

# Blending Augmented Reality and Cloud – Need of the hour and an innovative approach

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## ABSTRACT

Augmented Reality (AR) is perceived as the technology of the future. AR has become one of the best known buzzwords associated with user interface of future shown in Ironman, Avatar, Minority report movies etc. AR has become so important and its importance is visible through the act of IT giants investing a lot of money of AR related products. Microsoft has already started working on AR with Holo Lens and so is other giants. Google glass has opened doors for many innovative applications in the field of AR. Three students and a professor from Amrita University, India have built AR Headset named GetVu and it supports so many applications through gesture. World talks about AR and we have done innovative attempt to blend AR and Cloud. AR has got lot of limitations. In order to outweigh such limitations we are going to use cloud which is a type of outsourcing.

**KEY WORDS:** Augmented reality, cloud computation, pattern, image based augmented reality, multiplayer game, dynamic, storage.

## 1. INTRODUCTION

A composite view for the user that combines the real scenes of the world viewed by the user and the virtual scenes generated by the device which augments the scene with additional information. This technology is called Augmented Reality. Users get a visual treat through such a technology. Basically the digital experience of the user increases. This bridges the gap between the real world and the Virtual world. Augmented reality is a lately evolving technology that duplicates the real world environment by adding virtual elements into the real world elements by the computer. Augmented reality blends the real world elements with the virtual elements that are generated by the computer. The virtual elements generated by the computer are basically intended to engage, entertain and completely immerse the user into the system. The augmented reality concentrates on creating a system where user can view the world in a completely different manner. This increases the chance of getting a better feel for the users who love playing games and application related to gestures. Mobile phones and video games are the prior elements which led to the enhancement of augmented reality. Augmented reality focusses on creating an environment where user would not find any difference between the real world and the virtual elements.

In Gartner's hype cycle for emerging technologies in 2011 augmented reality has just passed the peak, but is still at stage Peak of inflated expectations (Figure.1). Gartner's review predicts the time for mainstream adoption to be 5–10 years. Augmented reality is now on the hype curve in a position where mass media hype begins. Those who have been observing the development of augmented reality have noticed the tremendous increase in general interest in augmented reality.

Cloud is the other technology we are using. Cloud Computing is a recently (less than a decade) developed technology. It works on establishing small or large groups of remote servers for centralized data storage. So the data required for our usage in applications can be retrieved from cloud. The combination of augmented reality and cloud is one of the evolving technologies which provides an indirect view of the objects around us by displaying a computer generated virtual object in front of the user. Not just Location based augmented reality can be combined with cloud computing technology but also with pattern based AR, image based AR, text recognition through AR and multiplayer online AR games. In this paper we are going to show the advantages of using cloud in AR.

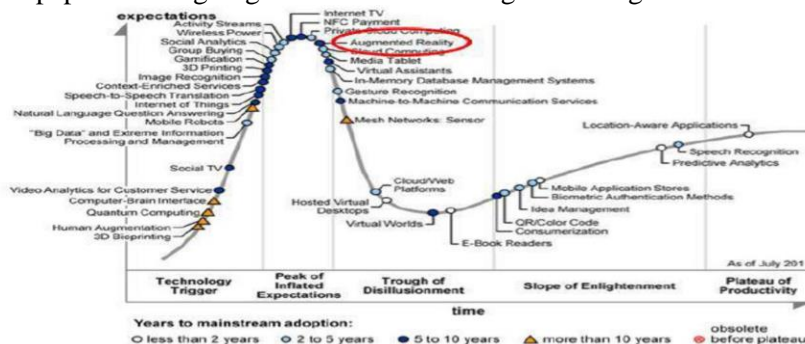
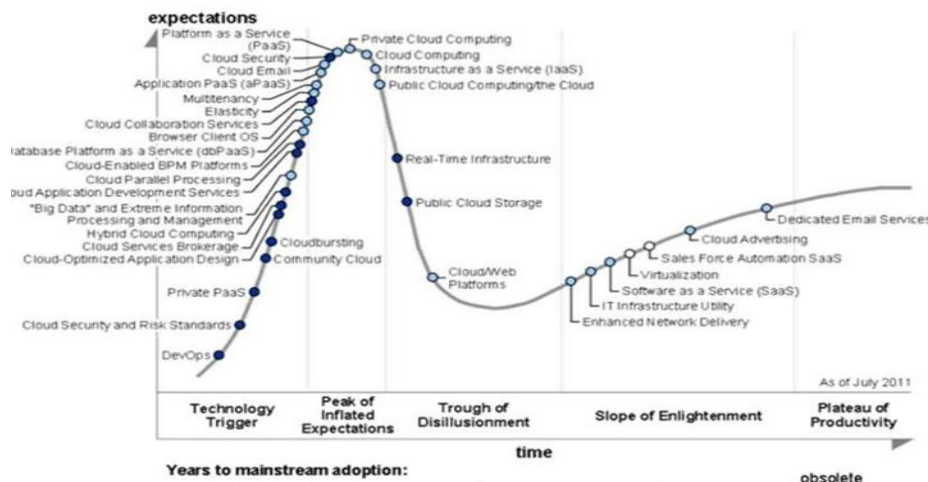


