T. C.

BAHÇEŞEHİR ÜNİVERSİTESİ

DESIGN AND DEVELOP

ONLINE DIETARY SELF-MONITORING APPLICATION

BY TURKISH HABITS

Master's Thesis

YAŞAR KEMAL KOÇAK

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Thesis Supervisor: Asst. Prof. Dr. Dilek KARAHOCA

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Assoc. Prof. Dr. M. Tunç BOZBURA
Graduate School Director

I certify that this thesis meets all the requirements as a thesis for the degree of Master of Arts.

Prof. Dr. Adem KARAHOCA
Program Coordinator

This is to certify that we have read this thesis and we find it fully adequate in scope, quality and content, as a thesis for the degree of Master of Arts.

Examining Committee Members	Signature
Thesis Supervisor Asst. Prof. Dilek KARAHOCA	---
Member Prof. Dr. Adem KARAHOCA	---
Member Asst. Prof. Dr. Yalçın ÇEKİÇ	---

DEDICATION

This thesis is dedicated to my parents, who grown me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my loving and supportive wife, Saime Koçak, who has been a constant source of endless support and encouragement.

İstanbul, 2014 Yaşar Kemal Koçak

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Special thanks and appreciation to my caring wife, Saime Koçak, she always tested my implementations by using different portable devices and reported result of them. She helped and supported to me to find more nutrition data with calories. My thanks must go to my parents, my brothers and their wives, and my friends who helped to find clients in order to apply application and usability testing.

İstanbul, 2014 Yaşar Kemal Koçak

ABSTRACT

DESIGN AND DEVELOP

ONLINE DIETARY SELF-MONITORING APPLICATION

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Yaşar Kemal Koçak

Information Technologies

Asst. Prof. Dilek Karahoca

May 2014, 45 pages

The purpose of this research is to design and develop useful online dietary self-monitoring application in order to trace and monitoring all daily physical and nutrition activities with calorie information by take into account Turkish habits. Chronic and acute diseases of obesity and overweight problems have been growing because people are getting more passive in their lives with using technologies in big cities of Turkey. People have less physical activities and more eating and nutrition activities in their life. Thus, with the advantage of using technology, online dietary self-monitoring application is designed and developed as a web application in order to create awareness of how peoples' daily activities affect their lives. Users who work in weekdays are selected for sample. 10 female and 7 male users between 19 and 51 ages are selected as a volunteer. Dietary Self-Monitoring Application is used by sample users for one day according to the usage scenario. After using DSMA for one day, System Usability Scale survey and DSMA Usability survey applied to the users as an online without any interfere. According to the SUS survey average score and usability test score, sample users thought that DSMA application is a useful and effective online dietary self-monitoring application by Turkish habits.

Keywords: Dietary Self-Monitoring, Nutrition Activities Monitoring, Physical Activities Monitoring, Daily Activities Calories Calculation, Daily Activities Reporting

ÖZET

KİŞİNİN GÜNLÜK AKTİVİTELERİNİ TAKİP EDEBİLMESİ VE KENDİNİ İZLEME AMAÇLI TÜRK ALIŞKANLIKLARINA GÖRE ONLİNE BİR UYGULAMA TASARLAMAK VE GELİŞTİRMEK

Yaşar Kemal Koçak

Bilgi Teknolojileri

Yrd. Doç. Dr. Dilek Karahoca

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Bu araştırmanın amacı Türk alışkanlıklarına göre kullanıcıların günlük fiziksel ve beslenme aktivitelerini kaydetme ve bu aktivitelerin kalori bilgileri ile birlikte takip edilebilmesi için kullanışlı ve faydalı bir online çalışan uygulama tasarlamak ve geliştirmek. Türkiye'de, büyük şehirlerde, teknolojinin, hayatımızın her alanında fazla kullanılmasıyla birlikte, obez ve fazla kilolu nüfus her geçen gün artmaktadır. Bunun nedeni artık insanların daha pasif bir yaşam sürerken, fazla ve sağlıksız beslenmesidir. Fazla kilolu ve obez olmanın neden olduğu kronik ve akut hastalıklar artmaktadır ve telafisi olmayan hastalıklara neden olmaktadır. Bu nedenle, teknolojinin fazla kullanılması avantajından faydalanarak, kişinin kendi günlük fiziksel ve beslenme aktivitelerini takip edebilmesi ve bu günlük aktivitelerin kişinin sağlığında ki etkilerini izleyebilmesi için online çalışan kullanışlı ve faydalı bir uygulama geliştirme amaçlanmıştır. Bunun için DSMA uygulaması tasarlandı ve geliştirildi. Uygulama 19 ve 51 yaşları arasında değişen, 10 kadın ve 7 erkekten oluşan bir kullanıcı grubuna uygulatılarak, kullanışlılığını ve faydalı olup olmadığını ölçümleme amaçlı iki tane anket uygulanmıştır. Uygulanan anketlerin sonucunda kullanıcıların büyük bir kısmı DSMA uygulamasının kullanışlı ve faydalı olduğunu düşünmektedir.

Anahtar Kelimeler: Beslenme Aktiviteleri Takibi, Fiziksel Aktiviteler Takibi, Günlük Aktivitelerin Kalori Hesaplaması, Günlük Aktivitelerin Raporlanması, Diyet Amaçlı Kendini İzleme

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ABBREVIATIONS

ALF : Activity Level Factor

BMI : Body Mass Index

BMR : Basal Metabolic Rate

DGA : Dietary Guidelines for Americans

DGAC : Dietary Guidelines Advisory Committee

DSMA : Dietary Self-Monitoring Application

ITU : International Telecommunications Union

ICT : Information and Communication Technologies

SDLC : System Development Life Cycle

SUS : System Usability Scale

XP : Extreme Programming

1. INTRODUCTION

Maintaining a healthy body weight is important for good health. On the contrary, obesity and diseases of obesity and overweight problems has been growing in big cities all over the world. Obesity can cause many chronic and acute diseases. People are getting more passive in their lives with using technologies and they have bad nourishment habits such as too much eating, fast food, cookies, etc. It causes to malnutrition. Passive life with malnutrition has harmful effects on people's health. This had been considered big problem for developed countries. Nowadays it is has been considered big problem for new developing countries such as Turkey.

According to the research for Turkey, percentage of 17.2 individuals over 15 years old are obese for 2012. Overweight and obese rates increased for each research. When we sum of these two rates, more than percentage of 50 individuals may counter chronic and acute diseases results from weight problems.

Table 1.1 Body mass index results by years and sex

Distribution of body mass index values of 15 years and over individuals by years and sex

(%)

Years	Sex	Total	Underweight	Normal weight	Overweight	Obese
2012	Total	100.0	3.9	44.2	34.8	17.2
	Male	100.0	2.7	44.7	39.0	13.7
	Female	100.0	5.1	43.6	30.4	20.9
2010	Total	100.0	4.7	45.5	33.0	16.9
	Male	100.0	3.5	46.1	37.3	13.2
	Female	100.0	5.9	44.7	28.4	21.0
2008	Total	100.0	4.2	48.2	32.4	15.2
	Male	100.0	2.7	48.1	36.9	12.3
	Female	100.0	5.9	48.2	27.4	18.5

Note: Figures in the table may not add up to total due to rounding.

Source: Turkish Statistical Institute, Turkey Health Survey, 2012

People are accustomed to use technology on each field of life by using portable devices and internet. Using smart phones and other portable devices with internet connection provides to develop applications to use on time. As a result, main field of the study is defined as with the advantage of using information technology what projects can be developed or what actions can be taken in order to decrease obesity and overweight problems in Turkey.

Application will be designed and developed in order to use as dietary self-monitoring. Self-monitoring is important to overcome disordered eating and passive life activities. Firstly, people have to realize current behaviors so as to change and improve their attitudes about it. Self-monitoring will become an important part of improving users' eating habits and daily activities. Because of this, self-monitoring is selected to work on.

People want to monitor their daily activities to follow their diet schedule. Also, dieticians of the people want to see their patients' daily activities to give a diet schedule and monitor it. Self-monitoring daily activities provide this. This contribution will be able to change and improve peoples' life style and gain new attitudes. It will be applied to evaluate what is the contribution of self-monitoring.

There are some studies about diet self-monitoring that they mostly focus on paper or self-monitoring sheets. These are many limitations to use self-monitoring sheets or papers. People always need to carry these papers and sheet and they have to fill on time. Also, people have to fill it with their literacy. It causes to non-standard usage and they are hard to comment.

With the development of technology, new studies use technology devices such as personal digital assistant (PDA) to develop dietary self-monitoring application. According to the research, the use of an electronic device, such as a PDA, for self-monitoring food intake represents an improvement over paper diaries. Using technology devices with a dietary software program facilitates the recording process. Software programs' monitoring data give information about when recorded at the time of eating or in a delayed period. It is important to reliability of data.

Designing and developing useful online dietary self-monitoring application is important to gather accurate nutrition and physical activities data. Because of this, DSMA application should be implemented to work over all portable technology devices which have internet connection and browser programs.

All of finding researches are based on different countries habits. Cultures and daily life habits have huge effect on peoples' nutrition and physical behaviors. Most common eaten nutrition and beverages are different for each culture. Thus, the purpose of this research is designing and developing useful online dietary self-monitoring application by Turkish habits.

2. LITERATURE REVIEW

2.1 MAIN FIELD RESEARCH

There are many fields related on dietary self-monitoring. Thus, while dietary self-monitoring research, related fields also researched to find available sources and studies. These related fields are diabetes self-management education, dietary self-monitoring, telemedicine and screening user activities which affect body's intake and burned calories. All of these fields are objected to minimize the risk of long-term consequences associated with obese and overweight.

Information technologies provide new opportunities to design and develop new applications. Also information technologies widely used in all fields of life. User attitudes about technology and internet have been growing. According to the ITU ICT statistics for 2012, percentage of 45.13 of individuals uses the internet in Turkey, and percentage of 47.20 of households has internet in Turkey. Also it has been increasing each year. (Information and Communication Technologies Authority, Statistics, 2012) According to another statistics about internet usage with portable devices shows that in the first quarter of 2013 percentage of 41.1 of Internet users aged 16-74 used mobile or smart phones while percentage of 17.1 used portable computer (e.g. laptop, tablet) to access the Internet away from home or work. Moreover percentage of 47 of people in Turkey has smart phone. (McBDC Business Development & Consultancy Services Co.Ltd, 2013, Mobile Technology in Turkey) Thus, application should be designed and developed to work online and it should be used by any devices which has internet connection.

Self-Monitoring Dietary Intake: Current and Future Practices (Burke LE, Warziski M, Starrett T, Choo J, Music E, Sereika S, Stark S, Sevick MA.) article has important to compare current and future practices about dietary self-monitoring. This article reviews the literature on the use of paper diaries for self-monitoring food intake, identifies the strengths and limitations of paper-and-pencil diaries and their new counterpart, the electronic diary or personal digital assistant (PDA), and reports how participants were trained to use a PDA with dietary software in two pilot studies. The training focused on how to use a PDA and how to navigate the dietary software to self-monitor food intake.

