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Augmented Reality Apps for Real Estate

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1 ABSTRACT

Our research focuses on the appliance of real estate applications (RE-apps) especially on the unchartered topic of the use of augmented reality (AR) and in special cases for virtual reality (VR) in the field of real estate. Apps are small programmes on smartphones and tablets. These apps will be classified by their usage for a modern city. A sub-classification is made for the ability of AR functions.

Augmented reality means that the reality of the camera is enhanced with additional information through GPS and compass information, data from external knowledgebases, social media networks or real estate search engines. So a value for the user could be created that turns the real and the virtual objects in a multi-dimensional relationship to each another.

The paper analyses the usage und functionalities of the offered real estate applications concerning architecture, buildings, refurbishment and housing renewal. First results have been shown at the Pacific RIM Real Estate Society (PRRES) conference 2012 in Adelaide, Australia.

The work is based on extensive literature research providing a methodical comparison of applications available. Based on the results, the project covers the structural, technological and user related factors that facilitate or impede dissemination of AR-apps. As a result it is given a smart overview of the existing AR- and VR-applications and the market potential for real estate with a visionary conclusion of expected future developments.

2 INTRODUCTION

Apps are small programmes on smartphones or tablets which are characterized by simple usage and a flat training curve in usage in a short life cycle. They are often cheap products, created for consumers and distributed via virtual markets. (LANG; SITTLER 2011, p. 1) But technically seen apps are no new phaenomenon. (MAYER 2012, p. 13)

Though the worldwide sales of mobile phones to end users have reached a peak with 428 million units in the third quarter of 2012, this means a 3 percent decline from the third quarter of 2011. But the smartphone sales increased by nearly 47 percent. (GARTNER 2012a) Additionally the use of Non-Computer devices like smartphones and tablets increases rapidly. (COMSCORE 2012, p. 50) In this enviroment it is not surprising that an older whitepaper points out that mobile applications are achieving unprecedented download levels driven by the success of the Apple App Store. So the opportunities for mobile applications with AR are strongly increasing. (JUNIPER RESEARCH 2009, p. 1)

We began our research in 2010 with apps for finding property via smartphones. We early noticed that several categories of apps can be used in the field of real estate. (LANG; SITTLER 2011, p. 3) Further on we additionally classified the real estate apps by their usage of augmented reality (AR) functions. (LANG; SITTLER 2012a, p. 4). In addition to this paper some of the apps changed and many new came into range.

"Augmented reality (AR) is a term for a live direct or an indirect view of a physical, real world enviroment whose elements are augmented by computer-generated sensory input, such as sound or graphics." (KENT 2011, p. 1)

Following the definition of AZUMA (1997) an AR system has to fulfill following three requirements:

(1) Combines real and virtual

(2) Interactive in real time

(3) Registered in 3-D

According to the Milgram continuum of reality and virtuality AR is one of the possible states of mixed reality (MR), which begins with the real enviroment and is continously enhanced by additional data and external information. So as it can be seen in Fig. 1 AR is the picture of the real world enhanced eg. with data

