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A PERSONALIZED SUPERMARKET PRODUCT RECOMMENDATION SYSTEM USING AUGMENTED REALITY

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Abstract - *Online shopping is rapidly increasing because of the features it offers. Bringing online shopping aspects to offline retail will enrich customer experience. Augmented Reality (AR) interfaces developed for handheld devices, linked to a physical Smart Space will bridge the gap between offline and online retail aspects. The user will be able to interact with the products in the physical spaces while having access to online shopping features. We propose a Personalized Supermarket Product Recommendation system that uses Augmented Reality to provide navigation to a particular product within the confines of the supermarket while simultaneously providing access to additional information such as discounts and similar products.*

Key Words: *Recommendation system, Augmented Reality, Product recognition, Smart Shopping, User Experience, Human–Computer Interaction.*

1. INTRODUCTION

Key business leaders in the technology sector such as Microsoft, Google and Apple are currently committing to the trend of augmented reality. The improvement in hardware, and increase in mobile devices with high computing capabilities results in the current level of technological development. Added to it, the recent trends of Internet of the Things (IoT), deep learning (DL) and augmented reality (AR) approaches have also contributed to the way technological solutions are used and developed.

Nowadays, the daily trading operations which are driven by decisions made by customers leads to the growth of global economy. Customers are not only interested in the quality of the product but also the complete experience of purchasing the product. Thus, stores must be adaptive and must be considerate to this type of consumer. Knowledge about products plays a vital aspect in increasing interests of the consumer. This intended knowledge may be accessed by digital means. Online sales are gaining encouragement over brick and mortar sales. Offline retailers are undergoing hardships to engage customers at physical locations. Online shopping is more engaging and provides more customer satisfaction in comparison to brick and mortar shopping which traditionally doesn't offer online features. Hence, a need arises for bringing online shopping aspects to offline retail and convergence of offline and online retail. Bringing online shopping aspects to offline retail will make shopping more connected, social, engaging, and fun. To achieve the same, Augmented Reality is used in enhancing user perception in the real world by overlaying computer generated objects or information. The point that, the physical point of sale will remain strategic, as it provides the main contact between customers and brands is always true.

Modern customers have the power to pay for a desirable product. Therefore, stores have prepared content providers and offered a huge selection of products, with unprecedented opportunities to meet a variety of special needs and tastes. Matching consumers with the most appropriate products are a key to enhancing user satisfaction and loyalty. The recommender systems, which analyze patterns of the users, takes on the role of getting attention in order to recommend products to suit the individual tastes of the users. The concept of personal recommendations can add another dimension to the user's experience. When a user is viewing a particular product, the system automatically suggests other similar items that the user might be interested in. Additional offers and discounts applicable might also be highlighted. Augmented reality is used to provide these features in a more interactive and engaging manner.

Augmented reality (AR) provides an interactive experience in the real-world environment wherein the objects in the real world are enhanced by computer-generated perceptual information. AR provides us with a combination of real and virtual worlds. AR also provides real-time interaction by providing an accurate 3D registration of virtual and real objects. The overlaid sensory information can be constructive (i.e. additive to the natural environment), or destructive (i.e. masking of the natural environment). In this way, augmented reality can alter one's ongoing perception of a real-world environment.

As said before, one of the factors that makes online sales engaging is the recommendation of items, that the user might like. For including the same, a recommendation system can be used. A recommendation system is a subset of information filtering system which tries to predict the preference user would give to an item. They are primarily used in commercial applications. Personalized recommendations can be obtained by the use of recommender systems. Recommender systems helps users to take optimized decisions in their

transactions, to retain customers and enhance their shopping experience.

They are primarily used in commercial applications. Recommender systems helps users to take optimized decisions in their transactions, to retain customers and enhance their shopping experience. Therefore, in our paper, a detailed study of bringing the online shopping experience to offline is discussed.

2. LITERATURE REVIEW

Siti Salmi Jamaliab. (2015)[1]: This paper discusses the advancement process of a mobile prototype learning environment that utilizes mobile-Augmented Reality (mAR). This prototype is termed the Human Anatomy in Mobile Augmented Reality or HuMAR, and also the selected topic is that the anatomy of the human structure. The most objective of HuMAR is to assist students and it could potentially enhance their learning process. The work is proscribed to a little set of scholars within the preliminary study.

In order to look at the augmented or superimposed object, the HuMAR uses the tablet's screen. The flow of interaction starts with a marker, which might be specified as a picture on any surface, where the tablet's camera will work as a picture scanner. In HuMAR, image is detected as a marker, and is measured by the width of the required dimensions. Eventually, the tablet's camera detects and recognizes an assigned marker. Once a AR marker has been identified, an application installed on the tablet will display and superimpose the respective CG 3D object onto the screen. During this prototype, each bone image from the unit laboratory manual has been assigned with a selected marker in the prototype application. The size of the marker in terms of height and width are going to be set during development. The marker size is incredibly important, because the pose information is going to be detected within the identical scale, which has been set earlier.

