

Software Requirements Specification

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METU - Department of Computer Engineering
CENG 491 Senior Design Project I
Fall 2015-2016

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1. Introduction

1.1 Problem Definition

There is no official mobile or computer application that Milli Piyango Institution put on the market that one can check his lottery results. Although there are some modest attempts to fill this gap by some software companies, they are unstable,unreliable and quite slow to response.

Our mobile application shall let the user to learn his lottery coupon results, namely; On Numara, Şans Topu, Süper LOTO, Sayısal LOTO, by just taking the picture of his coupon with his android mobile phone and set the draw date, then the application shall display his prize. The application shall be free to be downloaded from either a mobile phone application store or similar services.

Specifically, this product shall enable the user:

- to check his lottery coupon by just taking photograph of the coupon.
- to enter the coupon data completely by hand.
- to review the coupon data that is acquired from taken photograph and to change it manually or to give a chance to take another photograph of the coupon.
- to record a coupon before the draw and to be notified automatically after the draw via Push Notification feature.
- to inspect the taken coupon picture with matching numbers marked via Virtual Coupon feature.
- to check past one year's lottery results.
- to be provided with numbers via Random Number Generator based on past lottery lucky numbers statistics.

1.2 System Overview

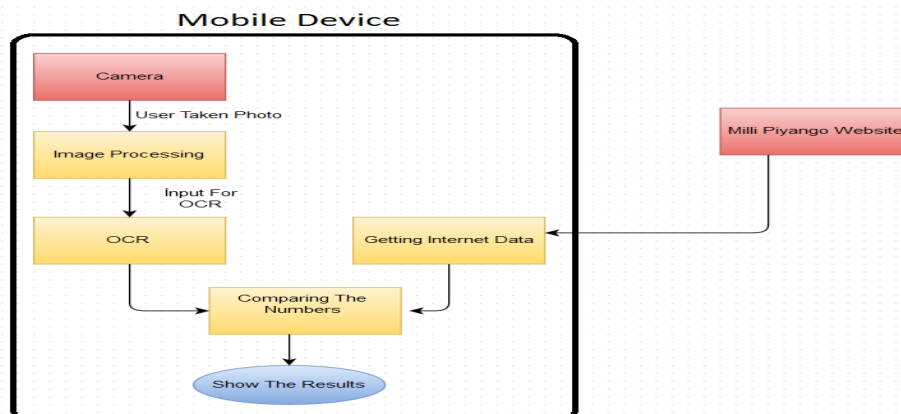


Figure 1 Rough System Architecture

- **Camera:** Camera of the android smart phone shall be used to take photograph, so non-android smart phones shall be out of the scope.

- **Image Processing**

Perspective Correction: Images acquired through cameras suffer from projective distortion, uneven lighting and lens distortion. We shall use methods to remove these effects/distortions for intelligent processing of images [3].

Line Detection: Line detection shall be used to extract logo and number block from lottery coupons. These cropped images shall be input for logo recognition and OCR operation.

Recognition of the lottery game: Application shall decide what type of lottery game it is queried via coupon's picture. These coupons are On Numara, Şans Topu, Süper LOTO, Sayısal LOTO, so Milli Piyango coupon shall be out of this application's scope.

- **OCR:** OCR (Optical Character Recognition) engines can convert a wide variety of image formats to text accurately. Four different types of font shall be trained for better character recognition. OCR shall be utilized to train the part of the coupon that contains the numbers played and to recognize the digits and characters in there.
- **Getting The Internet Data:** Application shall connect to Milli Piyango website and download the draw results.
- **Milli Piyango Website:** Milli Piyango Website is a server to obtain lottery results.
- **Comparing The Numbers:** Application shall compare the played numbers and the draw results.
- **Show The Results:** Application shall display the prize and the matching numbers on device screen with its user-friendly environment.

1.3 Assumptions and Dependencies

- Target platform should be only android smart phones.
- Types of coupons are On Numara, Şans Topu, Süper LOTO, Sayısal LOTO.
- There should be a stable Internet connection.
- Operating system of the device should be up-to-date.
- Smart phone should have modern RAM and CPU.

