Augmented Reality Shopping Tool

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ABSTRACT
Have you ever wished to shop without employees constantly asking if you need any help or those times when you have questions to ask but employees are nowhere to be found? This augmented reality shopping tool can alleviate these problems with a touch of a button and all it requires is a smart phone with a working camera. With help of this AR shopping technology, shoppers will be able to find out all the information on the tip of their fingers from price, availability, sale, style, colour and even reviews on a specific product without having to ask the employees. This study/tool aims to solve complications that may arise from lack of information provided by retailers and make shopping a better experience for the shoppers. It saves time for shoppers so that they can spend more time shopping and less time waiting.

Author Keywords
Human-computer interaction; Interactive technologies; Augmented reality; Shopping

INTRODUCTION
An AR shopping experience is not a new concept. Infact, there are stores that already utilize this technology to promote their brand. During this pandemic retail stores have struggled with keeping their stock clean, since tags are not always clearly visible using an app that can recognize the product and display pricing information, which will reduce points of contact. Similarly a system that can display different styles will also reduce unneeded trips to the back of the store. What we ultimately want to accomplish is to create an app that users can easily interact with and find information on specific products in the store on their own.

RELATED WORK
The present work draws on prior literature focused on AR Applications, such as the use of navigation, and the effectiveness of AR applications in shopping experiences.

Augmented Reality Shopping Experiences
Large shopping stores are often difficult to navigate and it can be overwhelming for customers to find specific information on a product or where a product is located [1,3]. Providing additional information to the user has been a common theme in the application of AR tools [1,2,3]. Solutions have been explored to incorporate AR with ML models to show customers where a product would be located regardless if it's in stock, using a Google Maps-like navigation functionality to guide customers through a store. [1]. Research has also found that the use of AR applications improved customer speed to find items by 2 - 3x times [3].

Effectiveness of Augmented Reality applications
Other works have performed surveys on customer behaviour and experiences and found that AR applications in retail and shopping environments enhances user experience [2]. Customers agreed that during the pre-purchase phase of the shopping experience, AR applications aided in the decision making process of purchasing a product [2].

Contribution
We intend to explore the concept of providing more product information to the user by utilizing object detection functionality for real world objects. This would provide users the ability to use their smartphone and smartphone camera to view an in store product, learn more information and take further steps in their shopping experience.

CONCEPT
To help conceptualize our project we first created low fidelity sketches. Following, we created a Rotoscope to further establish the concept of the AR application.

Sketches
The sketches illustrate the user's view in store as they hold their phone toward a product item to gain more information about it. In Figure 1, a user holds their phone up to view a t-shirt. The AR app detects the t-shirt and displays a user interface to show "Available colours" and "Reviews". Figure 2 incorporates user interactivity where the user can view "Other Locations" they can purchase the product, displayed in Figure 3.

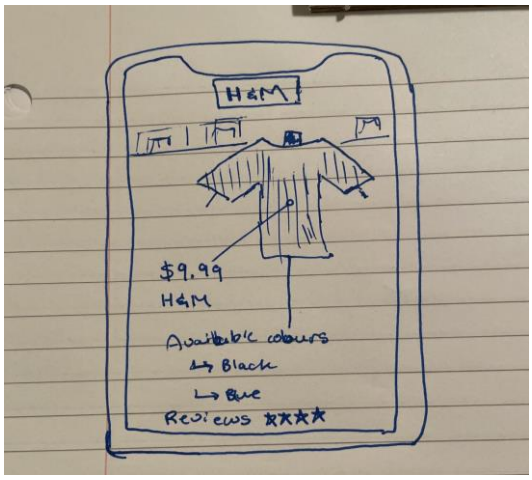


Figure 1. Sketch of AR app viewing a T-shirt for more info.

Figure 2. Sketch of AR app viewing a box of cereal. User selects "Other Location" to see other locations to purchase.

