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INDEX: Industrial Expert

Augmented Reality - Intermediate Module

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Augmented Reality - Intermediate Module

Overview Short introduction

Author: Paula SPANU

Augmented reality is a technology with accelerated dynamics that will change the way the digital environment will be integrated into the real world. The advantages offered by this technology are practically unlimited. AR applications can create extraordinary visual satisfaction for the user, generated by the potential of this technology to combine the real world with computer-generated information. To understand the direction and potential of augmented reality, we invite you to browse the content of the Augmented Reality module.

In this module, readers will have at their disposal the definition and the main concepts of augmented reality, they will discover its dynamics in time and the fundamental principles that underlie this technology.

In addition, those interested in AR application development will have the opportunity to discover the benefits offered by the ZappWork platform for application development through three tools: Widgest, Designer, Studio.

By combining the real world with elements of the virtual world, you will discover that augmented reality technology offers the opportunity to change the way it can do business.

You will discover solutionswhich will show you how to use augmented reality in business as well the case studies of successful use of augmented reality.

Learning objectives

By completing this module, you will gain the following knowledge and understanding:

- you will gain specific knowledge about the basic concepts used in augmented reality technologies;
- you will be able to report on the history of the evolution of augmented reality technology;
- you will identify and explain exactly the main fundamentals of augmented reality and virtual reality;
- You will understand the principles of Augmented Reality and how the different elements interact together;
- you will understand the features of augmented reality hardware;
- you will be able to identify the best augmented Reality software;
- you will be able to develop practical experience in creating your ZappAR account;
- you can design new augmented reality applications using ZapWorks;
- you will become familiar with the implementation of augmented reality in various fields and applications;
- you will be able to promote the use of augmented reality in business.





Types of augmented reality

There are six types of augmented reality technologies which can be grouped into two categories: triggered and view-based [8]:

- Marker-based AR.
- Market-less AR.
- Location-based AR.
- Superimposition AR.
- Projection-based AR.
- Outlining AR.

Marker-based AR. It is also called Image Recognition or Recognition based AR. This type of technology is based on image recognition (QR code, special symbol, marker). The AR device scans the image and calculates the position and orientation of a marker to overlay the content over objects, as you can see in the figure below.



Figure 1. Marker-based AR. Source: AnyMotion https://learn.g2.com/augmented-reality

In the next video you can see the AR application using Marker Based AR experience.

VideoMarker Based augmented reality







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Markerless AR.

This type of AR works without the help of any marker. This technology relies on location to generate AR content and uses a GPS, a gyroscope, and an accelerometer to provide user location data. The content is overlaid into a scene and holds it to a fixed point in space. Markerless Augmented Reality had a huge impact with Pokémon Go. Also, Wikitude's SLAM markerless augmented reality tracking is one of the most versatile cross-platform 3D-tracking systems available for mobile [2]. Google's ARCore SDKs and Apple's ARKit have developed markerless AR accessible on smartphones and tablets.







Figure 2. AR imagine using Markerless AR. Source: AnyMotion https://learn.g2.com/augmented-reality/

In the next video there are a lot of useful information about markerless AR technology , that could be helpful for you.



Markerless AR explained

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Location-based AR

This technology is based on the digital content mapped to a specific location. When a location is used, the objects are displayed on the screen as you can see in the next picture.



Figure 3. AR imagine using Location-based AR Source: https://blog.vakoms.com/everything-you-need-to-knowto-build-location-based-ar-app/

The next video provides the basics of the Location-based augmented reality technology and how to add virtual content to the real-world to be fixed in space at a specific location.

Location-Based AR (Basics)



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Superimposition-based AR. This technology partially or completely replaces the original image of an object with a recently augmented view of the same object. An example of the use of this technology is available in the image in the image below.



Figure 4. AR imagine using Superimposition-based AR Source: https://learn.g2.com/augmented-reality/

An example of the use of Augmented Reality Superimpose is available in the video below.

Augmented Reality Superimpose







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Projection-based AR.

It functions by projecting light onto real-world surfaces. Projection-based augmented reality works by projecting artificial light onto real world surfaces. Users can interact with the light by tapping the buttons which are just the projected light. Projection-based AR can detect touch and movement, to interact with the system. Such an example is shown in the image below.



Figure 5. AR imagine using Projection-based AR Source: https://learn.g2.com/augmented-reality

A good Projection-based augmented reality demo is available in the next video.





Projection-based AR



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Outlining Augmented Reality

The outlining AR technology identifies lines and boundaries that human cannot recognize as it is shown in the figure below. Is uses object recognition to understand the user's existing surroundings.







Figure 6. AR imagine using Outlining Augmented Reality Source: https://learn.g2.com/augmented-reality

Augmented Reality Hardware

Augmented Reality technology uses two types of hardware interfaces to overlay the digital information on the physical world: displays for the head and displays for the hand. Smartphones, Tablets, Smart Glasses, or even more complex Headsets are terminal devices to use AR. In the figure below there are some augmented reality devices used over time.



Figure 7. AR imagine using Outlining Augmented Reality Source: https://beyonddesign.typepad.com/posts/bim-360-docs

These mobile devices typically contain the hardware required for AR. Hardware components for augmented reality are the processor, sensors, display, and input devices.

The processor is the heart of the augmented reality system. It analyses the information received from the sensors, stores and processes data, and generates the appropriate signals for display.





At present, some smartphones and tablets are equipped with additional hardware modules specifically designed for AR applications.

