SmarTrav: A Digital handheld device for travelers

John Chang

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Rochester Institute of Technology

A Thesis Submitted to the Faculty of
The College of Imaging Arts and Sciences
In Candidacy for the Degree of
Master of Fine Arts

SmarTrav

A Digital Handheld Device for Travelers

By

John Yi-Chiang Chang
July 2001
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Date 3/15/2002
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CHAPTER 1

INTRODUCTION

The Problem

My family loves to travel. We have been to most of the cities in Taiwan (Where I am from). We had a long trip to the east coast of Canada and Nova Scotia in the summer of '99. In the summer of 2000, we went to some of the countries in Europe. During these trips we sometimes found it hard to get the local tourist information and also we had language problems in some of the countries in Europe, such as France and Spain.

I started to think about a device that could help travelers to get the information they need easily, and provide different types of aid to the travelers. This was the original concept my thesis.

Local Information

When the travelers go to a region which they are not familiar with, they will need to get the information of the specific region. That will include maps and transportation schedules. Also, they will need tourist information such as where to eat, stay, rent a car, and find the points of scenic interest in that region, as well as local customs practices, currencies, laws and regulations.

Reservations

It would ruin the whole plan if the travelers could not book the hotel to stay in or the flight to
go home. So to book these reservations is very essential for the travelers.

Positioning and Languages

It is also important for the travelers to know where exactly they are so that they will not get lost. When traveling in a region where they do not speak the language, communication could be a problem too.

Personal Communications

It would be good if the travelers had a device such as a cellular phone to communicate with other people. In case of emergencies, this could be a big help. This kind of device is also a very effective tool to keep in touch with family as well as business.

Memories

During the journey, most travelers like to keep memories. They take pictures, make recordings, write in a diary, or shoot videos. These media can capture moments and turn them into lasting memories.

Entertainment

Sometimes it takes a long time to travel from one place to another. It would be good if the travelers could have entertainment while making the trip. It could be music, video, books or games.
This thesis is about developing a solution to all these problems. The final solution will be a digital device which is small, light, easy to be carried, and has the functions to provide the travelers a better and more convenient way to enjoy their trips.

Analysis and Research

Software

I searched on the internet for similar products that already exist. While I found no products that can do things like this at this moment, there are many travel related software programs available on the internet and conventional market for the Palm Pilot\textsuperscript{1}, which is the most similar product to my concept. Palm Pilot users can download or purchase these programs and install them into their Palm Pilots to make them a helpful tool for traveling.

To understand how these programs work, I found a Palm OS web site\textsuperscript{2} which is designed for the Palm software developers. I joined the developer’s program and downloaded a Palm Pilot emulator which can run and test the palm software on the desktop computer. I also downloaded some of the programs in different categories, and ran them on the emulator to see what the functions were and how the user interfaces were designed. These categories included maps, flight checking and booking, currencies and travel plans (See Fig. 1 and Fig. 2).

\footnote{1 Palm Pilot, a type of PDA, (Personal Digital assistant). A tiny, fully functional computer that you can hold in one hand.}
\footnote{2 Palm INC. \textit{Welcome to Palm OS}, <http://www.palmos.com/>. 2001.}
Fig. 1. The Palm™ Emulator running a currency calculating software
Hardware

There are also many existing accessories which could be added on a Palm Pilot to make it more powerful, such as a GPS\(^1\) receiver, wireless access devices and digital cameras. The disadvantage is that you can add only one accessory on the Palm Pilot at a time.

Carrying several different accessories along on the trip is inconvenient for the travelers, so to design an all-in-one device would be a good solution to the problem.

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\(^1\) GPS, Global Positioning System: A navigational system using satellite signals to fix the location of a receiver on or above the earth's surface.
For the proper data storage system, I searched over the internet and magazines. I found several products that might fit in with the design. One of these products, called DataPlay™, really attracted my attention. Because of its ideal compact size, high volume data space and reasonable price range, I decided to choose this product to be the final solution of the storage system (See Fig. 3).

Fig. 3. The DataPlay™ digital media. Graphics by DataPlay™ INC.

Hand-held digital devices have become a part of everyday life. They are as common and indispensable as desktop computers. This has brought with it increased public concern over health and safety issues. These issues include driving safety and potentially dangerous exposure to radio frequency radiation. The final solution should be concerned with these issues.
CHAPTER 2

CONCEPT DEVELOPMENT

Goals

At the beginning of the development for this thesis project, I started with giving the goals of the design. The goal of the design is to develop the functions, appearance, and the ergonomic user interface of the device including the accessories.

Functions

To develop the functions of this device, I tried to simulate using this device for making a trip. I sorted the functions by three stages: Pre-Travel, On the Way and At the Destination.

