Improving the Effectiveness of Lifestyle Management Systems
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Abstract
Many experts suggest that daily habits are the essence of a happy and healthy life. Thus far, Lifestyle Management System has become increasingly popular around the world. However, most Lifestyle Management Systems available are not adequate for the purpose of behavior modification as that requires consistent effort and guidance. This report will explore features that could improve the effectiveness of a Lifestyle Management System from 8 related research publications and discuss the possibilities of integrating these features into a web-based calendar/diary interface.

1. Introduction
The goal of this project is to build a calendar/diary interface that enables people to record their daily habits. Our daily habits directly influence our health and overall wellbeing. However, good habits are in fact very hard to form and they require consistent effort to be made. In "How are habits formed: Modeling habit formation in the real world" [1], Lally and her research team came to the conclusion that it takes about 66 days before a new behavior becomes automatic. For this purpose, different Lifestyle Management Systems have been developed to help people form good daily habits. Numerous evaluations of currently available Lifestyle Management Systems have been conducted and the results show that there are few success stories in the field, most systems are adequate for behavior management and modification, the vast majority of users stop using the system before their new habit is formed. Obviously, simply allowing users to record their daily habits will not fulfill the task of assisting users to manage and modify their lifestyle, improvements on the effectiveness of the system is essential.

This report will examine different Lifestyle Management Systems from the 8 research publications in terms of Usability, Motivating Factors on the System and Support Provided to Users. These 3 aspects are considered to have the most critical impact on the effectiveness of a Lifestyle Management System and user’s usage frequency of the system. Lastly, this report will discuss the possibilities of integrating these findings to the web-based calendar/diary interface to improve the effectiveness of the system.

2. Literature Review
2.1. Usability
Usability is the measure of the quality of a user's experience. User’s usage frequency of a system is hugely determined by the usability of the system. In a worst-case scenario, a user will not use the system at all if he is not satisfied by the usability of the system. As mentioned earlier, behavior modification requires consistent effort, in order for users to use the system frequently, a good usability is vital. Apart from the 5 quality components (Learnability, Efficiency, Memorability, Errors, Satisfaction) that together define the usability of a system, a Lifestyle Management System should also provide the following features to improve its usability.

2.1.1. Access to the system
In "Evaluation of a Web-based Self-learning System for Lifestyle Improvement" [7], authors of the study examined a web-based Self-learning System for Preventing Lifestyle-related Disease developed by the NIH (National Institute of Health and Nutrition) of Japan. The purpose of the examination is to find possible improvement to the usability of the web-based system. Students from a college in Japan were asked to use the system during the trial and to finish a questionnaire concerning the usability of the system. Authors of the study analyzed participants' use history during the trial as well as information obtained from the feedback questionnaire. Results of the study suggest that most of the participants were able to access the web-based system every day. However, the authors found that about 30% of the participants only access the system once a day. The reason of low frequency of use was mostly that many people do not have access to a computer all the time during the day. Hence one of the key factors to improve the usability of a web-based system would be whether the system is mobile-friendly (The system offers a good user experience on a small screen) when users access the system on a phone. Because smartphones have better portability comparing to computers, it is easier for people to have access to a smartphone nowadays.

2.1.2. Ease of Data Recording
Most users do not have the time or knowledge to convert their meals into amounts of nutrition. Another proposed improvement in "Evaluation of a Web-based Self-learning System for Lifestyle Improvement" [7] was that the system
should have a built-in calorie calculator to estimate users' calorie intake of their meal, i.e., instead of asking the user how much calorie did they take for lunch, calculate it for them based on the food and amount they took.

The principle of simplifying data recording should be applied to other fields of data such as exercise taken too. Instead of asking the distance a user walked today, a better approach would be to ask the time they walked today, or even better - record the data for them. With the fast spread of Smartphones, more and more mobile-based healthcare systems are available to the public now. mobile-based healthcare systems have several advantages over web-based ones. One of the advantages is that most smartphones now have built-in sensors which can be used to record users' physical activities passively. By doing this, users are able to record their exercise data more accurately and with no effort. Furthermore, some research also shows that using Phone-Based Activity Monitors could have the effect of promoting physical exercise. In "Using Phone-Based Activity Monitors to Promote Physical Activity in Older Adults: A Pilot Study"[8], authors of the paper present a pilot study that examines the feasibility of using sensor-based activity tracking application to motivate older adults to stay active. 8 participants aged between 50 and 80 years used the application over a period of three weeks to track their daily physical activities. The result of this pilot study shows that participants increased their daily physical activity by 15% over the first week. Most of the participants were happy to stay active in order to obtain a better report of their daily physical activities. However there are two main issues that might stop people from using passive sensors to record their activities. The first issue is the portability of phones because users have to carry their phone everywhere they go. Another issue is that using passive sensors will increase the battery usage of the phone and reduce the battery life. Additionally, sensors on smartphones do not support web-based systems. In order to use the sensor-based activity tracking feature in this project, a mobile application version of the system must be developed.