Smartphones with augmented reality components

Lenovo Phab 2 Pro

Lenovo Phab 2 Pro is a smartphone with additional components (Google Tango Technology - advanced computer vision, image processing, special vision sensors) for augmented reality.



Figure 8. Lenovo Phab 2 Pro Source: by https://www.lenovo.com/

The next video presents some AR applications using Lenovo Phab 2 Pro, with Tango's 3D-motion tracking and depth perception, Lenovo™ PHAB2 Pro.

Lenovo Phab 2 Pro Product Tour - World's First Smartphone with Tango







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Asus ZenFone AR

Asus ZenFone AR is a 5.7-inch smartphone, with support for Tango and Daydream technologies from Google as it can see in the next picture. Tango is a new and interesting technology for augmented reality (AR) and Daydream it benefits from a virtual reality (VR) experience.







Figure 9. AR imagine using Asus ZenFone AR. Source: https://www.asus.com//

The next video presents AR experience with Tango from Google **that helps** you enjoy high-quality, immersive virtual reality.

Asus ZenFone AR







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Smart Glasses and Headsets

Smart glasses and headsets exist in various hardware and software configurations that allow the user to see the real environment along with virtual information:

- Head-worn (Smart Glasses, Headset): allows interaction via gesture and voice recognition;
- Hand-worn (Smartphones, Tablets): contains hardware modules made for AR applications;
- Spatial (projector, hologram).

The best headsets available for AR are the following:

Hololens is an AR headset developed by Microsoft with Windows operating system. Microsoft Hololens is equipped with transparent lenses, microphones, an HD camera, a light sensor, and the 'Holographic Processing Unit', which enables users to interact with the virtual content without any wires.



Figure 10. Microsoft Hololens AR application. Source: https://www.microsoft.com/en-us/hololens

The following video will introduce you to an immersive mixed reality experience offered by HoloLens 2.

Introducing Microsoft HoloLens 2







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Magic Leap

Magic Leap is an AR headset that overlays 3D computer-generated imagery over real-world objects by projecting digital light into the user's eye.



Figure 11. Magic Leap - A lightweight, wearable device that can interact with digital content in the world. Source: <u>https://www.magicleap.com/</u>

Discover more features of Magic Leap One by watching the following video.

Magic Leap One Creator Edition | Encounter New Worlds







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Google Glass Enterprise

Main features of Google Glass Enterprise:

- Voice commands: users can control key functions via audio commands, without selecting buttons manually.
- Built-in earphones: for a more immersive user experience.
- Lightweight: weighing only 36 grams, offering a comfortable experience for users.



Figure 12. Google Glass Enterprise.Source: https://www.google.com/glass/tech-specs/





In the following video you can find a lot of Glass Enterprise Edition applications in a variety of industries.

Glass Enterprise Edition 2: A hands-free device for smarter and faster hands-on work



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Epson Moverio

Epson Moverio is an AR headset very versatile and adjustable to every size and user's requirement. The Si-Oiled technology used by Epson Moverio provides users with a sharp, bright, and high-quality image. These smart glasses are powered by Intel Axom 5 processor and run on Android 5.1, making it easier for developers to develop AR apps.







Figure 13. Epson Moverio. Source: <u>https://www.epson.ro/products/see-through-mobile-viewer/moverio-bt-300</u>

In the next video you can see how Moverio Assist helps make repairs quicker with fewer mistakes.



Epson Moverio - an AR headset

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DAQRI Smart Glasses

DAQRI AR glasses main features:





- Worksense: users have access to productivity apps via DAQRI's Worksense content platform. These apps enable working hands-free while viewing real-time information.
- Ergonomic and lightweight: it is possible to use smart glasses in the office but also in warehouses and construction sites.
- 6DoF tracking: the AR glasses feature positional tracking for precise and reliable interactions with the surrounding environment.



Figure 14. DAQRI AR glasses. Source: <u>https://www.re-flekt.com/blog/why-daqri-smart-glasses-are-an-option-for-augmented-reality</u>

Watching the next video, you will find a demonstration of how DAQRI Smart Glasses work in a manufacturing environment to boost productivity.

Augmented Reality Smart Glasses in a Manufacturing Environment







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Exercise - Multiple Choice

Which of the following hardware configurations are in the AR devices category?

- □ Head-down.
- □ Head-worn (Smart Glasses, Headset).
- □ Head-up.
- □ Head-front.

The Principles of Augmented Reality (AR)

Augmented Reality Software

Augmented reality (AR) software works with devices such as tablets, smartphones, smart glasses, and so on. All these AR devices have to contain sensors and digital projectors that allow superimposed information and objects in the real world and the users to interact with the scenes. AR video technology includes "Video See Through" and "Optical See-Through" technologies [9]:

• "Video See Through" uses a camera to capture real-world images and then integrates virtual images to create the augmented image.





• "Optical See-Through" projects virtual images on a transparent screen, allowing the user to see the projected image of the virtual object on the screen, and through the screen the images of real-world objects.

At present there are a lot of software platforms that allow the development of augmented reality applications: ARKit (for the development of native iOS mobile applications). ARCore (for the development of native Android mobile applications), Wikitude AR SDK (to create augmented reality applications that add a virtual dimension to physical products), etc.

Various types of AR software combined with 3D technology have found applications in archaeology, architecture, marketing, training, healthcare, tourism, maintenance, and so on:

AR visualization software – This type of software enables organisations to create immersive experiences for consumers to interact with. AR visualization software users can upload 3D content and scale the image, adjust the colour, and incorporate the additional details needed to give the best user experience possible.

