

Fathima S J et al., 2019

Volume 5 Issue 2, pp. 35-47

Date of Publication: 19th August 2019

DOI-<https://dx.doi.org/10.20319/mijst.2019.52.3547>

This paper can be cited as: Fathima S J., S. A., Shankar, S., Surendiran, B., & Saranya, K. (2019).

*Advent of Augmented Reality Experience in Retail and Online Shopping and its Influencing Significance in Future.* MATTER: International Journal of Science and Technology, 5(2), 35-47.

This work is licensed under the Creative Commons Attribution-Non Commercial 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

## **ADVENT OF AUGMENTED REALITY EXPERIENCE IN RETAIL AND ONLINE SHOPPING AND ITS INFLUENCING SIGNIFICANCE IN FUTURE**

**Syed Ali Fathima S J**

*Assistant Professor, Department of Computer Science and Engineering, Kumaraguru College of Technology, Coimbatore, Tamil Nadu, India*  
[syedalifathima.sj.cse@kct.ac.in](mailto:syedalifathima.sj.cse@kct.ac.in)

**Shankar S**

*Professor, Department of Computer Science and Engineering, Hindusthan College of Engineering and Technology, Coimbatore, Tamil Nadu, India*  
[shankarhicet@hindusthan.net](mailto:shankarhicet@hindusthan.net)

**Surendiran B**

*Assistant Professor, Department of Computer Science and Engineering, National Institute of Technology Puducherry, Karaikal, India*  
[surendiran@nitpy.ac.in](mailto:surendiran@nitpy.ac.in)

**Saranya K**

*Assistant Professor, Department of Computer Science and Engineering, Kumaraguru College of Technology, Coimbatore, Tamil Nadu, India*  
[Saranya.k.cse@kct.ac.in](mailto:Saranya.k.cse@kct.ac.in)

---

### **Abstract**

*Augmented Reality (AR) is a trending technology that augments or superimposes an image generated by a computer system virtually into the real world environment for the user's viewpoint using a smart phone or other hand held devices. AR shows recent advancements in the shopping domain with various implementation trails and refinement. The simplicity and*

*flexibility in online shopping where people stay in their own place and do shopping brought a great challenge to retail shopping environment today. Retail stores are now struggling a lot to bring in the customers and the foot traffic has been greatly reduced due to which online sales are boosting and retail sales are stalling. This necessitates to bring new technological innovations to offline shopping to attract people. With the use of AR, it is possible to merge digital component to physical products in the store to stimulate the engagement of the shopping experience with more fun and joy. On the other hand, in the online shopping, though user reviews and product showcase aids the customers to analyze the quality, look and feel of diverse products, the buyer still cannot see how exactly the product fits in a real environment or how it works. Here plays AR a vital role in online shopping where it uses animations and visualization techniques to offer more value to their shoppers virtually aiding to see exactly the look of the product in user environment. This paper explains the advancement of AR in both retail and online shopping of various product domains with an implementation model of ShopAR for Online shopping and AR significance in near future.*

### **Keywords**

Augmented Reality (AR), E-Commerce, Retail Shopping, Online Shopping, Visualization, Smart Phone, Virtual Environment, ShopAR

