Gamification to Improve Adherence to Diabeteic Treatment in Saudi Arabia

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Abstract— **Diabetes mellitus is one of the most common illnesses in the twentieth century. Latest studies estimate a dramatic increase in diabetes cases in the Middle East. There are many Arab countries in the top ten countries where diabetes is most prevalent; Saudi Arabia is amongst these countries. Diabetes requires a great deal of care and management of several aspects of the patient's life. Ranging from keeping records of ones glucose levels and associated information, to having the emotional and social support needed to cope with the condition. This paper, proposes the first Arabic system for managing diabetes using gamification.**

Keywords-component; Diabetes; Gamification; Self-Care; e-Healthcare

I. INTRODUCTION

Diabetes mellitus is one of the most common illnesses today. According to the International Diabetes Federation (IDF), more than 382 million people worldwide are diabetics. The Middle East contributes a lot to the number [1]. Today, Saudi Arabia has the highest contribution to the number of Type 1 diabetic patients in the MENA region. Furthermore IDF shows that the prevalence of diabetes in the world and in Arab countries is on the rise. In fact, Saudi Arabia is one of the top countries for prevalence of diabetes. This indeed represents a major public health concern.

Diabetes is a serious illness that requires time and effort to maintain a good and healthy life. If it is left unmanaged and controlled it could lead to death or in the very least cause damages to many organs in the body especially eyes, kidney, nerves, heart and blood vessels [2]. Thus, monitoring diabetes is very crucial to prevent these complications. However, it is not an easy task. Even though, in some situations patients can control their diabetes by exercising and adopting a healthier life style, other patients require very close supervision and insulin to survive [2]. They also have to keep track of their blood glucose and watch their diet to maintain the average blood glucose level.

The Internet today offers a great medium for self-management assistant. Mobile and web applications that help users log their blood glucose and calculate their carb intake exists. These applications usually offer a single service that is mundane and repetitive, and they lack the ability to keep users coming back. However, incorporating behavioural insights with gaming techniques could provide an effective management tool for users. This is done through gamification, which is employing the principles of engagement, reward and motivation to certain tasks [3]. In fact, gamification is becoming a growing area in healthcare [4]. It encourages changes in behaviour and motivates users to learn new skills. This paper introduces the first gamified Arabic concept system for self-management of diabetes.

However, Saudi Arabia and the Arab countries in general lack applications that help Arab diabetic patients in self-managing their condition. A lot of the applications that exist today are limited to certain areas. MySugr for example, is an application that uses gamification to help users log their glucose readings and related information, is limited to USA and Europe [5]. On the other hand, applications that are not limited by geographical areas are still out of reach to many Saudi patients because of language barriers; they are not written for Arabic speakers and culture.

II. THE GAMIFIED SYSTEM

Sukr is a gamified self-management system for Arab diabetic patients. It aims to assist them in managing their condition and reinforce positive behaviour in managing diabetes. In Sukr users can keep a consistent record of their blood glucose tests, and visualize their progress by viewing their test results in graphs. Thus, helping them in recognizing any patterns that need further examination. Moreover, the system allows patients to add relevant information to their test logs, such as their food intake, calories, emotional status …etc. The gamified aspect of the system influences users behaviour, by rewarding them on certain tasks such as recording glucose level tests at least three times a day. It makes the repetitive and

mundane tasks of logging test results and other related information more enjoyable.

Furthermore, the gamification aspect of Sukr focuses on points, and users are encouraged to collect them. These points are represented in badges and leaderboards. Users are presented with a list of set goals to complete, and for each achievement they would be rewarded the points and badges [Table 1]. These tasks and goals have constraints to prevent users from cheating. There is a limit for the time frame that the task must be completed within. The achievements will appear in users profiles so that the social networking aspect of the game can be enforced. This will create a status for the user in the community and encourage others to achieve more goals and reach higher levels. Finally, the list of goals will expand and grow with the system.

TABLE I.   SAMPLE OF THE GOALS

Badge	Points	Goal
	10	Getting Started and registering in the system.
	20	Logging a test result.
	30	Logging test reading 3 times a day.
	15	Posting on the forum.
	30	Active in the forum; posting 10 times within a week.
	50	Logging test readings 3 times a day consistently for a week.

III.   RESULTS AND DESCUSSION

A working model of Sukr was designed and implemented. The system was tested for usability. After ensuring that the system meets the usability requirements and the guidelines, a preliminary test was conducted on two groups of people using the prototype. Group A consists of four leading medical doctors in Saudi Arabia, and group B consists of 7 Saudi diabetic patients. Both groups were asked to fill in a questionnaire. Furthermore, a Likert scale was used for both questionnaires.

To determine the need of the system by group A, the questionnaire yielded an overall agreement that it is needed in Saudi Arabia. Additionally, 75 percent of respondents strongly agreed to the usefulness of the graph and visual record function of the system in helping users managing diabetes and realising patterns.

Group B was asked to complete two sets of questions. The first set aimed to gather information about the respondents and examine their current situation. The other set of questions aimed to measure the degree of acceptance of the system based on the provided prototype. The respondents' age in group B ranged between 18-29 years old, with more than half diagnosed with diabetes less than 2 years ago. Interestingly, only 14.3 percent of respondents stated that they relay on online Arabic resources about diabetes, while 42 percent of them relay on English recourses. This could be due to the lack of sufficient Arabic content online. Moreover, a total of 42 percent of respondents do not interact with other diabetic patients.

After going through the prototype, the respondents of group B were asked to answer another set of questions about the system. Similar to group A, group B had an overall positive response to the system and its functionality. More than half (71. 4 percent) of them agreed that the gamification aspect of the system would encourage them to log their blood test results everyday. Moreover, the majority of respondents strongly agreed to the need of an online gamified management system with a social networking capability for diabetic patients in Saudi Arabia.

These preliminary results suggest that there is a need for a management system and an online community for Saudi Arabian diabetic patients. Moreover, gamification could be the answer for a better management system that would have positive behavioural influences on diabetic patients in Saudi Arabia. However, the system needs to be further tested by a larger group of users.

IV.   CONCLUSION

In conclusion, this paper presented an online system that helps Saudi Arabian diabetic patients in managing their diabetes. The main feature of this system is its gamification aspect, which was used to motivate users in managing their diabetes and reinforce positive behaviour. In particular, this system uses a gamification mechanism based on collection points and accomplishing goals. These in turn are represented in the form of badges. The system also includes a social network, which can further enhance the competition and overall experience of the user. The system was tested a group of doctors and patients. The overall preliminary results suggest the need for this system as an online tool to manage diabetes. In the future, further work would include expanding the system and the testing sample.

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