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OmniTrack: Designing Flexible and Highly Customizable Quantified-Self Tool

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전 재 호

OmniTrack: Designing Flexible and Highly Customizable Quantified-Self Tool

Advisor Jinwook Seo

Submitting a master's thesis of engineering

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Graduate School of Seoul National University

Department of Computer Science & Engineering

Seoul National University

Jae Ho Jeon

Confirming the master's thesis written by Jae Ho Jeon

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Chair_____Yeong Gil Shin_____(Seal)

Vice Chair_____Jinwook Seo____(Seal)

Examiner____Myung-Soo Kim__(Seal)

Abstract

OmniTrack: Designing Flexible and Highly Customizable Quantified-Self Tool

Jae Ho Jeon
School of Computer Science and Engineering
The Graduate School
Seoul National University

Self-tracking practices are becoming increasingly prevalent, but because existing tools does not fit one's tracking needs exactly, and most people do not have the ability to implement their own tools, people tend to 'appropriate' general-purpose tools to track their lives. To help people with self-tracking needs but lack the adequate tools, we designed and developed OmniTrack, a smartphone-based manual tracking application which the user can flexibly customize to fit their tracking needs. By interviewing 12 self-trackers and reviewing 62 self-tracking apps from the App Store, we were able to identify the design space of manual tracking applications. In the paper, we describe the design space and implications, and developed a prototype based on the results and present use case scenarios to demonstrate the usefulness of the tool. We discuss how the tool can be extended to be used in the context of medical environment, especially in the doctor-patient relationship.

Keyword : Quantified-Self, Self-Tracking, Self-Monitoring, Manual Tracking

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1. INTRODUCTION

Life-logging movements such as self-tracking and quantified self are becoming increasingly prevalent. In a study held in 2013 by Pew Research [15], around two thirds of U.S. adults track at least one indicator of health, including, but not limited to, weight, diet, or exercise routine. From scribbled memos to fully automated FitBit [17], there exist a wide variety of self-tracking methods of which people can choose upon. However, since smartphones are indispensable in today's lifestyle [20], leveraging the smartphone as a medium of life-logging and self-tracking is a convenient and a feasible choice, both in the scope of manual and automated tracking.

Although smartphone apps provide a strong advantage in its availability, finding an application that perfectly fits one's information tracking needs can be troublesome, and often impossible. Tools that are highly specialized have little or no flexibility over what can be logged. Fields are fixed and difficult to modify. Some apps provide a degree of flexibility, but is generally not satisfactory. Tools does not always satisfy user's information needs. Some tracking fields may come in useful, but some may not. Some apps for instance, refuses to save data unless every field is filled. However, editing the fields in the app is difficult, if not impossible in most apps. The best way to ameliorate the problem would be, of course, to build one's own tracking tool that would allow the tracking of whatever the user wants. However, not many users come from a programming background, or do not have the time or will to build tools that exactly reflect their needs. Therefore, users begin by enduring the tiresome process of existing tools and end up giving up tracking or appropriating general-purpose tools such as Excel.

We present OmniTrack, a customizable user-driven tracking application that aims to fit the need of many information tracking instances. By surveying 62 apps from

Apple App store and through a semi-structured interview of 12 self-trackers, we were able to identify the necessities of manual tracking tools and built a prototype application based on the study.

The contributions of this paper are the following: 1) exploration of mobile self-tracking space via app market analysis and interview, 2) the design and implementation of OmniTrack (Figure 1), a tool that facilitates manual self-tracking, and 3) use case scenarios to demonstrate the coverage of tracking practice made possible by OmniTrack.

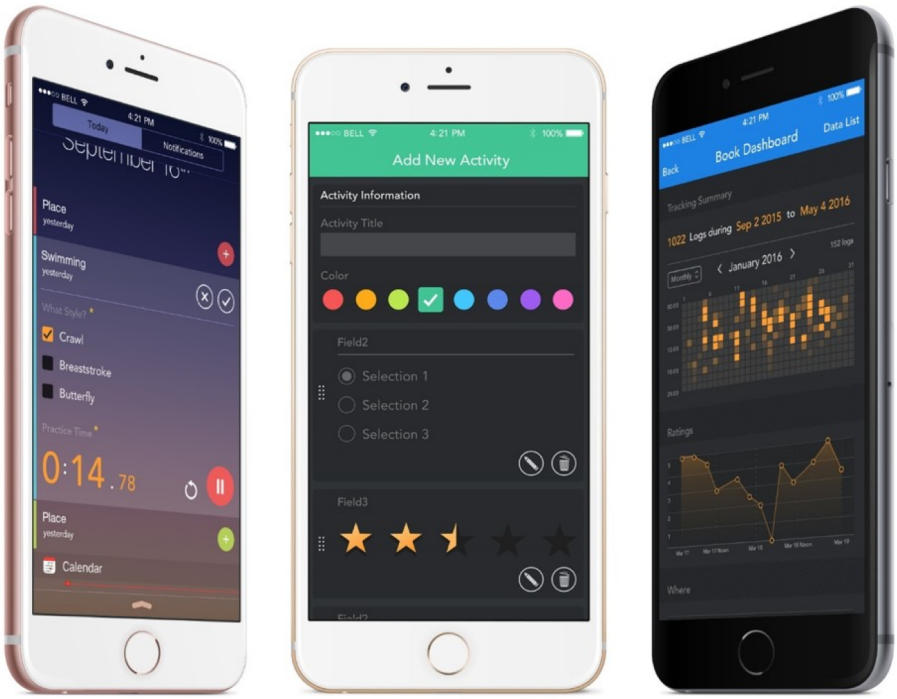

Figure 1. We designed and developed OmniTrack, a smartphone application which facilitates the collection and exploration of manually tracked personal data.

