Capital Metro Kiosk Interface Project

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ABSTRACT

This paper focuses on the development of an interactive kiosk interface system to assist Capital Metro and its users. The central goal of the system proposes to help bus riders navigate the bus system in a dynamic and user-friendly way. In order to do this, we researched Capital Metro's current system, the demographic statistics of commuters, and we looked into other transit systems. We conducted Card Sorting experiments to learn how users tend to think about bus kiosk concepts. We used the results to form the initial prototype and to develop an interactive Trip Planner. We anticipate conducting Usability Testing to get feedback on our design. We also propose further developments to the kiosk interface and system.

Categories and Subject Descriptors

H.5.2 [**Information Interfaces and Presentation**]: User Interfaces - Input Devices and Strategies

General Terms

Documentation, Performance, Design, Experimentation, Human Factors.

Keywords

Capital Metro, kiosk, interface, trip planner, interactive system, prototype, transit systems, real-time information.

1. INTRODUCTION

How users access bus route and time information is in a current state of renovation. With the advent of such technologies as wireless internet and interactive mapping, installing interactive kiosks at bus stops is an increasing trend among transportation service systems in the United States. Kiosks provide greater options for bus riders in terms of accessibility, providing information, and even allowing users to buy tickets before boarding a bus. The city of Austin's public transportation system, Capital Metro, does not currently employ the use of kiosks at bus stops. This project aims to develop a prototype of an interactive kiosk interface for Capital Metro and its users.

In order to do this, we first identified problems with the current methods that Capital Metro uses to disseminate bus and time information. We studied the demographics of the Austin bus riders. Furthermore, we looked at kiosks already in use to determine the features and current trends, and we investigated how a kiosk system would benefit Capital Metro and its users.

In order to develop the kiosk interface, we conducted a series of Card Sorting experiments that helped determine how users perceive transit and kiosk interface terminology. From the results we developed an interface layout and look for the kiosk. We also developed an interactive trip planner using current technology from Google Maps. While we have not had the opportunity to test the interface design and trip planner, we plan to conduct Usability Testing in the near future. We have developed a list of recommendations for future capabilities of the kiosk interface and the system as a whole.

2. PROBLEM DESCRIPTION

Currently, Capital Metro provides a printed catalog with route information which highlights only major stops. This version does not provide geographical context, which would be easily fixable if a map of Austin was overlaid with depictions of the routes. On the Internet, Capital Metro does have a simple trip planner but only provides PDF files of their printed catalog for download. Most recently, they have partnered with Google Transit to provide interactive bus route maps. This partnership is not well displayed on their Web site and is not integrated with the other Capital Metro information channels. Capital Metro could improve their users' experience by developing a more comprehensive bus route guide. In order to accomplish this goal, we developed a prototype design that communicates detailed and interactive bus route information.

Furthermore, we realized that kiosks could help us accomplish our proposed goals. Kiosk systems "are computer terminals open to the public" [1]. They can provide complete bus route information in a dynamic setting that is accessible to the self-reliant traveler. By taking out interactive prototype and developing it for a kiosk system, commuters would be able to access this information regardless of their technological experience. Moreover, a kiosk could provide a number of innovative and adaptive services that Capital Metro is not currently able to offer its users.

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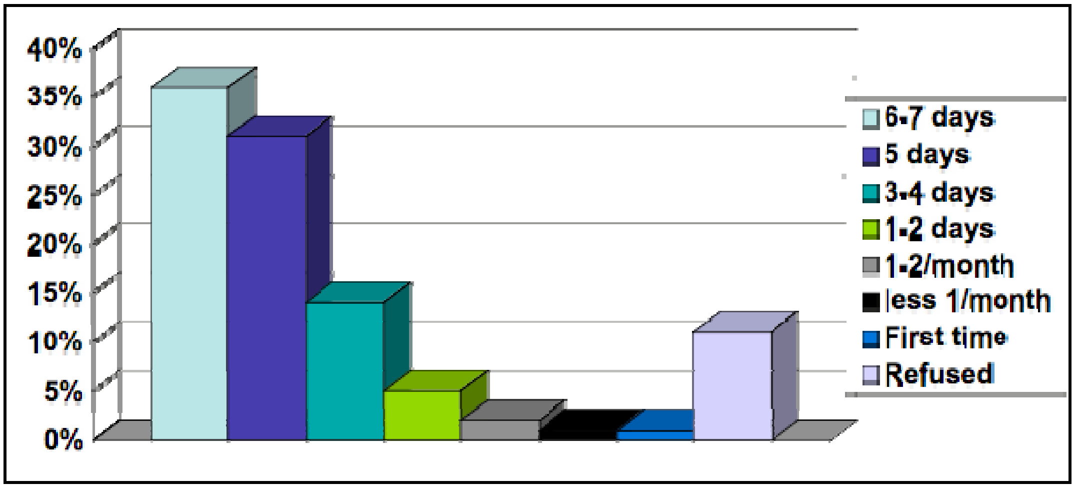

