Introduction

From the beginning of our project, we had several goals in mind. We knew we wanted to develop an interface that integrated software with hardware; we wanted something that would appeal to a broad spectrum of users; and we were interested in toying with the idea of ubiquitous computing. Over the early stages of brainstorming, we decided to pursue a device that would assist users in navigating around unfamiliar cities. Development of our personas allowed us to further flesh out our goals, leaving us with the question, what is the best possible device interface for a system that uses social networking to allow users to create, use, and ultimately share annotated maps of cities?

Over the semester, we have designed such an interface. We focused on the hardware aspect and produced a prototype that incorporates the majority of our device functionality. The device is handheld with a color screen and several buttons at the bottom. The screen itself shows a birds’ eye map of the user’s immediate location, as well as the user’s current position, thanks to a GPS receiver built into the device. The map, viewable in three different modes, gives the user a visual context of their location and displays annotated points of interest in their vicinity. The buttons allow the user to interact with the device by scrolling through annotations, panning and zooming around the map, recording annotations, and responding to feedback on the screen. The device can thus be used either to record one’s own findings or as a tool to navigate unfamiliar areas; the unimplemented social networking component provides a community context for users, allowing them to share their findings and take advantage of others’ travel experiences.

Personas and Scenarios

Our design process used personas and scenarios to develop a framework for our device. We based our personas on information obtained at preliminary interviews and created our test scenarios around these characterizations. Our three personas, Oswald Charles Davidson, Reggie Colburn, and Skai Walker, represented the spectrum of users we observed in interviews. Oswald is the anal-retentive person who is always on schedule, plans his trips down to the minute with pre-departure research, and for whom a change in plans is a difficult thing to deal with. Reggie is an average tourist who is willing to improvise, but likes to have an idea of his sightseeing and social plans before he leaves. Skai is the embodiment of wanderlust, preferring to travel without set plans and let herself go wherever she thinks she may find something interesting.

The scenario we used for testing was one familiar to many of our users: navigating downtown Boston. Beginning at a corner of the Common, the scenario lead users both imaginary and real through a list of tasks such as finding a coffee shop,
recording annotations, and wandering. The last task is admittedly quite vague, but it was important to us – our goals focused on making the device appealing to users such as Skai, and so the ability to use it for no specific purpose, but rather for wandering, was extremely relevant. While the other tasks within our scenario tested the interface itself, the “wander” task really tested our idea.

The precise scenario text given to users during interviews can be found in the Appendix.

**Interface Functionality**

The final prototype allows users to perform two main tasks: finding points of interest in a particular area, and annotating them. The device has been refined several times in order to streamline this process as much as possible and reduce user confusion.

For finding points of interest, the default method is simply to use the wheel to scroll through a list of all points on the map. The ones directly viewable scroll through in order from upper left to lower right, then the off-screen ones will scroll though in order of distance to the center of the screen. Each annotation displays both the username of the user who added the annotation as well as a description of the location. When selected, the annotation will increase in size on the map to indicate that it is the currently selected annotation. If the annotation is off-screen, an arrow will appear designating the direction of and distance away of the selection. More information about a selected annotation may also be displayed by pressing the “More Info” button on the device.

We also included the ability to both pan and zoom around the map as a means of improving ease of finding locations. The mode button is used to change between these modes and the annotation select mode. In zoom mode, the scroll wheel allows easy zooming in and out of the map and a magnifying glass appears onscreen to indicate that the device is zooming. In pan mode, arrows appear on the edges of the screen and the scroll wheel becomes a directional pad that indicates in which direction to pan the map. At any time when the user has panned away from his or her present location, a set of crosshairs appear on the screen. These are meant to indicate both that any annotation made at this time will appear at the crosshairs and that the screen is no longer tracking the user’s movements.

In order to add their own annotations, users can use the large, clearly marked annotation button on the front of the device. At this time, if the device is tracking the user, an annotation will be made at the user’s current location. Otherwise, the annotation will be made where the crosshairs are indicating. If an annotation’s additional information is shown when the annotation button is pressed, the user will append his or her annotation to the selected one.

At any time, the back button can be used to return the device to the previous state, as indicated in the flowchart on the following page.
Unimplemented Features

There were a few features left unimplemented, most of them because the time it would take to implement them was not proportional to the amount of value they would have added to the project. Some of them are also features that were infeasible in the method we used to prototype. These include:

- Having the annotations be voice recorded and then converted to text.
- Having the ability to pan and zoom while an annotation is currently selected.
- Having a backend for social networking and tagging of locations (although this was implemented in a rudimentary form).
- Having a fully working implementation on a currently available handheld platform.
- Having a PC interface for both the maps and social aspects of the overall design.

