Native Visualization of Mobile Activity Patterns

Bachelor Thesis in Computer Science

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Hiermit versichere ich, dass ich diese Bachelorarbeit 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.

Aachen, September 1st, 2013 Christian Janßen

Contents

Part I

Chapter 1 Introduction

Smartphones and their daily usages

Since the introduction of the smartphone and its ongoing boom in sales, those devices getting more and more important for their users. Nearly 30% of the German population own a smartphone and 50% of them use it on a daily basis [2]. Googling a question, making a phone call, sharing your location and status with your friends via facebook or just taking a snapshot of your lunch - smartphones are used in nearly every location and situation. With all these possibilities and potential in usage for everyday situations, it is getting harder and harder to keep track of when one has used its smarthphone, where it was used and most important, for what was it used. Knowing this may have a positive influence in productivity. While on the topic of productivity, another interesting fact is, that 72% of owners state that they use their smartphones at work [2]. The obvious question is, did one use its smartphone for relevant research or emailing, or was it used to chat on whatsapp or checking facebook. It would be desirable with focus on efficiency and productivity if by the end of the day one could check his or her smartphone activity and would see that one may have to improve his or her working or learning behavior, because the smartphone was used in a distracting way or, the more preferable case, that the smartphone was mostly used to get work done.

Need of a structured overview

Another situation in which nine out of ten users utilize their device is while they are on the move [2]. Again, it would be desirable if one had information how he or she got from place A to place B, how much time it took and what has been done in this time.
Not only has the computation power of smartphones significantly improved, their integrated cameras are also quite satisfying and are comparable to low-end digital cameras. Since most people tend to take pictures with their smartphone nowadays, it

would be helpful to get a simple overview in which one can easily see the exact position of the picture's location without taking any further investigation.

The lacking of the possibility to check what has been done with the smartphone may unconsciously lead to a distracting use of it. That is, because, as already mentioned, keeping track of all activities is extremely difficult and thus the total time of the daily usages is normally unknown. There exists a need of a structured overview which provides informations about time, location an d applications to get a self reflecting impression about one's daily mobile activities.

1.1. Objectives

Requirements for the application

Due to the stated need of an application which provides information about one's daily activities the main goal of this Bachelor thesis is to create such an application. Requirements for applications are normally high and the developer has the task to find optimal solutions for them. This application is no exception and thus has its own requirements. On the one hand it should display enough information to grant the ability to draw conclusions about one's daily activities but on the other hand it should also display the data in a visual appealing and intuitive way such that the visual appearance is not too crowded with unnecessary information.
The application should also offer the possibility to take minor adjustments to fit in one's individual needs and thus making the experience with the application feel. In contrast to that those adjustments should not be to detailed and low in number to keep the options structured and understandable.

Applications for partial solutions

As mentioned, the main objective of this thesis is to create an application which provides feedback and a self reflecting view for one's daily activities. There are some existent applications that partially fit in the described situation and offer solutions. For example one can use Google Latitude to see where he or she has been traveled respectively which routes were taken to reach a specific place. But it will not show which applications have been used at a specific place. Also while this thesis was written the support for Google Latitude was discontinued [3]. Another partial solution is facebook. One can share his or her location and photos on facebook but this will not show a route on a map nor does every one want to public his or her whole life on facebook.
To see the most used applications of the day one could take a

look at the operating systems utilization chart which displays the percentage of used battery life and shows the cpu usages in total time. Not only does it not take into account the visited location this is also a very impractical and non intuitive way of gathering information about one's daily activities.

Testing of graphical possibilities

Another objective was to create an application which provides manifold views of the user's daily activities. It should not be limited to a map displaying pins or a list of application names with the total time of usages. Instead the application should show what is possible to develop with the help of already existent graphical views and, what is even more interesting, with creation of new views. All views should differ from each other and show different possibilities in visualizing informations of one's daily activities while each one could be used as a stand alone self reflecting view.

The application of this Bachelor thesis should perform as a central information provider which combines the listed objectives and displays the daily activities of the smartphone. Those information will be presented in various ways and can be filtered by different criteria within a clear, intuitive graphical user interface.

Chapter 2 Background

This chapter provides background information about the main topic of this bachelor thesis. First, the ongoing trend of using a smartphone in nearly every situation and therefore the need of keeping track of one's own mobile activities is discussed. To grant an application the possibility to give self reflecting impressions the application itself needs to be provided with personal data of the user. The second section is about this provided data, its origin and how it is gathered. Once the origin of the information is discussed the next section talks about the representation of this it. In this context the meaning of native visualization is explained and an alternative is presented which involves a short introduction of a currently written master thesis. The last section lists and explains which hardware and software was used during the implementation.

2.1. Self reflection

ADD REFERENCE TO SELF REFLECTION PAPER!

A Smartphone has many usabilities. It can be used as a camera, newspaper, music player or as a portable gaming device and those are just a few examples. There are a lot more ways to use a smartphone and as mentioned in the introduction, they are used in nearly every situation. It is a modern multitool which was used by more than 23 million people in Germany in 2012 [2].