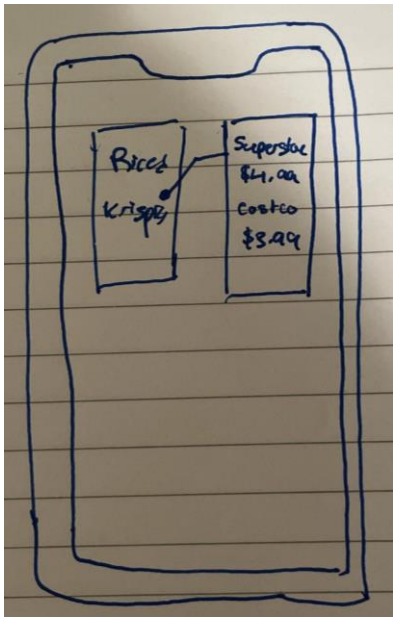
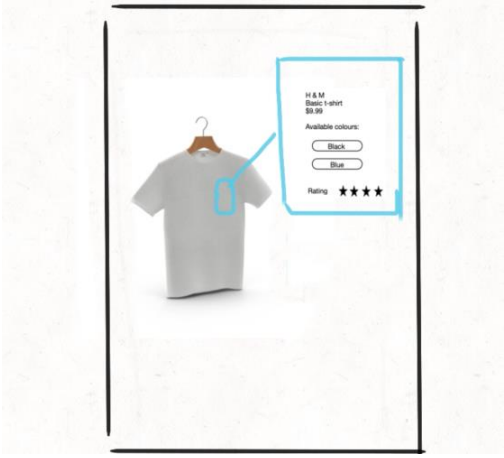


Figure 3. Sketch of AR app displaying other locations to purchase cereal.

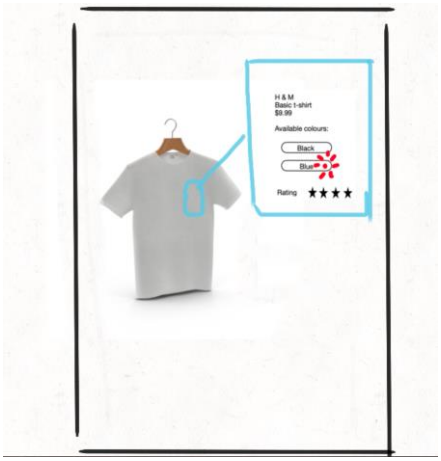
Rotoscope

The Rotoscope demonstrates how the user interacts with the AR application. We envision when the user browses for items in a store, the user will hold their phone for the AR application to view an item. The application detects the item and displays information about the product such as product name, price, reviews, and allows the user to select different colours of the product. The Rotoscope sketches depicts a user browsing a t-shirt, viewing the AR application, and selecting a blue and black t-shirt colour.

Rotoscope 1. User initially holds the phone for the AR app to view a t-shirt in store.

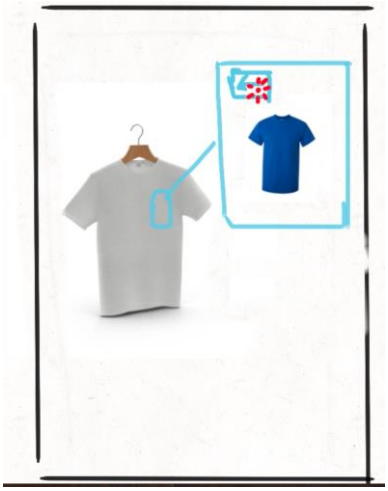


Rotoscope 2. AR app detects t-shirt and displays the User Interface to view different colours.

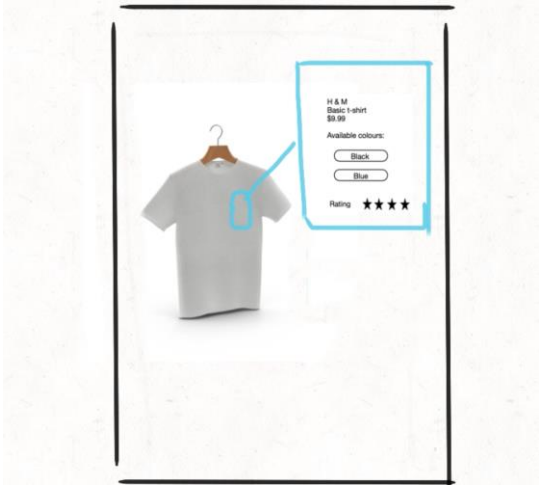


Rotoscope 3. User selects the "Blue" button.

