and from various locations on campus;
- A directory of students/faculty/staff;
- A directory of departments and buildings;
- A directory of scholarships offered by individual UT departments;
- Employment information on campus;
- Links between the events calendar, the directories, and the maps which guide users to the location of the people, places, and events selected (see Figure 1).

Partly funded by a seed grant from Apple Computer, the project is developed by an interdisciplinary team comprised of faculty and staff from across the University. The ultimate objective of Project iTOWER is to use advanced computer technology to create a single point of access for the widest possible array of official University services, and enable people to conduct official business with the University electronically and at their convenience. The first version of the kiosks moves towards this objective by merging three distinct areas of information technology: interactive multimedia, network navigation, and transaction processing. This project incorporates the various characteristics of promotional kiosks, informational kiosks and transactional kiosks. The kiosks developed provide such services as letting students and faculty know what is happening this week on campus, how to find a specific location on campus or locate a particular person. In the future they will also allow students and faculty to purchase football tickets or theater tickets without having to fall in line at the ticket office. They are similar in concept to automated teller machines in that they are publicly available computers linked to a wide-area network and housed in enclosures that protect the equipment from damage or theft. The iTOWER kiosks go beyond ATMs, however, by delivering a broad range of information gathered from a variety of different sources and making that information easily accessible to users through interactive multimedia.

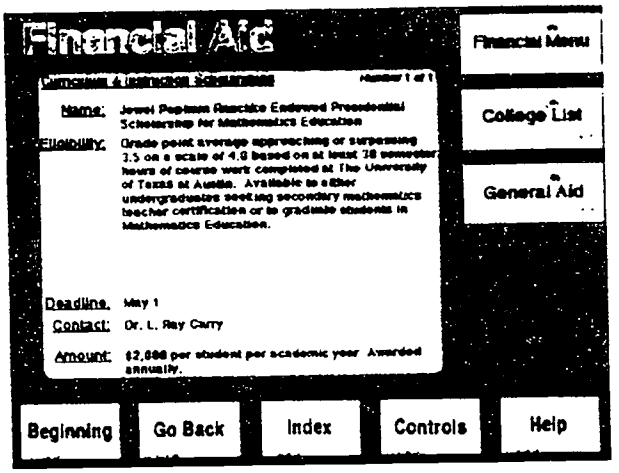
The interactive multimedia elements incorporated into the Kiosks include touch-screen interface, text, color graphics, audio, animation, and full-motion video. The interactive multimedia user interface for the iTOWER Kiosks was designed by an interdisciplinary team employing a variety of techniques. The team began with studying the literature on multimedia design and "hands-on" reviews of other multimedia products. In specific, the team studied other multimedia kiosks and evaluated their advantages and limitations. The overall design principle used in the design and development of the project is termed as "Intuitive Patterns of Interaction" (IPI). The IPI formula used for the iTOWER interface calls for (1) simplicity (e.g. the user is presented with no more than 8 new options[buttons] on any one screen), (2) consistency (e.g. relative button positions and responses to user actions follow the same patterns throughout the system), and (3) functionality-based application of multimedia elements (e.g. audio, video, etc. are not used unless they can be demonstrated to enhance ease of use and communication), and (4) flexibility (e.g. the user is given multiple, dynamic navigation paths and obvious controls to tailor system performance to individual needs). Early versions of the user interface were tested and refined through iterative prototyping cycles of use, feedback, evaluation, and modification. The results of user surveys, focus groups, and public access prototypes helped to refine the system so that it can better serve its users. As a result of these efforts, the first version of Project iTOWER has been made available at five most populous locations on campus. They are available to students, faculty and staff twenty-four hours a day.

Figure 1 depicts some of the screens of the Project iTower (Because of the conversion from full color pictures to the black&white on paper, the qualities of the screen dumps are poor.) The entire kiosk, at this point, contains 817 screens, 28 full-motion video clips accompanied by the audio, and 192 color graphics illustrating various topics. New segments are being added on a continual basis. Some of the distinctive features of the kiosk includes the use of captions. Because a large amount of information is provided through full-motion video, the caption is provided for hearing-impaired people. A user can control the volume of the audio for the video clips. This feature was added as a result of a field test when many users wanted to increase or lower the volume of the audio for a kiosk located at a high traffic area. A user also has the control of stopping the video clips at any time and branching to where she desires. The interactive campus map allows a user to find any buildings on campus regardless the location of a user. For example, if the user stands at the kiosk in the Education building, and she touches "you are here" button, the kiosk will tell the user that she is at the Education building and displays a picture of the building. The user can then touch any other buildings to find out what they are and how to get there. The

