Abstract

The primary focus of an augmented reality (AR) application depends on the use case. When it is used as a tool, performance should be the focus. If the application is used for art the focus should be engaging the users. At the moment there are no prototyping tools for AR. However, this does not mean that developers should shy away from making prototypes. While there are no defined best practices for working with AR, two crucial aspects are spatial correspondence and tolerance of movement.

This article discusses:

- The primary use of AR.
- The lack of prototyping tools for AR.
- The lack of best practices in the field of AR.

Technologies discussed:

Augmented Reality

Introduction

Getting started with augmented reality (AR) is easier than it seems, but to make a useful and working application is harder than it looks. To get started, one can find many online tutorials that explain the basics of all the major frameworks. However, when trying to create more complex content, most of the documentation is lacking. Besides the unhelpful documentation, the field of AR has many other challenges.The first part of this article will look into various papers and their findings. After that, the article will go into more detail about the primary use of AR, the lack of prototyping tools and the lack of best practices. Lastly, the article will end with a conclusion and a recommendation for both researchers and developers of AR.

Research Works

The report "An Overview of Augmented Reality" (Arena et al., 2022) explains that AR is one of the subcategories of Extended Reality (XR). Along with being a subcategory AR it also can be divided in four categories of its own; marker based, location based, projection based and overlap based. Later in the article a definition is given for what an AR application should be; *"the main feature of an AR system is to offer a service in real time"*. However this definition is incomplete and only highlights one of the features of AR.

Another article (Krauß et al., 2021) explores the challenges current AR and VR development teams face. In this study they found that within the field of XR four major roles can be defined for XR creators; concept developer, interaction designer, content author and technical developer. These roles help to divide the many different skill sets needed to create an AR or VR application. The major challenge they found in their research was the lack of prototyping tools.

The research from Dirin and Laine (2018) focuses more on the UI/UX part of AR. They define UX as *"the emotions that the user encounters while using a service, a product or an application"*. With this in mind they also state that emotional engagement should be the focus of AR applications. However, this only applies when the AR application is for entertainment or marketing purposes. In order to make their list of best practices an experiment was conducted where user responses of two different AR applications were compared.

Analysis

In research from Arena et al. (2022) the purpose of an AR application is to offer a service in real time, while Dirin and Laine (2018) state that the purpose of an AR application is to emotionally engage the user in the application. Both of these statements are not false, but also do not encapsulate the full potential of AR. An AR application should be both engaging and work in real time, but the primary focus also depends on what the other purpose of the AR application is. When the application is meant as a tool the focus should be on the performance side of the application as stated by Arena et al. (2022). However, when the AR application is meant as a form of art, the focus should be on the engagement side as stated by Dirin and Laine (2018).

The biggest problem found by Krauß et al. (2021) and one of the problems stated by Dirin and Laine (2018) is that there are no prototyping tools available for AR. According to the interviews done by Krauß et al. (2021) with XR creators, prototyping tools were either too complex for their needs or lacked the features to make a good prototype. Creators with no or little coding experience have to rely on developers if they want to test interaction or scale and spacing of objects. While making an AR application for a school assignment, the customer did not know what they wanted. At that stage it would have been useful to make small prototypes that could show the full potential of AR applications in combinations with large datasets. However, the only option to make prototypes to show the potential was by making a small application. In later stages of development, many discussions were held about complex features. If adequate prototypes of the desired behaviors were available, these discussions could have been prevented. This shows that prototyping is a necessary step in the development of applications. Because there is no all-in-one prototyping tool available for making AR applications, this is not achievable in a short time.

While there are no best practices for the field of AR yet, Dirin and Laine (2018) attempted to make a list based on the results of their experiment. Because the experiment was limited to two applications, the list is skewed towards the visual side of AR. For example one of the listed best practices is the use of models with high detail. Although it could help the user of the application with recognizing objects better, it could also damage the performance which can lead to user frustration. However, two other points in the list are crucial when making an AR application; spatial correspondence and tolerance of movement. When a user opens an application, it would be frustrating if the objects in the applications were far above or below where the user is aiming their camera. Furthermore, if objects disappear or make strange movements when the user moves their camera, they might think the application is broken.

Conclusion and recommendations

AR can both be used for tools and art, which makes it hard to define the main purpose of AR itself. The biggest challenge AR is currently facing is the lack of prototyping tools that are easy to understand and use. Additionally, the field lacks a complete list of best practices for creators to follow. While Dirin and Laine (2018) made a start at a list, it is recommended that more and different AR applications need to be examined in order to make a complete list. In regards to the lack of prototyping tools, it is recommended to still use prototyping software even if they are not specialized for AR, rather than not using any prototypes during development. Complex systems can be better understood when visualized, instead of having only texts to work with.

Sources

Arena, F., Collotta, M., Pau, G., & Termine, F. (2022). An Overview of Augmented Reality. Computers, 11(2), 28. https://doi.org/10.3390/computers11020028

Dirin, A., & Laine, T. (2018). User Experience in Mobile Augmented Reality: Emotions, Challenges, Opportunities and Best Practices. Computers, 7(2), 33. https://doi.org/10.3390/computers7020033

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