Pre-Travel

1. Destination information. In this category, there should be functions which are able to collect the information about a destination, including the visa and custom regulations, local weather conditions, estimated total expense for the trip and public security, so that the user can have a general idea of the place where he/she is going to visit.

2. Lodging information. Helping the user to find accommodations during the stay is another important function of the device. It should be able to find the best choices for the user in order to match the user’s needs, such as location, price range and quality.
3. *Transportation information.* This function should help those who are going to travel by airplane to book the flights and to compare different airline fares. Also it will provide the car rental information if needed. For the motorists, this device should be able to gather the detailed destination maps, as well as plan and display the route of the whole trip. This information can be downloaded from the internet by connecting to a computer, or downloaded directly from wireless sources.

**On the Way**

1. *Navigation system.* Combining the built-in GPS system and the map database makes it easier for the users to locate themselves and find directions. The wireless access can also update the latest road traffic information so that the users can find a second route to avoid traffic problems.

2. *Entertainment system.* For both the users traveling by plane and car, this function can provide entertainments, such as movies, novels, music and games, to turn boring times during the trip into interested ones. For example, with the DataPlay™ storage system, a two-hour movie can be fit into 2 double-sided DataPlay™ media. With high-speed wireless connection, users can also watch a live concert or a sport event.

**At the Destination**

1. *Local information.* This function should be able to provide the following information. The
currency (in a foreign country), points of interest, dining locations, regulations (e.g. traffic laws) and customs (e.g. how to tip in a restaurant). Also, a language translation function should be included.

2. **Personal communications.** The design should include the ability to communicate with others via voice and video transmission. These functions allow a user to have mobile communications with family and friends. For those who are on a business trip, this function will allow them to keep in contact at all times.

3. **Digital camera.** Most people who are traveling like to take pictures or record video on their trip to keep memories. A built-in digital camera on this device could save numbers of pictures into the data storage system to record the trip.

4. **Emergency aid.** In case something unexpected bad happens during the trip, this function could save a user’s life. For example, if the car were towed away because of violation, it could help you to get the car back. If someone got injured or became ill, it could show the nearest hospital or contact emergency service.
Criteria

After the goals were set, the criteria for the design were determined. These criteria were going to be the filters for evaluating different concepts. The concepts would be run through these filters to determine which best satisfied the most criteria.

1. Portability (size)

2. Weight

3. Screen size

4. Easy to open / deploy

5. Easy to operate

6. Ergonomics- for different age of users

7. Ergonomics- for different palm size of users

8. Ergonomics- for right-handed / left-handed users

9. Low cost

10. Numbers of components

11. Aesthetics

12. Durability

13. One-hand / hand-free operation
Concepts

When I started the concept development, I began by drawing quick thumbnail sketches, and tried to generate as much different shapes and configurations as I could (See Fig. 4 and Fig. 5). Then I developed further details of six of them, and made larger sketches (See Fig. 6 – Fig.13).

In all these concepts, besides the screen, I tried to include some parts as standard equipment.

The first one was the two-way camera. In order to satisfy the needs in both the personal communication and the digital camera functions, I came up with a two-way camera idea. The camera can be rotated to different position to perform both functions.

The second one was the built-in microphone and speaker system. This system was to perform the audio function and communication functions.

The third one was the wireless detachable earpiece. This earpiece is for hand free operation or private conversation, using Bluetooth\textsuperscript{1} technology.

---

\textsuperscript{1} Bluetooth\textsuperscript{TM} is an open standard for short-range, low-power wireless transmission of digital voice and data between wireless devices and desktop/handheld devices. It supports point-to-point and multipoint transmission
Fig. 4. Thumbnail sketches of the handheld device
Fig. 5. Thumbnail sketches of the headset
Fig. 6. Concept #1-1

Fig. 7. Concept #1-2
Fig. 8. Concept #1-3

Fig. 9. Concept #2
Fig. 10. Concept #3

Fig. 11. Concept #4
Fig. 12. Concept #5

Fig. 13. Concept #6
In the next step, I took these sketches and made a full-size, blue foam mock-up of each concept.
Concept #1, the “Folding Pistol” concept

This was the first concept that I came up with. Basically it folds up like a regular folding cellular phone, but I added a rotating handle as part of the bottom piece. On the handle there was a mouse pad for the user interface controller. It could be operated in both handle down position and handle up position. Inside the hinge was a two-way camera (See Fig. 14).

Fig. 14. The “Folding Pistol” concept Mock-up
Concept #2, the “Folding Earpiece” concept

This concept was similar to an ordinary folding cell phone, but I added a folding earpiece on the bottom part. The two-way camera was on the top of the same part. It had a mouse pad for the interface controller (See Fig. 15).

Fig. 15. The “Folding Earpiece” concept mock-up
Concept #3, the “Screen and Handle” concept

This concept, as implied by the name, was composed of the two major parts. The two parts were connected by one hinge and could be folded. The two-way camera was in the hinge, and the interface controller was a small trackball and a trigger button on the handle (See Fig. 16).