AR content management system (CMS) – An AR CMS lets users bulk upload raw 3D content that will eventually become the basis for AR experiences. This content can be managed and edited within the platform.

AR SDK – These tools allow users to build digital objects that will blend into the real world that will eventually become fully fledged AR experiences.

AR WYSIWYG editor software – This software enables users limited to a no coding background to create customised AR experiences. These tools have drag-and-drop capabilities that let users upload 3D objects and drop them directly into previously designed scenes.

AR game engine software – These solutions give game developers the framework for creating AR video game experiences. Using AR game engine software, users can create and edit 3D characters that can interact with the real world.

AR training simulator software – AR training simulator software leverages AR technology to train employees for certain jobs.

Industrial AR platforms – These solutions are typically used by organisations in the industrial field. These tools include interactive AR content that improves these employees' productivity, effectiveness, and safety.

The best augmented reality software

• ZapWorks https://www.zappar.com/







BRIO https://www.experience.briovr.com/



• Vuforia Engine https://www.ptc.com/en/products/vuforia/vuforia-engine



• RCore https://developers.google.com/ar



ARKit https://developer.apple.com/augmented-reality/



Wikitude https://www.wikitude.com/



• MAXST AR SDK http://maxst.com/#/en







Watching the next video you will find the best tools for augmented reality development: ARKit, Vuforia, ARCore, Wikitude, MaxST, Kudan, EasyAR, and other great SDKs.



DEVELOP AUGMENTED REALITY APP - BEST SDK AND AR TOOLS TO USE

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How to start to create an AR app. Create augmented reality applications

There are several relevant features of AR technology to take into account when you want to create augmented reality applications:

- Significant content can be developed;
- Offers positive, interactive, and unique experiences;
- May contain the conclusive visual interaction of the virtual and physical environment;
- Can create applications that draw attention to the products promoted through this technology.

Other considerations for augmented reality app you need are the following:

- Establishing the theme of designing the application;
- Identification of existing SDKs and platforms for the development of augmented reality applications (available platforms: Vuforia, Wikitude, and ARToolKit require advanced knowledge of C ++, Java, or C #, Blippar, Aurasma ZapWorks for beginners).
- Selecting the platform that fits the theme, available budget, and experience;
- Identifying 3D objects, downloading or creating them;
- Create a 2D tracker (a specific image that is placed on a surface and scanned by the AR device);
- Preparation of necessary 3D models, images, text files, and data and upload them to the selected platform.

To choose a suitable platform, it is necessary to analyse the features and benefits of the augmented reality tools.

The Augmented Reality SDK comparison chart is available here:

https://socialcompare.com/en/comparison/augmented-reality-sdks

The next video describes the state of the AR SDK industry, comparing features and revealing the best use cases for each solution.

The Best Augmented Reality SDKs.







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Platforms to create augmented reality applications

In general, augmented reality platforms have similar characteristics but also different features such as the tracking system, or the ability to recognize objects, each with their own strengths and weaknesses.

There are four different types of tracking systems that augmented reality platforms use: markerless tracking, face tracking, object recognition, and plane tracking.

Vuforia

https://www.ptc.com/en/technologies/augmented-reality

Vuforia is one of the most popular AR development platforms. It provides the fastest, easiest and most advanced AR content development solutions to orient and place virtual objects into the real world.

Vuforia features:

- Supports Android, iOS, UWP, and Unity;
- Works with Microsoft HoloLens 2;
- Markerless object recognition;





- Fat surface recognition using Vuforia Ground Plane, triggers AR content by recognizing images;
- APIs for Java, C++, Objective C++, and .NET via an extension of the Unity game engine.

Tools provided by Vuforia:

- Vuforia Studio transforms existing CAD and IoT data into AR applications.
- Vuforia Expert Capture is the best choice for AR-based training and instruction.
- Vuforia Chalk combines advanced AR collaboration tools with real-time video communications.

The next video shows a demo for Vuforia Engine to put content in the real world.

Vuforia Engine by Vuforia



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ARCore

https://developers.google.com/ar/

ARCore is Google's platform for building augmented reality experiences.





Key features of ARCore include:

- Motion tracking allows the phone to understand and track its position relative to the world.
- Environmental understanding allows the phone to detect the size and location of all type of surfaces: horizontal, vertical and angled surfaces like the ground, a coffee table or walls.
- Light estimation allows the phone to estimate the environment's current lighting conditions.

The next video introduces a preview of a ARCore and their augmented reality capabilities for Android phones.

Introducing ARCore



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ARKit

https://developer.apple.com/augmented-reality/

ARKit is designed exclusively for iOS devices like the iPhone and iPad.

The features of ARKit are:





- It allows to create a topological map with labels identifying floors, walls, ceilings, windows, doors, and seats.
- Instant AR placement is automatically enabled on iPhone 12 Pro, iPhone 12 Pro Max, and iPad Pro for all apps built with ARKit, without any code changes.
- Face Tracking tracks up to three faces at once on all devices with the Apple Neural Engine and a front-facing camera to power AR experiences like Memoji and Snapchat.

The next video shows what ARKit Augmented Reality is for iOS WWDC 2017.

Introducing ARKit Augmented Reality for iOS



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Wikitude AR SDK

https://www.wikitude.com/

Wikitude SDK is for Mobile Platforms such as: Android, iOS, Windows, Unity, Cordova, Xamarin, Flutter, React Native, Ionic, Adobe, AIR, Qt by Felgo, LBAR

Wikitude SDK supports Epson Moverio, HoloLens and Vuzix.