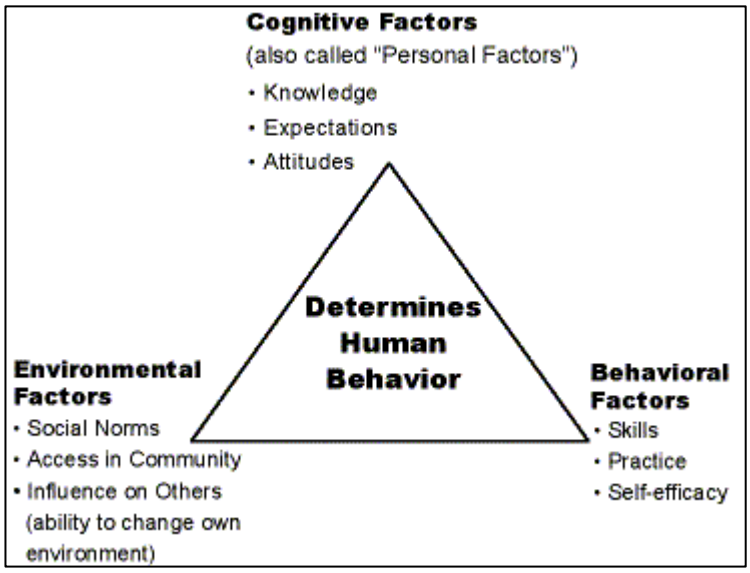
The goals of using the PDA were to improve adherence to the therapeutic diets and to self-monitoring.

Improving dietary self-monitoring and adherence with hand-held computers: a pilot study. (Glanz K, Murphy S, Moylan J, Evensen D, Curb JD.) The goals of this study were to increase diet self-monitoring, reduce the burden of monitoring food intake, and increase adherence to dietary goals within a clinical trial. 33 women participants used PDA based system for one month. Participants significantly increased self-monitoring, improved their attitudes toward self-monitoring and met their dietary goals more often.

Governments and Health Ministers of developed countries such as USA give importance to find solution to reduce obesity and overweight population. They have institutions and projects to decrease obesity and overweight problems. They have experience and sources to overcome it. Dietary Guidelines Advisory Committee (DGAC) published report Dietary Guidelines for Americans in 2010. According to the conclusions from the 2010 DGAC report, there is an important relationship between diet self-monitoring and body weight. This relationship formed the basis for the recommendations made in The Dietary Guidelines for Americans (DGA), 2010 *(*U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010).

According to the social learning theory of Alpert Bandura emphasizes the importance of observing and modeling the behaviors, attitudes, and emotional reactions of others (Bandura 1977). People can learn by observing others' behaviors and self-behaviors. Thus, self-management education is important to observe and change people's behaviors and attitudes.

Figure 2.1: Social learning theory factors



Source: Albert Bandura, Social Learning Theory, 1977

i. Observe and imitate behaviors of others,
ii. See positive behaviors modeled and practiced,
iii. Increase their own capability and confidence to implement new skills,
iv. Gain positive attitudes about implementing new skills, and
v. Experience support from their environment in order to use their new skills.

Under the light of these facts, basic principles of social learning theory will have effect on designing system. Application should be designed to observe and evaluate current behaviors of users. It should provide to show results of these behaviors and activities. According to these results of behaviors, users will be able to evaluate their experiences to gain new positive attitudes. Application will give information about health indicators and how daily activities effect on body weight.

2.1.1 Basal Metabolic Rate (BMR)

Users should know their current body weight statuses and their daily calories need in order to use dietary self-monitoring application. When users know their current statuses, they will understand what activities have effect on body weight better. Thus, user daily calories need, body mass index (BMI) and basal metabolic rate (BMR) calculations will be done in order to show users' current status.

Basal Metabolic Rate (BMR) is the number of calories required to keep your body functioning at rest, also know metabolism. There are many factors can change BMR

such as fear, stress, illnesses, gender, age, life activity level, weight and height. But some factors cannot be calculated so these are ignored in calculation. Revised Harris Benedict equation has two formulas to calculate BMR according to the gender. (Roza, Allan M; Shizgal, Harry M, 40: 168–182, 1984, The American Journal of Clinical Nutrition)

BMR for Men = 66.47 + (13.7 * weight [kg]) + (5 * size [cm]) − (6.8 * age [years])

BMR for Women = 655.1 + (9.6 * weight [kg]) + (1.8 * size [cm]) − (4.7 * age [years])

Results of these two formulas are going to shows the rate of energy expenditure at rest and are measured in kJ per hour per kg body mass. Thus, we need to use other formulas so as to calculate user daily calories need. Harris Benedict formula is the most used and accepted to calculate daily calories need. Harris Benedict formula needs to activity level factor to calculate daily need calories required to keep maintain peoples' weight.

Activity Levels

i. Sedentary (little or no exercise) : **ALF = 1.2**
ii. Lightly active (light exercise/sports 1-3 days/week) : **ALF =1.375**
iii. Moderately active (moderate exercise/sports 3-5 days/week) : **ALF = 1.55**
iv. Very active (hard exercise/sports 6-7 days a week) : **ALF = 1.725**
v. Extra active (very hard exercise/sports & physical job or 2x training) : **ALF= 1.9**

Daily need calories to keep body weight keep =

Basal Metabolic Rate (BMR) * Activity Level Factor (ALF)

2.1.2 Body Mass Index (BMI)

Body Mass Index is a measure of relative weight based on an individual's mass and height. (Quetelet, A. 1796-1874) In another words, it is used to give you an idea of whether you're underweight, overweight, and obese or an ideal weight for height. According to the research results, it is most widely accepted indicator. BMI can be used to show two important data. First of them is current body weight status of the people. According to the most widely accepted categories, it has four categories;

Body Mass Index formula (kg/m²) = Weight (kg) / Height (m) * Height (m)

Table 2.1 BMI categories

BMI	CATEGORY
Below 18.5	Underweight
18.5 - 24.9	Moderate Weight(Healthy)
25.0 - 29.9	Overweight
Above 30.0	Obese

Source: World Health Organization BMI Classification

Another important data is that moderate weight interval of the people can calculate by using table which defined above.

Moderate Weight Interval Start (kg) = 18.5 (kg/m²) * Height (m) * Height (m)

Moderate Weight Interval Finish (kg) = 24.9 (kg/m²) * Height (m) * Height (m)

Body health indicators will show current status of the users. We need to compare results of user daily activities and current user indicators. Thus, which activities and parameters have effect on body weight will be defined according to the search result?

2.1.3 Dietary Guidelines Key Recommendations

The 2010 DGA report encourage individuals to select a healthy eating pattern that meets nutrient needs at an appropriate calorie level over time in order to achieve these goals. Awareness of key recommendations of the 2010DGA report provides to select healthy eating pattern with appropriate physical activity level.

According to the 2010 DGA report, eating and physical activity patterns that are focused on consuming fewer calories, making informed food choices, and being physically active can help people attain and maintain a healthy weight, reduce their risk of chronic disease, and promote overall health. The Dietary Guidelines for Americans, 2010 exemplifies these strategies through recommendations that accommodate the food preferences, cultural traditions, and customs of the many and diverse groups who live in the United States. Poor diet and physical inactivity are the most important factors contributing to an epidemic of overweight and obesity affecting in all segments of our society.

According to the 2010 DGA report, people who are most successful at achieving and maintaining a healthy weight do so through continued attention to consuming only enough calories from foods and beverages to meet their needs and by being physically active. To curb the obesity epidemic and improve their health, many Americans must decrease the calories they consume and increase the calories they expend through physical activity. Thus, maintaining calorie balance over time to achieve and sustain a healthy weight is important.

As a result of this, The 2010 DGA report's key recommendations will be based on designing dietary self-monitoring application. Key recommendations about diet and physical activities will be used to define business requirements of dietary self-monitoring application.

The key recommendations from the 2010 DGA related to balancing calories with nutrition and physical activities to manage weight:

i. Prevent and/or reduce overweight and obesity through improved eating and physical activity behaviors.
ii. Control total calorie intake to manage body weight. For people who are overweight or obese, this will mean consuming fewer calories from foods and beverages.
iii. Increase physical activity and reduce time spent in sedentary behaviors.
iv. Maintain appropriate calorie balance during each stage of life childhood, adolescence, adulthood, pregnancy and breastfeeding, and older age.

In order to achieve energy balance and maintain a healthy weight, the 2010 DGA highlights several behaviors, including diet self-monitoring, that have been shown to promote weight management. Monitoring food intake has been shown to help individuals become more aware of what and how much they eat and drink. Also, monitoring body weight and physical activity can help prevent weight gain and improve outcomes when actively losing weight or maintaining body weight following weight loss.

Moreover, people should be aware of Energy Balance Equation. It means that daily intake calories must be equal to the daily burned calories in order to keep body weight stable. If people want to lose or gain weight, this equation is going to change.

To Keep Body Weight: Calories (Energy) IN = Calories (Energy) OUT

To Lose Body Weight: Calories (Energy) IN < Calories (Energy) OUT

To Gain Body Weight: Calories (Energy) IN > Calories (Energy) OUT

Observing current behaviors of the users can be done through recording all daily activities with details and results of these. Recording daily activities which has effect on body weight is the main problem for research. Besides, daily activities which activities and factors have important effect on body weight will be defined. Application will be designed to add and monitor these behaviors and activities. Thus, to-be system should be designed as a self-monitoring application and business requirements of it will be defined considering the key recommendations of DGA 2010 report. .

Monitoring daily activities of user will be used in order to take short-term outcomes. Users will be able to evaluate their behaviors and activities, and they can see which behaviors and activities have positive effect or negative effect on users' body weight and health. Calories information of activities will be used as an indicator. Designed self-monitoring application will be able to give experience support as a report and data to the users. Observing these behaviors and experiences provides to gain new information such as results and effects of them. This gained information is short-term outcomes of self-monitoring application.

Short-term outcomes about user behaviors and daily activities will provide to change current negative attitudes and creating new positive attitudes. Also users will be able to use short-term outcomes in order to make short-term decisions in their life. Users will be able to have enough knowledge about their daily life whether is healthy or not. If it is unhealthy, what changes in their life can be done to make their life style to be healthier.

After users using designed and developed application they should have monitoring data and report to take support from third person such as dietician. Application will be able to report all monitoring data and reporting to the user day by day.

2.2 SUMMARY OF RESEARCH

More than percentage of 50 of individuals in Turkey is obese or overweight. Moreover, it has been growing year by year. Obese and overweight causes chronic and acute diseases. Governments and departments of the countries want to take steps to decrease obese and overweight rate.

Innovations in information technologies and internet provide new opportunities to develop applications. Portable devices which have internet connection are widely used in turkey. With the power of information technology, projects can be developed to use as an online dietary self-monitoring tool real time. Online self-monitoring applications are more powerful and useful to gather accurate daily nutrition and physical activities data on time.

Creating awareness of peoples' behaviors and attitudes about health body weight, calories, nutrition and physical activities is important. DGA guidelines, body weight indicators and social learning theory will be used to design and develop dietary self-monitoring application. Dietary self-monitoring application should be designed to create awareness about keeping body health ideal.