Smartphones as modern multitools

As advantageous as it may be in everyday situations, the downside is that most people do not know how much time they spend on their phone and thus do not know how distracting it may be. For example, checking new mails may lead the user to also check the newest facebook messages and stay within this application a few minutes longer than expected. At least 50% of smartphone owners access the Internet with their device [2], thus most people are always available through instant messaging services like whatsapp. The result is that people write and receive messages

more often. And because smartphones are capable of running diverting games, one may uses its device to beat the last achieved high-score.

Distraction

But a smartphone can be a great helper too. It is an easy to use digital calendar which reminds the user of all upcoming events, it can be used as a travel guide or a navigation system, it allows to quickly respond to an important email and has many more useful advantages. But the previous short examples demonstrate that a smartphone can also have a distracting influence to its owner.

At this point the the idea of self reflection is needed. The concept of self reflection is the critical reflection on one's own actions and positions and coming to a conclusion. This can be used to assess the distracting influence of smartphones to its owner. But for an accurate assessment one needs to keep track of his or hers own daily activities, which is nearly impossible to do for a smartphone without the help of tools that provide background information.

Provide a self reflecting view

As mentioned, the help of a tool is needed which provides information about the owner's mobile day in a self reflecting manner. This tool in form of a smartphone application should display the information such that the user is able to instantly see where, when and for what the device was used. If one is provided with this data, he or she is able to say, that they used their smartphone in a productive manner or if they used it for entertainment. Further more, one could tell if he or she used the smartphone to divert themselves from working or studying. Although the application can display the needed information, the conclusion must been drawn by the user.

Possible improvements in productivity

With this application and the provided information a user may be willing to rethink his or her work respectively study behavior. This then could lead to less frequent use in distracting applications, thus improving efficiency and productivity in daily tasks.

As described, there is a possible application area for such a smartphone application. It would visualize data and information about the owner's daily activities in such a way that the application could be used as a tool for self reflection.

2.2. Provided Data

In the last section the idea of an application which displays information in a way such that one can use it for self reflection was described. What has not been described is from what source this data arises and how it is gathered.

The application itself will not gather the data it uses, instead the data is downloaded from a server and stored internally. The reason that the information will be collected externally, is the limitation of this thesis to the visualization.

Big Brother gathers data

The mentioned data arises from an external application called "Big Brother". This application is based on the master thesis of Torsten Kammer and was reimplemented and developed by diploma computer scientist Hendrik Thüs in 2013 [1]. ...
IMPROVE REFERENCES
The data Big Brother gathers, is send to a server where it can later be downloaded and used by the application developed for this bachelor thesis. The data contains amongst others information about the user's visited locations, the name of the currently used application, start and end time of used applications. This data is uploaded and stored to a web server, which is then accessed by this thesis' application.

Privacy issues

With the revelations published by Edward Snowden in June 2013 about the U.S. American spy program PRISM one might be concerned about privacy violation by third parties. It should just be said, that this project is still an experimental phase. If it should be published for a larger audience than the developers much work would be put into encryption and ensuring the prevention of unauthorized access by third parties.

Reasons for online stored data

One of the reasons why the data of daily activities is stored online is the limited storage of mobile devices. This way the used size of storage can be minimized and only needed information can be downloaded. The possibility to merge data from other devices the user owns like PCs, laptops and tablets is another reason to upload the data. Being able to access the data from multiple devices like tablets is also an important point.

The idea of a data set which also contains information about other used devices has great potential in granting an even better overview of one's daily activities and thus this would make the self reflecting view provided by the application even more meaningful.

2.3. Native Visualization

Now that the origin of the provided data has been explained, the idea of a native visualization will be brought closer.

Visualisierung meint dass darstellen von abstrakten Daten oder Informationen in visuell erfassbarer From. Dies kann nicht nur in der Informatik gefunden werden, sondern an vielen verschiedenen Stellen, genaugenommen überall wo jemand versucht etwas visuell auszurdrücken, beispielsweise einem Bild. Und dies ist nicht nur auf die heutige zeit beschränkt, Höhlenmenschen brachten damals schon ihr leben mit hilfe von Höhlenmaleri zum ausdruck. Visualisierung in der Informatik bezieht sich wie bereits erwähnt auf das darstellen von Daten in visuell erfassbarer Form, zB daten einer Befragung in balkendiagramme oder ein Graph für den Temperaturverlauf der letzten woche. Die Visualisierung hat in diesem falldie aufgabe die bereits erwähnten daten in ansprechnder und leicht erkennbarer art und weise darzustellen, sodass der nutzer leich daraus schlüsse ziehen kann.

Native visualisierung beschreibt das erstellen von visuell erfassbaren Objekten auf einem OS nur unter der zuhilfenahme von haus aus vorhandenen resourcen.

-what is native visualization -alternative Thomas work

2.4. Hardware and Software

Part II

Chapter 3 Implementation

"It's done, when it's done"

—An English Phrase

3.1. Paper Prototype

3.2. Time Schedule

3.3. Basic Layout

3.4. Data Management

3.5. Mapview

3.6. Chartview

3.7. Timeline

Chapter 4 Evaluation

Part III

Chapter 5 Conclusion

5.1. Review

Appendix A Bibliography

Online References

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[3] *Latitude discontinued*. URL: https://support.google.com/gmm/answer/3001634 (visited on 12/08/2013).