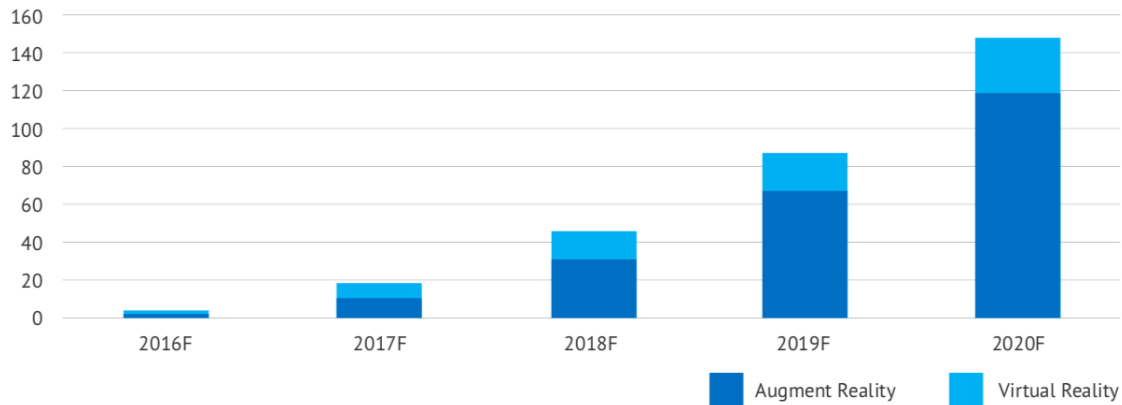
---

## **1. Introduction**

Augmented Reality (AR) is the rapidly growing technology expected to be a useful means in our day to day modern lives. Unlike Virtual Reality (VR) which involves huge hardware tools like Oculus Rift, HTC Vive or VR Glass to experience the immersive virtual world, AR tries to place the virtual elements in the real world environment to provide user with the enhanced user experience (Azuma, R. T., 1997) Also, the advancement of smart phone technology with the features of GPS, Accelerometer, velocity meter, digital campus etc. is the key for the greatest impact of AR in various fields like shopping, healthcare, education and automation industries. Enhanced user experience is achieved through AR which combines audio, graphics, and natural feel of touch feedback using natural user interface to the interactive real world environment where the user plays in.

The growth forecasts places Augmented Reality market at \$120 billion by 2020, rising to \$198 billion by 2025, showing a Combined Annual Growth Rate of 65.1%. AR data, AR commerce and AR advertising signify the important role in this large spend. extraordinary

growth and flourishing popularity of AR create a great impact and will become one of the most exhilarating technologies in the world. Juniper Research and Goldman Sachs analysis states that there will be the growth of AR market by 20–100 times in the next five years. Figure 1. Depicts the AR versus VR market size (Arround, 2018).



**Figure 1:** *Augmented Reality versus Virtual Reality Market Size*  
Source: Arround, 2018

The AR systems are categorized based on its implementation strategy such as marker based, marker-less and location based, superimposition based projection based. In marker based AR, any content or information in two dimension (2D) or three dimension (3D) format is stored as patterns in a visual marker which is a two dimensional QR code. The 2D QR can be sensed by camera device to read the content using computer vision techniques as an augmented object in the real world environment. This can be done by calculating the position and orientation of object data overlaid on the marker and involves only less processing power. Marker-less and location based AR is implemented using sensors which has position and location tracking capabilities. The most widely used marker-less AR device is considered to be smartphones with location detection features. Another type of system where artificial light is projected onto the real world surfaces to allow human interaction is known to be projection based AR. A system which provides fully or partially a new augmented view for an existing object refers to superimposition based AR which plays a major role in consumer applications. Table 1. Show the AR types and its emerging applications in various domains.

**Table 1:** *Augmented Reality Type and its Application Domain*

AR Type	Application Domain - Samples
Marker Based	Education, Marketing, Packaging, Shopping
Marker-less and Location based	Location Centric Applications like City Navigation, Visual positioning, Shopping, Rehabilitation, Interactive games
Projection Based	Engineering, Manufacturing, 3D Interactive Hologram in mid-air, Live art shows
Superimposed Based	Shopping, Marketing, Healthcare

According to a research study on Augmented Reality – Changing the face of retails by DigitalBridge during 2017, with the development of AR platform and AR toolkit inbuilt with the smartphone technology by Google and Apple, it is estimated that the consumers would expect about 74% of retailers to provide some kind of AR experience which will bring new AR revolution to the market (David, L., 2017). Apple and Google are the two giant industry focused on developing AR framework to offer developers to build AR applications with better immersive and realistic AR experience. Table 2. Lists the AR framework and its capabilities offered by Apple and Google.

**Table 2:** *Augmented Reality Frameworks and its Capabilities*

AR Framework	Capabilities
Apple - ARKit2	Developed for iOS with the capabilities of image detection and tracking and applies real world reflection to virtual objects.
Google - ARCore	Developed for Andriod and iOS with capabilities of motion tracking, light estimation and environmental understanding.

AR is playing a major role in consumer application due to the fact that it acts as a technology enabled feature to answer the questions like “how well a product fits into the user’s space” or “how well a product suits the specific user”. This additional feature adds value to the existing retail shopping experience and hence AR tries to enhance the following goals in the retail shopping experience.

- Improve in-store customer visits with the accumulation of technology enabled features to the physical products.

- Creating a distinguished branding thereby enhancing retailers' revenue.