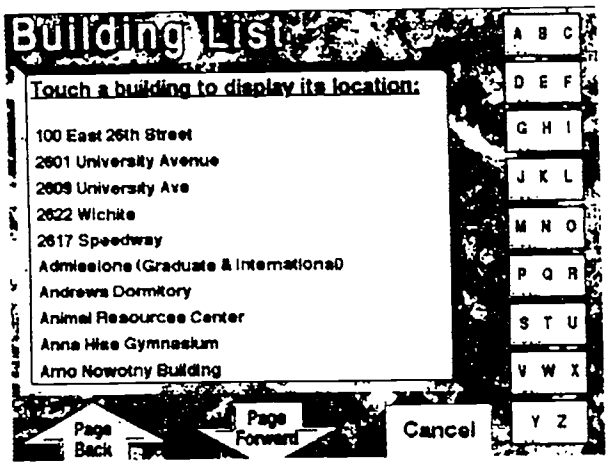
information such as student/faculty/staff directory, scholarships, events calendar, and employment information is linked directly to the university's administrative databases through internet. The information is, therefore, current and can be easily updated. A user can leave the kiosk at any time. When the kiosk is inactive for 1 minute and half, a screen saver about UT campus is invoked and plays until a touch from the next user.



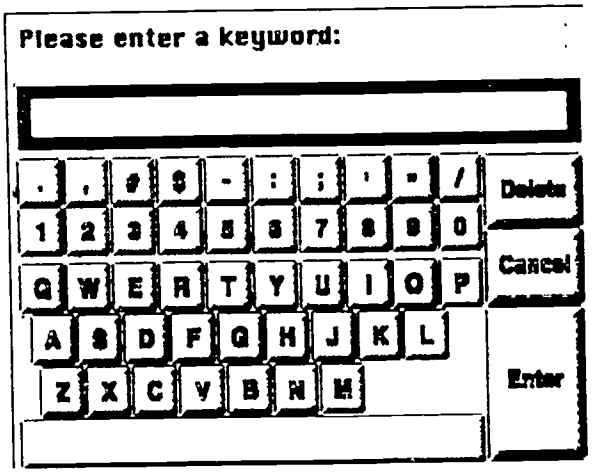
Multimedia introduction to UT



Financial aid information for colleges and programs



Searching various buildings on campus through alphabets



Searching student/faculty information through keyboard

Figure 1. Screens from the Project iTower

4 Results of the Field Evaluation

Since the official installation of the kiosks on campus last August, they have been used by hundreds of students, faculty and visitors. In order to see how the multimedia kiosks can serve their users, we use the following questions to guide our investigation: (1) How do users use such multimedia kiosks? (2) What information are they interested in? (3) What types of media are they interested in? (4) Will they prefer using multimedia kiosks to other forms of delivery systems and why? The data for examination to answer these questions are being obtained through several sources: (1) surveys, (2) on-line data collection, (3) observations, and (4) interviews. These data will provide a wide range of information from different perspectives. In this paper, we will concentrate on reporting the results from the survey data.

4.1 Method

As a part of the investigation, we want to know how students feel about using these multimedia kiosks. To find out, we asked 69 students to use the Project iTOWER system at their own convenience and fill out a questionnaire after the use of the system. This data was collected over a period of one semester. There are fifty female students and nineteen male students. Thirty-four are graduate students who were enrolled in the instructional technology classes in the College of Education and thirty-five are undergraduate students who were seeking teacher certifications and were enrolled in the computer literacy classes. These students were from different colleges on campus, representing eleven different majors and were of different backgrounds ranging from medicine to early childhood education. They were between the ages of twenty and fifty years old. Forty-five of the 69 students were using the kiosk system for the very first time when given this task while the other twenty-three students had used the kiosk in one way or the other previously. The survey questionnaire contains questions on the overall impression, the exact time using the kiosk, and demographic information. It also contains 15 items on a 5-point Likert scale related to the various aspects of the system: navigation/easiness of use, comprehensiveness, usefulness, interface, and future use, with 3 items for each aspect. For each item, students were asked to rate the statement such as "The kiosk is very easy to use," " I like its screen design," or " I would recommend it to other students" with 1 being not true at all and 5 being very true. These items are intended to address the functionality, usability and aesthetics of the system (Laurel, 1990). The higher the rating, the higher they think of the system. Students were also asked to write down all the parts they saw, and answer several open-ended questions such as "Which part of the system do you like the most and why," and "Which part of the system do you like the least and why."

In addition, these students were given the Group Embedded Figure Test (GEFT; Oltman, Raskin, & Witkin, 1971) to determine their learning styles. The GEFT has a score ranged from 0 to 18. A score of 18 indicated high field-independence while a score of 0 reflected high field-dependent. A high field-independent person (FI) tends to approach a problem analytically while a field-dependent person (FD) tends to approach a problem in a more global way. Previous research indicated that FI and FD people employed different learning strategies in accomplishing the same task (Liu & Reed, 1994). The mean score of the GEFT for this group of students was 9.159 and the standard deviation was 5.392. Students whose GEFT scores were one standard deviation below the mean (n=16) were grouped as field-dependent students. Students whose GEFT scores were one standard deviation above the mean (n=18) were grouped as field-independent students. Those students whose scores fell in between were grouped as field-mixed (n=35).

