Tallinn University of Technology

Faculty of Information Technology

Institute of Informatics

E-Governance Technologies and Services

Master Thesis

Citizen Centric e-Health Information System Model for Turkey

Author: Onur Alper Unur, MA

Supervisor: Enn Õunapuu, PhD

Tallinn 2016

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Author's declaration

I confirm that I have constructed this Bachelor's/Master's thesis individually and that the current paper has not been presented by anyone before. All resources, viewpoints, citations, and other materials from other authors that have been used in this thesis have been referred to.

Date

Signature

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Abstract

E-governance services became much more important with the fast developments in ICT sector. In the early steps of e-governance service development, publishing information from government via relevant governmental organization's web pages provided many benefits to government as well as citizens and businesses. From the citizen and business side, they don't want to be busy with paper based information and documents, touch-tone voice processing systems, phone calls or visiting governmental offices. Moreover, they will be disappointed if they cannot find information about their government. From the government side, government staff work time will not be consumed with answering basic questions about government procedures and services. That government information on the web will increase citizens and business convenience and reduce the workload of employees. In this regard, ICT shows us the important impacts even with the basic applications on government services.

Today, many countries has own e-services which are provides several facilities to their citizens. Some of countries have developed very about e-governance application, however many countries still can answers very basic requirements of their citizens such as providing static web sites via governmental websites. For determining of development level of countries and comparison among development level of countries, one of the main indicators is the health services. Some of countries' has been in low level according to world country rank list just because of problems in the health service's administration and organization, human resource management. Turkey also had many problems in the health era because of the insufficient or inappropriate strategy and politics, structural and organizational problems which are related serving health services, uncontrollable health plans, and coordination problems among health organizations, false and uneducated employments and insufficient technologic substructure.

This thesis purposes to design a web-based health information system model for Turkey as an example. The main focus of this work is provide to citizens that valuable services in the context of e-governance applications. My health application provides several eases to citizens about their healthcare processes and also this project useful to increase citizens' awareness about this critical topic.

The thesis is written in English and contains 88 pages of text, 5 chapters, 23 figures, graphs and diagrams, and 2 tables.

Abbreviations

A.Ö.F - Faculty of Open University

ALES - Entrance Examination for Postgraduate Education

ADSL – Broad Band Network Connection

BYBS – Prime Ministry Management Information System Center of Turkey

BHSM - Basic Health Statistics Module

CHAS - Centralized Hospital Appointment System

CRMS – Central Resource Management System

CD –Contextual Design

CDA - Clinical Document Architecture

DPT - Government Planning Organization of Turkey

DSS – Decision Support System

ERMS - Equipment Resources Management System

FMIS - Family Medicine Information System

EHR – Electronic Health Record

GP – General Practitioner

GUI – Graphical User Interface

HRMS - Human Resources Management System

HOMS - Private Health Organizations Management System

HCRS – Health Coding Reference Server

HL7 - Health Level Seven

ICT – Information and Communication Technology

IS – Information Systems

ITS - Investment Tracing System

ID - Identification

ISO - International Organization for Standardization

IEC - International Electrotechnical Commission

KPDS - Examination of Foreign Language Proficiency of State Employees

MoH – Ministry of Health

MTV -motor vehicles tax

NHDD – National Health Data Dictionary

NHIS - National Health Information System

ÖSYS - Student Selection and Placement Exam for University

OMG – Object Modelling Group

OGS- Automatic Toll Collection System

PTT - Organization of Post and Telegraph

SSK - Social Insurance Institution

TUIK – Turkish Statistics Institute

TV - Television

UI – User Interface

UK – United Kingdom

US – United States of America

UML – Unified Modelling Language

WHO – World Health Organization

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1 Introduction

1.1 Thesis motivation

In recent years, e-governance services had priority especially in ICT conferences and governmental meetings. With ICT and its significant reflection on e-governance services, governments and administrators start to emphasize that develop valuable e-services and bring them into real life services. With effects development of e-governance services, researchers have started to work on this term from the various perspectives. Organizations and researchers defined several e-governance application maturity models to determining the main concept of e-governance applications terminology. So far, some e-governance mature models defined by several researchers and research organizations. When looking these models, several organizations and researchers examined the e-governance services many points of view, such as managerial, organizational, technological and political. From these descriptions of e-governance maturity models, the most popular one is Layne and Lee's four stage model (Karen Laynea & Jungwoo Lee, 2001).It's the model which reflects these four maturity stage's well.

According to Layne and Lee's model Turkey's governance services have been in between catalogue and transaction layer. The reason of 'between in two layer' term here, some of e-governance applications provide questioning facilities but most of user of Turkey's s e-governance applications uses those applications just for informing.

For determination of development level of countries and comparison among development levels of countries, one of the main indicators is the health services. Some countries have been in low level according to world country rank list just because of problems in the health services administration and organization, human resource management. Turkey also had many problems in the health area because of the insufficient or inappropriate strategy and politics, structural and organizational problems which are related to health services, uncontrollable health plans, and coordination problems among health organizations, false and uneducated employments and insufficient technologic substructure.

E-health term which uses ICT's for restoring health of patients and increase patient's accessing facilities on health services, also being in Turkey's agenda (Nihat Yurt, 2004). "E-transformation of Turkey" project which starts under the administration of government planning organization (DPT) includes 15 action plans related with the health sector (Nihat Akpınar, 2004). With widely using of ICTs in the health sector; there are many problems emerged cause of there is no information based administration type, accessing problems on many required data for creation of health politics, health organs interaction and transaction problems. After publication of health transformation program of turkey in 2003, Turkey developed many valuable health services (WHO, 2012). These reforms also developed for the health information systems era of Turkey, however current health information services of Turkey, are using just for internal processes and with these several systems, many health data's of citizens gathered from government and saved in the governmental databases (A. Dogac et al. 2014).

For the purpose of providing valuable service to citizens, these data should turn into information with IS which contributes more value on health services, increase e-governance service maturity level and

increase society's welfare. Currently, there is not any e-health service which provides citizen's health information to citizen (MoH of Turkey, 2004).

Therefore this thesis project focused to analyzing of current Turkish health information system infrastructure and services, on the other hand, this research work focused to design user-centered e-health application which could increase Turkish e-governance maturity level and to provide valuable services to citizens.

1.2 Theoretical background/Literature overview

In this research, first of all, the author has followed design-science research methodology. Withal, this research is fed from one main theoretical concept which is e-governance services. Under the concept of e-governance services' maturity levels, Turkey's e-governance applications are examined by the author. Health service's importance has also examined under case of Turkey. This literature research has provided much information to the author to find a relevant new health information system development model. Additionally, in the end of main analysis parts of research, some technical modelling notations have been used for proposed e-governance service model. In the concept of contextual design approach, requirement specification techniques have examined by the author as a state of art. These modelling notations are: UML for use cases and mock-ups for prototyping.

1.2.1 The E-Governance Services Maturity Model

According to effects of ICT applications for governance services, so far, some e-governance maturity models have been defined by several researchers and research organizations. Some of these models are : Layne and Lee, Andersen and Henriksen, United Nations, Alhomod et al., Hiller and Belanger, Almazan and Gil-Garcia, Cisco, Gartner group, West, Moon, World Bank, Deloitte and Touche, Howard, Shahkooh et al., Lee and Kwak, Siau and Long, Wescott, Chandler and Emanuel, Kim and Grant, Chen et al.,Windley, Reddick, Accenture, the UK National Audit Office, and Netchaeva.

These e-governance maturity models have been categorized in three to six stages. However, when looking the features in the stages, mainly they are about the same things. As these models have several similarities, they also have some differences as well. However, they could begrouped under the stages of presence, interaction, transaction, integration. According to Abdoullah Fath-Allah et al, following table depicts comparing e-governance mature models under these four stage names (Abdoullah Fath-Allah et al., 2014).

Maturity stage	Focus	Maturity models
1	Presence	All models expect Andersen and Henriksen and Wescott
2	Interaction	Alhomod, Hiller and Belanger, Gartner, Moon, World Bank, Deloitte and Touche, Howard, Shahkooh, Siau and Long, Chandler and Emanuel, Kim and Grant and Windley.
	Enhanced information	UN, Almazan and Gil-Garcia and UK.
	Transaction	Layne and Lee, Cisco, Chen and Reddick.
3	Transaction	UN, Alhomod, Hiller and Belanger, Gartner, Moon, World Bank, Howard, Shahkooh, Siau and Long, Wescott, Chandler and Emanuel and Kim and Grant.
	Interaction	Almazan and Gil-Garcia.
	Integration (transformation, single point of entry)	Layne and Lee, Cisco, West, Deloitte and Touche, Chen and Windley.
4	Integration (transformation)	Layne and Lee, Andersen and Henriksen, UN, Alhomod, Hiller and Belanger, Gartner, Moon, Shahkooh, Siau and Long, Chandler and Emanuel, Kim and Grant, and Windley.
	Transaction	Almazan and Gil-Garcia, UK and Netchaeva.
	Personalization	West, and Deloitte and Touche.
5	E-participation (political participation)	Hiller and Belanger, Moon, Shahkooh, Siau and Long, Wescott, Kim and Grant and Netchaeva.
	Integration	Almazan and Gil-Garcia, Deloitte and Touche and UK.
6	Political participation	Almazan and Gil-Garcia.
	Integration	Deloitte and Touche, and Wescott.

Figure1.Focus of the e-government maturity stages. (AbdoullahFath-Allah et al.)

The first stage of almost all the maturity model features, are generally related to “presence on the web”. The maturity models used different terms about this stage but they all focus on the same features such as presence on the web, publish information, catalogue, bill-board, online presence etc.

The second stage is related to citizen’s interaction with the government. In the table, interaction means that the citizen can interact with government. Enhanced information means that information quality which is provided by the government is increased. Transition means that with government web services, citizens can do some transactions.

The third stage is related to citizen’s interactions in the concept of one stop shop. Transaction means that with government web services, citizen can do some transactions. Interaction means that the citizen can interact with government. Integration means that, government e-portals can work in harmony; they can share information with each other. It is the basic definition of one stop shop concept as well.

The fourth stage is related with transaction between citizens and government via web services and government web portals are integrated. Additionally, here, citizens can have own personalized account according to his/her needs. Integration or transformation means that government e-portals can work in

harmony; they can share information with each other. Its basic definition of one stop shop concept as well. Transition means that with government web services, citizen can do some transactions. Personalization means that in the government's e-portals, citizen can have own personalized account according to his/her needs.

The fifth stage is related with integrated e-services and e-services which can make citizen's e-participation possible. E-participation means that via government web services citizens can fill the surveys which are created by governments, citizen can participate in government e-portal's forums and citizen can use an online voting system. Integration means that government e-portals can work in harmony; they can share information with each other.

The sixth stages of all the maturity model features are generally related to e-services which can make possible citizen's e-participation and integrated government e-portal.Political participation means that via government web services citizens can fill the surveys which created by governments, citizen can participate in government e-portal's forums and citizen can use an online voting system. And integration means that government e-portals can work in harmony, they can share information with each other.

To summarize, according to this information, all the maturity models are mainly focused on four major stages of presence, interaction, transaction and integration. From these descriptions of e-governance maturity models, the most popular one is Layne and Lee's four stage model (Karen Laynea & Jungwoo Lee, 2001).It's the model which reflects these four maturity stages the best. So development of this research is based on Layne and Lee's description of e-governance maturity model.

When looking at these models, several organizations and researchers examined the e-governance services from many different points of view, such as managerial, organizational, technological and political. In this research, the author aimed to examine Turkey's e-governance services from information system perspective, so that; this research is aimed to examine the e-services from a technological point of view. As a technological point of view, descriptions of e-government mature models are stressing mainly several points which are as follows: basic web sites for cataloguing, interactive systems which citizen can make complete transactions online and integrated e-services which gather under e-portal and provide facility to citizen for make complete various transactions about different government agencies in the same online place.

1.2.2 Turkey's E-governance Services Maturity Level

In this section, Turkey's e-governance applications will be examined to have a general understanding about Turkish e-governance structure and determine the maturity level of Turkish e-governance services.

1.2.2.1 Turkish E-governance Applications

In recent years, e-governance services had priority especially in ICT conferences and governmental meetings. With ICT and its significant reflection on e-governance services, governments and administrators start to emphasize the value of e-services and work to bring them to life. As several countries' improvements e-governance services and increase of the country's awareness about e-governance services, Turkey has created the Prime Ministry Management Information System Center (BYBS) to follow developments and launches of e-governance applications (İnam, Ş. and Ayber, H., 2002). On the other hand, many projects are supported by Turkish government to create milestones of Turkey National Information Systems and 13 different groups are created to educate workers and raise public awareness.

Today, there are many projects, which are being used as Turkey's e-governance services. Those projects are in Turkish National Information Systems (KAMUNET) and all of them has their own information security substructure, messaging services, interfaces, numeric maps, databanks, data dictionaries and special functions. Those main projects are:

• Population and Citizenship Information System (MERNİS)

• Ministry of Finance Information System

• Ministry of Justice Information System

• Land Registry Information System (TAKBİS)

• Health Information Systems

• Education Information Systems

• Social Security Information Systems (İnam, Ş. and Ayber, H., 2002)

1.2.2.2 Turkey's e-governance services

When examine the Turkey's e-governance services; some of current, fast, 7/24, secured and qualified e-governance services are:

Turkey citizenship number questioning, SSK (Social Insurance Institution) service record questioning, SSK Retirement day questioning, heath report questioning, vehicle tax debt questioning, penalty and MTV (motor vehicles tax) questioning, natural gas bill questioning, A.Ö.F (Faculty of Open University) exam results questioning, ALES (Entrance Examination for Postgraduate Education) results questioning, ÖSYS (Student Selection and Placement Exam for University) results questioning, KPDS (Examination of

Foreign Language Proficiency of State Employees) results questioning, PTT (Organization of Post and Telegraph) zip code questioning, Tax identification number questioning, driver penalty point questioning, OGS (Automatic Toll Collection System (A System used in TCK Highways)) balance information questioning, stolen or loss mobile phone questioning, retirement age questioning, retirement salary questioning, income tax questioning, stolen vehicle questioning, national library database, ministry of education portal (Fatma Kübra Çelen et al., 2011).

These services mainly provide information to citizens about governmental offices. As seen above, most of Turkey's e-governance services have been created just for data questioning and publishing information.

1.2.2.3 Internet and E-governance Services Statistics for Turkey

In this section, Turkey's internet using ratio and citizens' online service's using areas are specified according to the Turkish Statistical Institute (TUIK) results of "Information and communication technology (ICT) usage survey on households and individuals" carried out in April, 2015.

TUIK's related survey discloses that;

At first, ratio of computer and Internet usage of individuals aged 16-74, 55.9%.During 2014-2015 period, ratio of computer and internet users of Turkey is, for male users 65.8%, for female users 46.1% respectively. Second point of this survey discloses that 69.5 per cent of households have access to the Internet at home.59.5% of the households who have not access to the internet at home, declared the main reason of not using internet at home as 'have no need'. 44.7 per cent declared as there is no sufficient knowledge to use internet and 38.5 per cent declared the reason as high connection costs. Statistics of the households who have access to the internet at home is 67.8 per cent According to it, 37.4 per cent of households have used fixed broadband connection such as ADSL, cable connection, optic fiber connection etc. 58.7 per cent of households used mobile broadband connection to access the Internet and narrow band connections used for accessing to internet at the rate of 2.7 per cent. Third main finding of survey, proportion of households with mobile phone is 96.8%. In April 2015, 96.8 per cent of households have mobile or smart phone, 29.6 per cent of households have fixed line telephone. At the same period, 25.2 of households have desktop computer, 43.2 of households have portable computer (inc. tablets) and 20.9 of households have smart TV. As the other finding, social networks took first place among the activities for Internet users. When looking the reasons of using internet are primarily 80.9 per cent of Internet users used internet for social media, proportion followed by reading online news, newspapers, news magazines with 70.2 per cent, to seek health related information with 66.3 per cent, to upload self-created content to any website with 62.1 per cent and to find information about goods and services with 59.4 per cent of users.

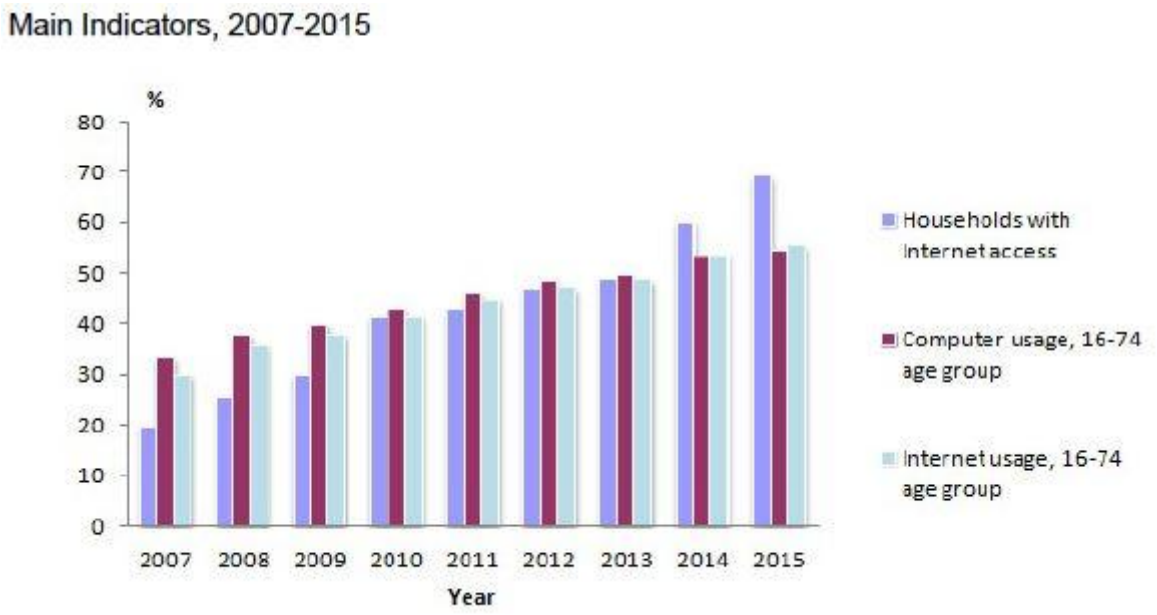

Figure 2, Household use of information technology, Source Turkish Statistical Institute 2015

Other findings are respectively;

87.1 per cent of internet users used internet mainly at home in the first quarter of 2015. This proportion followed by respectively 42.5 per cent at the workplace, 37.7 per cent at another person's home, 29.2 per cent at hotspots and 10.6 per cent at Internet café.74.4 per cent of Internet users who is away from home or work, used mobile or smart phones to access to internet in the first quarter of 2015, this proportion followed by respectively 28.9 per cent with portable computer such as notebook, net book, tablet, etc.33.1 per cent of internet users used internet to buy goods or services over the internet.94.2% of individuals which use Internet in the first quarter of 2015 used the Internet almost every day or at least once a week.

At last, main finding about e-governance services using discloses more than half of the Internet users used e-governance services. 53.2 percent of internet users interacted with public authorities over the Internet during 2014-2015. In this proportion, 50.5 per cent of users used internet to obtaining information from public authorities.

When we look at the findings of TUIK, 50% of internet users who uses also e-governance services, the most of users uses e-governance services just for getting information from public offices or country's main e-governance service's web page. Therefore, these findings disclose that Turkey's e-governance services have been in between catalogue and transaction layer according to the Henver et al. works (Hevner et al, 2004). The reason of 'between in two layer' term here, some of e-governance applications provide questioning facilities but most of user of Turkey's s e-governance applications uses those applications just for informing.