Application should be able to record all daily nutrition and physical activities. Burned calories of physical activities and intake calories of nutrition activities should be calculated. BMI, BMR and daily calories need should be calculated. All monitoring data should be reported for user.

All in all, Dietary self-monitoring application should be designed and developed. It will be design and develop by taking into consideration Turkish culture and Turkish cuisine. It should work online so that users can access application on time.

3. RESEARCH STATEMENT AND RESEARCH PROBLEM

3.1 RESEARCH STATEMENT

The primary goal of Dietary Self-Monitoring Application will be able to tracking all daily food intake, drinking and physical activities of the user. Dietary self-monitoring data will be able to report for users, dieticians and related services. Increasing awareness of people's daily life activities will be important so that users should make short-term decisions to change their daily life activities. So, Dietary Self-Monitoring Application will be designed and implemented so that users will be able to aware of what their daily life activities and effects of these activities by using monitoring reports and data.

Moreover, cultural differences should be taking into account in designing and implementing Dietary Self-Monitoring Application project. Because of that Dietary Self-Monitoring application will be designed in terms of the most common Turkish daily nutrition habits and physical activities.

3.2 MAIN PROBLEM

Design and develop a useful and effective online application in order to use as a dietary self-monitoring program by taking into account Turkish nutrition habits and physical activities. Calculate calorie results of daily life activities and health indicators. Dietary self-monitoring data will be used to improve or change users' attitudes about eating, drinking, weight control habits and lifestyle. Evaluate dietary self-monitoring application create or increase awareness of it. Also evaluate dietary self-monitoring application can affect users so as to make short-term decisions for behavioral treatment.

3.3 SUB - PROBLEMS

a) Create a relational database by taking into account Turkish nutrition habits and physical activities in order to use record dietary monitoring history.
b) Design useful and effective dietary Self-Monitoring application so that users can add daily nourishment and physical activities easily on time.

c) Design and develop a Dietary Self-Monitoring application in order to monitor and report daily life activities, calorie results of these activities and health indicators.

4. EVALUATION AND SUMMARY OF SOURCES

There are studies and applications in U.S. but there is no study and application in Turkey. There is no available nutrition and physical activities database to use. Hence, Turkish nutrition calories and physical activity calories database will be created and it will be used for dietary self-monitoring application for the first time.

DGA guidelines were prepared for Americans. This report was prepared so detailed in order to cover more people in each ages that over 2 years. There are many people from different nations live in U.S. Thus, DGA key recommendations can be used to design and develop dietary self-monitoring application for using in Turkey. DGA key recommendation will be used to define business requirements.

According to the studies, BMR is used to calculate daily need calories. BMI is used to define user body weight level for user's height. Energy balance equation will be used by comparing daily burned calories and daily intake calories. These indicators and calculations will be used for informing and reporting to the user.

5. DATA AND METHODOLOGY

Methodology**:** Qualitative methodology will be applied for this research. Dietary self-monitoring application will be designed and developed. Heuristic method will be used to select sample. Sample users will use DSMA for one day according to the usage scenario. SUS survey and DSMA survey will be applied to the users. Results of surveys will be analyzed and summarized.

Collecting Data**:** DSMA will be applied to users who are working in weekdays. They will use DSMA for one day in weekdays according to the usage scenario. Users are informed about usage scenario. There will be two surveys to collect data. System Usability Scale survey will be applied to analyze usability (Brooke, 1996). Also DSMA usability survey will be applied to take users' responses and reactions of the DSMA.

After sample users using DSMA for one day, surveys will be applied to the users over internet without any intervention. Results of the survey will compare DSMA monitoring data so that approving survey completed according to the usage scenario. After approving survey one by one, results of the surveys collected.

Analyzing Data**:** Results of SUS survey will analyze by using SUS scoring method. This scoring method yields a single number representing a composite measure of the overall usability of the system being studied.

Results of usability test will report to give information about users' responses as a summary. According to this summary report, DSMA application will be evaluated to create awareness about effects of daily activities of body health weight.

6. DIETARY SELF-MONITORING APPLICATION

Project Description: Design and Develop Useful Online Dietary Self-Monitoring Application by Turkish Nutrition Habits

Design and develop web application in order to use as an Online Dietary Self-Monitoring Application by taking into account Turkish nutrition habits. Application will be able to monitor physical and nutrition activities. Application provides to trace dietary daily activities. Users will be able to see their histories.

6.1 PROJECT SCOPE

Justification: People use portable technology devices which connect to the internet in their daily life. Consequently, Dietary Self-Monitoring Application should work on time regardless of location and device so that daily activities should be added and monitored effectively. So, I decided to develop web application in order to reach more people on time and cover more portable devices with developing one application. People can use web application regardless of their operating systems, browsers and devices.

Product scope description: Project will have new database which has nutrition and physical activity calories. Database will be created by using Turkish life style. System will have user management. Users will be able save their daily nutrition and physical activities. Users will be able to monitor calorie results of their activities day by day. Application will be able to report and monitoring data. Users will have monitoring data and report about their daily activities and they can share with dietician or third person by sending an email.

Acceptance criteria: Database should be cover users' nutrition and physical activities. User and session management should be completed. Users will be able to save their daily nutrition and physical activities on time regardless of using devices and location. Calorie and other indicator calculations should be validated.

Deliverables: Dietary Self-Monitoring Web Application, Relational Database to store and monitor user activities. Daily User Activities report with all details of DSMA

monitoring data. User's daily need calorie, daily burned calorie and daily intake calorie results and User's BMI and BMR indicators.

Constraints: Some nutrition information cannot be found in database. Nutrition calorie information and calculations will be done approximately. Application cannot validate user's inputs about time, amount and activities. Application expects that users will be accurate when they use application. Users should add nutrition activity with accurate amount type and right amount factor. Also users should add physical activity with right duration. Monitoring and reporting data will be based on these inputs.

Assumptions: If the user cannot find the nutrition data on database, they can add it to the database. We assume that user's information is right until the system users of application approve it. Nutrition items and calories of them will find on different sources, and they have different data about nutrition items. Thus, one of the finding sources will be accepted as a true. Thus, calculated intake calories and burned calories will be approximately. It will have margin of error.

6.2 SYSTEM DEVELOPMENT LIFE CYCLE (SDLC)

Each system and project has different structure and business. Even their characteristics are different; they have mostly same phases and steps. SDLC approach has four phases which are planning, analyze, design and implementation. Each phase has deliverables and these deliverables will be input for next phase.

SDLC approach will be used to develop Dietary Self-Monitoring application. SDLC phases applied by take into characteristics of Dietary Self-Monitoring application. How SDLC phases applied will be explain in selecting which SDLC methodology part (Dennis, A. & Wizon, B.H. & Tegarden, David, 2005).

A system development methodology is a formalized approach to implementing the SDLC. There are many ways to categorize system development methodologies. One important way is focusing on business that process-centered, data-centered or object-oriented. Object-oriented methodologies attempt to balance the focus between process and data by incorporating both into one model. Another important way to categorize

methodologies is sequencing of the SDLC phases and the amount of time and effort devoted to each.

Data and processes are center of the project for Dietary Self-Monitoring application. Thus object-oriented methodology should be selected as a methodology. Also iterative design and developments will be done in project according to the test results. At last, there is one person who takes responsible of all roles in project. Selecting which methodology depends on these three important factors for Dietary Self-Monitoring Application.

According to the factors which defined above, choosing a methodology is simple. Programming-centric methodologies have few rules and practices, all of which are easy to follow. These methodologies defined agile development. One of the programming-centric methodologies is Extreme Programming which is the best methodology in order to apply for DSMA.

Extreme programming is founded on four core values: communication, simplicity, feedback and courage. Three of the key principles that XP uses to create successful systems are continuous testing, simple coding performed by pairs of developers, and close interactions with end users to build systems very quickly. After a superficial planning process, projects perform analysis, design, and implementation phases iteratively. Testing and efficient coding are core to apply extreme programming. Extreme programming methodology can apply for small projects. Because of these advantages, extreme programming methodology is selected for DSMA.

6.2.1 Planning Phase

A project is identified when someone in the organization identifies a business need to build a system. People are passive in their lives especially in big cities. And people have fast food nourishment habits. These causes obesity and new diseases depends on obesity and weight problems. Thus, there is a business need that is creating awareness about daily nutrition activities, physical activities and how results of these activities affect

people's health. DSMA will be focused on it and it will be developed by take into account Turkish nourishment habits and Turkish cuisine.

A new business need creates new business requirements. Business requirements;

i. Saving user characteristics
ii. Adding user daily nutrition activities and calculate intake calories.
iii. Adding user daily physical activities and calculate burned calories.
iv. Monitoring user daily activities and reporting results of calculations.

6.2.1.1 Feasibility analysis

When the business need for the system and business requirements of it have been defined, it is time to create a more detailed analysis to understand the opportunities and limitations of proposed project better. Feasibility analysis guides to identify risks, limitations, opportunities and assumptions associated with the project. A feasibility analysis has three common techniques to do it. Technical analysis addresses on can we build it? Economically analysis address on should we build it? And Organizational feasibility addresses on if we build it, will they accept and use it?

6.2.1.1.1 *Technical feasibility*

I have never used such dietary monitoring application before. Also this is the first time I design and develop application which will be used for dietary self-monitoring. Because of this, technical feasibility analyzes results have important role to make decisions. A technical risk analysis is the essence of technical feasibility.

Modelling activity, nutrition, time and calorie data are the core of the project. Users should understand this modelling and they should be able to use it easily. So I decided the most important risk that is creating nutrition and physical activities' calories data. Also calculating accurate calories is a reasonable risk according to the users' activities with finding data.

Technical Risks

i. Creating nutrition activities data and calories of them according to the amount of nutrition. There is no current data.
ii. Creating physical activities data and calories of them according to the time and weight of the user. There is no current data.

I research available technologies to develop dietary self-monitoring application. Familiarity with the technology has important role to select which technology should be used. Thus, I decided to use technologies that I used before. Visual Studio 2012, .Net Framework 4.0, C#, MSSQL 2008 and IIS7 will be used to develop dietary self-monitoring application.

Familiarity with the current application has no affect for DSMA because there is no current system. If the user used such program before, it doesn't cause any risk. Project Size is limited. I will be responsible all roles of project team. Project schedule is relatively on analyses, design and develop phases.

Compatibility is not the risk. Dietary self-monitoring application won't use any third party services and data. Because of this there will be no integration with any services.

6.2.1.1.2 *Economic feasibility*

Dietary self-monitoring application is a master thesis project and development and operational costs doesn't estimate. Costs identified and listed. We focus on just intangible benefits on cost-benefits analyzes.

Development Costs

i. Web domain hosting
ii. MSSQL database hosting
iii. Development labor

Operational Costs

i. Hosting

Intangible Benefits

i. Increase awareness of user's life style whether is healthy or not.
ii. Creating short-term decisions to change nutrition habits.
iii. Creating short-term decisions to change physical activity level.

6.2.1.1.3 *Organizational feasibility*

Target users should have basic know how to use internet by using browsers. Thereby, even novice internet user can use DSMA without any support. Project will be used in every browser. Users of the system should have device and internet connection to use dietary self-monitoring application.

