ÇANKAYA UNIVERSITY
FACULTY OF ENGINEERING
COMPUTER ENGINEERING DEPARTMENT

Project Report
Version 1

CENG 407
Innovative System Designsd and Development I

Smart Booklet

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Abstract

Augmented reality is one of today's most popular topics. It is used in large fields such as marketing, real estate, decor, education, shopping, games, arts and museums, construction and so on. It is a technology that can be easily used as long as you have access to the Internet and the necessary applications. Augmented reality makes 3D feel like we are in a virtual universe. To date, traditional catalogs have only provided information in simple form in pictures and text. For this reason, with the catalog we will create using the augmented reality in our project, users can get information about all the content in the most realistic and detailed way. By reading the qr codes in the catalog, data such as photos, videos, maps and links are easily accessible.Our report contains some of the important methods each article.

Key words:

Augmented reality, smart booklet,QR code,smart phones.

1. Introduction

We aim to provide more realistic and detailed content by using qr codes in our catalog created with augmented reality. People can access all the information about our department in detail using our catalog. Our catalog aims to provide detailed information in many areas such as general publicity, laboratories, academic staff, curriculum, student community, students, news and communication. In order to present our department in a detailed and realistic way, we provide access to various media data such as photos, videos, maps, links by using qr code. In order to show people our labs in the most realistic way, we offer 360 degree visualization, video and photo data for academic staff, links for viewing the curriculum, maps etc. for communication, augmented reality technology. Augmented reality has very rich libraries. Each library has different functions. To mention the important libraries for us; ARCORE allows use on smartphones and tablets. Works on both ios and android. Wuforia; It allows 3D objects to be defined and used in real time. Wikitude; Mobile is required for augmented reality. It has the function like 3D model creation and video settling. In our catalog, we aimed to introduce our computer engineering department in the most detailed and realistic way. The general introduction of our school will be on the entrance page of our catalog. General information and photos about our school will take place. When we go to the other pages, information about our teachers and laboratories can be reached. Information such as the names of our academic staff, professors, CVs, room numbers and the courses they give can be reached. On the other page, we aim to show you our 360 degree labs. As we aim to use augmented reality in various fields and in every field, we provide the most accurate information with a direct link on the page where we introduce our courses. In the communication part of our school, we use all media tools by placing maps.

1.1   Problem Statement

State the problem to be solved. Why are you doing this work and what significance does it have in the relevant literature? Even if your project is applied (as opposed to research-oriented), you are building a system because a problem, requiring a solution in the form of a computer program, exists.

1.2   Background or Related Work

- **Article Title:** Illustrative visualization of 3D planning models for augmented reality in liver surgery

link : https://link.springer.com/article/10.1007/s11548-009-0365-3

Purpose Augmented reality (AR) obtains increasing acceptance in the operating room.They try use augmented reality for getting 3d view for surgical operations.But during the operation light is not enouhg then they try to diffrent light techniques and they get the 3d view. End of the using that techniques they can change the color of the objects thanks to do that they can focus of the area.

- **Article Title** :Multimedia Augmented Reality Interface for E-learning (MARIE) Fotis Liarokapis, Panos Petridis, Paul F. Lister & Martin White

link:https://www.researchgate.net/profile/Fotis_Liarokapis/publication/216813923_Multimedia_Augmented_Reality_Interface_for_E-learning_MARIE/links/02e7e5167fbde0b5b0000000.pdf

In that project target groups are students .They create a qr code and they use that qr code as a book. Thanks to use a special glases the qr code play a video or show some image about the class.Teacher can change the video or photos.

- **Article Title**: Web3D and augmented reality to support engineering education Fotis Liarokapis, Nikolaos Mourkoussis, Martin White, Joe Darcy, Maria Sifniotis, Panos Petridis, Anirban Basu & Paul F. Lister

link:http://www.wiete.com.au/journals/WTE&TE/Pages/Vol.3,%20No.1%20(2004)/03_Liarokapis29.pdf

The user, eg a student, accesses this system simply by typing a URL into a Web browser that addresses the index page of the presentation or launches the presentation from a desktop icon.ln this case, the student will be accessing a Web3D presentation with 3D, but no AR view , which illustrates the Web browser embedded in ARIFLite. This is the mode of operation for the Internet.For local Web and AR use, eg in a university laboratory environment or a seminar room, the student would

launch ARIFLite from an icon on the PC desktop. By using ARIFLite, the student can browse multimedia content as usual, but also extend the 3D models into the AR view. Switching to AR view causes the Web browser to be replaced with a video window in which the 3D model appears. The user can then interact with the 3D model and can compare it to real objects in a natural way.

