

What is Augmented Reality (AR)?

Augmented Reality (AR) is the application of computer-generated imagery embedded into live-video streams as a way to expand information as it relates to the real world. Through the use of AR technology, information about a user's surrounding environment, and the objects within it, are stored and then retrieved as an information layer on top of a live real worldview. The goal of augmented reality is to add information and meaning to a real object or place. Unlike virtual reality, augmented reality does not create a simulation of reality. Instead, it takes a real object or space as the foundation and incorporates technologies that add contextual data to deepen a person's understanding of the subject.

Components?

The main hardware components for augmented reality are: processor, display, sensors and input devices. These elements, specifically CPU, display, camera and MEMS sensors such as accelerometer, GPS, solid state compass are often present in modern smartphones, which make them prospective AR platforms. AR technology often expands to include head-mounted displays and virtual retinal displays for visualization purposes, and construction of controlled environments containing sensors and actuators.

Thank you!

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VISIT OUR AUGMENTED REALITY BLOG:

<http://go.osu.edu/duarblog>

FOR AN ONLINE VERSION OF THIS HANDOUT:

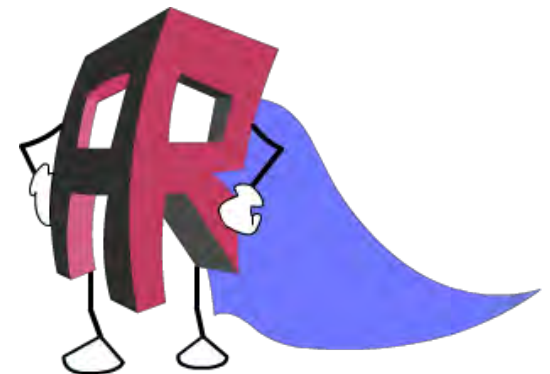
<http://go.osu.edu/duarhandout>

FOR AN ONLINE VERSION OF OUR PACKET:

<http://go.osu.edu/duarpacket>

A Beginners Guide to Augmented Reality

**Augmented Reality:
The Secret Identity**



Why AR in Education?

Augmented Reality links knowledge/content with relevant visual imagery. Something that traditional links and QR codes don't do. Augmented Reality can personalize learning, especially when utilizing video. It utilizes mobile devices, in a year when there is a definite shift away from laptops to iPads and mobile devices. It harnesses the concept of inquiry based learning, allowing students use their natural desire and instinct to explore and investigate. And especially, it gets students up and off their chairs and actively learning.

Applications?

- | | |
|--|---------------------------|
| 1) Medical Imaging | 12) Cause and Effect |
| 2) Aviation | 13) AI |
| 3) Training | 14) Representation |
| 4) Museums | 15) Reading |
| 5) Educators | 16) Ancient Civilizations |
| 6) History | 17) Dissections |
| 7) Urban Exploration | 18) Space |
| 8) Libraries | 19) Landmarks |
| 9) Making higher education and specialized content more accessible | 20) Alive Textbooks |
| 10) Educational Games | |
| 11) 3D | |

Downsides?

Many augmented reality projects rely on specific or customized hardware, and the mechanisms that correlate data added by technology with the real world are often technically very complex. Despite falling costs for hardware overall, augmented reality projects can be expensive to develop and maintain. And GPS is only accurate to within approximately 15-30 feet, and often does not work very well indoors. Today's augmented reality projects typically focus on individual users and may not lend themselves to team activities or group learning. And some people may not want to rely on their cell phones, or pay for smart devices. In addition, augmented reality projects may resemble entertainment, raising questions about their pedagogical value. Educators must be careful to ensure that activities have educational merit and that students do not become infatuated with the technology alone.

Developers Corner: Some Beginner Apps

Aurasma Lite

<http://www.aurasma.com/>

Using a smartphone's camera, GPS, compass, accelerometer and internet connection, the technology combines image recognition and a conceptual understanding of the 3D world to recognize objects and images and merge augmented reality actions into the scene. Without the need for barcodes or tags, the app is able to see its surrounding environment and make it fully interactive.

buildAR

<https://buildar.com/>

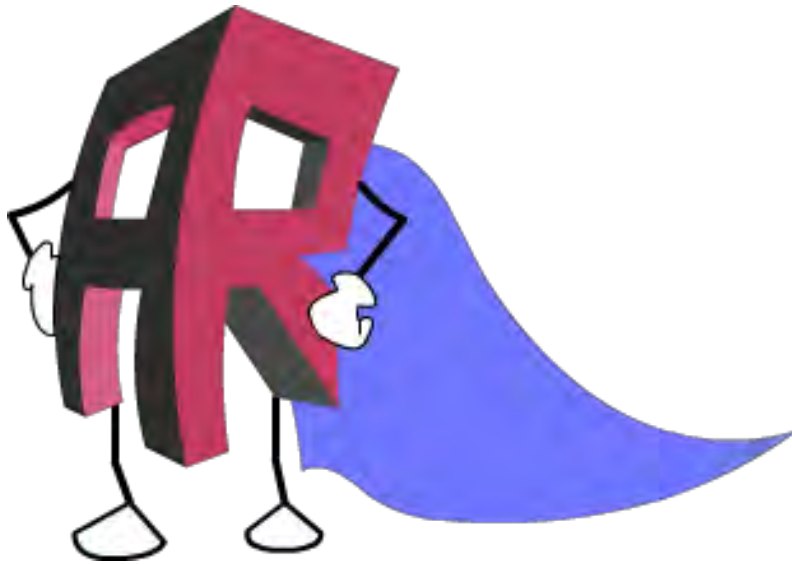
BuildAR Pro is a program that allows you to create your own 3D augmented reality scenes. BuildAR Pro uses marker-based tracking, which means that the 3D models appear attached to physical printed markers you can design yourself. By creating a set of these markers and some 3D models you can easily build up your own augmented reality scene. The 3D models can be made using almost any modeling program or downloaded from many websites on the internet. BuildAR Pro provides a graphical user interface that simplifies the process of authoring AR scenes, meaning that you don't need to be a programmer or computer expert to experiment with Augmented Reality.

Google Sketchup AR Plugin

http://www.inglobetechnologies.com/en/new_products/arplugin_su/info.php

With AR-media Plugin for Google SketchUp by Inglobe Technologies, users are allowed to visualize their 3D models using Augmented Reality directly in the real physical space which surrounds them. By means of the Exporting feature, users can create and publish augmented reality files autonomously. Files created by this feature can be visualized on any computer with the freely available AR-media Player, without the need of having Google SketchUp and the Plugin installed. All you need to make AR-media Plugin work is a personal computer, a webcam and a printed code attached to the software.

The Augmented Reality Utility Belt



WHAT IS AUGMENTED REALITY?

Augmented Reality (AR) is the application of computer-generated imagery embedded into live-video streams as a way to expand information as it relates to the real world. Through the use of AR technology, information about a user's surrounding environment, and the objects within it, are stored and then retrieved as an information layer on top of a live real worldview. The goal of augmented reality is to add information and meaning to a real object or place. Unlike virtual reality, augmented reality does not create a simulation of reality. Instead, it takes a real object or space as the foundation and incorporates technologies that add contextual data to deepen a person's understanding of the subject.

HOW DOES IT WORK?