2. RELATED WORK

In this section, we cover related work in the areas of (1) collecting personal information and its benefits, (2) tracking barriers and its workarounds, (3) automated tracking systems and (4) manual tracking systems.

2.1. Personal Information Collection

There has been a growing interest on collecting personal information in many areas of research including medicine, psychology, and ubiquitous computing. Life-logging research can be traced back to the mid-90s [21]. **Personal experience** [10] archiving focuses on collecting the multiple aspects of a person's life by leveraging various sensors.

Early life-logging systems focused on building a personal database, and usually incorporated extreme collecting methods. Examples include MyLifeBits [6] which gathered every possible data on the personal computer and SenseCam [22] which recorded video ceaselessly with a camera hung on the person's neck. Later, the idea of life-logging gave birth to the quantified self (QS) movement which envisioned the possibility of changing people's lives by reflecting on the collected personal data. People following the QS movement keep track of their target behaviors through various automatic and manual methods. The purpose of this self-tracking includes maintaining healthy behavior [4], better decision making [5], or just for reminiscing through journaling and archiving [13][22]. In addition, because self-monitoring is typically initiated with a specific goal in mind (e.g., maintaining health), providing proper feedback that convey comprehensive insights on the collected data is considered critical for designing self-monitoring systems [4][8]. The feedback enhances the person's self-awareness—being aware of one's current state—and lead to promoting the person's behavior in a positive way [3], which is referred to as

reactivity or reactive effects [12]. Our work builds upon the aforementioned research areas as we try to cover a wide range of data tracking scenarios.

2.2. Barriers in Tracking and Workarounds

Technological limitations or flaws in tool design may impose barriers in data collection, and can act as an obstacle for the tracking effort. For example, in cases where a single tool cannot exhaustively capture every aspect of what the user needs to, the incomplete tool acts as a barrier which hinders the tracking. In such cases, users may look for another tool which is useful for recording the leftover parts, or interweave both trackers [14] to complete their tracking.

In a study on self-tracking enthusiasts by Choe and colleagues [2], many quantified-selfers claimed that instead of using dedicated self-tracking tools, they preferred used generic tools such as spreadsheet, pen and paper, or custom-built tools if programming was an option. One of the reason for this was that the participants wanted to track and explore data in a single tool, but existing tools did not support such a complete tracking experience. Considering that these efforts were done by some of the extreme users, it is possible that this lack of 'universal' tracking is a tough barrier for average users who do not have as much resource to spare. According to the stage-based model [9] by Li and colleagues, the barriers cascade to later stages. Thus, this barrier could be problematic for the overall self-monitoring experience.

2.3. Automated Tracking Systems

Automated tracking has an incomparable advantage over manual tracking in which it does not require the user's attention in order to gather the targeted data, and therefore has near zero tracking burden. However, automatic tracking cannot track values that are subjective and the user's input is a necessity, such as tracking sleep

quality, taste, or exercise. Although powerful if used, automated tracking is limited to certain data features.

The scope of automated tracking includes recording the video of whatever is happening in the background [22], automated periodic measurement of patient's vital signs at the hospital, and recording the smartphone or computer application usage for various reasons such as keeping track of personal productivity [8][18] or looking for patterns in where the user uses a specific application [7]. In a work by Jeon and colleagues [7], the application usage data and the GPS coordinates were automatically collected and visualized to let users find the correlation between application usage and the location. Kim and colleagues [8] collected similar dataset to keep track of personal productivity and find if differently framed feedback has any effect on the productivity.

However, automated tracking is too broad to be generalized and we will set aside the automated tracking in this work. Our work will focus on ameliorating the manual aspects of self-tracking.

2.4. Manual Tracking Systems

There are specific tools for needs, such as recording the sleep behavior [1] or diabetes management [11], but since many people often fail to find a solution that exactly suits their needs, technologies that can cover a wide range of tracking variables could be a better fit. Examples include spreadsheet tools such as Microsoft Excel and Google Spreadsheet, which actually is one of the most widely-used tracking tools [2]. Survey tools such as Google Forms can also be used. However, these generic tools do not incorporate tracking-specific assessment and intervention components that facilitate tracking and help maintain self-awareness.

3. THE STUDY

To gain qualitative insights on people's self-tracking practice, we conducted a semi-structured interview and surveyed apps on self-tracking listed in the iPhone App Store.

3.1. Interview

3.1.1. Method

Twelve self-trackers who record at least one of their daily routines including, but not limited to, workout, studying, sleep pattern, and food intake were recruited through convenience sampling. Example questions from the survey are as follows:

- What kinds of personal information do you keep track of, and why?
- What types of fields (date, duration, count, amount…) do you collect when tracking the activity?
- How do you collect the data? Do you use a specialized app, or do you just jot down the details somewhere?
- How do you look up records that you collected a while ago?

3.1.2. Findings

From the interview, we found that people were tracking a range of activities. Frequently tracked activities include movie and book reviews that occur once or twice a month, go-out journals (for choosing what to do on the next date based on what was good and bad), study duration, finished pages, sleep duration et cetera. For recording recurring events, one participant recorded what she missed and did not do that day instead of redundantly tracking the same data every time.