4.2 Results and Discussion

The results indicated that 25 % of the students used the system in the mornings (before 12:00 noon; n = 17), 50 % used in the afternoons (between 12 noon - 5:00 pm; n = 35), and 25 % used in the evenings (after 5:00 pm; n = 17). These students were told that they could use the system as long as they wanted. The average time for using the system was 19. 25 minutes. Some used it only for a few minutes and others used it for as long as 1 hour 50 minutes (minimum = 1 minute, and maximum = 109 minutes).

The overall impression of the system was 3.97 on a 5-point Likert scale. The most frequently accessed information by the students includes the campus maps, maps of shuttle bus routes, stories about the University through the videos and animation, and the financial aid information (presented in text). The parts that were liked the most include the video stories about the University and the interactive campus maps. The most common reasons cited were liking the multimedia aspects (especially video, audio and animation) and having fun.

It is interesting to note that field-dependent students gave higher ratings of the navigation features of this kiosk than the field-independent students. The difference in the responses between the two groups was statistically significant ($p < .05$; $Mean_{FD} = 4.44$, $Mean_{FI}=3.94$). The items on the navigation features in the questionnaire addressed how easy it was to use the system, how easy it was to access the information and how easy it was to get lost while using the kiosk. This kiosk contains a large amount of visual materials including audio, video and graphics. The higher ratings by FD students indicated that this highly visual and graphical kiosk appeals to FD people more than the FI people. FD students felt that they could navigate through the system more easily without getting lost. The result supports other research findings which state that the field-dependent and field-independent people access information differently. Field-dependent people rely more on the video and graphical information when they are given the control while field-independent people prefer more textual information (Liu & Reed, 1994).

The results indicated that the ratings by the first-time users were consistently higher than those by non first-time users. Their higher ratings were reflected in the overall ratings of the system: Navigation/Easiness of Use, $Mean_{FirstTime} = 4.2$, $Mean_{NonFirstTime} = 4.0$, $P = .098$; Comprehensiveness, $Mean_{FirstTime} = 4.1$,

$Mean_{NonFirstTime}$ = 3.6, P < .01; Usefulness, $Mean_{FirstTime}$ = 3.9, $Mean_{NonFirstTime}$ = 3.4, P <. 05; User Interface, $Mean_{FirstTime}$ = 4.3. $Mean_{NonFirstTime}$ = 3.6, P < .01. Their higher ratings were also reflected through statistical significance in such individual items as the screen design, easy-to-use, the educational value of the system and the adequate amount of information. In terms of whether they would use or recommend the use of the kiosk system, the responses from the first time users and non first time users were not statistically different.

The undergraduate students participating in this study gave consistently higher ratings than the graduate students: Comprehensiveness, $Mean_{grad}$ = 3.71, $Mean_{undergrad}$ = 4.17, P < .01; Usefulness, $Mean_{grad}$ = 3.53, $Mean_{undergrad}$ = 3.9 P = .065; User Interface, $Mean_{grad}$ = 3.79, $Mean_{undergrad}$ = 4.37, P < .01. The ratings by undergraduates and graduates as to whether they would use the system in future were similar: Future use, $Mean_{grad}$ = 3.31, $Mean_{undergrad}$ = 3.26, P = .82. Their higher ratings also showed in the individual items such as easy-to-use, easy-to-access, adequate amount of information, educational value, and screen design.

The background information showed that the graduate students in this study had more experience with computers than the undergraduates. Some undergraduates are new to the computer technology and many of them are new to the interactive multimedia. To most of them, this is the first time to be exposed to a large scale multimedia product. On the one hand, it is encouraging to see that novice users found the kiosk system easy to use and appealing which was one of the goals of the project iTower. On the other hand, it is also important to point out that more experienced users tend to be more critical in evaluation. The result on first-time users vs non first-times has also indicated that first-time users of such multimedia systems are likely to be impressed by the various media components and the use of the state-of-art technology, while non first-time users are likely to be more critical in their judgment of the technology and the systems. It is, therefore, important to realize that an effective multimedia system should not only meet the needs of its novice users, but also stand the challenges from the experienced users.

It was also found that female students rated the usefulness of the kiosk significantly higher than the male students: Usefulness, $Mean_{male}$ = 3.37, $Mean_{female}$ = 3.9 P <.05. When they were asked whether they would recommend the use of this kiosk to their peers, the responses from female students were different from the male students. More female students would recommend the use of this system to fellow students while fewer male students would do the same ($Mean_{male}$ = 3.26, $Mean_{female}$ = 3.92). The difference between the female and male students' responses was significantly different (p <.05).

These results helped us to understand how users access such a system and their needs. Their feedback served as a basis for further revisions and improvements of the system. For example, upon students' suggestions, audio volume controls were added to each video clip so that users had more control as discussed in section 3 above. Currently, on-line data collection is taking plac at each kiosk workstation, which generates a significant amount of user data. This data is being analyzed. Together they will provide more information of how to design a multimedia kiosk more effectively.

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