ÇANKAYA UNIVERSITY
FACULTY OF ENGINEERING COMPUTER ENGINEERING DEPARTMENT

Project Report
Version 1

CENG 407 Innovative System Design and Development I

SMART BOOKLET EMPOWERED BY AUGMENTED REALITY

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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 QR CODE

1.1.1 What is the QR code ?

Technologies that make people's lives easier and make operations simple are increasing day by day. One of them is frequently used and one of the people's interest is QR code technology. A QR code (it stands for "Quick Response") is a mobile phone readable bar code that can store website URL's, plain text, phone numbers, email addresses and pretty much any other alphanumeric data [1]. The most important feature of QR code is that it makes the flow of information faster. When you want to get more than the information you see on the banner, or you want to note the information you see, you can easily obtain, record and use it at any time thanks to your phone and internet access. In addition, you can reduce the transaction time to a minimum thanks to the QR code applications introduced by banking systems. In this respect, qr code can be considered as one of the most important visual elements by accelerating the information flow and minimizing the duration of the transactions. QR code has been approved as an AIM Standard, a JIS Standard and an ISO standard [2]. In 2000 years, QR code is being issued as National standard in China [3]. qr code data capacity; only numeric code Max. 7,089 characters , alphanumeric Max. 4,296 characters , binary (8 bits) Max. 2,953 characters ,Kanji / Kana Max. 1,817 characters. The number of rows of the QR code is equal to the number of columns. The minimum size of the Row / Column is 20 and the maximum size is 177 points.

1.1.2 How to create QR code?

We can create our QR code in a very simple way by using sites such as Kaywa QR-code, QR Stuff and ZXing Generator. Select the type of content you are promoting. Enter your data in the form that appears. You can create dynamically and statically. Dynamic Qr codes can update content later, while static Qr codes remain content constant. With the create option, the QR code is immediately created, saved and used. One of the reasons QR code is preferred is that it is easily accessible. The generated code is placed in a magazine, poster, glass, etc. and people can access the information in seconds by scanning the QR code scanner applications that they downloaded to their smartphones.

1.1.3 Usage areas

QR code has a wide range of applications. Depending on the type of data recognized and the nature of the application, alternative actions can follow the decoding stage: a phone number can be automatically dialed, a short text message can be sent, a web page corresponding to the decoded URL can be displayed in a mobile browser, or a definite application can be executed[4]. Companies are placing them on billboards to facilitate rapid online purchasing, on food and beverage containers to provide access to nutritional information (or coupons or games), on movie posters to publicize trailers, in print media to encourage visits to websites, on products to provide ready access to user

manuals or instructional videos, on storefronts to link to reviews or menus, and on for sale signs to link to video tours or testimonials and also museums are placing them near displays to provide users with easy access to audio tours [5]. Some universities and companies used in catalogs, libraries and books. Andrew Walsh, a lecturer at University of Huddersfield, explains it like that: “At the University of Huddersfield we have used QR codes to deliver context appropriate help and information to blur the boundaries between the physical and electronic world. We’ve developed mobile friendly materials to deliver information skills materials directly to our users at the point of need, linked by QR codes on printed materials and on appropriate locations in the physical library.[6]”. Another way of use can be given to persons, location, telephone number, detailed information, pictures and videos about catalog. For example QR codes used in the Korean Journal of Urology. QR code is placed on the required pages. When the user scans the QR code, the video that is inserted into the code opens.

The usage area of the QR code should be expanded. It should be used wherever possible. It will be a great help for both publicity and information purposes in booklet to attract people's attention and provide a rich content visually. It helps helps banking transactions, promotions, advertising and more. QR technology is about to become a part of our lives with easy information flow and fast content provided to people.

1.2 Augmented Reality

1.2.1 What is Augmented Reality?

It is an advanced technology that enables the overlay of virtual objects such as audio, photos, videos, graphics or GPS over real images using the device's object recognition feature.It is a kind of realtime and interactive experience. So it improves existing reality and helps to adapt it to the real world we live in.Certain devices are needed to take advantage of this technology. For example smart glasses, smart phone etc. When you look at that object or material through these smart devices, the previously integrated applications show digital or electronic content in the real world. Augmented Reality applications can actually be described as animated QR codes. When the historical development of augmented reality is examined, augmented reality was first achieved in part by a director of photography, Morton Heilig, in 1957. He invented Sensorama, which gives audiences visual, sound, vibration and odor. I didn't have a computer management but that is the first example I made.