Chart 1: Capital Metro Bus Usage Frequency

3. COMMUTER INFORMATION & STATISTICS

Investigations regarding commuters who currently use the system generate insight into the stakeholders and users of the Capital Metro bus system. Stakeholders include Austin citizens, Capital Metro and the students, faculty and other professionals of the University of Texas at Austin. Users, Austin citizens who take advantage of metro services, are more specifically defined in a 2005 Capital Metro Origin and Destination Study [2]. Creative Consumer Research was hired to gather data for this survey (Capital Metro, 2005). They collected 20,449 surveys from October 5th through November 5th, 2005 and from November 29th through December 10th. They based the sampling plan on a 90% confidence level with a 5% margin for error [2].

The demographic data that Capital Metro found includes: 36% of commuters surveyed ride the bus 6-7 days a week, 31% ride 5 times a week, 14% ride 3-4 days per week and 5% ride Capital Metro at least 1-2 days per week (see Chart 1); about 50% of riders pay the adult fare; 37% pay the student fare; 9% either pay the senior rate, disabled rate, or refused to say [2]. 80% of the population prefers to speak English at home and 11% speak Spanish. The largest group of participants in the demographic study (35%) has lived in Austin for 7 years or more. The most common origins and destinations were "home" and "College/University". The majority of riders (61%) were between the ages of 19-25 [2].

4. RELEVANCE: An analysis of nationwide trends, examples and ACM studies

The majority of literature and research trends are project based and therefore this section will take a look at specific examples. The trend of kiosks in transportation services argues for its credibility. Other examples and ACM studies not only support the significance of a kiosk system, but also provide ideas and features to think about as we continue to re-develop our model.

According to the Distribution of Traveler Information Via Kiosks survey in 2004 from the Intelligent Transportation System's (ITS) Deployment Statistics, transit authorities in California, North Dakota, New York, North Carolina, Vermont, Delaware, Utah, South Dakota, Montana, and Colorado all provide public information kiosks for travelers [6]. In 2005, ITS released another survey and found that 17 major cities in the US use kiosks to provide real time transit schedules [12]. Kiosks development in the public transportation sector is growing.

The Phoenix study put together a cost analysis on making and implementing kiosk designs. These kiosks were supplied with a touch screen interface, an audio system and built-in printers. The total cost for initializing the system came to $459,732 for 25 outdoor and three indoor kiosks [13].

San Antonio, not unlike Austin, has experienced an increasing population and an increasing travel demand. The kiosks "provide information on incidents and congestion on the freeway network, transit schedules and fares, as well as navigational assistance" [3].

For the 1996 Olympic games, IBM designed a sophisticated and user-friendly kiosk network. IBM developed kiosks to share up to the minute information with over 3 million visitors [10]. Atlanta had 130 touch screen kiosks placed around the city in train stations, bus stations, visitor centers, hotels, airports and shopping malls. [10]. The kiosks offered visitors to the city information on "current traffic data, vehicle routes and public transportation schedules in multiple languages as well as tourist information, Olympic schedules and weather forecasts." The colorful screen displays include maps of the area. [10]. The project, also known as the Traveler Information Showcase, is "part of a national move toward Intelligent Transportation Systems (ITS) that use state of the art technology to improve transportation" [10].

We looked into specific ways to improve kiosks for the user. The following studies published by ACM focus on kiosk improvements and user studies implemented. The papers help guide our design choices for our prototype, influencing what directions we may want the kiosks to take in the future.

Getting it Across, for example, examines layout options. The authors Jan Borchers, et al. argue that "the success of [kiosk] systems depends largely on the attractiveness of their user interface, how easily they allow access to information or transactions for an anonymous, constantly varying group of users, with typically short dialogue times and a simple interface" [1]. The kiosk is a public system open to users of all skill levels, and so the system needs to be clear for users with all levels of experience. The authors drew their guidelines for the layout from areas such as Gestalt psychology, which interprets how viewers perceive images and objects, and other areas like "conventional typography (and) human computer interaction" [1]. Another paper, *Development of an Information Kiosk with a Sign Recognition System*, studies how to make a kiosk design