The main hardware components for augmented reality are: processor, display, sensors and input devices. These elements, specifically CPU, display, camera and MEMS sensors such as accelerometer, GPS, solid state compass are often present in modern smartphones, which make them prospective AR platforms. AR technology often expands to include head-mounted displays and virtual retinal displays for visualization purposes, and construction of controlled environments containing sensors and actuators. Most commonly used AR hardware is the smartphone.

DATE:
2/12/2013

WHY SHOULD AR BE USED IN EDUCATION?

<https://www.ssatrust.org.uk/newtechnologies/Pages/AugmentedReality.aspx>

“...the skill we need our students to have is 'learning to learn' as in today's knowledge economy, we are constantly required to learn, unlearn and relearn.” - Shameena Parveen (Co-founder of Edutech)

- ◆ Augmented Reality appeals to constructivist notions of education where students take control of their own learning, and interact with the real and virtual environments. In learning situations that are partly virtual, like AR, students can manipulate objects that are not real, and learn tasks and skills.
- ◆ Many early versions of portable AR illustrate the ability to enhance a live experience through discovery based learning. A visitor to an art gallery, museum or historic site can access AR applications that enable additional information, maps, audio content, or videos. Colleges and Universities are now providing campus tours that include AR content. One application for the iPhone called uTour comes with tours of Yale, Stanford, MIT and Harvard. While on campus, potential students just point their iPhone or iPod Touch at buildings or areas and campus details pop-up.

HOW CAN AR BE USED IN EDUCATION?

- 1) Medical Imaging: Doctors can access data about patients.
- 2) Aviation: Tools show pilots important data about the landscape they are viewing.
- 3) Training: Technology provides students or technicians with necessary data about specific objects they are working with, and how to accomplish certain tasks.
- 4) Museums: Artifacts can be tagged with information such as the artifact's historical context or where it was discovered.
- 5) Educators: Provide students with deeper, more meaningful experiences by linking educational content with specific places and objects.
- 6) Students: A class might use an augmented reality system to capture their thoughts or impressions when working with subjects or instructors.
- 7) Libraries: Scan a building to identify hours of service, find out if study rooms are available, or which librarians are on duty.
- 8) Making higher education and specialized content more accessible: By transporting lessons from the campus to the community. By combining technology familiar to students with locations that students see as their own, augmented reality has the potential to move learning out of the classrooms and into the spaces where students live. Encouraging informal learning that is easily accessible may prove particularly effective in engaging students, extending learning to spaces that might help them form connections with content, the locations that provide the context for it, and the peers that they share it with.
- 9) Educational Games: Challenge students to work out mysteries, makeshift scavenger hunts, and learn about what the environment around them can offer.
- 10) Reading: For young children, interactivity is a strong influence in learning. How enthralled would your child be using a pop-up book that seemed to really pop up? Sights and sounds can be a method of showing a child what animals sound like in real-life, enhance the background ambiance while reading, and more. A book about trains could engage the reader and make them feel like they were standing at the station.
- 11) Dissections & Anatomy: Augmented Reality gives us the ability to literally remove layers from a body for a more detailed examination. Of course, this could also work in a drafting class by peeling away the layers of a building to demonstrate to the students why certain framework is important to construction.
- 12) Space: There are smartphone and tablet apps that will allow you to view the sky and spot stars and constellations while providing their names. However, how much greater of an educational value would they have if they could bring the planet or star closer to them with statistical information?
- 13) Exploration: Apps utilizing your GPS location can provide your information about a historical landmark you are viewing or location that you are in. With AR technology, that landmark, statue, or restaurant could essentially come to life on your screen and tell you its story first hand.

WHAT ARE THE DOWNSIDES?

Many augmented reality projects rely on specific or customized hardware, and the mechanisms that correlate data added by technology with the real world are often technically complex. Despite falling costs for hardware overall, augmented reality projects can be expensive to develop and maintain. Today's augmented reality projects typically focus on individual users and may not lend themselves to team activities or group learning. In addition, augmented reality projects may resemble entertainment, raising questions about their pedagogical value. Educators must be careful to ensure that activities have educational merit and that students do not become infatuated with the technology alone.

APPS WE ARE DEMOING AT OUR BOOTH



"MagicPlan CSI" By Sensopia (Free)

MagicPlan CSI is the specific version of MagicPlan for Crime Scene Sketching. MagicPlan CSI MEASURES and DRAWS the FLOOR PLAN of a crime scene just by taking pictures. You can also position EVIDENCES and annotate your floor plan. An electronic REPORT is then automatically generated and sent to you by email.

iTunes: <https://itunes.apple.com/us/app/magicplan-csi/id480247904?mt=8>



"MagicPlan" By Sensopia (Free)

MagicPlan is the only application that measures, draws, and publishes an interactive floor plan on the web, just by taking pictures. With MagicPlan, everyone can create a floor plan in a few minutes. Benefit-detail about the benefits of your advertised product.

iTunes Store: <http://itunes.apple.com/us/app/magicplan/id427424432?mt=8>



"WIKITUDE Augmented Reality Browser" By Wikitude GmbH (Free)

Wikitude World Browser allows you to discover your surroundings in a completely new way. By using the camera, simply hold up your smartphone and explore what's around you in Augmented Reality (AR). See places, points of interests and other exciting AR content through your camera's field of vision – a truly engaging and immersive experience.

iTunes Store: <http://itunes.apple.com/us/app/wikitude-augmented-reality/id329731243?mt=8>



"Junaio Augmented Reality Browser" By metaio, Inc. (Free)

A mobile companion and instant source of information about places, events or bargains. What's on at the movies, where is the nearest cash dispenser, taxi stand or subway station? The best steak in town, or the hottest show? Finding your way inside exhibitions, getting added information on products, ads or news articles.

iTunes Store: <http://itunes.apple.com/us/app/junaio-augmented-reality-browser/id337415615?mt=8>



"Word Lens" By Quest Visual (Free, language packs \$4.99 each)

Instantly translate printed words from one language to another with your built-in video camera, in real time!

Languages available for purchase: French to English, English to French, Spanish to English, English to Spanish

iTunes Store: <http://itunes.apple.com/us/app/word-lens/id383463868?mt=8>



"String™ Augmented Reality Showcase" By String Labs Ltd (Free)

iTunes Store: <http://itunes.apple.com/us/app/string-augmented-reality-showcase/id417606536?mt=8>



"Aurasma" by HP

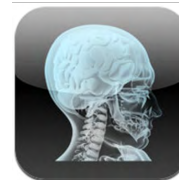
iTunes Store: <https://itunes.apple.com/us/app/aurasma/id432526396?mt=8>
Platform offered by HP. Available as an SDK or as a free app for iOS and Android mobile devices, Aurasma's advanced image recognition technology uses a smartphone's or tablet's camera to recognize real world images and then overlay rich media on top of them in the form of



"Spacecraft 3D" (Free) by NASA

NASA's Spacecraft 3D is an augmented reality (AR) application that lets you learn about and interact with a variety of spacecraft that are used to explore our solar system, study Earth, and observe the universe. Using a printed AR Target and the camera on your mobile device, you can get up close with these robotic explorers, see how they move, and learn about the engineering feats used to expand our knowledge and understanding of space.

iTunes: <https://itunes.apple.com/gb/app/spacecraft-3d/id541089908?mt=8>



"Anatomy 4D" (Free, Subscription) By Augmented Dynamics:

4D Anatomy takes viewers inside the human body via a simple-to-use 3-dimensional learning environment.