Figure.1. Gartner's hype curve

Gartner had a word on how much could cloud evolve long back and is conveyed in his hype curve released by Garner on cloud and its growth is shown below in fig.2. It is self-explanatory and the amount of opportunities in cloud is limitless.



**Figure.2. Hype curve for Cloud (Gartner – 2011)**

In this research work, the authors have tried to blend both upcoming and promising AR with Cloud and it has given promising results.

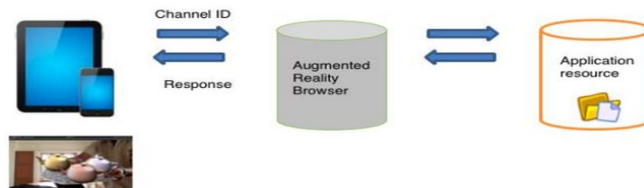
**Pattern Based AR:** Pattern based AR is one of the accurately embedding technology that combines the digital information into the augmented world. In this technology a pattern is created, stored and used as target on which the digital content can be embedded whenever the mobile camera tracks that particular pattern. We can create different patterns for different images. To generalize the pattern we can use QR code, bar code etc. Say for example we have created a sample Augmented reality application for reading a newspaper or magazine. Here when the newspaper or magazine is scanned AR digital content will be produced on the screen that has a pattern added to each and every topic. For each and every page in the newspaper or magazine QR code, bar code etc., are used to create patterns. These patterns are stored in the devices so that they can be used for tracking them in future. When a user wants to know more about a topic in that newspaper or magazine it is enough to look for the pattern in that topic. By matching the pattern the required material can be easily found and embedded into real world as AR. A sample AR app based on pattern is shown in Fig.3.



**Figure.3. Pattern Based AR**

Now if we use our devices for storing the patterns then only a countable number of patterns can be stored. This is a limitation in this technology. Whereas if we use cloud for storage of these patterns then it would be much easier to match the patterns we need. Also patterns can be stored in large number. Say if we get create an app for daily newspaper based on this technology then we need at least 30 unique patterns to be stored in our device for each topic in one newspaper on an average case which is practically not possible if we are buying newspaper for several years. So this is where cloud can be much useful. We just need to add our patterns to cloud regularly. Not only pattern but also the digital content with respect to all patterns can also be stored inside cloud so that they are also not limited.

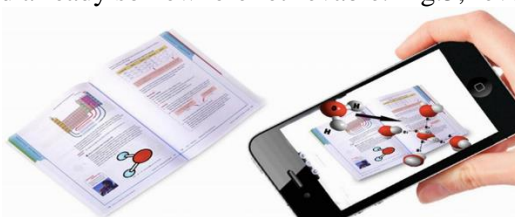
There are many varying factors like time according to which our surroundings changes. Say we have a new update of news which can again change with respect to time. So this has to be dynamically updated which is not possible if we store our data in the device. So when cloud is used we can easily update it and get the updated news dynamically. Generally digital content will be mapped to a pattern or image or any other augmented target. If the camera (for capturing targets) focuses on a target the digital content will be embedded over the target. Now if that digital content differs with respect to certain factors like time. This is called dynamic content. This is possible only by using cloud. Let us now see how it works.



**Figure.4. Flow chart for only pattern based AR Apps**

Augmented reality application is created using web technologies such as XML to map pattern and the corresponding digital content that is stored in the server, PHP to make the application content dynamic, HTML for front end logic, ADEL scripting. Once the application is deployed into the server, we can create a channel id for our AR Application which is nothing but similar to the URL for a web application. AR browser can now do the needful whenever it is triggered with the channel id. In the above fig Pattern based AR application requests the AR browser with its channel id. Then that requested application is executed in the user's phone or tablet by AR browser. Whenever the browser recognizes the pattern, request is made to the server in order to collect the related digital information. Now we will continue the same to Image based AR. The flow is shown in Fig.4. Next in the cycle to be tried is Image based AR.