Users should know what nutrition items are and what physical activities are. All of them should be added to the system for one day period (24 hours). Application will be able to hints to inform users about this. Application will have information about health indicators about body.

6.2.2 Analysis Phase

Analyses phase answer the question of who will use the system, what the system will do and when it will be used. During analyses phase, the project team investigates any current systems, identifies improvement opportunities and develops a new concept.

Internet users can use DSMA in order to monitor their daily nutrition and physical activities. They just need to device which connects to the internet. User can access website by using any internet browser applications. Users have to sign up the system by giving necessary input information. After sign up, users can login to the DSMA and they start to save their daily activities.

There is no current system and database because of this DSMA will be analyzed and designed without any reference system. Business requirements are defined according to the key recommendations from the 2010 DGA report. Requirement gathering step based on saving users' daily nutrition and physical activities with calories information. Saving all activities on time with accurate information is the main function of the project.

6.2.2.1 Business requirements

i. Application will be able to have nutrition items and calories data
ii. Application will be able to have physical activity calories data
iii. Application will be able to have user management
iv. Application will be able to add nutrition activities with meal and amount information.
v. Application will be able to calculate intake calories of added nutrition activities.

vi. Application will be able to add physical activities with time.

vii. Application will be able to calculate burned calories of added physical activities.

viii. Application will be able to calculate body mass index of user by using user's weight and height.

ix. Application will be able to show user's weight state by using body mass index indicator.

x. Application will be able to calculate Basal Metabolic Rate and daily calories need.

xi. Application will be able to monitor nutrition activities history and physical activities history of users.

xii. Application will be able to send an email about user's activities to the dietician or third person.

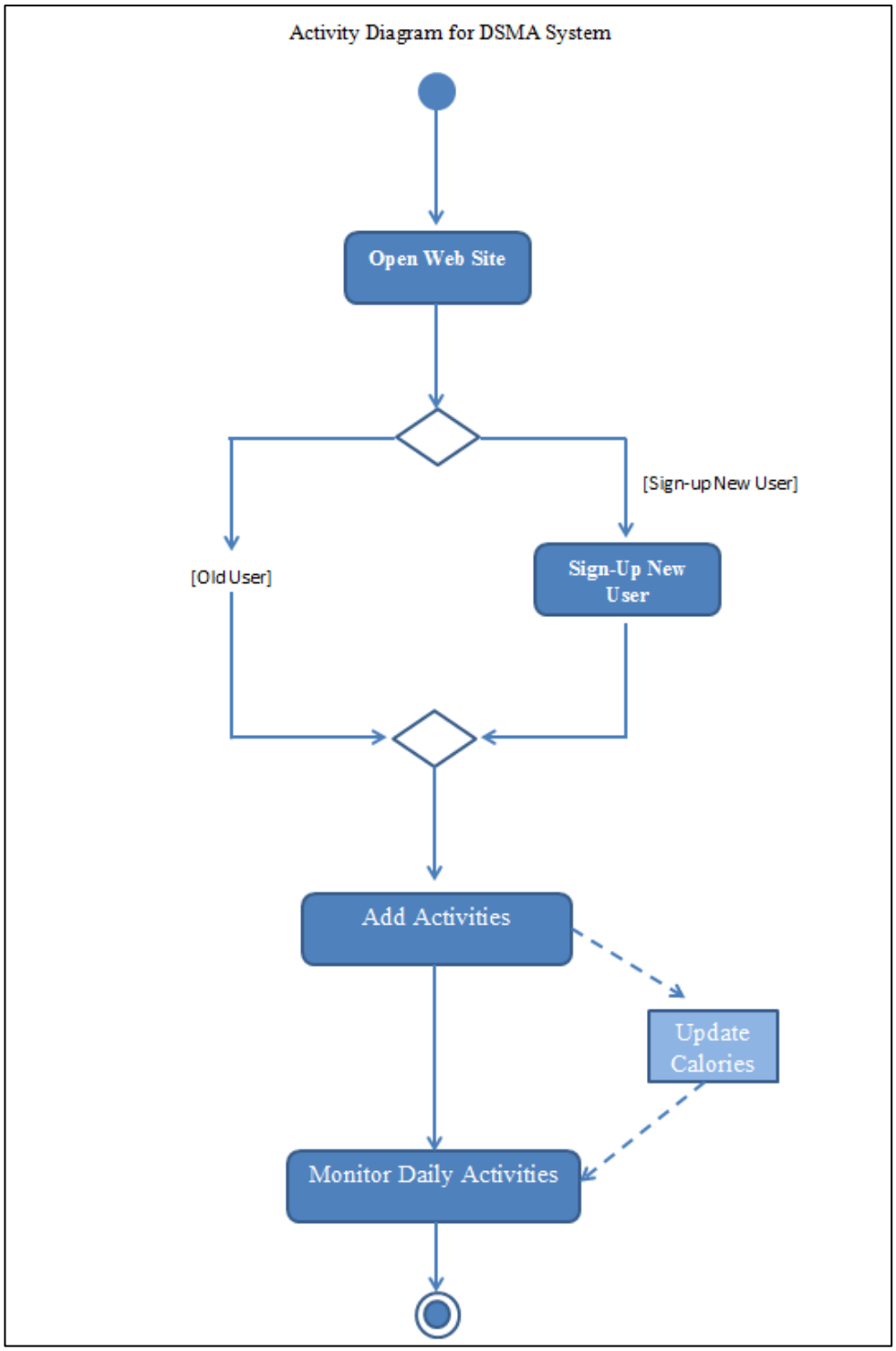
xiii. Application will be able to manage diet. User can start new diet and monitor diet activities.

xiv. Application will be able to store weight and height of the user periodically.

According to the business requirements, an activity diagram for DSMA system and use case diagram for DSMA system are prepared. These two diagrams will be deliverable for design phase. Interactions and activities within the systems should be designed useful.

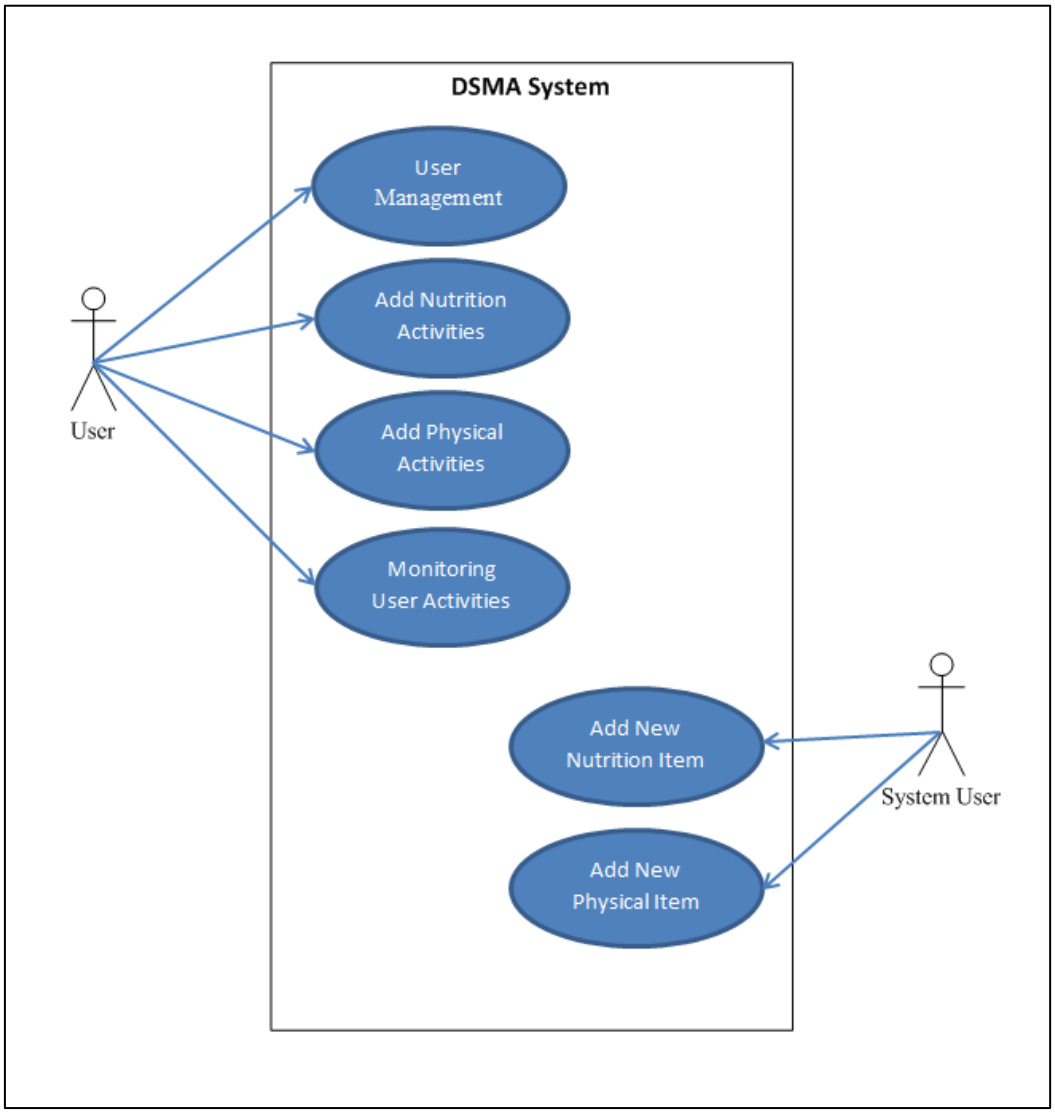
6.2.2.2 Functional model activity diagram

Figure 6.1: Activity diagram for DSMA



6.2.2.3 Use case diagram

Figure 6.2: Use case diagram for DSMA



6.2.3 Design Phase

The design phase decides how the system will operate according to the results of business requirements that defined in analysis phase. Business requirements, an activity diagram and use case diagram are deliverable for design phase. Extreme programming methodology is selected as a SDLC approach in project planning phase. Extreme programming bases on simplicity. Thus, design phase focused on simple and useful interface within the scope.