Wikitude AR SDK TOOLS





- 3D Encoder for Mac OS X
- 3D Encoder for WINDOWS

The main features of Wikitude:

- It uses CAD & 3D Models for Object Targets.
- It works with up to 1000 images that can be recognized offline and with thousands of target images hosted in the cloud.
- It offers its own SLAM Instant Tracking technology which can be dynamically connected to ARKit and ARCore.
- It icomes with many convenient features that simplify working with geo-referenced data.

The next video shows a way to track, save and share augmented reality experiences with Wikitude SDK 8. Also, it is focused on its features such as Scene Recognition, Instant Persistent Targets, Extended Object Recognition, and Unity Live Preview.

Watch the video Wikitude SDK 8 - Endless AR Possibilities

DeepAR

https://www.deepar.ai/augmented-reality-sdk

DeepAR integrates and supports masks, lenses, effects, and filters. It runs on Android, iOS, HTML5, and Unity.

Main DeepAR features:

- It can detect fast and precise faces, robust eye, nose and chin. It detects more than 68 facial feature points at up to 60 frames per second.
- It can track any face under almost light conditions from any angle, even when the head is turned 180 degrees either side
- It has real-time emotion detection based on proprietary neural network and deep learning models.
- It can detect all the core emotions Anger Disgust Fear Happy Sad Surprise Neutral – in real-time.





The next video shows information about the DeepAR SDK as well as the DeepAR Studio. It describes how this technology works, face tracking points and about dense face meshes.

DeepAR.ai Intro - How this tech works, the Tracking Points and the Dense Mesh

DeepAR - Introduction to SDK and Technology

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EasyAR

https://www.easyar.com/

EasyAR works on Android, iOS, UWP, Windows, Mac, and Unity Editor.

EasyAR features:

- It supports more older or mid- and low-end Android models.
- It includes planar image tracking for 2D images, smooth loading and recognition for more than 1000 local targets, video playback based on NW codes, recognition of QR codes, and multi-target tracking.
- EasyAR MotionTracking can be launched directly without installing other apps.





- It provides the ability to scan the environment to generate Sparse 3D point cloud maps in real time.
- It supports the real-time generation of 3D grid Map by scanning the environment, and enables the effects of collision and occlusion.
- It makes virtual objects more stable in space and reduces the drift caused by camera movement.

The next video shows how the EasyAR Studio technology works.



EasyAR Studio

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ZappAR

https://www.zappar.com/

Zappar is a leading global developer of augmented reality (AR) experiences and creative tools [9] on mobile devices accessible through iOS and Android. Zapparhas created exciting augmented reality experiences for brands such as Angry Birds, Warner Bros., and Coca Cola.





Zappar has developed the ZapWorks platform for AR content creation that integrates mobile WebAR support through QR codes. ZapWorks I is one of the most versatile and scalable AR platforms currently on the market

Zappar features include world tracking, face tracking, sketchfab integration and Beta Mobile WebAR support.

Zappar provides several tools to create AR content:

- **Zappar WebAR** makes AR accessible to everyone, everywhere by bringing immersive experiences directly to the mobile web browser.
- **ZapWorks Studio** enables designers and developers to create fully-customisable AR experiences across print, product, packaging, retail, events and much more.
- Universal AR is Zappar's best-in-class computer vision libraries including image, face and instant world tracking available as SDKs for a wide variety of platforms and languages.

The next video is a demo for creating AR experiences using ZapWorks.

Watch the video ZapWorks - The complete augmented reality toolkit

2 Hands-on Practical training in AR Technology Creating augmented reality applications with ZappAR Creating augmented reality applications with ZappAR

ZappAR

ZapWorks is a platform that allows users to create their augmented reality content.

Then the users can publish their content which can be viewed in the Zappar app if the users open the app, and scan an image with a zapcode on it.

How do you create an augmented reality application using ZapWorks? You must follow a few simple steps to experience Zappar.

Steps:

• Download the free Zappar app, which is available on iOS or Android, to get started creating zaps—or AR experiences. Open the page https://zap.works/ and click on the **FREE TRIAL**.







Figure 1. Download the free Zappar app. Source: https://zap.works/

• Choose an option...and click on button GET STARTED



Figure 2. Get started window. Source: https://zap.works/

• Create an account and log into ZapWorks, then add a zapcode onto the content that you're creating.

Fill in the required data and click on AGREE & REGISTER





Zapworks			
Welcome to ZapV Sign up to start your 30 day free trial and get acce	Vorks na to ZapWorks	Ad	and the
G Sign up with Cougle	Ø Sign up with Black		
peuspartégyahon com			
famous a	<i>t</i> u		
This of the fe		and the second se	
April - 10	¹⁰⁰ 1909	All a	
By registering, you apply to the Duer Agreement and to 2, percent of the register is possible or with real Privacy Pale	Address and and a state of the state		3D models in Studio
Areas free as associated LOG IN	ACREE & REGISTER		Import FBX, OBJ and now gITF models, or select from Sketchfalds huge library directly within Studia.

Figure 3. Welcome window.Source: https://zap.works/

• Confirm the account on your email.

ET .	
Verify your email a	ddress
To make sure that you can always access the Za create, please verify your email address by cl	pWorks content that you icking the link below.
VERIFY YOUR EMAIL	
Or copy and paste this link into you	r browser:

Figure 4. Create an account window. Source: https://zap.works/

• Create a ZapWorks Profile.







