Enriching Mobile File Exchange using Tangible Controls on Multitouch-Tables

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1 Introduction

The user interaction with digital media on projected multitouch-tables (MTTs) is a fast growing research domain. MTTs enable users to perform various multimedia tasks like sorting digital photos or creating music.

One MTT research domain deals with loading, viewing, manipulating, and exchanging digital content with the help of MTTs. Until now there exist only a few projects which empower the users to seamlessly view and manipulate files on MTTs (*Focus* [2], *Microsoft Surface* [1], *BlueTable* [8]). The support for third party content sources like mobile phones, laptops, USB-sticks, network shared folders, etc. is rare. Most of the research projects only present a statical amount of content or files to work with. They often concentrate on single isolated aspects of content presentation, manipulation or both but do not provide any functionality of adding additional content.

In a real life scenario, two (or more) people might want to show some digital files to each other sitting side by side at a *normal* table. Probably, they would print out the files first and then discuss and make some notes on the printouts. After the session they will most likely make corrections to the original files and make copies of the results for each other. Transferring the files between computers would be done typically by using an USB-stick or an email attachment. On most computer systems, especially mobile ones, there is a lack for support of simple file transfers. Existing technologies like Bluetooth or Wireless-LAN (W-LAN) are usually cumbersome and complicated to use. For this scenario a MTT would be perfect, as people could sit next to each other with their mobile computing devices placed on the MTT, talk to each other about the digital content which would be displayed directly on the MTT. They could manipulate the content directly on table and exchange the results just after their session.

Using the MTT for displaying file content offers the possibility for users to show their files to each other and, additionally, to manipulate or organize them. In the file system domain, the users might be able to perform simple organizational tasks like sorting files into folders, transferring, deleting, or renaming them.

Existing file exchange mechanisms for mobile devices are based on Infrared, Bluetooth, or W-LAN technology. The first two are widely available in mobile phones or PDAs but because of their limited speed they are unusable for large data transfers. W-LAN is integrated in modern mobile phones and laptops and is fast enough for large data transfers. It does not offer a direct file transfer mechanism, though, so that one of many available file transfer protocols have to be used. For example, there are FTP, WebDAV, NFS, SMB/CIFS, etc. to name a few important ones. So many available protocols add much complexity to the task of file exchange. Beside the supported protocol, the user has to figure out the connection partner's IP address or the device's network name.

2 Contribution

In this thesis I am going to contribute to the MTT community with the following ideas:

- Development of an intuitive MTT interface for file transfer between mobile devices
- Design and evaluation of alternative techniques for browsing and finding files in *large* data sets on MTTs
- Extension of the SLAP-interface [6], [7] with file management

3 Challenges

The main *interaction design* challenges will be:

- Using the "Design, Implement, Analyse cycle" (DIA cycle) for finding an appropriate solution for navigation in large hierarchical file sets
- Incorporation of SLAP widgets for file transfers
- Design of an user interface for file management on MTTs with appropriate affordances, feedback, and error prevention

- Implementation of simple to use multitouch gestures for touchscreens

The main *technical* challenges will be:

- Easy configuration mechanism for the mobile devices and the MTT

- Design of an extendable, easily configurable wireless-network-communication protocol between mobile devices and MTT

4 Related Work

Example use of file interactions on MTTs is presented in *Focus* [2]. Users navigate semantically through the files on the file system. They choose one "focus"-file and the system shows up additional files which are computed to be relevant with regard to the "focus"-file. The more relevant a file is, the bigger is its representation on the MTT. A. Collins and J. Kay present techniques for navigating and sorting digital files and emails using a digital stylus.

In *Augmented Surfaces* [4] J. Rekimoto and M. Saitoh used networked laptop computers connected with top-projected tables and walls to extend the laptop's screen. In this configuration content could be presented outside of the computer's screen. The system also offered functionality of saving content on tagged physical objects for later retrieval.

The *Ubitable* [5] divided the MTT into private and shared regions to provide a file exchange mechanism. The users simply drag files with their fingers from their private to a shared region for viewing and sharing. Another user can then drag the file from the shared to her private region (and into her computer).

A. Wilson and R. Sarin developed *BlueTable* [8], an easy to use MTT system which enables users to copy files between two camera-mobile-phones with preinstalled special software. The user makes photos with the mobile and places it on the MTT which recognizes the position and orientation of the mobile and displays the photos on the surface. The user can copy the photos by dragging them to a halo area of the another mobile on the MTT.

An interesting idea for establishing communication between two devices is to use *proximity regions* as described by C. Kray et al. in [3]. Their system defines inner, outer, and distal regions which are translated to accept, explore, or reject commands respectively. The mobile devices are recognized by using special markers on their displays. This technology can also be used for file transfers between the two devices.

5 Time Schedule

5.1 Literature Review and paper-based prototyping: 2 weeks

In the first phase I am going to review publications to familiarize myself with existing MTT systems, their applications, interaction styles, and techniques. Afterwards, I am going to try to derive my first prototypes from the collected ideas. I will run a few quick Design-Implement-Analyze (DIA) cycles using some paper based prototypes to collect my test-users' feedback of the system design.

5.2 Implementation of the back-end framework: 4 weeks

I am going to spend the second phase learning to use the existing RWTH-i10-MTT and its software frameworks. Thereafter, I am going to build up my own basic back-end infrastructure, which should provide basic, easily to establish network communication between the mobile devices and the MTT using a standardized file transfer protocol.

5.3 Implementation of the device position recognition: 2 weeks

Another task will be to find the device on the MTT surface to display a file-representation just around it. Therefore I will use special markers to recognize the device's position and orientation on the table surface.

5.4 Implementation of the front-end framework: 8 weeks

The first version of the front-end should allow basic interaction gestures like copying files from a source to a destination. During the development I will test the interaction with software prototypes by performing user tests. Further tasks will include pairing to the SLAP keyboard and sliders and implement functionality for renaming files, navigation within large directories and opening connections to network resources.

5.5 Refinement and evaluation: 4 weeks

In the last phase I am going to enhance, refine and stabilize the software so that further functionality could be tested. In particular, I am going to add additional gestures for viewing, deleting, renaming files, adding annotations etc. I am going to provide additional, alternative file representation styles and I will add additional communication support for network services.

5.6 Final user tests and evaluation: 2 weeks

In the end of the project, I am going to run a final user study and compare the user experience of my MTT system with performing file interactions on mobile devices without the help of a MTT.

5.7 Writing time: 4 weeks

During this time I am going to write down the thesis.

References

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