On the other hand, E-commerce is making a rapid progression in shopping sphere through its convenient experience at the place of consumer's site. But the major challenge of online shopping is the missing sensory elements of touch and feel of the product owing to uncertainty to the buyers regarding the product's quality and its specifications. This increases the rate of unsatisfied consumers and loss to the company as well due to increased return requests of the purchased products. AR tries to offer a solution to online shopping issues with the following objectives.

- Providing customers an enhanced experience in the web based or mobile app based virtual shopping environment.
- View an augmented 3D model of the product along with its specification details which the customer wishes at the place of their choice.

In this paper, the advent of AR technology in various domains of retail and online shopping is reviewed and its influencing significance in future is discussed.

## **2. Augmented Reality in Retail Shopping**

The major intention of AR application in retail shopping is to enhance the customers in-store shopping experience and also to increase the incoming visits of the consumers. Attracting the current generation of consumers into the store is quite challenging and requires smart move by the retailers at present situation.

### **2.1 Augmented Reality (AR) Techniques Enhancing In-Store Shopping**

In retail shopping, creating AR based mobile apps and websites for product promotion plays a major role. In-store signage is the marker based AR image on the physical products. Customers can scan this AR image using the mobile app to view the complete product information like specifications, dimensions, pricing, color variants, rating and reviews. In contrast, Wang, C., Feng et al. proposed a cloud based AR app where the customer can take snapshot of any item in the shopping mall and query the cloud based system for product information (Wang, C., & Feng et al., 2017). In-store Navigation offers the customers with entirely new experience where the shoppers can add the products of their choice using an in-store mobile app and the app then helps the user navigate to the items in the shopping cart using shortest route (Sheehan, A., & Etsy., 2018). Walgreens, a huge drugstore in US modeled their

shopping carts mounted with a tablet having a AR enabled app installed in it that helps the customer navigation easier with minimum effort.

Another technique used in-store is the AR enabled magic mirrors fixed on the walls. These mirrors enable the customers to try out the products of customer choice virtually on them without physically wearing or applying it while providing a real experience. It is mainly used for cosmetics and dressing applications where this mirror will act as a display window attracting more customers foot traffic towards it (Shaikh, A.A., et al, 2014). The shoppers visiting the store can stand in the front of this mirror which has an integrated camera or sensing device like Microsoft@ kinect for sensing the image of the person and brings the virtual view of the person to the mirror screen. The customers can then select the different products displayed on screen of their wish and preferable size to try on them more conveniently and with less time. This kind of technique is mostly used in apparel and cosmetics shopping applications. Topshop and Timberland are the known apparel shopping brands have adopted the virtual fitting room with Kinect enabled AR technology in their retail shopping store (Levski, Y., 2017). Warby Parker and Frames Direct are the eyewear shopping retailers using AR try-ons offering the users with option to upload photo using webcam and virtually superimpose available glasses to their faces. There are more and more apps been developed by retailers in conjunction with AR industry (Sheehan, A., & Etsy., 2018), Table 3. reviews the notable AR apps and websites to enhance in-store shopping experience.

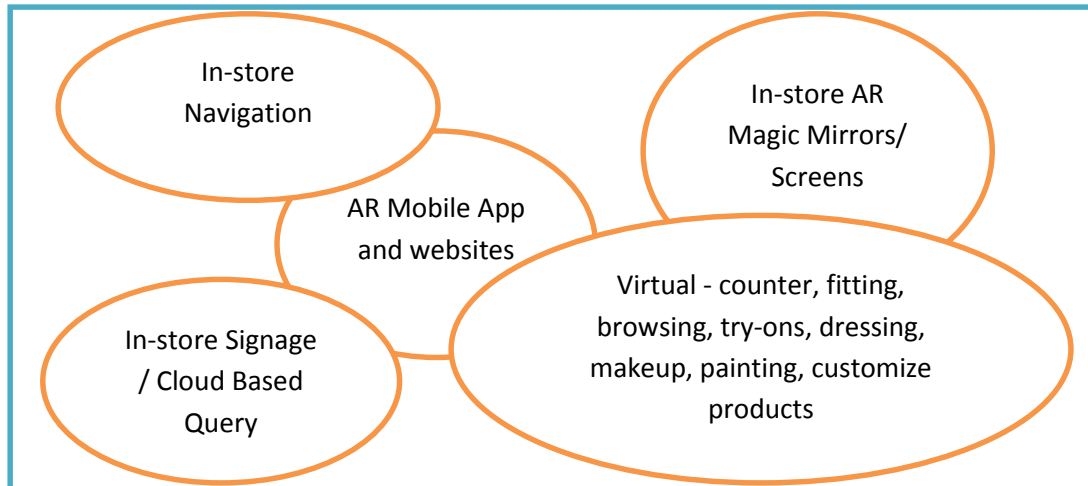
**Table 3:** Review of Augmented Reality (AR) Apps to Enhance In-Store Shopping

