ENRICHING PRODUCT EXPERIENCE BY Augmented Reality Technology

Gojko VLADIĆ 1 * - Nemanja KAŠIKOVIC 1 - Dragoljub NOVAKOVIĆ 1 - Ivan PINČJER 1 - Stefan ĐURĐEFIĆ 1
1 University of Novi Sad, Faculty of Technical Sciences, Department of Graphic Engineering and Design, Novi Sad, Serbia

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Abstract: A product Experience includes all aspects of the interaction with a product ranging from expectations to usage. A great product should offer a great experience and communication between product and consumer is important segment. For this communication to be successful, it has to use appropriate channels. This applies to all the types of communication, including advertising, promotional material, information on a website, product documentation, etc. For the expectations to be properly formed promotion plays important role and in order for the consumer to use product properly and to its full potential it must be accompanied by the proper documentation. Product documentation is very important element in achieving successful communication with the consumer after product purchase. In order to cater to the needs and preferences of all customers’ integration of all the media formats can be beneficial. Recently augmented reality has become able to provide integration of multimedia formats in order to enrich consumer experience. Augmented reality is not new technology, but just with wide availability of the internet access through mobile devices it can offer its full potential directly in the place of sale, consumer homes or almost anywhere. This paper aims to present possibilities for integration of augmented reality technology in all the forms of product-consumer communication and especially product documentation. This can lead to far better user experience and provide advantage for the early adopter organizations implementing this approach to the communication with the consumers.

Key words: Communication, augmented reality, product, consumer

1. INTRODUCTION

The trend that all successful businesses are becoming a digital businesses is prominent in last decade. This is reflected in the design, production, distribution, marketing being infused by the digital technologies. On the other hand a majority of the consumers in modern countries are becoming digital consumers. Communication channels on the relation business-consumer are changing. Social networking and mobility are used to transform purchasing experience and product usage. In response to these organizations providing products must look to digital technologies as leverage to ensure consumer engagement and competitive advantage in the market. Appropriate channels must be used for product – consumer communication in order to convey the necessary information. First and foremost product or a service must offer something useful and valuable to the consumer. Second important factor is the ease of use. Product which is difficult to use will lose its value. Often the product itself is not the problem but rather the way that the product communicates with consumers. When companies create a great product, it’s tempting for them to stop there convinced that product will speak about itself automatically. But that is false.

All types of communication, including advertising, promotional material, user manuals, maintenance instructions, information on a website, etc. in any of the formats electronic or print are conceived in the way that insure comprehensible and easily absorbable information flow. In order to cater to the needs and preferences of all customers’ integration of all the formats is needed. With so many different possible consumer points to contact it’s more important than ever to create a unified experience across all channels. In the age of mobile technology it is possible to make unified Omni-channel information dissemination strategy from a customer’s first information about the product such as website, TV or magazine advertisement, etc. to the place of sale where the purchase decision is made and the product documentation such as user manuals, maintenance and disposal instructions.

According to a Kwieth report, for United States, brands are failing to meet consumer expectations to deliver an experience that is seamless across both digital and traditional media. 53% of brands report that their main problem is an inability to offer a seamless consumer experience and achieve cross channel synergy. Brands must bridge this channel gap, as 54% of consumers expect seamless experience across digital and physical media [1]. As mobile technologies and widely accessible internet connection continue to reshape product purchasing and product usage behaviour, the businesses must find creative ways to seamlessly integrate physical and digital media. This is critical for offering pleasant user experience for today’s consumers who alternate frequently or simultaneously use digital and physical media. A seamless interaction is crucial for utilization of digital channels in order to enhance consumer experience.

*Correspondence Author’s Address: University of Novi Sad, Faculty of Technical Sciences, Department of Graphic Engineering and Design, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia, vladie@uns.ac.rs
communication and its impotence in the purchasing decision making processes but rather prediction of packaging evolution to the next level. Regardless of how good is the product if it is accompanied by poor documentation, consumers are unlikely to have a great experience with it and to use it fully and properly. Documentation must offer genuine support for your product or service which is conveyed in most comprehensible way. In order to offer good product experience consumers must receive clear information about:

- What is the product is and its purpose,
- Why the product is unique and how it differs from similar products,
- How to start using the product,
- How the product can be used in different scenarios,
- What is the best possible way to use the product.

So far digital and printed media managed to provide good platform for communication, but using augmented reality technologies can be utilized to achieve the goals of ensuring maximum consumer emersion by combining material and digital reality. Augmented reality can serve as an extension of the conventional product-consumer communication. This is achieved by including real-time modification of perceived context on the basis of interactions among the user, the environment and focal objects using augmented reality technologies. Augmented reality differs from virtual reality in that there is no attempt to completely replace the real world, the users are still able to interact with the real world, and at the same time perceive enhanced views with augmentations imposed on top of the real world image [4].

