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Diploma Thesis in Computer Science

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Erklärung

Hiermit versichere ich, dass ich diese Diplomarbeit selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe.

I hereby declare that I have created this work completely on my own and used no other sources or tools than the ones listed.

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Aachen, September 10th, 2010   AUTHOR

Acknowledgements

Thank God, this is over :)

Abstract

By using currently popular tools like blogs or wikis and services like social networks, the users are becoming more and more involved into the production of content instead of just consuming it. Since those tools are familiar to the users, this can be an advantage because they do not have to get used to new tools as they can be embedded in a kind of framework. ... has the ability to integrate nearly every content that is available in the Internet. Another advantage of ... is the fact that the collaboration part and the social part of a ... is an already integrated functionality.

Due to the ability of modern hand-held devices to determine its current position, the collaboration and networking factor can be extended by location-based services. It would be easier to communicate or to collaborate with other people if one knows where these persons are. People might spend less time for getting to know about the whereabouts of fellow students if they see who is around. Some situations can be handled more easily and effective if there is such a location-based PLE system that allows communication and collaboration. The implementation of an application for the ... Operating System will be focused on location-based scenarios for higher education. Students will have the possibility to offer help by providing skills and to receive help by searching for close-by people, to store and to retrieve information location-based, and to participate more active in lectures. This improves communication between students and helps them to improve their learning.

Contents

Part I

Chapter 1 Introduction

In Europe, the number of the Internet users rose by 297.8% between 2000 and 2009. In 2007, 56% of the German population used the Internet on a daily basis [10] and in 2009, 73% of the private households in Germany were able to access the Internet [1]. As of June 2010, 79% of the German population are Internet users [13]. It is obvious that the Internet becomes more and more important. And if one takes a look at the rising amount of mobile devices that have been sold lately, one can say that *mobile* applications using the Internet are becoming more and more important. In the second quarter of 2010, the global smart-phone shipments rose up by 43% [5] while the shipment of ...based smart-phones rose up by 886% in the second quarter of 2010 [2]. According to the BITKOM [7], 10 million owners of cell-phones (including smart-phones) make use of the Internet capabilities of their devices (as of 2010). Applications for mobile devices are used regularly by 4 million smart-phone owners. This shows that there is a great potential in mobile devices, especially for those running the ... Operating System.

Mobile Internet becoming important

Social networks are a huge success concerning to their customers. According to the German StudiVZ, MeinVZ, and SchuelerVZ, they have over 16 million registered users [11] and according to a Facebook press release, Facebook has 500 million active users worldwide of which 50% log in on a daily basis [4]. The people get more and more used to online networks and online tools, in which email, instant messaging, blogs and wikis are among the most popular services for communication and collaboration [3].

Huge success for social networks

Social networks with location-based services

Considering these two aspects – the rising sales figures of smartphones and the success of social networks – there is a great potential in developing applications for mobile devices that enable their users to connect to each other. Due to the capabilities of modern mobile devices, the networking-factor can be extended by utilising the functionality of those devices to determine their current position. Thus, social networks with location-based services can be provided to enable real-time communication and collaboration.

1.1. Objectives

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Chapter 2 Background

"The most compelling argument for the PLE is to develop educational technology which can respond to the way people are using technology for learning and which allows them to themselves shape their own learning spaces, to form and join communities and to create, consume, remix, and share material."

—*Graham Attwell*

This chapter provides background information on the main three topics on which this diploma thesis is based. First, the idea of a Personal Learning Environment is explained. It is shown how such a system can help the learner to organise, share, and publish the information. Afterwards, the functionalities of ... are explained. It is shown that ... can be used as a basis of a PLE by extending its functionalities. At the end of this chapter, a short introduction to the ... Operating System is given. This is a relatively new ... (released in 2008) which is utilised by mobile devices such as smart-phones or tablet PCs. The application WaveLoc that was implemented during this diploma thesis runs on ... because this is a promising [2] open source system and one can develop for it without being charged – in contrast to developing for the iPhone [8].

2.1. Personal Learning Environments

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Part II

Chapter 3 Implementation

The project WaveLoc consists of two parts, the first one is the server-based API and the second one is the application running on the client's ... devices. Some details of how these parts have been implemented are shown in the following sections.

3.1. Server-side (WaveLoc-API)

The WaveLoc API, as described in chapter **??**, offers functionalities to handle the information about the users that are stored in the database up to date, to provide data about participants of WaveLoc (users or POIs) that are close by, and it maintains the friends- and favorite-lists of every user.