of the Pisa tower. AR is based on the real world with a limited set of virtual objects mixed in. When only the virtual reality is enhanced with some real views it is called augmented virtuality (AV). It is pointed out that the virtuality continuum juxtaposes AR and AV (WAGNER 2007, p. 2) While AR shows the real world, AV shows a virtual reality based on a computer-generated world. The boundary between AR and AV is not strictly defined. (LANG; SITTLER 2012a, p. 2)
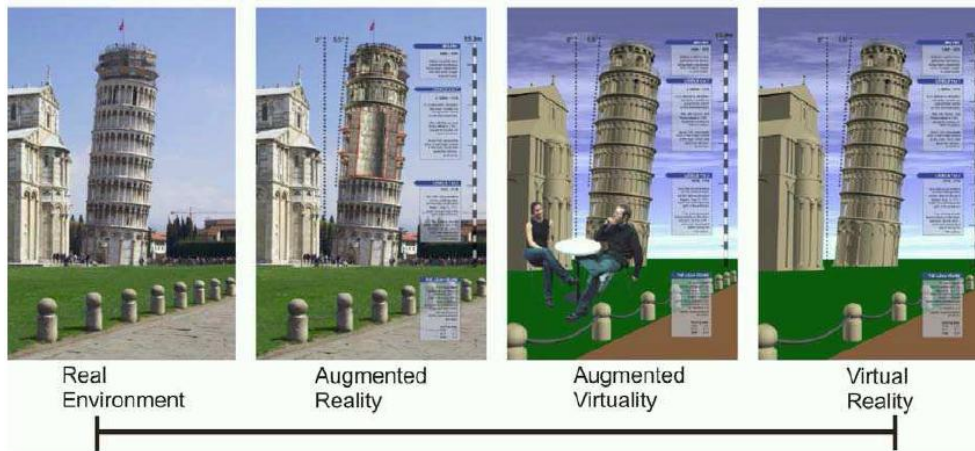

Fig. 1: Milgram continuum of reality and virtuality (SIEGLER; WIETZEL 2009, p. 90)

3   FIELDS OF AUGMENTED REALITY APPS FOR REAL ESTATE

The real estate sector even noticed that the development of apps is an important criteron of marketing for the customer. In early times AR-apps for the iPad have not been developed due to the lack of camera in the first generation. (CARMIGNIANI; FURTH 2011, p. 36) Only a few companies offer RE-apps. The number of AR-apps is even smaller. We pointed out that there is only few literature concerning AR in the field of real estate.There can be additionally mentioned (ALLBACH; MEMMEL; ZEILE; STREICH 2011), (GAWLITTA 2012), (KIPPER; RAMPOLLA 2013, p. 16) and (MEHLER-BICHER; REISS; STEIGER 2011).
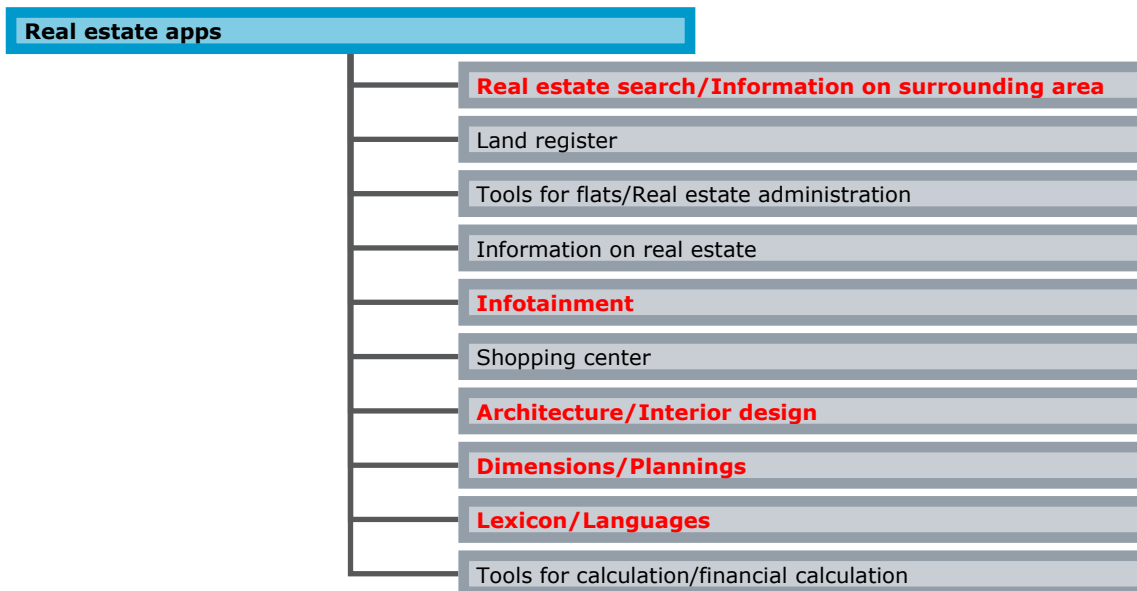

