REQUIREMENT ANALYSIS REPORT

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1 Introduction

1.1 Background Information

In accordance with the development of the technology in the direction of mobile platforms, smart devices are introduced to users which enables people use their mobile phones for too many applications. Most of these applications are based on Bluetooth and Java technology. Taking in account these fields, we decided to integrate this technology to facilitate health sector. With the support of Turkcell we will make a communication between doctors and patients immediately. Therefore, we wanted to make possible that people could be able to get health service whenever and wherever they want using their mobile phones.

1.2 Project Title

Our project is named as Turkcell Health Service.

1.3 Project Purpose

THS is a service that enables

- Patients to access doctors 7/24 and vice versa
- Chronic patients to be controlled via a device
- Patients to be alarmed to take their medicine

1.4 Project Scope

THS will be a modular product and we will develop it using Turkcell API, J2ME, JSP-Servlet, and MySQL. *THS* includes following features:

- Mobile consultation using 3G service

  Subscriber can access to the doctors which are provided by this service 7/24. This service will provide some specific medical monitoring devices which monitors heart rate, ECG, Blood pressure Heart rhythm regularity etc. and send this information to an

application running on a mobile phone via Bluetooth, then application sends this information to health service database provided that doctor needs while appointment. The system provides also a web page to doctors which include detailed information of patients. Doctors can write out the prescription which will be sent to social security institution.

- Tracking service

  Chronic patients are controlled with a device which patients should use 7/24. If the measurements of the patients exceed critical regions, service will inform doctor and person who is selected by patients before, about patient's exact location and these measurements.

- Alarm Service

  This service provides an alarm mechanism which will inform the patients about his/her medicine to be taken when its time comes. This service also sends a SMS which includes the menu of his/her diet in each meal a day.

1.5 Definitions, Acronyms & Abbreviations

THS: Turkcell Health Service

DD: Democratic Decentralized

SMS: Short Message Service

3G: Third Generation

GPRS: General packet radio service

1.6 Team

1.6.1 Structure

Our team has “Democratic Decentralized (DD) “structure. We do not have a permanent team leader. Every decision is made by team consensus.

Ground rules of our team are:

- Every Wednesday a meeting must be held and everyone must be on time.
- If somebody cannot come to the meeting, he must have an excuse.
- The given responsibilities in ex-meeting date should be completed until the next meeting date.
- Every team member should check his mail every day.
- Emergency meetings are done according to team consensus.

1.6.2 Member Roles

- Abuzer Miraç ÖZCAN Time Keeper
- Faruk YILMAZ Initiator, Optimist
- Birkan PALA Devil’s Advocate

1.7 Process Model

Our team is supposed to progress through analysis, initial design, detailed design, release of prototype, implementation, testing and maintenance phases in a limited time. Although we are going to try our best not to encounter problems during the project, there is always a possibility of not being able to complete the project owing to the existing risks.

Therefore, the first goal of our team is being successful in the release stage of the prototype. As process model of our project, we prefer to use ‘Spiral Model’. This model couples the iterative

natural of prototyping with the controlled and the systematic aspects of linear sequential model. The Spiral Model provides us with the chance of developing software in a series of incremental releases. As a start, we design the project only on paper and develop it phase by phase. By the linear sequential model property of Spiral Model, at every phase, we study on our task regions and analyze the software design again according to feedback from our assistant Ahmet KETENCİ. By this methodology, we better understand risks at each development step of large-scale software. Technical risks are considered at every stage of the project and can be reduced before become problematic for us.

2 Research

We have conducted a wide research on two main fields. Firstly we have conducted a market research on the mobile applications similar to our product, and also health services that we can get inspire or ideas. Second part of our research was technological research which helped us to decide on which platform, technologies, APIs and libraries we will use.

2.1 Market Research

2.1.1 Sprint Introduces a Mobile Solution for Healthcare:

Sprint today introduced a mobile computing solution designed to improve patient care and make hospitals more efficient. The solution gives physicians remote access to critical patient information via virtually any wireless and Web-enabled device, allowing doctors to more frequently monitor a patient's status – and even make changes to a patient's orders – without having to physically be in the hospital. The solution has the ability to notify a doctor if a patient's vital signs fall below a pre-determined level set by the doctor. This allows doctors to be immediately notified of a potentially life-threatening situation, regardless of whether they are at home or even out to dinner. Sprint's mobile computing solution transmits text- and graphics-based messages to physicians using Sprint Web-enabled PCS phones, the Handspring Treo 300, wireless and Web-enabled Personal Digital Assistants (PDAs) such as the Palm and HP iPaq, and laptop computers. In addition to improving the real-time access to data that can improve the quality of patient care, Sprint's mobile computing solution also helps hospitals greatly reduce

staffing costs by making doctors and staff more efficient. With immediate access to important patient medical information via a single hand-held device, doctors can make critical decisions and relay them quickly to attending nurses and staff.

