

Augmented Reality for wedding

ARWedding



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Mădălina Bumba

Business Information Technology
Hämeenlinna University Center

Author	Mădălina Bumba	Year 2019
Subject	Augmented Reality for wedding	
Supervisor(s)	Lasse Seppänen	

ABSTRACT

Augmented Reality brings a whole new dimension to an event and allows hosts to be creative. The goal of the thesis is to create an interactive wedding invitation using AR technology. It proposes to surprise the invitations and make the wedding imposing.

When the invitation is covered by a device camera that has the ARWedding application installed, all the virtual content will appear on the screen in real time. Using the application, guests will have access to much more information about the wedding than they would get in a conventional invitation such as a gallery with the bride and groom, food and drinks that will be served at the wedding, a provisional program of the event, details about the location references to a URL, showing exactly the location.

At the wedding, all the attention is focused on the bride and groom but is very important that each guest feels important. Because the number of guests is large, it is harder for the bride and groom to talk with each visitor and make them feel special. In this case, the application helps a lot by assigning to each one a customized message from the couple. Also, the guest has the opportunity to reply with a text message. In order to impress the guests, confirming online the presence to the event was made possible. All the confirmations and text messages received from guests will be stored in Gmail addresses of the bride and groom.

ARWedding is a mobile application that allows the guests to scan Augmented Reality invitation which has information about the event infused onto it that visitors need to have.

As long as Augmented Reality content remains innovative and engaging, customers will definitely adopt AR technology as a new and fun twist to using digital solutions.

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LIST OF ABBREVIATION

Table 1. List of abbreviations and terms

Abbreviations	Description
AR	Augmented Reality
RSVP	Répondre, s'il vous plaît
MR	Mixed Reality
SSL	Secure Socket Layer
iOS	iPhone OS
UWP	Universal Windows Platform
QR code	Quick Response code
2D	Two Dimensional
3D	Three Dimensional
GPS	Global Positioning System
API	Application Programming Interfaces
SDK	Software Development Kit
.NET	Network Enhanced Technology
IDE	Integrated Development Environment
ID	Identity Document
IP	Internet Protocol
SMTP	Simple Mail Transfer Protocol

1 INTRODUCTION

Wedding is one of the most important events in everyone's life. It is essential that the marriage rite remains in the guest's memory. Using the interactive wedding invitation, the bride and groom can communicate virtually with guests about how the program will proceed, inform them about the wedding menu, the activities that will take place at the event. The application also contains a list of how guests are arranged to the tables. It is also possible to access location by one click and to see a gallery with the memories of the bride and groom.

To make each guest feel important, the application will include a personalized video message from the bride and groom. Also, the presence to the event could be confirmed online, directly from the application.

The benefits of the application include that AR becomes more viral, in quick succession the quality of the content is improved, it's interactive and is free. AR applications are known to have success because rendered content is intermixed with real-world items. Even the AR content is attractive, but for a wedding, such a solution has not been developed. However, AR applications for events have managed to gain people attention.

Because AR allows creativity, the goal is to make an interactive wedding invitation, to bring a new dimension to the wedding event, making it formidable and the focus will be placed on the guests by making them feel special.

ARWedding is an application designed to surprise the guests by giving them invitations, different instead of a normal one, infused a lot of virtual content on it. All the guests need is a mobile or tablet with a camera to scan the invitation and the information will come out on the screen in real time. AR will certainly put the wedding in a very impressive effect and guests will remember the event for a long time. (Kumar, 2017)

This thesis will answer the following research questions:

- 1) What improvements will the application bring to the event?
- 2) What makes this application different from others?
- 3) How can guests confirm their presence using the application?

2 AUGMENTED REALITY (AR)

Augmented Reality is a thrilling area of interactive design, in which virtual content is integrated with displays of a real-life scene. With the advancement of personal mobile devices able to produce interesting AR content, the potential of Augmented Reality has begun to be noticed. (Tony, 2011, p. 29)



Figure 1. Augmented Reality. (Iram, 2017)

The term “Augmented Reality” is used to explain an admixture of technologies that allow real-life mixing of computer-generated content by displays live video. AR is a technology that adds digital information to the whole world that people can interact with in the same way they interact with the real-life, with other words, it brings vitality into reality (Craig, 2013, p. 2).

Augmented Reality offers the possibility to do things that are not accessible in the real world. It provides digital content which is placed in the world to improve it with things which normally cannot be seen, felt or touched. One of the most important aspects of Augmented reality is that people can stay in the physical world and there is no attempt to can think they are not in the real world, in the position which they are standing or sitting. AR is interactive, it can be applied in different area such medicine, education, entertainment, films such as *Iron Man* or *Minority Report* where the characters interact with the way of displaying the data that is projected on certain surfaces or that appear simply in front of them. (Andreea, 2017)

2.1 A guide to Augmented Reality

To get the effect by combining the real world with the digital world, a device with a camera, for example, a phone, tablet or laptop is first

required. AR applications utilize the camera device and advanced image analysis algorithms for detecting some elements on the image in real-time. Depending on what it detects, the application can offer different experiences by adding digital content like video, image, 3D model and so on onto the screen of the phone that flies over the detected elements. Moving the phone in different directions, the digital object sticks to the original place, in reality, giving the illusion that it is part of it. (Loredana, 2017)

2.1.1 Advantages

In this subchapter, the eight advantages of Augmented Reality are listed. It dilutes line between the virtual world and the real world by being highly interactive. If this is utilized in the medical industry, patients' life will become safer. The Augmented reality operates at the same time with the real-world environment. It can be applied for events as it makes things eye-catching and memorable. ("Advantages of Augmented Reality,disadvantages of Augmented Reality," 2012)