Fig. 16. The “Screen and Handle” concept mock-up
Concept #4, the “Head piece” concept

This was a special concept compared to the others. It had a head piece and a small remote controller. The head piece included the earphone, microphone and a mini projector for the video display. The interface control was operated on the separated controller. The head piece could be adjusted for different users. It could also be folded for storing and carrying (See Fig. 17).

Fig. 17. The “Head piece” concept mock-up
Concept #5, the “Simple” concept

I tried to simplify the components of the design in this concept. It had an oval shape body and a handle that could be rotated and hidden in the back. The controller was a mouse pad that could be operated with or without the handle being rotated out (See Fig. 18).

Fig. 18. The “Simple” concept mock-up
Concept #6, the “Stopwatch” concept

The idea was inspired by the stopwatch in so far as the way it would be operated. There were two small trackballs on the two sides of the top. Either one could operate as a button or a trackball so that both right-handed and left-handed users could feel comfortable with the operating position. The two way camera was on the middle of the top, and the earpiece was on the back (See Fig. 19).

Fig. 19. The “Stopwatch” concept mock-up
Final Design

After making the six mock-ups, I had a meeting with my advisors. We numbered these six concepts and ran each concept through the criteria filter determined earlier, evaluating them by giving them scores on each criterion. I then added these scores to acquire the sum. According to the sum of these scores, we determined which concept most closely satisfied the criteria and displayed the greatest potential to be the final design (See Table. 1).

Another issue that was determined to be important, but was not included in the criteria, was the attraction of the design to the audience of the thesis show. The final design should also be able to have a unique and uncommon appearance that would get the attention of the audience.

Based on the criteria and the attraction issues, I determined the concept that best satisfied both elements, and then selected this concept to further develop the advanced details.

The result showed that the “stopwatch” concept had the highest score but I thought that the form was not special enough to catch the audience’s eyes. So I decided to pick the second place, “Screen and Handle” concept, which had a more novel appearance than the others.
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Table 1. Criteria evaluation results
CHAPTER 3

FINAL DESIGN AND PRESENTATION

Final Design and Features

Final design

I selected the “Screen and Handle” concept and re-designed the form into an asymmetric shape, while shrinking the size of the hinge so that the whole design would look cleaner and simpler. I moved the two-way camera to the side of the screen, and figured out the arrangement of the earpiece, storage system and other components on the handle. I also named it “SmarTrav” to imply the smart way of traveling and also indicate that it is a cutting-edge, Hi-Tech device.

Features

1. 16:9 High-Resolution Screen

The 16:9 screen ratio is a new trend for displays. The high-resolution screen can display more than 65,000 colors for the optimal presentation of video and pictures. The wide-screen design also provides a better and easier reading environment as an information display. In addition, the 16:9 ratio supports wide-screen movies.

2. DataPlay™ Storage System

The double-sided DataPlay™ media can store up to 500 Mega bytes (250 Mb for each side) of
digital data of all formats. The compact size (39.5mm x 33.5mm x 3mm) makes it ultra-portable.

Travelers can easily carry several discs.

3. Two-Way Digital Camera

The camera is hidden in the right-hand side of the screen. It can be pulled out and rotated into two different positions. One is for the video chat function, facing the user. The other is for taking pictures, pointing away from the user.

4. The Bluetooth™ Wireless Earpiece

The detachable earpiece provides the user ability for hands-free operation. Moreover, when the user needs privacy using the communication function, the wireless earpiece is quite handy.

5. The One-Hand Easy Control

The control system of the design consists of one cursor-moving button and one trigger button. The user can operate this device with one hand very easily.

6. The Built-in Wireless Access Technology

There are several different wireless technologies built into this device. One is the GPS receiver, the others are mobile communication capabilities. The GPS receiver can perform global positioning functions. The mobile communication capabilities provide the data transmission and voice communications.
Presentation

3D Computer Model Renderings

Once I had decided the final form of the SmarTrav concept, I drew several detailed sketches of it (See Fig. 20). Then I built a model in the computer by using the program Alias\Wavefront Studio 9.0™.

![Fig. 20. The final design of SmarTrav](image)

After the model was built, I rendered a few static renderings and also a few short animations using the same program.
The static renderings were for the reference of the full size physical model and the posters for the exhibition (See Fig. 21). The short animations were be used in making the demonstration movie that would be shown in the exhibition (See Fig. 22).

Fig. 21. Static SmarTrav Alias™ renderings
Physical Model

When I started to make the full size model, I exported the technical drawings from the Alias|Wavefront Studio 9.0™ for reference (See Fig. 23).

