

## Developing an Intelligent Exercise Reminder System Infused with Sense of Community

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**Abstract.** The aim of this paper is to demonstrate the development of an intelligent exercise reminder system based on the theory of sense of community in order to motivate users exercise according to schedule. Theoretically, this system fulfills the requirements of the components that promote sense of community, namely membership, influence, integration and fulfillment of needs and shared emotional connection. Core modules are built using PHP and J2SE. An SMS gateway retrieves data from MYSQL database and exercise center coordinates are delivered to users through Garmin PeerPoint Message for supported mobile devices. The intelligent exercise reminder system also has an intuitive web-based user interface for user's easy access and exercise timetable management. The result of this research project is an exercise reminder system that not only reminds, but also motivates users to adhere to exercise schedule through sense of community.

**Keywords:** exercise adherence, reminder system, sense of community, connectedness

### 1. Introduction

There is no doubt that exercise could help to promote health for individuals. Besides bringing physiological benefits, such as reduced obesity, hypertension, increased metabolism, exercise could also provide psychological benefits, which include reductions in anxiety and depression [1] [2]. While general rules state that exercising thirty minutes for three days in a week could achieve body fitness, adhering to exercise schedule could be challenging even for advanced fitness enthusiasts. Dishman [3] defines adherence to an exercise program as the "level of participation a behavioral regimen once a person has agreed to undertake it". People either quit in an early stage or could not achieve health gain benefits due to not being able to meet the minimal requirements of exercising. Young [4], Dishman, Sallis and Orenstein [5] explored the factors affecting individual adherence to exercise program, which include personal, environmental and program factors. The goal of this paper is to develop an intelligent exercise reminder system based on the sense of community theory to motivate users to exercise according to schedule, attempting to shed light on the environment factor.

### 2. Literature Review

As argued by Young [4], Dishman *et. al.* [5], social support, such as family, peer and exercise partner participation, resembles an important environment factor in exercise adherence. Drawing from this argument, we endeavour to build an exercise reminder system adopting the concepts delineated in the theory of sense of community. McMillan and Chavis [6] provided a theoretical framework, in which four major attributes, namely membership, influence, integration and fulfillment of needs and shared emotional connection, defines the sense of community. Specifically, membership is defined as "the feeling of belonging or of sharing a sense of personal relatedness" and influence is defined as "a sense of mattering, of making a difference to a

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group and of the group mattering to its members”. Integration and fulfilment of needs is achieved when members are awarded by the individual-group relationship, and shared emotional connection is “the commitment and belief that members have shared and will share history, common places, time together and similar experiences”.

Sense of community theory has well been adopted in studying the impact of community on learning. For example Sadera, Robertson, Song and Midon [7] studied the role of community in online learning success and Dawson, Burnett, O’Donohue [8] proposes an effective measurement tool to gauge sense of community experience in higher education. To the knowledge of the authors, there is lack of attempt to adopt sense of community theory in the field of exercise adherence. Besides filling this knowledge gap, we take the first step to build a system guided by the concepts of sense of community theory.

### 3. Development of the Intelligent Exercise Reminder System

#### 3.1. Overview of Exercise Reminder System

The exercise reminder system (abbreviated as ERS from here on) has the ability to deliver automated exercise scheduling service and ability to improve user social experience by scheduling user with the same interest to exercise at the same place. Users are allowed to input their free timeslots into the system. After that, ERS will automatically send SMS (short-messaging-service) notification to the user when the time for exercising is approaching. However, this is not the only intended function of ERS. In order to stimulate user’s interest, ERS notification will also incorporate suggested nearest exercise centre based on user’s location, achieved through GPS (global positioning system). If user’s mobile phone supports GPS maps, then ERS will send the guide to guide route directly into user’s mobile phone. Else, user could refer to the online map for directions. In another attempt to motivate user to exercise, different kind of exercises are proposed each time when a notification is sent. Since social support is an important factor motivating individual to exercise, ERS asserts that an exercise centre with certain number of people could motivate user to exercise. Hence, ERS would propose exercise centres where many other users are going. Figure 1 depicts the flowchart of ERS and Figure 2 shows the components interaction and data transfer in ERS.