AR technology can be used by anyone. It could be transformed as a personal experience with offers received from a favorite site or shop, therefore a marketers' dream will be accomplished. Augmented Reality makes easier object visualization in a unique way by placing the digital assets in the real world and give the feeling the content exist in reality. This technology helps in the tourism sector and in travel. Travel applications can display exactly tourist and routes directions and also provides detailed information about visiting landmarks at a specific location. (Stuti, 2018)

2.1.2 Disadvantages

There are some disadvantages to this technology. Right now, the production of Augmented Reality based devices and maintaining them is expensive. The absence of privacy in AR applications is a cause for concern. Another issue is the low-level performance which needs to be addressed during the testing phase. With Augmented Reality, the people are missing out on the great moments. ("Advantages of Augmented Reality,disadvantages of Augmented Reality," 2012)

Using AR applications development is actually unattended. It is found that this increases the players' chance of getting hurt or suffers from some major injuries. Disassociation of reality is a disadvantage that Augmented Reality brings. Users spend much time getting preoccupied with an application that they actually fail to differentiate the real from the virtual world. Violent games increase aggressive traits in the thick of aspiring users, removing the requirement to have an ethical behavior and social responsibility. (Stuti, 2018)

2.2 History

Augmented Reality technology has its origin in computer interface research from the first days of computer science. Many concepts of AR have been founding in science fiction and movies like *The Terminator* in 1984 and *RoboCop* in 1987. The “Augmented Reality” term was invented by Tom Caudell, a researcher at The Boeing Company, in 1990. Throughout these years, Tom Caudell and his Boeing colleagues worked on the development of head-mounted display systems using the AR diagram to allow engineers to assemble complex wire beams superimposed on a plate, which cables would be arranged. During the next decade, systems using AR began to be developed. In 1994, Julie Martin has credited the first AR theatre production, titled *Dancing in Cyberspace*, using dancers who interact with the virtual environment on the stage. At the end of the 1990s, Hirokazu Kato created ARToolKit, a powerful library of equipment for creating AR applications, which helped Augmented Reality to be more accessible to a wider audience of developers and designers. (Tony, 2011, p. 31)

3 VIRTUAL REALITY (VR)

The definition of Virtual Reality comes, basically, from the meaning of “virtual” and “reality”. The description of “virtual” is “near” and the description for “reality” is that experience as a person begins. With other words, the term “virtual reality” means “near-reality”. Of course, this could mean anything, but it generally relates to a specific type of reality emulation. Humanity knows the world by perception and senses. There are five senses: touch, taste, hearing, sight and smell. Those are only just most obvious sense organs. People have many more senses than those, among them, balance for example, plus special processing of sensory information by the brain which is why certain people have a rich flow of information from the world to the brain. Everything that is known about reality comes from senses. Virtual Reality comes with a version of reality that is not in the real-life, but from people’s perspective, it will be perceived as real. (“What is Virtual Reality? - Virtual Reality Society,” 2017)

Virtual Reality, in the technical terms, is used to define a three-dimensional, computer-generated environment which can be explored by a person and with which they can interact. The person becomes a part of the virtual world and whilst there, they are able to interact with objects or execute a series of actions. (“What is Virtual Reality? - Virtual Reality Society,” 2017)



Figure 2. Virtual Reality. (“Augmented and Virtual Reality | Jabil,” n.d.)

In conclusion, Virtual Reality is about presenting human senses with a computer to create a virtual environment that people explore in the same fashion.

3.1 Virtual Reality changed the real-world

This technology gives the possibility to teleport anywhere in the world and gives the feeling of really being thereby creating with software help an artificial atmosphere. Virtual Reality services are used in many fields like construction, medical, education, engineering, entertainment, and media design. It enhances performance and improves the concept of understanding some subjects. The benefits that Virtual Reality brings are that virtuality is better than reality, it improves the skills in communication, helps to connects with other people, it gives detail view, and also gives users an unforgettable experience, take gaming into a new level, helping people to learn how to react to accidents. (“What is the importance of virtual reality? - Quora,” n.d.)

3.2 History

The technologies that Virtual Reality use today is built upon ideas that date to the 1800s, very close to the beginning of practical photography. The first stereoscope was invented in 1838 using twin mirrors to project an image. In the mid-1980 was first used the term “virtual reality” when Jaron Lanier, which found VPL Research, started to develop the gear which includes gloves and goggles for experience what he called “virtual reality”. In 1965, Ivan Sutherland, provide a head-mounted device called *The Ultimate Display*, that he said it would serve as a *window into a virtual world*. In the 1980s at NASA Ames Research Center, the system Interface Environment Workstation (VIEW) combined gloves with a head-mounted device to allow the haptic interaction. Thanks to the pioneering inventors of the past six decades who prepared the way for high-quality, low-cost to easily accessible devices, with their help build the virtual reality gear in our days. (“History of Virtual Reality | The Franklin Institute,” 2018)

4 MIXED REALITY (MR)

Mixed Reality is the result of combining the digital world with the physical world. It is the next step in evolution with computers, people and, interaction with the environment while unlocking the possibilities that until the moment we're limited to the peoples' imagination. MR mix the best of Virtual Reality and Augmented Reality. It is referring to cover all the compositions and variations of the real and virtual objects. (Brandor, Jesse, Nick, & Matt, 2018)