- In 1968, American computer scientist Ivan Sutherland and early Internet influence invented the head-mounted display as a kind of window into a virtual world.
- In 1975, an American computer artist, Myron Krueger developed the “virtual reality” interface in the form of op Videoplace, bu which enabled users to manipulate virtual objects and interact with them in real time.
- Steve Mann gave the world use of wearable computers in 1980.
- Thomas P Caudell of Boeing used the term “augmented reality ilk for the first time in 1990.
- The first truly working AR system was probably developed in 1992 by Louis Rosenberg at the Research Laboratory of USAF Armstrong. This was called Virtual Fixture, and it was an incredibly complex robot system at the same time as high speed. In the early 90s.
- In 2000, Bruce Thomas developed an outdoor mobile AR game called ARQuake.

- ARToolkit (a design tool) was launched in 2009 in Adobe Flash
- In 2013, Google announced the open beta version of Google (a mixed project).
- Microsoft announced augmented reality support and augmented reality headset HoloLens in 2015

1.2.2 Usage areas

The uses of augmented reality are highly developed. It is actively used in many fields such as marketing, real estate, shopping, games, cinema, device installation and repair, decoration, tourism and education. * / teknolo.com Especially with Pokemon Go mobile game published in 2016, millions of users all over the world became acquainted with Augmented Reality technology. In 2017, ARKit and ARCore Slam SDKs were released by Apple and Google in turn. In this way, both commercial and many independent game developers began to develop AR applications more easily. It was seen that the students achieved much more success with the use of education.A lot of work was done in areas such as advertising, furniture. These studies were enough to make people love the purified reality.

1.2.3 Advantages of Augmented Reality

- It can be used in the concretization of abstract concepts.
- It adds realism to the applications.
- Augmented reality applications provide enriched materials.
- It increases students' interest and motivation in the field of education. It also improves perception and facilitates easy learning.
- In the commercial sector, people have the opportunity to experiment with objects in the same environment.

1.2.4 Disadvantages of Augmented Reality

- The lack of some features on the devices we will use for our AR application leads to some restrictions. Memory, graphics power, processor facilities, internet facilities, etc. elements must be in sufficient condition in our device.
- AR applications are affected in the environmental conditions so the elements such as light and noise in the environment may adversely affect the AR application.
- Late detection of device responses at time of application, time constraints may prevent the application from running fully efficient.
- Devices with augmented reality applications (HoloLens, Google Glass, etc.) have high financial value.

1.2.5 Peripherals used for Augmented Reality

1.2.5.1 Hardware

For AR, hardware infrastructure and full use of users is very important to fulfill the given task. Alan B. Craig, in his book, Understanding Augmented Reality: Concepts and Applications, has divided the hardware of AG systems into three basic components; sensors, processors, and imagers. Components needed for LV environments

1. Sensors for GPS and camera etc ..
2. Viewers for tablet or portable screen etc ..
3. Can be desktop or mobile PC for processors.

1.2.5.2 Software

Augmented reality requires an interface that can hold the virtual and the real environment together, and this interface is often designed and released by software companies themselves. There are many libraries including AR technology. They are divided into open source and commercial. ARToolKit is one of the most widely used and widely used software package library in open source software. ARToolKit, developed by Hirokazu Kato in 1999, Hirokazu Kato washington university HIT Laboratory (The Human Interface Technology), written in C, with support in different languages.

1.2.5.3 Marker

Pointers are a tool for combining virtual and real environments.Pointer generation programs are stored in pat files with a numerical value (color codes 0-255) that expresses the hue of each pixel in the pointer pattern. ARToolKit type pointers can be 16x16 or 32x32. This type of pointers should be in square format and 50 percent of the image taken by the camera must match the numerical values in files with the extension “pat kayıtlı stored in the system.