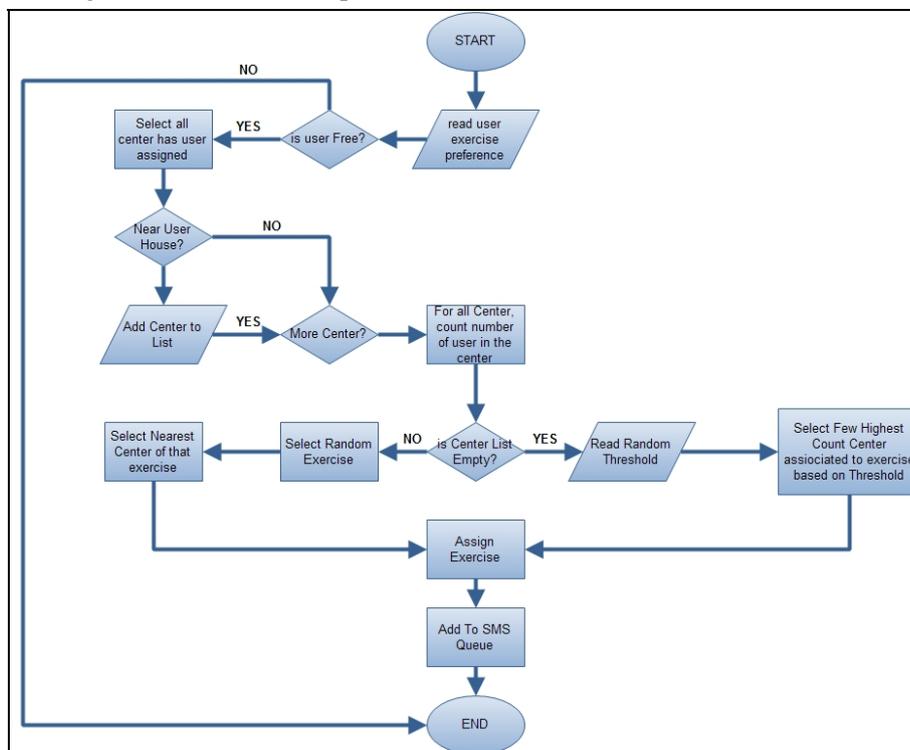


Fig. 1: ERS flow chart.

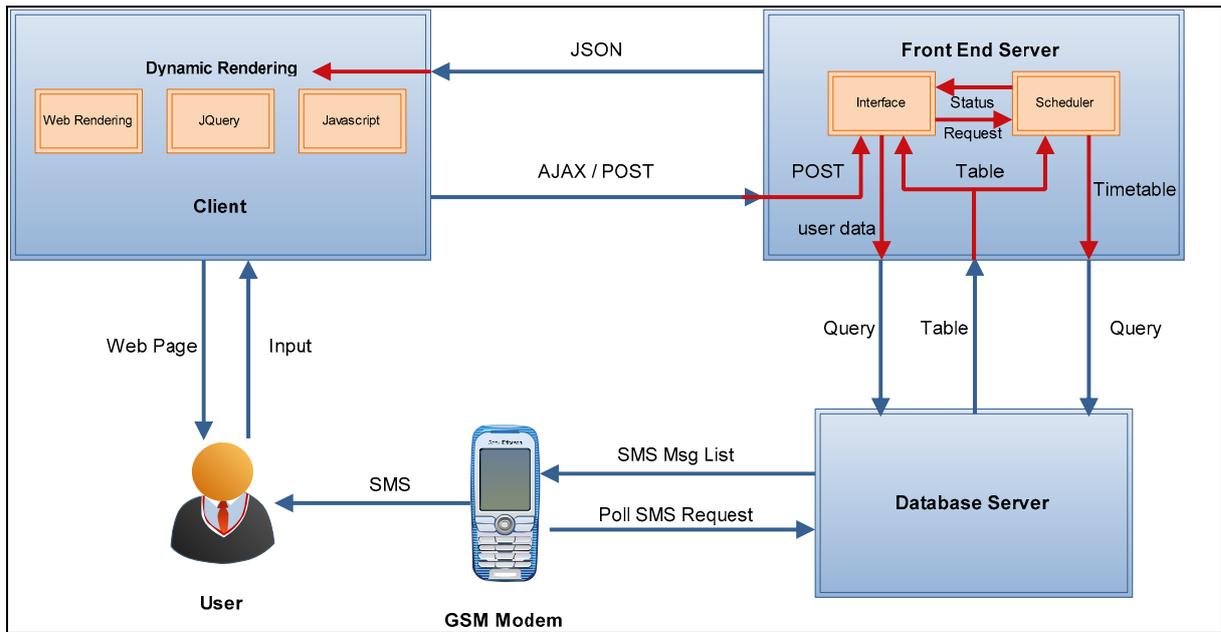


Fig. 2: Components' Interaction and Data Transfer in ERS.