Except in cases where the logs are automatically recorded by the used tool (e.g. RunKeeper [19] logs the trail and the duration of the exercise automatically), most information were recorded manually because automatic recording was not feasible (e.g. tracking planks or squats before going to bed, tracking one's daily mood, or sleep quality). The most notable point was that people seldom used specialized apps for recording the information, but rather resorted to "appropriating" unrelated and general tools. Examples of appropriating general tools are as following:

- **Microsoft Excel (Spreadsheet)**

  Simple number-based tracking such as sleep or studying duration were mainly done in Excel. Since Excel provides a wide variety of functionalities – which is fairly straightforward and familiar to most users – people appropriating Excel were most open to creative explorations such as drawing graphs or viewing the statistical values. Although the users were comparatively skilled in using Excel, most did not know, or did not bother to use the advanced features such as regular expressions. Therefore, in order to remove the unnecessary complexity in data integration, people entered in the data using a simplified format. For example, time was entered in a way that allows easy calculation between values – e.g. 14.5 for 2:30 pm.

  Line or bar graphs were frequently observed adjacent to the data to reveal longitudinal patterns in data.

- **KakaoTalk (Messenger)**

  Although Excel is not aimed to suit the needs of self-tracking, it does have various functionalities related to data collection, integration and visualization. Therefore, the use of Excel to track one's activities is not unexpected, and rather understandable. However, an interesting finding was

that some seemingly unrelated tools were used to track data, and KakaoTalk is an example.

People with the same purpose gather up in a group message and send messages whenever they feel the need to record information. Since everyone has a common understanding, the messages are not verbose and only contain necessary information. For example, in 'daily plank' group message, one sends the total count of finished planks year after completing a round. Because KakaoTalk is a messenger application, it does not provide proper means to store and process the tracking data. Therefore, the main focus is on simply and quickly recording the data, rather than viewing the recorded data and reflecting on it.

- **Instagram (Photo-sharing Social Network)**

  Social Media, when used for tracking, has a very small access burden because they are used even when tracking is not the reason for the usage. Similar to using KakaoTalk, some participants used multiple Instagram accounts to keep track of certain self-tracking entries. For example, special-purposed account for weight-loss was used for uploading meals throughout the day. Account is preferably set to private and shared among other people with same goals.

- **Naver Café (Internet Forum) Posting**

  Using group messaging or Instagram to track information is only feasible when the the tracking information is small. The advantage of using such existing Social Media to record data is that the access burden is reduced and information can be recorded without the task switching burden. If the tracking entry becomes too complex, the advantage of such tools is overwhelmed by the cumbersome input method and in this case, Internet

Forums were used instead. Each posting acts as a tracking entry, and the information is logged in a journal-like fashion. Photos and videos are occasionally included.

- **Evernote (Cloud-based Note-taking Tool)**

  If privacy is an issue and discretion is preferred, note-taking apps such as Evernote in which entries are not publically disclosed are favored over forum postings. Note-taking apps were preferred over Spreadsheet tools if the entry was more verbose and/or included images.

Participants tried using various apps to track their information at the beginning of their self-tracking experience. But they soon got rid of the apps and switched to the current method either because of the implied tracking burden or because the tool did not support what they wanted to track. Simplicity was one of the main criteria of choosing which tool to use. Appropriating tools such as messaging apps or Instagram effectively reduces tracking burden because participants would use the app even if tracking is not the main purpose. Although lack of functionality was one of the reasons for not using the tool, having too many inappropriate functionalities, especially fields that have to be filled in even though unnecessary to the user was one of the top reasons for tracking fatigue.

3.2. Mobile Tracking Application Analysis

3.2.1. Method

We searched for apps using the keywords Tracking, Logging and Recording, sorted by total rating count and filtered out apps that had zero ratings count. Apps that were unrelated to information tracking were removed from the final set. We used the App Market Explorer by 42Matters [16] to apply our search criteria because the App

Store did not allow custom filtering and sorting. We picked maximum 5 apps per application category, which resulted 62 apps in total.

3.2.2. Findings

By surveying the apps that met our inclusion criteria, we were able to identify the following 5 features that constitute an information tracking application.

- **Activity Setup**

  This refers to the brief description of the tracking item. If the app is designed to track a specific item - for example apps for recording running, daily mood, sleep, blood glucose etc. - this step is often omitted. However, if the app needs to track multiple items, such as apps for tracking books, food intake, medications etc., this step gives the user a chance to setup what the user wants to track. Activity description and miscellaneous settings such as measurement units and various constants are set up in this step.

- **Data Logging**

  This step is where the user actually records the data into the app. Depending on the attribute of the tracking item, the value is either instantly registered in the system, or is deferred until the tracking process is finished. Data types such as time duration, location trail or audio / video recordings are not saved until the event is over. Other data types such as text, image, number are instantly recorded into the system.

- ***Post-tracking notes***

  This step is only present in cases when the logging is deferred. For example, in apps like RunKeeper [19], the user starts the tracking process by pressing the start button, and ends the tracking by pressing the button again after some time has passed. The user is given a choice to make a quick comment

on the tracking event that occurred at the time. If the act of tracking can be finished in one-step, this step is unnecessary.

- **Schedule / Reminder**

  Some apps allow setting schedules and alert user if tracking routine is not satisfied. Such apps include medication taking, goal making, mood / sleep tracking et cetera. We found three types of reminder functionalities from the apps that we looked through.

  - **Alarm-like behavior**

    This is the most basic type of reminders. User is notified at the specified time point.

  - **Interval**

    The application sends out multiple notifications during the specified period. This is useful when the tracking needs to be done several times a day, e.g. measuring the blood glucose level.

  - **Dynamic**

    Some apps employ a dynamic reminder functionality in which the alert is only toggled if the user is behind schedule. If the tracking does not come into action for a certain period of time, the user is notified and is urged to act.