As already mentioned in section **??**, this API uses *PHP*, *MySQL* and runs on the web-server *Apache*. It is possible to transfer this system from one server to another one by installing the whole set of files onto the destination server. One only has to adjust some rights, the content of some files, and to set up the database. The scripts have to get write access to the folders `/smarty/cache`, `/smarty/configs`, and `/smarty/templates_c`. Thus, they have to get the required rights (`chmod 775`[1]). The only three files that have to be adjusted are the `.htaccess` in the root directory of the API, the `/data/config.php`, and `/data/server.php`. In the first file, only the domain has to be adjusted:

Transferring the API

```
1 ErrorDocument 404 http://wave.thues.com/404.htm
```

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[1] Full rights for the root-user and the owner and rights to read/write for every other user

The second file contains six variables concerning the API that determine default values, among others:

```php
1  <?PHP
     $mail_admin = "hendrik@thues.com";
     // the title of the application
     $appname = "WaveLoc";
5    // time when an inactive user is set offline
     $idle_time_sec = "300";
     // default radius
     $std_radius = "300";
     // default time to POI
10   $std_timetopoi = "15";
     // distance of offline-users
     $max_distance = "31337000";
   ?>
```

...

Chapter 4 Evaluation

To test and to improve the usability of WaveLoc, three sets of user-tests have been conducted. The first two with five users, the last one with three users. According to Nielsen [12], it is sufficient to conduct user-tests with five users. Thus, 17 user-tests with different students (including the final set of tests (see chapter **??**)) are more than required. As stated, the number of usability problems that are found in a test with n users and a total number of N problems is

$$N(1 - (1 - L)^n)$$

L denotes the proportion of usability problems discovered while testing a single user with a typical value of 31%. According to this formula, about 84% of the N problems can be found if five users are tested. The second set of user-tests with five persons should reveal another 13% of the original N problems. Thus, conducting user-tests with 10 persons should result in finding about 97-98% of the problems concerning the usability.

After conducting these three user-tests, a final test with 4 users has been conducted. The reason for this set was again to test the changes that have been implemented after each set of the first user-tests. The participants should consider the application operable intuitively.

4.1. Usability-Tests

The first two sets of user-tests have each been conducted with five students while the third one has been conducted with three students, each of them having different foreknowledge concerning smart phones.

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Part III

Chapter 5 Related Work

With the spreading acceptance of mobile devices [5] featuring functionalities that are able to determine the position of a device, the amount of location-based applications rose. There are many use-cases for this kind of tools. In the following, six examples of applications are presented that are in a certain way similar to WaveLoc.

5.1. Google Maps

The service *Google Maps*[1] is available for smart-phones like the iPhone, BlackBerry, or ... devices. Originally, it has been used as a digital map or for transit directions. Later on, several other features have been implemented, e.g. *Latitude* that displays the current position of friends. There is also the possibility to find location-based information such as messages that have been send using *Google Buzz*[2] (see figure **??**). The position of the mobile device is assigned to that message – if the user allows that – so that it can be found by others who are searching for location-based information. There is also the possibility to add pictures to those messages. But it is not possible to directly talk to the senders of such messages or to get to know their current whereabouts without adding them to Latitude. One only sees a message, bound to a location. Another functionality of Google Maps is to display Points of Interest that are nearby, ordered by certain categories. In selected cities, it is also possible to get the schedules of public transportation [6].

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[1] http://www.google.com/mobile/maps/
[2] http://www.google.com/buzz

Chapter 6 Conclusion

"Finally, in conclusion, let me say just this."

—*Peter Sellers*

This chapter summarises the whole process of developing the application WaveLoc. It depicts where problems occurred while implementing the application and which future work arises from this diploma thesis.

6.1. Review

The WaveLoc system enables its users to connect with each other and to find others that are nearby. These functionalities can be utilised to offer and to gain help among students. As backend that is used to handle the data and to exchange information such as images, documents, or videos, the service ... was proposed. This tool enables its users to communicate with each other, to share information, to discuss about specific topics, to create content collaboratively, and to store data location-based that may be accessed by others. Speicher [9] stated that ... is capable of being the basis of a PLE as depicted in the chapters 2.1 and **??**.

WaveLoc's requirements

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Appendix A Bibliography

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