Fig. 2: Classification of the real estate apps (LANG; SITTLER 2012b, p. 5)

We made an extensive internet and literature research to find some apps in several publications, but AR applications for real estate are only partially mentioned. A whitepaper concerning several business models of AR describes the AR search of property regarding the app of the German real estate search engine Immonet. (JÁNSZKY; SCHILDHAUER 2010, p. 26) The search of property is the best known and most distributed AR application in the field of real estate. Additionally MEHLER-BICHER; REISS; STEIGER (2011) try to classify the fields of applications of AR with education, presentation/visualization, collaboration, configuration/simulation and navigation/orientation. (MEHLER-BICHER; REISS; STEIGER 2011, pp. 73

77) It is often seen that in the literature real estate applications are mixed with architecture and other fields of applications. But real estate seems to be an enormous factor for the economy, so several fields are concerned. (LANG; SITTLER 2012a, p. 3)

We made a classification with the several fields of applications that are concerned with RE-apps with a sub-classification for the ability of augmented reality (AR) functions (in bold red). (LANG; SITTLER 2012b, p. 5)

The AR applications are a subset of RE-apps. As a field of research we collected a number of RE-apps for smartphones. This applications are mostly focused on the Austrian market, but some of them are international while there are no apps concerning a digital city (JAEKEL; BRONNERT 2013, pp. 35-63). (LANG; SITTLER 2012a, p. 4)

4 AR-APPS FOR REAL ESTATE

The following individual areas of applications are shown with examples and discussed with respect to AR-apps for real estate.

4.1 Real estate search/Information on surrounding area

We made a research on the main searching-apps in the field of real estate in the German speaking region and noticed that the first application was the app of www.immobilien.net, which took back their app from the Apple iTunes store meanwhile. So only the German RE-app www.immonet.de offers an AR-search through an own RE-app. (MAYER 2012, p. 13) The main reason why immobilien.net gave up their AR strategy was that the amount of findable objects within the app was very small, while flats could only be exact positioned when full data of the object is registered by the real estate agents. This is a problem in Austria, because only 10 % of all real estate on offer are currently geo-coded. In practice (even without AR) geo-coded objects that display full address information are 40 % shorter on the market. (LANG; SITTLER 2011, pp. 5-6)

In order to show how the app was running there are some screenshots shown below in Fig. 3.
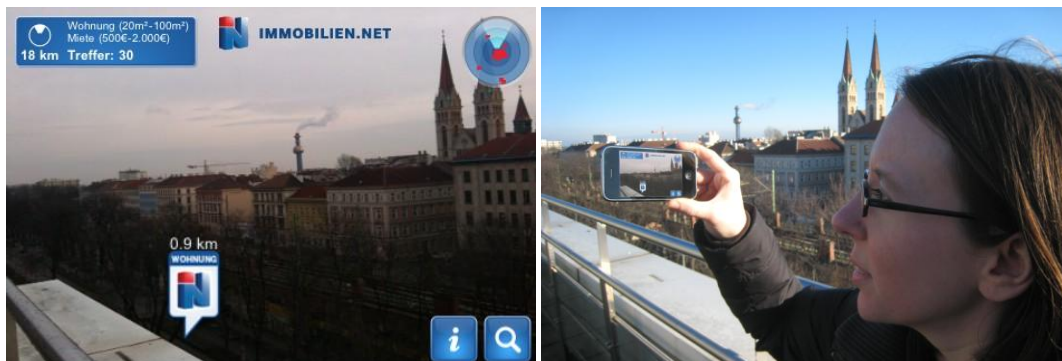