AR Mobile Apps in retail shopping	Description
LCST Lacoste App	Uses 3D modelling of the products to try on selected shoes virtually.
American Apparel – Shopping Assistant App	Scanning of in-store signage on a cloth displays product information.
Lowe’s in-store navigation App	Uses geolocation and Google Tango AR technology for indoor mapping.
Toys ’R’ App	Specially made for kids product where children can unlock AR-enabled activities to select and play with an item virtually nurturing them to buy it.
Magnolia’s home and lifestyle iOS App	Uses ARkit to given an experience to the users to

	check how the product looks in their home environment.
Anthropologie App	Provides detailed 3D images of the furniture with signage and adds reality view using lighting and shadow effects.
IKEA place App	Uses ARkit for furniture and house hold products.
Gap App	Offers virtual dressing room for clothing along with virtual fitting room for households.
Converse's Samplers App	Facilitates shoppers to buy for their friends or family using virtually try on shoes at the place of site by actual users.
L'Oréal Paris Makeup Genius App	Allows the shoppers to try virtual makeups and cosmetics with the options to blend, mix and match of different products similar to real time.
Sephora Virtual Artist App	Offers consumers an option of uploading their selfie image into app and apply makeup over it.
De Beers My Forevermark Fitting website	Marker based AR enabled jewellery fitting application where the De Beers jewellery pieces are embedded into paper pieces.
Dulux Visualizer App	Home interior app enables the user to visualize the look of the selected walls in their home when painted with different colours.
ARshop App	Cloud based AR app empowers customer to take photo in shopping mall and query the product information.

AR enabled mobile apps and websites facilitates the features of signage, navigation, virtual fitting and dressing whereas AR enabled in-store magic mirrors and screens offers virtual counters, browsing, fitting, painting, dressing and makeup facilities with product customization options for the incoming shoppers. Figure 2. Consolidates the AR techniques used in retail shopping stores.





**Figure 2:** Augmented Reality techniques at Retail Shopping Store

Source: Author

### 3. Augmented Reality in Online Shopping

Online shopping made shopping easier of any interested items from home. Nowadays the shopping experience is getting better and better and there is a rapid increase in number of online shoppers. With an advent of AR, one could imagine a shop where the users do shopping with no queues and crowd, get the feel of the product before actually having to buy it. Mangale et al. proposed virtual furniture using augmented reality where the users can buy furniture sitting in the home without visiting furniture store (Mangale S. et al., 2016).

In the present days, consumers get to shop from home, by viewing the product specifications, comparisons, reviews and pictures. By having this product information, shopping is not complete. There's no feature to visualize the product in the environment, where the user wishes to have. Due to this problem lot of people buy products without full satisfaction or may even return as it does not suit the need after received. Integration of AR intelligence in online shopping might overcome these major issues.

#### 3.1 Implementation Model of ShopAR for Online Shopping

ShopAR is a mobile app developed for online shopping. It's requirement and specification is given in table 4.



**Table 4:** ShopAR Requirement Specification

Requirement	Specification
Software Library	ARKit and ARCore
Mobile OS	Any OS with ARKit and ARCore library support Specifically, <ul style="list-style-type: none"><li>• iOS 11 and above versions</li><li>• Android Nougat and above versions.</li></ul>
Smart Phone	Any Smart Phone with ARKit/ARCore compatibility Specifically, iPhone, Asus Zenfone, Google Pixel, Samsung, OnePlus, Moto, Huawei

### 3.1.1 PEAS Description of ShopAR

PEAS description provides the specification of performance, environment, actuators and sensors requirements of ShopAR agent design.

#### 3.1.1.1 Performance

For better performance of the application there are several parameters which are expected as specified,

1. The device when in an AR session, must have less background tasks running
2. The device must be put in performance boost mode or the battery saver mode must be disabled.
3. Internet bandwidth must be decent enough to transfer asset data from the server to mobile device.

#### 3.1.1.2 Environment

Environment is the place where the user wishes to place the product to get an AR experience of what he/she is about to buy.