1.3 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.In 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

2. Software Requirements Specification

2.1 Introduction

2.1.1 Purpose of Project

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.

2.1.2 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.

2.1.3 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:** 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

2.2. Overall Description

2.2.1 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.

2.2.1.1 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.

2.2.2 Memory Constraints

2.2.3 Operations

Users will scan the QR codes related to the content of the page with their smart phones. The contents embedded in the code will be displayed on the phone. If the content is a link, s/he can browse the referenced link. If it is a video, s/he can watch, and in the case of 360 videos, user can give direction as desired. If a map is embedded in the code, s/he can look at the address in detail. With the contents embedded in the code, the user will learn about what is introduced in the catalog thanks to the augmented reality and virtual reality. In the other hand,When you approach the picture from the catalog from your phone and tablet with internet connection, the video in the picture will be played on your device with augmented reality.

2.2.4 Adaption Requirements

Users should have smartphones or tablet with camera working well and access the internet. In Android systems, versions 8 and 9 can automatically scan QR codes without an app. Some older Android versions require an app tos can QR codes. In iOS system, there is no need for any

application. The device automatically sees the code without pressing the shutter button. When the camera recognizes the code, a notification appears to open the link in Safari.Users will be able to use the internet with the help of libraries we will use in augmented reality.

2.2.5 Product Functions

In smart booklet, user use two functions : Help,scanning Qr code and images with augmented reality. Help section: Describes how to use the booklet and for what purpose. Qr code scanning section:The user scans the Qr code with the smartphone / tablet. Whatever the content introduced on the page, the content that the user will see when the code is scanned will also be relevant. Depending on the content embedded in the code, the user will perform various functions. Image with augmented reality: The user points the camera of his phone at the picture. Thanks to the interaction of the camera, the picture is played back as a video.Reappears as picture when video is finished

Photo: Photos will be displayed in the phone will consist of a series of photos fluently. Video: the video on the page can be viewed. Map: You will have the most detailed information about the address information. 360 videos: A detailed, realistic and easily accessible video about the content introduced with Virtual Reality technology is displayed. Link: Redirected to website (Mostly used for non-visual or periodically updated topics)

2.2.6 Constraints

There may be constraints because of many things. Because of the user and the other half because of the system. First of all, the code needs to be scanned. And if the code cannot be scanned due to a user-generated problem, it cannot perform smart booklet functions.In the augmented reality, internet may be interrupted, the phone may play video heavily, or problems may arise if the camera is not approached at the right angle to the picture. System-related error, the link placed in the code may be removed / corrupted or inaccessible for any reason.Another may have poor quality of the video or uploaded the wrong video into the picture.

2.2.7 Assumptions and Dependencies

User must have access the internet and smart phone or tablet. And their camera must be in good working order.

2.3 Requirements Specification

2.3.1 External Interface Requirements

2.3.1.1 User Interfaces

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

2.3.1.2 Hardware Interfaces

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

2.3.1.3 Software Interfaces

There are no external software interface requirements.

2.3.1.4 Communications Interfaces

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

2.3.2 Functional Requirements

2.3.2.1 User Use Case Diagram

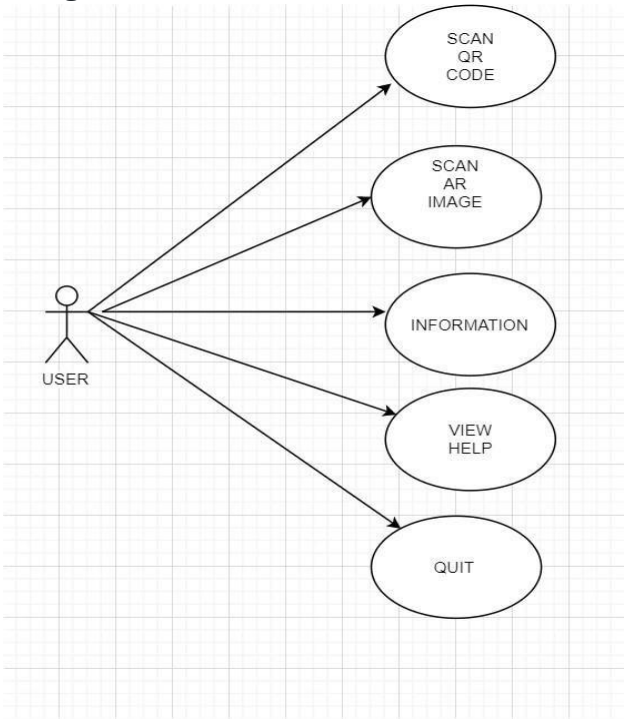

Figure 1 User Use Case Diagram

Initial Step-By-Step Description:

1. Make sure your smartphone or tablet has internet access without the camera malfunctioning.
2. Point your phone / tablet to the screen to read the code.
3. Set the entire QR code to fit your screen.
4. If you haven't been able to successfully read the code from your phone / tablet, you can try reading another code.
5. Point your phone / tablet to the screen to read the image.
6. Move the camera so that it is parallel to the picture from above and the picture fits on the screen.

7. If you haven't been able to successfully read the video from your phone / tablet, you can try reading another image.
8. Returns to the picture when the video is finished.
9. You can sign out after reaching all the content you want.

Brief Description:

The main purpose of the smart booklet is to introduce Cankaya University Computer Engineering by reading QR codes or image with augmented reality with media content such as photos, videos, links, maps and 360 videos that we provide with augmented reality.

2.3.2.2 Smart Booklet Use Case Diagram

Figure 2 Smart Booklet Use Case Diagram Brief

Brief Description:

After starting to use the Smart Booklet, the user is given 3 options: 1.Scan QR code or image 2.View help 3.Quit First, you can review our catalog according to the information you want to reach. You can then scan our desired QR code to access our media with augmented reality inside. These media, photos, videos, links, maps, etc. is presented to you. If an error occurs in the QR code you have read, first make sure that your device is connected to the Internet, that the camera is working well and that you have read the QR code to fit the entire screen. If you are still unable to access content, you can try scanning another QR code. You can reach the information of how you can read QR code in our Help section.AR has been used on pages like cankaya university and computer engineering. the picture directly to the camera of your phone - parallel and 90º angle. The video uploaded to the

picture will start playing on your device. When the video ends, you can access the AR content on the other page in the same way. After you reach the information you want, you can log out of the system.

2.3.3 Performance Requirements

2.3.4 Software System Attributes

2.3.4.1 Portability

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

2.3.4.2 Performance

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

2.3.4.3 Adaptability

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

2.3.4.4 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.

2.3.5 Safety Requirements

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

3.Software Design Document

3.1 Introduction

3.1.1 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.

3.1.2 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.

3.1.3 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

3.1.4 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.

3.1.5 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.

3.2 Design Overview

3.2.1 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.