Android:

https://play.google.com/store/apps/details?id=com.daqri.d4DAnatomy&feature=search_result#?t=W251bGwsMSwyLDEsImNvbS5kYXZ5aS5kNEBBbmF0b215I10

iTunes: <https://itunes.apple.com/us/app/anatomy-4d/id555741707?mt=8>



"FETCH! Lunch Rush" (Free) by PBS Kids:

App to teach math skills to elementary students through the use of visualization. Uses the camera to place graphics over real-world surroundings, then teaches elementary students to add and subtract using real world scenarios.

iTunes: <https://itunes.apple.com/us/app/fetch!-lunch-rush/id469089331?mt=8>

EDUCATIONAL APPLICATIONS

LIBRARIES

- ◆ When someone finds a book in the library catalog, they can have the option to snap a QR code or unique image of the book, which will first store the information about the book. Then the user can first be directed to a specific section of the library, and once they are in the right section they can use a mobile device to scan the book spines to start being guided towards the book they are looking for.
- ◆ Have the ability to walk down an aisle and see the reviews and popularity of an entire shelf titles just by pointing the camera lens on your phone at the spines or out-facing covers. [http://www.readwriteweb.com/archives/awesome augmented reality app could save librarian.php](http://www.readwriteweb.com/archives/awesome_augmented_reality_app_could_save_librarian.php)
- ◆ Scan a building to find out if study rooms are available, hours of service, or which librarians are on duty.

TEXTBOOKS AND CHILDRENS BOOKS

- ◆ Popar Books: Popar® Toys use Augmented Reality (AR) technology to create an immersive reading experience that will allow the user to see incredible virtually “real” 3D objects and animations that will pop off the book or card. <http://popartoy.com/>
- ◆ Martin-Gutierrez, Saorin, Contero, Alcaniz, Perez-Lopez & Ortega in 2010 in their paper *Education: Design and Validation of an Augmented Book for Spatial Abilities in Engineering Students*, looked at how an augmented book called AR-Dehaes helped students visualize and perform spatial engineering tasks. Albertina Dias also studied the use of an augmented book. Her 2009 research looked at the use of the miBook that uses augmented reality interfaces.
- ◆ A Japanese publishing company, Tokyo Shoseki, is producing textbooks that support free AR apps on smartphones, bringing characters to life for students to listen to. <http://www.zdnet.com/blog/asia/education-with-augmented-reality-ar-textbooks-released-in-japan-video/1541>

MUSEUMS

- ◆ iTacitus - Intelligent Tourism and Cultural Information through Ubiquitous Services: <http://www.itacitus.org/>
- ◆ Itacitus is a European research project funded for information society technologies. The project commenced in September 2006 and finished July 2009. During this time iTacitus explored ways in which information technology could be employed to encourage cultural tourism, by using augmented reality to provide compelling experiences at cultural heritage sites.

HISTORY

- ◆ Student Postmortem: Reliving the Revolution- Karen Schrier: http://www.gamecareerguide.com/features/263/student_postmortem_reliving_the_revolution.php
- ◆ The game takes place at the Battle of Lexington in Massachusetts. Players of the game are assigned various roles and sides in the battle and are able to interact with virtual historic characters. The game uses GPS data that triggers events on the players hand held device. Players use the experience to understand the battle.
- ◆ “...participants reignited their waning interest in history, and even began to see why it’s important to be historical thinkers...”
- ◆ Her paper on integrating AR games with education is published here: <http://cms.mit.edu/research/theses/KarenSchrier2005.pdf>

EDUCATIONAL APPLICATIONS

- ◆ Virtual History Roms: Presents a voyage to Ancient Rome, the capital of the largest empire in the ancient world, which has been reconstructed in virtual form and which you can explore in a “full-immersion” panoramic experience. The format provides the viewer with an insight into Roman civilization, from the digital reconstruction of the city's statues to aerial views of the metropolis as it stood 2,000 years ago, from the manipulation of models of the legionaries, gladiators and war engines to the 3D exploration of monuments such as the Colosseum, the Circus Maximus, Hadrian's Mausoleum and many, many others. The reconstruction of their original appearance, as seen from various angles, is overlaid and compared with their appearance in today's Rome.
- ◆ Virtual History Roms is available on the iTunes Store: <https://itunes.apple.com/us/app/virtual-history-roma/id410358487?mt=8>

NATIONAL GEOGRAPHIC CHANNEL

- ◆ Augmented reality exhibits from Appshaker (<http://www.appshaker.co.uk/>) for the National Geographic Channel allowed consumers to interact with the world. Using AR, users could play with dinosaurs, place themselves in certain scenes -- the moon landings, for example -- or play with some leopards.
- ◆ The brand toured Hungary with the exhibit and created the work using scenes footage from UPC and Nat Geo. <http://www.digitalbuzzblog.com/national-geographic-live-augmented-reality-installation-hungary/>

BIOLOGY, MATH, SCIENCE, AND ENGLISH

- ◆ learnAR by iNet: Use augmented reality to show detailed demonstrations of chemistry, biology, language, and technology. <http://www.learnar.org/>
- ◆ FETCH! Lunch Rush: App to teach math skills to elementary students through the use of visualization. Uses the camera to place graphics over real-world surroundings, then teaches elementary students to add and subtract using real world scenarios.
- ◆ Fetch is available on the iTunes Store: <https://itunes.apple.com/us/app/fetch!-lunch-rush/id469089331?mt=8>
- ◆ Science AR: Makes the Science AR posters come alive. This App works in conjunction with the Science AR posters. Once you have printed the Science AR posters, simply hold your mobile device up to different parts of the posters and watch the poster come alive with 3d models, videos and scientific diagrams.
- ◆ Science AR is available on the Android Market: https://play.google.com/store/apps/details?id=com.aurasma.skinned.science_ar&hl=en
- ◆ Science AR is available on the iTunes Store: <https://itunes.apple.com/au/app/science-ar/id587192926?mt=8>

ASTRONOMY & SPACE

- ◆ GoogleSkyMap: Turns mobile phone into a window on the night sky. It will identify objects that appear in the sky and allow users to search for them. Instead of looking at descriptions of constellations in a book and then attempting to identify them in the sky, you can use Google Sky Map to directly identify stars and constellations using the camera on your smartphone.
- ◆ GoogleSkyMap is available on the Android market: <https://play.google.com/store/apps/details?id=com.google.android.stardroid&hl=en>
- ◆ Star Walk: Launch the app and point your iPhone at the night sky, you'll see the stars, planets, satellites, and constellations in their proper place from your location. As you move your device, the star map updates in real time.