- **Article Title**: Enhancing the Tourism Experience through Mobile Augmented Reality: Challenges and Prospects

link:https://journals.sagepub.com/doi/full/10.5772/51644

Tuscany+, the first AR application, developed specifically for the Tuscany region by Fondazione Sistema Toscana, operates like a digital tourist guide. Drawing information from Internet sources, such as Wikipedia, Google Places and the region's official portal, Tuscany+, it delivers tourist information in Italian and English regarding accommodation, dining the city's nightlife and of course sightseeing. For the rime being it is available only to iOS [12]. Basel is another city with its own AR tourist guide. Having started as part of the project "Augmented Reality for Basel", it is now accessible through the Layar AR browser discussed previously, as one of the browser's available layers. Therefore, the application is available for iOS, Android OS, Symbian OS and BlackBerry OS. It is available in English, German, French and Spanish, and the content is drawn from the city of Basel's dedicated database. The users can retrieve valuable information for the city of Basel and its outskirts, and more specifically regarding its sites, museums, restaurants and hotels, while information for events and shopping centres are also available

- **Article Title**: Augmented Reality in Surgery
  link:https://jamanetwork.com/journals/jamasurgery/article-abstract/396410

1.3 Internet Research

Exploit the massive Internet resource by using the information tools. Pay attention to only credible web sites.

2. Summary

2.1 Summary of Conceptual Solution

This should be a conceptual description defining the solution to the problem. Avoid using code and implementation details here; instead, define the solution in terms of algorithms, pseudo code and clear mathematical reasoning. Also, use figures, tables, and statistics to get your point across. *This description will be used in poster preparation.*

2.2   Technology Used

Mention also the technology used to build the solution, such as java, .net, oracle, MySQL …
Also include a block diagram of your solution.

3. Software Requirements Specification

3.1 Introduction

3.1.1 Purpose

This Our goal is to create a catalog using augmented reality technology. In this catalog, we want to provide a detailed content using QR codes. We have a catalog target where visuality comes to the fore and combines with technology. For the time being, we will design the catalog on behalf of the computer engineering department. We want to create a detailed catalog system by taking into consideration the wishes of our teachers and students. In order to present the computer engineering department in a detailed and realistic way, we aim to provide access to various media data such as photos, videos, links by using QR code.When the user points the camera of the phone as well as the Qr code to the picture in the catalog, the video will be played on the phone. The video will be displayed to the user in the most realistic way.Catalog system for any company school etc. can be designed on behalf of. Our primary goal is to make a more useful and understandable design.

3.1.2 Scope of Project

At the beginning of our project, we aimed to make a catalog system with improved visuality. We know that catalogs are an effective method for people. We strive to make this more effective. We aim to have sections of the catalog in itself. Each section has its own video, photo, link, 360 degree visuals etc. We aim to separate. Since our project is a computer engineering catalog for the time being, we chose to apply certain surveys to our teachers and students. We will continue to duplicate these options with our advisor. According to their results, the area of each section will be different. Our research shows that this system is not very common in the school catalog system. We wanted to spread it. We will continue to develop the project by combining more ideas and ideas.