6.2.3.1 Architecture design

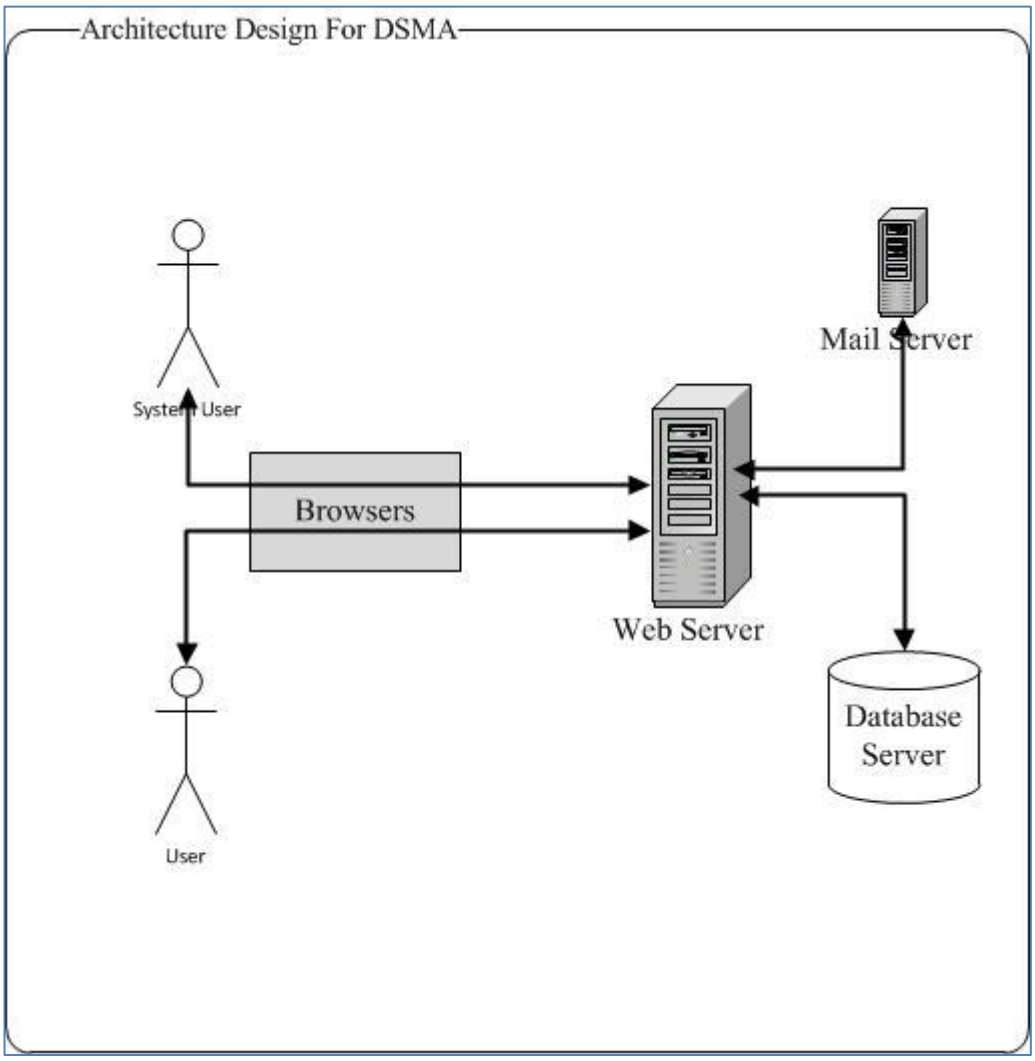
i. Domain hosting which run on iis7.

ii. .Net Framework 4.0 should be installed on domain hosting server.

iii. MSSQL database hosting.

iv. Integrated mail services with domain hosting

Figure 6.3: Architecture design for DSMA



6.2.3.2 Database design

Microsoft MSSQL will be used for database design and database development. Relational database design will be used for DSMA. User calculations and part of business functions will be done by using stored procedures. Thus, MSSQL database server version has to support stored procedures. All user data will be stored in database.

Database will be designed according to the business requirements which defined in analysis phase. Mainly, database will be used for user session management, monitoring user daily nutrition and physical activities.

6.2.3.2.1 *Gathering data*

Physical activity calories data is found on Harvard Health Publications. (Harvard Medical School, Harvard Heart Letter, July 2004) Activities are well described and studied. Power of the activity can affect burned calories. Thus, activities are divided in terms of power of it. We can't say that each person do these activities with same power and in same location. Location has effect on burning calories, for example running in the forest burned more calories running in gym. Also each person can't do physical activity for same power. These affects will be accepted, but it won't change calculations. Finding physical activity calories data has different format and structure. I have to work on finding data.

Table 6.1: Physical activity data example

Gym Activities	**125 pound person**	**Time**
Weight Lifting: general	90 calories	30 minutes

Source: Harvard Heart Letter

There is an example of one physical activity calories are listed for 125pound person and 30 minutes duration on table 1. It cannot be used for DSMA. Turkish weight metric is kg. Users will add their weights as a kg. So 125 pound has to convert kg. Also, 1 minute calories for each activity have to calculate in order to calculate user's burned calories.

125 pounds = 56, 81 kg

90 / 30 = 3 calories for 56, 81 kg

At last, 1 minute calories for 1 kg weight have to calculate for each activity. It is more useful and effective to calculate user's activities. It is calculated for Weight Lifting: General activity as an example.

3 / 56, 81 = 0, 0528 calories for 1 kg weight and 1 minute

Table 6.2: Converted physical activity data example

Gym Activities	**1 kg weight for 1 minute**
Weight Lifting: general	0,0528 calories

Source: Harvard Heart Letter

For all physical activities conversions and calculations will be done in order to find how many calories burned for 1 kg weight and 1 minute. Results of these calculations and conversions for each activity will be saved on Activity database table.

Finding nutrition data with calories is requiring more effort. There are many different variations for each nutrition item. Especially for Turkish cuisine, one reference cannot be finding. Thus, nutrition data will be finding on different sources item by item. Cuisine company websites and big brands of manufacturer web sites are used to find nutrition data. Ingredients information of packaged nutrition is used. And we assume that one of these finding results for one nutrition item will be accepted.

For example, 100ml milk has 62 calories on one source. 100ml milk has 61 calories on another source which that is big brand in Turkey. This differentiation can be because there is no guarantee that all milks have same substances with same amounts. Also there are many amount variations for nutrition item. Amount factor can change calories information. One brunch grape and 100gr grape has different calories information. Moreover each brunch grape cannot have same calories. Size of brunches can change by the grape. This is same for all nutrition items.

Also one nutrition item has multiple amount types so that users should add nutrition item more easy and accurate. Thus, most favorable calories information with different amount type for each nutrition item will be added to the data.

6.2.3.2.2 *Create database objects with primary keys and foreign keys*

Database tables, primary keys, foreign keys and fields will be created according to the needs of business requirements and functions that are defined in the analysis phase. Each table will have primary key. It will be used to provide uniqueness of the row. Also foreign keys will be used to create logical relationships among tables.

6.2.3.2.3 *Crate relationships among tables*

Tables have logical relationships according to the business functions and objects' states. MSSQL supports to create relationships to ensure data whether it is expected in Relational Database Design.

6.2.3.2.4 *Refine & normalize the database design*

After all tables and fields defined, database normalization will be done. Database normalization is the basic principle of relational database design which is the process of organizing the fields and tables of a relational database to minimize redundancy.

6.2.3.2.5 *Data conversion*

Nutrition calories and physical activity calories data conversion will be done. Table records will be added by results of conversion work. After completing data conversion, new nutrition items and physical activities by added as a database system user.

6.2.3.3 Interface design

Interface design will be done by user's familiarity of web applications. Internet users are accustomed to use page wall structure by using social media websites such as Facebook, Twitter and others'. Design specifications;

i. Most used parts of the web site will be left-center of the page.
ii. Less used parts which will give information about user's states will be on right side of the page.
iii. Menu and the user management parts will on the top center of the page.
iv. Nutrition activities part will be top-center of the main page. It will be most used in daily usage. Typical daily nutrition activities can be almost 20. It can be change by day and user.
v. Physical activities will be bottom-center of the main page. Typical daily physical activities can be almost 10. It can be change by day and user.

vi. Auto-complete text boxes will be used in order to find nutrition and physical activity. It is more easy and user friendly. Also users are accustomed to use it by using most used web applications such as Google.

vii. Colors will be used to show calorie indicators.

6.2.3.3.1 *Sign-up form*

Users have to fill all fields in sign-up form. Form fields will be validated according to the characteristics of the field by the DSMA application. If the user doesn't enter the value, user will be warned. Some fields in the sign-up form will be used for user and session management. And some of the fields which will be saved as a user attribute which will be used to calculate BMI indicator, BMR indicator, intake calories and burned calories. Because of this all fields in sign-up form will be necessary to fill by the user.

Sign up Form Fields for using user and session management.

i. Email address. It will be used for session management. Email address will validate by using regular expression check. DSMA system will check email address is used before. It must be unique.

ii. Name and surname. It will be used for user interaction. Maximum length check will be done.

iii. Password. It will be used for session management. Password length must be greater or equals five.

iv. Password Again. It will be used for validating and checking password. Users have to same password to validate it.

Sign up for fields for using to calculate calories' calculations. User have to fill it right in order to get accurate results and information.

i. Gender. Gender is a parameter to calculate BMR.

ii. Birth Date. Birth date will be used to find user's age. Age is a parameter to calculate BMR.

iii. Height. Height is a parameter to calculate BMR, BMI and burned calories.

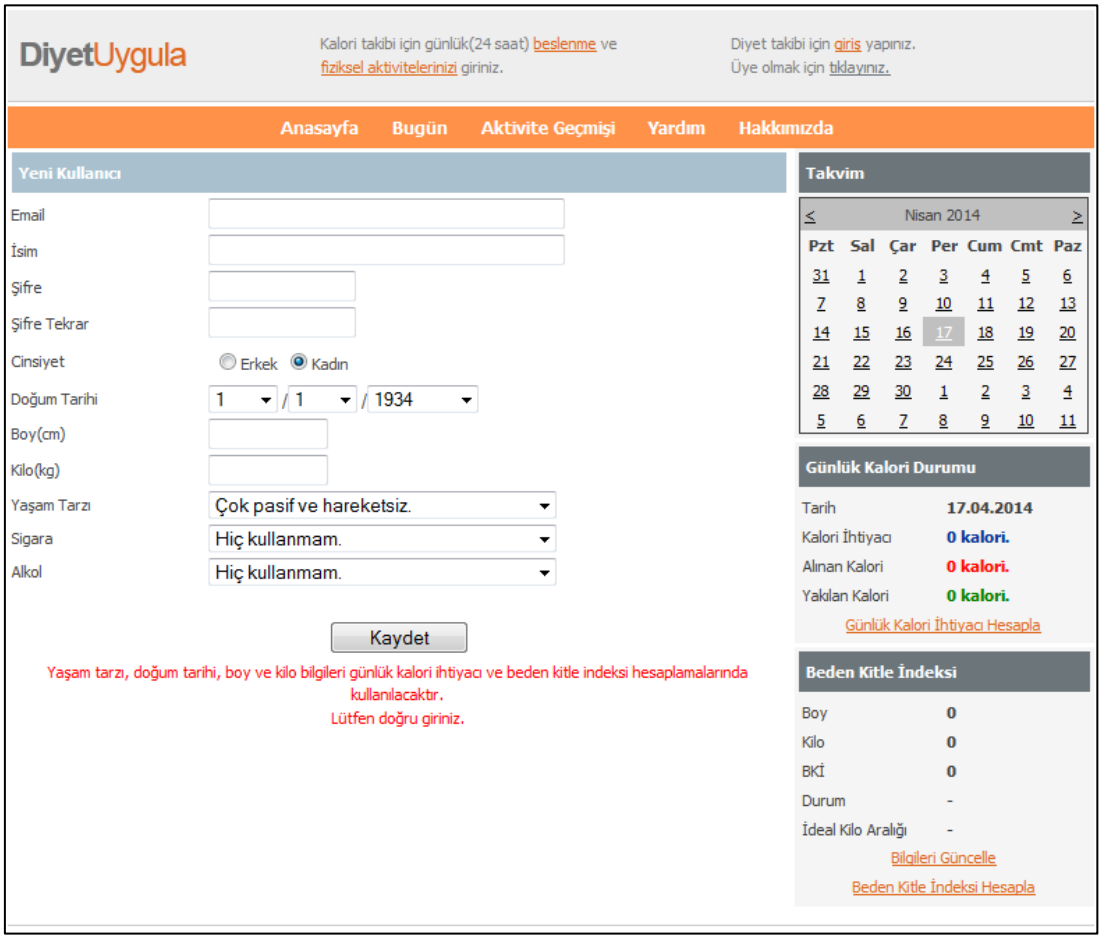
iv. Weight. Weight is a parameter to calculate BMR, BMI and burned calories.

v. Life Style Activity Factor. Life style activity factor is a parameter to calculate BMR and daily need calories.

vi. Smoking. It will be used whether it has effects on daily nutrition and physical activities.

vii. Alcohol. It will be used whether it has effects on daily nutrition and physical activities.