Tell us a bit about you

First name Paulina	Surname Spanu	
Role I'm an educator		~
	I live in	
Country Romania		
Please get in touch if this is incorrect.		
Looking to register with a different email?		NEXT STEP

Figure 5. Create a ZapWorks Profile. Source: https://zap.works/

• Create your ZapWorks workspace.

To create a workspace, you can use either the Business, Education or Hobby option.

You can choose: HOBBY for free, and check- I am using ZapWorks for non-commercial projects, and click on button- Create WorkSpace.



Figure 6. Create a ZapWorks workspace.Source: https://zap.works/

The next video presents the Zappar tools used to create augmented reality experiences.





Introduction to ZapWorks



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Which tool is right for you?

Depending on what you want to create, you can use ZapWorks Studio, ZapWorks Designer, Universal AR or Widgets.

Creating an AR application with ZapWorks Studio

Zappar - Studio creates amazing 3D experiences in AR, MR and VR.

ZapWorks Studio features:

- Fully scriptable using our comprehensive JavaScript-based scripting functionality
- Supports 3D models, including rigged animation
- Build gyroscope-oriented environments and 360-degree panoramas
- Harness Zappar's best-in-class image tracking algorithms for full augmented reality experiences



D



More info: https://docs.zap.works/studio/tutorials/

Steps to create an AR experience using ZapWorks Studio

• Open a new project:

Create project My new project



Select the right tool to build your augmented reality experience. ZapWorks includes editors to suit all abilities and use cases. Need help choosing? Watch our Which Tool? video.



Figure 7. Open a new project. Source: https://zap.works/

• Choose the trigger. For launching projects you need to select a type of triggers





Create project

My ne	w project	I
Choose yo Every proje ZapWorks	our trigger ct created using ZapWorks must be launched to allow the end user to experie offers multiple options for launching projects, which we call "triggers".	ence it.
	Zapcode Zapcodes can be scanned using the free to download Zappar app. Simply point and scan and the user will be able to enjoy your content.	•
回没回 以不必 回答法	WebAR QR code (NEW) QR codes can be scanned by virtually all smartphones. They are perfect when launching your project in WebAR. No need to download an app!	0
S	Deep link Deep links allows users to launch an experience without first having to scan a zapcode. Useful for non-imaged tracked experiences launched from an app or mobile web.	0
	Image lookup (via Embed SDK) The Zappar embed SDK can now be customised to recognise image lookups. Prices start at \$8,000. Get in touch to speak to a salesperson.	଼
< - •	> CREATE PRO	DJECT

Figure 8. Choose the trigger. Source: https://zap.works/

• Use a PNG file





Your zapcode	Which file should I download?
	For most uses download the PNG file. It's great for using in Microsoft Word, Adobe Photoshop, and other image editors. For vector editors, such as Adobe Illustrator and Inliccape, choose the SVG option.
	Printing your zapcode
VIV	It's best to make sure your code isn't too small when it's printed (at least 8mm diameter), and that it has enough contrast. For more information watch Zapcode Printing Best Practices.
H hug H 200	Available in a range of flavours
	You can also download your zapcode with an instructional graphic, as seen below. These inform your audience how to get Zappar and scan your code in a convenient way.
	Destination Layout Colour
	Choose what colour would you like the trigger to be:
n Ai + + <mark>-</mark> - Punkcer → RDCK Spanke - New Subtr New Subtr	+ D- ROOK + 10.8 V Dee models Tree Size
Cesktop Cocuments Cocuments Cocuments	No tens match you search.
Music Richares	
C 05-(C)	
Natural	
Network	
Network V K File name: How,3o,jend,a,jocatio Save as type: PNG (* grig)	

Figure 9. Use a PNG file. Source: https://zap.works/

Download Studio available here: <u>https://my.zap.works/downloads/</u>



Figure 10. Download Studio.Source: https://zap.works/





Download Zapworks Studio for Windows of for MAC

Download ZapWorks Studio 6

Start creating awesome 3D exeperiences in AR, MR and VR.



See what's new with ZapWorks Studio. Min requirements: Win 7 or later, MacOS Yosemite or later.

Figure 11. Download Zapworks Studio window. Source: https://zap.works/

• Open a new project

^{gi} Open		— = ×
Zapwarks	ALL PROJECTS NAME World Tracking 3D Model	LAST OPENED Sun, 2 Feb 2020, 16:15
NEW PROJECT	Mylocation	Sun, 2 Feb 2020, 15:51
IMPORT A ZPP FILE	googlemap Googlelocation	Sun, 2 Feb 2020, 10:59 Sun, 2 Feb 2020, 10:53
	Google location	Sun, 2 Feb 2020, 10:52

Figure 12. Open a project window. Source: https://zap.works/

• Select the option for a new project: Blank, Image Tracking, Face Tracking or 3D model.







Figure 13. Type of projects window. Source: https://zap.works/

More information to build a new experience you can find here: <u>https://www.youtube.com/watch?v=tmJx4AG5kL0&feature=emb_logo</u> In the next video are presented the steps to create an AR applications using ZapWorks Studio

ZapWorks - Introduction to Studio







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Creating an AR application with ZapWorks Designer

https://zap.works/designer/

Using Designer allows one to create more customised, interactive AR experiences with advanced image tracking, using video audio, buttons, links and more.

Allows you to arrange to content and choose transitions and animations.

- Drag and drop your photos and videos.
- Link to websites, create calendar and address book entries.
- Build simple multi-screen experiences.

Steps to build ZapWorks Designer:

• Open ZapWorks Designer https://zap.works/designer/







Figure 14. Open ZapWorks Designer Window. Source: https://zap.works/

• Select Designer tool.