**Image based AR:** Image Targets are images that will be tracked and the digital information is embedded over it. Image Targets won't need a special black and white regions or QR codes or Bar codes to be recognized. They are automatically detected and tracked and features are found in the image itself by comparing these natural features against a known resource database. Now the elements are embedded as digital information over the image. For every image a related digital content is placed over it. Now consider we have developed a sample augmented reality application that can be used for education purpose. If a student wants to study an image in a book that is quite difficult to understand like a molecular structure in Chemistry book. Student can scan the page and produce the virtual object of the molecular model making it easy for the reader to understand. So these animation models cannot be generated when scanned they have to be stored already somewhere retrievable. Fig.5, reveals the idea.



**Figure.5. Image based AR – Molecular example**

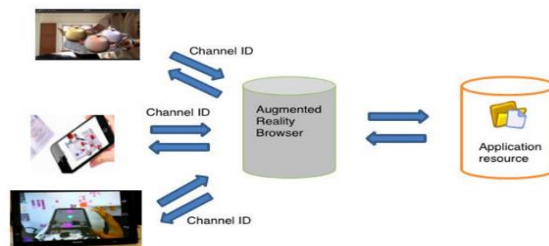
Expand this application so that it transforms the whole book into augmented reality content that is instead of one single image now we are speaking about a group of images for which we are providing digital contents like animation to help students understand better. Using our devices to store these animations and other digital contents is completely unwise because they occupy lot of space as the number of target images and respective digital content increases. So to overcome this limitation we use cloud. In clouds we can store how much ever AR digital contents and image targets we want. When the need for these digital content arises they are taken from the cloud and embedded over the images. So they also have to be stored in the cloud to avoid limitations. In the ordinary case i.e. without using cloud the contents of the augmented reality are not dynamic. To make it dynamic we use cloud. Here every time if something in the books changes then the cloud has to be updated so that new AR digital contents are displayed. We can further expand this idea by making the application supporting more than a single book as we have started using cloud. Thus because of cloud this sample application discussed will become very helpful for the student which was previously working for only countable number of image targets. Fig. 6 explains the flow chart for the innovation.



**Figure.6. Flow chart for pattern based and image based AR**

Created image based AR application is deployed into the server in order to obtain a unique channel id. Now the channel id will help the server not only to determine the application but also it will help the server to find the type of AR application. Finding out the type will help server to do the necessary preprocessing required to track the image which is different from pattern based AR like loading the features of the image to match etc.

**Multiplayer online AR Game:** Games in today's world have become a daily need. Computation of data for processing these games is generally done in a computer or mobile phone. But games like Clash of clans, Injustice among Gods etc., and needs large amount of data to be computed. So data computation is done in the cloud. Online computation makes the game run fast and runs it in an efficient way. Now using augmented reality to play such games increases the digital experience multiple times than what the user normally experiences. Let us say if we have created a sample application that uses augmented reality to create a virtual world in which the user can interact and play the game. When user plays the game his or her digital experience increase to a great level. At the front end the user can just see the game but the data computation happens in the cloud precisely the server as shown in below fig.7.



**Figure.7. Channel id and AR browser**

Whenever data has to be computed it is sent through a particular channel to the server. Hence we use a can plugin to run the channel. The augmented reality browser runs the application so that the data is transferred through channels to the cloud and then computation take place in it. Then the computed data is sent back to the application through the augmented reality browser via channel. So for huge computation of data cloud can be very helpful.

**Challenges:** The task of developing Application in AR with gesture itself was a major challenge and we could achieve good results in that. Then, interfacing with cloud was further difficult as there were no many researches done in this particular area of interest.

## 2. CONCLUSION

Thus blending augmented reality and cloud technology users digital experience and efficiency of computation can be increased to immense level. AR content can be made dynamic and large amounts of AR digital content like animation, 3D Models, videos, audios etc. can be stored and retrieved. This is how cloud helps us outweigh the limitations in today's augmented reality. Also the same can be extended to object recognition, frame based, and many other types of augmented reality including Text recognition.

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