2. AUGMENTED REALITY TECHNOLOGY

Augmented reality although not a new concept is novelty in every day usage. Advancements in the hardware of the mobile devices made it possible to capture the real world images, process them, simultaneously process the virtual content and to combine them in to augmented reality which is shown on the device’s display. Augmented reality is basically human–computer interaction technology that overlays computer-generated virtual elements onto real-world environment images. Most important characteristic of this concept is that the information displayed and image overlay are context-sensitive, which means that they depend on the observed objects thereby enhancing a user’s perception of reality by combining physical and digital content. This technology is widely available through different education content, games, etc. mostly intended for the mobile devices. [4, 5, 6].

There are different approaches to the augmented reality system design, foremost dependent on the intended use. Basic classification of technologies utilized can be done according to tracking technique, display technology and interaction techniques, table 1.

<table>
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<th>Classification of AR technologies</th>
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Especially interesting for application is Vision-based tracking technique which can be further divided into Marker tracking and Marker-less (Non-marker) technique. Marker tracking technique where the corresponding image descriptors are provided beforehand and stored into the database. Most of the applications are using marker-based technique. Marker-less (Non-marker) tracking technique where application recognizes images that were not provided to the application beforehand. This is much more difficult to implement because the recognition algorithm running in your AR application should identify patterns, colors or some other "features" that may exist in camera frames [7].

Examples for these two techniques are shown in figure 1. Figure 1a represents marker based tracking where the virtual object is placed upon a recognized image. As mentioned much more difficult to achieve is marker-less tracking shown in figure 1b as the software needs to recognize shape of the human hand and the position of the fingers in order to place virtual content and enable its interactivity with the hand movement.

There are also Sensor-based tracking and hybrid techniques.

![Fig.1. AR tracking](image-url)
2.1. Augmented Reality Hardware

Availability of the hardware is one of the driving forces behind explosion of augmented reality applications and move from the laboratories to the everyday life of the people. Minimal requirements are image input device, processing machine and display, figure 2. Simplest setups consist of web camera PC computer and monitor. In order to ensure mobility and full usability of the technology modern mobile device such as phone or tablet with back facing camera and appropriate application installed. Usability can be expanded even further with wearable technology such as Google glass or similar products. Such wearable technology frees users’ hands and enables him to perform manual tasks while he is given additional information or instructions.

Future development and integration of wearable electronics in to everyday life will provide new horizons for the implementation of the augmented reality in different human activities and pushing human-computer interaction further.

Using other technologies such as Eye-tracking which enables the computer to track momentarily user’s point of gaze, or point of attention, can further intensify emersion by providing virtual content only in the areas of user interest. Further more by incorporating an electro-myogram, electro-encephalogram, and electro-oculogram headgear eye movements, facial muscle movements, and brain waves can be translated into computer input, thus enabling other means of controlling the system.

2.2. Augmentation Process

The augmentation is produced after a series of transformations, as shown in the process for the creation of AR using marker-based tracking, figure 3. First, the real video image is captured and transformed. Then, this image is processed in order to determine position of the markers (containing an image pattern that is compared to patterns stored in a database). Next, the algorithm determines pattern orientation as the base for the coordinates frame and calculates the real position of the digital camera in relation to the physical marker. After that, the virtual objects are placed over the markers, and the final image is rendered and sent to the display [9].

Depending on the application, virtual objects placed over real image can be still images, video content, 2D or 3D graphics. Virtual objects can be also interactive, offering further functionality to the user, such as additional information on the content captured in the real world.

Fig. 3. The process for the creation of AR using marker-based tracking
3. AUGMENTED REALITY APPLICATIONS

Although augmented reality is still in its infancy it must be taken into consideration as a useful tool. Accenture Augmented Reality Survey finds 59 percent of participants have never had an opportunity to see augmented reality in a live situation, 30 percent is not sure how augmented reality works and 23 percent does not consider augmented reality particularly useful [10].

The same survey rivals that augmented reality would increase your likelihood of purchasing the product in case of use for:
- Virtual furniture app: 86%
- Virtual dressing room: 88%
- Color changing app: 73%
- Catalog app: 65%
- Shopping app: 75%
- Shoe sampler app: 87%
- Virtual vehicle manual: 75%
- Gamification app: 61%

Two years later, in 2016, we are witnesses of rise in use of such augmented reality capabilities, shown in Figure 4.