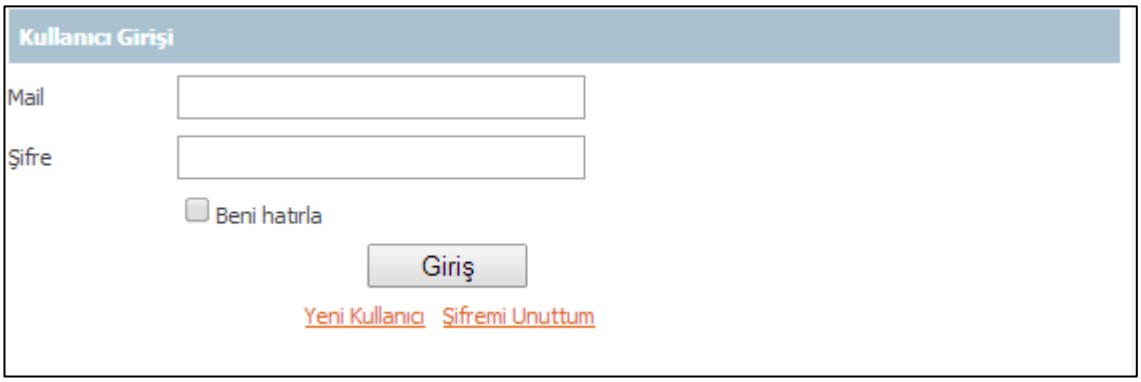
Figure 6.4: User sign up form screen



6.2.3.3.2 *Login form*

Login form has two fields, one of them is email address and the other one is user password. These two fields are necessary to login system. Also there is a "Remember Me" check box to remember username and password for next time. It is optional for usage. After filling email address and password field user can login by using Login button. If the user forgot password, user can resend password by using "Forgot My Password" link button.

Figure 6.5: Login form

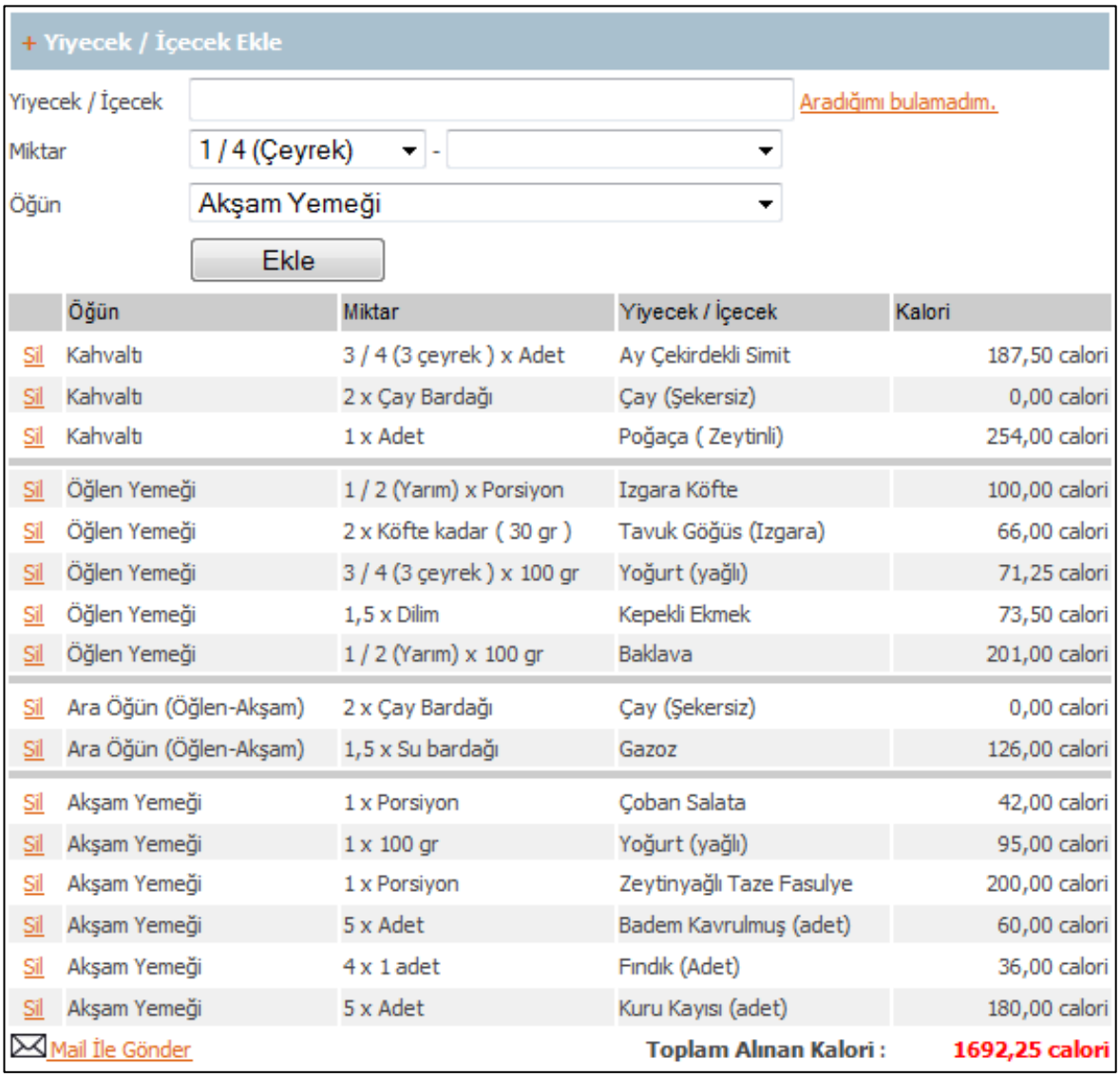


6.2.3.3.3 *Adding daily nutrition activities part*

There will be four fields to enter daily nutrition activities. First one is which nutrition taken. User will be able to find nutrition by typing its name. After typing two characters, autocomplete will work and search results will be listed. User will be able to select nutrition from search results which listed. After user selects nutrition name, amount factor and amount type will be loaded automatically. Amount factor and amount type fields will be used to calculate how much amount nutrition taken. The last field is meal. This field will be used for reporting to the dietician of user.

After filling fields, user should use "Ekle" button to add nutrition activity. DSMA system will be refreshed by post backing the web site. Intake calories will be calculated by automatically and intake calorie information will be updated. It will be shown by red color at bottom of the saving daily nutrition part. All saved daily nutrition activities will be listed with meal, amount, and nutrition name and intake calories information as a report. User can send this report to dietician by email.

Figure 6.6: Adding daily nutrition activities part



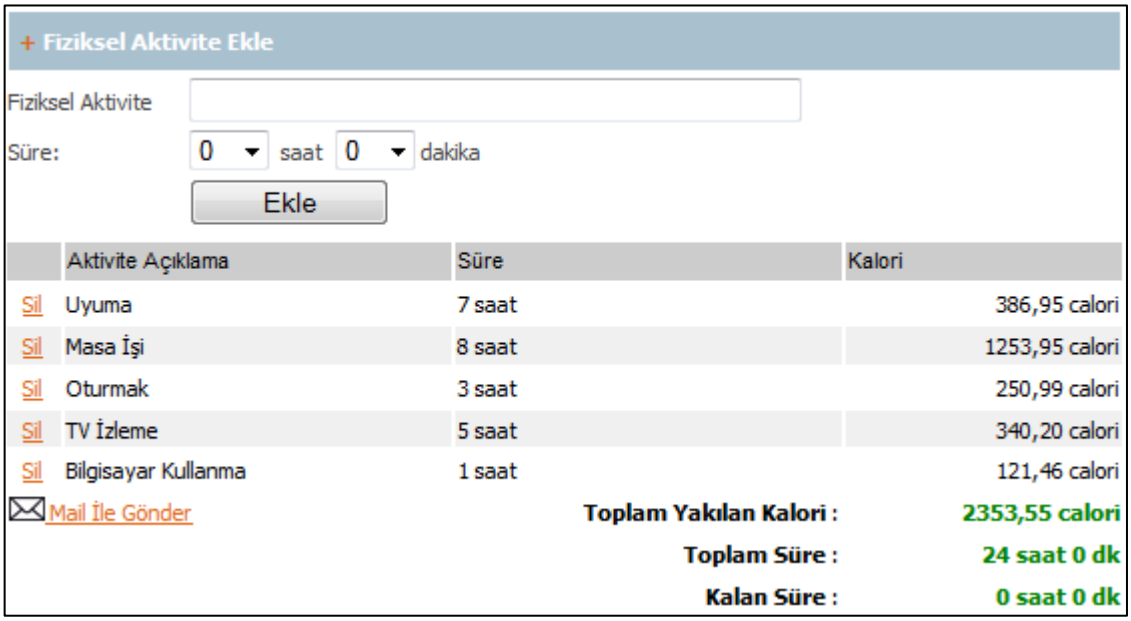
6.2.3.3.4 *Adding daily physical activities part*

There will be three fields on adding daily physical activities part on the main page. First one is which activity done. User can find activity by typing its name. After typing two characters, autocomplete will work and search results will be listed. User can select to the results which activity done. Other fields are hour and minute fields to save activity duration how long time user did it. It will be taken by hour and minutes from the user, because it is more useful. DSMA is going to calculate total minutes by using hour and minutes. When user fills all fields, user can add activity by using “Ekle” button. After

each adding activity, DSMA system will be refreshed by posy backing the web site. According to the each activity, burned calories will be calculated and it will be updated.

Also daily physical activities part shows total hours that user added. Users should add 24 hour activities. Thus, there is remaining time information that shows how much time remaining to complete 24 hours. After completing 24 hours activity, daily physical activity part lists with activity name, time and burned calories information as a report. User can send this report to dietician by email. Total activity time and total burned calories will be showed by green color.

Figure 6.7: Adding daily physical activities part



6.2.3.3.5 *User calories state part*

On right side of the main page, there will be a daily calories state part which will show user's calories indicators on active day. There will be date information to show active day of the system. User will be able to change active day by using calendar on page. First indicator is on daily need calories information. It will be calculated by using life style factor and Basal Metabolic Rate (BMR). It will be shown by blue color on daily calories state part.

Intake calories of user will be shown by red color on daily calories state part. Default value of daily intake calories is zero. When the user adds nutrition activities for active day, it will be calculated automatically and updated on time.