1.2.3. Health Services and Problems with ICT

For determination of development level of countries and comparison among development levels of countries, one of the main indicators is the health services. Some countries have been in low level according to world country rank list just because of problems in the health services administration and organization, human resource management. Turkey also had many problems in the health area because of the insufficient or inappropriate strategy and politics, structural and organizational problems which are related to health services, uncontrollable health plans, and coordination problems among health organizations, false and uneducated employments and insufficient technologic substructure (Harun Kirilmaz, 2005).

In Turkey, problems of health services administration in 90's still exist in 2000 (MoH of Turkey, 1993). In 90s, problems were mainly about the health structure that is gathered in the central authority and coordination problems among related organizations. Additionally, Turkey stayed face to face with many problems in the health services because of strategic administration lacks, non-effective, efficient and qualified health services in 2000s (Moh of Turkey, 2003).

Those problems in health services area are not specific problems for Turkey, at the same time they are not just limited with development level of countries. Thus, many problems emerges also several developed countries such as US, Canada and UK (Elizabeth A. McGlayn, 2004). In short, health services are vital services for all of countries in the world.

Health services when examined as an individual consumption element, perceived health level of person seems as an important factor. When the person had problem with his/her health status, at first that person assessing his/her condition and after then consulting for health office according to the results of own assessment. During this individualized assessment of health condition, information which is provided to this individual by his/her environment is being considered. Increasing of information accessing facility's and with widely using of ICT, also increases demand of health services as an economic factor. And these factors provide economic and social development and rise of welfare level (İsmail Mazgit, 1998).

Increase of easy access to information facilities and widely uses of ICT also increase of society's health level. With these increments of society's health level society's education level increasing as parallel and as a result, qualified man power emerging in the society. So, increment of national health level, indirectly influences education and population, nonetheless, they provide indirectly economic and social development of countries.

Today, with the important paces for using ICT in the health services, public administration and e-governance services has important data problems and as parallel, there are many problems emerging at the data gathering and analysis from the hospital record systems (MoH of Turkey, 2003).

E-health term which uses ICT's for restoring health of patients and increase patient's accessing facilities on health services, also being in Turkey's agenda (Nihat Yurt, 2004). "E-transformation of Turkey" project which starts under the administration of government planning organization (DPT) includes 15 action plans related with the health sector (Nihat Akpinar, 2004). With widely using of ICTs in the health sector; there are many problems emerged cause of there is no information based administration type,

accessing problems on many required data for creation of health politics, health organs interaction and transaction problems and there is no efficient information system uses in the health institutions (MoH of Turkey, 2004).

1.2.3.1 Turkey's Government Transformation Program and Health Reform Plans from ICT's Perspective

Turkey has published Transformation in Health document in the concept of government transformation program in 2003 to determine the lacking aspects in the system and determination of reforms.

With this publication of Ministry of Health declared Turkey's health reform plans for following years after 2003. This document is the first framework of the Health Transformation Program presented to the public opinion. The program specifies that;

"The program will be developed through researchers and negotiations that we will make and through suggestions and orientations that will be made by our public. However, we are not consuming time with unnecessary details to initiate the implementation, but we are not postponing reaching the good to seek for the perfect.

The Health Transformation Program will design the health system that is planned to be implemented in the future and will facilitate the transition to the designed system by evaluating the inheritance of the experiences of the ''reform studies" and "health project". Small but effective interventions made within the continuous change and development can be obtained and success can be provided."(MoH of Turkey, 2003).

In this publication, ICT's importance, also discussed under the "Information Systems" topic. According to the publication, main ICT related problems are defined below:

Each health institution uses statistics and patient's data within its own instead of whole sector. Different offices collect different data which is needed and these data is delivered to Ministry of Health. But this data has not been converted to the information and could not be used for the purpose of management. Because of inadequate data control on these data, statistical outcomes have not been reliable and this problem causes that prevent the data to be used in the decision mechanisms.

In the hospitals, there have been several problems such as unsystematically registered files and lost files in the archives. There are a lot of problem issued also for understanding of these registered file's content information. And in the reform plan, government authorities stressed important lack with following sentence, "There is not an integrated system in which health registrations of individuals are recorded and a disease registration and notification structure that analyzes the epidemiological data completely."

The distributed structure of Turkish health system brings that too many distributed health registration systems which developed from each hospitals by own efforts. And this causes to too complex structure. Shortly, there have not been any medical registration systems which could record health registrations regularly. The centralist attitudes of Ministry of Health of Turkey, there have not been any electronic register systems in many of Turkish hospitals.

For medical patient registration, there has not been any standard and these patient's data have couldn't use for integrated systems. So, information systems just used for collecting and storing data. For this reason, information systems benefits couldn't be obtained and those systems turn into a work burden.

Government has seen the fast change of technologic developments as a most important factor for information systems. They stressed that information systems can turn into old-technology even before completion of the project. At the same time Ministry of health stressed the importance of trained health staff and technical staff which will use these health information systems easily (MoH of Turkey, 2003).

So, as an information System perspective, main objectives of Health transformation Program of Turkey determined to be: ensuring standardized data in healthcare, creation of citizen's Electronic Health Records (EHR), provide standardized information to data analysis support for Decision Support Systems. Fast information interaction among stakeholders and increase efficiency in the healthcare system.

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1.2.3.2 Current situation after Health Transformation Program from ICT's Perspective

Following the Health Transformation Program, several IT systems have been developed such as National Health Information System (NHIS), Family Medicine Information System (FMIS), Centralized Hospital Appointment System (CHAS), Basic Health Statistics Module (BHSM), Core Resources Management System (CRMS), e-prescription system of the Social Security Institution.

Basic definitions of these systems specified below by the author for identify systems aims and create understanding for Turkish health services.

National Health Information System (NHIS)

NHIS of Turkeys is developed for collecting and to some extent sharing patients' Electronic Health Records. It's the nation-wide infrastructure of EHRs. It supports transfer of episodic EHRs from secondary systems to NHIS servers at the Ministry of Health. However currently just general practitioners can access the EHRs of their own patients through their Family Medicine Information System (FMIS). This system became operational in 2009. After August 2012, with the new version of NHIS (version_2.0), FIMS and NHIS collected under the one unique database and web service and became integrated.[1]

Family Medicine Information System (FMIS)

Family medicine information system benefit the solve one of the biggest problem to collect patient's health records. The system uses in the every part of Turkey and every citizen one family medicine who records the patient's data on the system. So, regular, understandable and standardized data of patient's has been recording and transferring to Ministry of Health servers. The application of FMIS is one of the e-Health applications, which will find the possibility of the most common usage in the entire country. Today, every citizen has own EHR files under the Ministry of Health's data center (A.Dogac et al.,2014) .This system uses the principle of family medicine that provides primarily health service for each citizen.

[1]The Health Coding Reference Server (HCRS) Available from: https:// skrs3.sagliknet.saglik.gov.tr

Moreover with this system, health records of citizens, recording during all of life of citizen. With FMIS, Turkey became a country which could do detailed reports and assessments for many health services such as pregnant monitoring success rates, baby monitoring success rates, vaccination success rates (Recep Akdag, 2010).

Centralized Hospital Appointment System (CHAS)

This system provides the facility for make appointment with hospital via call center phone number "182" or online through the CHAS web portal[2] and mobile applications such as android, IOS etc. And the system became operational in 2011.

Basic Health Statistics Module (BHSM)

This module is used to collect information for health status and health risks in the Central and Provincial Directorates of the Ministry of Health.

Core Resources Management System (CRMS)

This system developed to monitor the staff, institutions, and equipment of Ministry of Health. The system consists of the several components such as; Human Resources Management System (HRMS), Equipment Resources Management System (ERMS), Investment Tracing System (ITS), Private Health Organizations Management System (HOMS).

E-prescription system of the Social Security Institution

This system is providing the web based infrastructure for e-prescriptions and system became operational in July 2012. System provides seamlessly transactions between healthcare provider information system and Ministry's main e-prescription service which is Medula. Medula system is current pharmacy software which using in Turkey. E-prescription system is using among Social Security Institution, pharmacies software and Ministry of Health servers.

With these reforms, 98 per cent of public hospitals and 80 per cent of the private hospitals became connected with NHIS in 2013 and those hospitals are sending the patient's EHRs to NHIS server on a daily basis. At the same time 79.8 million people's electronic health records have been created in the NHIS. However, today only general practitioners are able to access the EHRs of their patients (A.Dogac et al, 2014).

1.3. Research methodology and research questions

In this section, research methodology and research questions of this thesis are defined by the author. Research methodology provides a guideline to make a systematic research process. In this systematic development process, research questions have defined by the author to define fundamental pillars of research and strategic progress of research.

[2]The Citizen Portal of the Centralized Hospital Appointment System

1.3.1 Design science framework

In this research, design-science research is followed as a research methodology. Design-science research framework is the research methodology for especially IT-relevant research works. According to Henver , March, Park, & Ram (2004) the framework meets behavioral sciences and design sciences in the IS product discipline. And they figured out the framework with Figure 3:

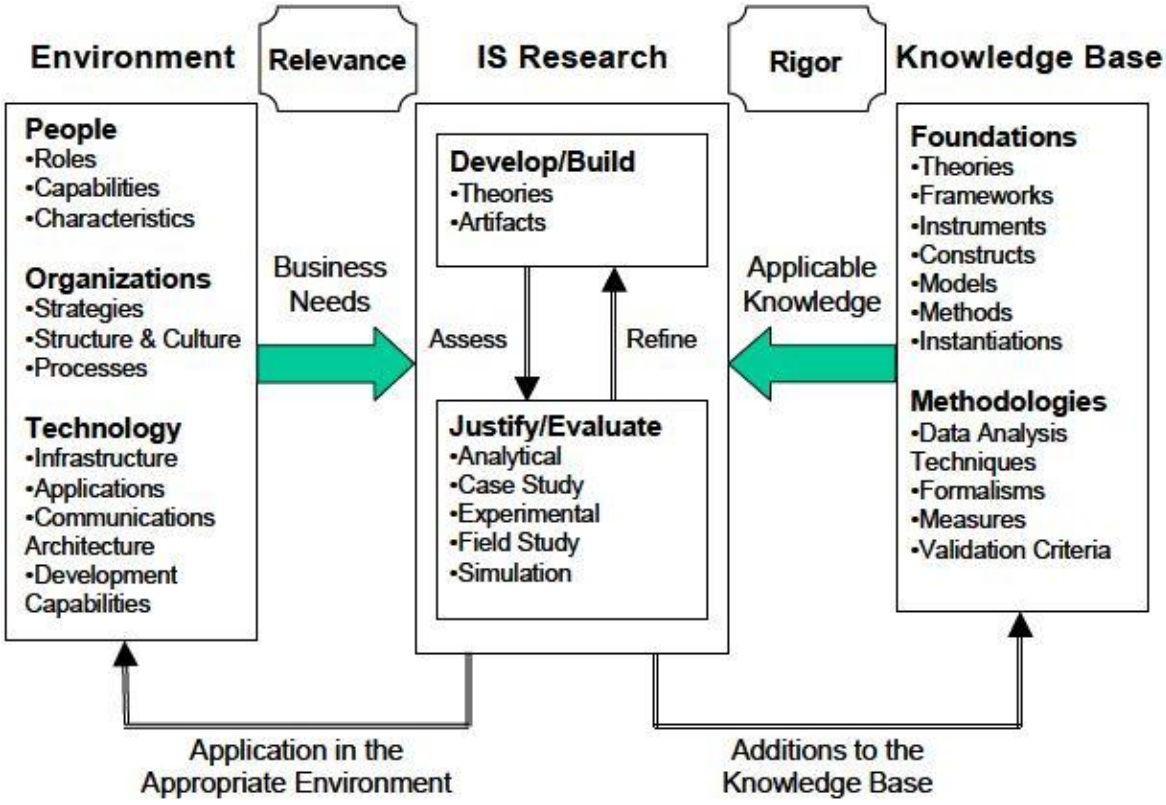


Figure 3.Information Systems Research Framework (Hevner et al. 2004, March)

According to this figure, the environment pillar includes people, organizations and technology, which define the problem space. This pillar also important to meet business needs with the real product well. The knowledge base includes foundations and methodologies which provide huge benefits on "develop/build" and "justify/evaluate" phases. Foundations are used in the development phase and methodologies are important to evaluation processes of production.

In this research, the author focused on Turkish e-governance services and their applications as the problem domain. According to e-governance technologies &services domain, the problem has examined in the theory of e-governance services' maturity model. Research includes both environment and knowledge bases around the new information system model development, which focus to designing an e-service which could increase Turkey's e-governance maturity level and provides Turkish citizens convenient information system. In this regard, design science research methodology has been used in the development phase of this research work.

1.3.2 Guidelines for the research methodology

According to the design-science research framework, based on the works of Henver , March, Park, & Ram, seven guidelines defined in the building of application of an artifact. Those 7 guidelines depicted in following figure and defined based on this research domain under the own names.

Guideline	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Figure 4 – Design Science Research Guidelines(Hevner et al. 2004, March)

Design as an Artifact:

The thesis artifact is a citizen centric e-health information model in the e-governance services context (see chapter 4).

Problem Relevance:

Turkey's e-governance services are mostly provides information to citizens and citizens are using e-governance services just for questioning data and to get information about governmental offices as stressed by the author in section 1. When looking these assets, according to the Layne and Lee's description of e-governance maturity model (Karen Laynea and Jungwoo Lee, 2001), Turkey have been in transaction layer which provides all requirements of catalogue layer and additionally fulfill some of requirements of transaction layer such as data questioning which requires working databases behind the information systems.

As stressed in section 1, health services are vital services for governments and one of the main influential services to determination of country's world rank. After publication of health transformation program of turkey in 2003, Turkey developed many valuable health services (WHO, 2012). These reforms also developed for the health information systems era of Turkey, however current health information services of Turkey, are using just for internal processes and with these several systems, many health data's of citizens gathered from government and saved in the governmental databases (A.Dogac et al., 2014).

For the purpose to provide valuable service to citizens, these data have to be information which contribute more value on health services, increase e-governance service maturity level and increase society's welfare. Currently, there is not any e-health service which provides citizen's health information to citizen.

Design Evaluation:

Design evaluation of this research has two main components, first the author analyses current e-health applications of Turkey from the ICT's perspective to create understanding of service's technical infrastructures, information system's architectures and work types. In the second evaluation process, author uses several system design elements such as system architecture modeling, use case scenarios and mockups to explanation of new health information service.

Research Contributions:

The research contributions, demonstrate citizen centric e-service and potential benefits of the application of this system into Turkey. Specifically, the author proposes the new e-service application for Turkey which uses Turkey's health information systems infrastructures. This research also uses to use case and mock-ups to determination on requirement specifications. These approaches are using in the concept of contextual design. Therefore, this research contributes to one different use case model for IS system modeling with use cases approach.

Research Rigor:

The author uses several approaches such as UML use cases and UI mock-up. In the concept of UML, textual based use case description model used by the author to describe for system's users scenarios. IU mock-ups used with the Balzamic mock-up tool to visualization of new system model.

Design as a Search Process:

During this research, Turkish e-health structure analyzed from the author to discover requirements of new citizen centric model development. Also, Turkish e-governance services have examined in the concept of e-governance maturity model to disclose Turkey's level according to maturity model. In the development phase of this work, UI mock-up methodology and use case modeling, scenario based modeling approaches examined in the concept of contextual system design. Contextual design (CD) is the design approach which using for system and product design. This approach defines fully customer-centered processes and using to determination of system specifications. Contextual design is used to understand environment needs, identify product concepts according to needs of environment and works on specific system definitions to figure out detailed level system processes (Karen Holtzblatt, 2001). This approach helps the design process of new e-governance application model.

Communication of Research:

As this thesis is written at a master level, it is not an objective to be published for the academic or commercial audiences.

1.3.3 Research questions

Given the absence of citizen centric e-health service for Turkey, the author proposes the following main research objective:

How to develop an integrated citizen centric e-health information service in Turkey?

Under this main research question, two abstract research question defined by the author to engage with requirements of citizen centric e-health service. These questions are respectively;

1. How to identify the e- health information system's infrastructure?
2. How to contribute more value to the current health system for increase society's welfare and increase e-governance service's maturity level?

First question is determined to create understanding of Turkey's health services infrastructure and question's findings provide the author to design relevant e-services model for Turkey. Second question is determined to drive author to find a valuable e-service solution.

Under these two main abstract questions, grammar questions defined by the author to make better analyzing and get the right answers before the development of new system and also these questions provide the author to stick with the right way during the system design. Moreover, these grammar questions will cover the main parts of research and findings will benefit to researchers who are interested in this topic. Grammar questions are:

1. How to identify the e- health information system's infrastructure?
    a. What are the current distributed health information systems of Turkey?
    b. What is the Turkish health information applications and services infrastructure?
2. How to contribute more value to the current health system for increase society's welfare and increase e-governance service's maturity level?
    a. What are the new system infrastructure and stakeholders?
    b. What are the new system's and user interfaces?
    c. What is the new system's contextual model?

1.4 The description of the thesis structure

According to the design science research methodology and research questions which mentioned above, remaining of thesis structured as follows.

In chapter 2, state of art has determined by the author. Use case and GUI mock-up techniques have examined in the concept of contextual design.

In chapter 3, Turkish health services are analyzed as detailed. Turkish health information services' infrastructure and Turkish health information systems has described by the author.

In chapter 4, the new e-governance application model developed by the author with using some of contextual design techniques. GUI mock-ups and use case scenarios have conducted under this section.

In chapter 5, conclusion and answers of research questions have described by the author.

2 The state of the art

In this part of research, the author gives an overview of some of contextual design steps which using for requirement specification and system description. Contextual design (CD) is a customer-centered design approach to describe a system in a simple and understandable way. With contextual design methodology, early development of system can complete successfully. UML use cases and mock-ups are two major components of contextual design. The author has examined these two main components of contextual design to disclose system processes and to create an understandable view to system development. Use cases and mock-ups also used in the development phase of the application model in chapter 5.

2.1. Contextual Design.

Contextual design (CD) is a design approach that using for system and product design. This approach defines fully customer-centered processes and using to determination of system specifications. Contextual design is used to understand environment needs, identify product concepts according to needs of environment and works on specific system definitions to figure out detailed level system processes. In this approach, user needs and customer data drive design decisions. User scenarios have been in the central of this approach, therefore contextual design based to user scenarios. CD has often powerful structure because structure of CD is pretty suitable to work with many other techniques such as UML, use cases, personas, lab-based usability testing, X-programming, and other methodologies. CD provides several of techniques which can be gathering under the same roof as a standard methodology. Some of techniques can be used for requirement analysis and system specifications; on the other hand some techniques can be used for producing of artifact. In the business sector, organizations which applied ISO 9000 or SEI processes well, they can work CD very well. Companies which are using Rational Unified Process, CD could use in the inception and elaboration phase of any project in the concept of business modeling disciplines and solution design disciplines (Karen Holtzblatt, 2001).

In this work, requirement specification and validation and system specification have used in the concept of Contextual Design Approach. During this research some of key steps of Contextual Design have used to analyzing of environment needs and developing of a new system model. These key steps are;

- Determination of system specifications with some methodologies such as UML, use cases, personas, lab-based usability testing, X-programming etc.
- Paper prototyping and UI design, preparation of system interface with mockups to determination of system GUIs.

