So'rah: An Arabic Mobile Health Application for Saudi Dietary Evaluation

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Abstract—Current studies show that obesity is reaching higher rate in Saudi Arabia. Health problems related to obesity, like diabetes, obstructive sleep apnea, and osteoarthritis are becoming serious concerns in the Saudi society. In the same time, mobile phones have been embraced by a rapidly increasing number of people worldwide in general and in Saudi Arabia in particular. Using smartphone mobile health applications to watch food calories is an effective method to fight obesity. However, most of the current mobile diet applications are available in English language and do not provide the number of calories for Saudi foods. This paper presents *So'rah*, a mobile health application for a dietary evaluation. *So'rah* aims to show the number of calories in Saudi foods based on barcode reading using a mobile camera, or typing full or part of a food's name. Moreover, the application allows guest (unregistered) users to explore the reviews for different kinds of foods. If users register in the application then they can review the taste and quality of the food and create a diet plan to maintain their weight by logging intake calories and follow up drinking water. In this paper, we will describe the development process of *So'rah* mobile application and the implementation challenges.

Keywords–*Mobile health; mHealth; Application; Dietary evaluation; Obesity.*

Figure 1. Overweight percentage changes from 2005 through 2013, for men and women in Saudi Arabia. [5]

I. INTRODUCTION

Saudis through time are becoming more concerned about their health and their eating lifestyle. This concern comes in the fact of Saudi Arabia now has one of the highest obesity and overweight prevalence rates [1]. Studies show that 7 out of 10 Saudis are overweight [2]. This is a direct result of Saudi Arabia becoming more developed. Populations in the developed world are mostly affected by obesity. The fast and busy style of modern life prevent people from the pleasure of thinking of the quality of their food and choosing the healthy ingredients [2].

Obesity is a major source of a number of diseases, including hypertension, diabetes, obstructive sleep apnea, hyperlipidemia, and osteoarthritis [1]. Previous studies have revealed that obesity is also among the major cause of co-morbidities, including cardiovascular diseases, cancers, and the related issues that may lead to morbidity and mortality [2].

In addition to the health problems, obesity represents a relative economic burden on countries economy [3].

Obesity is considered as a significant public health issue, which raise a concern globally. The World Health Organization (WHO) states th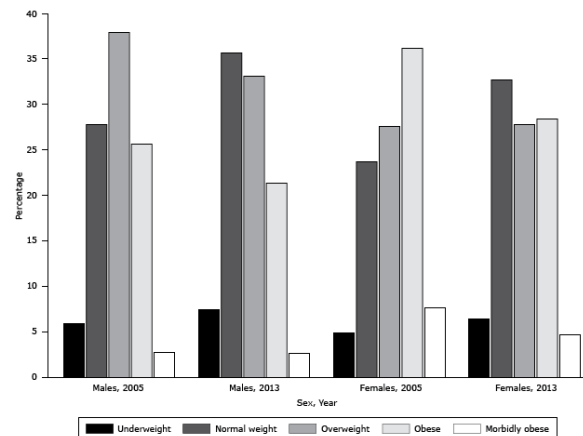at obesity rates have been nearly tripled worldwide, since 1975 [4]. Statics conducted in 2016, by WHO organization shows that 39% of the adults were overweight and 13% were obese [4]. The same statics show that 41 million children under age 5, around the world, were either overweight or obese [4].

Nowadays, Saudis become more aware that healthy eating habits will lead to a healthy life. The conducted survey in [5] shows that, although the overweight prevalence rates are high in Saudi Arabia, the overweight prevalence rates are decreasing, as shown in Figure 1.

Moreover, mobile phones have been embraced by a rapidly increasing number of people worldwide, in general, and in Saudi Arabia, in particular.

Therefore, using smartphone mobile health applications can contribute to decrease the overweight prevalence rates. B. Spring *et al.* [6] shows that, people who use mobile weight loss applications as a part of a comprehensive weight loss program, are better able to lose weight and keep it off.

There are several applications that have been developed to help people looking after their health. One type of these applications is calories counter applications. Users of these applications can keep track of the intake calories in their meals by calculating the number of calories in a specific amount of the consumed food. Some applications provide extra features like follow up users exercises and drinking water.