- **Overview / Feedback**

  Applications provided various means to present saved data to the user. The presentation method included just simply showing the collected data in a list, showing a graph of certain fields, showing the representative statistical

values such as mean, median or standard deviation, overlaying the data on a calendar to show on which day the data was tracked, and plotting the data on a map in some applications.

Data Types

To analyze which types of data are being collected, we checked the data types the apps were tracking. We were able to identify the following 13 data types used in tracking applications.

Field Data Type	Count
Long Text (Notes)	28
Numeric (Page, Height, Weight etc.)	23
Boolean (Yes / No / Skip)	21
Date (Duration, Point)	20
Radio Button	20
Single-lined text (Title, Name etc.)	16
Location	11
Time (Duration, Time point, Stopwatch)	10
Image	5
No Fields (count)	5
Checkbox	4
Likert Scale	2
Misc. (Weather, Address book entry)	2

Table 1. Occurrences of field data types in tracking applications.

Long text was usually available in the form of notes. Numeric values were used to record values with units such as height, weight, or page number. Some simple

tracking cases only asked for if the event was done or not (Boolean), and in some cases, it checked if the event was skipped temporarily for the day. Date was also a common data type among the apps, because most apps provided some means to explicitly select the date of the actual event. Multiple choices (predefined choices) were present in the form of radio buttons (preferably with more aesthetically designed units, but functionally equivalent to radio buttons). Single line text (short text) were used for simple delineation of the activity, such as specifying the title. Some apps recorded the location of the event, and some recorded the location trail of the user during the tracking event. Time is a similar data type to the Date data type, but its granularity is finer. Like the long text, images were often used for note-taking purposes. Some apps did not have any fields to track, and only had a button for marking the event as 'done'. How many times the events were finished successfully was the main concern of these apps. Checkboxes are similar to the radio buttons, but allow multiple values as the input. Likert scales were used to rate the event. Some apps enabled the user to record the current weather or tag the event with the people from one's address book, but this was very uncommon.

4. Design and Implementation

From the results from the interview and app review, we identified the factors that are important in a self-tracking tool and set the design rationale. From this design rationale, we designed and developed OmniTrack, a manual tracking tool which allows the user to create tracking activities and set only the necessary fields. Of the five stages of personal informatics systems defined by Li et al. (preparation, collection, integration, reflection, and action) [9], OmniTrack mainly aims to make the preparation, collection, and reflection stage more convenient for the user.

4.1. Design Rationale

- **Wide coverage of common information tracking practices**

  From the interview, we found that people were appropriating unrelated tools because there was no single tool that can accommodate their tracking needs completely. A tool to cover the information tracking practice in general should allow the user to track a variety of data fields in which the user can select upon. This corresponds to the preparation stage.

- **Lowering tracking and access burden**

  Tracking burden is one of the major reason that people give up tracking. Although manual tracking has a vast advantage of being able to record subjective information, the tracking process is extremely burdensome, and an adequate method to lower the burden is essential. The tracking burden can be minimized by reducing the number of required fields that has to be entered in, and by reducing the number of layers required to access the tracking page. This corresponds to the collection stage.

- **Supporting Data Integration and Exploration**

Data does not have much value if it cannot be explored thoroughly. The tool should support various interactive data exploration methods, or at least provide means to export the data into professional data analysis tools. This corresponds to the reflection stage.

4.2. Design and Implementation of OmniTrack

To address the mentioned issues and demonstrate the usefulness of the design rationale, we designed and implemented OmniTrack, a highly customizable manual tracking tool. OmniTrack supports Activity Configuration, Data Logging with iOS widget support, and Feedback, and is created with the design rationale in mind.

4.2.1. Activity Configuration

OmniTrack was designed to simplify the creation of arbitrary tracking activity, and

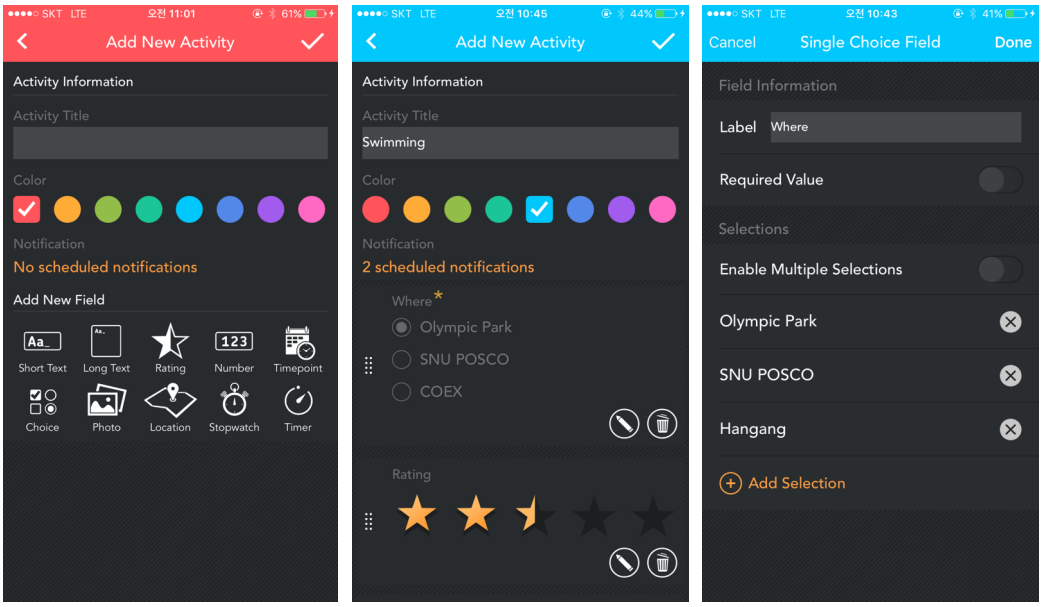

Figure 2. In the Activity Configuration panel, fields for creating the activity is set up, and miscellaneous settings can be modified.

therefore support setting up various fields for flexibility.