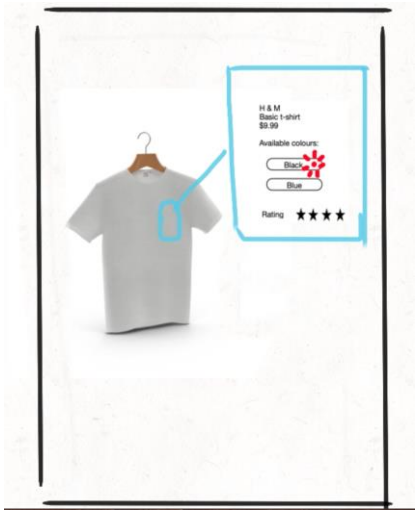
Rotoscope 4. User Interface displays blue t-shirt.



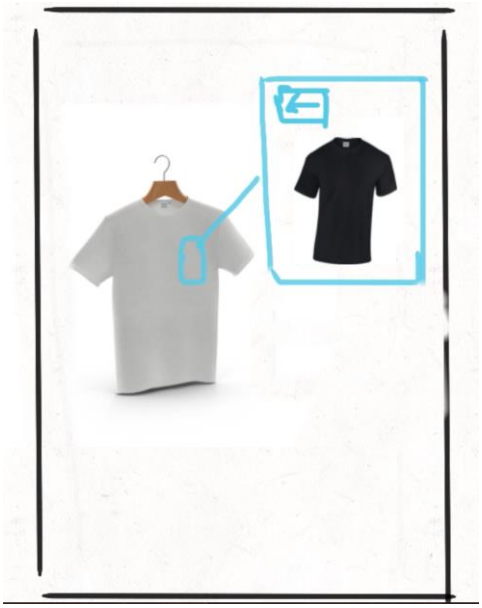
Rotoscope 5. User selects the "back" button.



Rotoscope 6. User Interface returns to the main screen.



Rotoscope 7. User selects the "Black" button.



Rotoscope 8. User Interface displays black t-shirt.

SYSTEM

Our system implements two different variations of our original concept: Object Detection and Image Detection.

Object Detection Demo

The Object Detection Demo depicts our Unity application viewing and detecting a plant (Figure 4 - 5), displaying a User Interface, different angles of the interface (Figure 5), and the user interacting with the interface by adding and removing items to the cart (Figure 6 - 7).

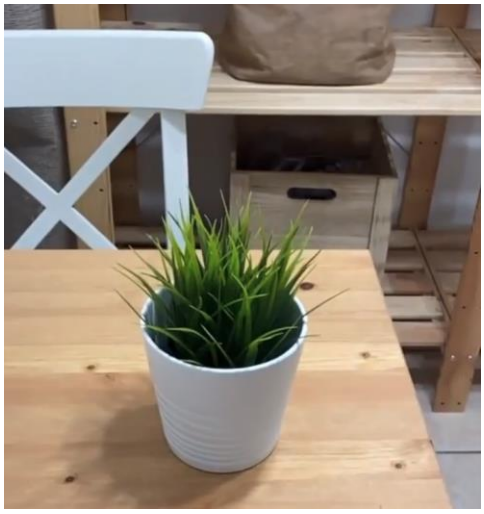


Figure 4. User initially holds the phone for the AR app to view an object in a store.

Figure 5. User interface appears after detecting the object.

Figure 6. User moves around to view User Interface, front facing.

Figure 7. User selects the "up" arrow to add the object to the cart.

Figure 8. User selects the "up" arrow to add two objects to the cart.

Figure 9. User selects the "down" arrow to remove all objects to the cart.

Image Detection Demo

The Image Detection Demo depicts the user viewing an image in order to simulate viewing a long sleeve shirt in a store. The demo demonstrates how the user would interact with the interface to view different shirt colours.