Fig. 3: Real estate search application Immobilien.net (LANG; SITTLER 2012a, p. 5)
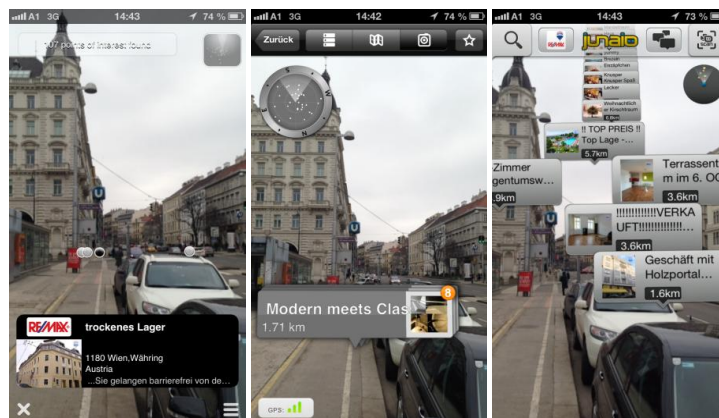

Fig. 4: RE/MAX real estate search with Layar, Wikitude and Junaio

Another field of application for AR-apps in the city is information on surrounding areas. The main apps are Layar, Wikitude and Junaio which show information on the surrounding offices, restaurants, educational infrastructure, etc. on the screen of the smartphone or tablet. The mentioned apps are partly described in AR-

literature: Layar (MADDEN 2011, pp. 36-39), Wikitude (KENT 2011, pp. 41-42), Junaio (KENT 2011, p. 37).

There are some real estate agents which use layers to show their property with an AR functionality. In Austria the company RE/MAX[1] uses the apps Layar, Wikitude and Junaio for this purpose.

4.2 Infotainment

A wide range of smartphone concerns entertainment and infotainment to prospective customers. In the field of real estate the Australian Commonwealth Bank uses AR in their app. The aim of this app was to show non technical users how to use AR functionalities for their AR-search app. With this app you use a marker to start the real estate market in the virtual city Cherryford Hill. A virtual person named Paul explains with voice guidance terms, transactions and purchase prices. (BROUGHALL 2011)

Fig. 5: CommBank 3D Reader

4.3 Architecture/Interior design

Another extensive use of RE-apps is architecture and interior design. In the last years there are aditionally several applications that use AR. Some of the first experiments were made by the company Ikea. (MEHLER-BICHER; REISS; STEIGER 2011, pp. 103-108) Today they offer their catalogue as an interactive AR featured one, but the AR functionalities are only for showing further information or videos, not for showing virtual furniture. (TRAK 2012)

In this field of interior design the Viennese company Meixner IT-Solutions[2] offers an AR-app called ViewAR that is able to place virtual interior in an real enviroment. Some other firms use their technology with white lable apps . Within this app you can place a virtual piece of furniture in your flat by using a marker. A marker is needed for showing the AR-app the position of the model.

Fig. 6: ViewAR

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[1] www.remax.at

[2] www.meixner.at

Using the orientation features of a smartphone or tablet like GPS,[3] compass, accelerometer and gyroscope it is possible to interact with the real enviroment. So a prototype application for architectural on-site visualisation could be build to simulate a bridge beetween two existing buildings (NIEDERMAIR 2012, pp. 20-21, 64).

Fig. 7: Prototype AR-app for showing a bridge (NIEDERMAIR 2012, p. 62)