Activity Information Subpanel

The title of the activity and the theme color used for easily distinguishing different activities is set in the activity information subpanel (Figure 2). These two information acts as the main identity of the activity. Notification schedule can be set up by pressing the orange text indicating the scheduled notifications.

Notification Scheduling

Notification settings can be scheduled in this menu (Figure 3). OmniTrack supports two notification scheduling types – notifying the user at the specified time point, or giving out notifications randomly between specified time points.

New Field Subpanel

OmniTrack supports 10 data types which can be used in creating an activity. Short / long text, rating, number, time point, choice, photo, location, stopwatch, and timer is

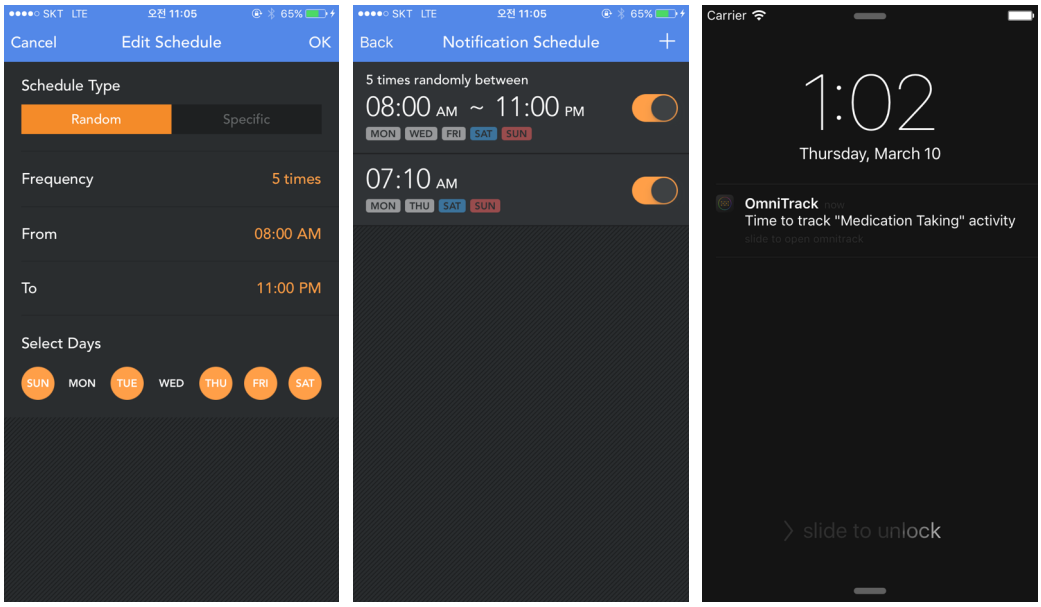

Figure 3. Notification settings can be modified in the Notifications panel.

supported (Figure 2). The field is added to the template when the icon of the corresponding field is pressed. Miscellaneous settings including the title of the field, order of the fields and various field-dependent settings can be modified by clicking on the edit button. This template will be used in the data logging step.

4.2.2. Activity List and Data Logging

Activity created in the activity configuration panel (Figure 4) is listed in the activity list and the quick logging widget (Figure 5). Information on the activity such as last tracking time and the total tracking count is listed in this panel, and the user can access the tracking screen by clicking on the name of the activity, and view the summary on the data by clicking on the summarized feedback button on the right. The activity settings can be modified later on – if the user decides that a field is unnecessary or necessary, it can be dynamically added – and the edit screen can be accessed from the activity list by swiping on the name of the activity.

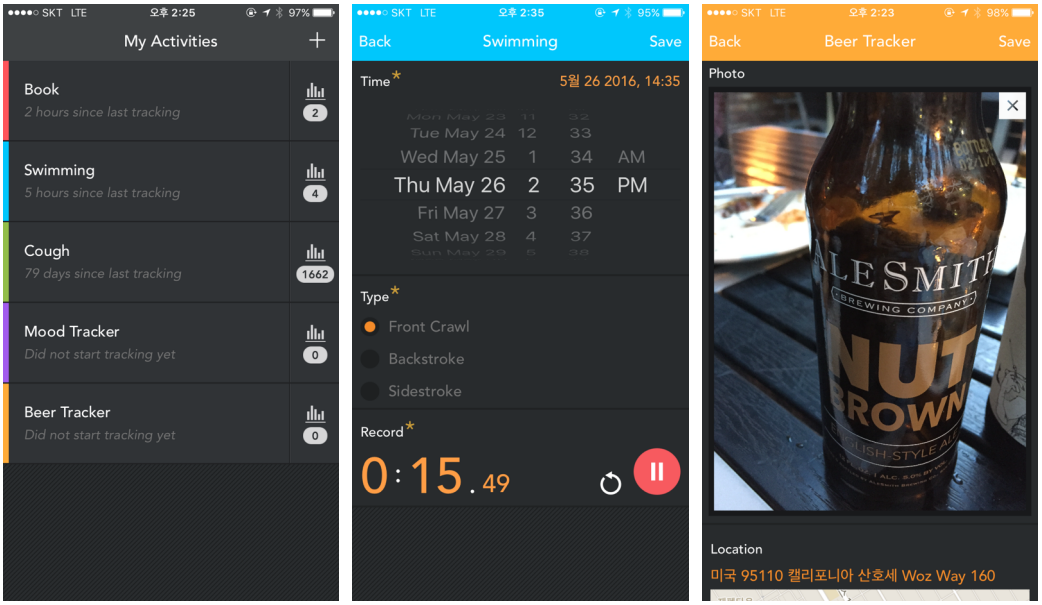

Figure 4. Activities created from the activity configuration panel can be accessed from the activity list panel. The user can log the data by clicking on the activity.