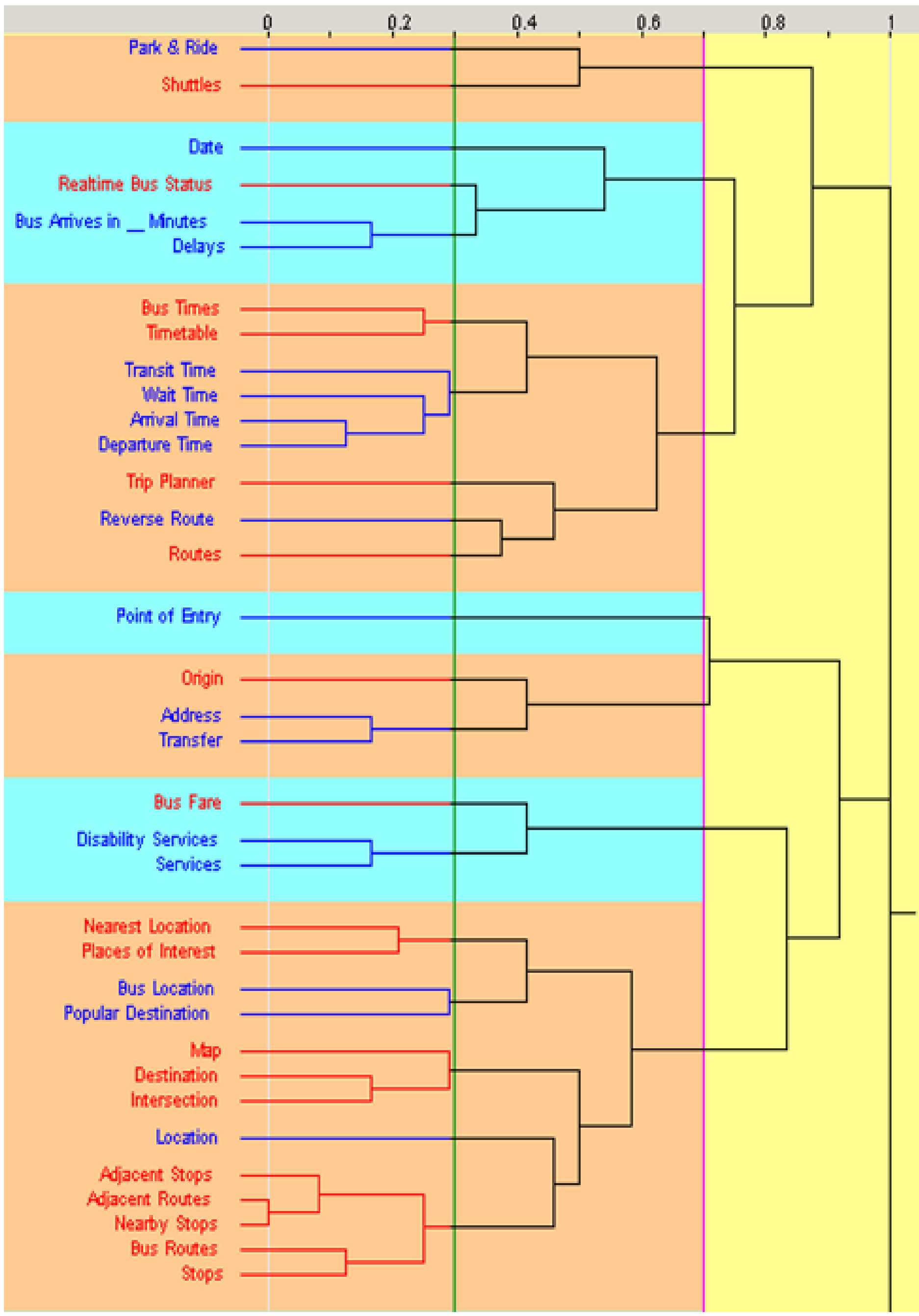

Figure 1: EZSort Chart

accessible to deaf users, through a system with built-in Japanese Sign Language recognition that specifically recognizes gestures. The aim of the paper is to show results from the prototype model and from user testing. They tested the kiosk in the Isahaya city office in Nagasaki prefecture for three months. [11]. They surveyed reactions from 27 users, 9 of which were hearing impaired. They found that 23 of the users "answered that this kind of system was necessary in the world, and 20 of them said the kiosk was usable" [11].

By taking these examples into consideration, we hope to emulate the user focus that they describe and perhaps even incorporate some of their innovative suggestions into a future model.

5. BENEFITS OF SYSTEM

Benefits of our design to Austin commuters include a more user-friendly bus information system. Users will no longer have to rely only on the Web site or printed route maps. These information sources do not always provide geographic context nor do they list all major stops on the routes. However, kiosks located at major bus stops will provide greater access to more thorough information. The users will not only see bus times and schedules, but also whether they missed a bus, which bus it was, and when the next one will come. Travelers could use the trip planner to find out traffic updates and print a detailed route map. Further development plans include implementing features for the handicapped, such as the hearing impaired, and will be discussed in more detail in a later section.