What is used above as a prototype is in other projects already in use. The app 3Don ARchitecture[4] is a 3D viewer for architectural models integrating a geo-tagged ability. (NIEDERMAIR 2012, p. 17) Vienna was one of the first cities that implemented the AR technology for visualization of a development in urban areas. The construction site is in the north of the city and called "Seestadt Aspern" and will be be developed in the next years. The Austrian company Ovos[5] set up a special layer using the app Layar (compare to chapter 4.1) for prospective customers. So you can see future buildings and architecture live on the construction site. (OVOS 2011) (LANG; SITTLER 2012a, p. 8)
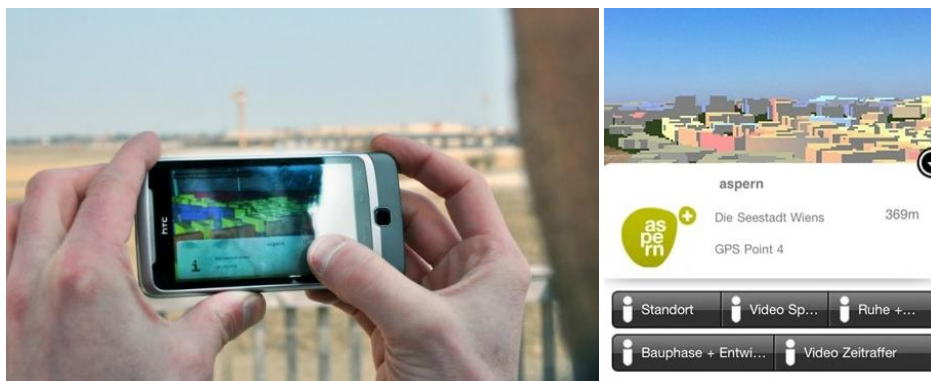

Fig. 8: AR app for large development area – Vienna Seestadt Aspern (OVOS 2011)

Fig. 9: Wohntraum am Olympiapark

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[3] Global Positioning System

[4] www.3don.co.uk

[5] www.ovos.at

Without using a third-part AR-app there are several projects that already use AR technologies. But these projects are located in Germany. The first app was "Wohntraum am Olympiapark" which is situated in the city of Munich. The title page of the project catalogue is used as a marker for the app. Beside additional information of the project the AR mode can be reached with the "3D view" button. So the whole project is shown on the display. The app was also programmed by the company Meixner IT-Solutions.

The second project is "AR Winterhuder Wohnkultur" which also offers additional information on the project and two ways of visualizing the site. The first way is a classical AR approach with a special logo in the prospect using a marker for getting the project shown as virtual model (using button pages 1-9). The second way is non-AR, but shows the architectural objects interactive by holding the camera around (using button pages 10-16). Knowing the position the app guides you through the 3D model. Strictly speaking this is not AR, is is virtual reality (VR) instead.

Fig. 10: Winterhuder Wohnkultur (AR view)

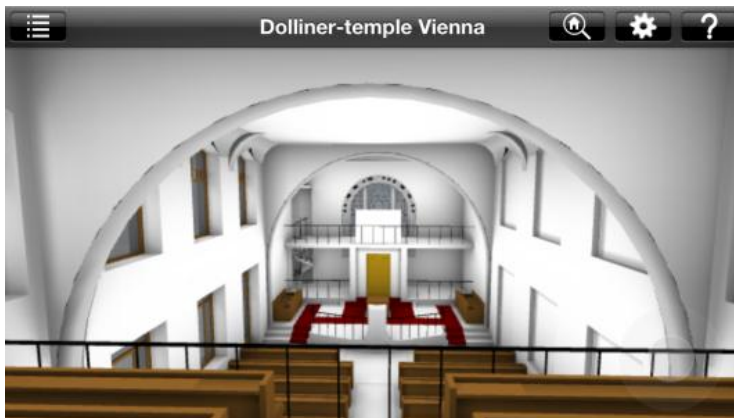Fig. 11: Winterhuder Wohnkultur (3D model)

Fig. 12: BIMx (Reconstructed 3D model of synagogue 1190 Vienna, Dollinergasse)

Other apps using this method of orientating in the building or interactive showing the 3D model are BIMx and iVisit 3D. All these apps can be used as an innovative method for 3D presentation of architecture setting

new standards. In Vienna there was a project which rebuilt the destroyed synagogues in the city with virtual models. (MARTENS; PETER 2009) The Austrian company A-Null Bausoftware[6] made it possible that these buildings are in a BIMx virtual environment. In this app you can virtually move inside the objects.

