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AUGMENTED REALITY: BUSINESS AND EDUCATION OPPORTUNITIES IN KENYA

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Abstract

Advancements in technology in the world today have created new ways of doing things and interacting with the physical world around us. In business, companies have embraced these technologies to satisfy their interests, create competitive advantage and develop new revenue streams. A company may be interested in user satisfaction, improving sales, improving efficiency in delivery but more so for a competitive advantage over competitors creating barriers for new entrants to their market space. Augmented Reality (AR) is an emerging Human-Computer Interaction technology that combines or overlays computer generated virtual objects and other feedback with real world scenes. Unlike VR, which replaces the physical world, AR enhances physical reality by integrating virtual objects into the physical world. The virtual object becomes, in a sense, an equal part of the natural environment. AR enables a user to add virtual information on top of real-world environment with the help of devices that support this technology which then help the user perform better in the tasks through interaction with this enhanced environment. This literature review gives an overview of key areas of potential adoption of AR in Kenya. Thus, in business and education. AR as a technology is worth investing money and time for its potential in business in this time and era. According to Ahonen (Farber, 2013), AR is expected to be adopted by a billion users by 2020, which implies that there is a big potential in augmented reality in the near future.

Keywords: Augmented reality, business, user experience, interaction

Introduction

Augmented Reality (AR) is one of the emerging technologies that have been in the center of attention among academics and business practitioners. AR is a technology which is capable of presenting possibilities that are difficult for other technologies to offer and meet. AR is a concept where elements from real life are augmented by additional visual information after recognizing the environment in order to guide the augmentation thus images of a real environment (e.g. video feed from a camera) are augmented with elements from virtual worlds in real time (e.g. 3D model, images, videos, text, etc.). There are two main groups of devices used in AR applications; fixed and mobile devices. Fixed devices are used in museum or in public places that make use of screens, or projectors to display images directly on physical objects while mobile devices are carried by the users. Mobile devices include hand-held devices such as tablets, smartphones and laptop computers. AR devices can either be optical-see through, where semi-transparent screed screen is used to relay information as if it is part of the real world and video see through where devices are used to capture scenes using one or several cameras, adding virtual information on the captured and recorded images and displaying it to the user (Koelle, Lindemann, Stockinger, & Kranz, 2014). AR has also become one of the audio-visual media for instance, news, means of entertainment and sports. Recently, it is being used in many fields such as business, education, medical and promotion. This paper will focus on opportunities offered by AR for the education and business sectors in Kenya.

Technology Penetration in Kenya

AR applications have become more transportable and broadly accessible on mobile phones. Kenya is one of the fastest growing economies in Africa in terms of internet penetration and mobile phone ownership at 58% and 83% respectively. According to Wangalwa (2014), Kenya has outdone itself in ensuring it tackles infrastructure barriers that have hindered it from emerging as a leader in the internet market. Statistics from the Communications Authority of Kenya (CAK) indicate that internet penetration in Kenya stands at 52.3 per cent, placing it in the lead board in the region. According to a survey carried out by Zab (2015) asserts that, in 2015, 58% of all phones that were sold in the country,

estimated 1.8m devices, were smartphones. Smartphones and tablets are becoming less expensive and many own them. In connection with the rapid growth of the smartphone market, mobile phones are becoming more and more a status symbol. This is mainly due to the fact that mobile phones are seen as an indispensable feature in our lives. Mobile phones influence our lives in a positive and sustainable way. The use of AR application on these mobile phones has been made possible by the increased availability of smartphones and tablets with internet connectivity and increasing power computing. Currently there are many augmented reality applications and development systems for Android and iOS (iPhone Operating System) smartphones and tablets. The most popular ones are: Wikitude, Layar, Metaio, Aurasma and Augment.

Theoretical Framework

The theoretical foundation of AR is grounded on the situated learning theory, constructivist learning theory and the technology acceptance model (TAM). According to the situated learning theory all learning takes place within a specific context and the quality of the learning is a result of interactions among the people, places, objects, processes, and culture within and relative to that given context (Brown, Collins, & Duguid, 1989). Thus, learning is a co-constructed, participatory process in which all learners are "transformed through their actions and relations in the world" (Driscoll, 2000, p. 157). On the other hand, the constructivist/interpretivist theories of learning assume that meaning is imposed by the individual rather than existing in the world independently (Dede, 2008).Thus, learners build personal interpretations of reality based on experiences and interactions with others, creating novel and situation specific understandings.

TAM models how users come to accept and use a technology. According to TAM, one's actual use of a technology system is influenced directly or indirectly by the user's behavioral intentions, attitude, perceived usefulness of the system, and perceived ease of the system. TAM proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use. Thus, learners especially at higher levels and business people in Kenya are acquiring latest devices due to individual use of these technologies and their ease of use.