For better AR experience the environment must have,

1. Less movement, so that the more feature points are got which improves the quality of world tracking.
2. The environment must be bright so that feature points can be calculated from the video input frames.

When tracking is done in such an environment, the AR experience is better.

### 3.1.1.3 Actuators

The final output is shown on the interface screen. The mobile device needs a touch screen, which is a better medium to interface with. The product's position can be moved and rotated. Zoom, tilt, light reflection, shadows and other aspects of the product are calculated by the mobile device.

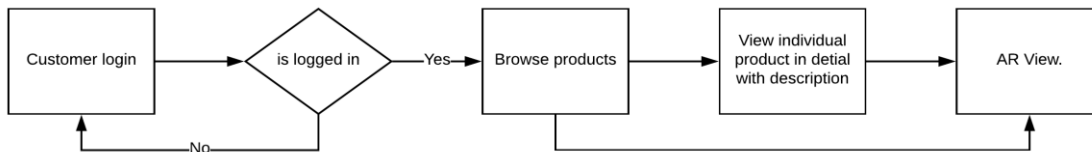
### 3.1.1.4 Sensors

Sensors are needed for various parameters. For world tracking, visual inertial odometry is implemented, which involves the use of,

1. Video input from camera to find feature points, plane detection and light condition.
2. For movement of the phone in real time, gyroscope and accelerometer is used.

### 3.1.2 Workflow

The ShopAR application's Workflow is designed as shown in Figure 3. The user first gets to login; after which he gets to browse the products. On browsing the products, he/she may want to see a product in specific. To view the product virtually in the desired environment, user may want to navigate to the AR module and clock ARview.



**Figure 3:** ShopAR Workflow

Source: Author

#### 3.1.2.1 Login and Browse Product

This module does the work of logging the user when he/she enters the user credentials. After logging in, the identity of the user is known and based on the user, there are a few customizations done, so that the shopping experience is made better. After login, the user gets to browse through all the products by its name, brand and various other parameters. Price comparison can be made from smartprix platform.

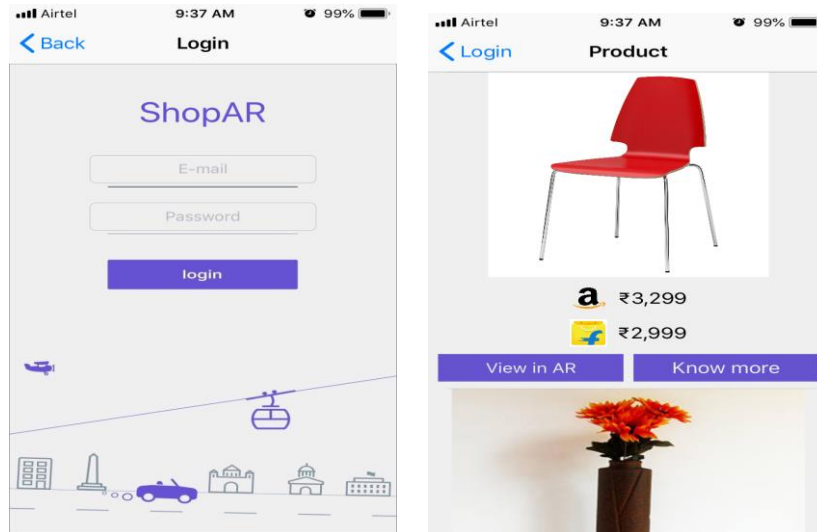


Figure 4. a) ShopAR – Login b) Browse Product

Source: Author

### 3.1.2.2 Surface Detection and AR View

This is the module which is user interactive. By providing an option to choose and place the product at whatever place we want to. User can change the position of the product and can also zoom to have a clear view.