Figure 15. Select ZapWorks Designer Window. Source: https://zap.works/

• Create a Zap code.





Figure 16. Create a Zap code Window. Source: https://zap.works/

The next step, having created a Designer code from the new zapcode page and selected it, is to add the zapcode to the image you'd like to track. You can download the code by selecting 'Edit Zapcode Content' and clicking the '*Download Your Zapcode'* button.

This will take you to a selection of zapcode designs which you can choose from, and then download as either a PNG or SVG file.

Use image editor for Editing and Uploading a Tracking Image (to add Zapcode to the corner). Upload the final image by dragging it from your desktop or with the upload button.

ZapWorks will analyze your image to ensure it will work well with the Designer. It will look for good contrast and detail across the image, as well as the correct zapcode ensuring that the image tracks solidly and provides a good user experience.

Example: <u>https://youtu.be/wReyz6-wBtE</u>





	Results on y	your tracking image
 Getting started Download your zepcode Upload your tracking image Analysing your tracking image Review tracking image 	God Material Post	Good detail and contrast across in Correct zapcode found
	EISCARD TRACKING IMAGE	USE THIS TRACKING IMAGE

Figure 17. Correct Zap code. Source: https://zap.works/

After confirming the image, ZapWorks will start processing it for use in the app. Then it can start designing the content in the ZapWorks Designer. To add the content, select an item from the list.

			a	Example	A TEXT Add a text object
				2	BUTTON Add a button object
			E-180		Add a contact object
			T man	T	CALENDAR EVENT Add an event object
Properties	Actions	Transitions	Appearance	Scene properties	COT TRACESIONAGE
	ABC	ABC	ABC	ABC	
ABC	1.10.0			and a second sec	
ABC	Rounded Raised	Square Flat	Square Raised	Bevel	DOWNLOAD PICK COLOR
ABC inded Flat F	Rounded Raised	Square Flat	Square Raised	Bevel	DOWNLOAD PICK COLOR BACKGROUND SOUND

Figure 18. Add items from a list. Source: https://zap.works/

CONTENT OPTIONS

Properties

The Properties panel defines the base settings for all content types, the settings available depending on the type of content selected.





Actions

Actions define custom behaviours depending on content type (**On Tap** or **On Finish**) More information: https://docs.zap.works/designer/content-options/actions/

Transitions

The Transitions panel allows each content object's arrival and departure to be individually customised.

All content types have the same transition properties and function the same way as Scene Transitions.

Scene Transitions define the animation of a scene entering and leaving on a device.

You can select from several options for both the transition in and out, as well as specifying the length of time a transition takes to complete and the delay before this transition starts.

Transition In

The 'Transition In' effect occurs when a scene is navigated to and defines how it enters, whether from the scanning of a zapcode (as with the first scene in your experience) or when one scene navigates to another, such as when a button is pressed and the 'Go to the scene' action is used.

Transition Out

The 'Transition Out' effect occurs when a scene is navigating to another scene and defines how the current scene leaves. For this reason, the 'Transition Out' effect relies on the following scene and will not work with a single scene by itself.

Appearance

The Appearance panel allows you to customise the look of your content.

Border

The type of border to surround the content object with.

Border Size

The thickness of the border.

Border Colour The colour of the border.

Depth

The Z-depth of the content object. The larger the value the further away from the tracking image it will appear.

Enable shadow

Whether or not to add a drop shadow to the content object. With a Designer type zapcode you can have:





- A maximum of 15 scenes per zapcode;
- A maximum of 40 items per scene;
- A maximum of 30 media files per object (e.g. 30 images in a Photo Album).

The next video explains the main stages in creating an AR application with ZapWorks Designer.

ZapWorks - Introduction to Designer



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ZapWorks Widgets

ZapWorks Widgets is recommended for beginners who want to start using AR. The Widgets tool is the simplest way to build a zap. It's super-easy - just drag and drop your content and the Widget tool will take control of laying it out in a clear yet attractive way.

The Widgets features:

- Drag and drop your photos and videos
- Create calendar events and address book entries
- Link through to websites





The Widget tool will arrange your content around your zapcode when scanned.

More information is available here: https://docs.zap.works/widgets/

We can upload photos, video files, URLs, contact details or event just by selecting the desired button



Figure 19. Select the Widgests tool window. Source: https://zap.works/

Image







Figure 20. Select a image . Source: https://zap.works/

Photo Album (select from the folder only the pictures you want)



Figure 21. Select the pictures from an album. Source: https://zap.works/

Video







Figure 22. Select a video window. Source: https://zap.works/

Sound







Figure 23. Add a sound window. Source: <u>https://zap.works/</u>

Contact

	Firstname		Last name		
	Company		Email address	PUBLISH	PREVIEW
UPLOND MAGE		9		Add are met	ar witter
Mobile Phone Transition	Work Phone	HEMANY C	Home Phone Provider	PHOTO A	LBUM select
Postal address		Website UR		VIDEO	iner of a line t
Facebook username		Twitter user	name .	AN SOUND	Carlo apress
facebook.com/				And a share	I welged
Linkedin (n.g. in/username)		YouTube (e.g	, user/tapparts)	Add a contact	
Britedin.com/		youtube.co	4		R EVENT
	CREATE	CONTACT		WEB LINK	a addant