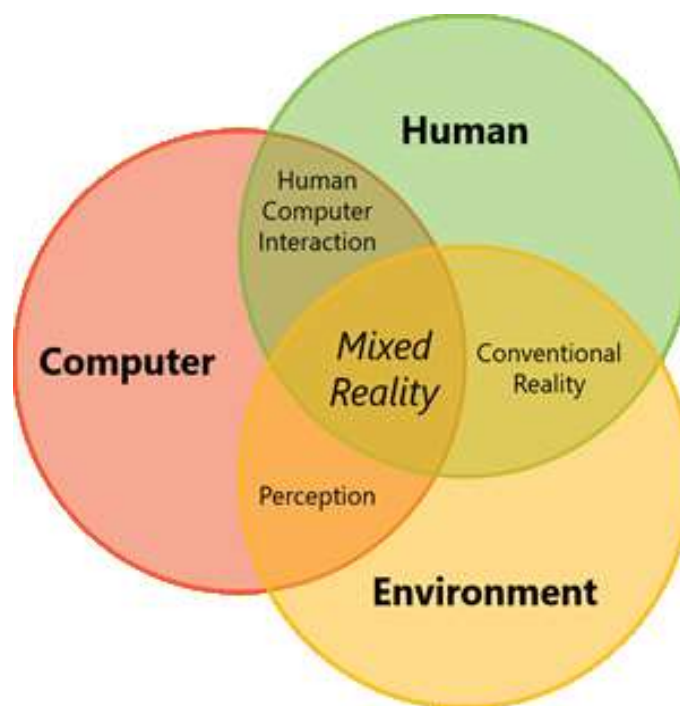


Figure 3. Mixed Reality. (Brandor et al., 2018)

4.1 Types of Mixed Reality

There are two types of Mixed Reality, one is Mixed Reality Continuum and the other one is Mixed Reality Independent which are detailed below.

4.1.1 Mixed Reality Continuum

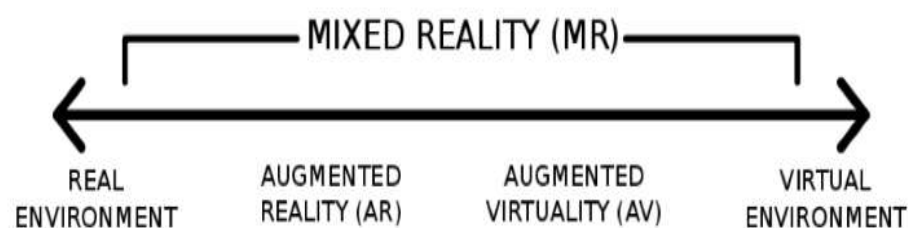


Figure 4. Mixed Reality Continuum. (“What is Mixed Reality (MR)? The Ultimate Guide to Mixed Reality (MR),” n.d.)

This covers all possible compositions and variations of virtual and real objects. On the spectrum, starting from the left is the natural world in which part there is nothing computer generated. On the right point on the spectrum, there is a virtual environment where all are computer generated. (“What is Mixed Reality (MR)? The Ultimate Guide to Mixed Reality (MR),” n.d.)

4.1.2 Mixed Reality Independent



Figure 5. Mixed Reality. (Bardeen, 2018)

Mixed Reality is used in referring to the whole spectrum of situations between the real world and the virtual world or is either as a standard concept. It tries to combine the highest quality of the Augmented Reality and Virtual Reality. When the virtual and real world are merged together, new visualizations and environments become possible where digital and physical objects can interact and coexist in real time. (“What is Mixed Reality (MR)? The Ultimate Guide to Mixed Reality (MR),” n.d.)

The technology and the operations use Augmented Reality and Virtual Reality as well as space and coordinates. Magic Leap is a company at the forefront of development Mixed Reality content, and they have kept a lead on the information in regards to what they are doing or developing. The scarce details that are known are that Mixed Reality uses a projector to showing images on semi-transparent materials which are reflected on the eye with the help of the beam-splitting technology. (Liza, 2017)

4.2 History

The “mixed reality” term was originally made know in 1994 by Fumio Kishino and Paul Milgram in the paper *A Taxonomy of Mixed Reality Visual Displays* which was a basis for a concept of the virtuality continuum and concentrated on how taxonomy categorization applied to displays. Ever since, the Mixed Reality applications go over displays, but also insert environment spatial sound, input, and location. (Brandor et al., 2018)

5 DIFFERENCES BETWEEN AR, VR, MR

As the world grows, people want to see new applications with multiple and diverse contents. Augmented Reality is the technology that excited people. AR comes with digital content superimposed on the actual reality, being the latest trend in the marketing area. Augmented Reality applications are more user-friendly than VR's; popularity of AR also grew thanks to Pokémon GO! game. In the user's perspective, Augmented Reality and Virtual Reality are the next steps towards the future. (DIDI, 2017) This technology will change the content in video, games, movies and makes them more attractive. In fact, Augmented Reality will become an essential part of the ecosystem and will make mobile devices much more useful.

Simple actions such as obtaining information in a traditional way will have a much faster and convenient digital correspondent. However, this does not mean that Augmented Reality stops on the smartphone. On the contrary, it will exceed the level of smartphone and will be implemented in other products that can corroborate the virtual with reality. (Mihai, 2017) It will radically change areas such as a wedding or other events. In addition, hardware enhancements allow faster and better tracking which can be used to create new applications.

Even those three technologies display virtual content, they are totally different. Below is showing some differences between Augmented Reality, Virtual Reality, and Mixed Reality.

Table 2. Differences between AR, VR, MR. ("Capital One BrandVoice: Truly Thoughtful Mother's Day Ideas You Haven't Thought Of Before," 2018)

Augmented Reality	Virtual Reality	Mixed Reality
Overlays information over real-life	Brings the user into another world entirely	Mixes digital content in the user world
Don't contain spatial awareness	Occludes user vision	Responds and reacts to the user "space"
Virtual objects superimpose on the real-world environment	Full artificial environment. Everything that the user sees is virtual	Real world combined with the virtual environment
Full immersion in a virtual environment	The digital objects enhanced with real-world	It interacts with both, the virtual environment and the real world
Physical environment	The environment is generated by a computer	Sit in the spectrum between virtual reality and physical reality

6 USE AR TECHNOLOGY TO IMPLEMENT PRACTICAL PART

Practical part has been realized in Unity, using Vuforia Engine for image recognition and AR projection. Adobe Photoshop CC 2019 was used in designing the four parts of the invitation and to make the frame which inform the users at the start of the application that they have to scan the invitation.