2.1.2 NCR Mobile Healthcare Solutions:

NCR's suite of mobile self-service healthcare applications helps you streamline operations and strengthen patient connections by enabling transactions on any hand-held device. Patients can choose to receive appointment reminders, pay bills or view lab results securely and conveniently by opting-in through the online NCR Patient Portal.

2.1.3 Telcomed Comprehensive Wireless Wearable Home Care Solutions:

Aim is to enable people to receive clinical grade medical monitoring wherever they may be located. And to do this in a way that fits seamlessly into both the patient's lifestyle and the physician's workflow.

2.1.4 Allegro Mobile Solutions:

Allegro's mobile healthcare applications can be fully integrated with virtually any back-end enterprise application or database enabling centralized control and the ability to incorporate multiple functionalities on a single handheld device. Applications enable you to effectively manage patients, staff, and resources, delivering high quality care and significantly reducing operational costs.

2.2 Technology Research

2.2.1 Platforms of Development

2.2.1.1 Mobile Application

Before we had decided on our project, we had to conduct a field research about the platforms that we would develop on. After some amount of research we finally come up with four alternatives:

1. Windows Mobile

    - C++ or .NET
    - Free distribution, just like normal applications or through market
    - Windows PC is needed to develop
    - Proprietary

2. Android

    - Java
    - Through Android Market ($25 one-time fees) or like normal applications
    - The platform is completely open source

3. iPhone

    - Objective-C or Java (Developing iPhone Applications using Java)
    - Through iPhone Market ($99/year fees)
    - Mac (Mac OS) is needed for development
    - Proprietary

4. Java

    - J2ME or JavaFX
    - Largely open source

- Portability across a variety of devices
- Support for mobile databases and server products
- Offer a wider selection of add-ons and development tools

The above technical facts have been very effective while taking our decision. The following features also exist in J2ME:

- Alone among all the current technology, and because of its modular approach to targeting small devices, Java ME (J2ME) has positioned itself as the **best solution for an extremely wide range** of small devices. With some incremental learning, a single java developer can **quickly master coding conventions from smart cards all the way to high powered devices** like set-top boxes and high end PDAs.
- The huge and fast growing base of java developers worldwide provides a **ready resource** for creating Java ME (J2ME) apps.
- Java ME (J2ME) promises developers and companies' **portability across the widest range of devices** imaginable. Profiles target specific devices, but portability is maintained to some extent across configurations.
- Java ME (J2ME) on handsets like cell phones is **supported by ALL the major carriers** (including Verizon Wireless, which had previously been a BREW-only supporter), unlike its competitors like BREW and Microsoft technologies.
- Java ME (J2ME) on handsets is **strongly pushed by ALL the major phone vendors** (Nokia, Motorola, Sony-Ericsson, etc), unlike partial competitors like BREW (which is not supported by the major phone vendors because they have their own competing OS called Symbian) or the competing Microsoft technology (which is a fringe player at best).

These above reasons led us to the decision of J2ME.

2.2.1.2 Application Server

1. Java application servers

The web modules include servlets and JavaServer Pages. Business logic resides in Enterprise JavaBeans (EJB-3 and later). The Hibernate project offers an EJB-3 container implementation for the JBoss application server. Tomcat from Apache and JOnAS from ObjectWeb exemplify typical containers which can store these modules.

A Java Server Page (JSP) (a servlet from Java) executes in a web container — the Java equivalent of CGI scripts. JSPs provide a way to create HTML pages by embedding references to the server logic within the page. HTML coders and Java programmers can work side by side by referencing each other's code from within their own. JavaBeans are the independent class components of the Java architecture from Sun Microsystems.

2. Microsoft platform

Microsoft has contributed the .NET Framework to the world of application servers. .NET technology includes the Windows Communication Foundation, .NET Remoting, ADO.NET, and ASP.NET among several other components. It works with (or depends upon) other Microsoft products, such as Microsoft Message Queuing and Internet Information Services.