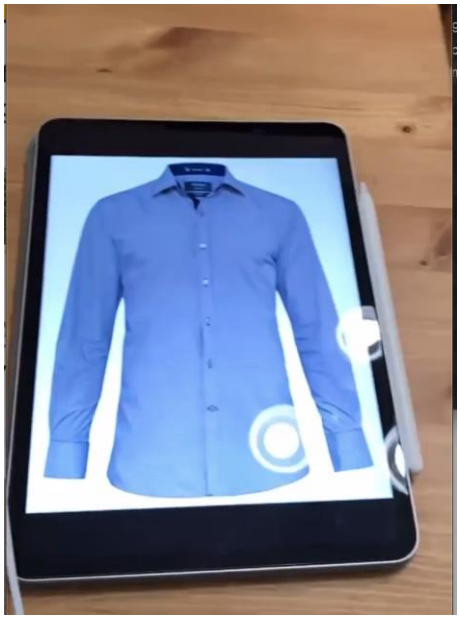


Figure 10. User initially views the image.

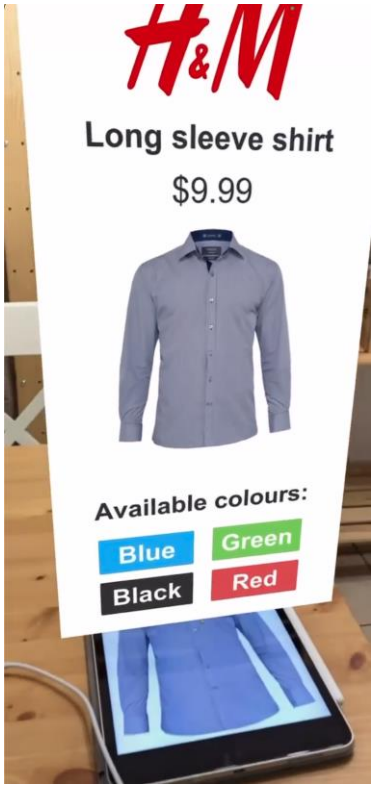


Figure 11. AR app detects image and displays User Interface.

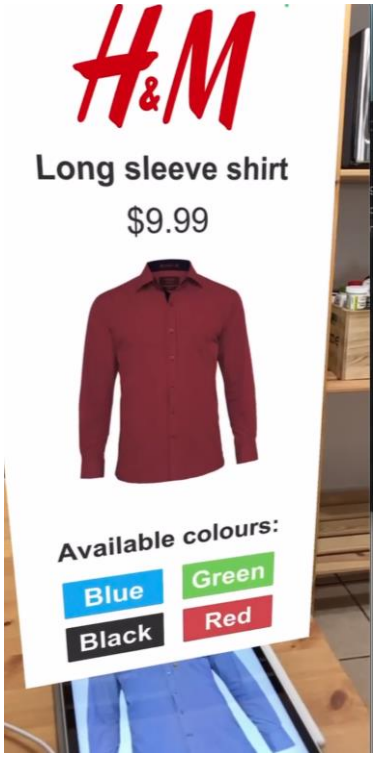


Figure 12. User selects "Red" to view a red long sleeve shirt.

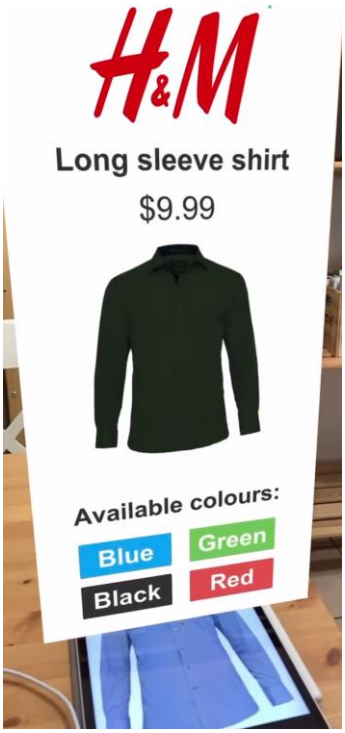


Figure 14. User selects "Green" to view a green long sleeve shirt.