3.2.2 Architecture Design

3.2.2.1 Simulation Design Approach

3.2.2.1.1 Sequence Diagram

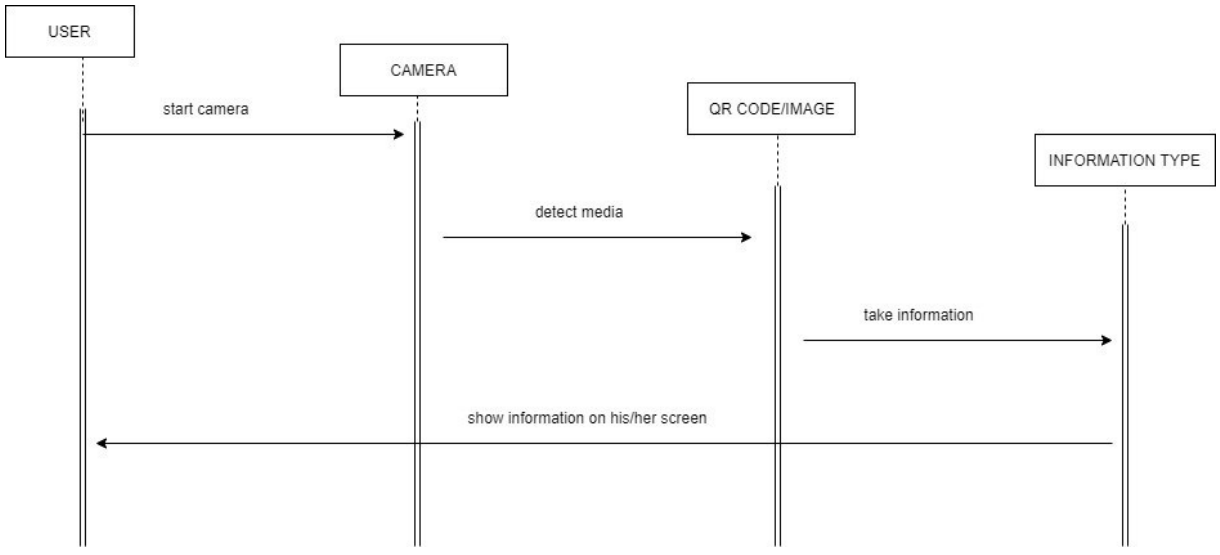

Figure 3 Sequence Diagram

Figure 3: display the sequence diagram. First, the user turns on the camera. reads the QR code on the page or the camera according to the instruction on the page. The information given to the code or picture is received and shown to the user.

3.2.2.1.2 Activity Diagram

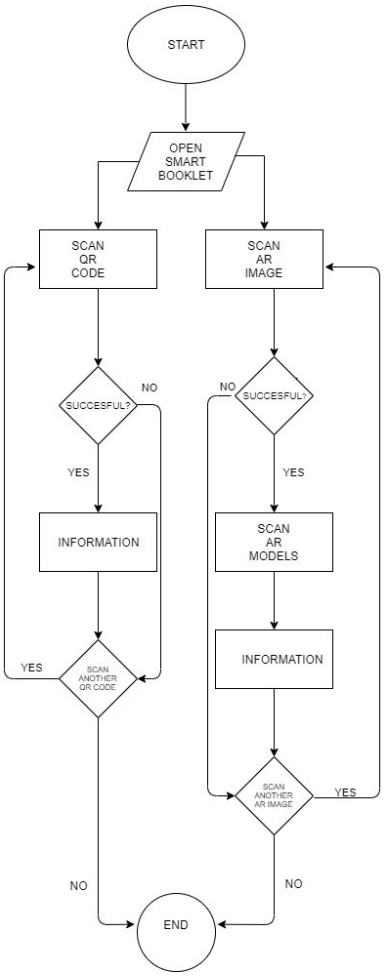

Figure 4 Activity Diagram

Figure 4: display the activity diagram. The acitivity diagram shows how the application works. After opening the smart booklet, the user scans the QR code or image on the page to the camera of the phone. Retrieves content if successful. If not, it may try to scan another code or image. The application is terminated if it does not want to display any other content.