However, most of the applications in the mobile markets are in English and not including Saudi foods in their official lists. Consequently, Saudi users for these applications will not be able to keep track of the number of calories in their everyday meals because their consumed food are not there.

Therefore, in the paper, we present a mobile health application, namely "*So'rah*", which is designed for Saudi users. The application aims to help the community to lower the rates of obesity and overweight in Saudi Arabia by providing the Saudi users with the information they need about calories in Saudi foods either by searching food lists using the name of the consumed food or scanning foods' barcode. To the best of our knowledge our application is the first Saudi mobile application which identifies foods by scanning their barcodes. In addition, the application supports extra features like reviewing foods in the application lists, creating diet plans for users to help them maintain their weight, and enhancing the application food lists by allowing users to add new foods. Food additions will only appear in food lists if they have been approved by the application nutrition supervisor; for details see Section III-A.

Paper overview: Section II discusses related work. Section III introduces *So'rah* mobile application. Section IV demonstrates and design the main features of *So'rah* mobile application. Finally, Section V concludes and discusses the application future directions.

II. RELATED WORK

In this section, we first review some of the trending calories counting applications according the heath websites [7] and [8] and a number of online magazines like [9] and [10]. Secondly, we compare them to the proposed features of our application.

Lose It [11], *MyFitnessPal* [12], *FatSecret* [13], and *Weight Watchers* [14] applications are well known weight loss applications which keep track of calories consumption for users, and help them to set their ideal weight as a goal and monitor their progress towards it. The food databases of these applications can be searched using a food's name. *Lose It*, *MyFitnessPal*, and *FatSecret* applications allow users to search food lists by scanning food's barcode. Moreover, *Lose It* and *FatSecret* applications can recognize eaten foods by their pictures.

The main feature of *Weight Watchers* application is that the recommended daily meals are under the supervision of certified nutritionists and dietitians, which makes the application like online diet clinic [14]. However, the application is not free and require a monthly subscription.

Food databases (lists) of these applications are comprehensive, e.g., *MyFitnessPal* has more than 5 millions foods in its database [12]. However, none of the previously mentioned applications have Saudi foods in their databases, and in case they have, like *MyFitnessPal*, then it is marked as a user addition which is not validated and approved by the application administrators.

To overcome this limitation some endeavours have emerged in the Arabic mobile stores.

Soraate [15], *Calorie counter from my diet* [16], *Calories guide* [17], and *My diet* [18] applications are examples of these endeavours. They are Arabic applications that help users to maintain their weight by following up the gained calories from everyday meals and the burned calories in daily exercises. Foods and drinks can be selected from applications lists of Arab foods which are updated regularly. Water and follow up drinking feature are also supported in some of these applications.

My diet application is considered as online diet clinic like *Weight Watchers* application. Users can consult certified nutritionists and dietitians to construct a customized diet plan. However, *My diet* application is also not totally free.

Food databases (lists) of these applications include Arab foods, which are not necessary to be Saudi foods, e.g., searching for *Jarish*, a traditional Saudi food, can only be found in *Soraate* application. Additionally, foods in these applications' databases are identified by name only. Therefore, scanning barcodes to identify foods are not supported.

Our application *So'rah* includes Saudi foods in its database and identifies foods by name and by barcode. Therefore, searching for Saudi foods using keywords or barcodes both are supported.

Table I shows a brief comparison between our *So'rah* application and the previously listed applications. The selected features for comparison are chosen based on the main functionalities of these applications.

It can be concluded from Table I that the implemented features of *So'rah* application cover most of the listed features except following up exercises, and synchronizing with health applications and/or smart watches to automatically get the users gained/burned calories. We consider these missing features important, but we preferred in the current version of *So'rah* to concentrate in developing a mobile application with a comprehensive database which will facilitate its use in the Saudi society. The missing features are implemented in the second version of *So'rah* which is currently under development.

Additionally, it can be noticed from Table I, that our application allows users to add new foods and in the same time it is considered to be full supervised by professionals. This comes as a result of prohibiting a food addition from appearing in food lists until it is approved by the application nutrition supervisor. On contrary, food additions in the other applications, require no approval, which could generate a miss leading information if the new addition is incorrect.