Glossary

- **User:** Any person who use the smart booklet.
- **Qr code:** Quick Response code is the trademark for a type of matrix barcode which is a machine-readable optical label that contains information about the item to which it is attached
- **Android:** is a mobile operating system based on a modified version of the Linux kernel and other open source software, designed primarily for touchscreen mobile devices such as smartphones and tablets
- **iOS:** an operating system used for mobile devices manufactured by Apple Inc.
- **AR:** Augmented reality is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory.
- **360° Vr Videos:** 360-degree videos, are video recordings where a view in every direction is recorded at the same time, shot using an omnidirectional camera or a collection of cameras.
- **Virtual Tour:** A virtual tour is a simulation of an existing location, usually composed of a sequence of videos
- **Qr Scanner:** Qr Scanner display the code and converting it to some useful form
- **SRS:** Software Requirement Specification

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3.1.3   Overall Description

3.1.4   Product Perspective

Smart catalog system is a system that can be used by any company and school. Users can easily access the information they want. He can move around the catalog any way he wants. Using augmented reality, it will reach a much more open catalog visually.We aim to make the catalog available in two ways. Play the video after swipe the QR code and zoom the camera to the picture. The catalog system will be divided into several sections. 360-degree visualization, video and photo maps, etc. to show people the most realistic catalog using QR code. We will offer augmented reality technology.

3.1.5 Development Methodology

We aim to use the visualizations at the highest level and integrate them with the user. We will develop a smart catalog on the web by taking advantage of the AR.js library. We will prepare a catalog using videos, links, photos. The libraries we use, which will be a system that can be opened on mobile, provide us this opportunity.

3.1.6 Product Functions

This subsection of the SRS should provide a summary of the major functions that the software will perform. For example, an SRS for an accounting program may use this part to address customer account maintenance, customer statement, and invoice preparation without mentioning the vast amount of detail that each of those functions requires. Sometimes the function summary that is necessary for this part can be taken directly from the section of the higher-level specification (if one exists) that allocates particular functions to the software product.

Note that for the sake of clarity

1. The functions should be organized in a way that makes the list of functions understandable to the customer or to anyone else reading the document for the first time.
2. Textual or graphical methods can be used to show the different functions and their relationships. Such a diagram is not intended to show a design of a product, but simply shows the logical relationships among variables.

Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

3.1.6.1 Function 1 (Add a function of your product)

Describe the function in detail. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

3.1.6.2 Function 2 (Add a function of your product)

Describe the function in detail. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

3.1.6.3 Function 3 (Add a function of your product)

Describe the function in detail. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

3.1.6.4 Function 3 (Add a function of your product) and so on…

Describe the function in detail. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

3.1.7 User Characteristics

This subsection of the SRS should describe those general characteristics of the intended users of the product including educational level, experience, and technical expertise. It should not be used to state specific requirements, but rather should provide the reasons why certain specific requirements are later specified in Section 3 of the SRS.

3.1.7.1 User Type 1 (Add a user type here)

Describe the user type in detail. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

3.1.7.2 User Type 2 (Add a user type here) and so on…

Describe the user type in detail. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

3.1.8 Constraints

This subsection of the SRS should provide a general description of any other items that will limit the developer's options. These include

1. Regulatory policies;
2. Hardware limitations (e.g., signal timing requirements);
3. Interfaces to other applications;
4. Parallel operation;
5. Audit functions;
6. Control functions;
7. Higher-order language requirements;
8. Signal handshake protocols (e.g., XON-XOFF, ACK-NACK);
9. Reliability requirements;
10. Criticality of the application;
11. Safety and security considerations

3.1.9   Assumptions and Dependencies

This subsection of the SRS should list each of the factors that affect the requirements stated in the SRS. These factors are not design constraints on the software but are, rather, any changes to them that can affect the requirements in the SRS. For example, an assumption may be that a specific operating system will be available on the hardware designated for the software product. If, in fact, the operating system is not available, the SRS would then have to change accordingly.

3.2   Requirements Specification

3.2.1   External Interface Requirements

This should be a detailed description of all inputs into and outputs from the software system. It should complement the interface descriptions in section 2 and should not repeat information there. It should include both content and format as follows:

1. Name of item;
2. Description of purpose;
3. Source of input or destination of output;
4. Valid range, accuracy, and/or tolerance;
5. Units of measure;
6. Timing;
7. Relationships to other inputs/outputs;
8. Screen formats/organization;

9.   Window formats/organization;

10. Data formats;

11. Command formats;

12. End messages.

3.2.1.1   *User interfaces*

The user interface will be worked on iOs and Android sytsems. We use theme for booklet design.