6. CARD SORTING

Because we decided to develop our own kiosk interface model, we felt that Card Sorting would be an apt method to help us determine how to lay out our interface. The purpose of Card Sorting is to gain insight into how the participant understands the terminology that will be used in the design of the product. In order to conduct Card Sorting, we first came up with a list of 58 terms and phrases that were related to the kiosk interface we were developing. Some of the terms, such as "Bus Routes," and "Timetable," were taken from bus transit terminology. Others, such as "Start Over," and "Help," were taken from kiosk and Web site terminologies. We printed each term or phrase onto an individual note card. Each of us took an identical stack of cards and a Card Sorting script and set out to find participants who belonged in the group of predefined users.

6.1 Conducting Card Sorting

Participants were asked to sort the cards into piles according to what made sense to them, and then to place a yellow Post-It on what they did not understand. After the cards were sorted into piles, users were asked to label the piles with a blue Post-It note. They were then asked to group piles together without moving any cards, and if possible label the super-group with a pink Post-It note. Lastly, they were asked if they could create any larger groups and label them with green Post-It notes.

6.2 Results and Analysis of Card Sorting

In order to analyze the card sorting data, the results of each experiment was entered into a spreadsheet and then into IBM's EZSort software. Using cluster analysis, EZSort produced a number of charts showing how the participants grouped the terms (see Figure 1). The closer the joining lines are to zero, the stronger the correlation of the terms. As the image shows, "Park & Ride" and "Shuttles" were often grouped together, but their grouping was not as strong as that of "Bus Arrives in _ Minutes" and "Delays" neither of which are as strong as the grouping of "Adjacent Routes" and "Nearby Stops." From this information, we were able to see how users thought about transit and kiosk navigation information. We were also able to determine what would be needed, both in terms of labels and navigation, to best assist a user who was trying to find information at a bus kiosk. We were surprised to discover that card sorters generally did not group Capital Metro and kiosk services, expressed by terms like "Purchase Tickets" and "Park & Ride," with Capital Metro and Kiosk information, with terms like "About Capital Metro" and "FAQ."

The spreadsheets were also consulted to see what terms users did not understand and what labels they came up with for their groups. The one term that nearly all evaluators had difficulty with was, "Point of Entry." Labels that participants came up with for their groups of transit terms included, "Route Information," "Services," and "Trip Planning." Labels that participants came up with for the kiosk and Web site terminology included, "Commands" and "Actions." From this we were able to extrapolate two things. First, card sorters understood which terms were linked to using a kiosk interface and which terms led to discovering information. Second, we were able to determine which terms future users might not understand; therefore we avoided those terms when we planned our interface.

7. CREATING THE INTERFACE

The interface was created in two parts. The first part was concerned with the layout and look of the screens of the kiosk. The second part was developing the Interactive Trip Planner.

7.1 The Layout & Look

Based on the results and analysis of the Card Sorting data, as mentioned above, we came up with the layout and look of the kiosk. First, by seeing how participants grouped the transit information and the labels they used, we were able to come up with a basic site map for the kiosk interface (see Figure 2). As can be seen by Figure 2, we used a mixture of terminology and labels from the Card Sorting, as well as a few labels that we came up with based on the EZSort results, such as "Tourist Information."

After developing the site map, we created the look of the kiosk interface. In order to do this, we created a design in Adobe Photoshop using the color scheme from the Capital Metro Web site, to maintain consistency (see Figure 3). We purposefully made the text and buttons as large as possible; users will interact with the kiosk through a touch screen and therefore large buttons will add a visual constraint to help prevent mistakes by users. For this iteration, we decided on a side-by-side design because it grouped the information both vertically and horizontally. The internal pages of the interface have the same two-by-two layout and pick up on the color scheme of the top level menu item that they were linked from. Furthermore, pages containing a high density of text have large up and down buttons to ease the use of scrolling through the information.