Figure 24. Add a contact window. Source: https://zap.works/

Calendar event





Event name	RSVP email address	_	
		FIRE PROPERTY FIELD	EVIEW
Start date	End date		
0][n	MAGE Add an shape without	6
Starttime End time All-day	Time zone	PHOTO ALBUM	
5:00 PM	Europe/London.	Add a photo obum a	vipri
Location / address		VIDEO YouTube, Vesso or V	cost :
		Abd is bound webpet	
		A CONTACT	
		CALENDAR EVEN	π.
CAL	ALEVENT	WEBLINK	

Figure 25. Add a calendar event. Source: https://zap.works/

udd a web link widget			
		PUBLISH	PREVIEW
	SCREENSHOT	MAGE Add an arrest	pi wapit
	CUSTOM IMAGE	PHOTO AL Add is pools	DUM abum witget
	- 1	H VIDEO	neo in igiloed
	- 1	Att a sound	witpet
			webpet
CREATE WEBLINK			R EVENT
		WEB LINK	a weight

Figure 26. Add a web link page. Source: <u>https://zap.works/</u>

After uploading the items, you want - view the created AR app - and PUBLISH the app to make it visible to others

The result is visible by scanning the zapcode with the Zappar App







Figure 27. Publish window. Source: https://zap.works/

With a Widgets type zapcode it can have:

- a maximum of eight widgets
- a maximum of 30 media files per widget (e.g. 30 images in a Photo Album).

The next video presents the features of the Widget tool and the steps to create the AR experience.

ZapWorks - Introduction to Widgets







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Create an AR app for streaming a location with WhatsApp, from a smartphone using: ZapWorks Studio, ZapWorks Designer and Widgets.

Exercise - Multiple Choice

What types of tracking systems do augmented reality platforms use?

- □ Face down tracing.
- □ Markerless tracking.
- □ Face up tracing.
- □ Object lost

Multiple Choice

In order to choose a suitable platform, it is necessary to analyse:

- \Box 2D models.
- \Box The features and benefits of the augmented reality tools.
- □ Pictures.
- □ Resolution.

Multiple Choice

Wikitude AR SDK tool is:





- \Box 2D pictures for WINDOWS.
- \Box 3D Encoder for WINDOWS.
- \Box 3D objects for WINDOWS.
- $\hfill\square$ 1D scenes for WINDOWS.

Multiple Choice

What is Zappar's tool for creating AR content?

□ ZapWorks Face.

□ ZapWorks Studio.

□ ZapWorks Object.

□ ZapWorks Picture.

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AR Based Business Models

Introduction to Business Models

In recent years, augmented reality technology has changed the way of doing business by engaging users and by making the concepts interactive. Augmented reality continues to revolutionise the business world, regardless of activity. Tech industry analysts and visionaries say augmented reality will revolutionise business. Augmented reality is set to be a \$50 billion industry by 2024.

The major advantage of this technology is that the hardware (phones and tablets) is accessible to everyone, and the use of applications is intuitive and understandable. Moreover, with the mobile versions of Google ARCore and Apple ARKit, users have a device at hand that can be used for augmented reality.

In industry, with AR it is possible to digitise the product in 3D and to understand the prototype easier. Moreover, managers can easily make the right decisions, and operators can act efficiently, thus increasing the profit generated.

AR technology is also changing the medical world by translating complex medical concepts into interactive 3D shapes. 3D visualisations of the human body help doctors make more precise decisions and increase success rates.

AR plays a significant role in customer marketing. The apps help consumers imagine their products right in their homes.

This technology improves the way companies interact with customers. Companies have identified the opportunity offered by augmented reality to engage potential customers in virtual sensory experiences. AR applications known on the market demonstrate that this technology is the right tool to stimulate customer involvement.

Augmented reality is a technology that helps companies in any industrial field from process optimisation to increase user involvement (Figure 1). The possibilities of using this technology in industry are limitless.



Figure 1. Augmented reality benefits. Source: Paulina Spanu





The next video explains AR and how it is now used in business.

How AR is used in business.



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Different Types of Business Models

Different Types of Business Models

Many types of business augmented reality apps are available on the market. AR can be found in almost every field, starting with social media and ending with e-commerce.

How to use augmented reality in business?







Figure 2. Augmented reality for business. Source: Paulina Spanu

There are two business models for AR.

- 1. User pays for:
- One time to see/use.
- Recurring user subscriptions.
- AR content stores.
- 1. Corporate pays for:
- Utility to loyal customers.
- Advertising using AR as a way of subsidising free content to users.

Hyundai has developed the owner's manual for AR. Their consumers receive information about vehicle repairs, maintenance, and features. The app contains instructional videos, 3D overlay images that appear when users scan different areas of their vehicle, such as the engine compartment.

Companies such as Walmart and Chipotle use AR to train employees.

Sephora has an app that allows customers to see what their makeup products will look like.

Ticketing company StubHub created an augmented reality application that allowed users to view a 3D display of the stadium where the Super Bowl was played [2].

Thyssenkrupp (the German multinational conglomerate) has incorporated HoloLens solutions to make the design process more personal for customers and to reduce delivery time [3].

Wayfair uses AR to show customers what the furniture in their home will look like.

Hardware development is big business. Many companies have made major investments in augmented reality hardware. Facebook has paid \$2 billion for Oculus, the makers of the Oculus Rift virtual reality system.

Magic Leap is a company that develops easy-to-wear technology that combines the digital and physical worlds.

Apple has bought the German augmented reality start-up Metaio.





Microsoft, Sony, and Samsung are companies that have made major investments in augmented reality hardware.

CISCO uses a custom AR application to allow technicians to launch virtual demonstrations directly from devices to increase the efficiency of their device installation. The AR application has eliminated the need to read manuals and increases the accuracy of first-time installation [4].