3.2.1.2   *Hardware interfaces*

The application works on Android, IOS mobile devices and tablets. No other hardware is required.

3.2.1.3   *Software interfaces*

There are no external software interface requirements.
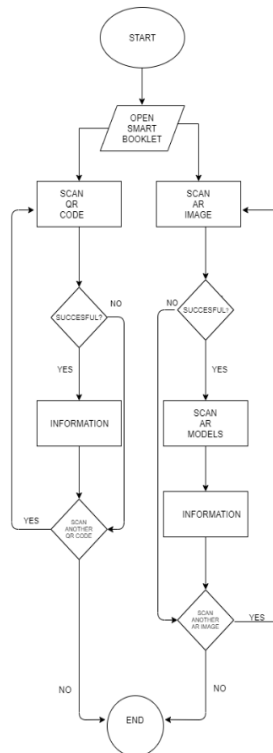
3.2.1.4   *Communications interfaces*

User must have browser to connect to website. So s/he need to have internet connection.

3.2.2   **Functional Requirements**

3.2 Functional Requirements

3.2.1 UMLDiagram

1. Open smart booklet.
2. Scan the QR code to access the content on the number you opened.
3. If you encounter an error, try scanning again.
4. According to the content of the code you read will reach our model.
5. You can read other QR codes if you have any other information you want to reach.
6. Once you have all the information you want, you can turn off the system from your smartphone.

3.2.3   Performance Requirements

This subsection should specify both the static and the dynamic numerical requirements placed on the software or on human interaction with the software as a whole. Static numerical requirements may include the following:

a. The number of terminals to be supported;

b. The number of simultaneous users to be supported;

c. Amount and type of information to be handled.

Static numerical requirements are sometimes identified under a separate section entitled Capacity. Dynamic numerical requirements may include, for example, the numbers of transactions and tasks and the amount of data to be processed within certain time periods for both normal and peak workload conditions.

All of these requirements should be stated in measurable terms.

For example:

"95% of the transactions shall be processed in less than 1 s." rather than, "An operator shall not have to wait for the transaction to complete."

NOTE: Numerical limits applied to one specific function are normally specified as part of the processing subparagraph description of that function.

3.2.4   Design constraints

This should specify design constraints that can be imposed by other standards, hardware limitations, etc.

3.2.4.1 *Standards compliance*

This subsection should specify the requirements derived from existing standards or regulations. They may include the following:

 a. Report format;
 b. Data naming;
 c. Accounting procedures;

Audit tracing.

For example, this could specify the requirement for software to trace processing activity. Such traces are needed for some applications to meet minimum regulatory or financial standards. An audit trace requirement may, for example, state that all changes to a payroll database must be recorded in a trace file with before and after values.

3.2.5 Software system attributes

There are a number of attributes of software that can serve as requirements. It is important that required attributes be specified so that their achievement can be objectively verified. Subsections provide a partial list of examples.

3.2.5.1 Portability

- All smartphones and tablets using ios and android operating system can use smart booklet.
- Internet connection required.

3.2.5.2 Performance

- Fast internet connection is very important.
- There may be differences in display time depending on the size of the content.

3.2.5.3 Adaptability

- The QR code should be compatible with Android and iOS system as it will open with a browser.

3.2.5.4 Usability

- Each page will contain one or more QR codes or image with AR.
- The user will scan the code and display the page content with augmented reality technology.

3.2.5.5   Safety Requirements

There will be no security vulnerability as no personal data is received from users.

4. Software Design Description

4.1 Introduction

4.1.1 Purpose

Our goal is to create a catalog using augmented reality technology. Designing a different intelligent catalog system using QR codes in our catalogs. We want to create a new catalog system. We are currently designing this for the computer engineering department only. It will be a catalog rich in content and accessible to the desired information. In order to present the computer engineering department in a detailed and realistic way, we aim to provide access to various media data such as photos, 3D, videos, links using the QR code. The catalog will be presented to the user in the most realistic way. Our primary goal is to make a more useful and understandable design.