Final point, users of *So'rah* application can write reviews about foods in our lists, and like/dislike previously written reviews. These reviews can be comments on the food itself, like its taste, or can be a space for fellow users to exchange recipes, eaten experiences or recommend restaurants for this particular food. Therefore, the reviews section can be considered as a reviews section and a chatting forum in the same time. However, with the reviews section, users can locate and track fellow users chats about a particular food because they know that all reviews about a food appear in its information page.

A detailed discussions and justifications of *So'rah* features will be presented in the next section.

III. APPLICATION CONSTRUCTION

This section discusses the application main features and briefly discusses its design. It also presents a system architecture for our application which foster its practical deployment.

TABLE I. Summary of the applications.

Feature	So'rah	Cal. counter	Soraate	mDiet	Cal. guide	Lose It	FatSecret	MyFitnessPal	Weight Watcher
Calories for Saudi foods	√	partially	√	partially	partially			not validated	
Search by food name/barcode	√	name	name	name	name	√	√	√	√
Log exercises		√	√	√		√	√	√	
Sync. with health apps						√	√	√	√
Sync. with Smart watches						√		√	
Water tracking	√	√	√	√		√		√	
Support Arabic language	√	√	√	√	√				
Food reviews and rating	√		rating						
Chatting forums		√		√		√	√	√	√
User can add new food	√	√						√	
Application is free	√	√	√	partially	√	partially	√	partially	
Supervised by professionals	√	√	partially	and consultancy	√	√	√	partially	and consultancy

A. The Application main Features

In *So'rah* application, we have four types of users as following:

- **Guest user**: A user who does not register in the application but wants to use some of the application features.
- **Registered user**: A user who does register in the application and can use the full features of it.
- **Nutrition supervisor**: A user who have the privilege to approve food additions done by registered users.
- **IT administrator**: A user who have the privilege to monitor reviews written by registered users, and look after the system in general.

All types of users can conduct a search by name or by barcode for a food and can retrieve its information in separate page. Food information page contains: food's name, food's picture, number of calories in a portion of this food, and food's composition content table; if available. Note that food portions can be cups, plates, slices, 100 grams, etc., and food's composition content table is the nutrient data in this food like protein, fat, vitamins, etc. [19].

Guest users can register in the system to access the full features of the application. To register in the system users should provide a username, a password and a phone number. Users can optionally provide their height, waist, hips, weight, date of birth, and gender, to be used later to construct diet plan.

Registered users can write reviews for foods. They can delete their own reviews. Users also can like/dislike others reviews to express their agreement or disagreement with these reviews. Moreover, registered users can add new foods to feed the application database. In case of food addition, registered users should provide full food information same as the one presented in the food information page. The addition request should be forwarded by the system to the nutrition supervisor for approving. If approved, then, the addition request will be forwarded by the system to the IT administrator to add it to the system database. The supervisor and the administrator should be notified by an SMS if new requests are arrived and need to be processed.

Most importantly, registered uses can create, delete, and manage a diet plan. If users choose to construct a diet plan then they will be requested to input their height, weight, waist, hips, date of birth, and gender; if they have not input them in the registration. Depending on these information the system will firstly, determine the user body mass index (BMI), i.e., a measurement of the user body fat based on the weight in relation to the height. The value of the BMI is used to categorize users as underweight, normal weight, overweight, or obese [19]. The waist and hips measurements are used to calculate users abdominal fats [19]. Secondly, the system will calculate the minimum and maximum number of calories that a user can take per day. The user will be requested to choose a target number of calories in the range between the minimum and maximum. After that, the system will monitor user progress towards losing weight by calculating the number of gained calories recoded daily by the user, and compare it to the target number of calories chosen by the user. In addition, the system tracks users water drinking by requesting users to log their daily drinking amount.

The IT administrator is the person who looks after the system from the technical point of view. In addition, the administrator is responsible of monitoring users reviews and delete inappropriate ones if found.

1) Strong Aspects: A research was conducted in 2015 [20] to define the features of the ideal weight loss applications depending on the insights of Saudi women. The research concludes that the suggested themes for an ideal weight loss application include: Arabic language, culturally sensitive, motivational support and social networking, and user-friendly interface.

So'rah supports Arabic language and is designed for Saudi society. Moreover, the application provides a review section which can be used by fellow users to exchange experiences. *So'rah* also implements an easy to use interface which requires no special technical skills. According to this, *So'rah* could be considered as an ideal weight loss application for Saudi women.