In this chapter the platforms that are used to accomplish the practical part are detailed. Here the definitions are giving and also how the applications work.

6.1 Unity

Unity is a cross-platform game engine, developed by Unity Technologies. Built-in IDE, it has the ability to deploy to a number of platforms and is becoming the most popular game engine in the industry. Some of the best games on the market are created using Unity Engine like *Shadowrun* and *Dead Tigger*. Because it is free, more than one million developers use it, even schools encouraged to teach Unity, due to the fact its relatively easy learning curve and initialize students to game development. It is designed for ease of use with high productivity. Unity's name comes from its particular strength which is the ability to deploy on a wide-reaching number of platforms with few changes and ease to the project's structure. Unity can deploy on iOS, Android, OS X, Web plugin, Windows, Xbox 360, Flash, Wii U and PlayStation 3. It opens a lot of opportunities and allows one to choose from three languages to write scripts like C#, JavaScript and BOO. Even though three languages are available, it is recommended to use only one throughout the entire project to keep away from any conflicts and to be easy to read and understand. (Habbak & Cushnan, 2013, p. 34)

6.2 User Interface (UI)

UI is used to create a user interface in the application or game. This chapter describes Unity UI features for instance as a creating a Canvas, animating elements and position them, sizing layouts automatically and defining user interactions. ("Unity - Manual: Unity UI: Unity User Interface," 2019)

6.2.1 UI Canvas

The Canvas is a Game Object. All UI elements ought to be inside of Canvas, so in other words, they are its children. To create a UI element one chooses the menu `GameObject > UI element` it and automatically creates a Canvas if there is no Canvas in the scene. This element is created as a child of this. The area of the Canvas is shown as a rectangle of the Scene View, which

makes easy the UI elements position without needing to have the Game View display at all the times. (“Unity - Manual: Canvas,” 2019)

It is possible to have more Canvas in a scene, but to use a UI element there needs to be at least one available Canvas. Each Canvas has a number of different possible Render Modes. The Render Mode can be set by using the Render Mode pop-up menu. Scene Space – Overlay is the most common and it is the default Render Mode setting for a Canvas. With Screen Space – Overlay selected, the UI will overlay the scene. All of the UI elements will be drawn on top of everything else rendered in the scene. In this mode, the Canvas will fill the screen automatically and will resize automatically if the screen settings change. (“UI Canvas - Unity,” n.d.)

6.2.2 UI Panel

The most basic UI element is the Panel. Its main function is hold other UI elements. Here one can add a background on it, depending on what the developer wants. By default, the Panel is giving the background image which is just a grey rounded rectangle as a source image with medium opacity but can be taken that out entirely or replace it with an image.

Panels are very useful when developers starting laying out the UI and want items to scale appropriately with each other based on different screen sizes. To create the Panel, use the Create menu UI > Panel.

6.2.3 UI Button

The button element detects user input and can trigger an event. User input is usual the pointer hovering over or clicking on the button graphic. To create this Button, use the Create menu UI > Button. Like all elements, the button must be the child of the Canvas. The button element requires an Image (Script) and a Button (Script). It also includes an optional text element attached as a child. The text element is optional and can be removed if the button does not need any additional text. Normal, Highlighted, Pressed and Disabled color defines the tint color that will be applied to the target graphic when the button is in each of these states. (“UI Button - Unity,” n.d.)

6.2.4 UI Image

The Image component is used to give UI elements actual graphical presence on the screen. Images can be used to make up the backgrounds of buttons, panels, sliders and literally anything is wanted to be put on UI composition. The first property of an image component is the Source Image. This is a reference to the Sprite that the Image is displaying. When using None, the color will be used to represent the outline of the image. The next property is the color. This color is multiplied to the color of the

sprite. The UI Image can be added from the Create > UI > Image. (“UI Image - Unity,” n.d.)

6.2.5 UI Text

The Text component is used to render text on the screen as part of UI layouts. The primary property of a Text component is Text. This is the string that will be shown on the screen. It can be used as a simple label, or dynamically to show things like the score for example. The Character section of the component defines how the characters of the string will look. The Font is the font asset used for this component. Unity supports TrueType, OpenType and Font typefaces. Because it is authoring an external game or application, the fonts must be included in the project assets in order to be used. The style can either be Normal, Bold, Italic or Bold and Italic. The Font Size will be the font size that it is forced to. If the font size is too large to fit within the rest, then the text will not be displayed, unless Overflow settings are used. The Paragraph section defines how the text will sit within it is rest. Text can be aligned left, center or right, top, middle or bottom. To create this Text element, use the Create menu to Create > UI > Text. (“UI Text - Unity,” n.d.)

6.3 Vuforia Engine

Vuforia Engine is the most used platform for AR development. AR content can be easily adding advantaged functionality computer version to iOS, Android and UWP applications for creating an experience with AR, whose content interact with objects from real-world. (“Overview,” n.d.)