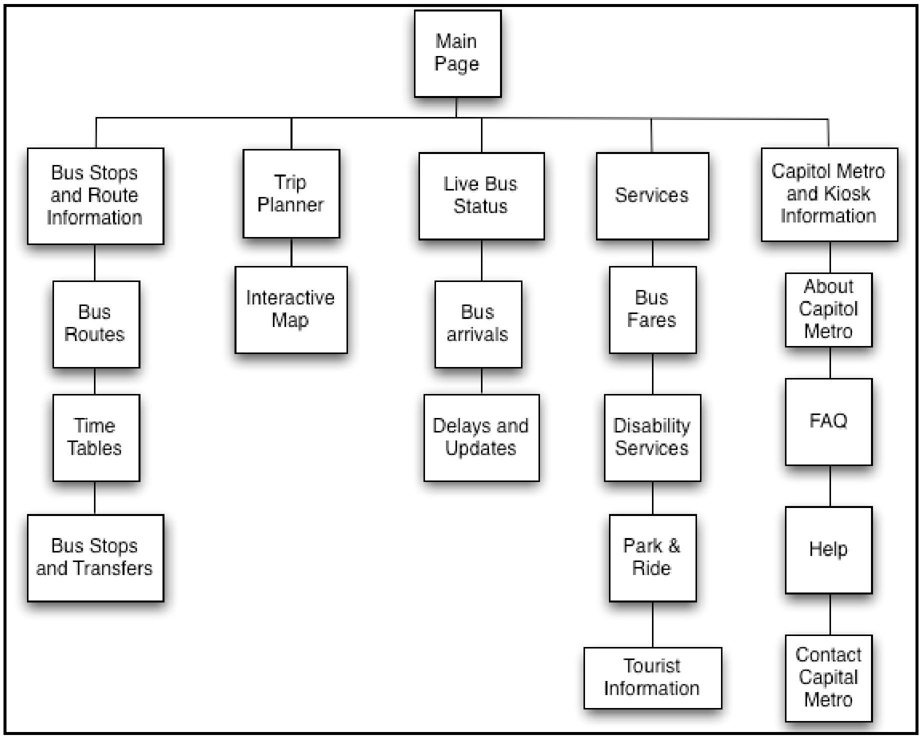

Figure 2: Site Map of the Kiosk Interface

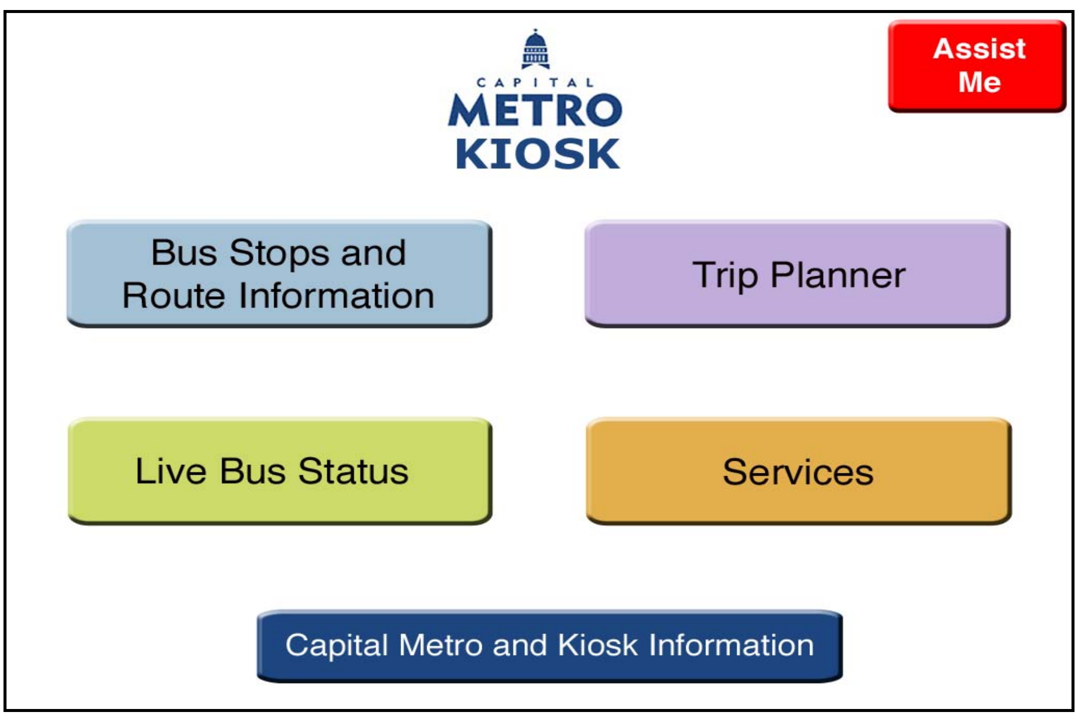

Figure 3: Start Page of Kiosk Interface

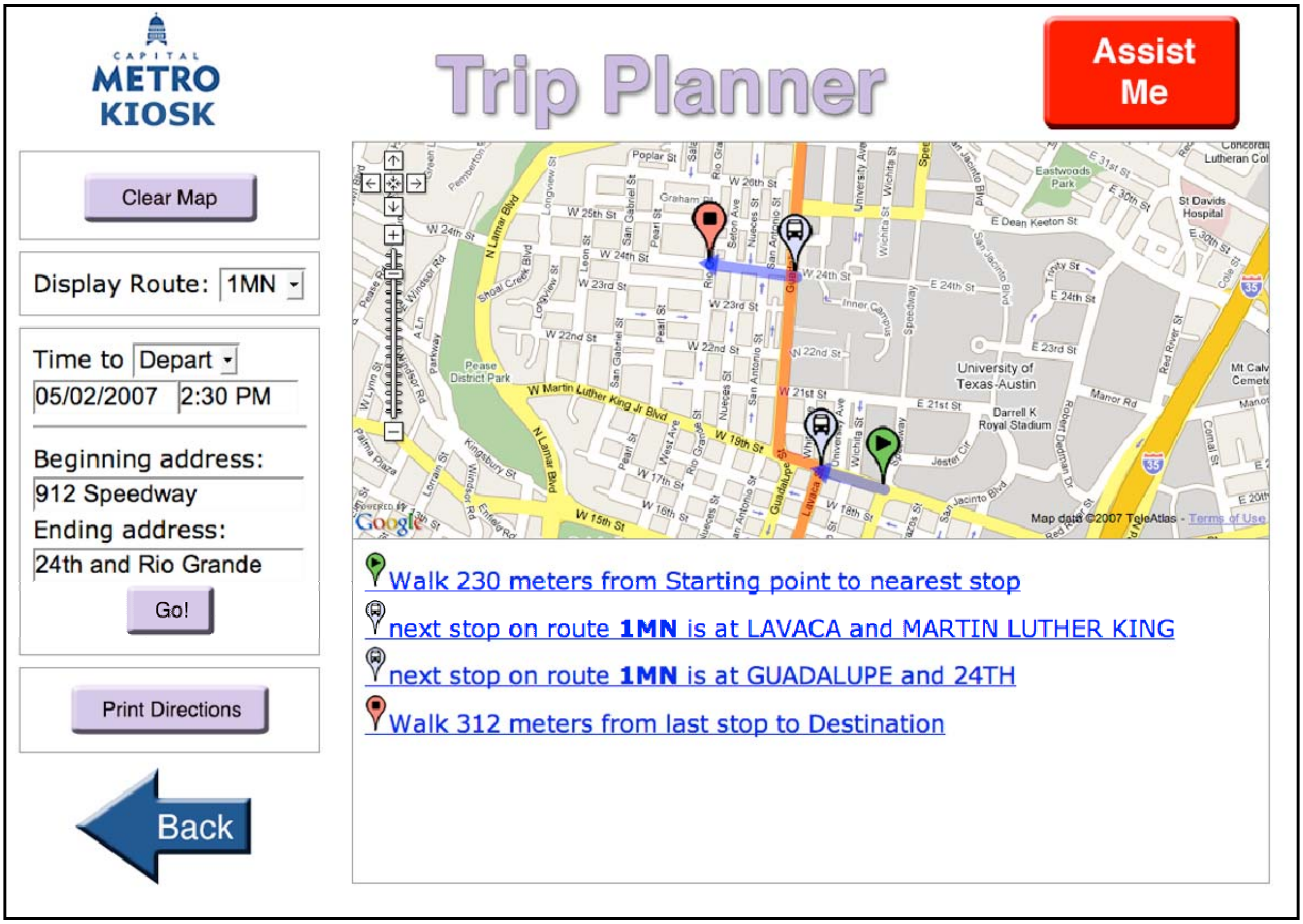

Figure 4: Interactive Trip Planer

7.2 The System

The Interactive Trip Planner is based jointly on the AJAX (Asynchronous JavaScript) and XML method of creating interactive web applications, and the Google Maps open API (Application Programming Interface), which allows for a high level of user interactivity and ample freedom in the presentation of information. The Google Maps API allows for the input of any GIS type data, including latitude/longitude pairs, and street addresses, and overlays this information graphically on an interactive Google map. The style, composition, and representation of the overlays are completely customizable. The AJAX philosophy of web application design allows for small bits of data to be shared between the server and client when refreshing parts of the interface without necessarily having to refresh everything. These processes allows for faster request times and quicker refresh rates. This aspect alone makes rich interactive web applications usable and dynamic to the user's input. These two qualities, the Google Maps' open API, and the dynamic and quick nature of AJAX programming, forms the cornerstone of our group's Interactive Trip Planner.