Quick Logging Widget

To lower tracking burden, we utilized the iOS today widget as a way to quickly log simple activities. Activities that are simple enough to be logged using a single tap – such as checkbox, radio button, rating and stopwatch toggling - can be directly tracked from the widget without having to open the app. Activities that do not contain any other field than the logging time can be directly logged by pressing the logging button, and with activities with additional fields, a screen containing the fields is revealed when the button is pressed. If the activity contains fields that require complex input such as text field, image, or location, the widget acts as a shortcut which opens up the new log screen in the main app.

4.2.3. Data Overview

In the data overview panel, a heatmap which depicts when the tracking was done is shown. Auxiliary data such as the total number of logs in that month is shown on top, and the user can explore to other month by pressing the arrows. Fields that can be

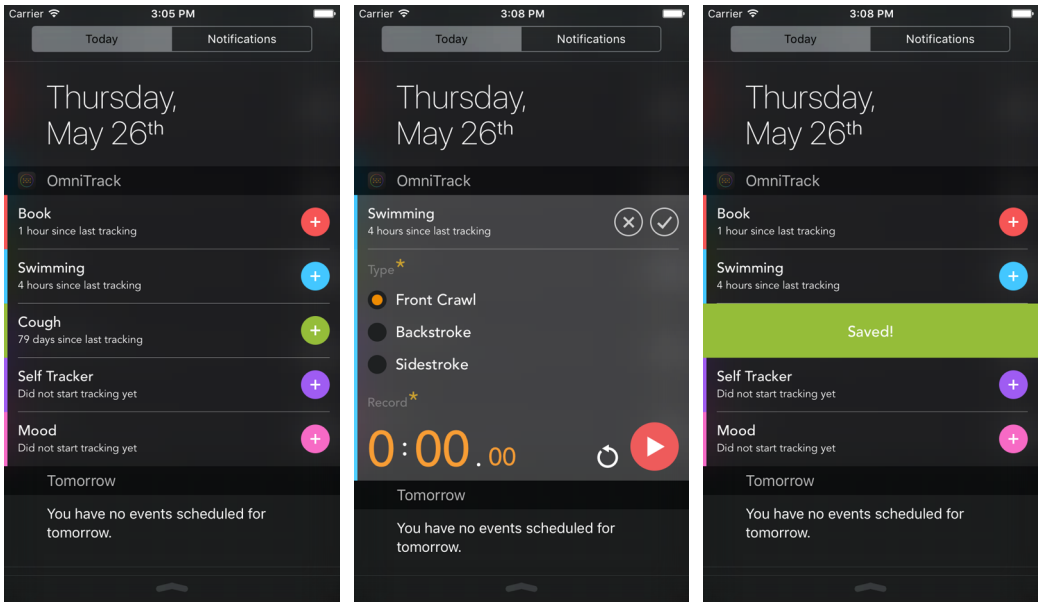

Figure 5. Simple and quick tracking is possible from the Quick Logging Widget.

summarized, such as the choice field, rating field, or number field are summarized to a bar graph or a line graph. The raw data can also be viewed by pressing the Log List button on the navigation bar. Data can be modified by pressing the edit button from the data list.

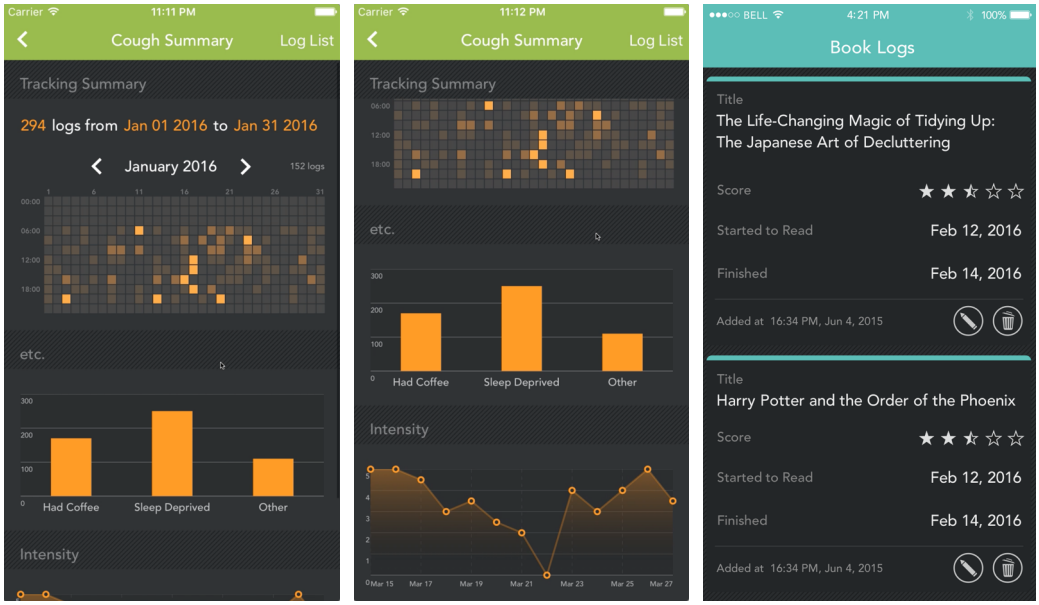

Figure 6. Data overview panel.