With the iVisit app architects can upload their own projects. It is developed for architects and designers, to allow users to view panorama renderings. In the navigation mode you can look around in your model by moving the smartphone or tablet. The views are genrated by rendering only images. This property is not in Vienna. But again this is also Virtual Reality, even a smart way to present property.

Fig. 13: iVisit 3D

4.4 Dimensions/Plannings

As a planning tool the app SOLight from the Austrian company Anvartec[7] is used to show the sun path throughout the whole year. The app calculates the exact sun path for the current GPS position and overlays the live picture with the sun path in front of the surrounding area (houses, trees, mountains, etc.). The difference between the summer and the winter sun positions could be helpful for visiting an object and detecting several lightning problems e.g. with new or prospective condominiums. (LANG; SITTLER 2012a, p. 9)
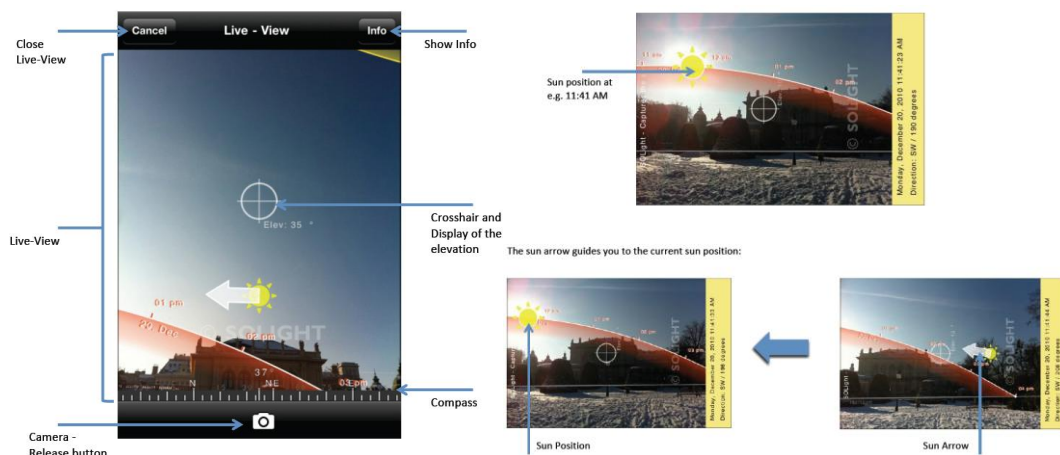

Fig. 14: SOLight (ANVARTEC 2010, p. 2, 4)

4.5 Lexicon/Languages

Tourism is one of the most wanted categories for apps, while the use of smartphone features is applicable for AR use. In this field the app Word Lens was developed. It is an entirely new tool for live translations using the camera image to immediately translate the appropriate language. The result is simultaneously displayed in the desired language. Currently the translation of Spanish, French, Italian and German into English (and vice versa) is supported. With this application every language challenge or sign reading on a construction site will be no problem any more. (LANG; SITTLER 2012a, p. 9)

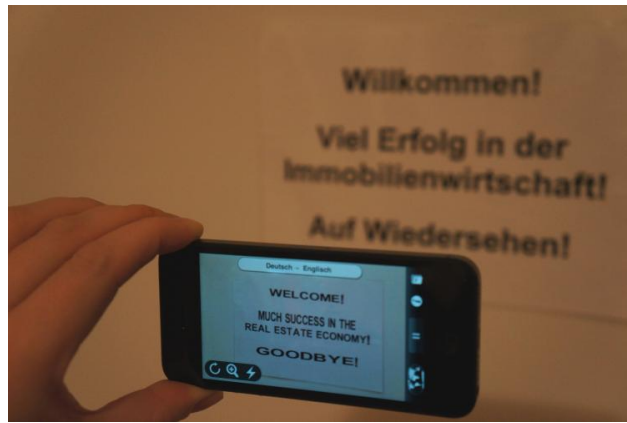[6] www.a-null.com
[7] www.anvartec.at

Fig. 15: Word Lens

5 CONCLUSION

"AR is still in infancy state, and as such, future possible applications are infinite" (CARMIGNIANI; FURTH 2011, p. 38)