3.2.2.1.3 Class Diagram

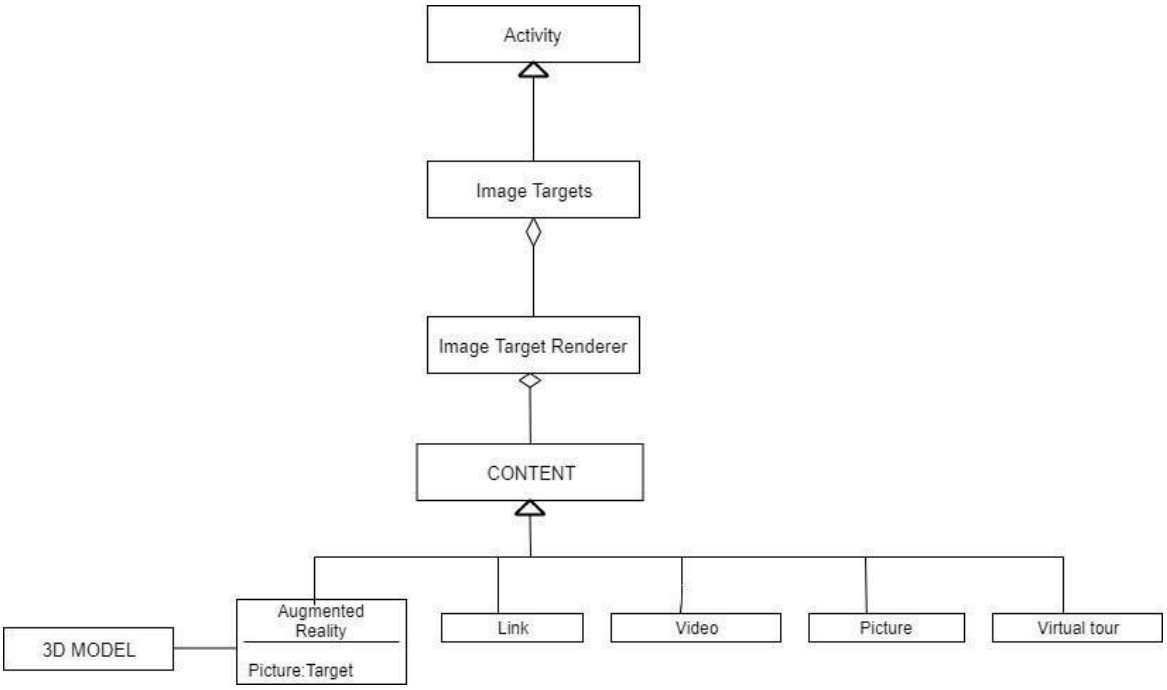

Figure 5 Class Diagram

Figure 5: the class diagram shows the connection between the components. We can understand what is going on in the content, how to get to the activity section as shown in this diagram. **3.2.2.1.4 Application Architecture**

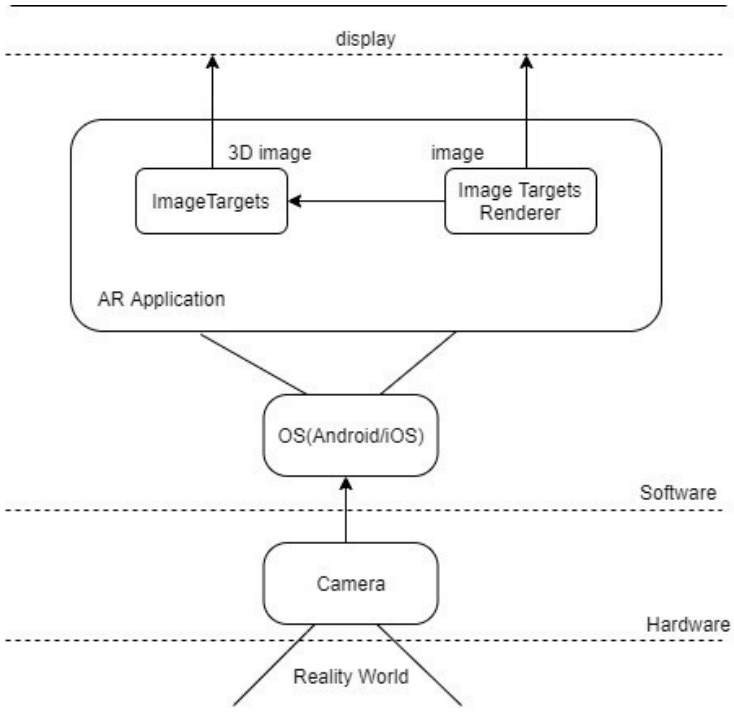

Figure 6 Application Architecture

Figure 6, the architecture of our application is specified in general.

3.3 Use Case Realization

3.3.1 Smart Booklet with AR System

3.3.1.1 UI Design

Cover page of the smart booklet: A cover page that the user sees under any circumstances to access the catalog.

About Cankaya University: This page provides general information about the school. You can access the video content on this page using the QR code. In order to use the page without error, you must have internet access and smart device.

Computer Engineering: A general introduction to computer engineering. The user reads the QR using his smart device. Then you can access the video about the branches of computer engineering. To use the page without error, you must have internet access and smart device.

Laboratory: Users can see laboratories at school. In order to use the page without error, you must have internet access and smart device.

Why Cankaya University Computer Engineering? : When you read the QR code on the page, there is the answer to the question of choosing Cankaya University Computer Engineering. A short video is being played. Internet access and smart device must be used to use the page without errors

Undergraduate Program: This section contains content about undergraduate programs. We can read the QR code from the screen and then access the link. In order to use the page without error, you must have internet access and smart device.