At the heart of our Interactive Trip planner is the client-server model of communication. The client, a kiosk with Internet connectivity and a web browser, sends requests to a central server that contains the information. The server includes a database containing route points, intersection coordinates, points of interest, and other collections of information. Layers of scripting languages, such as PHP, and JavaScript receive the client's requests and transform the raw database information into useful XML documents. These XML documents are received by the client and then transformed into overlays such as bus stops, route paths, and arrows communication direction, by using the Google Maps' API. The entire process of query, response and graphical transformation is very quick and can be done many times without the need of reloading the entire session.

There are three ways for a user to send a request to the server. The first involves the use of a text box in the kiosk navigation menu screen, allowing for keyboard input of a beginning and a destination address. Once the user sends the request via the "Go!" button the client will request an address to coordinates using the Google Maps API to convert the addresses into beginning and ending latitude and longitude number pairs. Once the client receives the information from Google Maps, these pairs of numbers are then submitted to the server by way of a PHP script. The second method involves the direct touching of the kiosk map screen to indicate a beginning point and a destination point. The process of submitting the latitude and longitude sets to the server is similar as the former method. Likewise, a mixture of both input forms can be achieved. Once the beginning and destination points are set and the information is overlaid onto the map, a user can click on either the beginning or destination point, choose to delete that point and then reset it to a new place on the map. Any information that has already appeared on the map, such as overlays, routes, and directions, and not including the opposite of the beginning and end point pair, will be erased and recreated appropriately with the new set. Additionally, a user can request the display of a particular bus route by using a drop down menu. Only the overlay of the route, and no additional points, is displayed to the user in this action.

A user will be able to print the given route information directly from the kiosk. The printed route information would be similar to the information shown on the kiosk screen. This information would include: which bus stops are closest to the start and the destination points, the routes to be taken, the potential transfer spots, as well as additional information as the prototype evolves. This information will be relayed in chronological order to the user.

The directions shown on the kiosk screen are clickable, meaning that a user can click on any element of the directions shown, and the client will automatically pan and center on that specific spot on the map. This feature gives context to the information and shows relative distance to all elements of the direction set. Additional features, such as zoom and pan are built directly into the Google Map and can be achieved through their controls.

8. ANTICIPATED TESTING

8.1 Anticipated Usability Testing

We will test the interface prototype by conducting a number of Usability Tests. Users will be asked to participate in testing that will help analyze the success of our initial design. Researchers will explain to the evaluator that testing is directed to evaluate the prototype and not them. Usability testing will take place in the School of Information's IX Lab. After signing a consent form and receiving instructions the Usability Testing will begin. The user will be asked to perform a set of tasks while giving commentary on what they are doing. In order to develop a deep and narrow prototype, we will assign the evaluator 6 specific tasks to test, rather than allowing them to randomly explore the system. These tests will range from "Click the Reset Button" to "Find out what bus to take to get from 2402 Rio Grande to Cesar Chavez and Congress." The tasks will be separated according to difficulty. Evaluators will be divided into two different groups, while conducting their tasks independently. Both groups will be assigned alternating tasks ranging in difficulty and always progressing from easier to harder. Researchers will be videotaping the interview as well as keeping notes on the evaluator's step-by-step actions and commentary. At the end of testing researchers will conduct a post-interview. We will ask the evaluator to clarify any questions he or she had about his or her experience with the prototype. The evaluator will also be asked to fill out a post-questionnaire based on their experience.

8.2 Anticipated Usability Testing Analysis

Although we have not yet performed actual Usability Testing, initial reactions to the kiosk interface are positive. Anticipated results will be based on quantitative and qualitative measures. Touch click logs will be analyzed in order to understand how easy or how hard a task was to perform. We will run ANOVA tests on the data from both the click logs and the post-questionnaires from both groups of users. This testing will determine how significant the learning curve is. We will reject the null hypothesis if our data is .05 statistically significant. To interpret qualitative measures, the evaluator's comments and non-verbal expression, interview notes, and open-ended questions from the post-questionnaire will all be used to analyze the user's personal reaction to the prototype. This information will be coded based on a Likert scale of 1 to 7 to interpret how the user felt the prototype performed, from its weakest to its strongest level of performance. This data will also tell the researchers what the evaluators liked and disliked about the interface. All of this information will aid in the iterative design method that will evolve into a more user-friendly system.

8.3 Other possible testing

Further recommended testing includes reliability testing in a high-traffic/volume setting. During the high traffic testing, the system will be exposed to a high volume of use ranging from 100-150 interactions in a 24-hour period. The tasks will include using functions the system will be expected to perform on a daily basis. This testing will help researchers evaluate the prototype's ability to perform in a simulated real life setting and monitor its performance outside of a controlled lab. High traffic testing will help researchers gather information on the system's weaknesses and strengths when exposed to a high amount of usage.

9. FUTURE IDEAS FOR DEVELOPMENT

In developing this project we have come up with a number of ideas for future developments, such as accessibility for non-English speakers as well as for the handicapped and potential physical features of the kiosk.