Karen Holtzblatt, defined the key steps of Contextual design According to the his work, paper prototyping - UI design and Use case definition –Object modeling steps have used in this work. These steps are explaining below (Karen Holtzblatt, 2001).

Paper Prototyping and UI design

This steps are using during testing and modifying phases of development of product. Paper based mock-ups reflect user interfaces. User feedbacks could easily get with determination of test scenarios on these mock-ups.

Karen explains the purpose of this prototyping type as;

“

•Provide a reliable way of talking with users about the proposed system

• Create buy-in through co-design with users

• Deepen the requirements of the system

• Verify the design before committing ideas to code

• Begin visual design with a tested interaction design and layout (Ian Alexander and Neil maiden, 2004). “

Use Case Definition and Object Modeling

Use cases could use for any designed system or methodology to description of system or product. It’s the common and understandable methodology among all of stakeholders.

Karen explains the purpose of this use case modeling as;

“

•Provide a clear mapping from the User Environment Design and storyboards to use case identification and object modeling

•Create validated requirements, thereby allowing developers to focus on optimizing the implementation (Ian Alexander and Neil maiden, 2004). “

2.1.1 User Interface Design

Paper mock-ups are allows organizations that early prototyping facility and with this, user tests could do during system analyzing phase. During last years, many mockup tools developed by several companies. This shows that increase the level of interest to UI mock-ups. It uses as requirements artifacts and in the ICT environment, mock-ups are using in the most of agile development approaches (Ferreira J. et al, 2007). Additionally, using of user interface mock-ups, eases to understanding of product very well and statistical studies also proves that, even those works proves also that mock-ups are reducing costs during the development phase of project (Ricca, F.et al, 2010). Mock-ups are shows the system views to customer and creates a valuable understanding. In the ICT, generally mockups are using with scenarios which defining the use cases of product. Therefore, mockups also so close with user stories (Cohn, M.,2004). Mockup building has a lot of advantages during development of product. First of all, with UI mockups provide to product developer that real customer requirements, with the customer feedbacks,

developer could evaluate requirements very well. Secondly mockups minimize the product risks for in the usability level. Then, mockups are also avoid time-waste for unnecessary UI developments.

2.1.2 UML – Use Cases

The Unified Modeling Language (UML) is an industry standard modeling language with a rich graphical notation, and comprehensive set of diagrams and elements. It includes several diagrams such as package diagrams, class or structural diagrams, object diagrams, composite structure, component diagrams, deployment diagrams, use case diagrams, activity diagrams, state machine diagrams, communication diagrams, sequence diagrams, timing diagrams, interaction overview diagrams and profile diagrams. The Unified Modeling Language (UML) first appeared in the 1990's as an effort to select the best elements from the many modeling systems proposed at the time, and to combine them into a single coherent notation (Addison-Wesley, 2005).The Object Management Group (OMG) defined standards of UML and still the OMG managing the UML standards. The Unified Modeling Language also approved as an ISO standard by the International Organization for Standardization (ISO) in 2005 (ISO, 2005).

This work examining use case part of UML for my health service system specification and detailed analysis.

2.1.2.1Use Case

Use case is defined as "the specification of a sequence of actions, including variants that a system (or a subsystem) can perform, interacting with actors of the system" (OMG, 2006) according to the Unified Modeling Language (UML) definition. Use cases are mostly using in the early stages of product or service development for acceptance testing (I. Jacobson et al, 1998). As a natural language text, use cases have advocated by software development methodologies such as Unified Process [0-7] for practical usage of use cases. In the early stages of software development this kind of text based descriptive use cases, seen as better for requirements specification phase. Another reason of that, natural language could understand better then diagrams from all of stakeholders. Some of use case templates also provide guidelines for text based structural use case description (Stephane S. Some, 2009).

With the "Writing Effective Use Cases" book, Alistair Cockburn has become the one of popular researcher who working on use cases. His book based on the practical uses of use cases and his main idea is simplicity (Cockburn 2001). Cockburn's main success scenario consist of three to nine steps, additionally Cockburn clarifies many other requirements such as scope, level, interests, success guarantees, preconditions, stakeholders, etc (Stephane S. Some, 2009). Cockburn's template is shown in Table 2(A. Cockburn, 2001). On the other hand, the common used another template is Rational Unified Process use case template which shown in Table 1(I. Jacobson, 1998).

As shown in Table 1 and 2many differences can be seen regarding use case description elements. However, mainly two semantic parts have been in both use case template. According to the Stephane S. Some works, these two semantic parts have defined as a static part and a dynamic part (Stephane S. Some, 2009);

Static part is related with system state such as preconditions, post conditions and descriptive properties such as actors, priority, description etc. Dynamic part is related with behavior of use case. It includes trigger, main flow and alternative flows.

Element	**Description**
Name	The name of the use case.
Brief Description	A brief description of the role and purpose of the use case.
Flow of Events	A textual description of what the system does in regard to the use case (not how specific problems are solved by the system). The description is understandable by the customer.
Special Requirements	A textual description that collects all requirements, such as non-functional requirements, on the use case, that are not considered in the use-case model, but that need to be taken care of during design or implementation.
Preconditions	A textual description that defines a constraint on the system when the use case may start.
Postconditions	A textual description that defines a constraint on the system when the use cases have terminated.
Extension points	A list of locations within the flow of events of the use case at which additional behavior can be inserted using the extend-relationship.

Table 1: Rational Unified Process use case description template.

Element	Description
Number	The use case number
Name	Should be the goal as a short active verb phrase
Goal in Context	Longer statement of the goal, if needed
Scope	What system is being considered black-box under design
Level	One of: Summary, Primary task, Subfunction
Preconditions	What we expect is already the state of the world
Success End Condition	The state of the world upon successful completion
Failed End Condition	The state of the world if goal abandoned
Primary Actor	A role name for the primary actor, or description
Trigger	The action upon the system that starts the use case, may be time event
Main Success Scenario	The steps of the scenario from trigger to goal delivery, and any cleanup after <step #><action description>
Extensions	Extensions, each referring to the step of the main scenario <step altered><condition> : <action or sub.use case>
Sub-Variations	Sub-variations that will cause eventual bifurcation in the scenario <step or variation #><list of sub-variations>
Priority	How critical to system / organization
Performance Target	Amount of time this use case should take
Frequency	How often it is expected to happen
Superordinate Use Case	Optional name of use case that includes this one
Subordinate Use Cases	Optional, depending on tools, links to sub.use cases
Channel to primary actor	e.g. interactive, static files, database
Secondary Actors	List of other systems needed to accomplish use case
Channel to Secondary Actors	e.g. interactive, static, file, database, timeout
Open Issues	Optional list of issues about this use cases awaiting decisions
Due Date	Date or release of deployment

Table 2 - Cockburn's template for fully dressed use cases.

Customized Use Case Template by Onur Alper Unur

Use Case Name and Number

3 Brief Description

A brief description of the role and purpose of the use case.

4 Flows

4.1 Main Flow

A textual description of main flow of users which as a normal behavior of process (not how specific problems are solved by the system). The description is understandable by the customer.

4.2 Alternative Flows

A textual description of alternative workflows of system which is not optimum flow but it describes the other flows in the process (not how specific problems are solved by the system). The description is understandable by the customer.

4.3 Exceptional Flows

A textual description of exceptional workflows of system. It depends on unexpected behaviors of user.

5 Special Requirements

A textual description that collects all requirements, such as non-functional requirements, on the use case, that are not considered in the use-case model, but that need to be taken care of during design or implementation.

6 Preconditions

A textual description that defines a constraint on the system when the use case may start.

7 End State

The goal of use case scenario

8 Extension Points

A list of locations within the flow of events of the use case at which additional behavior can be inserted using the extend-relationship.

3. Analysis of Turkey's Current Situation

In this part Turkish current situation is examined by the author to answer the following research questions;

How to identify the e- health information system's infrastructure?

It is main how question which drive the author to identify the Turkish e-health structure. Answer of this question provide an understanding about of Turkish services and show to author what type of e-governance application needed to provide a valuable services to Turkish citizens. Under this main question, two grammar questions answering in this section by the author to feed this research for development phase of research (see chapter 4). These two grammar questions are following;

a. What are the current distributed health information systems of Turkey?
   To create understanding of each Turkish health information system and with this question has defined by the author also for examining of these systems working type with all of stakeholders.
b. What is the Turkish health information applications and services infrastructure?
   With this question, the author is examining Turkish health information system architecture and technical requirements for working in this infrastructure.

3.1 E-Health Projects of Turkey

Turkey has developed several healthcare ICT infrastructures according to the Health Transformation Program. These infrastructures have gathered under the one main infrastructure which as Health-Net (Saglik-Net in Turkish). This main infrastructure has several information systems such as National Health Information System (NHIS) (Dogac A et al, 2011), Family Medicine Information System (FMIS)[3], Centralized Hospital Appointment System (CHAS)[4], Basic Health Statistics Module (BHSM), Core Resources Management System (CRMS) and the E-prescription System. The main objectives of Health-Net project of Turkey are:

Creation of Electronic Health Records (EHR) of citizens

Ensuring standardized data which could be used in healthcare

Data analysis facilities for administrative units with Decision Support System

Increase the information flow among healthcare stakeholders

Increase effectiveness and efficiency of healthcare system

Saving resources

[3]The Family Medicine Model of Turkey Available from: http://www.ailehekimligi.gov.tr/
[4]The Centralized Hospital Appointment System (CHAS). Available from (in Turkish): http://www.hastanerandevu.gov.tr/Vatandas/hakkimizda.jsp

To ensure these facilities, some major components are also added on the Saglik-Net structure such as the Health Coding Reference Server (HCRS)[5], National Health Data Dictionary (NHDD)[6] and Decision Support Systems. Additionally Saglik-Net infrastructure has seamless integration with e-prescription system of Turkish Social Security Institution. The system architecture of Saglik-Net depicts in figure 5 which includes main components.

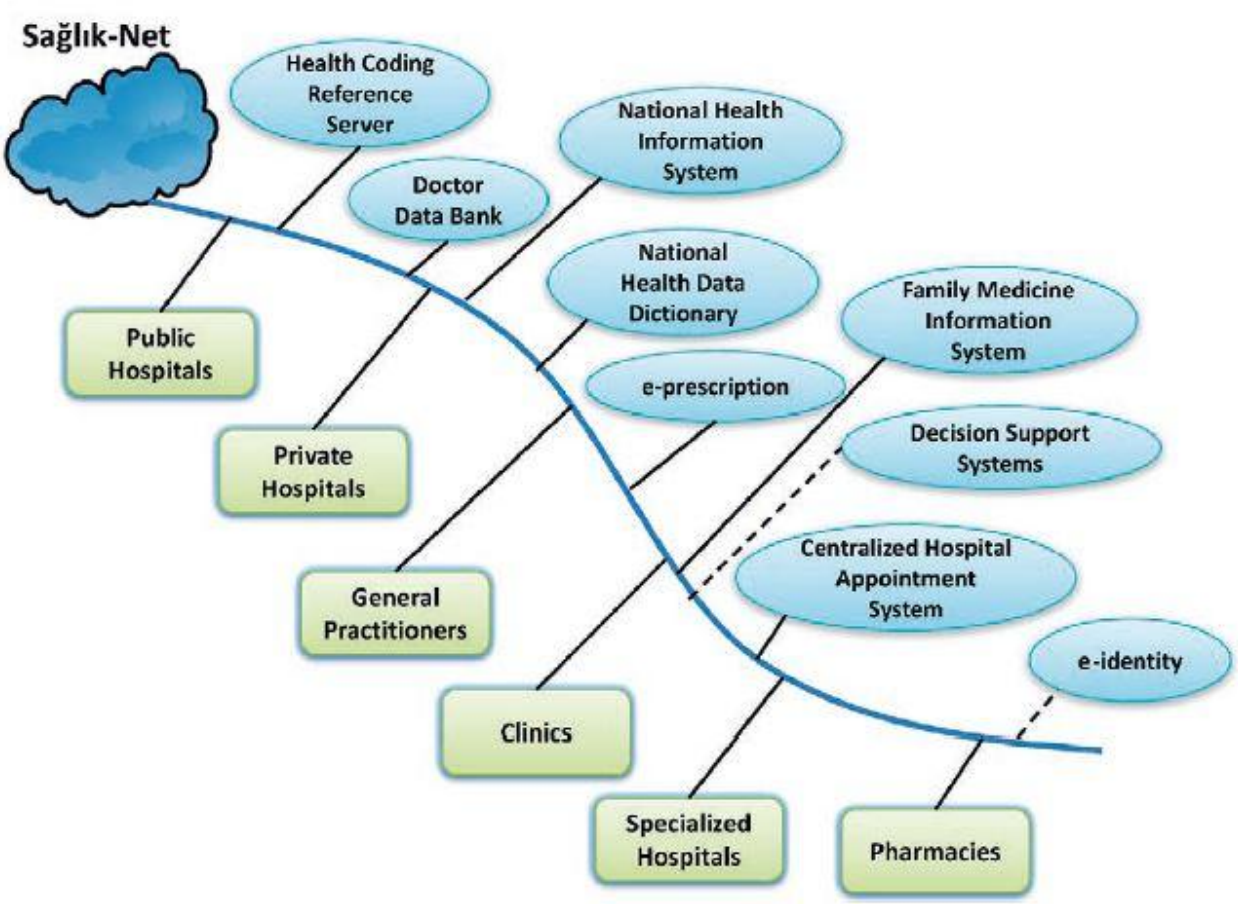


Figure 5 Saglik-Net (Health-Net) System Architecture. (A. Dogac et al).

3.1.1 National Health Information System

National Health Information System of Turkey (Dogac A et al, 2011),is developed for collecting and to some extent sharing patients' Electronic Health Records. It's the nation-wide infrastructure of EHRs. It supports transfer of episodic EHRs from secondary systems to NHIS servers at the Ministry of Health. However, currently only general practitioners can access the EHRs of their own patients through their Family Medicine Information System (FMIS). This system became operational in 2009. After August

[5]The Health Coding Reference Server (HCRS) Available from: https://skrs3.sagliknet.saglik.gov.tr
[6]The National Health Data Dictionary (NHDD) of Turkey v2.0 [cited November 11, 2013]. Available from: http://www.e-saglik.gov.tr/dosyalar/USVS2_30032012.pdf

2012, with the new version of NHIS (version_2.0), FIMS and NHIS collected under the one unique database and web service and became integrated.

The first version of the NHIS has been created from two separated systems; NHIS and FMIS. These two separated systems used to have their own databases and web services and this separated structure of NHIS has been created to gather electronic health records data from the primary and secondary care territories. However, two separate systems created a different and important problem, which is data duplication. This caused the creation of same data in both databases. After the release of NHIS 2.0 in August 2012, system became technically more skilled and compliant. With the new release, two separated systems have been merged and became protected. At the same time all health institutions are connected to one unique system in the client side applications.

In the new version of NHIS, the episodic EHRs - which are also called Transmission Data Sets -have been aggregated with Minimum Health Data Sets. The previous version of NHIS had 41 Transmission Data Sets such as "Infant Nutrition", "Vaccine Notification" and "Diabetes". With the NHIS 2.0, seven broader Transmission Data Sets have been determined, which could collect 65 Minimum Health Data Sets in various combinations. These Transmission Data Sets are namely "Examination", "Patient Demographics", "HIV", "Test Results", "Inpatient", "Citizen Registration" and "Death Notification".

The Transmission Data Sets have been determined according to HL7 CDA standard. In short, The Minimum Health Data Sets and elements of the MHDSs have determined according to the CDA sections and CDA entry classes and their attributes. NHIS EHR payload have been created from "transmission schema" instance and at the transport layer HL7 v3 Web Services Profile[7] have been used in this system.

Healthcare provider information systems are automatically generating the data which is required from NHIS and sending these data to NHIS by invoking NHIS Web Services. Therefore, this process is transparent to the health professionals. There is not any change in the usability skills of health professionals, these information systems vendors have to develop an interface between NHIS Servers and institution's information system which could fill the NHIS Servers' required format for EHRs.

The NHIS system is also open for extensions. When a need for a new EHR document is issued, the existing Minimum Health Data Sets could be updated or changed if possible. If not, new Minimum Health Data Sets could be created by using the existing data elements and if there is a need for new data element, National Health Data Dictionary could be expanded by defining a new data element. After this process, these updates are being applied and reflected on operational electronic services.

3.1.2 Family Medicine Information System (FMIS)

Family medicine system has entered Turkey's agenda very late, when compared to other countries. Previously, health posts were used for delivery of primary healthcare services. With the Health Transformation Program of Turkey, family medicine system entered Turkey's agenda. Today, the system

[7]HL7 Web Services Profile, Release 2. Available from: http://www.hl7.org/special/committees/projman/searchableprojectindex.cfm?action=edit&ProjectNumber=30111

is being used all over Turkey and each general practitioner is responsible from about 3500 citizens and citizens could change their GPs anytime they prefer according to the geographic constraints.

FMIS is developed on the principle that each citizen has a family physician, which takes care of that citizen's health. Thus, with this system, every citizen could contact directly with his/her family doctor when citizen has a health problem. At the same time, system's environment allows regular recording of citizen's health records. With this recording facility of FMIS application, individual's health status can be followed from the time of creation and maintained easily. These data about each individual is being kept in doctor's information bank and this data will be an important resource for future when citizen has a health problem. This system also keeps necessary information such as vaccination information for babies, birth control information of pregnant women for providing useful information to citizen during development of babies.

According to the structure of family physician service, treatment of diseases starts with the family physician, and then family physician examines and cures him/her. So, patient could receive quick medical attention and advice from family physicians and he doesn't need to go to hospital and wait in the long queue for a little sickness.

This system also has online connection laboratories. Family physician could request tests electronically from laboratories for patients via this system. Again, test results could be sent back to family physician from laboratories. During this process patient just has to go to laboratory and enter the tests. Therefore patients don't have to deliver laboratory results themselves.

Family physicians also could send patients to the relevant units of hospitals if needed. This method prevents patient from going to wrong department and wasting time. System is already integrated with hospital online reservation system. Therefore, family physician can set the reservation information details and even write a note on the reservation form. At the same time, the patient could do this reservation on his own from Centralized Hospital Appointment System. FMIS also provides facilities for physicians to follow patient's demographic information and diagnosis after hospital appointments. So family physicians could receive detailed information about his patient.

When a patient deals with FMIS application, family doctor records his health information on this system and during next visiting to family doctor, the doctor could easily find patient's previous diseases and see which treatment is applied. Thus, patient could receive optimal treatment. This means that the collected data turns into useful information with this system.

This system has been first applied on September 2005 in Duzce pilot zone. After the pilot project, system has been integrated with 12 provinces until the end of August and today the system is being used in 81 provinces of Turkey.

Implementation of FMIS

This system is explained as national primary care records exchanging system among general practitioners (GPs) and the Ministry of Health. With this system, the healthcare data, which is under the responsibility of GPs, is also being defined via Minimum Health Data Sets and added into the National Health Data Dictionary.

Family Medicine Information System has a client-server based architecture (Dogac A. et al, 2014). The Ministry of Health hosts the application's centralized part in Ankara and GP's use desktop-client applications in their own offices. Via the client applications, GPs can store or retrieve data transactions with the Ministry's servers. System communication is provided with web services from the Ministry side. The client applications use unique NHIS web services which are HL7 compliant. Until three years ago a simple FMIS client application has been distributed to GP's for free by Turkish government. Even then, many GPs were using 3rd party FMIS client applications because of higher usability and capabilities.