Vuforia Engine gave a great boost to the Augmented Reality industry. It was one of the fastest tracking algorithms on the market which is less predisposed to low light and trackable occlusion. This makes the applications created to be user-friendly and at the same time easy to use. Vuforia is offered free and this is the best of all. (Habbak & Cushnan, 2013, p. 26)

6.3.1 Marker-based tracking

In AR, markers are objects or images registered with the application which act as information generates in the application. While running an AR application, when a device’s camera identifies these markers in the real world, this triggers the virtual content over the object or image in the camera view. Marker-based tracking uses a variety of different marker types like QR code, Image Target, physical reflective markers, and 2D tags. Of all this, Image Target is the simplest and most common type of marker. (“Unity - Manual: Vuforia,” 2018)

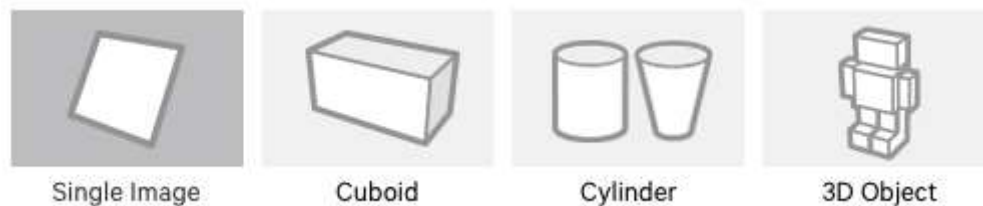


Figure 6. Common types of Image Target. (“Unity - Manual: Vuforia,” 2018)

6.3.2 Image target

The type of marker used in Marker-based tracking is Image Target. Those are images which are registered manually in the application, acting as triggers to display virtual content. Image Target must be used that contain distinct shapes with complex contours. This facilitates image recognition and tracking algorithms to recognize it. (“Unity - Manual: Vuforia,” 2018)

6.3.3 Markerless tracking

Markerless tracking applications are typically more commonly position-based or location-based AR or MR. This form of tracking is based on technologies such as GPS, gyroscope, accelerometer and more complex image processing algorithms to place virtual information or objects into the environment. These objects are subsequently treated by VR software and hardware as if it were connected or anchored to certain real-world objects or locations. (“Unity - Manual: Vuforia,” 2018)

6.3.4 Cloud recognition

The service of Vuforia Cloud Recognition is an enterprise-class Image Recognition solution that permits developers to manage and host Image Target online. It is available with the Cloud, Pro, Development and Enterprise licenses. Usage is determined by “recos” or a total number of image recognitions per month that the application performs, it counts the images when a target is matched. The API used to execute the query determined the result of Image Recognition query. The result of the query returned to the Cloud Recognition Web API is a list of match ID matching IDs classified by recognition trust. This API does not receive a traceable target result. (“Cloud Recognition,” n.d.)

Query API	Result
TargetFinder API (SDK)	Image Target Trackable
Cloud Recognition Web API	List of Target IDs

Figure 7. Cloud Recognition. (“Cloud Recognition,” n.d.)

6.4 Unity fits with Vuforia

Vuforia Offers OpenGL SDK which can be used to create AR content, without using Unity. However, Unity contains a lot of tools that can make content looks incredibly good and realistic. (Habbak & Cushnan, 2013, p. 35)

Starting with Unity 2017.2, Unity integrates the Vuforia Engine, and developers have been able to create Vuforia applications directly in the Unity Editor. Vuforia integration makes performance optimization possible, allowing developers to focus on creating the best AR experience. (Vergara, 2018)

Unity opened its license options to give anyone permission to deploy to iOS and Android for free. This is good because to be able to deploy simple Vuforia applications, is not need to acquire their license. Unity using Vuforia utilize a webcam to detect the image and show how the AR content will look exactly on the image without having the applications implemented on the device first and this opportunity saves time. (Habbak & Cushnan, 2013, pp. 35–36)

6.5 Visual Studio IDE

Visual Studio is an application package which helps developers to create, run and debug the .NET applications. It is intelligent software which makes simpler application development targeting to .NET technologies. (Edureka, 2015)

Visual Studio 2017 contains numerous new, exciting characteristics and IDE productivity improvements to support Windows application development, Azure development, web and cloud development, cross-platform mobile development, and more. (“Visual Studio 2017 Compatibility | Microsoft Docs,” 2018)

IDE comes from Integrated Development Environment and helps to simplify application development with the support of its components. It is famous because of its components. By using IDE, developers can

implement a .NET application instead of writing code from scratch. IDE helps to write the initial code required to develop a .NET application. (Edureka, 2015)

6.6 C# - a programming language

The reason for the choice of C# as a programming language for the practical part is that Vuforia uses it. C# is a well-structured language and has a higher learning curve, is less prone to mistakes and much more robust than other languages. For most professional studios it is the language of choice. (Habbak & Cushnan, 2013, p. 34)

6.7 Adobe Photoshop CC 2019

In these times, Adobe Photoshop is an essential tool in the graphics field for every discipline, being one of the most important computer programs.

At first view, it can be intimidating because of the complexity of options, tools, shortcuts, and the existing of a lot of baffling arrays of plug-ins and add-ons (Bauer, 2013, p. 1).

Gaining control of Photoshop is easy. Graphics designers, photographers, fine artists, web designers, videographers use Photoshop in their work. Adobe Photoshop CC is the new version of Photoshop and CC means Creative Cloud which is not available as box software, only by dues of Adobe Creative Cloud. (Bauer, 2013, p. 3)

7 AR WEDDING SOLUTION IMPLEMENTATION

This chapter will present the way how the practical part was done. In the first part is present how the wedding invitation was designed. In the second part is to explain all the steps that are needed to develop the application using Augmented Reality. The third part is about coding, more exactly explaining how was made the connection between Unity and Gmail, where all the message from the guest will be stored.

7.1 Wedding invitation design

Building the practical part started from the design of the wedding invitation which was done with the aid of Adobe Photoshop CC. The four parts of the invitation are to be quite detailed, but not too much so that the guests, wanting to know more about the event, access the ARWedding application.

The design of the invitation is made up of a light blue background to the center and the edges tend to the black non-color. Each part contains a silver-colored frame with different patterns.