Another strong point is that *So'rah* requires no registration to search its food lists. This could result in more potential users for our system; users who want to register and users who want not to register. Most of the available weight loss applications require registration before using any of their features.

Bearing in mind that an email is not essential in Saudi Arabia to get governmental services, some Saudis, in particular elders, do not have email accounts but they have phone numbers. For that, *So'rah* confirms registration via SMS mobile messages instead of emails. This could result in more potential users for our system. Most of the available weight loss applications confirm registration via emails.

In addition to these aspects, *So'rah* application presents several strong points and novelties comparing to current Arabic
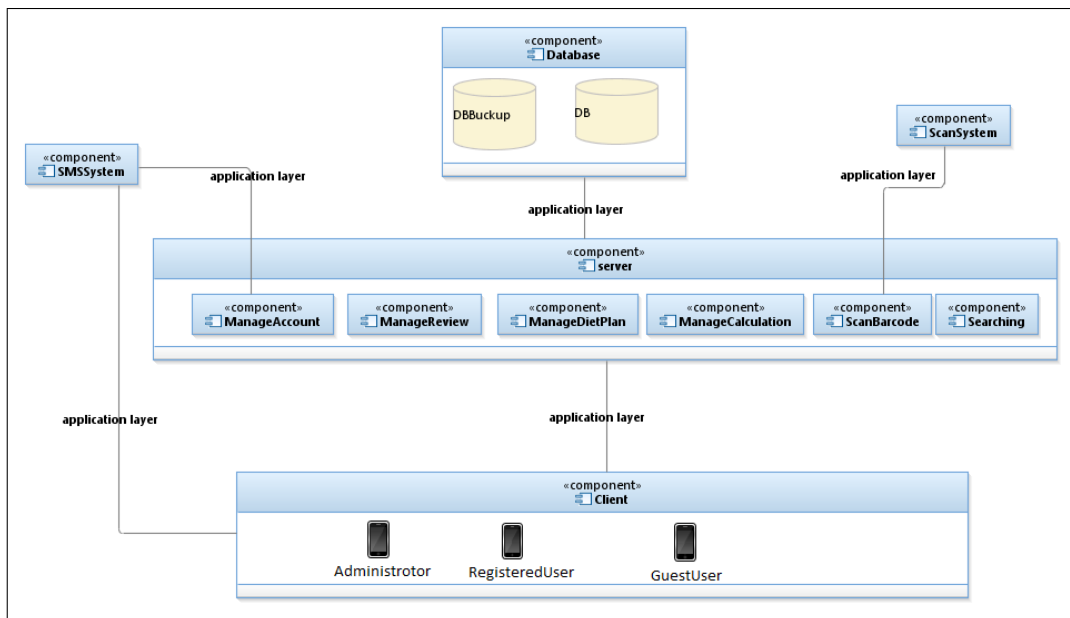
Figure 2. The System Architecture

dietary applications as been previously mentioned in different sections of this paper.

B. The System Architectural Design and Implementation

Considering the system programmers experiences and known that most Saudi participants [20] own Android mobile phone, the application was designed and implemented to target mobile devices running Android platforms. However the system can also be reproduced to other mobile operating systems, such as iPhone, Windows mobile, BlackBerry, etc.

The system was implemented using the Android Software Development Kit (SDK) [21]. SDK provides the needed tools and APIs to create applications for Android platform using Java programming language [22].

The Java programming language is an object oriented language, i.e., it depends on having separate entities (objects) which encapsulate the code of their functions and variables [22]. For that, an object oriented approach was followed in the design process of *So'rah*. We developed a *use case* diagram and a *class* diagram for our system with all the supporting information. Presenting the detailed design process for the application is out of the scope of this paper; interested reader can refer to [23] for information about object oriented design. The design is then mapped to Java programming language for implementation.

So'rah system architecture which identifies the system core components and their relationship is presented in Figure 2. As may be seen in the figure we choose the client server architecture because we have subsystem provides services to instances of other subsystems. The subsystem that provides services called server, the subsystem that consumed services called client.

This separation of the applications services into client/server components allows these components to be distributed in different physical machines. Additionally, this

separation allows each of these components to be updated without affecting other components [23].