5. Use Case Scenarios

To validate the usefulness of OmniTrack, we selected three common tracking cases from the QuantifiedSelf blog [23] and from the interview result, and demonstrate it through our prototype.

Allergy Cause Tracker

Finding the cause for a symptom –e.g. for an allergy occurring sporadically – is one of the main reasons for self-tracking. However, because the causes can be different for each person, such tracking cases are difficult to generalize. Nevertheless, because people experience such symptoms repetitively, they do have a vague idea of what is causing discomfort, and therefore the users can start with a list of suspicious candidates.

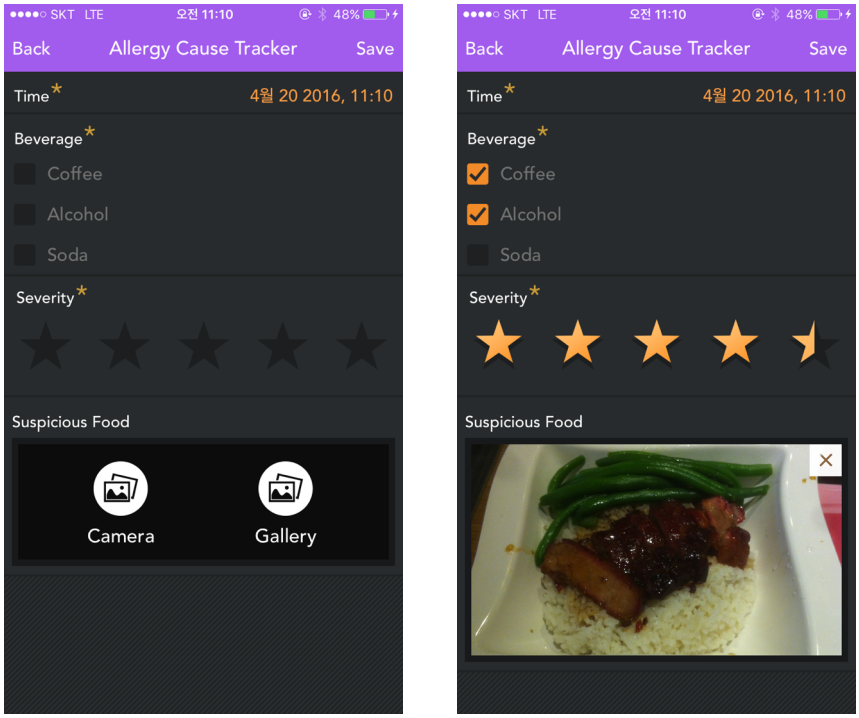

Figure 7. Allergy cause tracker example.

Study Tracker

Although not frequently found in literature, many interviewees (particularly the ones preparing for an examination) claimed that they were logging their study duration along with miscellaneous information such as sleep duration. If simply recording the duration is the purpose, one can use the quick widget and start the timer, and stop the timer when tracking is finished. If more context is required, one can add additional fields into the activity and record it in the app.

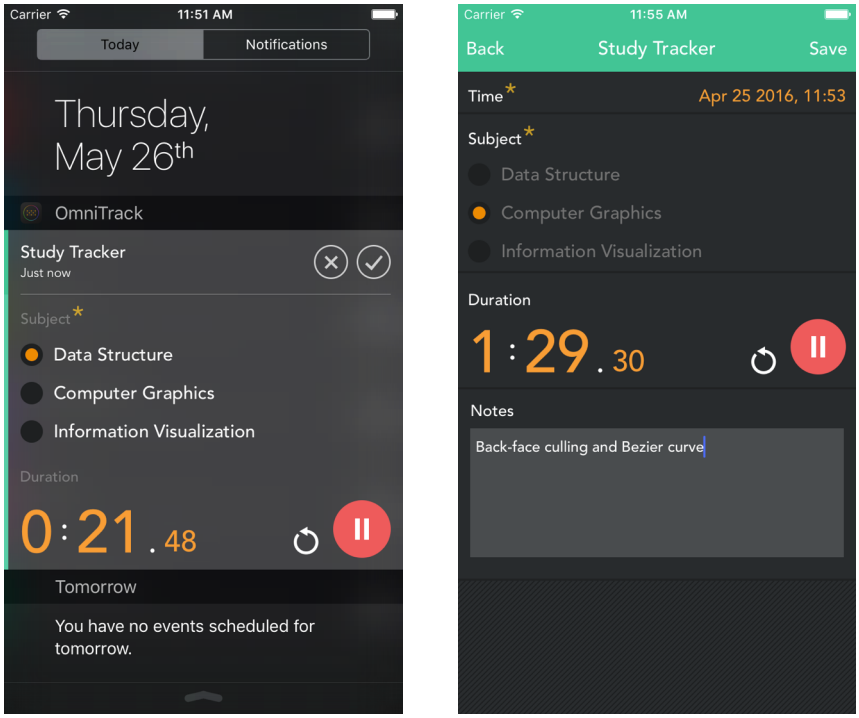

Figure 8. Study tracker example.

EMA-like scenario

The scheduling feature can be used to gather patient generated data at the specified time point. For example, the doctor may ask an overweight patient to measure his weight every Sunday at 1pm, and the patient would be notified every Sunday. The doctor can use this data to view the pattern in the patient's weight.