At last, burned calories of user will be shown by green color on daily calories state part. Default value of daily burned calories is zero. When the user saves physical activities for active day, it will be calculated automatically.

User daily need calories, intake calories and burned calories shows current calories state of the user on active day. These three indicators will be important outputs of the system.

Figure 6.8: Daily calories state part

6.2.3.3.6 *Body mass index part*

On the right of the main page, there will be a body mass index part that will show user current weight status and indicators. It will be calculated by using height and weight of user. There are three important indicators on BMI part. First one is BMI value. Second one is a description of BMI state. This description can be underweight, moderate weight, overweight or obesity. The last one is user optimal weight interval to be moderate weight.

Figure 6.9: BMI state part

6.2.3.3.7 *Activity history page*

Activity history page will be able to list daily calories information by historically. If the user uses DSMA more than one day, user can follow total calories of all days. It will be able to show difference between total intake calories and total burned calories day by day. User can send this report to dietician by email.

Figure 6.10: Activity history page.

6.2.4 Implementation Phase

Final phase in SDLC is the implementation phase. It needs more attraction and longest part. There is an iterative work until application is built and tested to ensure it performs as designed. Implementation part has development and testing. After application development done, unit testing will be done to ensure applications functions works as defined in scope. After system build, application will be tested to check all functions of application done within the scope. It is construction part in implementation phase.

After construction, installation will be done on web hosting. Web application will be published on web hosting server. When the DSMA system publishes on the net, it will be tested on different browsers and different devices. According to the test results, SDLC will be worked and it goes until project completed.

After project development completed and published, maintenance and support processes will start. Database server and web hosting server will be accessible on time. System user will add new nutrition item and physical activity to the DSMA.

7. USABILITY

People use many devices to connect internet, but we focus on which devices more portable and easily use. Smart phones, netbook and notebooks are our target for DSMA. All of these devices can have different operating systems. Because of this, we don't want to restrict users according to the by using device or operation systems. According to the marketing research, percentage of 75 of people use Wi-Fi while percentage of 49 of people use mobile internet for Turkey. (McBDC Business Development & Consultancy Services Co.Ltd, 2013, Mobile Technology in Turkey) Thus, we decided to develop web application to reach all of users. Internet connection and devices which has browser application are necessities to use DSMA.

DSMA design is based on functionality and simplicity. Basic web application development components and simple design is selected. One template works on each application, there is no variation by device or operating system.

7.1 USAGE SCENARIO

Users have to access to the DSMA web site address by using their devices with internet connection. A new user scenario for one daily usage is defined step by step.

i. User is going to sign up to the DSMA system by using sign-up form. User has to fill all fields on sign-up form in order to start DSMA. If the user has already signed up before user can go next step that is login.
ii. User is going to login to the DSMA system by using login form. User can check remember me so that user will be logged to the system automatically.
iii. User is going to check the daily need calories information.
iv. User is going to check user's current BMI indicator and weight level of it.
v. User is going to use DSMA system for one day (24 hours).
vi. User is going to add all daily nutrition activities within 24 hour. Even if a nutrition activity has zero calories such as drinking water. User has to add it.
vii. User is going to add all daily physical activities within 24 hours including sleeping, sitting, watching TV etc.
viii. User is going to check whether all daily activities added with accurate information or not.

ix. User is going to check calculated total intake calories.

x. User is going to check calculated total burned calories.

xi. User is going to compare calculated daily need calories, total intake calories and total burned calories.

xii. User is going to evaluate comparing results and make decisions about it.

xiii. As a result of user evaluation and decisions, user should define what short-term changes should be taken in user's daily life.

xiv. User is going to apply usability test.

8. FINDINGS

Sample is determined as a heuristic and people who are working in weekdays are selected. All of participants used DSMA for one day of the weekday. Each participant joined to the survey as a volunteer. 19 people wanted to join survey but two of them didn't follow usage scenario and then those two users' surveys removed from sample. So, 10 female and 7 male participants used DSMA according to the usage scenario and they applied surveys successfully. Participants' surveys compared with DSMA monitoring data in order to approve survey.

Minimum age of sample is 19 and maximum age of sample is 51. Average age of sample is 31. Average age of sample can be considered as youth working age. According to the BMI indexes of sample, 1 user obese, 7 users are overweight and 9 users are moderate weight. Nearly, half of the participants are overweight.

8.1 SUS SURVEY FINDINGS

Scoring SUS for each participant

i. For odd items: subtract one from the user response.
ii. For even-numbered items: subtract the user responses from 5
iii. This scales all values from 0 to 4 (with four being the most positive response).
iv. Add up the converted responses for each user and multiply that total by 2.5. This converts the range of possible values from 0 to 100 instead of from 0 to 40.

Participants' grades for each questions added to the Table 4. SUS scores calculated for each participant. According to the SUS scoring method, a SUS score for each participant above a 68 would be considered above average and anything below 68 is below average. According to the SUS survey results, one user score is below 68 and 16 users' score is above 68. It means that 16 users of 17 users found DSMA is useful and just one user of sample DSMA is not useful. Besides, average score of all participants is 83. One of the participants uses internet lower than two hours for a day, and 16 participants of the participants uses internet more than two hours for a day.

Table 8.1 SUS survey results

Participants	Questions										
		q1	q2	q3	q4	q5	q6	q7	q8	q9	q10	SUS Score
	P1	5	2	4	1	5	1	4	1	5	2	90
	P2	4	1	4	2	5	2	4	1	4	1	85
	P3	3	2	3	2	3	2	3	2	4	2	65
	P4	2	2	4	2	4	2	4	2	4	2	70
	P5	5	1	4	2	5	1	4	1	4	1	90
	P6	3	1	1	1	5	1	5	1	5	1	85
	P7	3	1	5	1	5	5	5	1	5	5	75
	P8	5	1	5	5	5	1	5	1	5	2	87,5
	P9	5	1	4	1	5	1	3	1	5	1	92,5
	P10	5	1	4	1	5	1	4	1	4	1	92,5
	P11	3	1	5	1	4	2	5	1	5	2	87,5
	P12	3	1	2	2	4	1	3	1	3	2	70
	P13	5	1	5	1	5	1	5	1	5	1	100
	P14	4	1	4	2	4	1	5	1	5	2	87,5
	P15	3	2	4	1	4	1	4	2	4	1	80
	P16	5	1	5	4	4	1	4	1	5	3	82,5
	P17	4	2	4	2	4	2	4	2	4	2	75
											Mean	83,2353

8.2 DSMA USABILITY TEST FINDINGS

Usability test will be applied to the user after they use DSMA for one day. Users have to follow usage scenario when they use DSMA. All questions are targeted to evaluate what results of using DSMA are.

DSMA Usability survey applied to evaluate users' reactions to the DSMA application usage. Usability survey results showed us whether DSMA is effective to create awareness of how daily activities affect peoples' body weight. Usability test will be summarized question by questions. Question 7 and question 8 are related to the daily monitoring data, so they won't be analyzed detail.

Question 2 results: Two users of the sample selected their body weight level wrong, but 15 users of the participants selected body weight level are right. Users' responses compared to the BMI calculations of DSMA.

Table 8.2 DSMA usability test question 2 results

Q2. What is your body weight level?		
Answer Options	**Response Percent**	**Response Count**
Underweight	5,9%	1
Moderate weight	58,8%	10
Overweight	29,4%	5
Obese	5,9%	1

Question 3 results: DSMA showed daily calories need of the users, even though four users of the participants still didn't know how many calories need. On the contrary 13 participants (percentage of 76, 5) learned it.

Table 8.3 DSMA usability test question 3 results

Q3. Do you know how much calories do you need for one day?		
Answer Options	**Response Percent**	**Response Count**
No, I don't know	23,5%	4
Yes, I know. I learned from DSMA application.	76,5%	13
Yes, I have already known	0,0%	0

Question 4 results: 10 participants (percentage of 58, 8) learned what their ideal weight interval is by using DSMA. One user of participants didn't learn it even though DSMA showed it for each registered user. 6 users of participants had already known.

Table 8.4 DSMA usability test question 4 results

Q4. Do you know what your ideal weight interval is?		
Answer Options	**Response Percent**	**Response Count**
No, I don't know	5,9%	1
Yes, I know. I learned from DSMA application.	58,8%	10
Yes, I have already known	35,3%	6

Question 5 results: 15 users (percentage of 88, 2) of participants saved all daily nutrition activities, two of the participants couldn't save some of them.

Table 8.5 DSMA usability test question 5 results

Q5. Can you save all nutrition activities by using DSMA application?		
Answer Options	**Response Percent**	**Response Count**
No, I coudn't save	0,0%	0
Yes, but I couldn't some of them.	11,8%	2
Yes, I saved all activities.	88,2%	15

Question 6 results: 11 users of participants (percentage of 64, 7) saved all daily physical activities successfully, 6 users (percentage of 35, 3) of them couldn't save some of the physical activities.

Table 8.6 DSMA usability test question 6 results

Q6. Can you save all physical activities by using DSMA application?		
Answer Options	**Response Percent**	**Response Count**
No, I coudn't save	0,0%	0
Yes, but I couldn't some of them.	35,3%	6
Yes, I saved all activities.	64,7%	11

Question 9 results: As a result of daily self-monitoring data, 9 (percentage of 52, 9) users of the participants decided that they need to change eating behaviors. 6 users (percentage of 35, 3) of the participants thought that no need to change. At last, 2 users (percentage of 11, 8) of the participants decided that they need less eating activities.

Table 8.7 DSMA usability test question 9 results

Q9. As a result of daily nutrition activities report, what should change to keep your body weight ideal?		
Answer Options	**Response Percent**	**Response Count**
No need to change, I have well nutrition behaviors.	35,3%	6
I need less eating activities; I have too much eating	11,8%	2
I need more eating activities; I don't have enough	0,0%	0
I need to change eating behaviors with healthy	52,9%	9

Question 10 results: 3 users (percentage of 17, 6) of the participants thought that they live active and they do enough sport. They don't need to change. Apart from this, 16

users (percentage of 83, 4) of the participants though that they need to change to keep body weight is ideal.

Table 8.8 DSMA usability test question 10 results

Q10. As a result of daily physical activities, what should change to keep your body weight ideal?		
Answer Options	**Response Percent**	**Response Count**
I live too much passive, I need to be more active and I need to do sport.	23,5%	4
I live passive; I need to be more active.	23,5%	4
I live active; but I don't do sport. I need to do sport.	35,3%	6
I live active and I do enough sport.	17,6%	3

Question 11 results: Usability test score is 4, 41 is over 5. When we calculate this score over 100 by multiplying 20, it equals 88, 2. Just 2 users of the participants are hesitant. Four users are agreed and 9 users are strongly agreed.