IV. APPLICATION DEMONSTRATION AND VALIDATION

This section presents an overview of the mobile application from the user perspective and demonstrates its use in a practical deployment.

A. So'rah Demonstration

As mentioned in Section III-A, we adopt a simple user interface. The interface uses buttons with considerable size to be appropriate for fingers use. The application core function is to show the number of calories in foods either by scanning the food barcode or by searching the application's database using food's name. Therefore, the main screen of the application shows these two options very simply, as shown in Figure 3. Figure 4 shows the steps to search by food's name while Figure 5 shows the steps to scan a food's barcode.

In case of searching by food's name, keywords are enough for searching, the exact name of a food is not required. If a part of the food's name is typed, then the application will give a list of suggested food items, as shown in step 3 of Figure 4.

If the intended food is allocated then a separate screen will be displayed to show the food's information. The screen has a button to display the reviews on this food, as illustrated in Figure 6.

Users are not require to register in the application to be able to search, to scan barcodes, or to view reviews. However, if users register in the application they will have extra features to boost their plan in loosing weight and to participate in food reviewing and addition.

To register in the application users can press the registration button in the main screen. Users then will be asked to provide a suggested user name, a password, and a telephone number to complete the registration, as shown in Figure 7. In addition,
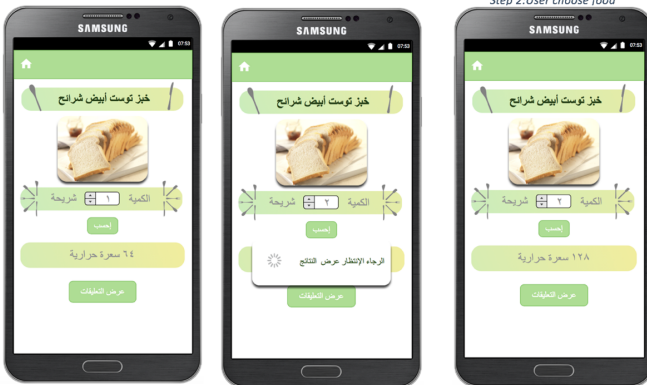
Figure 3. *So'rah* Main Screen

Figure 5. Search by Food's Barcode

Figure 4. Searching by Food's Name

Figure 6. View Reviews

Figure 7. Registration Process

users can provide their hight, weight, waist, hips, gender, and birthday. The extra information are used to calculate the user body fat and abdominal fat. Registered users can construct a diet plan to follow up their weight by pressing *construct a diet plan* button from the user profile screen, as shown in Figure 8. If users have not provide the extra information (hight, weight, waist, hips, gender, and birthday) during registration then they will be asked to provide them. According to these information,

the minimum and maximum daily calories to be consumed are calculated in addition to the body fat and abdominal fat.

Users after that will enter their consumed food for each meal in the day. The application will calculate the gained calories and compare them to the target daily calories. The system will follow the users progress in loosing weight. Users' weight will be updated according to the daily calculation and

Figure 8. Construct a Diet Plan

users will be informed if they reach the ideal weight.

Registered users can also add reviews, delete their previously written reviews, and like/dislike others reviews.

1) The Application Validation: The application functions and interfaces were preliminary tested and validated by a formal committee from the Software Engineering Department at King Saud University. In addition, an informal testing on a small group of random users was conducted to preliminary investigate the application usability.

Currently, *So'rah* team and with the collaboration of the Department of Food Science and Nutrition at King Saud University is carrying a formal testing to investigate the effectiveness of *So'rah* application in losing weight and its usability. However, the result is not available yet.

V. Conclusion and Future Work

In the paper, we present the first version of *So'rah* application. We first question the need for such an application. After that, we review the related works and highlight how our application is different. Finally, we demonstrate the application design and implantation process.

The first version of *So'rah* concerns calculating the gained calories from consumed food. Currently, we are in the design phase for the second version of *So'rah* which enhances the functionality of the first version by adding the calculation for burned calories during exercises.

Additionally, in the meanwhile we investigating the effectiveness of *So'rah* application in helping users to lose weight.

In the future, we are planing to enrich the application features by classifying foods according to their suitability for some medical diseases like kidney diseases, diabetes, high blood pressure, etc.

Acknowledgment

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