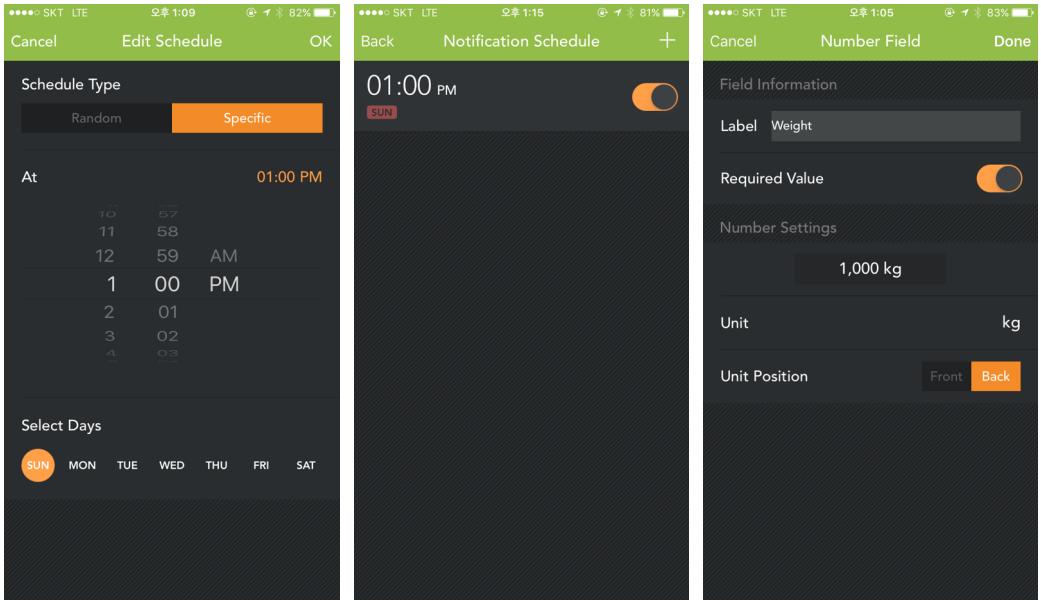

Figure 9. EMA-like tracker example.

6. Discussion and Future Work

To identify the possible benefits of self-tracking in diverse contexts, we interviewed 5 medical doctors from various medical departments to enquire the current self-tracking practices in the context of doctor-patient relationship. We asked the doctors if they request the patients to track one or more features of their lives, and whether such data was used to augment consultation and treatment. However, we found that in Korea, the allocated consultation hours to each patient is extremely short (typically around 3~5 minutes) due to the low medical charge, and therefore doctors do not have the time to review the data. The doctors claimed that if the the tracking data to be of use, a summarized view which allows the information to be picked up in a glance would be necessary. Preferably, the system should allow flexible data analysis and visualization, such as allowing related activities and its fields to be juxtaposed, and unrelated fields to be hidden. The system should act as a platform in which the doctor and patient can review the health data in a comprehensive way.

Moreover, patients with chronic diseases need to be aware of their condition constantly, and is critical for them to track the health status and review it before the situation becomes serious. For example, mood disorders are 'episodic', meaning that the unhealthy condition occurs periodically, and if any anomalies in the pattern is found, appropriate measures can be taken to prevent the disorder from recurring. However, it is difficult for the patient to always keep track of their daily lives every day, therefore, the need for automated tracking is substantial. Therefore, the tool should ultimately become a hub for automatic and manual tracking, receiving input from various hardware that support automatic tracking and allowing a semi-automated tracking approach.

7. Conclusion

In this paper, we presented OmniTrack, a flexible manual tracking system designed to support arbitrary self-tracking use cases. Our goal was to provide a powerful tool which suits various tracking needs to the people with self-tracking needs, but do not have the ability to find the right means, or create their own well-tailored tracking tools. By interviewing a sample of the self-tracking population and surveying popular self-tracking apps in the App Store, we identified the design space of manual tracking and developed a mobile application OmniTrack to demonstrate the usefulness of the derived design criteria. We demonstrated the coverage of the developed application by presenting use cases. As future work, we plan to extend this work to accept automated tracking inputs and provide a more flexible overview of the tracking data to accommodate the tracking needs of a wider population, and plan to prove the usefulness in the context of doctor-patient relationship through a deployment study.

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국문 초록

유연하고 쉽게 사용자화 할 수 있는 퀀티파이드 셀프 도구 디자인

서울대학교 대학원

컴퓨터공학부

전재호

최근 들어 자신의 삶에서 일어나는 일들을 기록하는 '셀프 트래킹'의 인기가 늘어나고 있다. 하지만 사용자들은 자신이 원하는 것과 일치하는 툴을 잘 찾기 어렵고, 적당한 툴을 개발할 수 있는 사람들은 매우 적기 때문에, 사용자들은 일반적인, 셀프 트래킹과 관계 없는 툴을 적절히 '전용' 하는 모습을 많이 확인할 수 있다. 이 연구에서는 셀프 트래킹에 대한 욕구는 있으나 적절한 툴을 찾지 못하는 사람들에게 도움을 주기 위해서 유연하게 자신에 맞게 개인화를 할 수 있는 매뉴얼 트래킹 툴인 OmniTrack 을 디자인하고 개발하였다. 12 명의 셀프 트래킹을 하는

사람들을 인터뷰하고, 셀프 트래킹과 관련이 있는 앱 62 개를 앱스토어에서 찾아 리뷰를 하여 매뉴얼 트래킹 어플리케이션의 디자인 스페이스를 확인하고, 이런 툴을 개발할 때 따라야 하는 가이드라인을 제시하였다. 또한, 이 가이드라인을 따른 스마트폰 앱의 프로토타입을 만든 후, 사용 가능한 예를 제시하며, 이 툴이 의료 환경에서 환자와 의사의 소통을 도울 수 있는 도구로서 활용될 수 있을 가능성에 대해서 논의하였다.

키워드 : 퀀티파이드 셀프, 셀프 트래킹, 셀프 모니터링, 매뉴얼 트래킹

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