4.1.2 Scope

We wanted to use a more powerful visual in our project. Catalogs are one of the most effective methods for people. We want to make it more effective. QR codes in the catalogs with the help of video, 3D, links, etc. We wanted to design a visualized catalog. Nowadays such catalogs are widely used, but we have seen that it is not very common for schools and develop intelligent catalog system on behalf of the school.

4.1.3 Glossary

- **User:** Any person who use the smart booklet.
- **QR Code:** Quick Response code is the trademark for a type of matrix barcode which is a machine-readable optical label that contains information about the item to which it is attached
- **Android**: It is a mobile operating system based on a modified version of the Linux kernel and other open source software, designed primarily for touchscreen mobile devices such as smartphones and tablets.
- **iOS:** An operating system used for mobile devices manufactured by Apple Inc.
- **AR:** Augmented reality is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory.
- **Activity Diagram:** Activity diagram is defined as a UML diagram that focuses on the execution and flow of the behavior of a system instead of implementation.
- **Sequence Diagram:** A sequence diagram shows object interactions arranged in time sequence.
- **Class Diagram:** A class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.
- **Qr Scanner:** Qr Scanner display the code and converting it to some useful form
- **SDD:** Software Design Document

4.1.4 References

References for your SDD document.

4.1.5 Overview of document

This documentation contains software design information for the Smart Booklet Empowerted by AR. These details were determined by sequence diagram, activity diagram and class diagram. The design which is designed for the catalog is included in this catalog with all its pages.

4.2 Motivation

An exciting team that loves to develop. We think that augmented reality will add a lot to the future. Since we love to design, we wanted to combine our talents in this project. We aimed to improve ourselves with this project.In our project, we aimed to provide users with the most realistic content. With the smart booklet, people will be able to access the content in the catalog in a realistic manner not only by reading and passing a page, but also by means of their phones and software. For the time being, we present the computer engineering department of our school with all aspects (academic staff, laboratories, undergraduate program, etc.). However, we aim to implement this project in other areas in the future. We implement augmented reality and QR code technology in the project. Our project which will be used in smart phones and tablets will be able to work on operating systems such as Android and iOS.

Description of Problem

Today, most people are searching their catalogs in their free time or something they want, but they may be beyond their guess, because they can't really see it. Because of this problem, they did not use the catalog system very much. According to research on humans, they often use the catalog system to pass the time. We want to break this perception. So we want to get QR codes and photos, 3D images, the presentation we want.

4.3 Architecture design (You can use your sections and headers)

Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

4.3.1 SDD subsections here…

Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

4.3.2 SDD subsections here…

Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

4.4 Data structure design (You can use your sections and headers)

Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for

the paragraph. Use this style for the paragraph. Example DB table:

Table 3 Data Field Type

Attribute Name	Attribute Type	Attribute Size
LastName	String	30
FirstName	String	30
MaidenName	String	30
Address1	String	50
Address2	String	50
City	String	30
State	String	2
Zip	Int	6
Year	Int	4
AdditionalDegrees	String	50
Spouse	String	30
Children	String	50
CurrentEmployment	String	50
ReceiveEmails	Boolean	1