The above mentioned classifications in the use of AR have different relevance in terms of their capabilities in use and their benefits for the user. The size of the circles indicates the estimated market share. In comparison to the results of 2012 there is a a sharp shift towards architecture and interior design at the expense of real estate search. (LANG; SITTLER 2012a, p. 10)
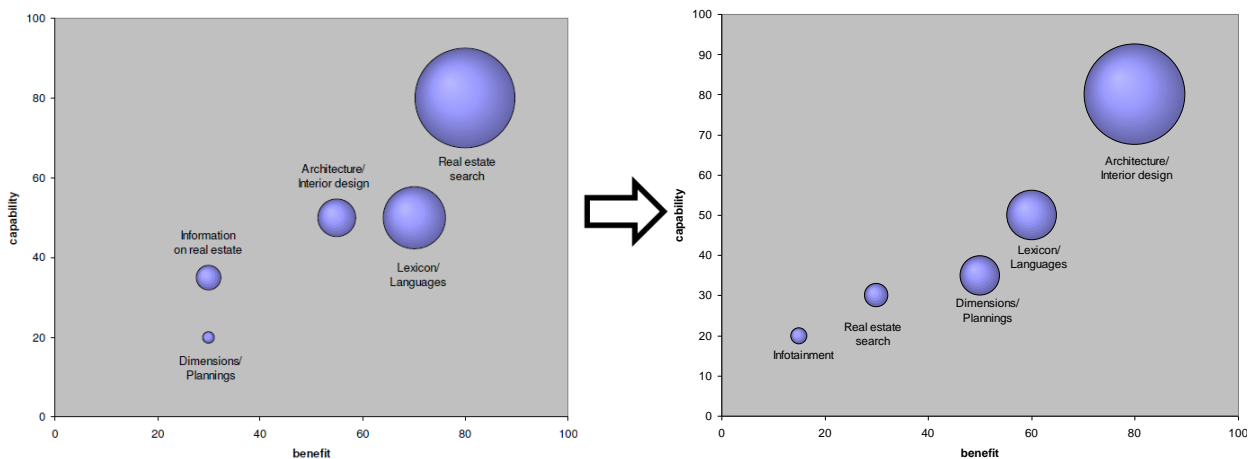

Fig. 16: Capabilities in use and benefits for the user of AR RE- apps (first graphic LANG; SITTLER 2012a, p. 10)

The focus of AR and VR is located on presentation and visualization. AR is predicted to be increasingly used in a major number of areas and it is a question of time when AR-apps will become a familiar technology. (BIESZKE 2011, p. 41-42) AR is a revolutionary technology, which is more and more used in real estate. Even the augmented view of a construction site with the virtual building is possible. The site notice board can be as anchor of the marker for the virtual sightseeing. The broker could stand in front of the desired site showing the customers house by AR animation and virtual tours before construction begins. (GAWLITTA 2012, p. 67 70) In addition VR-apps give well known visualization for prospective customers and are easier to create. With the new standard of Building Information Modeling (BIM) an intelligent model-based design process gives added value to the entire lifecycle of a building and infrastructure project. (AUTODESK 2011)

Apps enhance the perspective of customers with showing how his future home looks like. Also location based services with GPS will influence the customer use. (TÖNNIS 2010, p. 166) Especially the field of real estate should benefit from the increasing AR market. (LANG; SITTLER 2012a, p. 11)

6 SUMMARY OF USED AR-APPS

The following table (in two parts with Fig. 17 and 18) shows all mentioned app available in any of the main app stores.