2. Overall Description

2.1 Product Functions

2.1.1 Use-Case Model Survey

Name	Generate numbers via Random Number Generator
Function	Generating numbers based on past lottery lucky number statistics
Actors	User, Mobile Phone

Name	Select How to Enter the Numbers
Function	Asking user to select how to enter the numbers

Actors	User, Mobile Phone
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Name	Take photo of the coupon
Function	Taking photograph of the lottery coupon
Actors	Mobile Phone, Camera

Name	Enter the numbers by hand
Function	Entering the numbers manually
Actor	Mobile Phone

Name	Image Processing of Photo
Function	Perspective Correction, Line Detection, Logo Recognition
Actor	Camera, OCR

Name	Recognize digits via OCR
Function	Converting numbers on image to text accurately
Actor	OCR

Name	Review the coupon data
Function	Reviewing the coupon data and letting to change data
Actor	

Name	Store the coupon info. via Push Notification
Function	Recording coupon's information before the draw and notifying automatically after draw
Actor	Milli Piyango Web Site

Name	Obtain Lottery Results
Function	Downloading lottery results from Milli Piyango

	Web Site
Actor	Milli Piyango Web Site

Name	Process to compare the numbers
Function	Comparing the coupon data and the draw results
Actor	

Name	Show the Results on Screen
Function	Displaying the prize to screen
Actor	

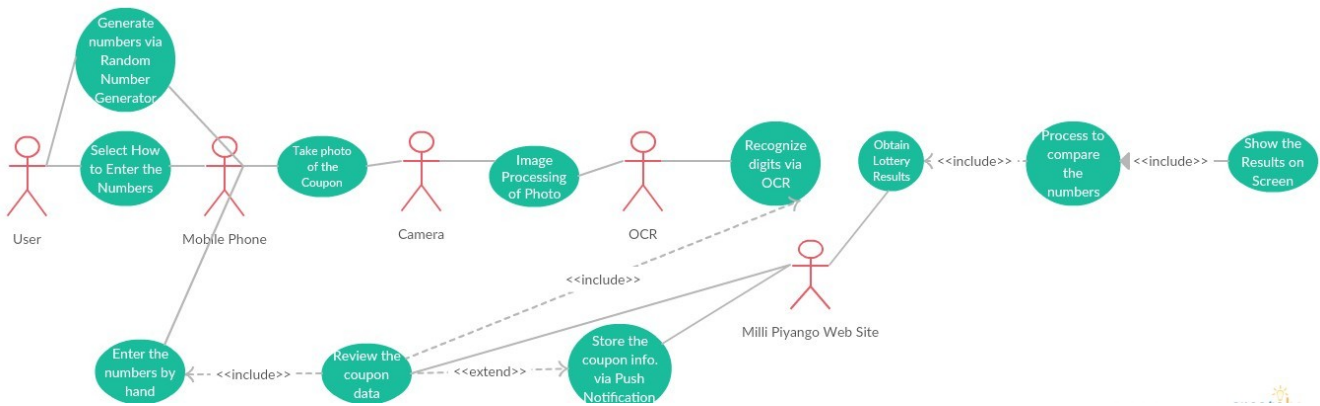


Figure 2 Entire Use-Case Model Diagram of the Product

2.1.2 Actor Survey

Name	User
Description	Starts the application.

Name	Mobile Phone
Description	Communicates with the user and manages the application.

Name	Camera
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Description	Takes picture.
Name	OCR
Description	Converts numbers on images to text.
Name	Milli Piyango Web Site
Description	Keeps lottery results.

2.2 Interfaces

2.2.1 User Interfaces

- **Entering Screen:**
 - Application shall display “Random Number Generator ” menu.
 - Application shall display “Past Lottery Results” menu.
 - Application shall display “Check Coupon” menu.
 - Application shall display “Exit” menu.
 - **Random Number Generator:**
 - Application shall display “Choose Game” menu.
 - **Choose Game:**
 - Application shall display “Game List” menu.
 - Application shall display “OK” menu.
 - **Numbers:** (*Generate numbers via Random Number Generator Use Case*)
 - Application shall display suggested numbers and past lucky number statistics.
 - **Suggest Another:**
 - Application shall display another set of suggested numbers and drawing statistics of these numbers.
 - **Lottery Results:**
 - Application shall display “Game List” menu.
 - Application shall display “Choose Date” menu.
 - Application shall display “OK” button.
 - **Lucky Numbers:**
 - Application shall display lottery results for chosen game and date.
 - **Check Coupon:** (*Select How to Enter the Numbers Use Case*)
 - Application shall display “Take Photograph” menu.
 - Application shall display “Virtual Keyboard” menu.
 - **Take Photograph & Virtual Keyboard:** (*Take photograph of the coupon & Enter the numbers by hand Use Cases*)
 - Application shall display the acquired coupon data.
 - Application shall display “Edit” menu.
 - Application shall display “Enter Date” menu.
 - Application shall display “Push Notification” menu. (*Store the coupon info. via Push Notification Use Case*)

Application shall display “OK” button.