4.5 Use case realizations

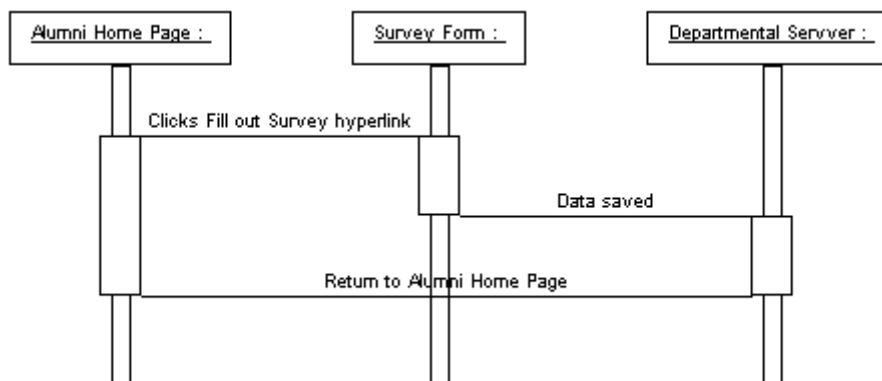Describe use case realizations and provide figures. Use this style for the paragraph. Sample figure:
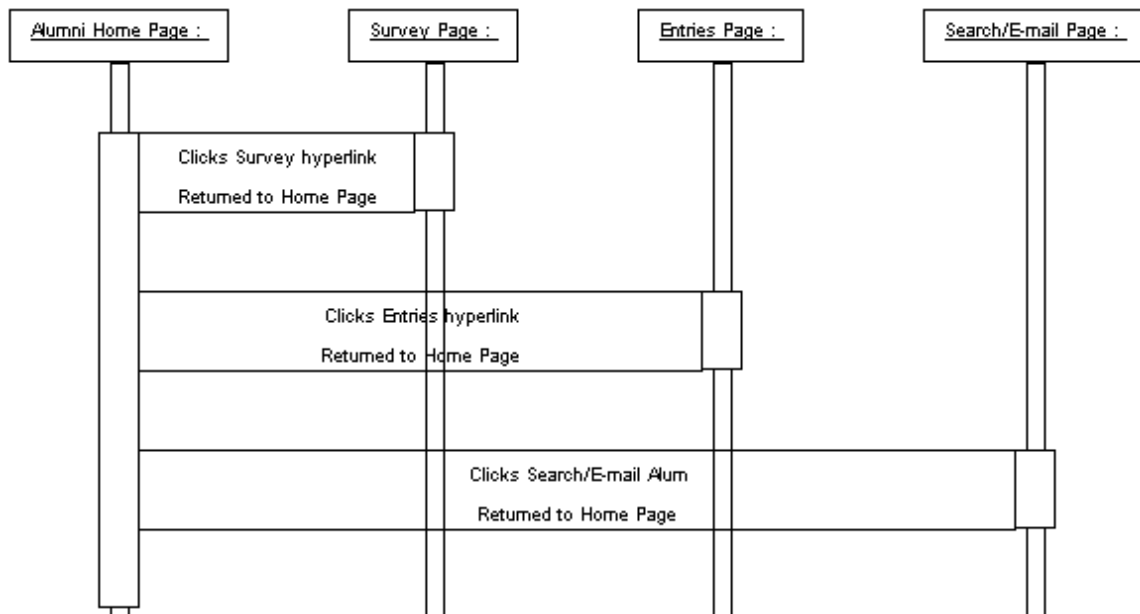
Figure 1 System Sequence Diagram

Always cite your figures, table inside the text.

4.5.1   Use Case: Use Case 1 (Add use cases here)

Refer to use cases provided in SRS. Provide and cite figures…


Figure 2 Survey Sequence Diagram

4.5.2 Use Case: Use Case 2 (Add use cases here) and so on…

Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph. Use this style for the paragraph.

4.6 Interface design

1.Cover page of the Smart Booklet

Çankaya Üniversitesi
Bilgisayar Mühendisliği
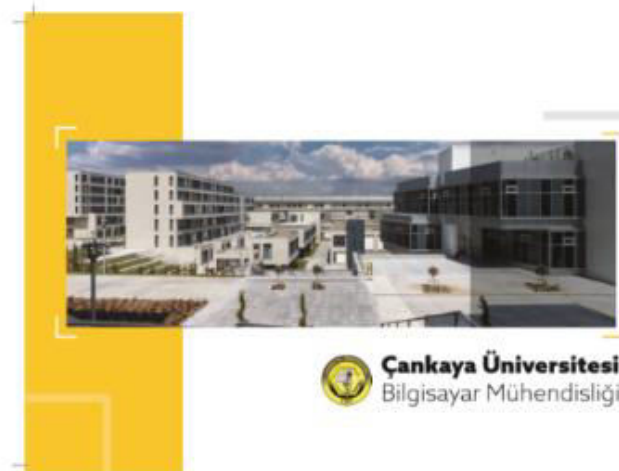
Summary: Cover page of the smart booklet.
Actor: User
Precondition: None Exception: None
Post Conditions: None
Priority: Low

2.About Cankaya University

Summary: The page consist with general information about the school. The user can access the video on this page by reading his/her phone's camera.
Actor: User
Precondition: The smartphones/tablets and internet access.
Basic Sequence:

Cover Page

Basic Sequence:

1. User must have smartphones/tablets and uninterrupted internet access.
2. User should point the phone in a low and parallel way to the picture.
3. If the application works correctly, the user will be able to view the video properly.