2.2. Motivating Factors

Again, forming or changing our daily habits requires long-term effort to be made. motivating factors are the factors that encourage users to keep up their effort to behavior management. If the usability of a system will decide whether a user will start to use the system, motivating factors of the system will determine whether the user will stick to using the system.

2.2.1. Motivation from peer

Behavior modification requires user's long-term effort. In order for users to use the Lifestyle Management System consistently, the system should keep the user motivated by different means until their new habit has been formed.

In "Self-efficacy: toward a unifying theory of behavioral change" [3], Bandura claimed that Vicarious experience could affect self-efficacy. The term "Vicarious experience" means that, when people see someone accomplish certain task, their self-efficacy will increase when performing similar tasks. This theory is the basis of the peer learning technique and is now widely used in health promotion. Authors of the paper "Effect of web-based healthcare system on behavior modification"[2] applied this theory to a web-based healthcare system to encourage users' behavior management and modification. The system gives users the access to other users' daily behavior data and enables users to follow other users' training progress. A six-month-trial was held in 2009 in Nakatsugawa City, Japan to test this healthcare system. Participants of this trial were told to walk with a pedometer every day and upload their data once a week. Analysis of the uploaded user data shows that the continuance rate (Participants who continued to walk everyday and uploaded their data on time throughout the trial) of those who viewed other users’ daily data was 75.6% while the continuance rate of those who did not view any other users’ daily data was 57.1%. The results of the trial suggest that viewing other people’s daily health and progress data could potentially increase the users’ continuance using rate of the system and encourage behavior management and modification.

This paper suggests that users can get motivated through the "Vicarious experience", which in this project, refers to other users' successful case of behavior management and modification. Therefore, one way to keep users motivated and encourage users to continue their efforts to lifestyle modification is to allow users to view other users' progress and achievements. Noting that the system must be able to sort different users into a number of groups based on their personal information and goals so that only relevant peer information is provided to users.

2.2.2. Design Principles based on learning theories

Authors of the paper "Habit Change as a Learning Process: Design Framework for Mobile Interventions " presented a framework for interventions based on learning theories, and also introduced a mobile habit change application called "Mindless Change".

The basis of the framework lies heavily in learning and behavioral theories. The most important design principle is to engage the user in an active dialog (Figure 1) when using the system. In this way, the system is able to provide rich and motivational feedback to the user as well as raise their curiosity to motivate them to take further action. User actions are responded with positive feedback and
reflection (Figure 1e) to create a feeling of competence. Furthermore, autonomous planning is supported by the system, which means users are able to define their own customized goals and tasks. It is also noted that the user should take small steps when customizing tasks so that every step is challenging yet achievable.

![Figure 1: Wireframe presentation of "Mindless Change"](image)

### 2.3. Support to Users

In an European FP7 project called "Preve", people are studying how to capacitate people with personal IT services and solutions that encourage them to modify and manage their lifestyles in order to preserve their overall wellbeing. Results of the project so far strongly suggest that forming and maintaining new habits requires support and guidance. This literature review will discuss two sources of support that can be provided to users. The first one is peer support from other users, and the second one is personalized advice obtained from conducting analysis based on the user’s information.

#### 2.3.1. Peer Support

Authors of the paper "Beyond health tracking: A personal health and lifestyle platform" suggest that peer support is the most effective way to help and guide people who want to change their lifestyle. To this purpose, Authors of the paper introduced the idea of "co-producers" where co-producers can be doctors, friends, family or anyone relates to the individual. Furthermore, the authors have developed a PHLR (personal health and lifestyle record) and a platform that monitors and assesses an individual’s lifestyle and gives personalized advices on how to improve the user’s lifestyle.

An alternative solution to support peer support is to integrate the system into social media platforms such as Facebook. i.e., users of the system can post their progress on Facebook to get support from professionals and friends. Additionally, users can also invite their friends to join the system via Facebook or mobile Contacts. As a result, the system will enable more interactions between individuals and their supporters in order to guide and motivate individuals.

#### 2.3.2. Support from the System

The authors of "A Web Application for an Obesity Prevention System Based on Individual Lifestyle Analysis" [6] developed an obesity prevention system that helps a user to change his/her lifestyle with a web application. The web application of this system is able to detect whether a user has habits that are considered as risk factors of obesity. After the detection, the system will display the results of the analysis in forms of graph and list to let the user directly see the deficiency of his/her lifestyle and encourage the user to change his/her lifestyle. The authors have conducted several experiments with participants, and the results show that by using the obesity prevention system, participants realized the consequences of their current lifestyle and were motivated to improve it.