EDUCATIONAL APPLICATIONS

- Star Walk is available on the iTunes Store: <https://itunes.apple.com/us/app/star-walk-hd-5-stars-astronomy/id363486802?mt=8>
- Theodolite HD: Launch the app and point your iPhone at the night sky, you'll see the stars, planets, satellites, and constellations in their proper place from your location. As you move your device, the star map updates in real time. multi-function augmented reality app for the iPad that serves as a compass, GPS, map, zoom camera (photo & movie), rangefinder, and two-axis inclinometer. Theodolite overlays real time information about position, altitude, bearing, and horizontal/vertical inclination on the iPad's live camera image, like an electronic viewfinder. App is great for hiking, boating, hunting, golf, sports, sightseeing, navigation, and finding your way around. Theodolite is used extensively by surveyors, geologists, architects, engineers, competitive sportsmen, military personnel, and search and rescue workers around the world.
- Theodolite HD is available on the iTunes Store: <https://itunes.apple.com/us/app/theodolite-hd/id425456242?mt=8>
- Star Chart: You can now have a virtual star chart in your pocket. Look through the eyes of your iPhone or iPad* to see a virtual window into the whole visible universe. Star Chart calculates, in real time, the current location of every star, planet and moon visible from Earth and shows you precisely where they are, even in broad daylight.
- Star Chart is available on the Android Market: <https://play.google.com/store/apps/details?id=com.escapistgames.starchart&hl=en>
- Star Chart is available on the iTunes Store: <https://itunes.apple.com/us/app/star-chart/id345542655?mt=8>
- Sun Seeker: Provides a flat view compass and an augmented reality camera 3-D view showing the solar path, its hour intervals, its winter and summer solstice paths, rise and set times and more and a map view showing solar direction for each daylight hour.
- Sun Seeker is available on the Android Market: <https://play.google.com/store/apps/details?id=com.ajnoware.sunseeker&hl=en>
- Sun Seeker is available on the iTunes Store: <https://itunes.apple.com/us/app/sun-seeker-3d-augmented-reality/id330247123?mt=8>
- Spacecraft 3D: NASA's Spacecraft 3D is an augmented reality (AR) application that lets you learn about and interact with a variety of spacecraft that are used to explore our solar system, study Earth, and observe the universe. Using a printed AR Target and the camera on your mobile device, you can get up close with these robotic explorers, see how they move, and learn about the engineering feats used to expand our knowledge and understanding of space.
- Spacecraft 3D is available on the iTunes Store: <https://itunes.apple.com/gb/app/spacecraft-3d/id541089908?mt=8>
- Star & Planet Finder: Star & Planet Finder guides you to see stars, planets, constellations and satellites in the sky. Simply choose a planet from the list, and move your device according to the pointer display, the pointer represents the planet.
- Star & Planet Finder is available on the iTunes Store: [iTunes: https://itunes.apple.com/us/app/star-planet-finder/id361753588?mt=8](https://itunes.apple.com/us/app/star-planet-finder/id361753588?mt=8)

GEOGRAPHY

- GeoGoogle: A great helper when it comes to acquiring geography skills and judging distances to specific destinations. Students can learn geographical measurement such as latitude and longitude by applying GeoGoggle to real-world surroundings. The app also allows you to calculate altitude and the distance between two points using a 3D compass.
- GeoGoogle is available on the Android Market: <https://play.google.com/store/apps/details?id=diesel.peko.geogoggle&hl=en>

MEDICINE & ANATOMY

- ♦Hallux Angles By ockendon.net: http://www.ockendon.net/halluxangles_homepage.htm

EDUCATIONAL APPLICATIONS

- ♦ Hallux Angles is a clinical measurement aid to assist in the preop radiographic planning process for forefoot surgery.
- ♦ Hallux Angles is available on the iTunes store: <http://itunes.apple.com/us/app/hallux-angles/id398338105?mt=8>
- ♦ Anatomy 4D: 4D Anatomy takes viewers inside the human body via a simple-to-use 3-dimensional learning environment.
- ♦ Anatomy 4D is available on the Android Market: https://play.google.com/store/apps/details?id=com.daqri.d4DAnatomy&feature=search_result#?t=W251bGwsMSwyLDEsImNvbS5kYXFyaS5kNERBbmF0b215Il0.
- ♦ Anatomy 4D is available on the iTunes Store: <https://itunes.apple.com/us/app/anatomy-4d/id555741707?mt=8>

GETTING BACK TO NATURE

- ♦ The World Park Campaign By New York Central Park: <http://www.theworldpark.com/campaign/>
- ♦ By employing mobile devices, Central Park was turned into an outdoor mobile museum. Traditional and interactive media let consumers scan the placed symbols with their mobile devices to watch commercials and discover unknown facts, rare stories, and movie scenes just as they would at the event.

TRAINING AND OPERATIONS

- ♦ BMW Augmented Reality: http://www.bmw.com/com/en/owners/service/augmented_reality_introduction_1.html
- ♦ BMW Service is planning to use this technology as a means to assist BMW Service staff in their highly demanding technical work. BMW Augmented Reality techniques provide ideal support in maintenance work on complex technical innovations in the vehicle. Using special data goggles and wireless access to a powerful computer, BMW mechanics have all the information at their disposal, precisely where they need it: in the workshop, at the vehicle.

EDUCATIONAL GAMES

- ♦ The MIT Teacher Education Program, in conjunction with The Education Arcade: <http://education.mit.edu/projects/mitar-games>
- ♦ The MIT Teacher Education Program, in conjunction with The Education Arcade, has been working on creating "Augmented Reality" simulations to engage people in simulation games that combine real world experiences with additional information supplied to them by handheld computers. The first of these games, Environmental Detectives (ED), is an outdoor game in which players using GPS guided handheld computers try to uncover the source of a toxic spill by interviewing virtual characters and conducting large scale simulated environmental measurements and analyzing data.

BASIC LEARNING

- ♦ Based on augmented reality, "Letters Alive" by Logical Choice Technology, brings a kingdom of 26 seemingly alive digital 3-D animals into the classroom with the ultimate goal of teaching English-language literacy skills to students. Accompanied by 94 sight word cards, the Letters alive creatures (each representing a letter in the alphabet) act intelligently. They have the capacity to respond to statements and questions the students build. Letters alive applies research-based best practices of reading instruction, but in a way that has proven to be engaging, effective and fun. <http://www.logicalchoice.com/>
- ♦ Also by Logical Choice Technology is "Storybooks Alive", where Amos Alligator's Airport Adventure is an exciting interactive storybook for kids of all ages. Join Amos

EDUCATIONAL APPLICATIONS

Alligator as he attempts to get to the airport on time. Discover objects, watch short videos, and play mini-games as you interact with the pages of this book. Words are highlighted as they are read aloud, allowing even the youngest children to enjoy the adventure.

- ◆ SnapShot Showroom: Visualize furniture in a room using augmented reality.
- ◆ SnapShot Showroom is available on the iTunes Store: <https://itunes.apple.com/us/app/snapshop-showroom/id373144101?mt=8>
- ◆ MagicPlan: MagicPlan is the only application that measures, draws, and publishes an interactive floor plan on the web, just by taking pictures. With MagicPlan, everyone can create a floor plan in a few minutes. Benefit-detail about the benefits of your advertised product.
- ◆ MagicPlan is available on the iTunes Store: <http://itunes.apple.com/us/app/magicplan/id427424432?mt=8>

EXPLORATION

- ◆ Word Lens: Instantly translate printed words from one language to another with your built-in video camera, in real time!
- ◆ Languages available for purchase: French to English, English to French, Spanish to English, English to Spanish
- ◆ Word Lens is available on the iTunes Store: <http://itunes.apple.com/us/app/word-lens/id383463868?mt=8>
- ◆ Junaio Augmented Reality Browser
- ◆ A mobile companion and instant source of information about places, events or bargains. What's on at the movies, where is the nearest cash dispenser, taxi stand or subway station? The best steak in town, or the hottest show? Finding your way inside exhibitions, getting added information on products, ads or news articles.
- ◆ Junaio is available on the iTunes Store: <http://itunes.apple.com/us/app/junaio-augmented-reality-browser/id337415615?mt=8>
- ◆ GoSkyWatch: Easily and quickly identify and locate stars, planets, constellations and more by simply pointing to the sky. Your personal telescope to the wonders in the night sky. Go outside and explore the night sky.
- ◆ It is available on the iTunes Store: <http://itunes.apple.com/us/app/goskywatch-planetarium-for/id364209241?mt=8>
- ◆ WIKITUDE: Wikitude World Browser allows you to discover your surroundings in a completely new way. By using the camera, simply hold up your smartphone and explore what's around you in Augmented Reality (AR). See places, points of interests and other exciting AR content through your camera's field of vision – a truly engaging and immersive experience.
- ◆ It is available on the iTunes Store: <http://itunes.apple.com/us/app/wikitude-augmented-reality/id329731243?mt=8>

OTHER AR IN PRACTICE EXAMPLES

The following links provided by the Horizon Report series (2010-2013) show other examples of current projects that demonstrate the potential of augmented reality. (<http://www.nmc.org/horizon-project/horizon-reports>)

•Arhrrrr - An Augmented Reality Shooter

<http://www.youtube.com/watch?v=cNu4CluFOcw>

This video demonstrates an augmented reality game created at Georgia Tech Augmented Environments Lab and the Savannah College of Art and Design Atlanta. The dynamic, interactive game uses a handheld mobile device, a table map — and Skittles candies.