Exception: The Internet connection may be lost or the AR may be a problem.
Post Conditions: None
Priority: High

3.Computer Engineering

Summary: The page consist with general information about computer engineering. The user can access the video about branches of computer engineering on this page by reading his/her phone's camera.
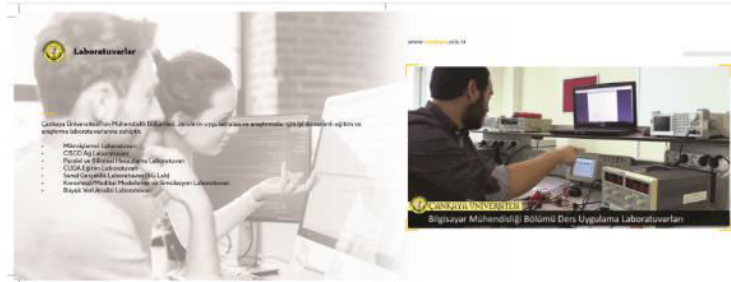**Actor:** User
Precondition: The smartphones/tablets and internet access. **Exception:** The Internet connection may be lost or the AR may be a problem.
Post Conditions: None
Priority: High

4.Laboratory

Summary: User can view labs in school in video.
Actor: User
Precondition: The smartphones/tablets and internet access.
Exception: The Internet connection may be lost or the AR may be a problem.
Post Conditions: None
Priority: High

5.Why Cankaya University Computer Engineering?

Summary: The answer to the question Why choose Çankaya University Computer Engineering is found in the video after reading the picture on the page.
Actor: User
Precondition: The smartphones/tablets and internet access. **Exception:** The Internet connection may be lost or the AR may be a problem.
Post Conditions: None
Priority: High

6.Undergraduate Program

Summary: Page contains information about the undergraduate program. Read the QR code on the page so that it fits perfectly on the screen. Thanks to the code you have read, you can find detailed information on the page from the link embedded in the code.
Actor: User
Precondition: The smartphones/tablets and internet access.
Basic Sequence:

1. User must have smartphones/tablets and uninterrupted internet access.
2. The user should read the QR code on the page to fit the screen exactly on the phone.
3. After reading, the content embedded in the code can access the title of the current page.

Exception: The Internet connection may be lost,code may not fit properly into camera or the links may be broken.
Post Conditions: None
Priority: High

7. Academic Stuff

Summary: After the Qr code is read properly, detailed information about the academic staff will be available.
Actor: User
Precondition: The smartphones/tablets and internet access. **Exception:** The Internet connection may be lost,code may not fit properly into camera or the links may be broken.
Post Conditions: None
Priority: High

8.Contact Information

Summary: Contact and address information are available on both campuses of the school. There are 2 QR codes on this page. In one of them detailed map information can be accessed and in the other one can be e-mailed directly.
Actor: User
Precondition: The smartphones/tablets and internet access. **Exception:** The Internet connection may be lost,code may not fit properly into camera or the links may be broken.
Post Conditions: None
Priority: High

Summary: Contact and address information are available on both campuses of the school. There are 2 QR codes on this page. In one of them detailed map information can be accessed and in the other one can be e-mailed directly.
Actor: User
Precondition: The smartphones/tablets and internet access. **Exception:** The Internet connection may be lost,code may not fit properly into camera or the links may be broken.
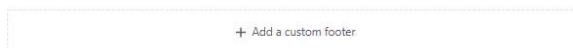**Post Conditions:** None
Priority: High

9.Back Cover

Summary: Back cover page of the smart booklet.
Actor: User
Precondition: None. **Exception:** None **Post Conditions:** None
Priority: Low

4. References

+ Add a custom footer

4.7   Help system design

Describe help system / user manuals for your product.

4.8   Index