The client applications could work either online or offline modes. Therefore, GPs can record patient data locally and synchronization process with the MoH (Ministry of Health) Web Services could be done later with new local data. Offline using mode of client applications is very useful when GP visits to patient's home who can't come to office (old patients). Also this approach is useful when GPs visit their patients with their portable computers in the rural areas. Moreover, retrieving data from the MoH central servers facility is also quite useful approach in some cases such as a citizen moving to another city. In this situation, the new GP is assigned to the citizen and GP will be able to retrieve patient's all previous records into his client application via the Web Services.

In the family medicine domain, Minimum Health Data Sets defined below.

• Infant Observation

• Child Observation

• Vaccine Tracking

• 15-49 Age Woman Observation

• Pregnancy Observation

• Puerperal Observation

• Death Notification

• Generic Patient Examination

• Consultation Notification

According to the A. Dogac et al. works, the architecture diagram of FMIS is presented in figure 6.

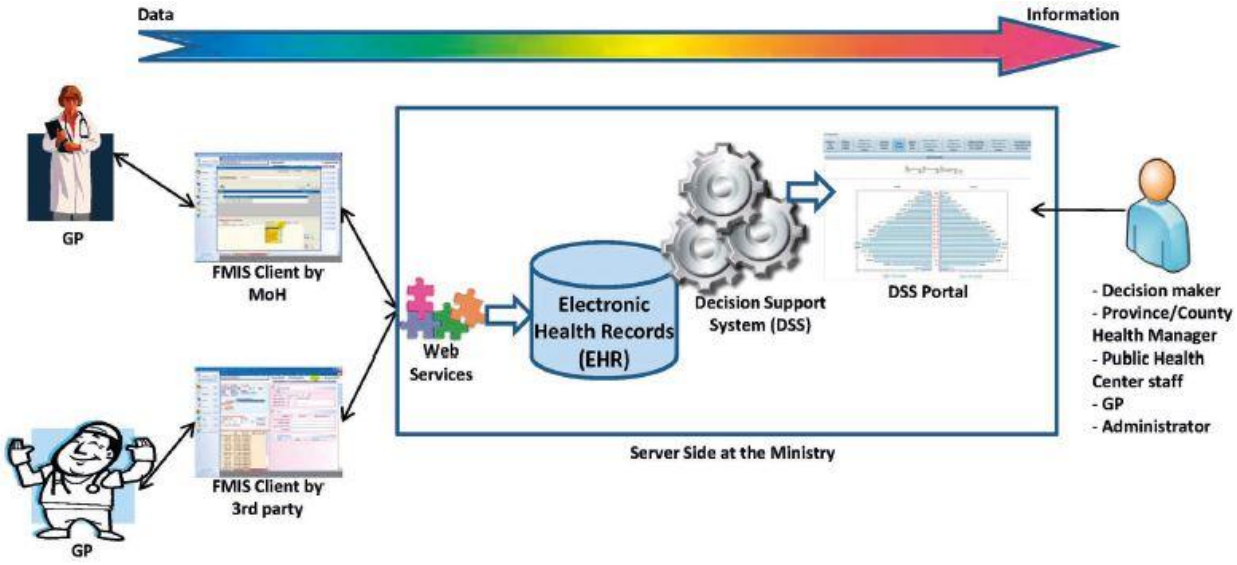


Figure 6.FMIS System Architecture (A. Dogac et al., 2014)

Decision Support System of FMIS

The Decision Support System (DSS) of FMIS mainly provides statistics to show overall view of patient records. DSS could also filter those statistics as whole country, per province, county or per GP. Moreover, DSS provides the facility for grouping patient records. For example, it's possible to find all women who are at the final stage of their pregnancy with one click.

- DSS is Oracle Business Intelligence based solution[8] and it could provide some customized interfaces via Web. Those customized interfaces are;
- Decision makers of Ministry of Health could see all primarily care data in Turkey.
- Administrators can see all data of the Web portal. They can also create a new interfaces or queries.
- Province/County Health Managers: They can see all data of province or county which they are responsible.
- Public Health Center staff: In Turkey, there is a Public Health Center for each 100.000 population. The staff can have same capabilities as Province/County Health Managers.
- General Practitioners: The GPs are able to access all of own patients data (Dogac A. et al, 2014).

3.1.3 National Health Data Dictionary (NHDD)

National Health Data Dictionary as one example of number of standards that have been developed by the MoH to ensure nation-wide compatibility and semantic interoperability of health information systems in

[8]International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10). Available from:http://apps.who.int/classifications/apps/icd/icd10online/

Turkey. It defines all the data elements that are used in some forms according to the international standards. A data element consists of; identifying and definitional attributes, relational and representational attributes and administrative attributes. First version of NHDD released on middle of 2008.

The National Health Data Dictionary is developed for standardized meaning of data to sharing among stakeholders and uses from all parties for the same purpose. With these data definitions and formats in NHDD, health institutions could receive a reference to use it their own information systems. Thus, NHDD has provided big advantage to data interoperability. Different applications could work easily via NHDD. This dictionary is composed of data elements and data sets conforming to ISO/IEC 11179-4 Standard[9]. In the first version, NHDD was active with 46 Minimum Health Data Sets and 261 data elements. After feedbacks from decision makers and improvements of NHDD, today, there have been 65 Minimum Health Data Sets and 464 data elements. Some example data have been given below (Dogac A. et al, 2014).

• Address

• Name

• Main Diagnosis

• Vaccination

• Treatment Method

• Diastolic Blood Pressure

• Healthcare Institution

• Marital Status

The data groups used for data collection which is called as Minimum Health Data Sets (MHDS) and in NHDD, 46 minimum health data sets are formed as depicted in figure 8. In the other words, MHDS are used during transactions of certain health services. Today MHDS covers the critical health data but these data sets will be extended in the future with more detail. Some of MHDS are:

• Citizen/Foreigner Registration MHDS

• Medical Examination MHDS

• Prescription MHDS

• Pregnant Monitoring MHDS

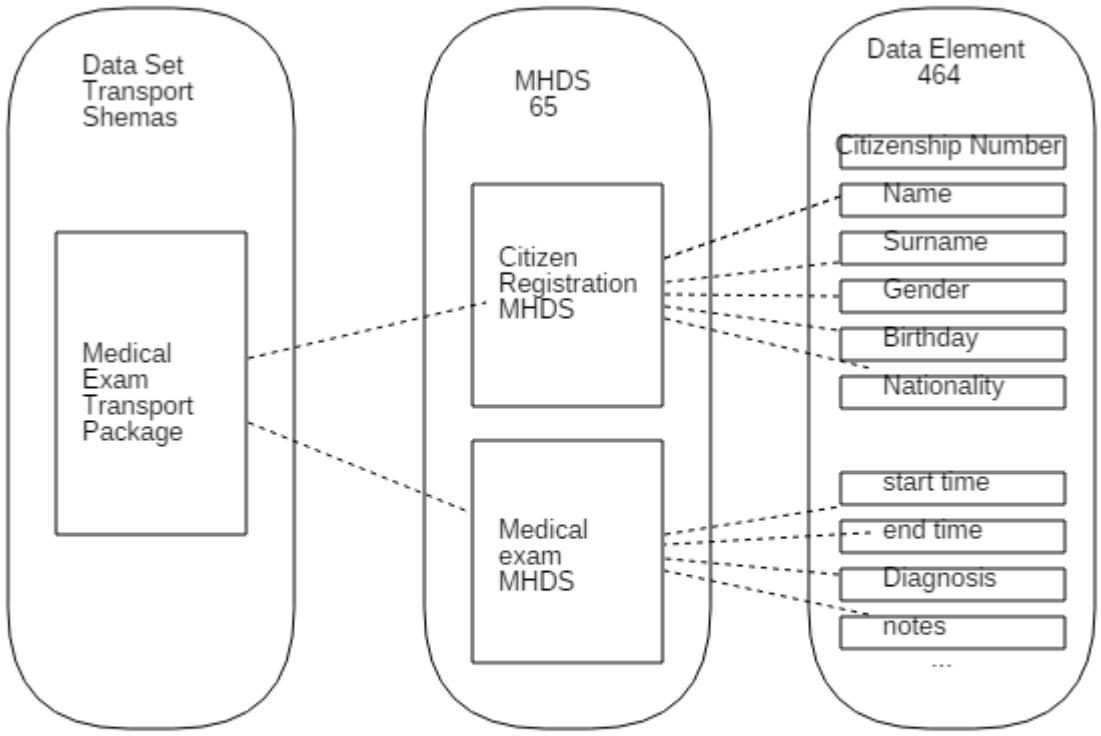
• Cancer MHDS

• Inpatient MHDS

• Death Declaration MHDS

[9]Information technology -- Metadata registries (MDR) -- Part 4: Formulation of data definitions, (ISO/IEC11179-4), http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=35346

(Kose, I. et al, 2008)



National Health Data Dictionary Structure of Turkey

Figure 7 – National Health Data Dictionary Structure – Onur Alper Unur

3.1.4 Minimum Data Sets (MHDS)

NHDD is a main dictionary which is referenced on the topic of health in the entire Turkey. It provides interoperability among health institutions with the standardized form of data. These standardized data groups consist of minimum data sets (MHDS) which is national standard on the issue of data collection. By the help of MHDS system, paper-based forms turn into valuable electronic format and a lot of facilities are provided; such as fast document transfer, regular documents in archives (servers), paperless transactions etc. MHDS system has an updatable structure and it could be developed with new requirements. In future, this approach will be more valuable when adding on it administrative and financial data. This, changeable and updatable structure allows these kind of new developments on this structure.

Most of Minimum Health Data Sets with data elements are coded with the coding systems which are available in Health Coding Reference Server (Dogac A. et al, 2014).With this facility, all health institutions of Turkey could use the same format even with the different applications.

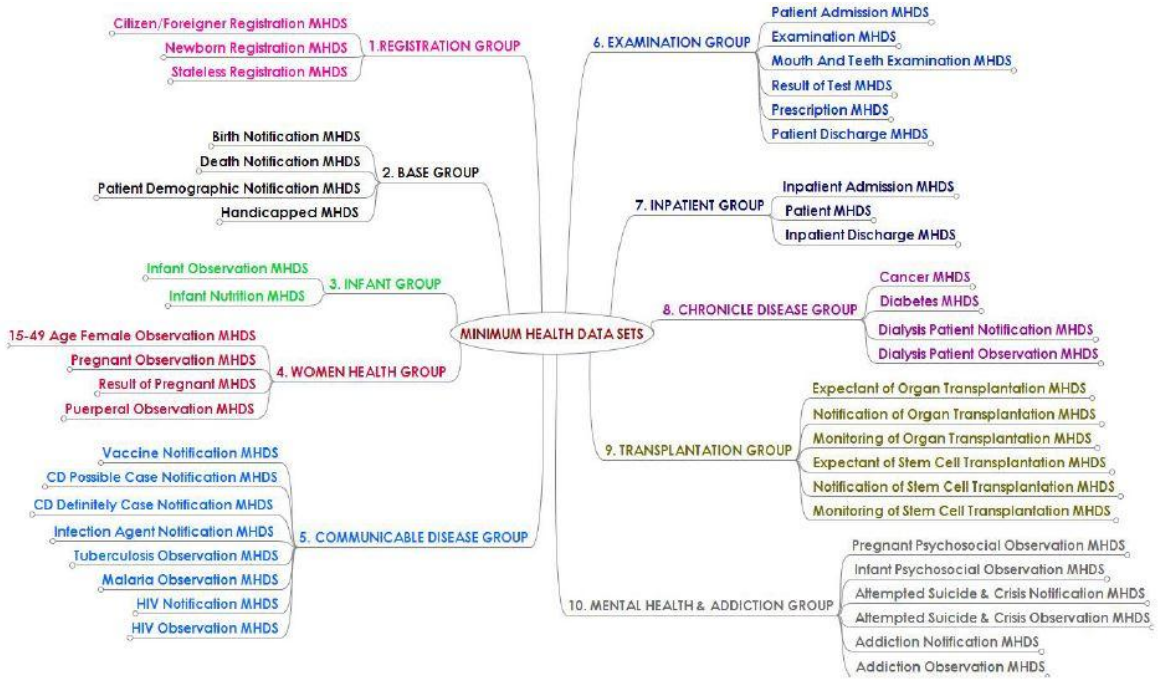


Figure 8 - Minimum Health Data Sets (A. Dogac et al., 2014)

3.1.5 Health Coding Reference Server (HCRS) e-Health's basis:

Health Coding Reference Server is a reference system that serves all international and national coding and classification systems that are used in Turkey for local and remote applications. It includes;

Doctor Data Bank (Information for the entire professional)

Institute Codes

Classification and diagnostic Codes (ICD-10, ICPC 2)

Death Cause (ICD-10)

Communicable Diseases (ICD-10)

Drug Codes (ATC)

Profession codes

Vaccine Codes (HL7)

Today, there are 329 coding systems maintained by the server and some of international coding systems which serving with Health Coding Reference Server, ICD-10 and Anatomical Therapeutic Chemical Classification System . Most of these coding standards are defined for specific information sets such as Clinics, Pregnancy Result, or Baby Monitoring Calendar (Dogac A. et al, 2014).

3.1.6 Centralized Hospital Appointment System (CHAS)

This system provides the facility for making appointments with hospital via call center phone number "182" or online through the CHAS web portal and mobile applications such as android, IOS etc. And the system became operational in 2011. Currently, when examining of system processes, all of public healthcare professionals are sharing their calendars with the Ministry of Health first, and then CHAS Web Services using for provides facility to citizen for making appointment in 15 days according to calendar information of health professionals (Dogac A. et al, 2014).

3.1.7 E-Prescription System

The e-prescription system of Turkey has developed by Social Security Institution and this system is built on web-based infrastructure which lays on the Medula system of Social Security Institution[10]. Medula system was developed for automatic reimbursement of medical expenses of the citizens according to the social security situation. The e-prescription system became operational in whole of Turkey in July 2012. This system has seamless connection with Medula system via Medula Web Services and healthcare professionals still have the same rules for prescribing on their Medula applications. ICD -10 codes are used by healthcare professionals when preparing patient's e-prescriptions. Each e-prescription takes unique number to identify in the Medula system. With this system, the healthcare professional can also find information for patient's ongoing medications with Web-based application of Social Security Institution[11]. With this facility of system, medication amount which is not yet consumed from patient could be followedby the healthcare professional.

In this system, after creation of e-prescription, healthcare professionals give that unique prescription number which created under the Medula system. When patient applies to pharmacy, citizen ID and e-prescription number of patients asked by pharmacy. Pharmacies are using the Medula Pharmacy Software which provides some e-prescription facilities to pharmacies such as query, view and dispensation of e-prescription. Medula Pharmacy Software also keeps track of medications and prevents redundant dispensation. At the same time, if pharmacies a specific product is not available, a replacement with equivalent product is offered by the system.

[10]https://medeczane.sgk.gov.tr/eczane/login.jsp
[11]HL7 Version 3 Standard: Transport Specifications Overview. Available from: http://www.hl7.org/v3ballot/html/infrastructure/transport/transport-intro.htm

3.2 Turkish Ministry's Institutional Information Technologies Projects

3.2.1 Core Resource Management System (CRMS)

Turkish MoH has implemented the "Core Resource Management" project for effective and efficient resource management. The CRMS developed to gather health directorates of 81 provinces under one central organization. This system is used to provide current and correct information to decision makers in order to follow material resources. At the same time, CRMS developed to monitor institutions, healthcare staff of Ministry of Health. The system includes following components;

• Human Resources Management System (HRMS)

• Equipment Resources Management System(ERMS)

• Investment Tracing System (ITS)

• Private Health Organizations Management System (HOMS)

(Dogac A. et al, 2014).

3.2.2. Basic Health Statistics Module (BHSM)

Today, health statistics of 81 provincial could be gathered under the MoH's web-based central database with the Basic Health Statistics Module. Data gathering with electronic forms from Health institutions of 81 provinces, after evaluation of data from decision makers, health reports are prepared according to the needed statistics for management. Currently, there have been 70 Health Statistics Forms and some of them already been reported to the World Health Organization. But most of these forms are still filled manually. Some forms are also available under the FMIS such as Infant/Child Follow-up or Pregnancy Follow-up (Dogac A. et al, 2014). To improve this module, decision support systems of FMIS are developed to provide these forms electronically instead of manual BHSM reports. The BHSM includes two components which are Ministry's Central Organization and Provincial Health Directorates. So BHSM software includes two main modules which cover these two major components. System also used to discover health risks and indicators in Turkey.

4. New IS model development

Research questions

In this part Turkish current situation is examined by the author to answer the following research questions;

How to contribute more value to the current health system for increase society's welfare and increase e-governance service's maturity level?

With this main how question the author examining the findings of e-government environment. According to these finding from chapter 3, a new e-health application model creating by the author in this section. Under this main question, 3 grammar question defined by the author to disclose new system's architecture, user scenarios and GUI mock-ups.

What are the new system infrastructure and stakeholders?

The system architecture design has been developed under this grammar question. It gives general overview to system and stakeholders.

What are the new system's and user interfaces?

This question drives the author to create GUI mock-ups of system to show the systems usability from the citizen perspective.

What are the new system's contextual descriptions?

This grammar question has been answering by the author in this chapter with natural text-based use cases and user scenarios. Use cases are one of the main outputs of this research.

4.1 New system infrastructure and architecture

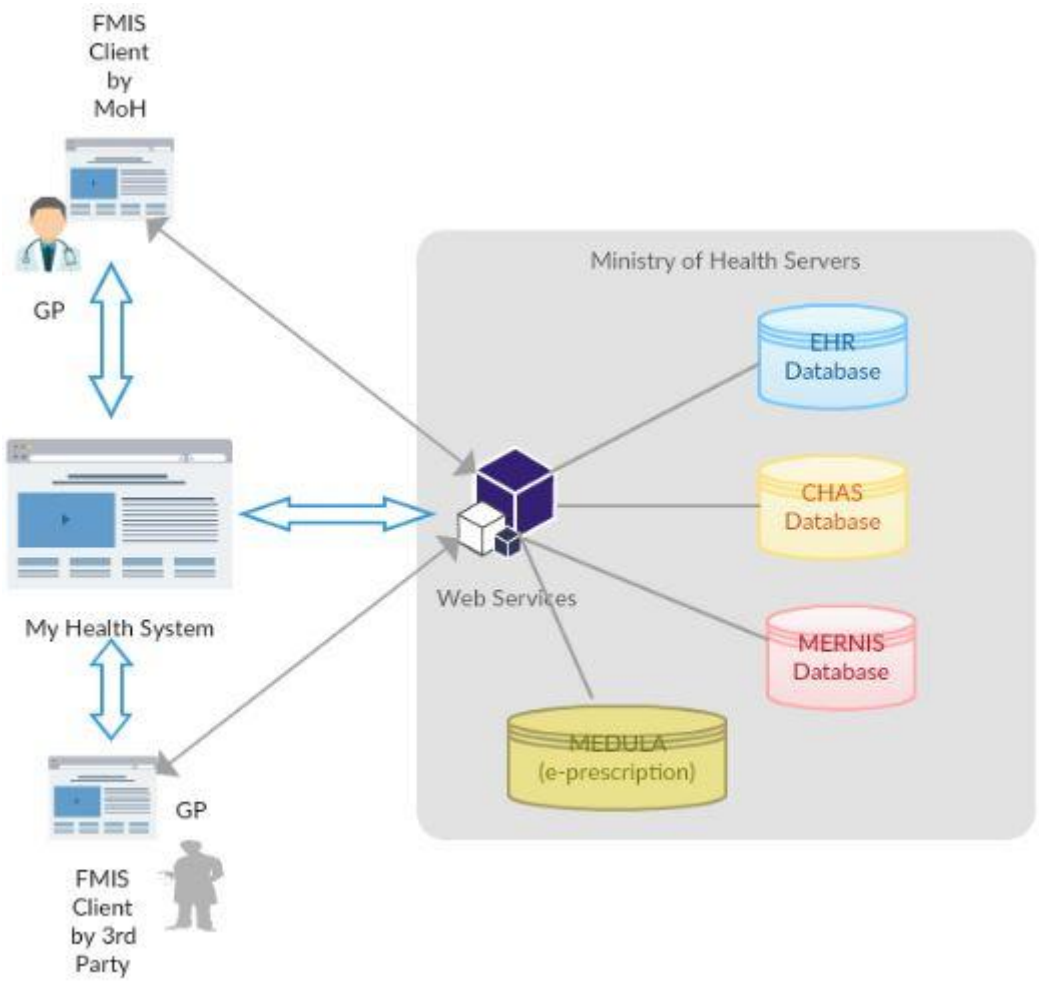


Figure 9 – My Health application system architecture – Onur Alper Unur

My health system is provides valuable facilities to Turkish citizens. This system developed for create citizen-centric e-health application model for Turkey. System values can define as following points.