3. Zend platform

Zend offers an application server called Zend Server — used for running and managing PHP applications.

These above reasons led us to the decision of Java application servers, specificly JBoss.

2.2.2 Programming Languages

2.2.2.1 Mobile Application

When we look at all the possible technologies, libraries, platforms that we will use in our project; we have seen that the most convenient programming language is Java. Because J2ME includes a set of core libraries that provides most of the functionality available in the core libraries of the **Java** programming language, all these reasons led us to use Java language as our

applications default developing language. And also we will develop our mobile application *THS* in NetBeans environment.

2.2.2.2 Server-Side

As we mentioned before our project *THS* will have a simple web interface for doctors and patients. For this purpose we needed to search for current web developing languages and frameworks. At first glance we have the following options:

- PHP
- Java
- ASP

2.2.2.2.1 PHP

PHP is very common in today's web market. Most of the web applications today are developed with PHP and its various frameworks.

Advantages:

- PHP is very popular along web developer
- Easy to code
- Easy to find code samples on web, because PHP is open source

Disadvantages:

- PHP seems to be popular among hackers and hobbyists, which is a bad reputation
- PHP has a confusing and inconsistent class/object system

2.2.2.2.2 Java

Java is another option for server-side development,

Advantages:

- Leads ‘enterprise’ tools and in general has better support for web services and other connectivity mechanisms.
- Maturated and advanced in last 3 years
- Easy to detect errors while coding
- Open source

Disadvantages:

- Edit / compile / loop timeframe in Java tends to be slower
- Java is complex
- Big apps eat huge amounts of memory

2.2.2.2.3 ASP

Microsoft's Active Server Pages is widely supported in many web applications as well. Below advantages and disadvantages of ASP can be seen.

Advantages:

- Easy to program
- There are many web sites and books about ASP with lots of free code
- Well integrated components

Disadvantages:

- Too much dependency on Microsoft
- Poor performance in big projects
- Connection to database is expensive as MS-SQL is a product of Microsoft that needs to be purchase

As a result, after the research we have conducted on server-side coding; we decided on using Java, because it seems to be more convenient for our project.

2.2.3 Database Management

2.2.3.1 Oracle

Advantages:

- Runs on many platforms.
- For very complicated store procedure, it runs faster.
- Have many advanced functions such as Real Cluster, Flush back recovery.

Disadvantages:

- Oracle DBA and developer cost higher to hire and train.
- Not convenient for small applications/projects.

2.2.3.2 Ms SQL

Advantages:

- Faster for big projects
- More resistant to data corruption due to the binary log keeping

Disadvantages:

- In order to have full performance, powerful hardware is required.
- Only runs on Windows.
- Expensive

2.2.3.3 MySQL

Advantages:

- Is not always free but very cheap
- Has pure performance due to its default table format MyISAM
- Binding with too many programming languages

Listing all pros and cons of these 3 database servers, we decided to use MySQL due to its compatibility with Java and much more advantages over other servers.

3 Requirement Analysis

3.1 System Requirements

3.1.1 Hardware Requirements

Considering our project, strictly defining hardware requirements is not wise. By the time as our number of users increase, our hardware requirements will change. As a baseline, we need a single Pentium 4 computer with 1 GB of ram. Nevertheless, as the number of users increase some enhancements on hardware configurations must be considered:

- Moving to a multi-processor and vast memory (both ram and durable storage) server
- Creating a clustered server architecture

3.1.2 Software Requirements

- Windows or Linux operating system
- IIS or Apache(depending on operating system)
- JBoss
- J2ME
- Java Virtual Machine
- MySQL Server as DBMS