The main part of the four contains the most complex frame and the rest contains some parts of this frame to be all parts of the invitation in the same context. The text color is white, containing two styles and different sizes to highlight the important words.



Figure 8. The main part of the invitation

The second part of the invitation contains instructions where are added three images and some text to explain exactly the steps to follow in order to use the application.



Figure 9. Instructions for using the application

The third part contains information about confirming the presence of the guests. Here are added the phone numbers of the bride and the groom so that those who do not have a smartphone where to download the application and cannot confirm their presence online to can do it by calling the grooms.



Figure 10. RSVP

The fourth part contains a “Thank you” message addressed to the guests.



Figure 11. Last part of the invitation

7.2 Insert Vuforia into Unity

In order to create the application, it was necessary to download a version of Unity into which Vuforia Engine is included, so the Unity 2018.1.1f1 online version was chosen. During Unity installation, must-select options are platform supports for iOS, Android, UWP and also Vuforia Augmented Reality Support, then the installation can be finished. After Unity is installed, the software is open and a new project is created where the name of the project and location should be completed.

It is recommended to use the 3D project set up and Enable Unity Analytics to select ON. The first step after creating the project is to activate Vuforia Engine by selecting File > Build Settings... and then select Player Settings. In the right part is founding “XR Settings”. Under this section, “Vuforia Augmented Reality” must be checked.

7.3 Insert Augmented Reality into Unity

After activating Vuforia Engine, its features can be added to the project from the Unity GameObject Menu or right click on the Hierarchy tab. Start by adding AR Camera that can be added from Unity GameObject > Vuforia > ARCamera or from right click on the Hierarchy tab. This is the special camera type that supports the application of Augmented Reality for both portable and digital eyewear.

7.4 Add Image Target into the scene

Adding Image Target into the scene is made by selecting the associated Game Object in the GameObject menu > Vuforia > Image. The Image

Target will be added in the Hierarchy tab which will be visible in the scene. The target object can be configured in the Inspector.

7.5 User interface

When the application is open, a Canvas is showing. It contains two Panels, one at the top of the screen and one at the bottom of the screen. Each of those includes text.

On the first Panel is display the text “Image not found” and on the second one, the text which is showing looks like “Scan the image”. In the center of the screen is added an image, build with the help of Adobe Photoshop CC, which makes users understand that they need to scan the invitation.

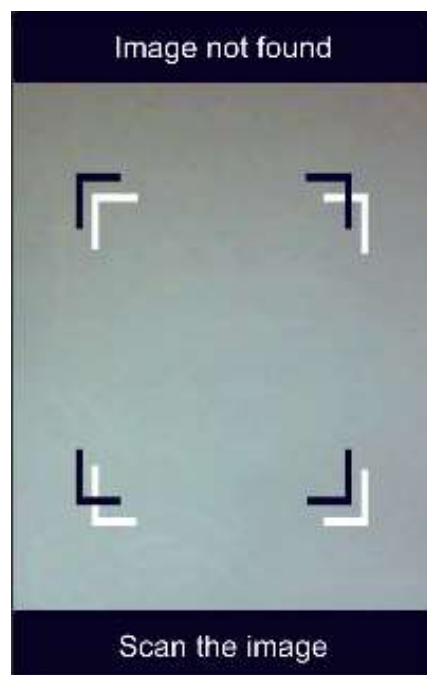


Figure 12. Scan frame

When Image target is found, the Canvas with all its content disappears and the virtual objects appear on the invitation. When the image target is lost, the Canvas appears again, which indicate to the user the device’s camera is no longer placed above the invitation or the application cannot detect it.

7.5.1 Video

When Image Target is found, a welcome video from the bride and groom is placed over the wedding invitation. To insert this video into the application is necessary to add a Cube Object or a Quad Object. In this case, a Quad Object is used, added by pressing right click on the Image Target from the Hierarchy tab, choosing the 3D Object and from those options the Quad Object is selected. In this way, it will be added as a child of the Image

Target which will be detected when the invitation is found. The dimensions of the Quad are so that it to cover the entire Image Target.

At first instance, the Object has a white background and the goal is to replace the background with the video. To attach a video file to the GameObject, the Video Player component must be added to Quad Inspector. It gives the possibility to add from its Source property, type of source for the video which can be Video Clip or URL.

To assign a Video Clip, the video file must be imported manually into Unity, drag and drop it into field Video Clip. The second way is to add a video from a URL. Unity reads the video which is found on the URL at the run time. The Quad Object is disabled and just when Image Target is found, it will be enabled.

7.5.2 Menu

There are two menus which can be accessed to navigate anywhere into the application. First is the main menu which appears automatically after video playback. The second menu is placed on the bottom of the screen. In contrast to the main menu, the second one is always on the screen and it can be accessed without browsing to the menu every time.

The main menu is a child of the Image Target. It is made up of a Canvas containing seven buttons. Each button is made up of a white background, black background and text. The white background size is bigger than that of the black one to create a frame of the button.

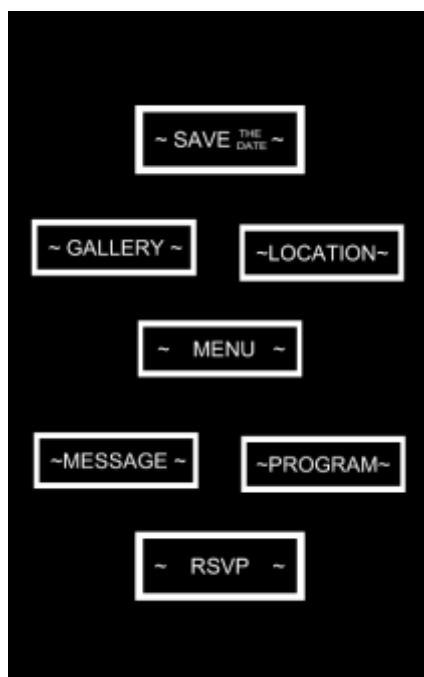


Figure 13. Main menu

The bottom menu is inserted in Canvas, composed of two images and one Panel. The first image shows an open menu hamburger and the second one a close menu hamburger. The images are switching. If the button is pressed the first time, the open menu image is changed to close menu image and the Panel with all seven buttons appears on the screen. If the close menu button is press, its image is changing with the open menu which generates closing Panel. All Panel buttons are the same as those from the main menu and have the same functionality.