- **Edit:** (*Review the coupon data Use Case*)
Application shall let the user to modify the acquired coupon data.
Application shall display “OK” button.
- **Results:**
Application shall display the prize. (*Show the Results on Screen Use Case*)
Application shall display “Virtual Coupon” menu.
Application shall display “Lucky Numbers” menu.
 - **Virtual Coupon:**
Application shall display the taken coupon picture with matching numbers marked.
 - **Lucky Numbers:**
Application shall display all the lucky numbers of this draw.

2.2.2 Hardware Interfaces

For the product to run, you shall need an Android device. To get accurate results, your device should have a high resolution camera. Also, since image processing is resource-hungry, your device should have modern RAM and CPU.

Since neither the mobile application nor the web portal have any designated hardware, it does not have any direct hardware interfaces. The physical camera is managed by the camera interface in the smart phone and the hardware connection to the Internet is managed by the underlying operating system on the mobile phone and the web server.

2.2.3 Software Interfaces

As it has already been stated, product shall run on only Android devices, so it shall not need any specific software from the user's side other than it. The mobile application communicates with the web server in order to get lottery results.

However, product shall depend on some libraries and tools to be developed. User interface module to be implemented shall interact with user and according to its input, shall activate image processing module. Image processing module shall be implemented with OpenCV libraries which prepares input for OCR operation. Tesseract OCR, which is Open Source free software, shall convert numbers on image to text accurately. Web module shall connect to Milli Piyango Web Site and shall gather related data. User interface module to be implemented shall display the results.

2.2.4 Communications Interfaces

As it has already been stated, Internet connection is obviously necessary for a complete operation but, you do not need any special configuration for your network adapter.

2.3 Constraints

The product does not support any operating system other than Android. Free, Open Source technologies shall be utilized in the development. The Internet connection is also a constraint for the application. Since the application fetches data from the the Internet, it is crucial that there is an Internet connection

for the application to function. Also, scope of application is limited to On Numara, Şans Topu, Süper LOTO, Sayısal LOTO.

A free OCR, namely; Tesseract OCR shall be utilized. Also, OpenCV library's free packages are highly utilized for image processing. The project shall be developed on Linux PCs mostly. OpenCV C++ and Code::Blocks shall be used to test image processing algorithms on PC. Java Eclipse with Android SDK, NDK, OpenCV, Tesseract OCR (Optical Character Recognition) shall be used for Android development.

3. Specific Requirements

3.1 Functional Requirements

ID: FR1

TITLE: Download mobile application

DESC: A user should be able to download the mobile application through either an application store or similar service on the mobile phone. The application shall be free to be downloaded.

DEP: None

ID: FR2

TITLE: Mobile application - Run

DESC: Given that a user has downloaded the mobile application, then the user should be able to run the mobile application.

DEP: FR1

ID: FR3

TITLE: Run – Opening Screen

DESC: Given that a user run the mobile application, then the first page that is shown shall be the opening screen.

Application shall display “Random Number Generator” menu.

Application shall display “Past Lottery Results” menu.

Application shall display “Check Coupon” menu.

Application shall display “Exit” menu.

DEP: FR2

ID: FR4

TITLE: Opening Screen - Random Number Generator

DESC: Given that a user has entered Random Number Generator menu in Opening Screen, then user shall be prompted to choose a game type.

DEP: FR3

ID: FR5

TITLE: Random Number Generator – Game Type

DESC: Given that a user chosen a game type, application shall display suggested numbers and past lucky number statistics for those numbers.

DEP: FR4

ID: FR6

TITLE: Opening Screen - Past Lottery Results

DESC: Given that a user has entered Past Lottery Results menu in Opening Screen, then user shall be prompted to choose a game type and after that a date in past one year.