3.1.3 Development Environment Requirements

- NetBeans IDE
- MySQL Administrator

3.2 Functional Requirements

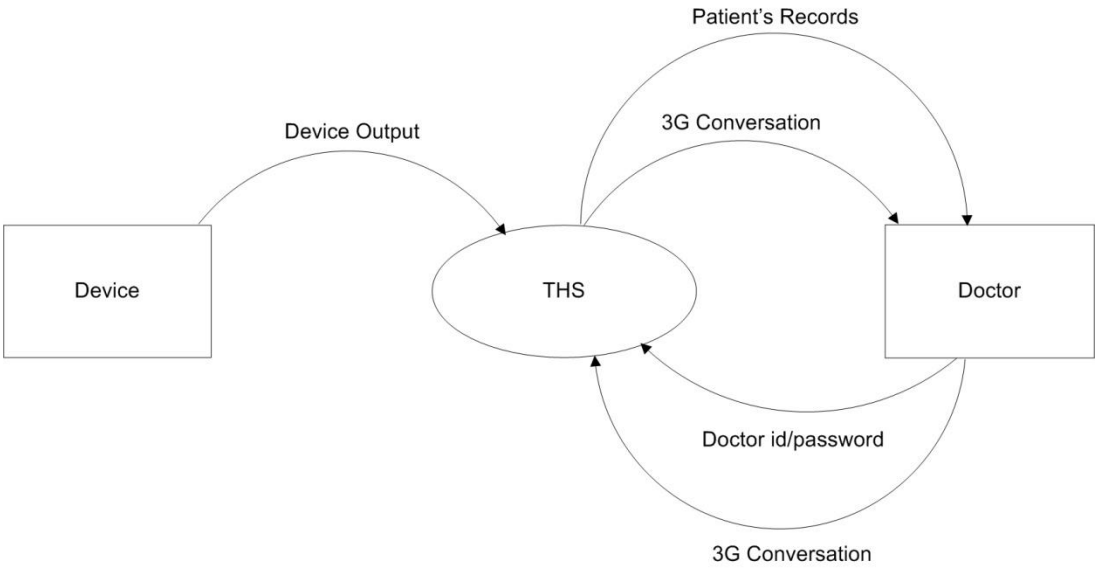
THS user could be able to communicate each other. Patients could be tracked for emergency situations and they can set up an alarm to be reminded about their diet and medicines. Capabilities of *THS*, what it can do are listed in detail in 4.3 Use Case Scenarios part.