- Citizens can see historic reports, prescriptions and tests with this system and its useful feature for public awareness and society's welfare.
- With the increasing demand of the citizens from government, this application provides more transparent service.
- Citizens also can arrange appointment on this system with the more efficient and understandable way.

In the architectural layer of the system, MoH servers provide the main data to the system. Under the central Moh Server several e-governance information systems are using such as electronic health records, central hospital appointment system, Mernis and Medulla system. EHRs provide to health records of user's to a system which using in reports, tests features of the system. System uses CHAS structure to provide the appointment feature. Mernis database using the check citizen ID and password for e-governance interactions and Medula system is using to provide e-prescription features to user.

Connections between MoH and My Health application provides from government web services. The system interacts with stakeholders with XML based HL7 technology. Other stakeholders of system are family medicine client application which provided from MoH or 3rd parties.

4.2 Use cases and Mock-ups

In this part, the system mock-ups represents usability features of the My Health system. With these GUI mock-ups, natural text-based use case descriptions using by the author to provide an understandible view about the system. UI mockups provide to product developer that real customer requirements, with the customer feedbacks, developer could evaluate requirements very well. At the same time, mockups minimize the product risks for in the usability level. Lastly, mockups are also avoid time-waste for unnecessary UI developments. . In the early stages of software development, text based descriptive use cases, seen as better for requirements specification phase. Another reason of that, natural language could understand better then diagrams from all of stakeholders.

1-User Registration Page

1 Brief Description

User registration, explains that user's registration process on the system for use the system. This use case describing that which information needed for user registration process. Actors of this use case are every Turkish citizen.

2 Flows

2.1 Main Flow

2.1.1 User is declare that register request to the system

2.1.2 System asks user to populate following fields.

a. ID number: User's Turkish citizenship number.
b. Password: User's e-government portal password.
c. Name/Surname: Name information of citizen
d. Telephone number: Telephone number of user
e. E-mail address: e- mail address of user

Information which is requested above is compulsory.

2.1.3 User enters information and clicks register button.
2.3.1 Explain that invalid citizen ID or password information submission. 2.3.2 Explain that false format entrance for e-mail.

2.1.4 Entered information saved by the system and system led the user in the system (see 6.1).

2.2 Alternative Flows

This use case has not any exceptional flow.

2.3 Exceptional Flows

2.3.1 State of false user name or password information entrance:
System alerts the user about invalid user name or password and doesn't do anything.

2.3.2 Declaration of e-mail in the false format
System alerts the user about false e-mail format and doesn't do anything.

3 Special Requirements

3.1 Big and small character typing ability should provide to the user for user name field.

3.2 Big and small character and also numbers typing ability should provide to the user for password field.

3.3 Just numbers should provide to user when user filling the telephone number field.

4 Preconditions

This use case has not any exceptional flow.

5 End State

5.1 User registered in the system.

5.2 User Entered in the system.

6 Extension Points

6.1 3-Home Page

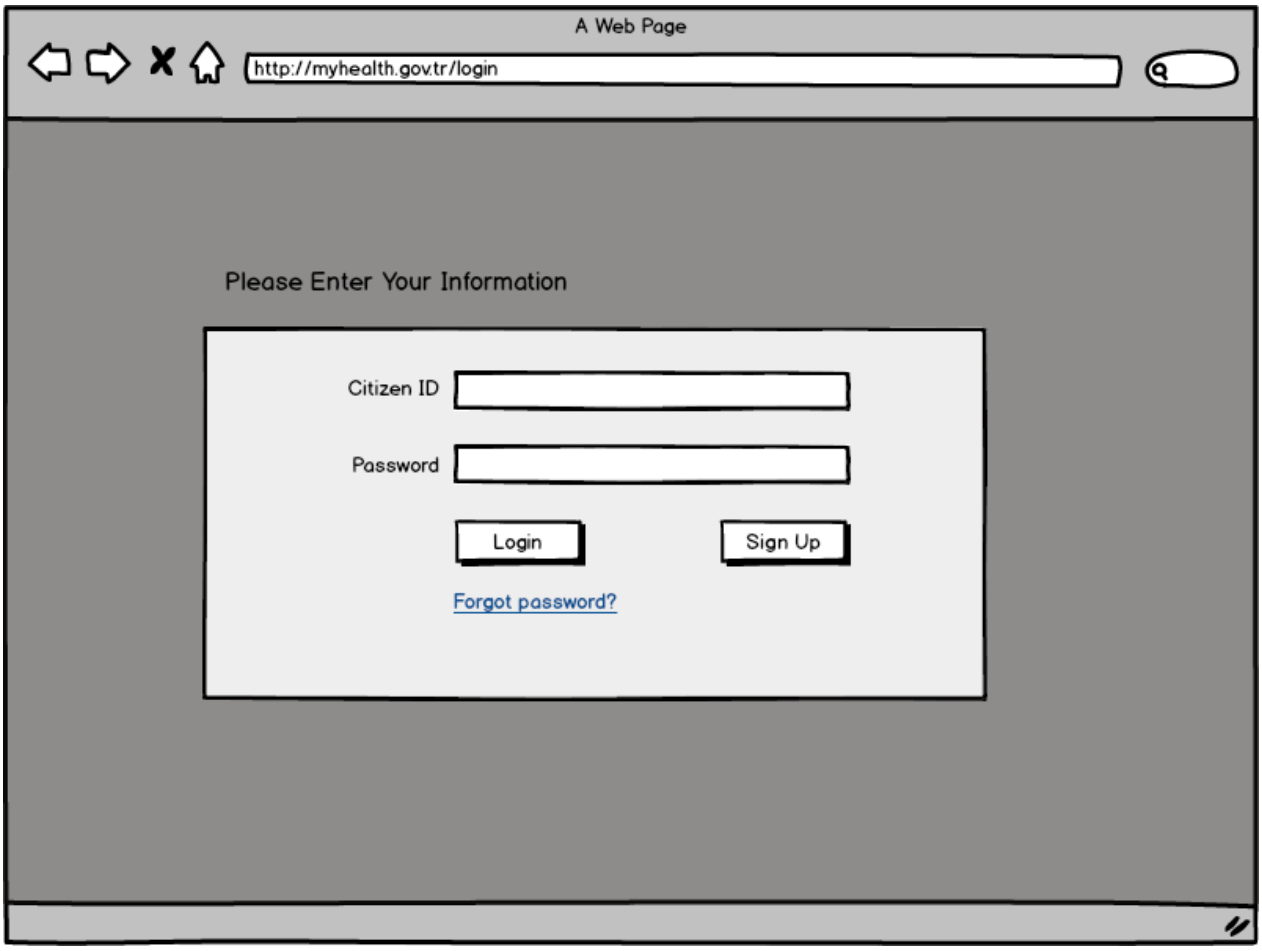


Figure 10 –Login Page - Onur Alper Unur

2-User Login Page

1 Brief Description

User login page is the page which provides to user that enter in system. This use case describing that which information needed for user login process Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System asks to user that citizen ID and password (see 3.1).

2.1.2 User enter his user name and password

2.1.3 System checks the user's information and led the user in the system.
False declaration of user's information explains in 2.3.1.

2.2 Alternative Flows

2.2.1 User's click the sign up button
The system led the user to registration page (see 6.1).

2.3 Exceptional Flows

2.3.1 State of false user name or password information entrance:
System alerts the user about invalid user name or password and doesn't do anything.

2.3.2 Declaration of e-mail in the false format
System alerts the user about false e-mail format and doesn't do anything.

3 Special Requirements

3.1 Big and small character and also numbers typing ability should provide to the user for ID and password field.

4 Preconditions

4.1 User should be already registered to system.

5 End State

5.1 User Entered in the system.

6 Extension Points

6.1 1-User Registration Page

3- Show Common Fields For All Pages

1 Brief Description

This use case is describes common fields which shows to user in the all pages of the system. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user following sub sections of system.

a. Top Menu
   Here following system pages links show to user with buttons.
   i. Main page
   ii. Appointments
   iii. Messages
   iv. Share
   v. Helpdesk
b. Left Menu
   i. History
   ii. Prescriptions
   iii. Sick reports
   iv. Tests
   v. Allergies
c. Logout Button

2.2 Alternative Flows

This use case has not any alternative flow.

2.3 Exceptional Flows

This use case has not any exceptional flow.

3 Special Requirements

This use case has not any special requirement

4 Preconditions

This use case has not any precondition

5 End State

5.1 Common fields of system has shown to user.

6 Extension Points

6.1

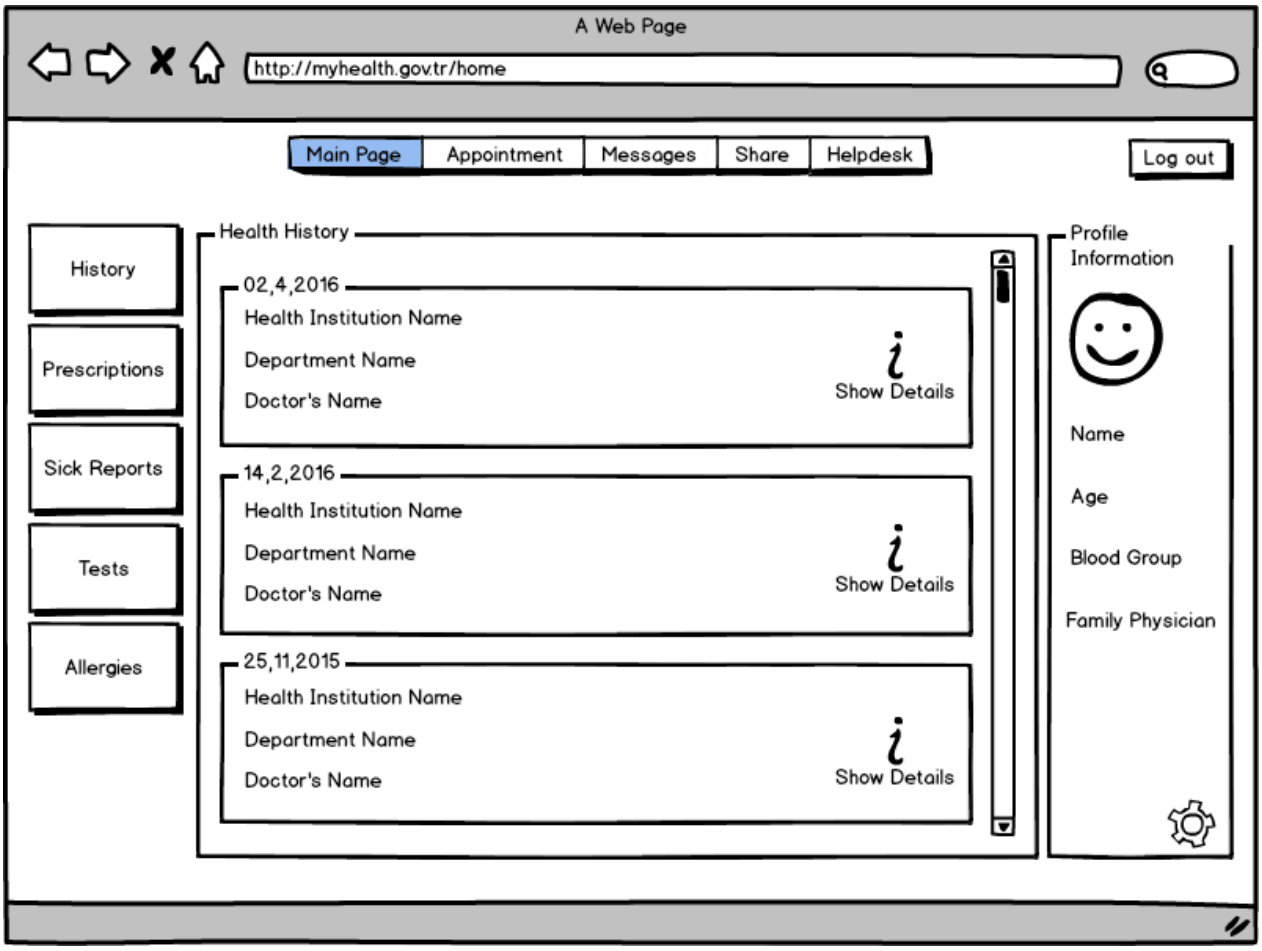


Figure 11 –Home Page - Onur Alper Unur

4-Home Page

1 Brief Description

Home page is the page which shows to user that home screen of system. In this use case home screen parts are describing. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user following sub sections of system.

System shows to user following information with common fields of system (see 6.1)

a. Health Histories

Health history of user shows to user with following information

i. Date: Date of visit
ii. Health Institution Name
iii. Department Name

Additionally, show history details link provides to user in this part

b. Profile Information

i. Profile picture of user
ii. Name of user
iii. Blood group of user
iv. Users family physician's name

Additionally show profile settings link provides to user in this part

2.2 Alternative Flows

This use case has not any alternative flow.

2.3 Exceptional Flows

This use case has not any exceptional flow.

3 Special Requirements

This use case has not any special requirement.

4 Preconditions

4.1 User should be login the system.

5 End State

5.1 Home page has shown to the user.

6 Extension Points

6.1 3- Show Common Fields for All Pages

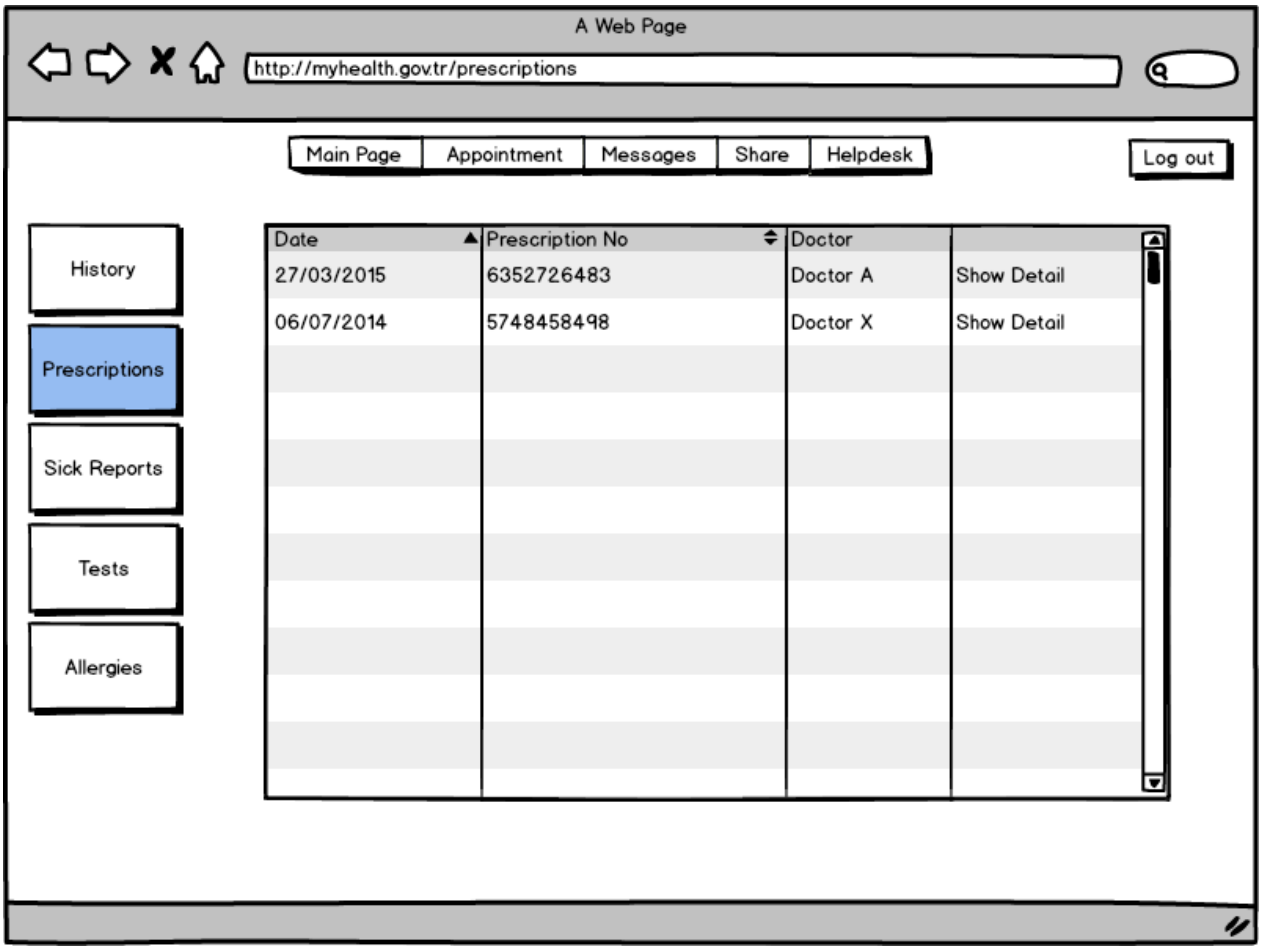


Figure 12 –Prescriptions Page - Onur Alper Unur

5- History Page

1 Brief Description

History page is the page which shows to user that all of the old health institution visits. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user lists of old health institution visits with the following information.

a. Health Histories
   Health history of user shows to user with following information
   i. Date: Date of visit
   ii. Health Institution Name: institution name which visited by the user.
   iii. Department Name: department name which visited by the user
   iv. Show detail information: Users can see detail information of visiting with the show detail information button. This flow explaining in 2.2.1.
   v. Share this information: Users can share these own information via the share button. This flow explaining in 2.2.2.

2.2 Alternative Flows

2.2.1 User clicks the show detail information button which is on each health history.

2.2.1.1 System shows to user following information on the separate screen with the back button (see 3.1).

a. Diagnosis : Users diagnosis shows to user with following indicators
   i. Diagnosis Date
   ii. Diagnosis
   iii. Physician Name
   iv. Department name
b. Prescription: User can see the prescription details about this visit with the following indicators
   i. Prescription Name
   ii. Prescription Number
   iii. Physician Name
c. Sick Report: If user had a report from related visit. The report information show the user with the following indicators
   i. Report Date
   ii. Report Number
   iii. Type of Report

2.2.1.2 User clicks the back button and turn back to history page which lists the each historic data of user.

2.2.2 User clicks the share button to share chosen historic data.

2.2.2.1 System asks to user following information with the separate screen.

a. E-mail address of the user which information sharing with (see 3.2)
b. Share button.