Academic Stuff: After reading the QR code, information about academic staff is available. In order to use the page without error, you must have internet access and smart device.

Contact Information : Contact information is available for each campus of our school. There are 2 QR codes. You can reach the map, e-mail information with contact information. In order to use the page without error, you must have internet access and smart device.

Back Cover: Back cover page of the smart booklet.

3.3.1.2 Database Design

In our project, only the content that will be shown to the user will be kept in our database. These include video, photos, links and map information. There is no need for any user or admin information.

3.3.1.3 User Function Design

The User Function Describes the possible functions of the registered user. There are certain subsystems that allow users to access the content they want to login from the page cover. They can

reach certain sub-sections such as getting information about the university and getting information about computer engineering. It is possible to read QR codes and access content such as video. Can be formatted according to requests.

3.3.2 User Interface

1.Cover page of the Smart Booklet

Figure 7 Cover Page of the Smart Booklet

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

2.About Cankaya University

Figure 8 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:

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

Figure 9 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

Figure 10 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?

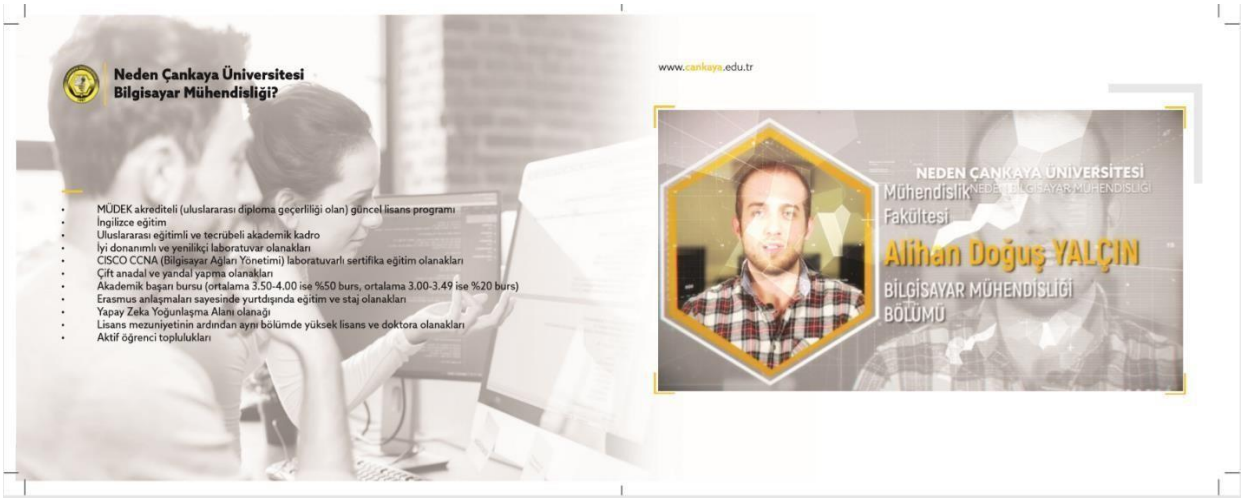

Figure 11 Why Cankaya University Computer Engineering?