•ARIS Mobile Media Learning Games

<http://arisgames.org>

ARIS is an alternate reality gaming engine created by the University of Wisconsin's Games, Learning and Society research group. Virtual objects and characters can be placed at certain locations in the physical world; players can interact with them using their mobile devices.

•ARSights

<http://www.arsights.com>

ARSights uses locations and structures in Google Earth to project augmented reality models of historical buildings and sites. Students can take virtual field trips, looking at three-dimensional models from different angles while seeing where on the globe they are actually located.

•eTreasure

<http://www.etreasure.ch/site/>

eTreasure is an augmented reality team-based urban game used for teaching cultural heritage to grade school students in Switzerland. The game is developed by Webatelier.net, a laboratory of the University of Lugano.

•Flynn Park Elementary School LIONS Program

<http://www.litzsinger.org/flynnpark.html>

Working with the Litzsinger Road Ecology Center near St. Louis, Missouri, Flynn Park Elementary participated in an NSF-funded grant program (Local Investigations of Natural Science, LIONS) to build and play augmented reality games in science and history. (For more detail on the grant program, see <http://www.glsconference.org/2008/session.html?id=42>).

•LearnAR (Specialists Schools and Academies Trust)

<http://www.learnar.org/>

This UK-based project, designed for secondary students, includes 3D augmented reality models for several subjects, including biology, world languages, physics and religion. Students from subscribing schools can print out AR markers that then can display intricate 3D models for further examination. LearnAR is an augmented reality resource that makes use of a digital, video, or web camera to display virtual content layered over real world content. For example, to learn how the body works, major organs of the body are displayed on screen when the user points his webcam toward another person's chest. Students from subscribing schools can print out AR markers that then can display intricate 3D models for further examination.

OTHER AR IN PRACTICE EXAMPLES

•Scimorph

<http://scimorph.greatfridays.com>

Scimorph is an augmented reality learning game designed to stimulate discussion among gradeschool students and their teachers around the scientific issues dealt with in the game's scenarios. Scimorph is an alien that students can place into different environments to observe what happens.

•Mirror Worlds

<http://www.augmentedenvironments.org/lab/2009/10>

Students at Georgia Tech have created a tour of campus that switches between a view of an avatar in a virtual world and augmented reality superimposed on the real world. Users choose their view and can move back and forth between the two.

•Video: TAT's Augmented Reality Concept Unveiled (Joseph L. Flatley, Engadget, 9 July 2009.)

<http://www.engadget.com/2009/07/09/video-tatsaugmented-reality-concept-unveiled/>

Swedish company The Astonishing Tribe (TAT) is developing augmented reality software for mobiles that allows users to tag themselves with their Facebook page, Twitter account, a business card, and more. When a tagged person is viewed through others' mobiles, these tags appear and, when selected, open specific links.

•Wikitude World Browser

http://www.wikitude.org/world_browser

With the Wikitude World Browser, users can view their surroundings through the camera on a mobile device, seeing historical information, nearby landmarks, and points of interest. Content is drawn from Wikipedia, Qype, and Wikitude, and users can add information of their own.

•Wimbledon Seer App Serves Augmented Reality on a Grass Court

<http://www.fastcompany.com/blog/kit-eaton/technomix/augmented-reality-hits-wimbledontennis-championship>

(Kit Eaton, Fast Company, 22 June 2009.) An augmented reality app assisted the 500,000 ticket holders at Wimbledon this year. Fans saw information about each match, news feeds, menus of local restaurants, and more superimposed on a view of the venue on their mobiles.

•Augmented Reality, Blogs and Geo-Tagging to Connect Students with their Environment Abroad

<http://blogs.dickinson.edu/edtech/2010/11/23/augmented-reality-blogs-geo-tagging-toconnect-students-with-their-environment-abroad/>

Study Abroad students from Dickinson College visiting Japan were assigned the task of documenting their surroundings using augmented reality. They built a simple AR layer that was complemented with geo-tagged photographs and blog entries. The project's goal was to help better familiarize students with the new surroundings.

•Powerhouse Museum Augmented Reality Application

<http://www.powerhousemuseum.com/layar/>

The Powerhouse Museum has developed an augmented reality application that allows visitors to use their mobile phones to see Sydney, Australia, as it appeared one hundred years ago.

•Radford Outdoor Augmented Reality (ROAR) Project

<http://gameslab.radford.edu/ROAR.html>

OTHER AR IN PRACTICE EXAMPLES

ROAR is an augmented reality game developed by researchers in the Games, Animation, Modeling and Simulation (GAMEs) Lab at Radford University. The project uses AR to help teach K-12 students more about Native American history and teamwork through a game called Buffalo Hunt. The project was done in collaboration with HP Labs and MIT.

•Skidmore Campus Map

<http://academics.skidmore.edu/blogs/onlocation/2010/10/21/augmenting-reality/>

The Skidmore GIS Center used augmented reality to create the Skidmore Campus Map.

•Text Spaces in Augmented Reality

<http://blogs.ubc.ca/etec540courseproj/courseassignment-major-project/>

Text Spaces in Augmented Reality is a project at the University of British Columbia using AR in conjunction with text. The project gives many examples and a list of references related to the subject.

•Augmented Reality for Special Education

<http://go.nmc.org/augme>

This wiki was launched to explore the applications of augmented reality for special education, specifically for deaf and blind students. Augmented reality glasses, for instance, have potential to serve as speech recognition aids to display text as others are talking, allowing freedom for a deaf individual to attend speaking engagements without a sign language interpreter.

•BuildAR

<http://go.nmc.org/build>

BuildAR is a Layaar-based augmented reality platform that allows people — even without development experience — to create and host mobile augmented reality content online. Student-created content can be enhanced with augmented reality in creative ways.

•The Earthquake AR Project

<http://go.nmc.org/earthq>

The Earthquake AR project was started in response to the 2011 earthquake in Christchurch, New Zealand. The project is exploring how mobile augmented reality can reveal data sets that would be helpful in the reconstruction of a demolished building.

•Getting Learning out of the Classroom with Augmented Reality

<http://go.nmc.org/getti>

One educator is exploring ways students can learn and interpret their surroundings using two free GPS-enabled apps that allow users to attach audio recordings and other information to a particular place in order to augment reality.

•Who Do You Think You Really Are?