2.2.2.2 User fill the other user's e-mail and clicks the share button.

System alerts the user that information shared. False recipient e-mail information declaration flow is explaining in the 2.3.1.

2.3 Exceptional Flows

2.3.1 False recipient e-mail information declaration.

The system alerts to user that there isn't any user in the system with this mail. And system doesn't do anything.

3 Special Requirements

3.1 Detail information and share page will show with the pop-up screen.

3.2 Recipient's e-mail has to be already recorded in the system.

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User saw the details of chosen health history.

5.2 User shared the chosen health history data.

6 Extension Points

This use case has not any extension point.

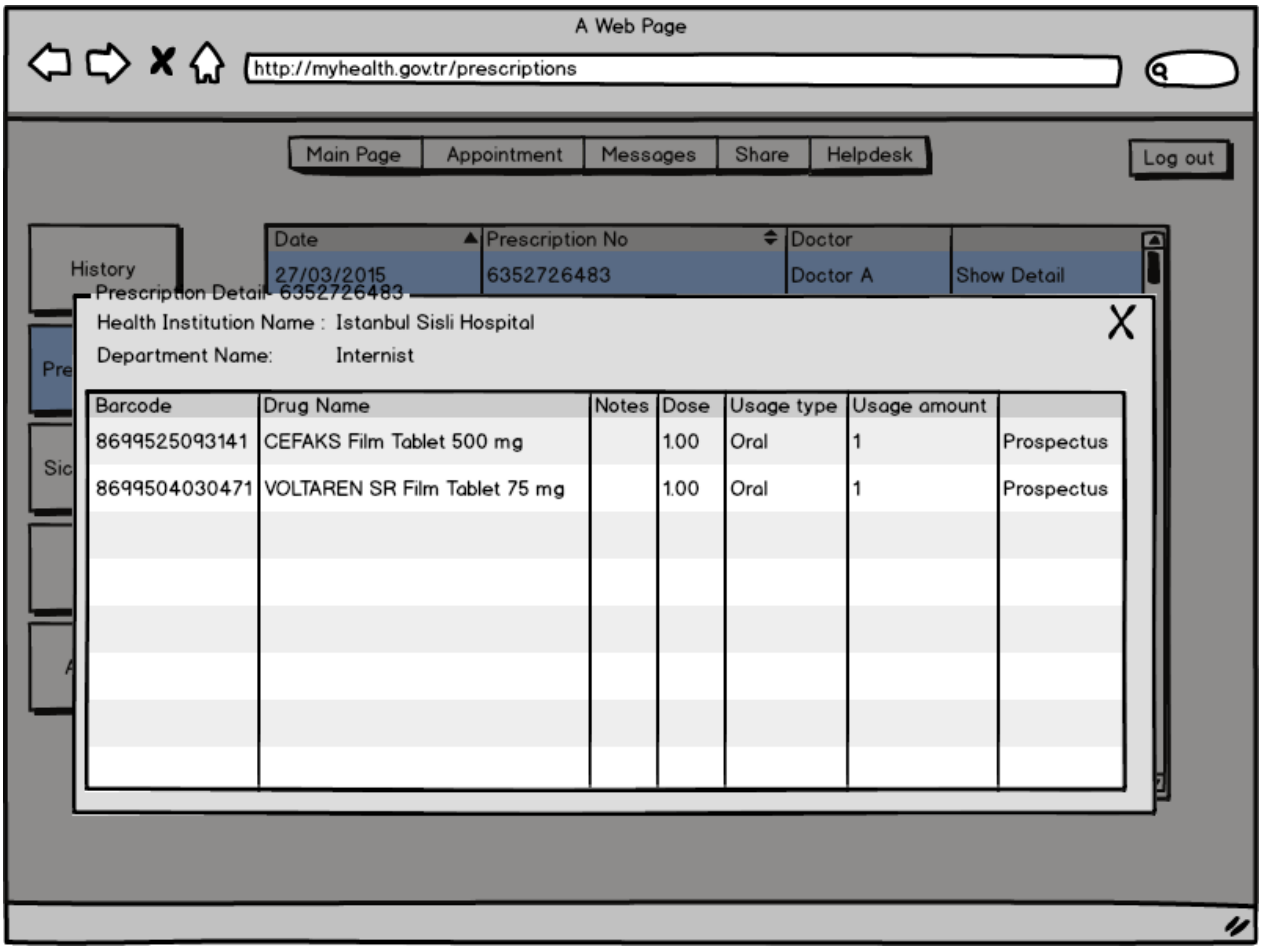


Figure 13 –Prescription Detail Page - Onur Alper Unur

6- Prescription Page

1 Brief Description

The prescriptions page is the page which shows to user that all of the prescriptions until current date. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user lists of old health institution visits with the following information.

System shows to user lists of prescriptions with the following information.

a. Date: Date of prescription
b. Prescription no: Number of Prescription
c. Physician: The physician name who wrote that prescription
d. Show detail button: To see prescription details.

User's clicks on show detail button, this flow is explaining in 2.2.1.

2.2 Alternative Flows

2.2.1 User clicks the show detail information button which is on each prescription.

2.2.1.1 System shows to user following information on the separate screen with the back button (see 3.1).

a. Prescription no : number of prescription
b. Health Institution Name;
c. Department Name:
d. Prescription Form
    i. Barcode
    ii. Drug Name
    iii. Notes
    iv. Dose
    v. Usage Type
    vi. Usage Amount
    vii. Prospectus : Prospectuses of drugs of chosen prescription

User's clicks on prospectus button, this flow is explaining in 2.2.2.

2.2.1.2 User clicks the back button and turn back to history page which lists the each prescription data of user.

2.2.2 User clicks the prospectus button to share chosen historic data (see 3.1).

System shows the user that prospectus of each drug.

2.3 Exceptional Flows

This use case has not any exceptional flow.

3 Special Requirements

3.1 Detail information and prospectus information will show with the pop-up screen.

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User saw the list of prescriptions.

5.2 User saw the details of chosen prescription.

5.3 User saw the prospectus of each drug.

6 Extension Points

This use case has not any extension point.

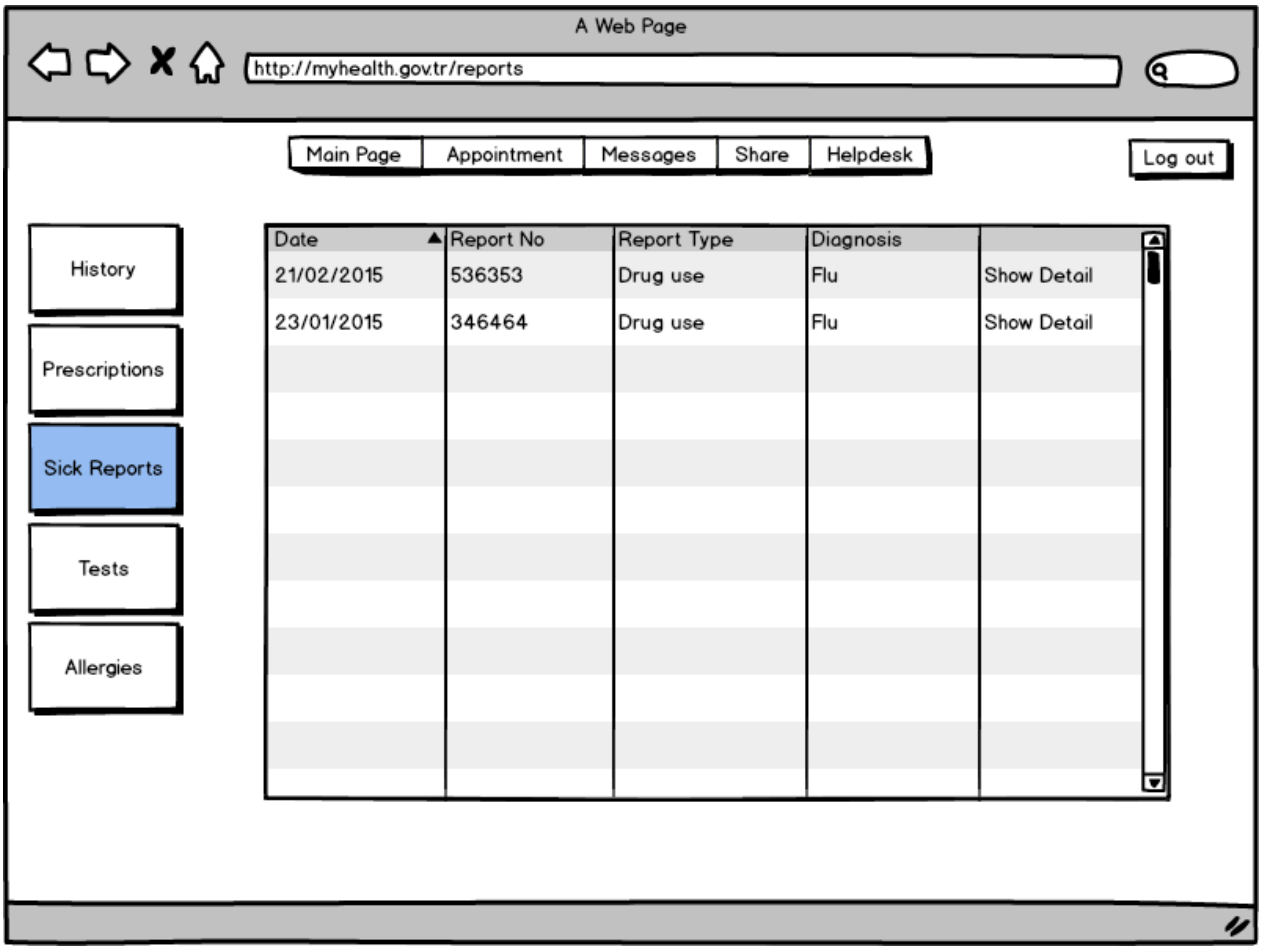


Figure 14 –ReportsPage - Onur Alper Unur

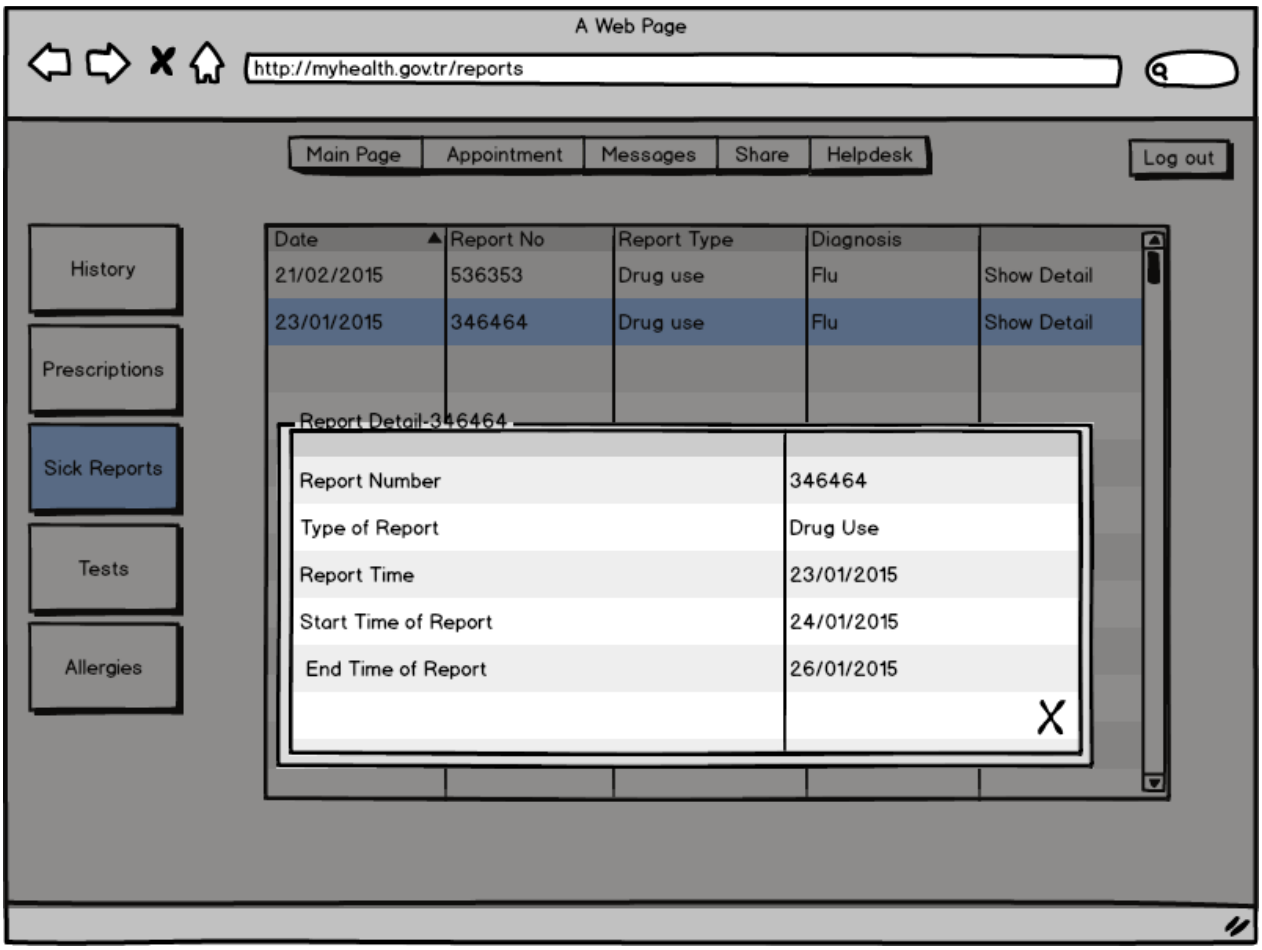


Figure 15 –Report Detail Page - Onur Alper Unur

7- Sick Reports Page

1 Brief Description

The sick reports page is the page which shows to user that all of the sick reports until current date. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user lists of sick reports with the following information.

a. Date: Writing date of report
b. Prescription no: Number of report
c. Report Type: Type of Report
d. Diagnosis
e. Show details button.

User's clicks on show detail button, this flow is explaining in 2.2.1.

2.2 Alternative Flows

2.2.1 User clicks the show detail information button which is on each report.

2.2.1.1 System shows to user following information on the separate screen with the back button (see 3.1).

a. Report Number
b. Type of Report
c. Report giving time
d. Start time of report
e. End time of report

2.2.1.2 User clicks the back button and turn back to reports page which lists the each report information of user.

2.3 Exceptional Flows

This use case has not any exceptional flow.

3 Special Requirements

3.1 Detail information of reports will show with the pop-up screen.

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User saw the list of reports.

5.2 User saw the each report's details.

6 Extension Points

This use case has not any extension point.

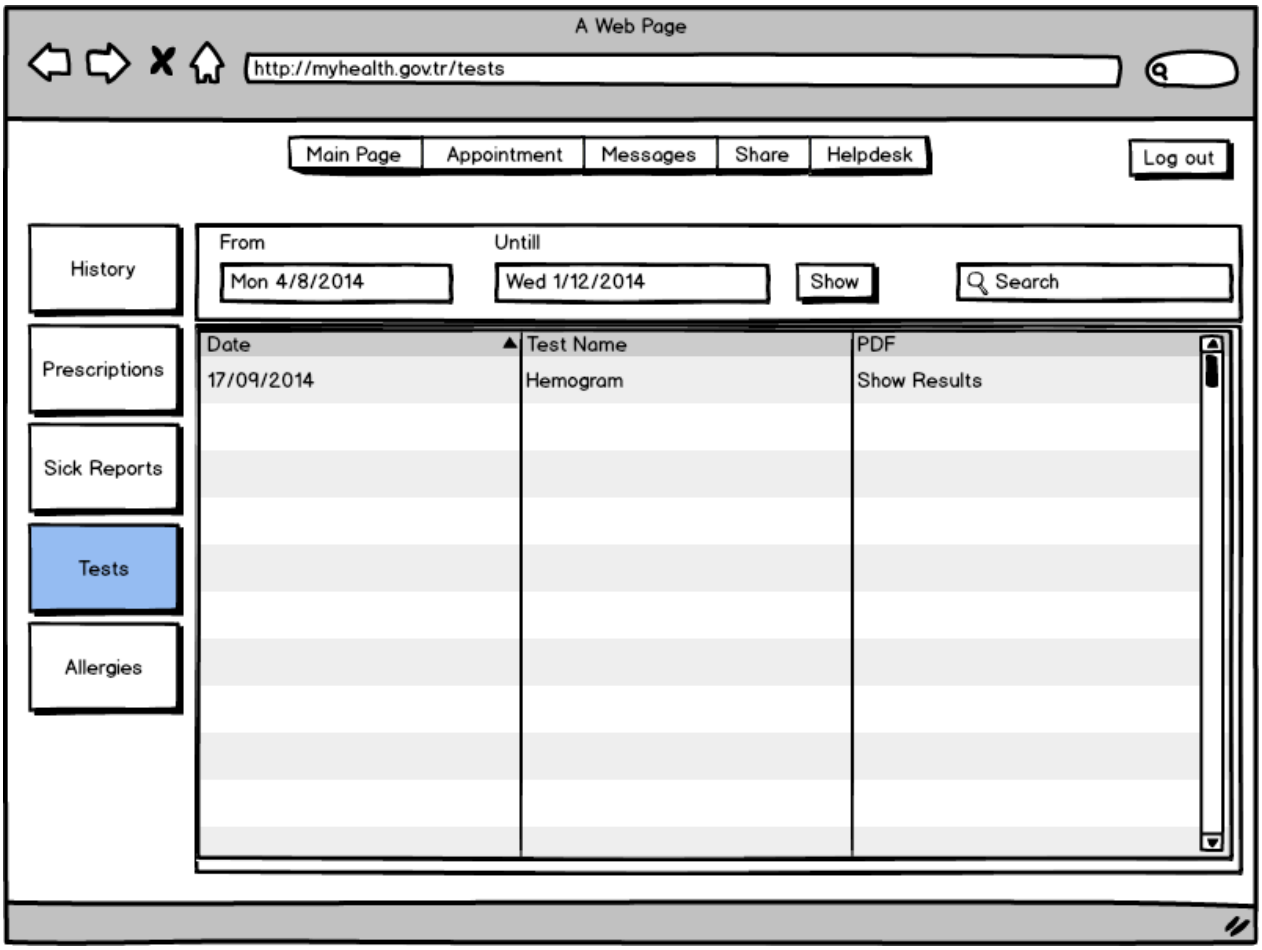


Figure 16 –Tests Page - Onur Alper Unur

8- Tests Page

1 Brief Description

The tests page is the page which shows to user that all of the tests and their results until current date. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user that lists of tests with the following information.

a. Filtering Field
   i. Date From: The date declaration for since which date the user want to filter his tests.
   ii. Date Until: The date declaration for until which date the user want to filter his tests.
   iii. Show Results Button: Shows results according to date declarations of this field.
   iv. Search field: User can search specific test results from this field according to the name of test.

