1962

Sensorama

Morton Heilig, a cinematographer, created a motion-simulator called Sensorama (pictured left) with visuals, sound, vibration, and smell.

1968

Sword of Damocles

Ivan Sutherland creates the first augmented reality system, which is also the first virtual reality system, in what is to be known as the "Sword of Damocles", owing to the large apparatus suspended above the user's head. It presents 3D wire-frame graphics on stereoscopic display that is tracked by one of two different 6DOF trackers: a mechanical one and an ultrasonic tracker. Due to the limited processing power of computers at that time, only very simple wire-frame drawings could be displayed in real time.

1975

Videoplace

Myron Krueger creates Videoplace that allows users to interact with virtual objects for the first time.

1989

Jaron Lanier (pictured left) coins the phrase "Virtual Reality" and creates the first commercial business around virtual worlds.

1992

"Augmented Reality"

Tom Caudell (pictured left) and David Mizell coin the term "Augmented Reality" while working on a project that assembles cables into aircraft. The term Augmented Reality referred to computer-generated information that lived on top of the real world.

KARMA (Knowledge-based Augmented Reality Maintenance Assistant)

The Columbia KARMA AR system prototype is developed, and used to explore how AR could provide maintenance information to assist in the repair of laser printers. The group published an early, major paper on an AR system prototype in 1992, but reworked for CACM the next year.

First Smartphone

IBM and BellSouth introduce the first smartphone (pictured left), the Simon Personal Communator. It has a 1 Megabyte of memory and a B/W touch screen with a resolution of 160 x 293 pixels. The IBM Simon works as phone, pager, calendar, address book, fax sender, and e-mail device. It weighs 500 grams and cost 900 USD.

1993

GPS (Global Positioning System, official name "NAVSTAR GPS")

GPS achieves initial operational capability. To the left is an artist rendered picture of the satellite. Although GPS was originally intended for military applications, in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges for using GPS. The accuracy of civilian GPS receivers is typically in the range of 15 meters. More accuracy can be gained by using "differential" GPS (DGPS), correction signals from fixed, ground based reference stations.

1994

Steve Mann (pictured left) starts wearing his EyeTap device. Steve Mann (1994-1996) Mann wears a mobile camera and display for almost every waking hour. The camera and display switches seamlessly allowing online videos to see what Steve sees and to send him a live feed show up on his mobile display.

Paul Milgram and Fumio Kishino write their seminal paper "Taxonomy of Mixed Reality Visual Displays" (IEICE Transactions on Information Systems). Milgram and Kishino describe a continuum that spans from the real environment to the virtual environment, and they define Augmented Reality, closer to the real environment and Augmented Virtuality, which is closer to the virtual environment. Milgram and Kishino's definition of Mixed Reality (MR) is commonly accepted as defining Augmented Reality.

1995

NanoCam

Jun Rekimoto and Katashi Nagao create the NaCam (pictured left), a Stereo Vision Camera Attachment for Palmtop Computers. The NanoCam also uses a nearly powerful workstation, but has a camera mounted on the mobile screen that is used for optical tracking.

1996

Jun Rekimoto presents 2D matrix markers (square shaped barcodes, see image to the left). Jun Rekimoto's paper lays the groundwork for using fiducial markers to allow camera tracking with six degrees of freedom.

1997

First Camera Phone Picture

Philippe Kahn invents the camera phone, a mobile phone which has a built-in digital camera. On June 11, 1997, Kahn used his invention to take the first camera phone image: a photo of his newborn daughter, Sophie, delivered 5ML. Today more than half of all mobile phones in use are camera phones.

1998

Map In The Hat

Bruce Thomas et. al. present "Map-in-the-hat" (pictured left), a backpack based wearable computer that in addition to a GPS receiver is equipped with a head-mounted display. The system is utilized for navigation guidance, but also supports the user in the collection of data used for several other AR projects.

HT in Sports Broadcasting - Sportvision

Perhaps the most visible use of augmented reality up until mobile applications is a wide variety of graphics overlays used on television broadcasts of sporting events. These AR graphics require real-time light registration to the action even with a moving and zooming camera. These include the virtual first down line in NFL football games, virtual advertisements floating with race cars, and virtual ads inserted within in stadium and on the field. These are mostly simple 2-D graphics, albeit sometimes projected onto objects in the 3-D scene.