<http://go.nmc.org/uqthc>

The London Natural History Museum developed an interactive dinosaur film optimized for tablets that incorporates gesture-based manipulation and augmented reality, where extinct creatures appear to roam the Attenborough Studio space.

FURTHER RECOMMENDED READING

The following educational articles and resources are recommended for those who wish to learn more about augmented reality.

•20 Augmented Reality Experiments in Education

<http://interactyx.com/social-learning-blog/20-augmented-reality-experiments-in-education/>

(Jodi Harrison, Social Learning Blog, 17 September 2012)

Blog post about some of most commonly used augmented reality applications used in education.

•Augmented Learning: An Interview with Eric Klopfer (Part One)

http://henryjenkins.org/2008/07/an_interview_with_eric_klopfer.html

(Henry Jenkins, Confessions of an Aca-Fan, 7 July 2008.)

Henry Jenkins interviews AR game developer Eric Klopfer, who gives insights into why this area of AR has promise in education and beyond.

•Augmented Reality Technology Brings Learning To Life

<http://www.gse.harvard.edu/blog/uk/2009/09/augmented-reality-technology-brings-learning-to-life.html>

(Chris Dede, Usable Knowledge: Harvard Graduate School of Education, September 2009.)

This article deals with educational uses for augmented reality, particularly in the middle grades, and discusses its potential to engage students. The article also touches on curriculum development for AR in the classroom.

•If You Are Not Seeing Data, You Are Not Seeing

<http://www.wired.com/gadgetlab/2009/08/augmented-reality/>

(Brian Chen, Wired Gadget Lab, 25 August 2009.)

This Wired article gives a good overview of augmented reality, including where it currently is situated and what to expect in the future.

•Map/Territory: Augmented Reality Without the Phone

<http://radar.oreilly.com/2009/08/mapterritoryaugmented-reality.html>

(Brady Forrest, O'Reilly Radar, 17 August 2009.)

This brief interview discusses what forms augmented reality might take beyond its application for mobile devices.

•Visual Time Machine Offers Tourists a Glimpse of the Past

<http://www.sciencedaily.com/releases/2009/08/090812104219.htm>

(ScienceDaily, 17 August 2009.)

New applications for smart phones offer augmented reality on the go. While on location, visitors view historical sites as they were hundreds of years ago.

FURTHER RECCOMENDED READING

•Delicious: Augmented Reality

<http://delicious.com/tag/hzk10+augmentedreality>

(Tagged by K-12 Horizon Advisory Board and friends, 2010.)

Follow this link to find additional resources tagged for this topic and this edition of the Horizon Report. To add to this list, simply tag resources with “hzk10” and “augmentedreality” when you save them to Delicious.

•Augmented Reality in a Contact Lens

<http://spectrum.ieee.org/biomedical/bionics/augmented-reality-in-a-contact-lens/0>

(Babak Parviz, IEEE Spectrum Feature, September 2009.)

Developers at the University of Washington in Seattle have created a contact lens that features augmented reality. They are also exploring the use of contact lenses to measure blood glucose, cholesterol, and more.

•Map/Territory: Augmented Reality Without the Phone

<http://radar.oreilly.com/2009/08/mapterritoryaugmented-reality.html>

(Brady Forrest, O'Reilly Radar, 17 August 2009.)

This brief interview discusses what forms augmented reality might take beyond its application for mobile devices.

•Visual Time Machine Offers Tourists a Glimpse of the Past

<http://www.sciencedaily.com/releases/2009/08/090812104219.htm>

(ScienceDaily, 17 August 2009.)

New apps for smartphones offer augmented reality on the go. While on location, users view historical sites as they were hundreds of years ago.

•Augmented Reality - Its Future in Education

<http://www.publictechnology.net/sector/augmented-reality-its-future-education>

(Mark Smith, publictechnology.net, 15 November 2010.)

This post offers a look at how augmented reality can have an impact on education.

•Blended Reality: Superstructing Reality, Superstructing Selves

<http://www.iftf.org/node/2598>

(Kathi Vian, Institute for the Future, 4 March 2009.)

This in-depth report looks at the impact of augmented reality as it is increasingly integrated into technology and society, focusing specifically on the transformation of sensory perception and its implications culturally.

FURTHER RECOMMENDED READING

•Collaborative Augmented Reality in Schools

<http://ltee.org/uploads/cscl2009/paper236.pdf>

(Lyn Pemberton, Marcus Winter, University of Brighton, 2009.)

This brief research paper discusses the use of augmented reality for collaboration and learning, and describes a specific collaborative project deploying three AR prototypes.

•How Augmented Reality Apps Can Catch On

<http://radar.oreilly.com/2010/10/two-waysaugmented-reality-app.html>

(Mac Slocum, O'Reilly Radar, 13 October 2010.)

This article discusses standards for development of AR applications.

•How Others Are Experimenting With Augmented Reality

<http://www.poynter.org/how-tos/digitalstrategies/e-media-tidbits/99162/how-the-newyork-times-others-are-experimenting-withaugmented-reality/>

(Dorian Benkoil, poynter.org, 30 October 2009.)

This post discusses how The New York Times and other publishers are exploring the use and application of augmented reality. The author also suggests how AR can be used in conjunction with other technologies such as the semantic web and smart objects.

•21st Century Lessons with Mobile Augmented Reality (Video)

<http://go.nmc.org/lesso>

(K12 Mobile Learning, 26 May 2011.)

Mobile AR tools are a convenient way to augment classroom resources in a way that allows students to use their devices for discovering new or hidden content. This video displays how simple it can be to attach videos to handwritten text, creating a lively experience with paper, a pen, and a mobile device.

•Augmented Reality: Coming Soon to a School Near You?

<http://go.nmc.org/arcomi>

(Sarah Jackson, MindShift, 20 April 2012.)

Because the number of people who own a mobile device has drastically increased in the past five years, AR programs are more readily available. This article explores ARIS, an open source mobile learning platform that facilitates interactive storytelling through the use of augmented reality. Educators do not require any programming experience to start building their own games, specific to their curriculum.

•Augmented Reality for Chemists (Video)

<http://go.nmc.org/augm>

(Art Olson, Chemical & Engineering News, 19 September 2011.)

This video makes augmented reality easier to understand by demonstrating how it is built, using a webcam to track all the possible motions of a 3D model of a chemical.

FURTHER RECOMMENDED READING

•Google's 'Project Glass' Augmented Reality Glasses Are Real And In Testing

<http://go.nmc.org/glass>

(Chris Velazco, Tech Crunch, 4 April 2012.)

Google has revealed its augmented reality glasses model that will allow the user to do things like snap a photo on command, send a text by voicing it, and display the location of nearby friends. But the author of this article notes that it may be a while before we see these in public.

•An Open Letter to Augmented Reality

<http://go.nmc.org/openl>

(Clark Dever, Wired UK, 13 February 2012.)

This letter asserts a different perspective about the path that augmented reality has taken. The writer believes that there have not been adequate advancements in the technology given the level of buzz it has garnered. He urges augmented reality developers to leverage cloud-connect experiences and drop the notion of smartphone cameras and webcams as the sole looking glasses for augmented reality.

•TEDxYouth: Marko Todorovic on AR

<http://go.nmc.org/tedxy>

(Marko Todorovic, TED, 8 December 2011.)

Marko Todorovic of Live View Studio discusses and demonstrates benefits and applications of augmented reality to connect youth with educational content. Books and other objects become interactive when hidden information is displayed through a smartphone or other digital device.