The system provides filtering features to user in this field.

b. Content Field
   i. Date: Writing date of report
   ii. Test Name: Name of test
   iii. Show PDF Button: User can see the pdf document of test results.

User's clicks on show filtering results button, this flow is explaining in 2.2.1. User clicks of show pdf button, this flow is explaining in 2.2.2.

2.2 Alternative Flows

2.2.1 User's clicks on show filtering results button.

System shows to user filtered results as a chronological in the content field of test screen.

2.2.2 User clicks of show pdf button

The system show the user that results of chosen test in the pdf formatted document. In this screen there is also back button to go back the previous test results page (see 3.1).

2.3 Exceptional Flows

This use case has not any exceptional flow.

3 Special Requirements

3.1 PDF results of tests will show with the pop-up screen.

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User saw the list of tests

5.2 User filtered tests

5.3 User searched specific test by name.

5.4 User saw detailed test results with pdf document.

6 Extension Points

This use case has not any extension point.

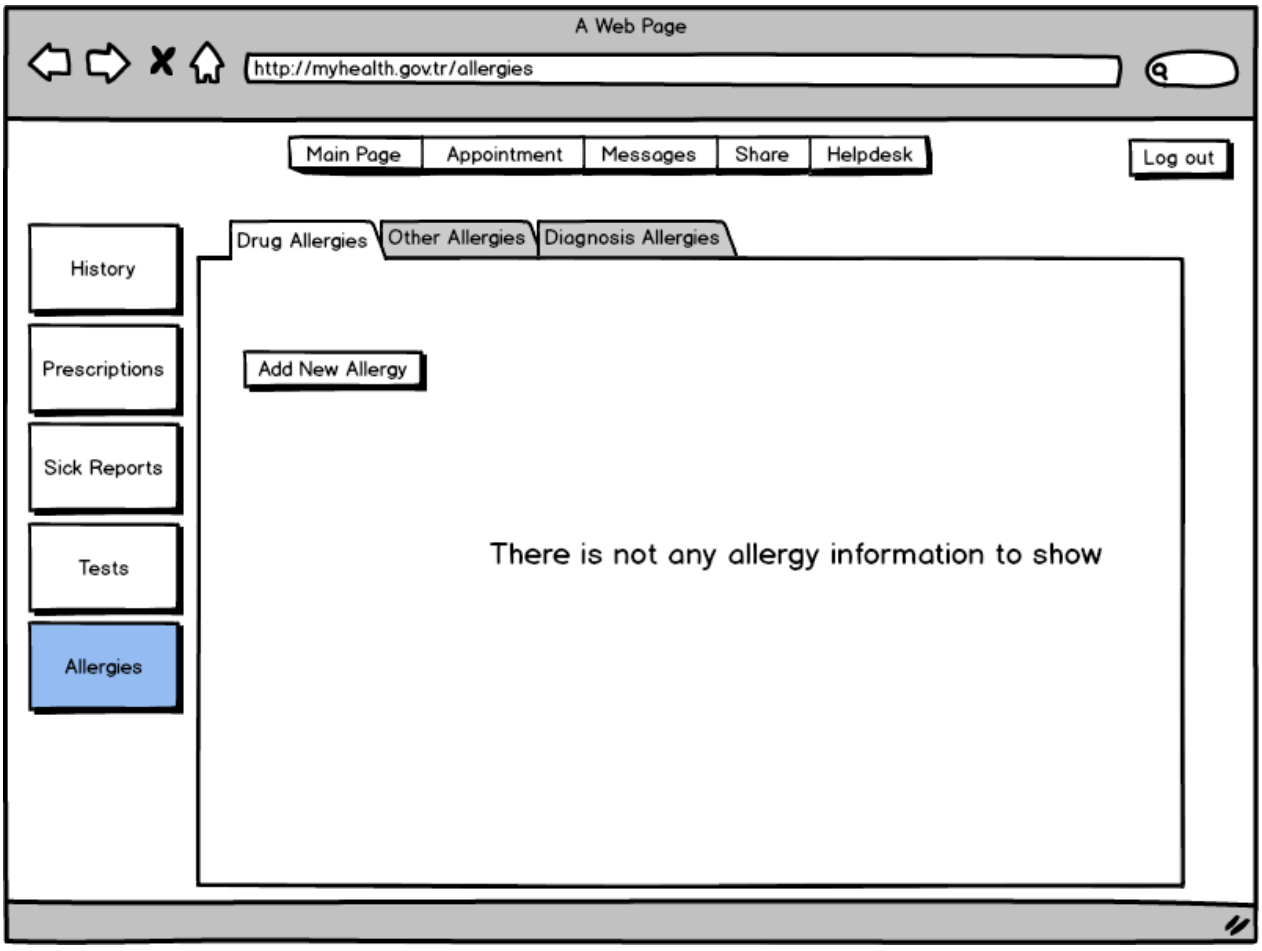


Figure 17 –Allergies Page - Onur Alper Unur

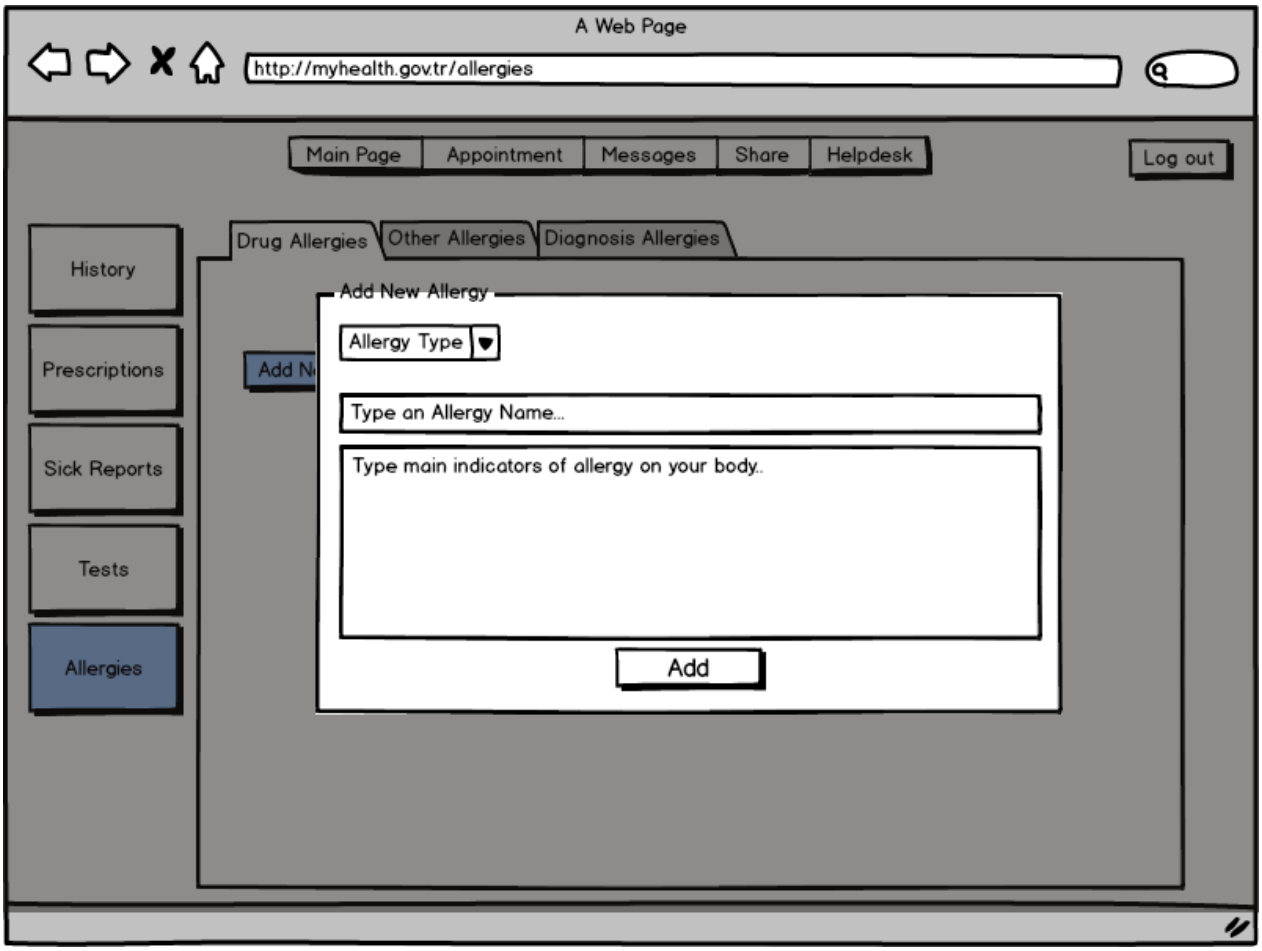


Figure 18 –Allergies Detail Screen - Onur Alper Unur

9- Allergies Page

1 Brief Description

The allergies page is the page which shows to user that allergy information of user. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user that allergy field with the following information.

a. Drug Allergies
   i. Allergy Type: Type of allergy
   ii. Drug Name: name of drug which user has an allergy about.
   iii. Indicators: main indicators of allergy definition field
   iv. Add New Allergy Button: User can add a new allergy with clicking this button.

b. Other Allergies
   i. Name: Name of allergy
   ii. Indicators: main indicators of allergy definition field
   iii. Add New Allergy Button: User can add a new allergy with clicking this button.

   The system provides add new allergy features to user in this field. Adding new allergy flow is explaining in 2.2.1.

c. Diagnosis Allergies
   i. Date: Date of diagnosis
   ii. Diagnosis: Physician's diagnosis note
   iii. Department: Related department of institution
   iv. Physician name: The name of physician

2.2 Alternative Flows

2.2.1 User's attempts to adding new allergy

2.2.1.1 System asks from user to fill-in following fields with the separate screen (see3.1)

a. Allergy Type: Type of allergy information requesting from the user. There are two type of allergy show to user in this filed (see 3.2)
b. Allergy Name Field: Text field wants the name of allergy from user.
c. Indicators Field: Text field wants the brief description of indicators of allergy from user.
d. Add Button:

2.2.1.2 User enters information and clicks on the add button

The system is saving that information and turning back to the allergies page. Users empty declaration about allergy type, name field and indicators field, explaining in 2.3.1.

2.3 Exceptional Flows

2.3.1 Users empty declaration about allergy type, name field and indicators field.

The system alerts to user for entrance data to all fields and doesn't do anything.

3 Special Requirements

3.1 Add new allergy field will show with the pop-up screen

3.2 Allergy type field should show with combo box which has two options.

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User saw the drug allergies

5.2 User saw the other allergies

5.3 User sew the diagnosis allergies

5.4 User added a new allergy

6 Extension Points

This use case has not any extension point.

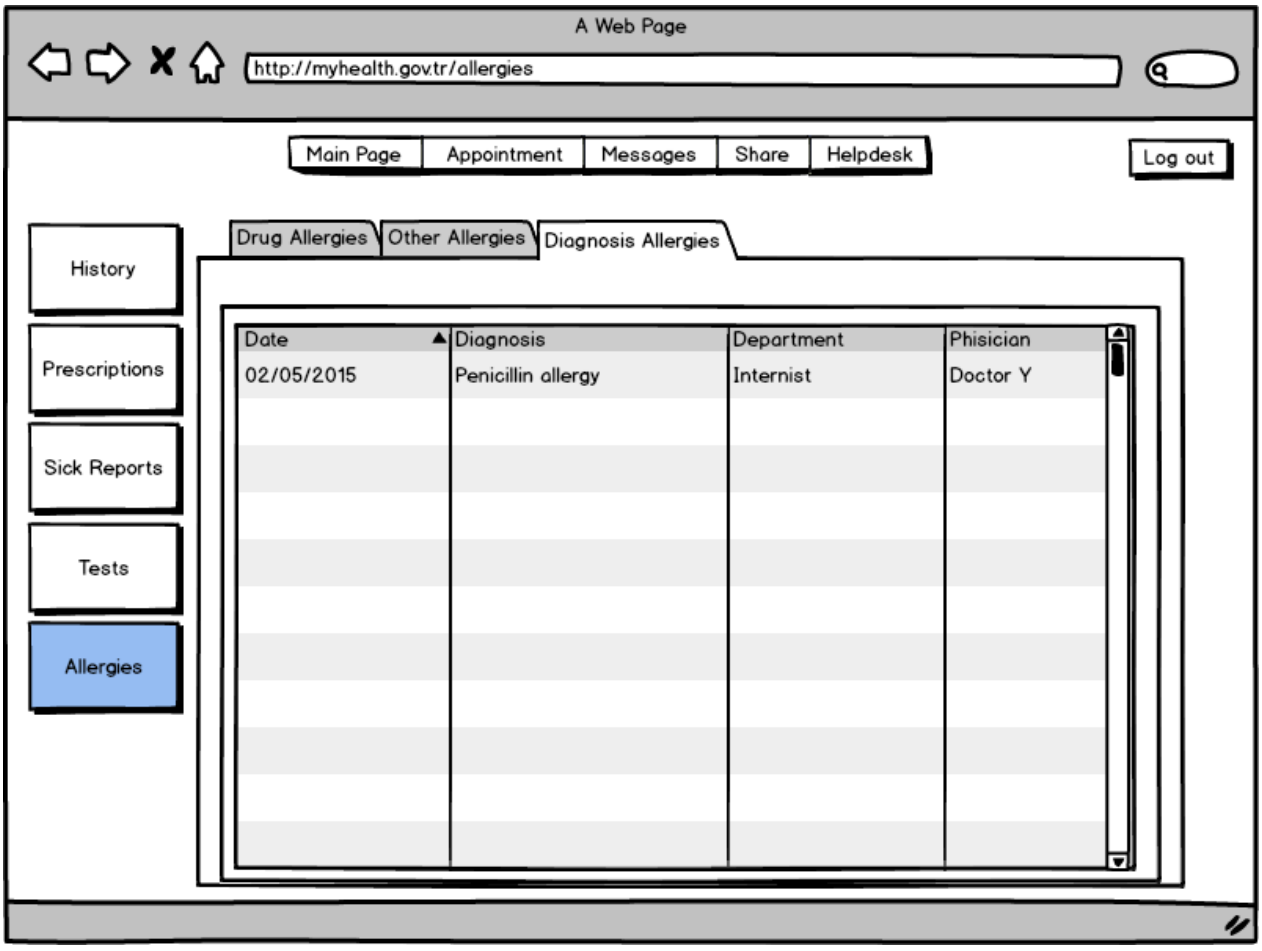


Figure 19 –Allergies Page - Onur Alper Unur

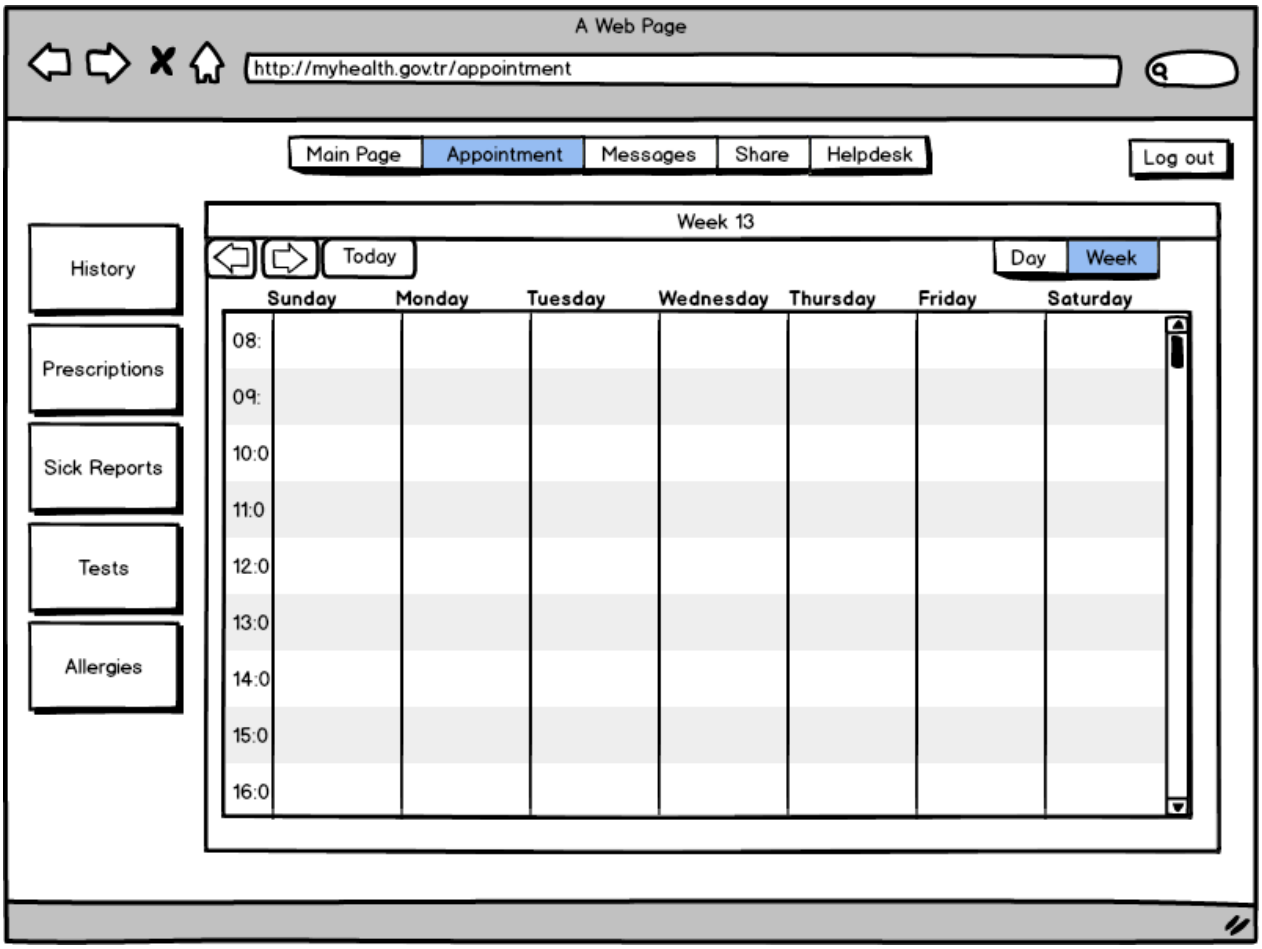


Figure 20 –Appointment Page - Onur Alper Unur

10- Appointment Page 1

1 Brief Description

The appointment page 1 is the page which shows to user that basic calendar to choose a date for appointment. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user calendar with the following capabilities.

a. Week view: Week view button for calendar functions
b. Day view: Day view Button for calendar functions
c. Months: Month transitions in calendar as basic calendar function

2.1.2 User's clicks a convenient date and time in the calendar

2.1.3 The system asks to user that chose a family physician or hospital.
This information asking to the user with separate screen (see 3.1) And also here the back previous screen button provide to user from the system.

2.1.4 The user chose a institution which will visit for treatment.
The system led the user to appointment detail page (see 6.1)

2.2 Alternative Flows

This use case has not any alternative flow.

2.3 Exceptional Flows

This use case has not any exceptional flow.