I picked Ren Shape 350 Board™ as the primary material of the model. I used a band saw for cutting the material, and the milling machine for cutting the grooves. Then I sanded it and finally painted it. I also made a display case with wood and transparent plastic for the model (See Fig. 24 and Fig. 25).

For DataPlay™ media discs to be shown with the model, I wrote an email to DataPlay™ INC and asked them to send me a sample since it was not out on the market yet. After few days they sent me a free sample, so I placed it on the model to make it looked more realistic.
Fig. 23. The technical drawings for model making

Fig. 24. The model making process
Posters

I took the static rendering and used Adobe Photoshop™ to make the two posters to be shown in the thesis show exhibition. One of them showed three different positions of the design and briefly introduced the product. The other showed the features and functions of the design (See Fig. 26 and Fig. 27).
THE NEW STYLE OF TRAVELING
SmarTrav

- A LIGHT-WEIGHT, PORTABLE DEVICE DESIGNED FOR TRAVELERS
- THE ULTIMATE SOLUTION TO KEEP TRAVELERS SAFE AND INFORMED
- ALL-IN-ONE DESIGN FITS IN THE TRAVELERS' HANDS
- COMPLETELY CHANGES THE WAY WE TRAVEL AND BRINGS THE SMART WAY OF TRAVELING

Fig. 26. Poster #1 for the exhibition

WHAT CAN SmarTrav DO?

- GPS SYSTEM
- HI-RESOLUTION 16-9 COLOR SCREEN
- TOUR INFO
- BLUE TOOTH WIRELESS EARPIECE
- MAP SYSTEM
- DATAPLAY™ 500 MB STORAGE SYSTEM
- VIDEO CHAT
- DIGITAL CAMERA
- ENTERTAINMENT
- TWO-WAY DIGITAL CAMERA

Fig. 27. Poster #2 for the exhibition
Demonstration Animation Movie

I used Adobe After Effects™ and Adobe Premiere™ to make the demonstration animation. Some photographs I took were used in the animation as well as the Alias™ animation renderings.

The total length of the animation movie was three minutes and fifteen seconds. It briefly introduced the features and functions of the design. At the end of the movie there were credits (See Fig. 28 and Fig. 29). Also there is a copy of the animation file in the CD-Rom attached to the back cover which is in MPEG format (See Appendix).

Fig. 28.Screen shots from the introduction animation
Fig. 29. More screen shots from the introduction animation
Before the thesis show exhibition, I made a plan for the arrangement of my thesis project presentation. There would be a computer playing the animation, two posters on the wall and the full size model in the showcase. I drew a planning sketch using the Alias|Wavefront Studio 9.0™ (See Fig. 30.), but because of the location assigned to me in the gallery, I had to make some changes to the arrangement. The show held in Bevier Gallery at R.I.T. lasted for two weeks (See Fig. 31).
Fig. 31. Photos from the thesis show exhibition
CHAPTER 4

EVALUATION AND CONCLUSION

Evaluation

During the thesis exhibition show held from April 23rd to May 9th in 2001, I received many comments and suggestions from the committee, advisors and exhibition audiences, most of which were positive. I sorted the comments into the following three categories: technology, design, and presentation.

Technology

"To go wireless" is a new trend for almost all consumer products, especially electronics. Based on a number of wireless transmission technologies that were developed recently, numerous products and services have been brought to market. Moreover, products designed to integrate different technologies into one device are continually being announced. The design I presented is a good example of this all-in-one idea.

Design

Most people in the audience appreciated the concept and the form of this design, but felt that the accessories of the SmarTrav were not well developed. A case for carrying this device
should be included in the development of the design. A USB\(^1\) port for connecting to the computer should have been included in the model too. A few functions, such as voice activating system and language translation were mentioned in the design goals but were not presented in the introduction movie.

Presentation

Although the combination of two dimensional posters, full-size model and a short animation provided a general idea of how SmartTrav would work, there were still several improvements that could have been made. If I had had enough time, I would have created an interactive simulation program showing some scenarios that could let the audience simulate using this product. Also, I was planning to make a small swiveling stage for the showcase of the model, but due to the limited time this plan was never carried out.

Conclusion

This thesis project was the first individual design project I have ever accomplished. It was a chance to prove to myself and to others that I was able to have so much work done in such a limited time. I also learned many different skills throughout the whole process. Before this thesis project, I did not know how to make an animation movie, and I had never made such a detailed

\(^1\) USB, Universal Serial Bus. A royalty-free connector standard for PCs. The USB allows up to 127 peripherals – including joysticks, scanners, printers, and keyboards – to be linked from a single socket, offering high speeds and improved plug-and-play facilities
physical model either. This project was a very valuable experience in my life, and it really meant a lot to me.

As new technologies change with each passing day, I am sure that there will be a product like SmarTrav that can help the users to do so many things on the market very soon.
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