BARS (Battlefield Augmented Reality System)

Simon Julier et. al. present BARS. The system consists of a wearable computer, a wireless network system and a see-through HMD. The system uses the user's current location and field-scene with additional information about environmental infrastructure, but also about possible enemy ambushes.

First Commercial Camera Phone

Sharp Corporation releases the first commercial camera phone to public. The official name of the phone is J-SH04. The camera lens has a resolution of 0.1 megapixels.

2000

AR-Quake

Bruce Thomas et. al. present AR-Quake, an extension to the popular desktop game Quake. ARQuake is a first person perspective application which is based on a 6DOF tracking system using GPS, a digital compass and a fiducial marker based vision tracker. The system is equipped with a wearable computer system in a backpack, an HMD and a simple two-button input device. The game can be played in or outside the real world. Virtual representations of real world objects, movement and actions are performed by movements of the user in the real environment and using the simple input interface.

mARAD

Regenbrecht and Specht present mARAD, using ad-hoc ad-hoc wireless video transmission to a host computer which is taking the burden of computation off the wearable computer. The system is based on augmented images are sent back to the visualization device over a separate analog channel. The system uses a fiducial marker based tracking system and the batteries allow for an uninterrupted operation of 5 hours at max.

2001

ISAR 2001 - Mobile AR Restaurant Guide

Columbia's Computer Graphics User Interfaces Lab presents a mobile implementation of their mobile AR restaurant guide at ISAR 2001, running on their MARS platform. The application recommends nearby restaurants and overlays on the user's view, and linked to restaurant menus, photos, and restaurant URLs.

Archeoguide

Vlahakis et. al. present Archeoguide, a mobile AR system for cultural heritage sites. The system is built around the historical site of Olympia, Greece. It provides a virtual walk through the ancient site of Olympia, with reconstructions of ancient temples and statues, and avatars which are competing for the win in the historical run in the ancient Stadium. Reconstructions are based on CAD models. Tracking is performed using GPS. Within the system a scalable setup of mobile units can be used, starting with a notebook-sized system with HMD, down to palmtop computers and Pocket PCs.

AR PDA

Jürgen Fruend et. al. present AR-PDA, a concept for building a wireless AR system, based on commercially available palm-sized hardware. Basic design ideas include the augmentation of real objects with virtual information and virtual objects, for example for illustration of functionality and interaction with commonly used household equipment.

TOWNWEAR

Hess et. al. introduce TOWNWEAR, an outdoor system that uses a fiber optic gyroscope for orientation tracking. The fiber optic gyroscope is used to measure the 6DOF head direction accurately with minimal drift, which is further compensated by tracking natural features.

BatPortal

Joseph Newman et. al. present the BatPortal, a PDA based, wireless AR system. Localization is performed by measuring the travel time of ultrasonic pulses between specially built devices worn by the user, so called "Bats" and a network of ceiling mounted receivers, placed in the building walls. The system can support an HMD based system, but also the more well known BatPortal using a handheld device. Based on a 2D display and the user's position, the system calculates the 3D direction of the user's view is estimated, and a model of the scene with additional information about the scene is rendered onto the PDA screen.

2002

Michael Kalkusch et. al. present a mobile augmented reality system to guide a user through an indoor building to a predetermined target. The system presents a world-registered wire frame model of the building labeled with directions and distances to the target location. The system uses a three dimensional world in miniature (WIM) map on a wrist-worn pad that also acts as an input device. The WIM is tracked by a fiducial marker based wall-mounted ARToolkit markers observed by a head-mounted camera, and an inertial tracker.

InterSense's IS-1200

Leonard Naimark and Eric Foxlin present a wearable low-power hybrid visual and inertial tracker. This tracker, later to be known as InterSense's IS-1200, is capable of tracking in large scale, such as a complete building. This is achieved by tracking a combination of IR LEDs, inertial, and a variety of different codes and combining the result with an inertial sensor.

Steven Feiner is the leading pioneer of mobile augmented reality. In his first paper on the subject, Feiner, S. B. "Augmented Reality: A New Way of Seeing." he discusses how augmented reality systems that can enhance and enrich a user's view of the world". Sci-entific American, April 2002.

2003

Dorum Gusen presents a mobile AR authoring system for creating and editing 3D hypermedia narratives that are interwoven into physical environments and collaborative virtual environment. They system was designed for authors who are not programmers and who are unfamiliar with 3D design and who need a comprehensive set of 3D design and visualization. It allowed authors to preview their results on a desktop workstation, as well as with a wearable AR or VR system.