3 Special Requirements

3.1 Alert screen will show with the pop-up screen.

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User pick the date and time for health visit

5.2 User pick the institution to visit

6 Extension Points

6.1 11 – Appointment Page 2

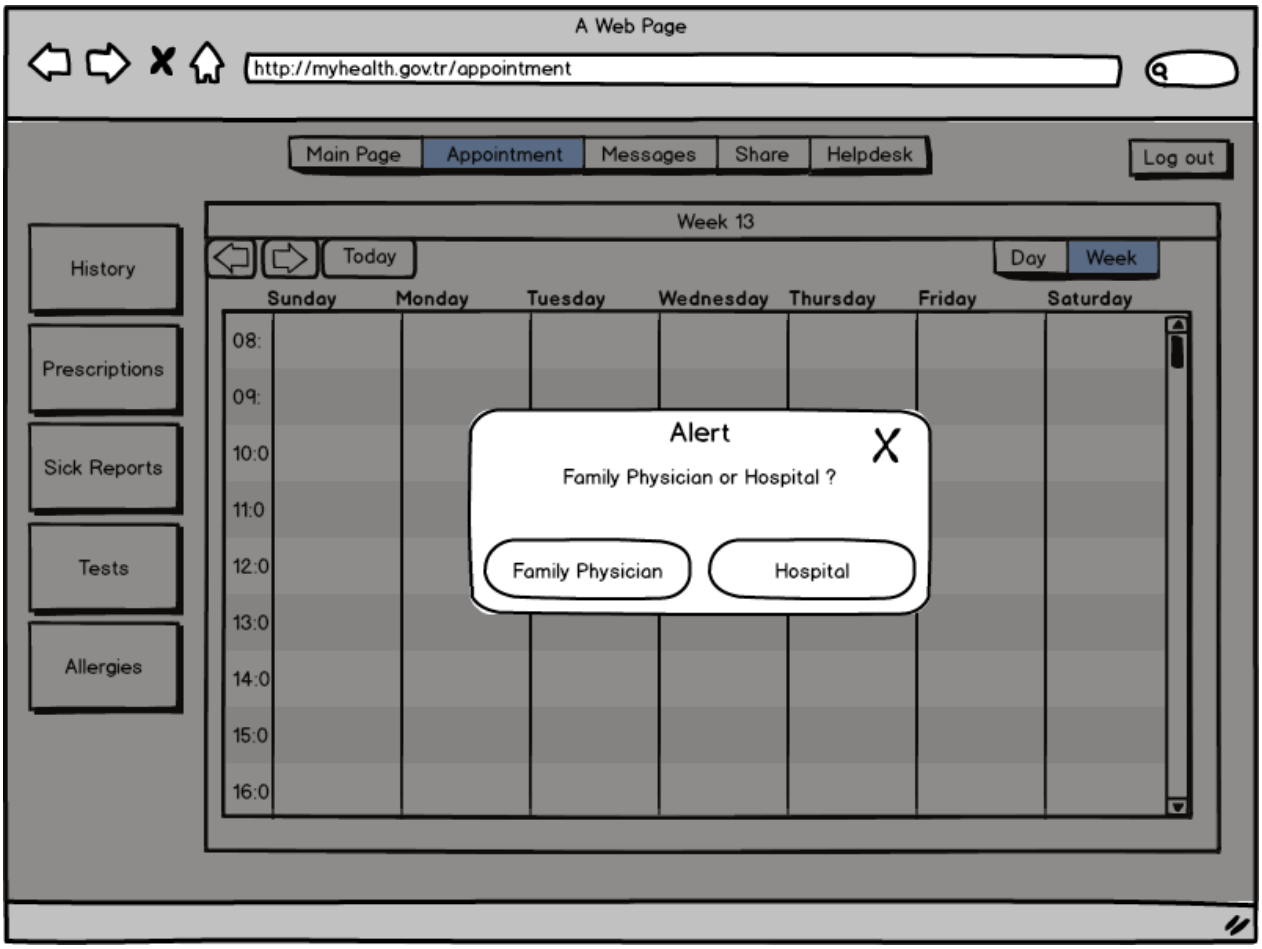


Figure 21 –Appointment Page 2 - Onur Alper Unur

11- Appointment Page 2

1 Brief Description

The appointment page 2 is the page which asks to user detailed appointment information. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user appointment detail page with the following fields.

a. Small Calendar: Small calendar with the day view.
b. Health Institution Field: In this field, all of the institutions show to user according to the user profile's city information.
c. Department Field: Departments shows to user according to the institution information.
d. Appointment Date: Date information which defined in appointment main page. User can also change this information.
e. Appointment Time: Time information which defined in appointment main page. User can also change this information.
f. Available Doctor Lists: Available doctors show to user according to date/time criteria.
g. Map Information: Institution's map information has shown here.
h. Address Label: Institution's address information has shown in this field.
i. Save Button: The button for submission of appointment.

2.1.2 User fill-in all fields and click the submit button.

2.1.3 The system check information and alerts to user about application is completed

The appointment is saved in the relevant part of calendar in the appointment page and the system led the user to main appointment page

2.2 Alternative Flows

This use case has not any alternative flow.

2.3 Exceptional Flows

This use case has not any alternative flow

3 Special Requirements

This use case has not any specific requirement

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User applied for appointment

6 Extension Points

This use case has not any extension point.

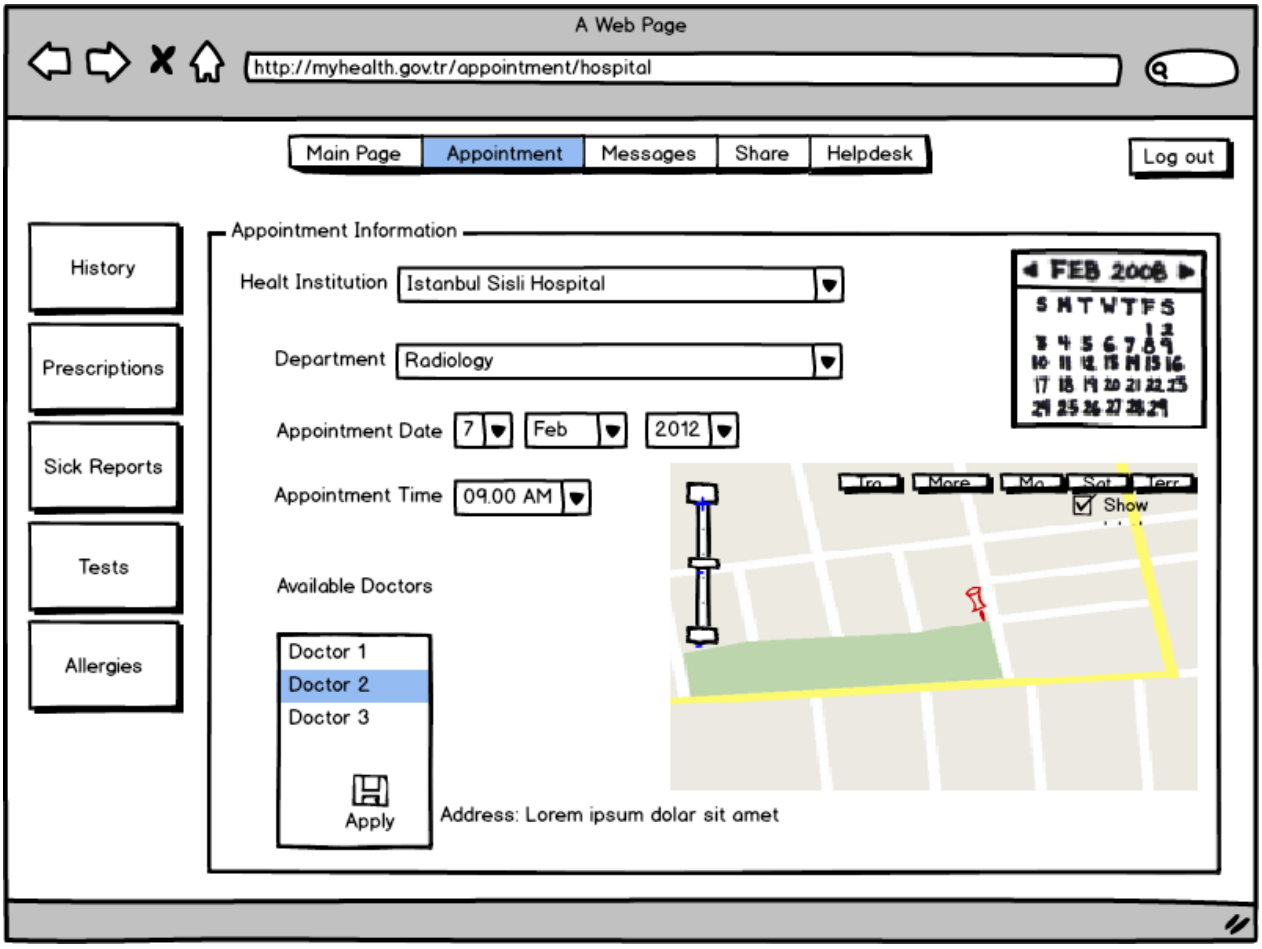


Figure 22 –Appointment Detail Page - Onur Alper Unur

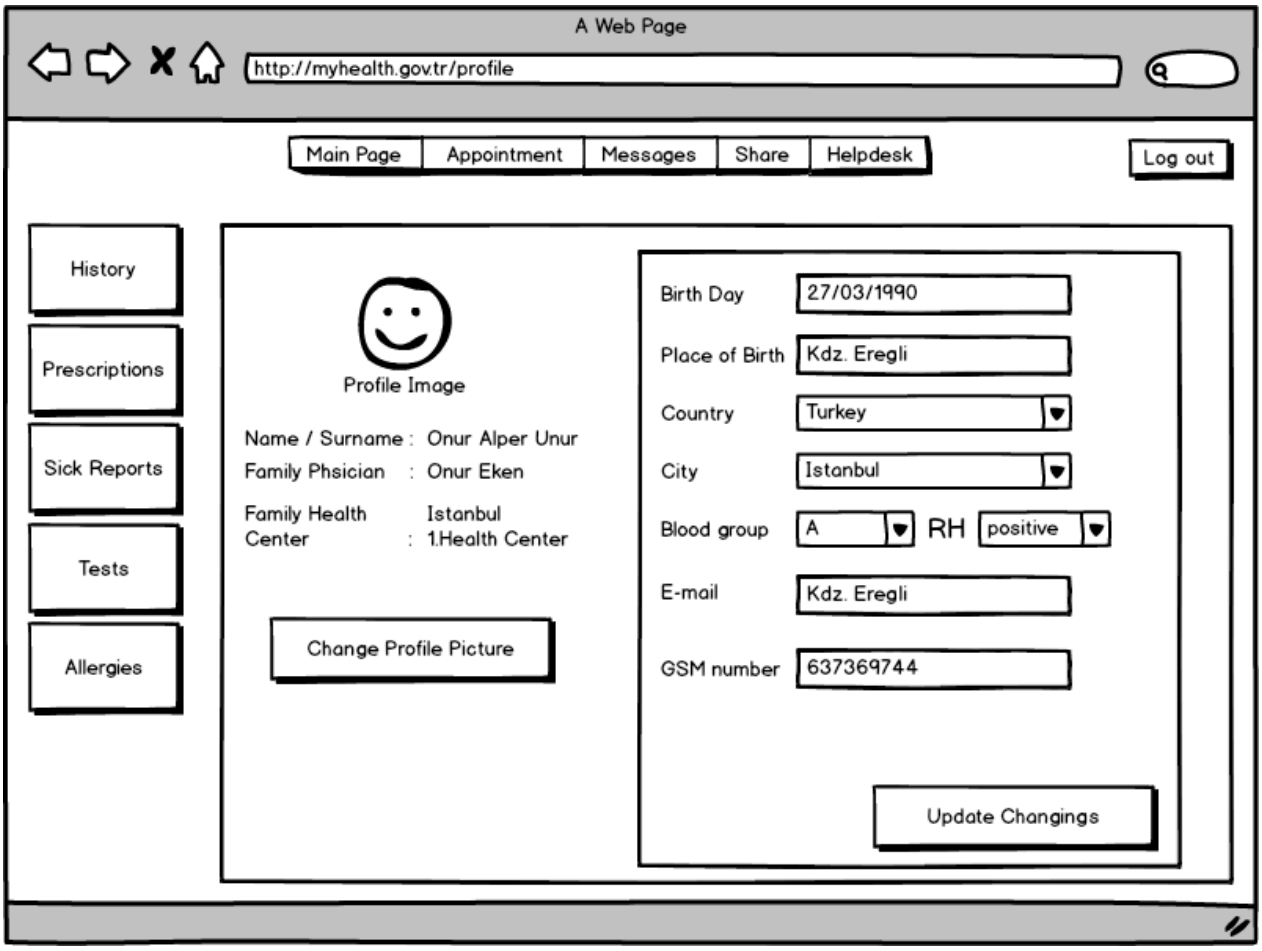


Figure 23 –Profile Page - Onur Alper Unur

12- Profile Page

1 Brief Description

The profile page is the page which shows to user that profile information of user. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to user that profile screen with the following information.

a. Information Field
   i. Profile Picture: User's profile picture
   ii. Name/Surname: User name and surname information
   iii. Family Physician: User's family physician's name
   iv. Family Health Center: User's declared family health center
   v. Update Image Button : update button for request image changing
b. Update Information Field
   i. Birthday: Birthday data field.
   ii. Place of Birth: Birth place data field.
   iii. Country: Current country data field
   iv. City: User's city data field.
   v. Blood group: User's blood group declaration field
   vi. E-mail : e-mail of user
   vii. GSM number: phone number of user
   viii. Update Changing Button: update button

2.1.2 The user change own information and click update changing button

User's empty declarations for some or one field explaining in 2.2.1. The users update request for profile image flow explaining in 2.2.2.

2.1.3 The system saves user information and update profile information of user.

2.2 Alternative Flows

2.2.1 User's empty declarations for some or one field

The system alerts the user for declaration of all fields and doesn't do anything (see 3.1).

2.2.2 The users update request for profile image

2.2.2.1 The system asks to user for choosing image from user's desktop

2.2.2.2 The user chooses a picture and click submit button

2.2.2.3 The system submitting and changing the profile image of user (see 3.2).

2.3 Exceptional Flows

2.3.1 Users empty declaration about allergy type, name field and indicators field.
The system alerts to user for entrance data to all fields and doesn't do anything.

3 Special Requirements

3.1 System alert have to be shown in pop-up screen.

3.2 The profile image of user's can't be bigger than 2 MB.

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User changed the profile information

5.2 User changed the profile image

6 Extension Points

This use case has not any extension point.

13- Messages Page

1 Brief Description

Messages page is the page which shows to user that messaging screen. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows main messaging screen with the following fields and list messages under the message list field.

a. Inbox (default)
b. Sent
c. Create New Message Button
d. Message List Field

User click in Sent flow is explaining under 2.2.1, User click on create a message flow is explaining under 2.2.2.

2.1.2 User Click a message for see that message details

Message details includes following fields.

a. Subject
b. Sender
c. Message
d. Text box for answering message
e. Send Button

2.1.3 User writes a reply message to another user and press the send button

2.1.4 The system informs user that message sent.

2.2 Alternative Flows

2.2.1 User click in Sent

2.2.1.1 System shows to user following information on the separate screen with the back button (see 3.1).

2.2.1.2 The system informs the user that message sent and led the user in the main message screen (see 6.1)

2.2.2 User click on create a new message

2.2.2.1 System shows to user following fields on the separate screen with the back button (see 3.1).

i. Recipient
ii. Subject
iii. Text Area
iv. Send Button

2.2.2.2 User fills these fields and pressing on send button.

2.2.2.3 The system informs the user that message sent and led the user in the main message screen (see 6.1)

2.3 This use case has not any alternative flow.

3 Special Requirements

3.1 Detail information and share page will show with the pop-up screen.

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User saw messages list..

5.2 User saw that message detail.

5.3 User replies the message.

5.4 User created the new message.

6 Extension Points

This use case has not any extension point.

14- Help Desk Page

1 Brief Description

The help desk page is the page which shows to user that information book about system processes. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 System shows to *information book* with the following capabilities (see 3.1).

2.2 Alternative Flows

This use case has not any alternative flow.

2.3 Exceptional Flows

This use case has not any exceptional flow.

3 Special Requirements

3.1 Information book presents with intelligent pdf reader component.

4 Preconditions

4.1 User should login the system.

5 End State

5.1 User sees that information book.

6 Extension Points

6.1 This use case has not any extension point.

15-User Logout Page

1 Brief Description

User logout page is the page which provides to user that exit from the system. Actors of this use are system users.

2 Flows

2.1 Main Flow

2.1.1 User clicks the logout button.

2.1.2 The system asks to user about ‘are you sure to go’ with an alert.

2.1.3 User is press on the yes button and log out from the system
Users click on back button, explaining in 2.2.1

2.2 Alternative Flows

2.2.1 Users click on back button
The system led the user to main screen of the system (see 6.1).

2.3 Exceptional Flows
This use case has not any exceptional flow

3 Special Requirements

This use case has not any special requirement.

4 Preconditions

4.1 User should be login to system.

5 End State

5.1 User exists from the system.

6 Extension Points

6.1 3- Home Page

5. Conclusion

In this thesis, contextual design methodologies used by the author to create the e-health application model for Turkey as an example. This methodology provide to author to detailed system requirement specification. In the concept of contextual design, several techniques used to description of the system such as use cases and user interface mock-ups.

In the literature part e-governance services maturity model examined to discover Turkish services' level of maturity according to the common maturity model. And health services importance defined with the several works about health topic. Due to develop a citizen –centric valuable e-health application for Turkey and contribute to value on Turkish health information systems to increase Turkey's e-governance applications maturity level, Turkish current health services examined by the author to create understanding for Turkish health service's infrastructure.

End of analyze chapter of this research, author developed a citizen – centric e-health application model for Turkey. With this model, citizens can see historic reports, prescriptions and tests with this system and its useful feature for public awareness and society's welfare. With the increasing demand of the citizens from government, this application provides more transparent service. Citizens also can arrange appointment on this system with the more efficient and understandable way.

Answers of research questions are;

How to identify the e- health information system's infrastructure?

- What are the current distributed health information systems of Turkey?
- What is the Turkish health information applications and services infrastructure?

With the analyzing e-governance service's maturity model and analyses of Turkish health infrastructure provided to author various understanding about e-governance applications and Turkish e-governance services which are already provided. Turkish health services have gathered under the one main infrastructure which as Health-Net (Saglik-Net in Turkish). This main infrastructure has several information systems such as National Health Information System (NHIS), Family Medicine Information System (FMIS), Centralized Hospital Appointment System (CHAS), Basic Health Statistics Module (BHSM), Core Resources Management System (CRMS) and the E-prescription System. Some of useful services which contribute a much value on this infrastructure are Health Coding Reference Server (HCRS) [6], National Health Data Dictionary (NHDD) [5] and Decision Support Systems. Additionally Saglik-Net infrastructure has seamless integration with e-prescription system of Turkish Social Security Institution.

How to contribute more value to the current health system for increase society's welfare and increase e-governance service's maturity level?

- What are the new system infrastructure and stakeholders?
- What are the new system's and user interfaces?
- What is the new system's contextual model?

To increase the maturity level of the governance services of Turkey, interaction based applications should develop by the government. Turkey, currently provides range of information system, however they can just provides static information to user or basic questioning. Therefore, Turkish e-governance services should provide the interaction features to user. And this way could solve with user-centric valuable services which uses those gathered data with usable information systems. Contextual design (CD) is a customer-centered design approach to describe a system in a simple and understandable way. With contextual design methodology, early development of system can complete successfully. UML use cases and mock-ups are two major components of contextual design. The author has examined these two main components of contextual design to disclose system processes and to create an understandable view to system development. Use cases and mock-ups also used in the development phase of the application model.

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