Name of the App	Layar	Wikitude	Junaio	CommBank 3D Reader	ViewAR	aspern Die Seestadt Wiens
Vendor	Layar HQ	Wikitude GmbH	metaio Inc.	Commonwealth Bank of Australia	Meixner IT-Solutions GmbH	ovos media consulting gmbh ovos realtime 3D gmbh
Category		Information on surrounding area		Infotainment	Architecture/ Interior design	Architecture/ Interior design
Description		Augmented Reality browsers for live views of the surrounding information of the desired object. Hotspots, pubs, premises around the location are shown in the live view of the camera of the smartphone. Individual layers for own purposes can be viewed.		With this app (and the concerning marker) the real estate market in the virtual city Cherryford Hill can be visited. Terms as transactions and purchase prices are shown. This fun app is used for explaining AR.	App for visualizing furniture, interior design, kitchens and even whole architectural buildings. With a marker the object could be viewed in the display of the smartphone or tablet.	Using the Layar AR-browser the building site named "Seestadt Aspern" can be viewed through the camera of the smartphone. With 3D-objects the future buildings are shown schematically from special viewing points onsite. The virtual city is contributed by additional texts, pictures and videos.
Operating System	iOS, Android	iOS, Android, Blackberry, Windows Phone	iOS, Android	iOS	iOS	iOS, Android
Price	free	free	free	free	kostenlos	free
Hyperlink	www.layar.com	www.wikitude.com	www.junaio.com	www.commbank.com.au/personal/home-loans/3d-reader.aspx	www.viewar.com	www.ovos.at

This table is a personal choice of the authors and raises no claim to completeness.

Fig. 17: Summary of used AR-apps (part1)

Name of the App	Wohntraum am Olympiapark	AR Winterhuder Wohnkultur	BIMx	iVisit 3D	SOLight	WordLens
Vendor	HI Wohnbau GmbH Meixner - IT5	Wulff Hanseatische Bauträger GmbH	Graphisoft SE	Abvent R&D	Anvartec Dipl.-Ing. Bernd Rene Ruprechter	Quest Visual Inc.
Category	Architecture/ Interior design	Architecture/ Interior design	Architecture/ Interior design	Architecture/ Interior design	Dimensions/Plannings	Lexicon/Languages
Description	The app uses AR-technology to show the project "Wohntraum" in Munich (Germany) by a virtual and 3-dimensional object. The title of the project-folder is used as an anchor to see the object from several angles.	The app uses AR and 3D modeling technology to present the project "Winterhuder Wohnkultur" in Hamburg (Germany). A special logo in the project-folder is used as an anchor to see the object from several angles or navigate throug the virtual property.	Virtual reality app which shows virtual objects which can be walked through like in a jum-and-run game. Architecture is simply imported and shown to the customer.	The app is available in two versions. The Lite version is free, but only shows one panorama each day. For heavy users the Pro app with the same functions shows views of buildings and architecture, which you can move throug ba handling the smartphone or tablet.	With this AR-app you can see detailed information concerning all sun paths with highest and lowest positions of the sun. To determine the solar time of an apartment you can check the light intensity with this app.	With this app short words an sentences could be translated live within the camera view of the smartphone. Currently the translation of Spanish, French, Italian and German into English (and vice versa) is supported
Operating System	iOS	iOS	iOS, Android	iOS	iOS	iOS, Android
Price	free	free	free	free / 17,99 EUR	2,99 EUR	4,49 EUR [1]
Hyperlink	www.hi-wohnbau.de	www.winterhuder-wohnkultur.de	www.graphisoft.at/produkte/bimx	www.ivisit3d.com	www.anvartec.at	www.questvisual.com

[1] The app is free for testing. One App-in language (in both direction) costs EUR 4,49.
This table is a personal choice of the authors and raises no claim to completeness.

Fig. 18: Summary of used AR-apps (part2)

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