Similarly, In “An Integrated Web-based Platform for the Provision of Personalized Advice in People at High Risk for CVD", authors of the paper presented an integrated web-based platform that is able to detect the factors that could potentially increase the risk of Cardiovascular Disease (CVD) by using the Body Mass Index (BMI). The analysis is based on the user’s genetic and lifestyle information. Personalized advice on reducing the risk is also provided to the user after the analysis.

Both systems here have introduced the "risk factor analysis" feature for the purpose of reducing the risk of certain disease. This idea can be applied to our daily habits calendar as a general health guide - The system analyzes user’s activities (e.g., eating and exercise) in a period of time and gives warning to the user if the user’s activities could potentially lead to any disease or unhealthiness. For example, If a adult user’s daily sugar intake exceeds 200g (recommended sugar daily intake is 90g for normal adults) for over a week, the system will warn the user about the harm of high sugar intake and suggest the user to cut his sugar intake. In addition, the system could provide personalized workout advices or tips based on users’ goals and body status. e.g., if a male user weights 70 kg and his goal is fat loss, the system will use the corresponding formula to calculate the recommended amount of exercise for fat loss purpose, then convert the amount of exercise into specific workout plan. e.g., to walk for one hour every day. The system should also give advices on the user’s diet as well. In order for this feature to work, a big amount of research on nutrition and healthy lifestyle is required.
3. Conclusion

This report has explored several features and improvements for the web-based daily habits calendar as well as other Lifestyle Management Applications. According to the literature review, forming and changing habits require consistent effort and support, hence it is apparent that simply meet the project requirements of allowing users to record their daily habits data is not sufficient for behavior management and modification. Improvements in a variety of aspects need to be made in order to increase the effectiveness of the system as well as user’s usage frequency of the system. More specifically, a Lifestyle Management System should focus on its Usability, Motivating Factors and Support Provided to Users so that its users are always motivated and guided.

4. Future Work

Some of the features discussed in this paper can be carried out on the implementation phase of this project, such as a built-in calorie calculator, integration with social media platforms and positive feedback provided to users after they complete a task. Some of the features require further research, for example, if the system is to give personalized advices/warnings to users, more research in the areas of nutrition and healthcare is required for analyzing user’s information and status. Other Improvements to the system such as peer support, mobile-friendly system or mobile-based system are out of the project scope. However, all proposed features and improvements are capable of enhancing the effectiveness of the system and therefore should be considered in future development of the system.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Requirements</th>
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<tbody>
<tr>
<td>Mobile-friendly</td>
<td>Make the system Mobile-friendly to improve user's experience for mobile users.</td>
<td>Use software that supports mobile-friendly site development.</td>
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<td></td>
<td></td>
<td>Take a mobile-friendly test.</td>
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<tr>
<td>Simplified data recording</td>
<td>Simplify user's activity recording using built-in convertor. Users only need</td>
<td>Some research on converting different food into amount of calories as well as</td>
</tr>
<tr>
<td></td>
<td>to specify the type and quantity of their activity.</td>
<td>converting exercises taken into calories burned.</td>
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<tr>
<td>Passive sensor recording</td>
<td>Use sensors on smartphones to passively record user’s physical activity.</td>
<td>A mobile-based version of the system that supports passive sensor recording.</td>
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<tr>
<td>Peer support</td>
<td>Allow users to view other users' progress to create a &quot;Vicarious experience&quot;</td>
<td>Implementation to allow communication / information sharing between users based</td>
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<tr>
<td></td>
<td>in order to motivate the user.</td>
<td>on their similarity.</td>
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<td></td>
<td>Allow peer support between users who have similar goals.</td>
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<tr>
<td>Personal advices by</td>
<td>Provide user-specific support / advice by analyzing user's information and</td>
<td>Research in the areas of lifestyle and nutrition.</td>
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<tr>
<td>system analysis.</td>
<td>activities to keep the user on the right track.</td>
<td>Implementation to provide support / advice to users by analyzing user's</td>
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<td></td>
<td></td>
<td>information and activities.</td>
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<tr>
<td>Autonomous planning</td>
<td>Users are able to define their own customized goals and tasks.</td>
<td>Implementation to allow goals and tasks customization.</td>
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<tr>
<td>Small steps</td>
<td>Split goals into sub-goals, each sub-goal should be challenging yet</td>
<td>Implementation to allow goals and tasks customization.</td>
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<tr>
<td></td>
<td>achievable.</td>
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<tr>
<td>Positive feedback</td>
<td>Give users positive feedbacks after they meet a goal/sub-goal.</td>
<td>Implementation to give positive feedback after user completes a task.</td>
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Table 1: A summary of features discussed in the Literature Review
5. Reference


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