7.5.3 Save the date

Save the date - page provides information about the date, time and location where the event will take place. All that information is inserted into an image. Inserting the image into the application requires the following steps. Adding the image to Unity is done manually by dragging and dropping it from a local folder into the Unity folder. To make image Sprite, select the image that opens the Inspector tab where can be seen Texture Type and from its option, Sprite (2D and UI) is required. After selecting the option, click the Apply button.

Next step is to create an empty GameObject and make it the child of the Image Target. This GameObject contains an image and a back button that leads to the main menu. All that remains to be done for the image to be displayed is drag and drop it on the Sprit Renderer component in the Sprite section. Also, size adjustment is important in the design of the page.



Figure 14. Save the date - page

7.5.4 Gallery

There is the risk of attending a wedding without knowing the bride and groom so well and the gallery page was made especially for those guests who do not know the bride or the groom or who have not met them for a long time. Of course, it also addressed to the close guests, giving them some of the memories from the lives of the bride and groom.

This page contains the Canvas, which, in this case, is no longer the Image Target's child, a Panel and a back button. All the charm of the gallery page is in the content of the Panel. It comprises two children, namely a Panel including as many images as the grooms want, added manually in Unity as the image form Save the date - page was added and a GameObject positioned in the center of the Canvas. To make is functionally is needed C# code which will be addressed in the following.



Figure 15. Gallery page

7.5.5 Location

The location page is the easiest to accomplish. A GameObject is created in which a script with the following code is added.

```
public void Localizare()  
{  
    Application.OpenURL("URL");  
}
```

Figure 16. Code form the Location page

In the above code is created a class named Localizare() inside of which is found Application.OpenURL() method which opens the URL from the brackets in a browser. The application opens in Google maps the location where the event takes place. This gives the user the possibility to find out more about the address.

7.5.6 Menu

Drinks and food served at the wedding are a great interest for the invitations and surely this page will be the most visited one. Here are an image and a back button. Image contains a list of wedding menu. The wedding invitations will be handed out to the guests two months before the event and they will be able to access the application since then, but given that the wedding menu is set two weeks before the wedding begins, instead of the menu image, an image will appear with the text “The menu will be displayed two weeks before the event”, and once the exact menu is known, it will be loaded on the page.



Figure 17. Menu page

7.5.7 Message

When this page is accessed, three buttons appear. The first button is positioned at the top of the page indicate an arrow to the left, where to navigate back to the main menu. The other two buttons are, one where the user can see the personalized message from the bride and groom for the person using the software and the other one offers the opportunity for each guest to send a message to the couple.

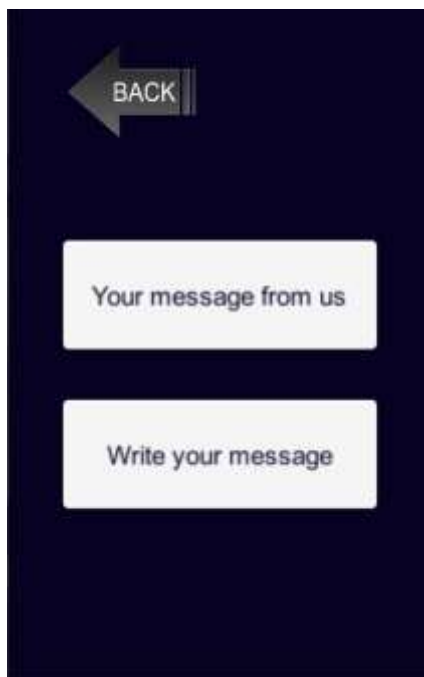


Figure 18. Message page

In the following, attention is directed to the button where guests can access personalized message from bride and broom. By clicking this button, the invitation image cannot be detected any more so that the guests could not scan it.

In the restaurant where the event takes place, there will be image targets on the table for each guest. The name of each guest will be positioned on top of those images so that the pictures will not be confused. It is possible to create as many image targets as the guests will be. The reason why the images will be different for each guest is that different videos appear on their screen when the device detects them.

In Unity, those images will be loaded, and the video will be placed over each image. Because the wedding has many guests, in order not to load the application with many videos, they will be uploaded to a website, and in Unity, only the links will be added.

It has been mentioned above that guests can send their message to the bride and groom. In the page where guests can send their message, an image is inserted as a background, inside of which two Input Fields are added, one for name and one for a text message. Also, the page provided with a send and a back button.

If the send button is pressed before the fields are filled correctly, a message with the text "Complete all fields" appears above this button to inform the user that their message cannot be sent before all the fields are completed successfully. In case all fields have been right completed, the message will be sent to the couple's Gmail addresses.

Figure 19. Message from guest's page

7.5.8 Event program

The page displays the program of the event, such as the beginning of the religious ceremony, the time when the party starts, activities time and hour when the party is ended. The construction of this page is similar to that of the menu page.



Figure 20. Program page

7.5.9 RSVP

To create the RSVP page, a Canvas has been added, whose children are a background image, three input fields, one for inserting the name, one for email and one for the confirmation message. Each input field contains a representative text for the user to know how to complete it. If the fields have not been filled in or have been filled in incorrectly, an error message appears when you click the send button.