### 3.2. Exercise Reminder System Core Module Algorithm

The intelligent scheduling algorithm is responsible to perform statistical analysis on the user activity and centre statistic. They gather and process the statistic, and recommend an appropriate centre and exercise to the user. The function `analyzeCenterStatistic($username, $date, $time)` first gathers all centers and exercises where other users are assigned to, follow by filtering and selecting those exercise which user prefers, as well as all centers that associated to the exercise. Next, for all centers, the function filter out those which are far from user house, and sort all remaining exercise centers according to number of user assigned to it. The location of a user is achieved through the function `isNear($user1_state, $user1_lat, $user1_lng, $user2_state, $user2_lat, $user2_lng)` by first obtaining user coordinate and center coordinate. By calculating the distance using Haversine formula, we could compare the distance to a threshold defined earlier. As long as the distance is lesser than the threshold, it is consider near. The function above is then able to determine whether the center is far away from the user or not. Next, ERS assigns users to the nearest exercise center based on the number of users already assigned in the exercise center. function `assignRandomExercise($username, $date, $time)` achieves this objective. Figure 3,4 and 5 presents a snapshot of timeslot screen, online map directions and mobile phone route notifications from ERS respectively.

### 3.3. Algorithm Testing

This section demonstrates the test result of ERS. The first scenario illustrates a situation where there is no other pre-assigned user in any of the exercise centres and user has not specify any exercise preference type. In this case, ERS will assign exercise type randomly to the user based on the nearest location. Table 1 shows that the nearest exercise centre is the swimming pool and hence, the user is assigned to swim in a total of 56 out of 200 random testing. ERS algorithm also supports user preference on exercise type. For example, Table 2 shows that user is being assigned to bowling regardless of location if he sets his preference as bowling.

The next scenario depicts exercise centers with pre-assigned users. In order to test the working of this scenario, we fill the number of population for each exercise centers as show in Table 3. Table 4 reports the number of assignments to the top three nearest and most populated exercise centers, in this case, the swimming pool (as we controlled other exercise population as zero).



Fig. 3: Timeslot screenshot

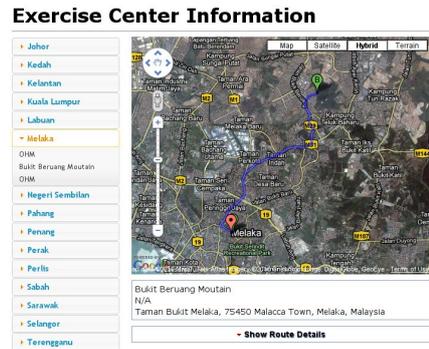


Fig. 4: Online map direction screenshot



Fig. 5: Mobile phone route notification

Exercise Name	Number of Assignment
Jogging	0
Moutain Climbing	0
Jungle Tracking	0
GYM	0
Swimming	0
Golf	0
Archery	0
Bowling	200

Table 2: User Preference Influence Test Result

Exercise Name	Number of Assignment
Jogging	30
Moutain Climbing	12
Jungle Tracking	18
GYM	45
Swimming	56
Golf	13
Archery	15
Bowling	11

Table 1: Random Exercise Assignment Test Result

<b>Exercise Name</b>	<b>Center Name</b>	<b>Center Population</b>
Swimming	Mbmb Swimming Pool	30
Swimming	Malacca Hotel Apartment	25
Swimming	Malacca Perfect Condo	20
Swimming	Everly Resort Hotel Malacca	10
Swimming	Oma Golf & Country Club	10
Swimming	Air Keroh Country Club	10

Table 3: Center Population Distribution

## 4. Conclusion

Exercise adherence and motivation to exercise is important for everyone because of the many health factors that are associated with being physically active. This has inspired us to develop an intelligent exercise reminder system (ERS) infused with sense of community theory. ERS is delivered through a dynamic web page for rich user experience. Users are expected to have higher motivation to adhere to exercise schedule due to close integration of ERS with the theory of sense of community. Once a user registered in ERS, he would know that there are many other users are participating in exercise initiative (membership). In addition, user's exercise type preference and number of other users in exercise centers affects ERS exercise schedule, resulting in a mutual influence of each other in ERS (influence). The relief from tedious self-timetable arrangement and the benefit of meeting other user with similar interest fulfilled the concept of integration and fulfilment of needs. Finally, the ability to know that users are being assigned to the nearest exercise center and exercising with users of similar hobby promotes the feeling of shared emotional connection.

As this paper demonstrates the development of ERS from theoretical and practical perspective, future research could engage on evaluating the degree of exercise motivation before and after using ERS. This would provide deeper understanding of the effectiveness of ERS to motivate users to exercise.

Table 4: Single Center Multiple Exercise Assignment Test Result

GYM	Air Keroh Country Club	0
<b>Swimming</b>	<b>Mbmb Swimming Pool</b>	<b>18</b>
<b>Swimming</b>	<b>Malacca Hotel Apartment</b>	<b>17</b>
<b>Swimming</b>	<b>Malacca Perfect Condo</b>	<b>15</b>
Swimming	Everly Resort Hotel Malacca	0
Swimming	Oma Golf & Country Club	0
Golf	Oma Golf & Country Club	0
Archery	Mahkota Parade	0
Bowling	Mahkota Parade	0

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