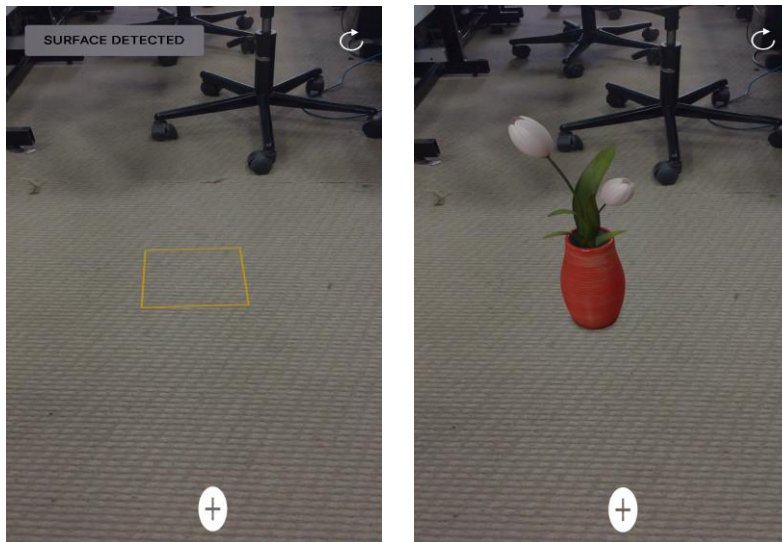


Figure 5: ShopAR – a) Surface Detection b) ARView

Source: Author

This kind of app will provide a platform where the shopping is made more comfortable. This will make the user satisfied by providing a virtual view of the product at real environment.

This can be implemented in all existing online shopping, so that the customers will be able to make better decisions before buying an item.

#### **4. Augmented Reality Significance in Future Shopping**

Augmented Reality has currently taken a considerable role in transforming the retail and online shopping experience especially in the field of apparel, shoes, cosmetics, jewelry, eyewear, toys, home décor, painting, households and furniture shopping. AR is also being used in design, development and sales of engineering and industry products and there are wide opportunities to be explored. It is also used for product brand promotions. With the invention of various smart phone and communication technologies, the advent of AR has opened up various possibilities in all sectors from small scale to large scale industry. It is now used from the start of product design in industry until marketing to reach the end users. The world is evolving, the trend is changing, people prefer to have new stuffs and effects embedded to existing world. In order to attract consumers and survive in competitive market, AR will become essential key and a smart move for retail and online shopping sectors to give an extraordinary and interactive shopping experience. In addition to the enhanced shopping environment, AR also efforts to make the products stand out and branding awareness yielding to the higher revenue in ecommerce domain.

#### **References**

- Apple Inc. ARKit - Apple Developer. Retrieved from <https://developer.apple.com/arkit/>
- ARCore. Retrieved from <https://developers.google.com/ar/>
- Arround. (2018, October 29). Augmented Reality Versus Virtual Reality Market Size. Retrieved from <https://medium.com/@arroundsmm/augmented-reality-versus-virtual-reality-market-size-54894b818de3>
- Azuma, R. T. (1997). A Survey of Augmented Reality. Presence: Teleoperators and Virtual Environments, 6(4), 355-385. <https://doi.org/10.1162/pres.1997.6.4.355>
- David L. (2018, April 06). DigitalBridge Research - Augmented reality is changing the face of retail Mobile Industry Eye. Retrieved from <https://www.mobileindustryeye.com/latest/report-augmented-reality-changing-the-face-of-retail-digitalbridge/>
- Levski, Y. (2017, November 02). How Augmented Reality Benefits Retail and Shopping. Retrieved from <https://appreal-vr.com/blog/ar-in-retail-shopping/>

Mangale, S., Phansopkar, N., Safwaan Mujawar, S., & Singh, N. (2016).

Virtual Furniture Using Augmented Reality. *IOSR Journal of Computer Engineering*, 1, PP 42-46.

Shaikh, A.A., Shinde, P.S., Singh, S.R., Chandra, S., Khan, R.A., (2014). A review on virtual dressing room for e-shopping using augmented reality. *Int. J. Soft Comput. Eng.*, 4(5), 98–102.

Sheehan, A., & Etsy. (2018, February 21). How These Retailers Use Augmented Reality to Enhance the Customer Experience - In-person Selling and Pop-Up Shops. Retrieved from <https://www.shopify.com/retail/how-these-retailers-are-using-augmented-reality-to-enhance-the-customer-experience>

Wang, C., Feng, Y., Guo, Q., Li, Z., Liu, K., Tang, Z., Tung, A.K., Wu, L., & Zheng, Y. (2017). ARShop: A Cloud-based Augmented Reality System for Shopping. *Proceedings of the VLDB Endowment*, 10(12), 1845-1848. <https://doi.org/10.14778/3137765.3137790>

What is Augmented Reality (AR) - Ultimate Guide to Augmented Reality (AR) Technology. (2018, October 04). Retrieved from <https://www.realitytechnologies.com/augmented-reality/>