•Augmented Reality and Geotagging in Japan

<http://www.educause.edu/ero/article/augmented-reality-and-geotagging-japan>

(Ryan Burke & Todd Bryant, Educause Review, 29 March 2011)

Review on Japan's geotagging project, using tags created by students.

•Augmented Reality for Teaching Spatial Relations

<http://www.ascilite.org.au/conferences/hobart11/downloads/papers/Yeom-concise.pdf>

(Maier, Klinker, & Tonniss; Conference of the International Journal of Arts & Sciences; Toronto 2009)

Research paper that describes an approach for increasing the understanding and ease the learning of chemistry for students visualizing and controlling virtual models of molecules in a intuitive way.

•Collaborative Augmented Reality in Education

(Hannes Kaufmann, Institute of Software Technology and Interactive Systems,

<http://www.researchgate.net/>

Research paper the dicusses specially designed AR applications to explore 3D modeling and mathematics.

FURTHER RECCOMENDED READING

•The Potential of Collaborative Augmented Reality in Education

http://www.academia.edu/718351/The_Potential_of_Collaborative_Augmented_Reality_In_Education

(Marin Vlada & Grigore Albeanu, University of Bucharest, 2004)

Research paper that describes the collaborative paradigm and its impact on using AR for increasing the presence of new technologies in education.

•Web3D and Augmented Reality to support Engineering Education

<http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.70.7785>

(Liarokapis, Mourkoussis, White, Darcy, Sifniotis, Petridis, Basu, & Lister;

University of Sussex, Falmer, UK Centre for VLSI and Computer Graphics, Department of Informatics; 2004)

Research paper that illustrates AR architecture by configuring it to deliver multimedia content related to the teaching of mechanical engineering.

•Learning Through Situated Simulations: Exploring Mobile Augmented Reality

<http://www.educause.edu/library/resources/learning-through-situated-simulations-exploring-mobile-augmented-reality>

(Gunner Liestol, University of Oslo, 2011)

Research bulletin that illustrates and reports on a series of experiments with siutated simulations tested with students in Norway, Athens, and Rome over the past couple years.

•Generating 3D Models for Augmented reality Projects with Xbox Kinect—Part 1

<http://www.arined.org/?p=778>

(Nedim Slijepcevic, Educational Applications of AR, 3 October 2012)

Research paper on using Microsoft Kinect and 3D modeling to create augmented reality applications.

DEVELOPERS CORNER

DEVELOPERS VIEW: BEGINNERS

◆Aurasma Lite

- ⇒ Using a smartphone's camera, GPS, compass, accelerometer and internet connection, the technology combines image recognition and a conceptual understanding of the 3D world to recognize objects and images and merge augmented reality actions into the scene. Without the need for barcodes or tags, the app is able to see its surrounding environment and make it fully interactive. The app currently works on the iPhone 4, iPhone 4S, iPad 2, and Android devices. You can download Aurasma for free from the App Store or Google Play. <http://www.aurasma.com/>
- ⇒ Aurasma also has an official Youtube channel, where they post news and tutorials on using their program. <http://www.youtube.com/user/AurasmaLite/videos?query=Tutorial>

◆buildAR

- ⇒ BuildAR Pro is a program that allows you to create your own 3D augmented reality scenes. BuildAR Pro uses marker-based tracking, which means that the 3D models appear attached to physical printed markers you can design yourself. <https://buildar.com/>
- ⇒ By creating a set of these markers and some 3D models you can easily build up your own augmented reality scene. The 3D models can be made using almost any modeling program or downloaded from many websites on the internet. BuildAR Pro provides a graphical user interface that simplifies the process of authoring AR scenes, meaning that you don't need to be a programmer or computer expert to experiment with Augmented Reality.
- ⇒ BuildAR's website has a fairly thorough breakdown of how to use their product, with video tutorials provided. <https://buildar.com/help>

◆Google Sketchup AR Plugin

- ⇒ With AR-media Plugin for Google SketchUp by Inglobe Technologies, users are allowed to visualize their 3D models using Augmented Reality directly in the real physical space which surrounds them. By means of the Exporting feature, users can create and publish augmented reality files autonomously. http://www.inglobetechnologies.com/en/new_products/arplugin_su/info.php
- ⇒ Files created by this feature can be visualized on any computer with the freely available AR-media Player, without the need of having Google SketchUp and the Plugin installed.
- ⇒ All you need to make AR-media Plugin work is a personal computer, a webcam and a printed code attached to the software.

DEVELOPERS VIEW: MORE ADVANCED

- ◆Looking to create your own augmented reality applications? You have several options. First, choose your platform.
- ◆Augmented Planet gives a detailed list of different platforms and what software developer kits can be used to create an augmented reality application on them: <http://www.augmentedplanet.com/resources/developer-tools/>
- ◆Each developers kit is different, and will require diverse plugin's, programs, coding knowledge, and support.
- ◆The common software developer kits (SDK's) are: String, Metaio, Vuforia, and Total Immersion.
- ◆If you want some form of a 3D model in you application, then you can either make your own 3D model or download it.
 - ⇒ HONKIAT.com reviewed and provided detailed articles and descriptions on both options.
 - ⇒ Design 3D Model: <http://www.hongkiat.com/blog/25-free-3d-modelling-applications-you-should-not-miss/>
 - ⇒ Download 3D Model: <http://www.hongkiat.com/blog/60-excellent-free-3d-model-websites/>

DEVELOPERS CORNER

DEVELOPERS VIEW: OTHER METHODS TO CHECK OUT

•**Argon:** <http://argon.gatech.edu/>

Augmented reality browser by Georgia Tech's Gvu Center that uses a mix of KML and HTML/JavaScript/CSS to allow developing AR applications; any web content (with appropriate meta-data and properly formatted) can be converted into AR content; as of November 2011, available for iPhone only.

•**ARToolKit:** <http://www.hitl.washington.edu/artoolkit/>

An open source (dual-license: GPL, commercial) C-library to create augmented reality applications; was ported to many different languages and platforms like Android, Flash or Silverlight; very widely used in augmented reality related projects.

•**ArUco:** <http://www.uco.es/investiga/grupos/ava/node/26>

A minimal library for augmented reality applications based on OpenCv; licenses: BSD, Linux, Windows.

•**DroidAR:** <https://github.com/bitstars/droidar>

An augmented reality framework for Android, featuring location based and marker based AR.

•**Goblin XNA:** <http://goblinxna.codeplex.com/>

A platform for researching 3D user interfaces, including mobile augmented reality and virtual reality, emphasizing games; written in C#, based on Microsoft XNA Game Studio 4.0, BSD license.

•**GRATF:** <http://www.aforgenet.com/projects/gratf/>

An open-source (GPLv3) project, which includes C# library for detection, recognition and 3D pose estimation of optical glyphs. The project includes application, which does 2D and 3D augmented reality.

•**Hoppala Augmentation:** <http://www.hoppala-agency.com/>

A web based content platform for creating geolocation based mobile augmented reality.

•**Metaio Mobile SDK:** <http://www.metaio.com/products/sdk/>

Offers free natural features tracking that is available for both Android and iOS.

•**Metaio Creator:** <http://www.metaio.com/products/creator/>

A desktop tool to create and publish AR scenarios.

•**Mix Augmented Reality Engine (mixare):** <http://www.mixare.org/>

An open-source (GPLv3) augmented reality engine for Android and iPhone; works as an autonomous application and for developing other implementations.