4 Modeling

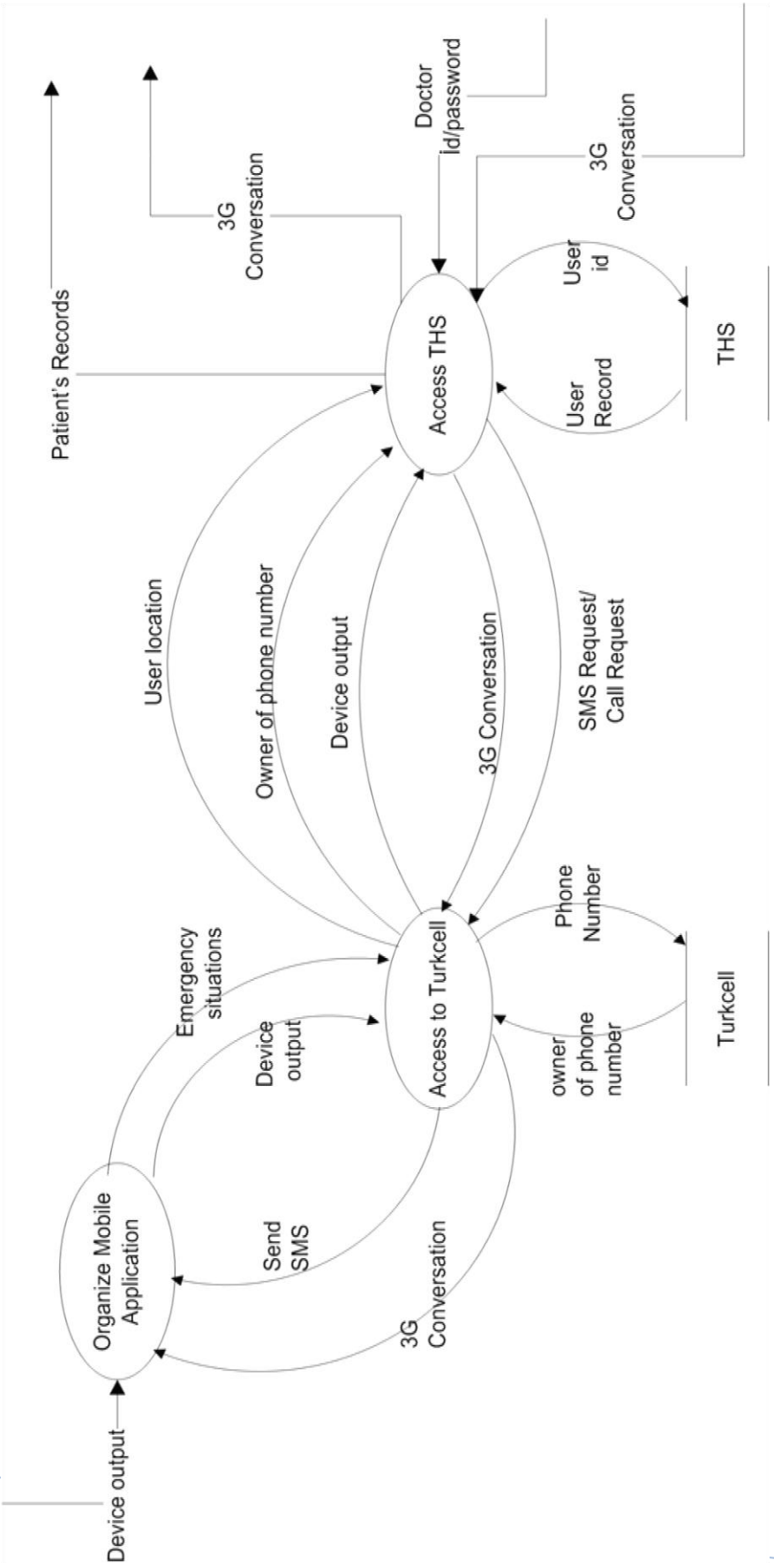
4.1 Functional Modeling

4.1.1 Data Flow Diagrams

Level 0 DFD: THS Project



Level 1 DFD: THS



4.1.2 Data Dictionary of Data Flow Diagrams

Name	Device Output
Input to	Organize Mobile Application
Output from	Device
Description	Sends information to mobile phone via Bluetooth

Name	Emergency Situations
Input to	Access to Turkcell
Output from	Organize Mobile Application
Description	Send information to Turkcell Server

Name	Send SMS
Input to	Organize Mobile Application
Output from	Access to Turkcell
Description	Alarm SMS

Name	3G Conversation
Input to	Organize Mobile Application
Output from	Access to Turkcell
Description	Connection between doctor and patient

Name	Owner of phone number
Input to	Access to Turkcell
Output from	Turkcell Database
Description	Sends name of the owner of the phone number

Name	Phone number
Input to	Turkcell Database
Output from	Access to Turkcell
Description	Sends phone number

Name	User Location
Input to	Access THS
Output from	Access to Turkcell
Description	Sends patient's location

Name	Owner of phone number
Input to	Access THS
Output from	Access to Turkcell
Description	Sends name of the owner of the phone number

Name	Device Output
Input to	Access THS
Output from	Access to Turkcell
Description	Update patient's records

Name	3G Conversation
Input to	Access to Turkcell
Output from	Access THS
Description	Communication between doctor and patient

Name	SMS/Call Request
Input to	Access to Turkcell
Output from	Access THS
Description	Request to Turkcell for sending SMS and calling the relatives

Name	User Record
Input to	Access THS
Output from	THS Database
Description	Get the related information about patient

Name	User id
Input to	THS Database
Output from	Access THS
Description	Query user id