Lacoste has created the LCST Lacoste AR mobile application, which allows users to try on shoes [5].

The next video presents four examples of how companies are using AR to make a real difference to the customer experience and how companies like IKEA, Rolex, Warby Parker and Nike use AR technology.

Different Types of Business Models



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Case studies of successful use of augmented reality

CASE STUDY - Augmented reality training system developed for phased-array ultrasonic nondestructive testing (NDT) equipment [7].

The AR application has been developed on UPB-CAMIS with the industrial partner NAMICON TESTING SRL (www.namicon.com).





The augmented reality for phased-array ultrasonic non-destructive testing (NDT) equipment application has been developed using Unity 5.6.0 game-engine platform integrated with Vuforia SDK toolkit for devices with an Android operating system.

The AR application creates the following real-life scenario to inspect a corroded oil pipe using the phased-array ultrasonic NDT. This implies the use of an ultrasonic probe connected to the main device unit. The probe has to be moved along the surface of the pipe and a corresponding ultrasonic image appears on the display of the main unit of the testing device.



Figure 3. Using the real ultrasonic inspection device on an oil pipe. Source: Catalin Amza

The AR experience implies the use of a fixed marker (for the generation of the inspected product – in this case an oil pipe) and the use of a movable marker (for the generation of the ultrasonic probe).

The moveable marker is placed on top of that handle with magnetic means.



Figure 4. Markers used to generate AR content Source: Catalin AMZA

The application displays several aids for the trainee/user, including help on using the application. Furthermore, the basic principles of the NDT process are explained to the user.





	NAMEON .
Help with the MENU About the app	AR TRAINING
Enter the Abox AR section	View tutorial on using the
• • • • • •	



Various screenshots of the application while in use. Once the fixed marker is detected, a pipe is displayed in the middle of the screen. The diameter of the pipe can be varied using a slider.



Figure 6. Various screenshots of the application. Source: Catalin AMZA

On-screen NDT instructions for the user.



Figure 7. Various screenshots of the application. Source: Catalin AMZA

Visual aid indication on using the probe in a real environment.







Figure 8. Various screenshots of the application. Source: Catalin AMZA

Choosing the type of testing/scanning (in this case C-scan).



Figure 9. Various screenshots of the application. Source: Catalin AMZA

Simulated C-scan image shown on the main unit display when the probe is moved along the pipe.



Figure 10. Various screenshots of the application. Source: Catalin AMZA

Choosing the type of testing/scanning (in this case C-scan).







Figure 11. Various screenshots of the application. Source: Catalin AMZA

The application will detect the probe marker and displays a corresponding 3D object. The user can then move the probe along or across the virtual pipe in order to obtain the ultrasonic image on the simulated NDT device display.

Bosch Automotive Service Solutions [4] Case studies of successful use of augmented reality

https://www.bosch.ro/

Augmented reality is a technology that has gone beyond the realm of gaming and has expanded significantly in many industrial applications. Augmented reality (AR) is a technology that overlaps digital content and information with the physical world. Information can be of various types, such as sounds, videos, graphics, and 3D models. AR technology can be described by its four features: real-world and digital world overlap, 3D recording, real-time interaction, and portability.

RA helps SMEs build applications that transform the way employees design products, use machines and equipment, produce and deliver products in a smart world of digital production.

It can be said that RA is a component of Industry 4.0 that could interact with IoT systems, fundamentally changing the way people operate in the production flow.

In this regard, many companies are reconsidering the way they design, produce, operate equipment and deliver their products.

This case study presents the common Bosch augmented reality platform used to develop AR applications in new forms of human-process-product-equipment interaction using AR technology.

Bosch offers augmented reality solutions to support companies in various phases of the value chain: from production to service and repairs to training. Bosch developed the CAP platform (Common Augmented Reality Platform) to integrate the production of visual and digital content directly into the authoring process.





CAP allows importing data directly into existing editing systems to create the augmented reality content.

With Bosch's Common Augmented Reality Platform (CAP), companies can deploy AR solutions on their own and spread them widely.

Bosch uses the augmented reality technology for its technical service training thus literally increasing the transparency of the training contents for the participants.

By using AR, repair processes accelerate, and the quality of work increases. AR applications can provide support by displaying additional information for engineers.

In Romania, <u>Bosch Automotive Service Solutions</u> offers augmented reality applications for car services. The augmented reality application shows the information right at the place where it is needed to support technicians.

The next video presents all relevant repair information at a glance using augmented reality technology by Bosch.

Bosch augmented reality for the automotive workshop



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Toyota - mixed reality for digital car engineering





Toyota used Unity to create and implement mixed reality applications on Microsoft's HoloLens2 in the automotive production process.

In the next video you can find explanations of how mixed reality helps Toyota achieve Kaizen in many aspects of field design, production, and services.

Watch the video Enabling remote assistance in field service

Watch the video Using mixed reality for training and guidance at Toyota

Watch the video Toyota makes mixed reality magic with Unity and Microsoft HoloLens 2

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Quiz

What types of tracking systems do augment reality platforms use?

□ face down tracing

- □ markerless tracking
- □ face up tracing
- □ object lost





Multiple Choice

In order to choose a suitable platform, it is necessary to analyse:

 \Box 2D models.

- \Box The features and benefits of the augmented reality tools.
- Pictures.
- \Box Resolution.

Augmented Reality Overlay means

- \Box An image or graphic used to explain something
- \square An image or graphic superimposed over an image target
- \Box An image or graphic available on the laptop
- \square An image or graphic available on the smartphone