3.1. Product Promotion

As shown in Figure 4 augmented reality can be a powerful tool for product promotion. Adding additional content to IKEA Catalog enables users to place selected furniture in their own room, gamification of content used by McDonalds, shopping assistance by Fitnect application and promotional usage by adding 3D, sound, video and other content to the packaging (or rather triggered by packaging image) are some of the applications of augmented reality technology for product-consumer communication enhancement. Packaging thus occupying consumer attention and developing relation between product and consumer can be beneficial at the point of purchase.

Additional content can be in the form of useful information presented as text, sound, images, video, 3D object or 3D animation, it can be even interactive introducing gamification elements. Gamification of content is basically application of typical game playing elements (like point scoring, rules of play, competition with others, etc.) to other areas of activity. This is used typically as an online marketing technique to encourage engagement with a product or service through forming the community of users.

3.2. Consumer Education and Training

Virtual reality has a long history in education of military, medical, industrial training, etc. in developed counties. Augmented reality is offering to overcome limitations of virtual reality opening up a whole new field of applications and enhance the effectiveness and attractiveness of training and learning, Figure 5.

Proper demonstration is key for success in hands-on courses. Now instructions can be given in real time while performing the task. Using augmented reality technology can reduce the risks when using expensive equipment which is often inaccessible for training and thus reduce or avoid training costs if mistakes are made during skills training. Advanced applications can provide authentic learning experience and ‘active’ training through immersive simulations and engage consumers in ways that were never possible before.
3.3. Product maintenance

Development of applications especially in the area of product maintenance of industrial systems, although applicable for any mechanical product, is beneficial and can ensure following of proper procedures in disassembling and assembling operations, thus avoiding additional expenses. Providing information in real-time while operation is done is crucial. Placing markers on the parts of equipment can help identification and ensure correct order of operations. Today technology offers the recognition of real three dimensional objects and they can be used as triggers. This has enabled manufacturers to make augmented reality instructional applications for usage or maintenance of the products that were manufactured earlier and markers have not been placed in the production phase.

Augmented reality offers optimization of the processes in the factory setting also. Recognition of equipment in factory setting and matching it to the digital map makes paper layout plans obsolete. Through a new technological feasibility to mix augmented reality with geolocation, recognition and tracking technologies it is possible to integrate storage and transportation systems, thus further improving logistics and reducing a possibility of mistakes. Research on the manufacturing applications of augmented reality is a growing area with the goal to enhance process development, manufacturing processes, as well as the product, leading to reduced cost and better quality of the products.

Tang and others compared three instructional media in an assembly system: a printed manual, computer assisted instruction using a monitor-based display and a head-mounted display. They found that, by using overlaying instructions offered in by augmented reality on actual components, the error rate for an assembly task was reduced by 82% [7].

4. TECHNICAL CHALLENGES IN AR

Augmented reality is still relatively new technology, so creating and developing content is still limited and difficult. Significant technical knowledge is required to create adequate 3D models, videos and other material for augmented reality. As the new software technology augmented reality is not supported by hardware optimization, which causes some issues with stability and flexibility of the applications. Images can be frozen and respond with several seconds delayed, some registration errors can be encountered during usage due to intensive processing.

Unlike applications for product promotion, applications intendant for training and maintenance require a higher level of accuracy in tracking. Main problems are high frequency motion as well as rapid camera movement. Further development of computer vision, inertial and hybrid tracking techniques, alongside using lasers, RFID and other types of sensing devices will be required for augmented reality to achieve full functionality in all segments. Registration or placing of virtual objects in the correct position is difficult as different tracking methodologies have different error sources, due to latency problems between data streams, synchronization and computational delays, misalignments between sensors, and/or incorrect registration algorithms [8]. Fixing these issues is critical for future consumer acceptance. Applications are still too large and occupy much of a mobile device’s capacity.
For the logistics application precise geolocation is most important. Current state of GPS still is error prone, which is most troublesome for the users. This issue is partly solved by the recent advancement in wireless technology, assisted GPS (A-GPS) and local positioning systems (LPS).

Aside of technical challenges, user acceptance challenges cannot be ignored. As with all new technology, most people are unfamiliar with the benefits and operation of augmented reality applications. Some predict social issues with the use of this technology in training environment.

5. CONCLUSION

The ultimate augmented reality goal is to create a system that is as good as the real world or even better and more efficient due to introduction of augmentations. Augmented reality can enhance a perception and understanding of the real world. Despite mentioned challenges the future of augmented reality is bright. It already found its way into the everyday life through video games for the mobile devices. The novelty of the augmented reality, instant information and enhanced perception will change the communication between products and consumers. Adoption of the technology is in the hands of people and companies, but implementation possibilities are vast. Having in mind limitation of the hardware it is necessary to study the best tracking method for a particular application in order to ensure the best results and user experience. Implementation of augmented reality technology can be introduced in order to enhance product experience. The usage is not restricted to a particular product, or particular activity in the communication with the consumer.

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