The Siemens SX1 present an indoor AR guidance system running wireless-ly on a PDA. They exploit the existing wireless infrastructure with a minimal need for infrastructure. The application provides the user with a 3D representation of the surrounding of the environment by using a Windows Mobile port of ARToolKit for tracking and runs directly on the PDA.

Daniel Wagner and Dieter Schmalstieg present an indoor AR guidance system running autonomously on a PDA. They exploit the existing wireless infrastructure with a minimal need for infrastructure. The application provides the user with a 3D representation of the surrounding of the environment by using a Windows Mobile port of ARToolKit for tracking and runs directly on the PDA.

Human Pacman - Mobile AR Application

Adrian David Cheok et. al. present the Human Pacman. Human Pacman is a mobile augmented reality entertainment system that is built upon position and perspective sensing via Global Positioning System and inertia sensors, and tangible human computer interfaces. In the game, virtual characters and virtual cookies are sent from a central server to the real world experiencing mixed computer graphics fantasy-reality pervaded by using wearable computers that are equipped with GPS and inertia sensors for players' position and perspective tracking.

2004

Matthias Wilhelmy et. al. present a system for tracking 3D markers on a mobile phone. The system uses a fiducial video-see-through augmented reality system on a consumer cell phone. The system can track and display a number of different 3D markers, and correct integration of rendered 3D graphics into the live video stream.

Visual Codes

Michael Rohs and Beat Gfeller present Visual Codes, a system for tracking on mobile phones. These codes can be attached to physical objects in order to provide additional information and functionality. They are also suitable for display on electronic screens.

OSGAR

Elydon Machado Coelho et. al. presents OSGAR, a scene graph with uncertain transformations. In their work they target the problem of registration in mobile AR. In contrast to most mobile scenarios where high quality tracking is not available and overlay graphics will not align with the real world, uncertainty is used to dynamically adapt the display to mitigate the effects of registration errors.

The Invisible Train - Mobile AR Application

The Invisible Train is shown at SIGGRAPH 2004 Emerging Technologies. The Invisible Train is the first multi-user Augmented Reality application for handheld devices.

Gizmondo

Gizmondo becomes the one of the first commercial attempts to bring AR to the masses. It is introducing AR for interactive gaming on a mobile platform.

2005

Gizmondo

Introduces multiplayer gaming for a mobile platform.

Daniel Pelaekes, Alexander Gerkens and Phil Hove develop a "Scenic cast".

Project ULTRA shows how to use non-invasive augmented reality (AR) and PDAs to support people in multiple domains such as the maintenance and operation of complex machines, construction and production, and education and cultural heritage. Further, ubiquitous computing environments is developed to create AR scenes for the maintenance tasks.

ARTerrain - Mobile AR Application

Andreo Naccyzzoni ports ARToolkit to Symbian OS and develops ARTerrain, a game for Nokia's N-Series phones, the first collaborative AR application running on a mobile phone. The game was presented at the Singapore Mobile Gaming best game award for 2005, and the technical achievement award.

2006

Reitmayer et. al. presents a model-based hybrid tracking system for outdoor augmented reality in urban environments using accurate, real-time overlays on a handheld device. The system combines an edge based tracker for accurate and robust pose estimation, a mechanism to deal with fast motions, measurements of gravity and magnetic field to avoid jitter, and a model-based 3D-to-2D registration framework which allows for a reliable automatically after dynamic occlusions or failures.

Wara - Mobile AR Application

Nokia presents Wara, a multi-sensor mobile phone AR prototype application that combines GPS and compass data with location overlays the Lumitracer near-finder image stream captured by the camera with graphics and text in real time, simulating the user's surroundings.

Wikitude - Mobile AR Application

Mobilizy launches Wikitude, an application that combines GPS and compass data with Wikipedia entries. The application displays points of interest overlays on the real time camera view of an Android smartphone.

2007

Medical applications for users. Sending visual cues to help MS patients better keep their balance.

Facial feature tracking to allow for expressive control of avatars. For example, a conductor could command a certain set of virtual instruments with the movement of his eyes.

HIT Lab NZ and Saatchi and Saatchi deliver the world's first mobile phone based AR advertising application for the Wellington Zoo.

Rohs et. al. compare the performance of two mobile AR navigation systems, one for navigation via mobile phone, presents map-based visual cues, and the other one using a GPS based virtual compass. In their user study they demonstrate the advantage of dynamic perspective maps in terms of navigation speed and interaction in terms of search time and degree of exploration of the search space.