DEP: FR3

ID: FR7

TITLE: Lottery Results - Game Type

DESC: Given that a user has chosen a game type and a date, application shall display lucky numbers of this draw.

DEP: FR6

ID: FR8

TITLE: Opening Screen - Check Coupon

DESC: Given that a user has entered Check Coupon menu in Opening Screen, user shall be prompted to enter the numbers by taking photograph of the coupon and by entering a virtual keyboard.

Application shall display "Take Picture" menu.

Application shall display "Virtual Keyboard" menu.

DEP: FR3

ID: FR9

TITLE: Take Picture – Camera

DESC: Given that a user has selected Take Picture menu, camera shall be activated and user should take a photograph of the coupon. To get the best results, environment should be bright, coupon should be undeformed. Taken photo shall be input for perspective correction.

DEP: FR8

ID: FR10

TITLE: Image Processing - Perspective Correction

DESC: Given that picture is taken, image processing unit shall be in charge. In first step, namely; in perspective correction step; projective and orientation distortion, uneven lighting, lens distortion, wrinkles and scars on image shall be fixed and the user shall be prompted for review.

DEP: FR9

ID: FR11

TITLE: Image Processing – Line Detection

DESC: Given that perspective correction on picture is completed, number block between two lines on coupon shall extracted and this block shall be fed into OCR and game logo shall be directed to Logo Recognition.

DEP: FR10

ID: FR12

TITLE: Image Processing – OCR

DESC: Given that number block between two lines on coupon extracted, OCR shall recognize the digits line by line and return them in a file for further action.

DEP: FR11

ID: FR13

TITLE: Image Processing – Logo Recognition

DESC: Given that logo above the upper line is extracted, game type shall be recognized via image's logo.

DEP: FR11

ID: FR14

TITLE: Virtual Keyboard – Select Game & Enter Numbers

DESC: Given that a user selected Virtual Keyboard menu, user shall be prompted to select game type via Game list menu and then shall be prompted to enter numbers for every lottery coupon column he played. User should press OK when he finished.

DEP: FR8

ID: FR15

TITLE: Review - Edit

DESC: Given that image processing on picture has completed or numbers has been entered via Virtual Keyboard, user shall be presented with the acquired game type, numbers and shall be prompted to enter the draw date. If user wants to change anything, he should do that by clicking Edit menu. If user wants, he shall be directed to Check Coupon menu again by clicking Try Again menu. User should proceed by clicking OK menu or Push Notification menu.

DEP: FR9, FR14

ID: FR16

TITLE: Edit - OK

DESC: Given that user has reviewed the coupon data, he shall learn the prize in seconds by clicking OK.

DEP: FR15

ID: FR17

TITLE: Edit - Push Notification

DESC: Given that user has reviewed the coupon data, he can save the coupon data to be notified after the draw.

DEP: FR15

ID: FR18

TITLE: OK & Push Notification – Obtain Lottery Results

DESC: Given that user has clicked OK or Push Notification, Milli Piyango website shall be queried with the given game and date and the related numbers shall be downloaded.

DEP: FR16, FR17

ID: FR19

TITLE: Lottery Results - Compare

DESC: Given that user has downloaded the data from Milli Piyango website, user numbers and lucky numbers shall be compared.

DEP: FR18

ID: FR20

TITLE: Compare - Prize

DESC: Given that user numbers and lucky numbers has been compared, prize shall be displayed on screen with the amount of matching numbers and the matching numbers.

Application shall display “Virtual Coupon” menu.

Application shall display “Lucky Numbers” menu.

DEP: FR19

ID: FR21

TITLE: Prize - Virtual Coupon

DESC: Given that user has clicked Virtual Coupon menu on Prize menu, application shall display the taken coupon picture with matching numbers marked.

DEP: FR20

ID: FR22

TITLE: Prize - Lucky Numbers

DESC: Given that user has clicked Lucky Numbers menu on Prize menu, application shall display all the lucky numbers of the draw.

DEP: FR20

3.2 Nonfunctional Requirements

3.2.1 Usability

Since the users are assumed to have the common knowledge of using an easy smart phone application, there are no specific usability requirements. We guess it takes no more time to become productive on using this application than using an e-mail application.