Table 8.9 DSMA usability test question 11 results

Q11. DSMA is a useful and effective application to use as a dietary self-monitoring application?							
Answer Options	**Strongly Disagree**	**2**	**3**	**4**	**Strongly agree**	**Rating Average**	**Response Count**
	0	0	2	6	9	4,41	17

9. DISCUSSION

I observed two users of the participants when they were using DSMA. They hardly decided to the amount of nutrition that eats. Users didn't decide how amount of nutrition that want to eat before take it. It was an example of unconscious nutrition habit. Besides, according to the all my observations and experiences with participants, they were just focus on nutrition activities to keep body weight healthy. Even DSMA forced to the users to add physical activities, they were not aware of how daily physical activities affect body weight. There is a misconception, if someone wants to keep body weight is healthy, they just have to control nutrition activities.

Sample users thought DSMA application is useful and effective application in order to collect daily activities self-monitoring data with accurate information on time. According to the results of SUS survey and DSMA usability test, users realized what their nutrition and physical activities are. User learned effect of their nutrition and physical activities as calories. Reporting all daily activities, calorie information, BMI and BMR body weight indicators as a self-monitoring data found DSMA application is useful and effective application to keep body weight is healthy. In another words, DSMA application can be used to prevent chronic and acute diseases of obese and overweight problems.

10. RESULTS

The purpose of this study is designing and developing online dietary self-monitoring application by taking into account Turkish habits in order to create awareness about how daily activities affect peoples' weight and health. DSMA application designed and developed as an online application. Heuristic sample users used DSMA with portable devices and all kind of computers that have internet connection. There was no any restriction about which device can use to the users.

Sample users used DSMA for one day according to the usage scenario. Two surveys applied to the sample users to evaluate DSMA usability. Survey results analyzed and summarized. SUS survey score average is 83, 2 over 100 and DMSA usability test score is 88, 2 over 100. According to these two indicators, heuristic sample users found that DSMA is a useful and effective online application to use as an online dietary self-monitoring application by Turkish habits.

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APPENDICES

APPENDIX 1: Applied SUS Usability Survey in Turkish

1. DiyetUygula.com sayfasına kayıtlı olduğunuz, mail adresiniz nedir?

   ……

2. Bir gün de ortalama kaç saat internet kullanıyorsunuz.
   a. 2 saatten daha az
   b. 2 saatten daha fazla

Mail Adresi: _____ Tarih: ___/___/___

DiyetUygula.com Tez Uygulama Anketi

DiyetUygula.com ile bir günlük(24 saat) beslenme ve fiziksel aktivitelerinizi kaydettikten sonra, uygulama anketi doldurulacaktır.

Anketi tamamladıktan sonra lütfen "Bitti" butonuna tıklamayı unutmayın.

		Kesinlikle Katılmıyorum				Kesinlikle Katılıyorum
1.	Bu web sayfasını daha sık kullanabileceğimi düşünüyorum.	☐	☐	☐	☐	☐
2.	Web sayfasını gereksiz yere karmaşık buldum.	☐	☐	☐	☐	☐
3.	Web sayfasının kullanımı çok kolay.	☐	☐	☐	☐	☐
4.	Web sayfasının kullanılabilmesi için yardım gerektiğini düşünüyorum.	☐	☐	☐	☐	☐
5.	Web sayfasında ki işlemler güzel bir şekilde ilişkilendirilmiş.	☐	☐	☐	☐	☐
6.	Web sayfasında çok fazla tutarsızlık olduğunu düşünüyorum.	☐	☐	☐	☐	☐
7.	Web sayfasını kullanmayı, bir çok kullanıcı kolayca öğrenebilir.	☐	☐	☐	☐	☐
8.	Web sayfasının çok kullanışsız olduğunu düşünüyorum.	☐	☐	☐	☐	☐
9.	Web sayfasını çok rahat kullandım.	☐	☐	☐	☐	☐
10.	Web sayfasını kullanmaya başlamadan önce öğrenmem gereken bir çok şey var.	☐	☐	☐	☐	☐

Uygulama hakkında yorum:

APPENDIX 2: Applied SUS Usability Survey in English

i. What is your mail address that you use for DSMA?

   a. ……

ii. How many hours do you use internet for one day?

   a. Less than two hours

   b. More than two hours

System Usability Scale

Instructions: For each of the following statements, mark one box that best describes your reactions to the website *today*.

		Strongly Disagree				Strongly Agree
1.	I think that I would like to use this website frequently.	☐	☐	☐	☐	☐
2.	I found this website unnecessarily complex.	☐	☐	☐	☐	☐
3.	I thought this website was easy to use.	☐	☐	☐	☐	☐
4.	I think that I would need assistance to be able to use this website.	☐	☐	☐	☐	☐
5.	I found the various functions in this website were well integrated.	☐	☐	☐	☐	☐
6.	I thought there was too much inconsistency in this website.	☐	☐	☐	☐	☐
7.	I would imagine that most people would learn to use this website very quickly.	☐	☐	☐	☐	☐
8.	I found this website very cumbersome/awkward to use.	☐	☐	☐	☐	☐
9.	I felt very confident using this website.	☐	☐	☐	☐	☐
10.	I needed to learn a lot of things before I could get going with this website.	☐	☐	☐	☐	☐

Please provide any comments about this website:

APPENDIX 3: Applied DSMA Usability Test in Turkish

DiyetUygula.com Tez Uygulama Anketi

DiyetUygula.com ile bir günlük(24 saat) beslenme ve fiziksel aktivitelerinizi kaydettikten sonra, uygulama anketi doldurulacaktır.

Anketi tamamladıktan sonra lütfen "Bitti" butonuna tıklamayı unutmayın.

3. DiyetUygula.com sayfasına kayıtlı olduğunuz, mail adresiniz nedir?

   ……

4. Bir gün de ortalama kaç saat internet kullanıyorsunuz.
   a. 2 saatten daha az
   b. 2 saatten daha fazla
5. Kilo seviyeniz nedir?
   a. Az kilolu
   b. Normal(İdeal) Kilolu
   c. Fazla kilolu
   d. Obez
6. Bir gün için ihtiyacınız olan, almanız gereken kalori miktarını biliyor musunuz?
   a. Hayır, bilmiyorum.
   b. Evet, diyetuygula.com üzerinden öğrendim.
   c. Evet, zaten biliyordum.
7. İdeal kilo aralığınızı biliyor musunuz?
   a. Hayır, bilmiyorum
   b. Evet, diyetuygula.com üzerinden öğrendim.
   c. Evet, zaten biliyordum.
8. Günlük tüm beslenme aktivitelerinizi kaydedebildiniz mi?
   a. Hayır, kaydedemedim.
   b. Evet, ama bazılarını kaydedemedim.
   c. Evet, hepsini kaydedebildim.
9. Günlük tüm fiziksel aktivitelerinizi, kaydedebildiniz mi?
   a. Hayır, kaydedemedim.
   b. Evet, ama bazılarını kaydedemedim.

c. Evet, hepsini kaydedebildim.

10. Günlük tüm beslenme ve fiziksel aktivitelerinizi kaydettikten sonar, oluşan durum hangisidir?
    a. Yakılan kalori > Alınan Kalori
    b. Yakılan kalori < Alınan Kalori
    c. Yakılan kalori = Alınan Kalori
11. Günlük kalori durumuna göre, olması gereken sonuç nedir?
    a. Kilo kaybetmek
    b. Mevcut kiloyu korumak
    c. Kilo almak
12. Günlük beslenme aktivite sonuçlarına göre, daha sağlıklı yaşamak için ne yapmalısınız?
    a. Değişiklik yapmama gerek yok, düzenli besleniyorum.
    b. Daha az beslenmeliyim, çok fazla besleniyorum.
    c. Yetersiz(az) besleniyorum, daha fazla beslenmeliyim.
    d. Sağlıksız ve düzensin besleniyorum, daha sağlıklı beslenmeliyim.
13. Günlün fiziksel aktivite sonuçlarına göre, daha sağlıklı yaşamak için ne yapmalısınız?
    a. Çok pasif ve hareketsiz yaşıyorum, daha aktif ve spor yaparak yaşamalıyım.
    b. Pasif yaşıyorum, daha aktif olmalıyım.
    c. Aktif yaşıyorum, ama spor yapmıyorum. Spor yapmalıyım.
    d. Aktif yaşıyorum ve spor yapıyorum.
14. DiyetUygula.com kalori ve aktivite takibi için kullanışlı bir uygulama mı?

Kesinlikle Katılmıyorum ☐ ☐ ☐ ☐ ☐ Kesinlikle Katılıyorum

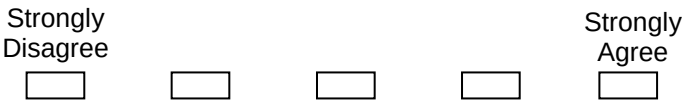
APPENDIX 4: Applied DSMA Usability Test in English

1. What is your mail address that you use for DSMA?

   ……

2. What is your body weight level?
   a. Underweight
   b. Moderate weight
   c. Overweight
   d. Obese
3. Do you know how much calories do you need for one day?
   a. No, I don't know
   b. Yes, I know. I learned from DSMA application.
   c. Yes, I have already known
4. Do you know what your ideal weight interval is?
   a. No, I don't know
   b. Yes, I know. I learned from DSMA application.
   c. Yes, I have already known
5. Can you save all nutrition activities by using DSMA application?
   a. No, I couldn't save
   b. Yes, but I couldn't save some of them
   c. Yes, I saved all activities.
6. Can you save all physical activities by using DSMA application?
   a. No, I couldn't save
   b. Yes, but I couldn't save some of them
   c. Yes, I saved all activities.
7. After saving all nutrition and physical activities, what is your daily calories result?
   a. Burned calories > Intake calories
   b. Burned calories < Intake calories
   c. Burned calories = Intake calories
8. As a result of net calories, what will happen
   a. Loss body weight
   b. Keep body weight
   c. Gain body weight

9. As a result of daily nutrition activities report, what should change to keep your body weight ideal?
    a. No need to change, I have well nutrition behaviors.
    b. I need less eating activities; I have too much eating activities.
    c. I need more eating activities; I don't have enough eating activities.
    d. I need to change eating behaviors with healthy nutrition.
10. As a result of daily physical activities, what should change to keep your body weight ideal?
    a. I live too much passive, I need to be more active and I need to do sport.
    b. I live passive; I need to be more active.
    c. I live active; but I don't do sport. I need to do sport.
    d. I live active and I do enough sport.
11. Do you think that DSMA is a useful application to use as a dietary self-monitoring application?



CURRICULUM VITAE

Adı Soyadı: Yaşar Kemal Koçak

Doğum Yeri ve Yılı: Ulukışla / 1983

Yabancı Dili: İngilizce

İlk Öğretim: Ulukışla İnkilap İlköğretim Okulu, 1997

Orta Öğretim: Aksaray Anadolu Meslek Lisesi, 2001

Lisans: Boğaziçi Üniversitesi, Bilgisayar ve Öğretim Teknolojileri Eğitimi, 2006

Yüksek Lisans: Bahçeşehir Üniversitesi, 2014

Enstitü Adı: Fen Bilimleri Enstitüsü

Program Adı: Bilgi Teknolojileri (İngilizce, Tezli)

Çalışma Hayatı:

Digiturk, Yazılım Geliştirme Uzmanı, 2008, ----

Ceva Lojistik, Analist Yazılım Geliştirme, 2007, 2008

UND Naz Teknoloji, Yazılım Geliştirme, 2006, 2007