DEVELOPERS CORNER

•**PTAM**, non-commercial use only. <http://www.robots.ox.ac.uk/~gk/PTAM/>

•**Vuforia Augmented Reality SDK, formerly known as QCAR, Qualcomm AR SDK (QCAR)**: <https://developer.qualcomm.com/mobile-development/mobile-technologies/augmented-reality>

A free AR solution for detection and tracking of reference images and markers using natural feature detection that is available for both Android and iOS.

•**Webcam Social Shopper**: <http://www.webcamsocialshopper.com/>

Web based software for integrating apparel visualization on e-commerce sites.

•**Junaio**: <http://www.junaio.com/>

A browser designed for 3G and 4G mobile devices. It was developed by Munich-based company metaio GmbH. It provides an API for developers and content providers to generate mobile augmented reality experiences for end-users. Currently, it is available for iPhone and Android platforms.

•**Layar**: <http://www.layar.com/>

Specializes in mobile augmented reality, using geolocation-based AR and vision-based AR.

•**Wikitude**: <http://www.wikitude.com/>

Software published in October 2008 as freeware. It displays information about the users' surroundings in a mobile camera view. Wikitude was the first publicly available application that used a location-based approach to Augmented Reality.

•**Total Immersion**: <http://www.t-immersion.com/>

Total Immersion provides the world's most widely used commercial augmented reality platform. Through its patented D'Fusion® software solution, Total Immersion blurs the line between the virtual world and the real world by integrating real time interactive 3D graphics into a live video stream.

•**String**: <http://www.poweredbystring.com/>

A high performance, Software Developer Kit (SDK) aimed at developers who wish to create true augmented reality applications that can be experienced with an iOS device such as iPad 2 or iPhone.



OTHER RESOURCES USED



- 1) Augmented Reality: http://en.wikipedia.org/wiki/Augmented_reality
- 2) Ge EcoImagination: http://ge.ecomagination.com/smartgrid/#/augmented_reality
- 3) Augmented Reality Applications as of 2011: http://en.wikipedia.org/wiki/Augmented_reality#Applications_as_of_2011
- 4) Augmented Reality in Education: http://wik.ed.uiuc.edu/index.php/Augmented_Reality_in_Education
- 5) Environmental Detectives (ED): <http://education.mit.edu/ar/ed.html>
- 6) TechTips Augmented Reality: <http://library.osu.edu/blogs/techtips/2009/09/21/techtips-augmented-reality/>
- 7) How Augmented Reality Works: <http://www.howstuffworks.com/augmented-reality.htm>
- 8) Pranav Mistry The Thrilling Potential of SixthSense Technology: http://www.ted.com/talks/pranav_mistry_the_thrilling_potential_of_sixthsense_technology.html
- 9) Future Uses for the iPad in the Operating Room, A Game Changer?: <http://tco.osu.edu/tag/augmented-reality/>
- 10) 10 Amazing Augmented Reality iPhone Apps: <http://mashable.com/2009/12/05/augmented-reality-iphone/>
- 11) Google Begins Testing Its Augmented Reality Glasses: <http://bits.blogs.nytimes.com/2012/04/04/google-begins-testing-its-augmented-reality-glasses/#>
- 12) CES 2012 Aurasma Reveals New 3D Augmented Reality Engine and Games: <http://www.guardian.co.uk/technology/gamesblog/2012/jan/10/aurasma-augmented-reality-games>
- 13) Education with Augmented Reality AR Textbooks Released in Japan: <http://www.zdnet.com/blog/asia/education-with-augmented-reality-ar-textbooks-released-in-japan-video/1541>
- 14) 10 Mind Blowing Augmented Reality Campaigns: <http://www.business2community.com/marketing/10-mind-blowing-augmented-reality-campaigns-0160078>
- 15) Augmented Reality in a Contact Lens: <http://spectrum.ieee.org/biomedical/bionics/augmented-reality-in-a-contact-lens/0>
- 16) Introduction to Augmented Reality: <http://www.se.rit.edu/~jrv/research/ar/introduction.html>
- 17) 35 Awesome Augmented Reality Examples: http://www.bannerblog.com.au/news/2009/06/35_awesome_augmented_reality_examples.php
- 18) Augmented Reality Helping Students Read: <http://wusfnews.wusf.usf.edu/post/augmented-reality-helping-students-read>
- 19) BuildAR Information: <http://www.buildar.co.nz/home/what-is-buildar/>
- 20) Augmented Reality in Education: <http://augmented-reality-in-education.wikispaces.com/>



OTHER RESOURCES USED



- 21) 5 Reasons to Get Excited About Augmented reality in 2013: <http://venturebeat.com/2012/12/23/augmented-reality/>
- 22) 7 Ways Augmented Reality Will Improve Your Life: <http://mashable.com/2012/12/19/augmented-reality-city/>
- 23) 5 Top Augmented Reality Apps for Education: <http://www.hongkiat.com/blog/augmented-reality-apps-for-education/>
- 24) 8 Excellent Augmented Reality Apps for iPad: <http://www.educatorstechnology.com/2013/01/8-excellent-augmented-reality-apps-for.html>
- 25) 5 Uses of Augmented Reality in Education: <http://www.freotech4teachers.com/2013/02/5-uses-of-augmented-reality-in-education.html>
- 26) Screw GoogleGlass, I want my Augmented Reality Heads-Up-Display contact lense: <http://venturebeat.com/2012/12/05/screw-google-glass-i-want-my-augmented-reality-heads-up-display-contact-lenses/>
- 27) Fisher-Price Magically Morphs iPads into Kids' Toys with Augmented Reality: <http://www.cultofmac.com/209647/fisher-price-magically-morphs-ipads-into-kids-toys-with-augmented-reality-ces-2013/>
- 28) Layar Creator Brings Interactivity to Nature: <http://www.layar.com/blog/2012/07/25/creator-brings-interactivity-to-nature/>
- 29) Moonwalking: <http://www.moon-walking.com/>
- 30) Augmented Reality Apps Transform Class Time: <http://thejournal.com/articles/2012/09/12/augmented-reality-apps-transform-class-time.aspx>
- 31) Appealing Apps for Educators: Augmented Reality for Educational Engagement: <http://www.appolicious.com/education/articles/12777-appealing-apps-for-educators-augmented-reality-for-educational-engagement>
- 32) 6 Smart Augmented Reality Apps: <http://www.hackededucation.com/2011/03/16/6-smart-augmented-reality-apps/>
- 33) Groundbreaking Augmented Reality-Based Reading Curriculum Launches: <http://www.prweb.com/releases/2011/10/prweb8899908.htm>
- 34) Augmented Reality Vs. Virtual Reality: Which One Is More Real?: <http://techcrunch.com/2010/01/06/augmented-reality-vs-virtual-reality/>
- 35) Discovery learning with augmented reality: <http://learningwithipads.blogspot.com/2012/04/discovery-learning-with-augmented.html>

Thank you!

To CONTACT Us

Names: Larissa Borcz & Jonathan Diehl

Organization: The Digital Union, at The Ohio State University

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ONLINE CONTACT FORM:

<http://go.osu.edu/ducontactform>

VISIT OUR AUGMENTED REALITY BLOG:

<http://go.osu.edu/duarblog>

FOR AN ONLINE VERSION OF THIS PACKET:

<http://go.osu.edu/duarpacket>

FOR AN ONLINE VERSION OF OUR HANDOUT:

<http://go.osu.edu/duarhandout>