9.1 Special Needs

Users have special needs and we plan to address those needs by providing a variety of services.

9.1.1 Additional Languages

With the option to access information in languages that represent our demographic. Based on the Capital Metro 2005 Origin and Destination Study 28% of patrons are Hispanic, of which 11% prefer to speak Spanish at home. As revealed in the Olympic Message System kiosk project (OMS) [8] there is neither a universal user nor a universal language. Researchers found that the system's QWERTY keyboard and number pads did not reflect the structure of multiple languages. Non-English speaking users found it difficult to adapt to a system that did not culturally "translate." When asked to enter their names, users from Eastern and Middle Eastern countries did not understand what order to type in: this was a cultural divide. Not every OMS user was familiar with English nor its alphabet which made it difficult to request or understand information. Some Olympians had to refer to their name badges to learn how their names were spelled in English characters to retrieve and send messages.

Our bilingual component will enable Spanish speakers to access information in a format that correlates to the language structure. For example, to request information on how to reach "5th Street" users will enter "Calle 5." Not only does this feature translate the command it also differentiates the order in which words are spoken in these two languages. In Spanish, the noun "Calle" precedes the adjective "5" unlike in English. This linguistic tweak is necessary in order for the kiosk and the user to communicate.

9.1.2 Users with Disabilities

Capital Metro adheres to the Americans with Disabilities Act, and our kiosk design will as well. It is important to respond to the needs of the handicap. We plan to integrate a sign language recognition feature as implemented in the Japanese kiosk project in Nagasaki [11]. This would afford special needs users the ability to access information in a manner that is specifically tailored to their needs. We will introduce a component that will recognize American Sign Language. Different users require different means of communication and our goal is for the kiosk to be accessible to all potential users.

Vision impaired users also have unique needs. We recommend the development of a voice-activated feature that will provide the same information that is available to all of its users. Another anticipated element is an "enlarge text" option specifically for users with some but limited visual ability. This tool will make information on the interface easier to read, for example tabs and arrows will be bigger in size than on the standard interface.

9.2 Physical Kiosk Features

Users will also be able to request updates from Capital Metro by using the kiosk. Utilizing a touch screen keypad patrons will be able to sign up to receive email from Capital Metro. These messages will alert users of bus route changes and new bus routes, changes to existing services such as fare rates and temporary delays, such as those due to detours. In regards to the physical structure of the prototype we plan to extend the body of the kiosk so that it not only features the interface but also a flat screen monitor above eye level. This monitor will alert users as to the proximity of approaching buses. The monitor will also inform users of which buses departed within a 10-minute range. This monitor will have a scrolling news ticker running across the bottom of the screen and will communicate news headlines and weather alerts. This monitor will keep users aware of up-to-the-minute bus travel and current affairs.

Printing is another option that could be available with a kiosk system. This can be utilized in two ways. First, as mentioned above, a user could have the option of printing out the results from the interactive Trip Planner. Second, a method of ticket purchasing could be added so that users could buy and print tickets before the bus arrives.

In terms of safety we plan to add a "panic" button. This button will emit a piercing sound scaring off potential attackers and alerting bystanders. Upon activation Capital Metro Security Division will be immediately notified. In the event the alarm is set off along the University of Texas campus parameter, both UT Campus Police and Capital Metro will be alerted.

10. CONCLUSION

Capital Metro presently employs resources that include: printed route maps, a PDF map on their Web site and an interactive map, through Google Transit. Capital Metro has not yet put into practice a kiosk system that could facilitate the dispersal of precise information, for all potential commuters, in a dynamic format. We researched the practices of other transportation organizations and looked at scholarly papers and articles discussing kiosk designs to gather ideas to outline a kiosk interface for Capital Metro. We used Card Sorting as a tool for our screen layout; through testing users we gained insight into how bus riders categorize transit information. We used this data to determine how we grouped information on our kiosk touch screen. We fashioned an interactive trip planner through Google's API resources. Thus far initial reactions have been positive. We plan to test the prototype for thorough feedback in the near future to improve the model and its maneuverability for users. Our research generated further ideas and features to execute, including a multilingual mechanism and aids for the handicapped.

11. ACKNOWLEDGMENTS

Misty Whited, a Public Relations specialist from Capital Metro, provided our team with the results of an internal study on Capital Metro demographics. She is our liaison within Capital Metro and released this information as per their open policy on public information. Mr. Van Sutherland, GIS Coordinator for the Capital Metro Transportation Authority, provided our team access to Capital Metro GIS (Graphic Information System) data, on bus routes, bus stops, and coverage as per their public policy.

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