The message will be sent only if all three fields were filled correctly. Once the confirmation message is sent, it is automatically received by the bride and groom in the Gmail accounts.

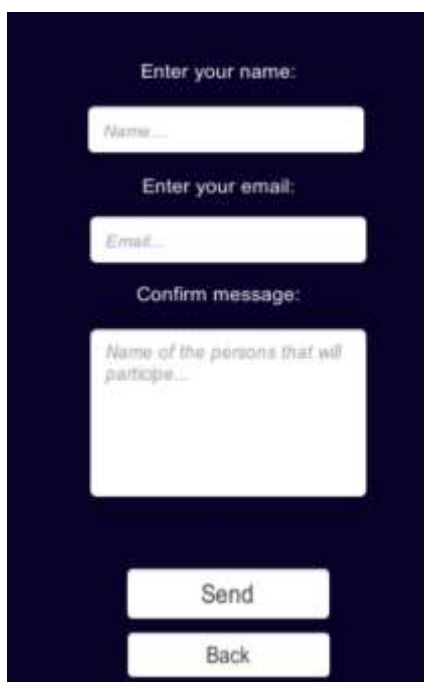
The image shows a mobile application interface for an RSVP page. It features a dark blue background. At the top, there is a label 'Enter your name:' followed by a white text input field with the placeholder text 'Name...'. Below this is another label 'Enter your email:' followed by a white text input field with the placeholder text 'Email...'. The third section is labeled 'Confirm message:' and contains a larger white text area with the placeholder text 'Name of the persons that will participate...'. At the bottom of the form, there are two white buttons: 'Send' and 'Back'.

Figure 21. RSVP page

7.6 Send e-mail via Unity

The .NET 2.0 framework makes it easy programmatically wise to send an email to any email address by using Gmail account. It contains a class name `System.Net.Mail.MailMessage` which permits quickly building an email message. By means of namespace like `System.Net.Mail` and `System.Net` System can be done sending the text from Unity to Gmail addresses. `System.Net.Mail` contains classes used to send electronic mail to a Simple Mail Transfer Protocol (SMTP) server for transfer. The `System.Net` namespace gives a simple programming interface for numerous protocols used today on networks. The `WebRequest` and `WebResponse` classes devise the basis of pluggable protocols and implementation of network services allows to develop applications which use Internet resources and do not worry about the details of the individual protocols. First of all, is check if `InputField` is completed and after is used a specific `MailMessage()`

class object to initialize a new instance of the MailMessage class. The recipient address is written in the message To.Add("recipient"). If there are multiple recipients, the address will be separated with a comma. For every field, in this case, user name, user email, and the message creates an instance to display it in the email. For sending emails an SMTP host is needed, containing a host's IP address or name and port or name. In this case, is used Gmail as SMTP host whose name is smtp.gmail.com and the port is 587. Using Gmail account to send emails requires that the recipient is authenticated as a Gmail user, so it is just to send the encrypted Gmail account credentials over SSL to validate and send an email. After enabling SSL for connection encryption, is created a System.Net.NetworkCredential object and here must be set the username and password required by SMTP account. Once all is done, the message can be sent via one button which contains smtp.Send() function. Sending the email might take a few seconds, depending on the Internet connection. After the code was done, a problem arose due to Gmail because in Security Gmail section is a part name *Less secure app access* which blocks automatically the application who send emails to it. After turn on access, the emails could be sent. (Dave, n.d.)

8 RISKS ANALYSIS

There are some risks which can appear during the thesis work. In the following, some of them will be presented, as well as a description of how to prevent them and actions to rectify the risks in case they appear.

Table 3. Risks

Risk	Description	Prevention	Action to rectify the risks
Programming gets too hard.	Programmer does not manage task purpose.	Find easy and interesting tasks, do not complicate.	Asking for help.
Light affect image detection	The reflection of the sun's rays on the Image Target that prevents its detection.	The right choice of the wedding invitation paper.	Prevent guests about it.
Scanning invitation more than 1000 times.	For a free package that Vuforia offers is a limit of 1000 scans and overtaking them is no longer possible to use the application.	Buy a package with unlimited scans.	Make sure the application is available for guests just before one day the event is started
No internet connection.	If there is no internet connection, the application cannot be used.	Every guest makes sure that have a good internet connection.	If the application cannot be used there is information about the date, time and the location on the main part of the invitation.
Studying too much	Lead to delay	Learning just the part is needed to know for the theoretical and practical part.	Daily goals.
Computer breaks	Computer breaks and causes file loss	Save all the time files in the cloud.	Try to recover the files.

9 CONCLUSION

The happiest moments in someone's life are usually accompanied by a kind of celebration. Those events are surrounded by specific rules of etiquette which dictate how the bride and groom are supposed to celebrate it and how they should act in order to show respect for the guests of honor.

Augmented Reality is a new technology that brings digital information into the real world, using a smartphone camera. By scanning the Image Target, all virtual elements come to life in a second on the screen.

The goal of the thesis is to impress the guests by digitizing the invitation using the new and impressive Augmented Reality technology and make the event stay in the invitees' memory for a long time.

The application will bring many improvements to the wedding such as inform the guests before some weeks the event take place about the wedding program and the menu where they can see what food will be served and what drinks are there. The opportunity to find easy the location is an advantage because the grooms will know that all the guests will be at the wedding place.

It is different from the other solutions because it includes online confirmation which is a good opportunity for guests and also includes a personalized message from bride and groom to every guest and each of them will feel really important and for sure they will take the possibility to text a nice message for grooms.

This application will make a strong connection between the couple and guests and all that is new about the event will be displayed as soon as the details are known.

What is certain is that the mobile device population is growing, and the level of processing power is rising too. There will be more and more clients which will carry phone able to displaying AR content, and after the application is download, they will be far more interested in the future AR applications.

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