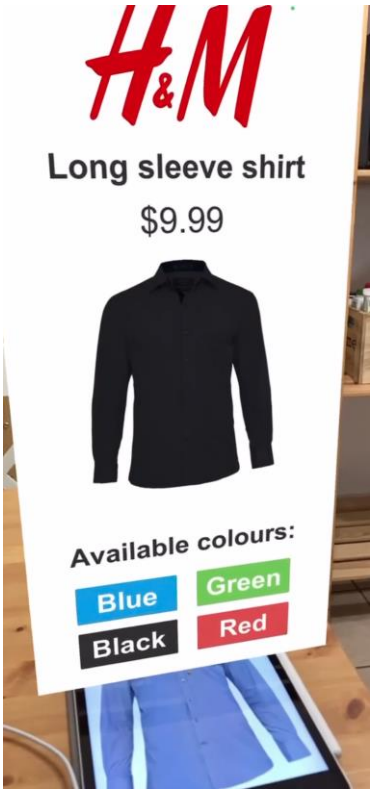


Figure 12. User selects "Black" to view a black long sleeve shirt.

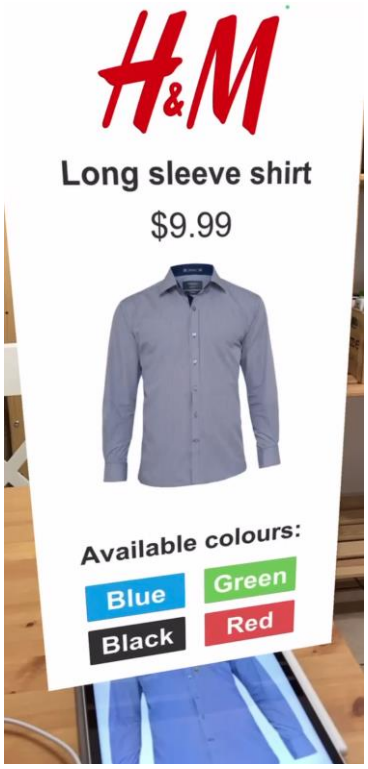


Figure 15. User selects "blue" to view a blue long sleeve shirt.

SYSTEM DESCRIPTION AND CHALLENGES

The current system allows the user to scan one specific image and one specific object, upon scanning the image or object a

custom user interface will popup and allows limited interaction from the user. The most challenging part of implementing the project was placing the user interface over the image or object tracked and ensuring the user could interact with the user interface. To accomplish this we had to create a script to pass the AR camera and position of the image to the prefab when the image or object is scanned. Another difficulty was generating the object file, this required over 30 scans and due to many merges the initial position (where the initial x, y, and z values are placed in the object) of the object file was incorrectly placed, which introduced errors when placing the user interface.

POSSIBLE APPLICATIONS SCENARIOS

The MR application was designed with the reality of COVID-19 in mind. Due to the pandemic many retail stores were mandated to enforce social distancing within their facilities. As a way to help to reinforce this mandate, the AR shopping tool allows users to browse items in a store safely, view different variations of an item they like, and add items to their shopping cart and to be picked up at check out without having to physically touch any items. This encourages people to enter retail stores safely and minimizes the spread of COVID-19.

LIMITATIONS

Our original goal was to create multiple panels with information that can be swiped left or right. Due to bugs regarding image positioning the current implementation only works with a single screen/panel. So, there is a limited amount of information that we can display for a single product. The app also only works with one image due to difficulties implementing multiple image tracking with different prefabs. Due to time constraints and some unforeseen difficulties in creating the 3d object scans, only one object is able to be scanned. The app also has difficulties in scanning the 3d object, with testing we found that it seemed to only work in the same lighting condition the object files were generated in and it only works when scanned from specific angles.

FUTURE WORK

For future implementations, it would be great to display a digital 3d form of the product for users to view. This will allow users to have a better understanding of the product they are purchasing without having to physically contact them. Another feature may be to enable digital interaction such that people are able to 'try on' clothing for an example. The user interfaces are also hardcoded for each object or image at the moment, future work could focus on pulling data from a product database to dynamically display the information needed. This would require that the prefabs be created at runtime and attached to the correct object or image files. Future work could focus on the advantages of generating the object files using the lidar system on the newer iPhones.

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