Tools Used to Develop the System

For the entirety of our prototypes, we used Macromedia Flash. The main advantage of this platform was that it allowed relatively quick implementation of advanced graphical features like panning, scaling, adding and removing shapes, changing colors of objects, rotations, etc, which was ideal for the goals we wanted to achieve with our project. The downsides of Flash are that its programming interface is a little clunky and sometimes we would waste a lot of time making more trivial features work because of this. Often, we were fighting against the tools instead of working
towards the interface. Ultimately, however, it’s unlikely that any other application would have allowed us to implement our design as quickly as we did as completely as we did.

Design Evolution
The basic concept for the device didn’t really change much once we had settled on our idea (Figure 1). We talked a lot about the characteristics of the device we wanted, and these basic characteristics influenced our decisions throughout the design evolution.

- One handed usability
- Maximize screen size
- Natural interaction flow

Figure 1. Original Design Sketch

The basic idea for how to present information to the user on the map screen (Figure 2) was also present throughout the design evolution.
As is often the case, it seemed that the devil is in the details—our top-level design ideas seemed to fit well, but we found we needed multiple iterations and redesigns of the specific aspects of the interaction in order for it to start to feel natural to users.

We built prototypes based loosely on our design sketches – but moved to a directional pad for selecting annotations instead of the scroll wheel envisioned in the sketches. We also added two buttons on the front of the device to allow the user to zoom in and out on the map.

Our first live test with the paper prototype was a usability disaster. From a testing standpoint, however, it was a major success because it quickly identified some of the major usability problems which we were able to correct before we spoke to our second user.

The first thing to go was the directional pad – we found it to be an awkward way to select annotations and we went back to the original idea of a scroll wheel.

We also found that the use of color on the device was not consistent with the connotations that go with the colors in our society, and in some cases was not even self-consistent.

Lastly, it became clear to us that there were several key functions missing, such as the ability to pan around the map without walking around. We changed to a three-mode system to control the major aspects of the device. The SELECT button in the middle of the scroll wheel was moved to the side and replaced with a MODE button that switches between wandering, panning, and zooming modes. In wandering mode, the scroll wheel scrolls through all of the annotations on the screen in order. In panning mode, touching the scroll wheel pans the view in the direction the user is touching.
zooming mode the scroll wheel zooms the map in and out. The foam and paper prototypes are displayed in Figure 3.

After the last interviews with the low-fi prototypes we decided there were a few more functions the user would require to really have the kind of natural experience they wanted with the device. These included the ability to see information about a location in a full-screen view, and the ability to annotate at a place that they are not physically located at.

From these discussions we arrived at the revised interaction flow that is the backbone of our current implementation, and chose to add an additional button, dubbed
“CANCEL” and labeled with a blue “X” to dismiss annotations and get the user back into tracking mode when they have left it. Figure 4 shows the revised interface implemented in Macromedia Flash for interaction testing.

Figure 4. First Interactive Prototype

Following heuristic evaluations we discussed the results with the evaluators and found several more areas where we could improve the interface. We added the beginnings of a social networking interface in the form of a login screen which prompts users to select other participants’ annotations to import. We also changed the system to allow users to select annotations that were off their current screen and added a direction indicator (Figure 5).

After a third round of testing, it was clear to us that there were still several repeated tripping blocks for users when they tried our interface. One revolved around the symbols used on the buttons not being clear. In our final design, we changed visual appearance of the buttons so that they more clearly indicated what their function was. Another major problem involved users being able to successfully annotate at a location other than where they were standing. Users did not find it intuitive to press the “SELECT” button to get the device to annotate where they were looking instead of where they were standing. Most users expected the device to always annotate at the center of the screen regardless of if they were in tracking mode or not. Since this is what users seemed to expect and there was no compelling reason not to do this, we altered the device’s functionality to match this model.
Figure 5. Final Design With Off-screen Arrow Indicator

Links of Interest
Flash prototype: http://fsweb.olin.edu/courses/engr3220/sa2004/engr3220-blue/final/prototype.htm

Division of Labor
Mike Curtis: Interface updates, “Design Evolution” section
Dan Lindquist: “Functionality,” “Tools,” and “Features” sections
Mikell Taylor: “Introduction,” Personas and Scenarios” sections, interaction flow diagram

Appendix

Scenario
You’re in downtown Boston, a location with which you’re rather familiar. You’ve got a warm, sunny afternoon with nothing to do but wander. To compliment your wanderings, you have with you this device that provides you with annotated locations you’ve downloaded prior to leaving, and which also allows you to record your own annotations. This afternoon, you want to do the following things:
- Find a good donut place
- Find a good coffee shop
- Take a walk around Boston Common
- Record an annotation for your favorite restaurant downtown
• Record an annotation for your favorite random tourist attraction downtown
• Wander around and check out whatever catches your
With these goals in mind, use the interface to simulate your experience. Play with the
device, try to find its limits, annotate as necessary, and see if there’s anything missing in
the functionality that you’d like to see in the next version.