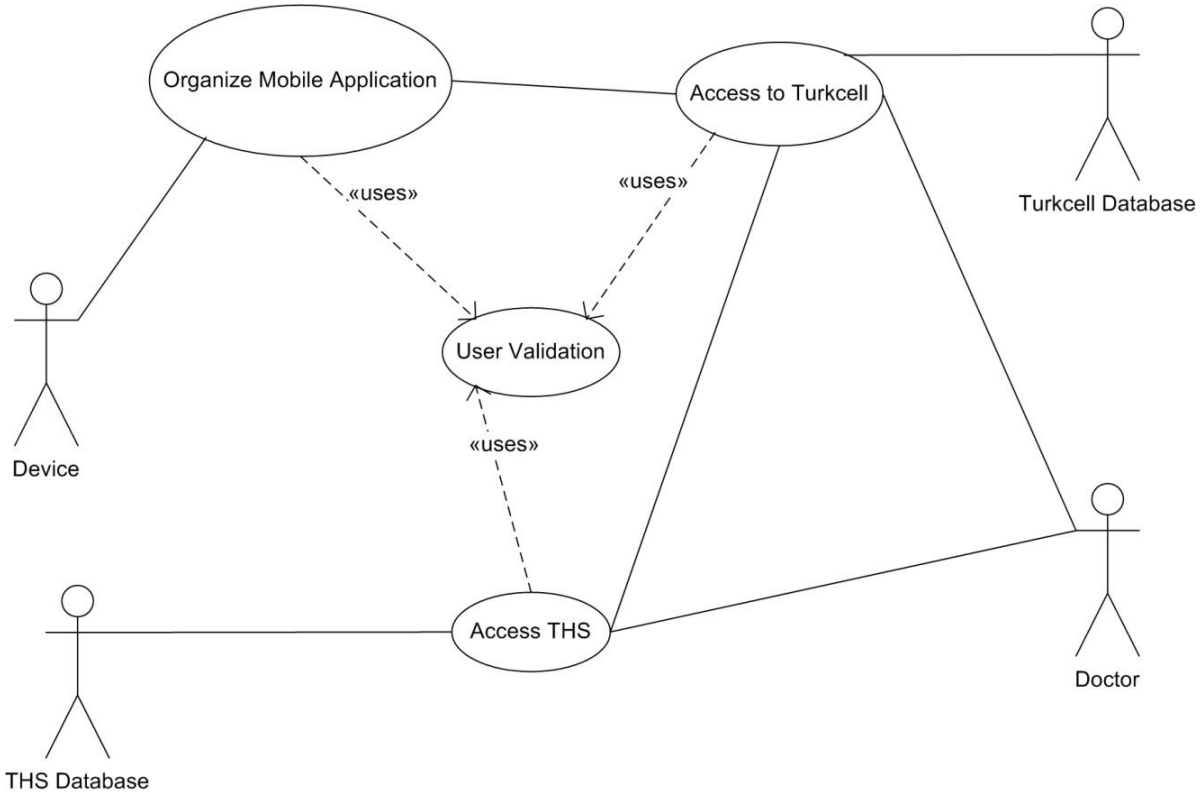
Name	Patient's Records
Input to	Doctor
Output from	Access THS
Description	Sends patient's information to doctor

Name	3G Conversation
Input to	Doctor
Output from	Access THS
Description	Communication between doctor and patient

Name	Doctor id/password
Input to	Access THS
Output from	Doctor
Description	Login the THS

Name	3G Conversation
Input to	Access THS
Output from	Doctor
Description	Communication between doctor and patient

4.2 Use Case Diagram



4.3 Use Case Scenarios

4.3.1 Use Case 1: Organize Mobile Application

This use case is for communication between special device and mobile phone.

Actors: Device used by patient

Pre-Condition: The user should subscribe THS.

Post-Condition: The connection is established between device and mobile application.

Basic Flow:

1. The user should start the mobile application.
2. Device will send test information to the mobile phone via Bluetooth.
3. After receiving mobile application will send this information to THS via Turkcell.

4.3.2 Use Case 2: Access to Turkcell

This use case is for communication between mobile application and THS via GPRS, 3G, SMS, etc. User id which is used for THS Database will also be sent to THS Server. In addition, it is used for video conversation between doctors and patients. Moreover this case is used for getting the location of users.

Actors: Mobile phone, doctors, patients

Pre-Condition: The user should subscribe THS.

Post-Condition: The connection is established between mobile application and THS or patients and doctors.

Basic Flow:

1. To communication between mobile application and THS via GPRS, 3G, SMS, etc. :

1.1. It will send the information coming from mobile application to THS and vice versa.

1.2. THS will send alarm SMS to the patient via Turkcell.

1.3. If necessary, it will call patient's relatives and emergency service.

2. It will find the user id of owner of the phone number and sends it to THS Server.
3. It will provide video conversation between patients and doctors.
4. If necessary location of the patient will be sent to THS.

4.3.3 Use Case 3: Access THS

This use case is responsible for keeping and updating the patients' records. It will also serve a web interface to the doctors. In addition, communication requests are sent in this case.

Actors: Doctors.

Pre-Condition: The user should subscribe THS.