The HuMAR provides 3D bone images with the 360 angles that project the topic point more efficiently onto the visual plane to facilitate good understanding. In HuMAR, hand movements, as an example finger interactions, are required.

To enable HuMAR, the user should click on the application from the tablet. The appliance begins with the particular environment by using the camera of the tablet device aimed toward a marker within the unit laboratory manual. Once the marker has been recognized, the respective augmented 3D model is displayed and superimposed onto the device screen, that the user can see the augmented object. An end user can view an augmented 3D model of part/s of a bone when the user moves the camera of the tablet device into the realm of the marker.

User interactions, which encompass body or hand gestures with the mobile device are a standard characteristic of the kinesthetic sort of learning. This learning style provides a more enthusiastic learning environment and serves to motivate students.

Deepti Nirwal, Ruchita Baglane (2017)[2] : The objective of this project is to build a solution to develop a system that will provide same comprehensive information one gets while using online shopping systems. This system will enable users to browse various products placed on shelves of the retail stores and get interactive information about them which will be overlaid on top of the real world (physical) products.

The paper implements two different use cases of augmentation in the shopping mall scenario. 1) Product augmentation and 2) Shelf augmentation. Using product augmentation, the application starts scanning the product. Then it augments the product's information on the top of that product including product name, company, price, specifications, discount and many more. By using shelf augmentation, when the user points the mobile towards the marker which is attached to the shelf, the system retrieves the marker information from the shelf's metadata file. Then it augments the basic shelf details including shelf number, type of the products on the shelf, capacity etc. along with the list of the products on the shelf at the bottom of the screen through which we can browse to get information of the product.

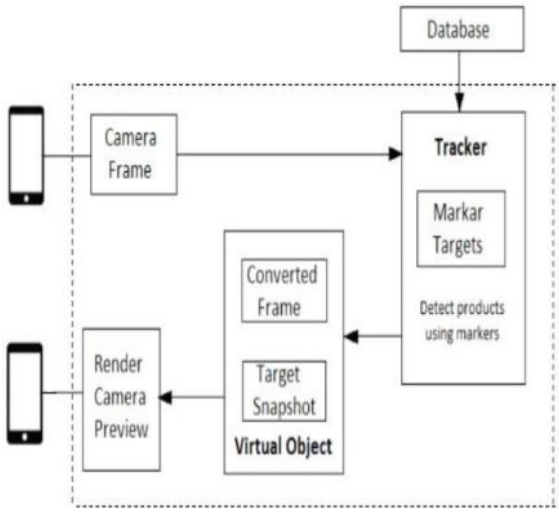

Fig -1: AR Interface

The limitation in the proposed paper is regarding the search option. When a user searches for a required product, the shelf number where the product is placed is displayed but is not navigated towards the object.

Zulqarnain Rashid, Enric Peig (2015)[3]: The paper illustrates how to bring online shopping features to offline retail and enrich customer experience. In this paper they present Augmented Reality (AR) interfaces developed for handheld devices, linked to a physical Smart Space to bridge the gap between offline and online retail. Offline retailers are experiencing hardships to engage customers at physical locations.

Online shopping is more engaging and provides more user satisfaction. Hence, a need arises for bringing online shopping aspects to offline retail and convergence of offline and online retail. To achieve this objective, two subsystems were chosen: an RFID based smart shelf, and an augmented reality (AR) system using markers. The smart shelf is able to inventory and determine the approximate location of all the items, which have previously been labeled with an RFID tag. The AR system uses an AR marker to map the physical coordinates of the shelf to the screen coordinates of a handheld device showing a live image of the shelf.

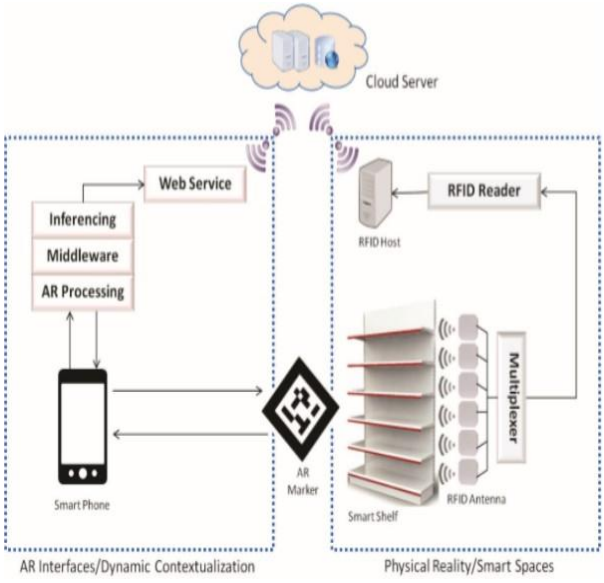

Fig -2: RFID Architecture.