AR Application in Education

Although current teaching methods work successfully, most education institutions are interested in introducing more productive methods for improving the learning experience and increasing the level of understanding of the students. The emergence of new technological innovations in computing technologies has provided the potential for improving them. For instance, the web-based Virtual Learning Environments (VLEs) that many universities have adopted for aiding the teaching process are characteristic for this. The potential power of AR as a learning tool is its ability "to enable students to see the world around them in new ways and engage with realistic issues in a context with which the students are already connected" (Klopfer & Sheldon, 2010, p. 86). AR has the potential to engage and motivate learners to explore material from a variety of differing perspectives, and has been shown to be particularly useful for teaching subject matter that students could not possibly experience first-hand in the real world. The adoption or integration of AR in education rely on the inherent characteristics of interactivity. AR is a highly interactive technology which makes it suitable for the concept of "learning by doing". This interaction ranges from interaction with virtual objects to complex interactive features between physical and virtual objects. AR combines the real environments with virtual objects creating an immersive feeling for the user. Dede (2009) states that immersion in a digital environment enhances learning in terms of multiple perspectives (i.e. changing frame of reference), situated learning (i.e. learning in the same context where the knowledge is applied) and transfer (i.e. the application of the acquired knowledge).

In addition, AR has features such as games and simulations which aid learning. These features provide an experience that is highly visual, interactive and three-dimensional. AR increases accessibility of virtual education content where learners can access virtual content through computer devices such as desktops, laptops, mobile phones and specialized kiosks. Further, it allows students to interact with the education content by leveraging what they know about their physical world enabling them to move around by changing perspectives, moving closer or further to change the scale, reaching out to grab objects etc. In addition, the students are in control over the way information is delivered to them and how they examine the content, hence, taking care of the students' differ-

ent preferences.

Wu and Chiang (2013) indicates that applying 3D animations provided more enthusiasm for the learning activity, better performance in understanding the appearances and features of objects and improve the spatial visualization capabilities especially when its used for teaching. This can be very beneficial for primary school pupils. Children can learn through experiences, and visuals can be used to help them learn. For instance, they can learn new knowledge about astronomy, which can be difficult to understand, and children might better understand the solar system when using AR devices and being able to see it in 3D. Further, learners could change the illustrations in their science books by using this AR. In health care training for example, students can install AR application on their mobiles which can be used to track patterns in a sick person's body using a training model. Through this a student can be able to see an animated simulation in 3D indicating precisely when, where and in what the various maneuvers should be performed and the student can change the point of view of simulation by moving their mobile phones in different directions via the animation.

Literature review indicates that learning does occur in virtual environments (Harrington. cited in Rasalingan, Muniandi, & Rasalingan, 2014) and evidence do exist of AR application that have been tested in an education setting. 'Classroom of the Future' is one of the earliest works of AR (Cooperstock, 2001), AR application for teaching mathematics and geometry education Construct3D (Kaufmann & Schmalstieg, 2002), AR application for geography students about earthsun. AR application used to explain to students how specific parts of a computer could work in practice (Fernandes & Miranda, cited in Liarokapis, 2007).

Collaboration

Collaboration facilitates learning through enabling students to interact with each other as well as the educational content at the same time. The major potential of AR is that student can have multiple views; they can discuss, and interact with 3D models simultaneously. AR permits learning via remote collaboration, in which students and instructors not at the same physical location can share a common virtual learning environment populated by virtual objects and learning materials and interact with another within that setting. Thus, collaborative environments allow seamless integration with existing tools and practices and enhance practice by supporting remote and collocated activities that would otherwise be impossible (Billinghurst & Kato, 1999).

AR Applications in Business

The business sector in Kenya is already recognizing the enormous potential latest technologies are offering. AR creates brand awareness and boosts customer engagement in an exciting way. It also allows companies to regain ownership of the customer experience through the use of branded apps. Such opportunities involve engaging in e-commerce, the automobile industry, real estate, advertising, and in sports.

Enhance E-commerce

AR can be used to create an in-store experience for on-line shoppers merging the benefits of in-store shopping with the convenience offered by the online environment eg. AR solutions offered by IKEA which gives an in-store experience to the customer at home letting them see IKEA products together with the existing furniture. AR can be used to provide clients with additional information when selecting a product or service as well as allowing clients to better understands it, its specifications, how it works and how a product will look like in situ. It makes it easier for buyers to purchase from home or on the mover thus eliminating the period of the time between making a decision and actually making the purchase.