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

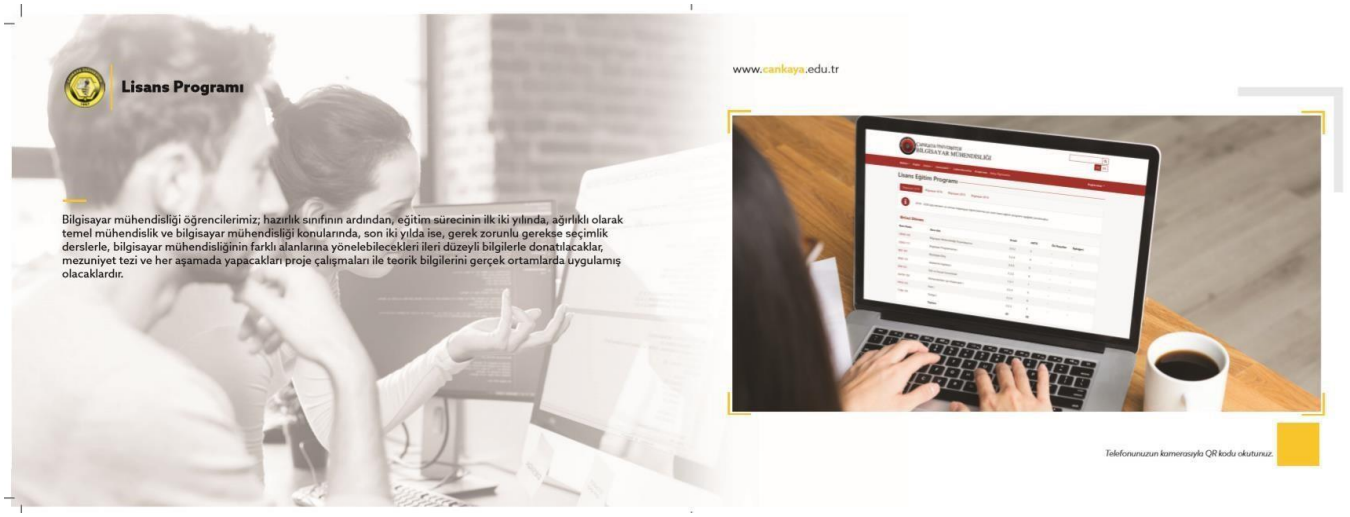

Figure 12 Undergraduate Program

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

Figure 13 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

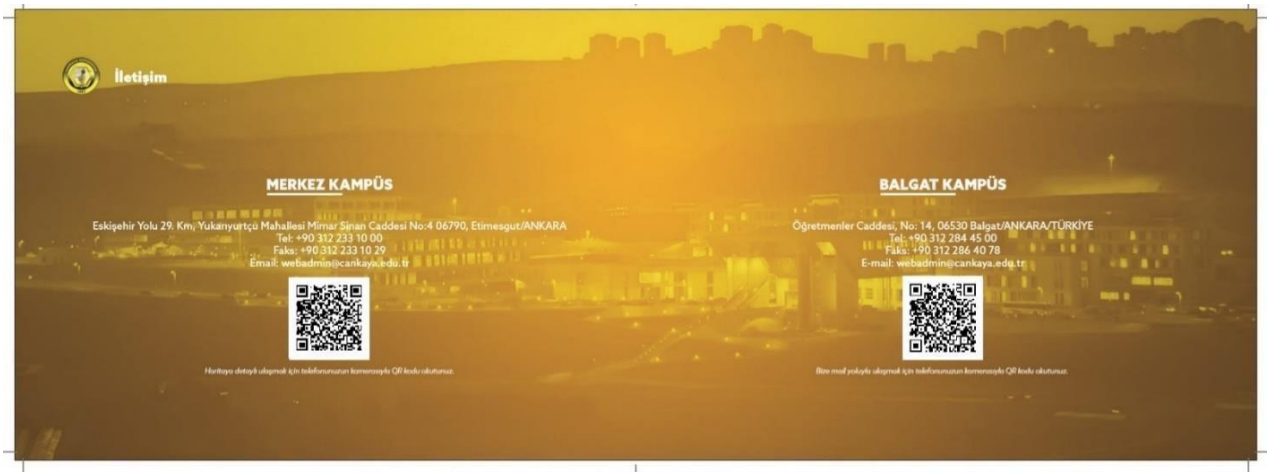

Figure 14 Contact Information

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

9.Back Cover

Figure 15 Back Cover

Summary: Back cover page of the smart booklet.
Actor: User
Precondition: None.

Exception: None

Post Conditions: None

Priority: Low

4.Conclusion

Augmented reality has become a technology we encounter in every aspect of our lives. QR code is a visual technology that helps people with easy information flow, facilitating transactions and fast access. By combining these two technologies, we aim to promote our department in the best way. We will create a smart booklet with the most detailed and realistic information about our school and our department will have. With the researches and articles we have made, we have learned how to use the methods and programs in our project.

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