To turn a shelf into an RFID smart shelf, a set of antennas must be placed on the shelf. Since there is no a priori information on where the products will be placed, the whole surface must be covered which is a limitation. The distance between antennas determines the accuracy of the location information. Antennas are placed every 25 to 30cm in both vertical and horizontal directions, this consumes space and expensive to install antennas.

Junho Ahn, James Williamson (2015)[4]: The paper illustrates how to build an indoor mobile augmented reality system for healthy grocery shopping by leveraging the sensing and AR capabilities of smartphones and the knowledge of health rules in order to recommend appropriate products to purchase or identify products to avoid.

The system consists of an external image labeling service, a mobile component, and a remote cloud server component. To determine the initial location of a user in the grocery store, the mobile component sends a product snapshot to the cloud server component, which forwards that snapshot to an external image labeling service.

This external image labeling service returns the product identity to the cloud server, which then determines the current location (aisle) of the user by referring to an indoor layout of the grocery store. After uniquely identifying the aisle in the grocery store, the mobile component estimates user motion, thus providing a position estimate within the aisle, as well as orientation. The user also inputs his/her health roles on the mobile client, for example, seeking some combination of low-calorie, low-sodium etc. This position estimate along with orientation and health condition is then again communicated to the server, which consults the product location database along with its health rules to come up with a recommendation of products to buy or avoid.

Fig -3: AR Shopping App

This paper is limited to generalizing the health concerns. It names the product with red tag if it is unhealthy and green tag if it is healthy. Naming products as unhealthy can rise issues from the product companies.

Edmanuel Cruz, Sergio Orts Escolano. (2018)[5]: In this paper, we propose a system that combines deep learning and augmented reality techniques to provide the customer with useful information. First, the proposed system uses deep learning architecture to learn the visual appearance of various areas of the store. Then, customers can take a picture of the area where they are located within the store using their mobile devices. Uploading this image to the system trained for image classification, we are able to identify the area where the customer is located.

The mobile application proposed in the paper is able to automatically detect where the user is located and provide guidance to the item that the user is looking for. Furthermore, the user can project and manipulate virtual items in an AR fashion, to check if the item satisfies their personal preferences. The navigation screen depicts an arrow in an AR manner and behaves like a compass, pointing toward the next way-point. Finally, if the users follow the directions, it will lead them to the location of the object they have chosen.

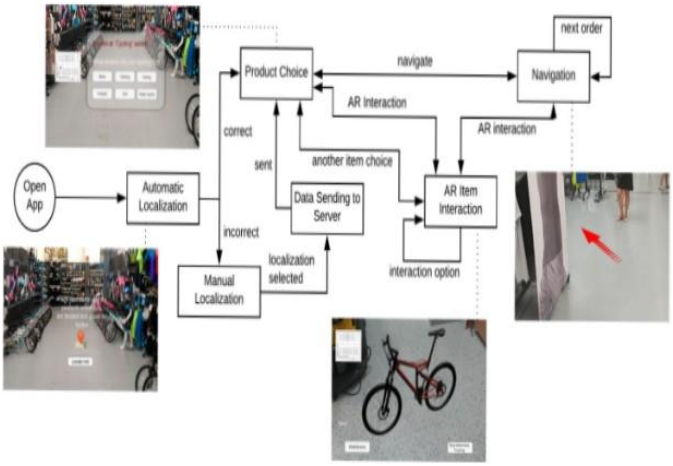

Fig -4: Mobile Application Workflow

In this manner, the user could interact with a 3D model of the item. The presence of an Internet connection is one of the main limitations of the presented work. Since the use of DL techniques requires high-performance computing to process input data in real time, it is not possible to perform the image recognition process on the mobile phone. Besides, it would dramatically increase power consumption. The second limitation of the presented system is related to ML part of the presented system. Since the DL model was trained using product and store images acquired at a specific time, if the visual appearance of these products changes, the system would need to be re- trained with new acquired images.

3. CONCLUSION

Online shopping is rapidly increasing thanks to the features it offers. Bringing online shopping aspects to offline retail will enrich customer experience. Augmented Reality (AR) interfaces developed for devices, linked to a physical Smart Space to bridge the gap between offline and online retail aspects. The user is ready to interact with the products within the physical spaces while having access to online shopping features. Nowadays online sales are gaining encouragement over brick and mortar sales. Offline retailers are experiencing hardships to interact customers at physical locations. Online shopping is more engaging and provides more customer satisfaction as compared to brick and mortar shopping which traditionally does not offer online features.

However, now companies are following a unique approach to distribute services and products among multi-channel. There's significant progress in multi-channel retailing. Hence, a requirement arises for bringing online shopping features to offline retail and convergence of offline and online retail. Bringing online shopping aspects to offline retail will make shopping more connected, social, engaging, and fun.

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