Automobile Industry

Cars are becoming platforms to participate in the digital world in a fully networked sense, just like tablets and phones, according to Venkatesh Prasad, a senior technical leader with Ford Motor Co.'s innovation division. AR can augment the effectiveness of navigation devices on automobiles. Information can be displayed to the driver on an automobile's windshield indicating destined directions and meter, weather, terrain, road conditions and traffic information as well as alerts to potential hazards in their path (Couts, 2011; Griggs, 2012).

Real Estate

Businesses have seen the benefits of technol-

ogy especially in the real estate market. The internet has opened tons of doors for real estate business starting from internet advertising through online listings and ending up with virtual tours. Each of these technological advances facilitated fast and smooth property selling. AR is getting so popular in real estate in the recent years for the following reasons: the user is engaged through visual interaction. Clients emerge themselves into the new dimensions of the property on sale. From a 2D picture an AR app can produce a 3D creation of the property which can be viewed from different angles, sections of the house can be taken off to reveal the layout of different floors, not just the bits that a camera can capture. Clients can use the app on smartphone or tablet to select the property (current or future) they want to check out. Moving up the phone and moving it around creates a window into the property, allowing for a virtually walk around it and check out everything, including where one can put their furniture, what color they want to paint the walls, etc. The client are given the privilege of walking down the street, pointing the smartphone camera at a house for sale, and seeing real-time information such as price, for-sale status, contact information, even pictures or virtual tours. Customers tend to arouse conversations with the company, family and friends once they find property that they are interested in using AR bringing about viral word of mouth publicity.

Mobile applications with AR are easily available on modern mobile devices, there is no easier way to reach potential property buyers with all the information about available apartments and houses on sale. Thus, AR offers the easiest way to reach more customers. When potential clients engage through digital media, statistics of the number of people interacting with their collateral, times and places, length of interactions, action taken (purchased, viewed, shared through social media) can also be quantified. This provides direct return on investment and it gives a clear picture for new projects.

Advertising

Several brands are utilizing AR to promote and market their products, e.g. LEGO, JC Penny, Adidas, etc. AR applications have been designed in such a way that they involve the user in a more collaborative way rather than the traditional marketing. In this way, AR enhances product previews such as allowing a customer to view what's inside a product's packaging without opening it (Humphries M. 2011). AR can also be used as an aid in selecting products from a catalog or through a kiosk. Scanned images of products can activate views of additional content such as customization options and additional images of the product in its use (Netburn, 2013). AR is used to integrate print and video marketing. Printed marketing material can be designed with certain "trigger" images that, when scanned by an AR enabled device using image recognition, activate a video version of the promotional material. Nowadays, mobile augmented reality (MAR) makes it possible for sellers and advertisers to improve their print advertisements in their portfolio of media plan tactics. Companies, such as Coca Cola in Germany and Absolut Vodka in Spain, use MAR to add extra dimension and zest their cur- rent printed advertisements (Lisa, cited in Alkhamisi & Monowar, 2013). Augmented reality combines the advantages of the print and digital world encouraging the customer to delve ever deeper into the shopping journey.

Sports

AR has become common in sports telecasting. Sports and entertainment venues are provided with see-through and overlay augmentation through tracked camera feeds for enhanced viewing by the audience. Football teams are searching for new ways to connect with their fans. In organizing special events, they communicate with fans via social media while keeping an eye on cutting edge technologies, such as image recognition, virtual and augmented reality. AR is also used in association with football and other sporting events to show commercial advertisements overlaid onto the view of the playing area. Augmented reality can be used to boost sporting events in the following ways: event marketing, Outdoor Advertising; where banners are scanned for the access to the club's website, team shop and ticket office. The app ensures that fans can stay connected with the club wherever and whenever they wish, logos can be used as a point of reference for critical information by sports fans, augmented newspapers which enables fans to view video content straight from their match-day programs using their mobile devices that are triggered from the team's logo on the page

Conclusion

The opportunities offered by AR technol¬ogy are enormous. Many applications and services are currently emerging in all sectors. The use of AR in education and business is in its infancy in Kenya. AR affords educators the ability to leverage physical space as an additional layer of content for students to observe, manipulate and analyze (Perry et al., 2008; Squire & Klopfer, 2007). Augmenting the physical environment with digital information transforms that environment into a venue for multiple learning opportunities. In business, AR can drive value in four important ways. Thus, creating an in-store experience at home, enhancing and updating of print media with digital content, cost saving and increases business sales. AR offers numerous possibilities and opportunities to the education and business sectors now and in the future. It is therefore important not to overlook what AR can do to improve the education and business sectors in Kenya.

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