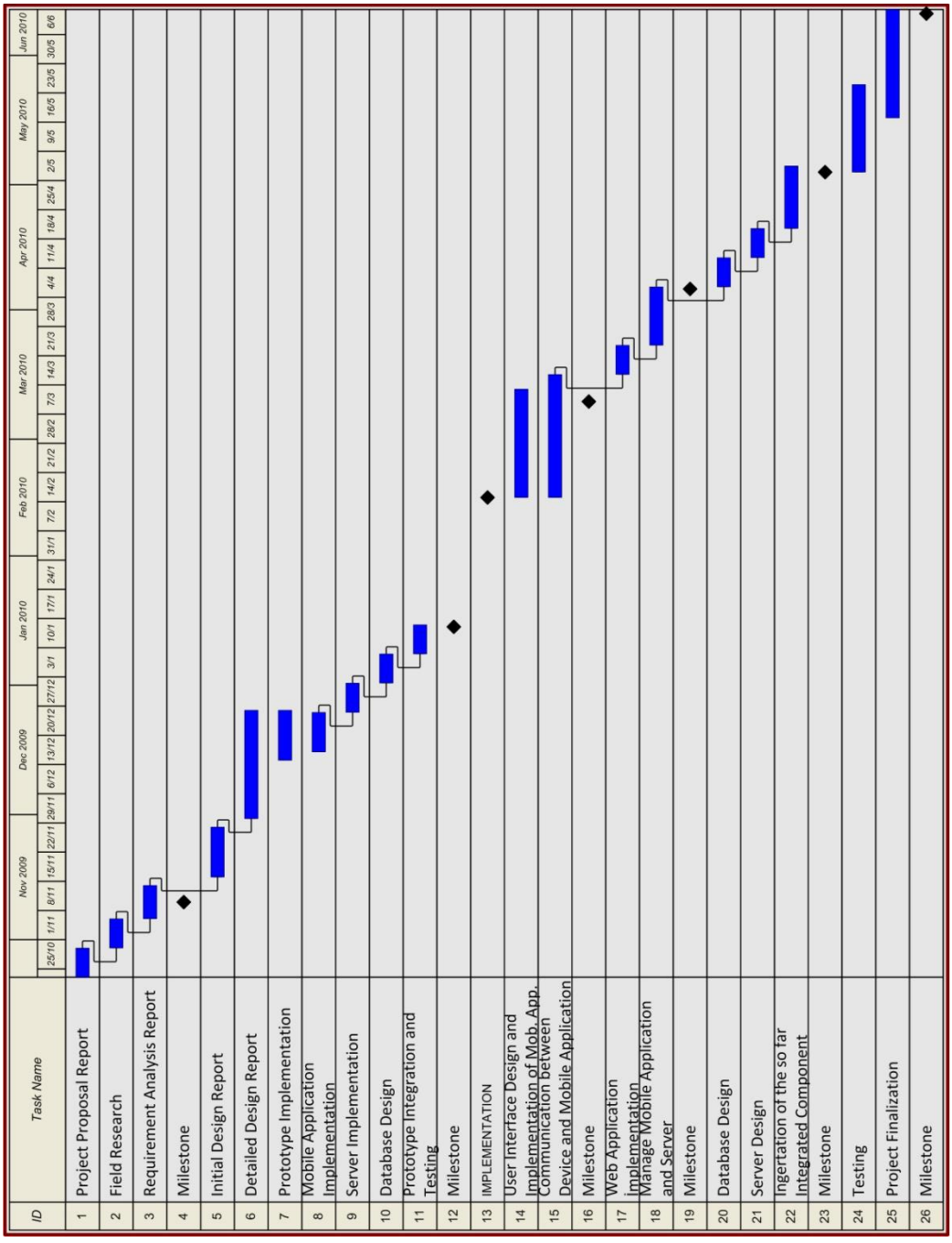
Post-Condition: The connection is established between doctor and Turkcell.

Basic Flow:

1. Keeping and updating the patients' records:
   1.1. It will keep the patients' records in THS database.
   1.2. It will update the records of patients according to the information which is measured by device. This information comes from Turkcell.
2. It will serve a web interface to the doctors. This web interface will include:
   2.1. Patients' information
   2.2. Video conversation service
   2.3. Alarm service
3. To send communication requests:
   3.1. If necessary send alarm SMS request to Turkcell.
   3.2. If necessary send emergency call request to Turkcell in order to call relatives.
4. It will arrange video conversations.

5 Project Scheduling

5.1 Gantt chart



6 Task Assignment to Each Group Member

In our project, each member is responsible for specific tasks as follows:

- Birkan PALA: Mobile application implementation.
- Faruk YILMAZ: Server implementations.
- Abuzer Miraç ÖZCAN: Database design and implementation.

Each member is responsible for detailing the above main tasks into minor tasks, distributing them to the group members and checking whether those minor tasks are done properly and in time.