3.2.2 Reliability

- Availability: Application shall be available 7/24. Maintenance access shall be done 3:00-6:00 am. When there is no Internet connection, user can only choose Push Notification mode being deprived of immediate result.
- Mean time to repair (MTTR): The system is allowed to be out of operation approximately 4 hours after it has failed.

3.2.3 Performance

- Response time for a transaction : average ~ 5 seconds , maximum ~ 10 seconds
- Throughput : 100 words/second
- Capacity : Limited Milli Piyango Web Site's simultaneous connection capacity
- Degradation mode : Only Push Notification when there is no Internet connection
- Resource utilization :
 - Memory: %5
 - Disk: %1
 - Communications: %0.1

3.2.4 Supportability

Data and operations in classes shall fit together. There shall not be extraneous dependencies between classes. Comments shall explain why things are done rather than what is done. Unit tests for every single class shall be implemented. Code repetition shall be avoided.

Since primary development environment requires Java language, we shall adopt suggested name conventions by Sun Microsystems where a name in “CamelCase” is one composed of a number of words joined without spaces, with each word's initial letter in capitals.

We shall use OpenCV, Android SDK,NDK, Tesseract OCR.

Maintenance access shall be 3:00-6:00 am if necessary.

4 Data Model and Description

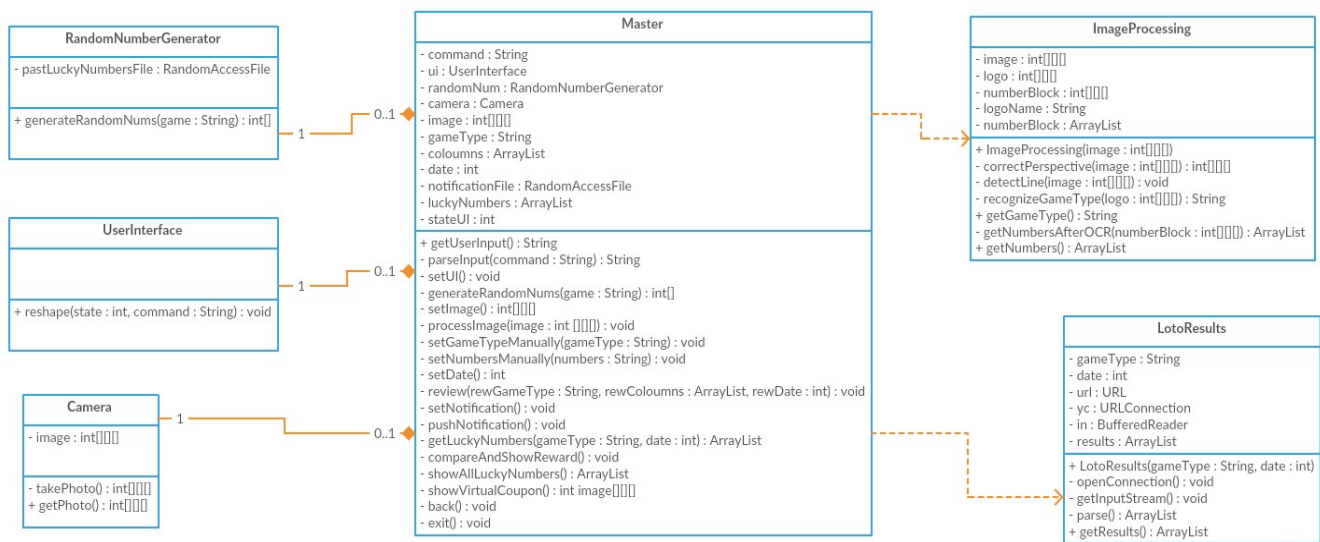


Figure 3 Class Diagram

About this template

This template was adapted by Emre Akbas from two sources: the IEEE 830 [1] and the “Modern SRS package” [2].

5 References

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[2] Appendix C of Don Widrig, Dean Leffingwell, “Managing Software Requirements: A Unified Approach,” Addison-Wesley Professional, Release Date: October 1999, ISBN: 0201615932.

[3] L. Jagannathan and C. V. Jawahar, Perspective Correction Methods for Camera-Based Document Analysis, URL: <http://imlab.jp/cbdar2005/proceedings/papers/P6.pdf>

[4] Bill Karatzidis, Software Requirements Specification for GParted, June 19 2010, URL:
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