GroundCam

Ethrad and Hübner present the Ground-Cam, a system consisting of a camera and orientation tracker. The camera points at the ground behind the user and provides 2D-tracking. The tracking quality is better than that of an optical desktop mouse.

Klein and Murray present a system capable of real-time localization and mapping in parallel with a monocular camera in small workspaces. It is an AR system for a video see-through camera, processes the tracking and mapping task on two separated threads.

Eye of Judgment

Sony released the Eye of Judgment for Playstation 3 in Japan on October 25, 2007 and in America on April 24, 2008.

Ark Quiles

Dr. Steven ZHOU and his team at the National University of Singapore, Interactive Digital Media Institute, developed ARQuiles (Ark) the world's first commercially available linked reality interactive consumer product, on 1 March, 2007 in Singapore.

watch the commercial:

2008

METAIO presents a commercial mobile AR application, Wagner et. al. have been working on a six-month exhibition on Islamic art. In their paper they describe the experiences made in this project.

Wagner et. al. present the first real-time 6DOF implementation of natural feature tracking on mobile phones, achieving interactive frame rates of up to 20 Hz. They heavily modified the popular SIFT and SURF methods in order to gain more speed and reduce memory requirements.

2009

U.S. Postal Service - Virtual Box Simulator

The Virtual Box Simulator is a simple application of 3-D AR provided as a web service by the U.S. Postal Service. It allows users the right size of flat Rate Box, you hold up a printed "marker" page in your Webcam to preview how a standard Flat Rate Box would ap-pear materials to ship in order to compare to the available box sizes.

ARtenal - Mobile AR Game

Amberly Spawn et. al. develop ARtenal, the first mobile AR game with high quality content at the Nokia Research Center. The game is based on Tiger developer M.T.Cronovalp's with a fast GPU AR processing except for tracking are running on the CPU. The game uses a combination of high frame rates on a mobile phone class device despite the highly detailed content and natural feature tracking.

Layar - Mobile AR Application

SPRIntermobile launches Layar, an advanced variant of Wikitude. Layar uses the same approach as Wikitude but adds a flexible registration mechanism, called the Layar platform. Content layers are the equivalent of web pages in normal browsers. Existing layers include Flickr, Twitter, weather, Google maps, Wikipedia, Friends Reunited, Craigslist, Yelp, real estate, media coverage, Macro disease and trauma, nature and cultural guides. On August 17th Layar were global winning almost 100 content layers.

Esquire - Augmented Reality Issue

The December 2009 issue of Esquire magazine featured six Augmented Reality experiences triggered by a black and white block "marker" printed on the magazine cover, inside front and back, offer downloading the custom software, holding up the marked pages started playback of the accompanying multimedia content. Some of the virtual experiences change with the orientation of the magazine page.

Sean White introduces SiteLens, a hand-held mobile AR system for urban design and environmental planning. SiteLens creates "Situated visualizations" that are related to and displayed in context of the surrounding environment. An orientation of geocoded urban-renewal concentration data are overlaid at the sites at which the data was recorded.

MapLens - Mobile AR Application

Morrison et. al. present MapLens which is a magic lens application that augments a paper map. Lens uses a paper map. They conduct a broad user study in form of an outdoor location based game. Results show that the paper map facilitates place-making by serving a common anchor point for referencing to the physical. The field trials show that the main potential of AR maps lies in their use as a collaborative tool.

2010

WordLens - Mobile AR Application

Word Lens is an Augmented Reality Translator for iPhone. It uses the Word Lens OCR engine, all you have to do is point your camera to the text, sign, or phrase that you need translated. Word Lens then replaces the original text, overlaying the translated phrase for you on your phone's screen as if you're seeing the translation through the real world. Hence the augmented reality aspect.

2011

Logovision's algorithms can identify any video and create detailed payloads for all specific content within the video. This allows viewers to interact with any object in Logovision Enabled content. Through these interactions viewers can learn more about content, purchase products, get storyline and bios or receive general background info.

Logovision changes the definition of direct response television. The application recognizes the visual portion of the program and enables the content producer to refer the consumer to ANY URL link. So consumers can simply take a photo of any commercial (while watching it) and order the product or service being advertised. Or while watching a television show, a consumer can purchase the leather jacket or dress being worn by the actor on the screen. They can refer the program (complete with video link to that episode) to a friend via text message. While watching sports events, they can purchase tickets to events...