Investigating the Use of Context History in Task Management

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Abstract

Some abstract ...

Preface

I would like to thank . . . Also, a special thanks to . . .

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1 Introduction

1.1 Topic

Task and time management applications help users stay organized by keeping track of notes, meetings, tasks etc. Many applications exist that are directed towards this purpose, ranging from simple note-taking applications and to-do lists to more advanced ones like calendars and scheduling applications. A calendar typically holds events or appointments for a user while a to-do list will keep more detailed and lower level tasks. All of these applications have in common that they relieve the user of having to remember things, thus allowing the user to focus more deeply on other things.

Context awareness is also a field of research that has received more attention in recent years. The reason for this is the increasing number of mobile devices that are available and also the increasing functionality of these devices. When it comes to context awareness, the sensors in mobile devices play a huge role. There are more sensors packed into these devices now than ever before, which allows applications to collect very specific types of contextual information. This in turn allows for the development of applications that have very specific and tailored purposes.

By combining context awareness and task management, we open up for new types of applications. Smarter systems could be built that leverage contextual information, both past and present, to adapt its behavior to accommodate very specific situations. A calendar system for example, could evaluate a user's upcoming meeting and the current location of the user. Taking into account the distance between the user and meeting location, the system could then deliver a reminder at the appropriate time, allowing the user to catch the meeting. Another example would be a to-do list application that could leverage contextual information about previously performed tasks to provide task recommendations to the user.

1.2 Problem description

Task and time management applications are valuable tools that are used by many people. These applications can be especially valuable on mobile devices as the users can carry these devices with them, thus having the application data easily accessible. Concrete and popular examples of such applicatios are calendars such as Google Calendar[1] or to-do list applications such as Trello[2] or Todoist[3]. Even though these, and many similar applications are very useful, their functionality and usefulness could be further improved by integrating user context.

Utilization of contextual information in different scenarios have been widely researched. However, we have found no research that studies the usage of such information in the specific domain of task and time management systems. Many systems are improved by making them context-aware. One example of this is Learning Management Systems (LMS) that can suggest learning content based on the users current context, and in doing so increasing the amount of learning for the user. Following examples such as this, it is believed that task management

applications can also reap the benefits of context awareness.

This study will look into the area of utilizing contextual information in task management applications.

1.3 Research questions

2 Related Work

2.1 Context

> "Context is any information that can be used to characterize the situ- ation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and application themselves"

2.2 Context awareness

2.3 Intelligent task and time management systems

2.3.1 Calendar systems

2.3.2 Task management systems

2.4 Context history

3 Methodology

In order to address the research questions, we need to develop a proof of concept system that is able to investigate and utilize the concepts in question. It was decided that a to-do list application would be a good candidate for investigating these concepts. A calendar would also be suitable, but a to-do list application was chosen over this because of simplicity.

The most natural choice of platform is mobile devices. This is because we are creating a context-aware application, and contextual information are more easily available on such devices. We also chose to develop the app for the Android Operating System.

3.1 User group

For the recommender to be able to differ between user tasks, these tasks needs to be assigned different types and be categorized. However, categorizing typical and everyday tasks will require a lot of effort. In order to reduce the amount of work needed for this, it was decided that the scope should be narrowed down by selecting a specific user group. Students were selected for this, and more specifically students in an educational environment. This is both because the tasks of such a specific user groups can be much easier categorized, but also because access to the user group is easily available in this case.

Although students were selected as the target user group, typical educational tasks can vary greatly between undergraduate and postgraduate students. This is also dependent on what semester the student in question is currently in. A bachelor student might have very different tasks than a master student doing his/hers master thesis. A small questionnaire was made to determine if we needed to differ between these two types of students. The results of the questionnaire, see Section 4.1, reported small differences between the tasks of the different types of students. It was thereby decided that the tasks should be categorized for all students.

3.2 Application

3.2.1 General application design

By choosing to create a todo-list application the user should be able to perform actions that are normal for such applications. These actions include creating and storing tasks, as well editing and deleting them. The tasks should also be possible to arrange into lists. The application in this study is developed in a way that supports all these aspects. When a todo-item or task is created, a date will be attached to that particular task, thereby organizing the tasks with similar dates into lists.

We would also need a schema for storing context information, as well as a recommender that will process the stored contexts and provide recomendations. A conceptual model of the application is shown in Figure 1. The lines pointing towards the recommender represents its input, whereas the line pointing outward is the actual recommendation. The input for the recommender consists of three parts:

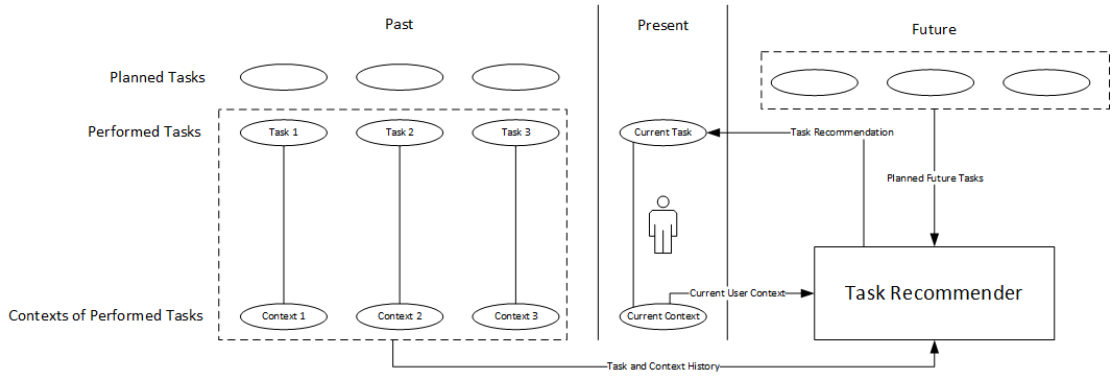

Figure 1: Conceptual model of the application.

- The tasks that the user needs to do (planned tasks).
- The tasks that the user has previously done (task history).
- The contexts of related to the previously done tasks (context history).
- The users current context.

By taking all these components into account, the recommender will be able process the information and suggest a task for the user.

3.2.2 Context acquisition

By storing contextual information about how tasks are performed, the recommender will be able to not only provide recommendations based on current and planned contexts, but also take into account in what contexts tasks have been done previously. A certain task may work well in one context and poorly in another. However, before designing the overall schema of context representation, decisions on what contexts to actually use and collect needs to be made. In a mobile device there are typically many types of contexts that can be potentially collected. These are:. . . reference do context types + figure . . .

The actual contexts collected in the app are:

- *Location:* Both the planned location of the task as well as the actual location of where the task is performed is stored.
- *Activity:*
- *Time:* Each task is given timestamps both when they are started and ended. By doing this it is possible for the recommender to separate tasks that are done at specific times of the day, week or even month. Time spent doing a task is also tracked, as this may differ from the difference between the start and end times (users may pause doing a task).

3.2.3 Context storage

Describe how the contexts are stored in the database... representation.

3.2.4 Recommender

When creating the recommender-part of the application, several decisions needed to be made. First of all, we needed to decide what kind of recommendations to make. There where many possible ways to do this:

- Location proximity recommendations.
- Recommendations based on time of day.
- Recommendations based on time spent on previous tasks.
- Recommend tasks with fixed starting times.
- Recommend tasks based on the shortest traveling distance between tasks.
- Recommendations based on regularity of task occurrences.
- Combinations of the above.

After deciding what to recommend, the underlying logic also needs to be decided. A recommender will need some form of logic for comparison, so that it can know that it should recommend one task over another. Such logic already exist in some systems. We have seen Netflix recommending movies and Amazon recommending books. It is necessary to analyze these systems for potentially reusable recommendation algorithms:

Neural networks

Neural networks describes the process in which the computer...

Probability calculations

The second approach is to use probability calculations to perform the recommendations. This is the approach that was decided to be used in this project.

Unfinished ...

4 Results

4.1 Student tasks

Hopefully this will be a useful chapter ...

5 Conclusion

Some conclusion.

Bibliography

[1] Google calendar. https://www.google.com/calendar.

[2] Trello. https://trello.com/.

[3] Todoist. https://en.todoist.com/.

.1 Student tasks questionnaire

What degree are you currently taking?

- ○ Bachelor degree
- ○ Master degree
- ○ Ph.D. degree

I make a list of the things I have to do during a day/week

- ○ Never
- ○ 1-2 times per week
- ○ Almost every day
- ○ Every day, multiple times

Do you use task/time management applications such as calendars or todo-lists?

- ○ Yes
- ○ No

How regular do you perform the following tasks?

	Every day	Every week	Every month	Irregular, zero or few times per week	Irregular, zero or few times per month
Reading (books, papers, internet etc.)	○	○	○	○	○
Writing (reports, theses, essays etc.)	○	○	○	○	○
Course exercises	○	○	○	○	○
Attend lectures	○	○	○	○	○
Group work	○	○	○	○	○
Meetings	○	○	○	○	○
Practical work (programming, development etc.)	○	○	○	○	○
Give presentation	○	○	○	○	○

Figure 2:

On average, how often do you perform the following tasks (frequency)

	Less than once per week	1-2 times per week	3-4 times per week	About once a day	Multiple times per day
Reading (books, papers, internet etc.)	○	○	○	○	○
Writing (reports, theses, essays etc.)	○	○	○	○	○
Course exercises	○	○	○	○	○
Attend lectures	○	○	○	○	○
Group work	○	○	○	○	○
Meetings	○	○	○	○	○
Practical work (programming, development etc.)	○	○	○	○	○
Give presentation	○	○	○	○	○

What other tasks that were not previously mentioned do you do, and how often?

Do you think an application that recommends tasks for you based on the history and context of your past and planned activities, would be useful to you?

- ○ Yes
- ○ No

What would be the most useful feature to you?

Figure 3: