

# Experimental Study On Virtual-Reality Based Retail Mall Called “V-Mart”

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## Abstract

V-Mart is a virtual reality-based smartphone application that will allow users to experience the immersive-ness and lifelike quality of a typical brick-and-mortar shop with a few added advantages of an e-commerce website, employing low-cost devices with limited interaction capabilities. In this article, we provide some of our findings for developing and constructing a VR-based retail mall, as well as outline the approach utilized to create V-Mart. With the available technology and our V-Mart prototype implementation experience, we believe that 3D retail apps are possible.

## Keywords

Virtual Reality; Augmented Reality; 3D E-commerce; COVID-19; Pandemic; Online shopping.

## 1. Introduction

V-Mart is a virtual reality-based smartphone application that will allow users to experience the immersive-ness and lifelike quality of a typical brick-and-mortar shop. The World Health Organization (WHO) proclaimed the new pathogenic Covid-19 outbreak to be a Public Health Emergency of International Concern following the outbreak. Everything was shut down, and no one was permitted to be out in public for any purpose. When the government imposed social distance rules and a limit on the number of people permitted in shopping malls, consumers flocked to internet shopping since it was more convenient. But, when it comes to buying, the most essential component is "trust," which e-commerce websites do not provide since consumers do not have the opportunity to inspect the goods in person, which is a key factor in allowing the consumer to make an educated decision. As a result, this V-Mart solution was created, which combines the benefits and convenience of e-commerce websites with the in-store experience.

V-Mart focuses on providing people with all of their monthly necessities. Customers that use V-Mart will be able to shop at their leisure, from anywhere and whenever they choose. Users may stroll through the mall, selecting and inspecting anything they desire to purchase in 3D. When the user selects the product, the screen will display all of the relevant information about the product. If the user does not want to spend too much time exploring, they can utilize the navigation or search functions. Users will be able to rate and express comments on their shopping experience and particular goods, and they will also receive suggestions based on their input and purchase history.

## 2. Literature review

In (Walczak, Sokołowski, & Dziekonski, 2018) various methods and their limitations for interacting with users in virtual reality environments are discussed. Various devices and their benefits and drawbacks have been discussed. The author also discussed a solution to the aforementioned issues by introducing a new interaction method known as the

CSII (Contextual Semantic Interaction Interface) technique. It is based on client-server architecture, with the server being a 3D virtual space and the client being a smartphone, and communication between them being via Wi-Fi.

In (Glazer, Hobson, Deming, Royer, & Fehlhaber, 2010) A method is provided for displaying the location of the store to the user in a 3D simulation via web browser to provide the user with a lifelike shopping experience. This is accomplished by receiving a request, after which the server displays the store's webpage to the user.

In (Maas & Hughes, 2020) The initial focus is on using AR and VR technology in e-commerce and how it may improve existing shopping techniques. The second emphasis is on integrating 2D shops into open-world games, which will result in consumer satisfaction while utilizing VR stores.

### 3. Existing system architecture

Brick-and-mortar shopping entails customers' physical presence and face-to-face interaction with retail items and employees. Though brick-and-mortar businesses have many advantages such as in-person interaction with the product, no risk of fraud, free delivery, consumers can take home products' the same day they bought it, and the most significant difference is that it is extremely difficult to replicate the experience these brick-and-mortar stores provide. However, there are a few limitations in the current system, which are as follows:

#### **Existing system constraints:**

**Operating hours and timings:** There are no stores that can remain open 24 hours a day, seven days a week. As a result, the customer must adjust their schedule and be available according to the store's operating hours.

**Crowd:** In times when social distancing is practiced, going to physical stores where people come from different cities and mass gatherings occur is extremely dangerous.

**Delivery:** No physical stores deliver to customers' homes.

**Queues:** Customers must wait in line for their turn to scan each item and pay, which takes a long time.

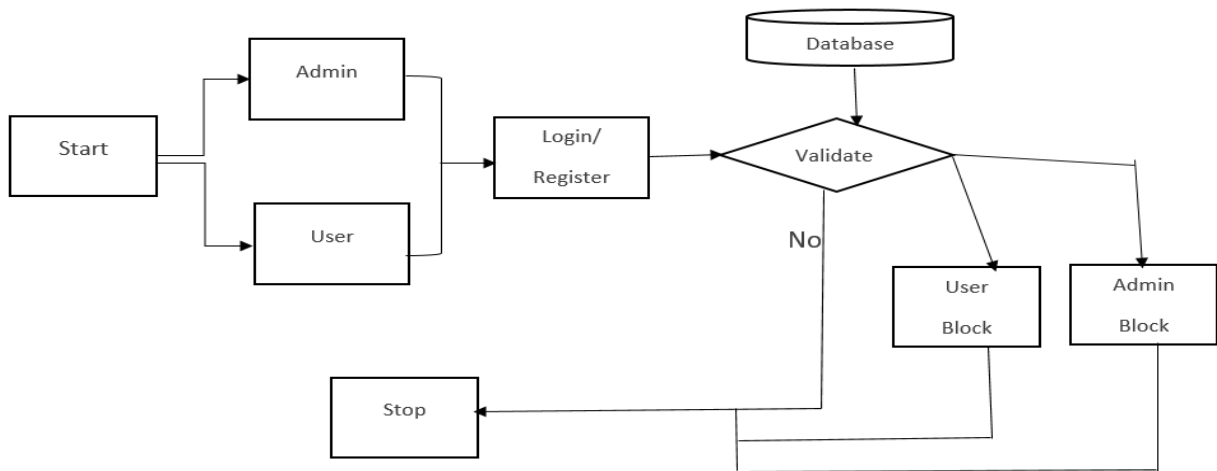
**Size constraint:** Products are limited due to store size constraints, which is why physical stores have limited products.

**Shopper preferences:** People of the younger generation are more technologically savvy, so they will always prefer online shopping over traditional shopping.

This project aims to address the limitations of the current system by creating a solution that combines the immersive and lively experience of traditional stores with the additional functionalities of e-commerce from the comfort of one's own home.

### 4. Proposed system architecture

Figure. 1 Shows the workflow of the proposed system. The proposed system is explained by dividing it into two blocks, one for the user-end process and other one for the admin-end process.



**Figure. 1 Proposed system workflow**

#### 4.1 User block

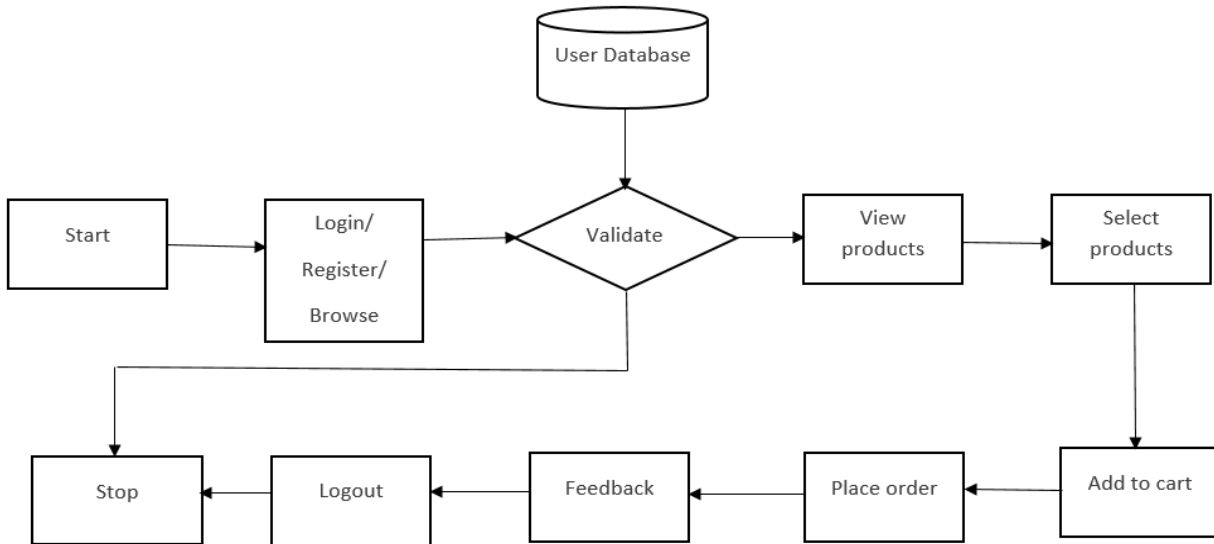
Any new user will have the option of registering or browsing the mall and adding products to their cart without registering. If the user tries to check out, he or she must first register and log in to the app with their credentials in order to use any applicable coupons and place the order.

**Figure. 2 V-Mart log-in page**

#### Log-in/Register

Figure. 2 Shows the login page of V-Mart. To login to the system, the user is required to fill email and password fields. While entering the password, the password will be masked using different characters and this is done using Nodejs package called bcrypt, which is used for hashing and decrypting passwords. During the registration procedure, the

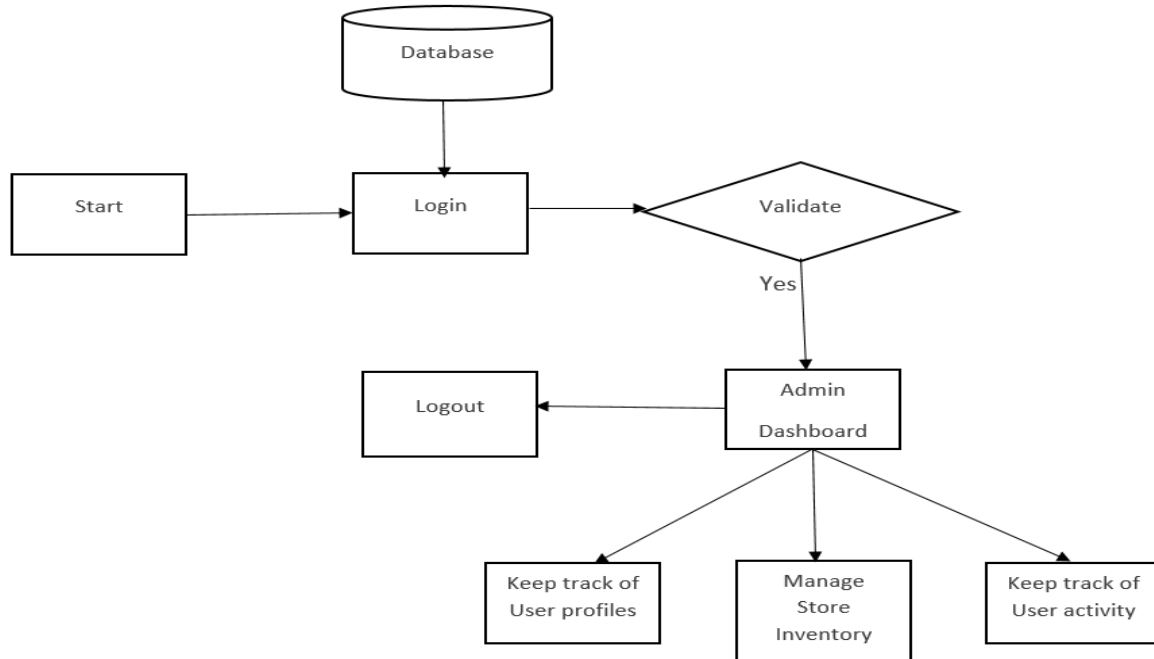
user's email address will be confirmed. New users will receive an email after successfully registering, and if they want to access through numerous accounts, they must use separate emails.



**Figure. 3 User end process**

Figure. 3. illustrates the process followed by the system from the user's perspective. A profile must be created in advance by the user who wishes to shop. The profile will contain all of your personal information, such as your location, which will be used to determine whether or not the app's features are available to you. During the login procedure, the user's credentials will be checked against those stored in the database to see if they match. Once the person has been validated through this way, they are free to continue purchasing.

With the help of a virtual reality headset, the user can browse multiple products and take a walk through a virtual mall. Users can add an item and control the quantity according to their preferences. Users can see the products they have added to their cart in my cart. Following that, the user can place an order. When it comes time to place an order, the user can see the total amount and choose any payment method. Users may view their orders in order history, and they can provide feedback on any product or the entire shopping experience.



**Figure. 4 Admin end process**

## 4.2 Admin block

Figure. 4 illustrates the process followed by the system from the admin's perspective.

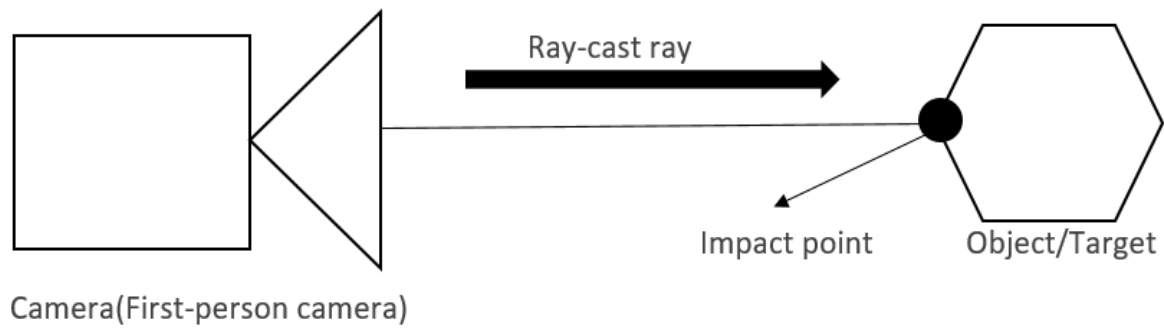
This system will be used by the administrator to track users and their activity, as well as manage the store's inventory. A database is used to track and update user profiles. The customer profile contains the e-personalized consumer's data as well as that of related individuals, such as people who share similar interest, so that V-Mart can offer the user the selections and information that may be of interest to him, as well as dynamically categorizing the relevant products to match each specific customer profile. The customer profile is immediately updated in the database as a result of user behaviors (e.g., shopping list creation).

The object tracing technique used in our project is illustrated in the next section.

### Object tracing process

The most crucial task in virtual reality shopping is to detect the object and interact with the object.

Figure. 5 represents the Object detection and interaction process.



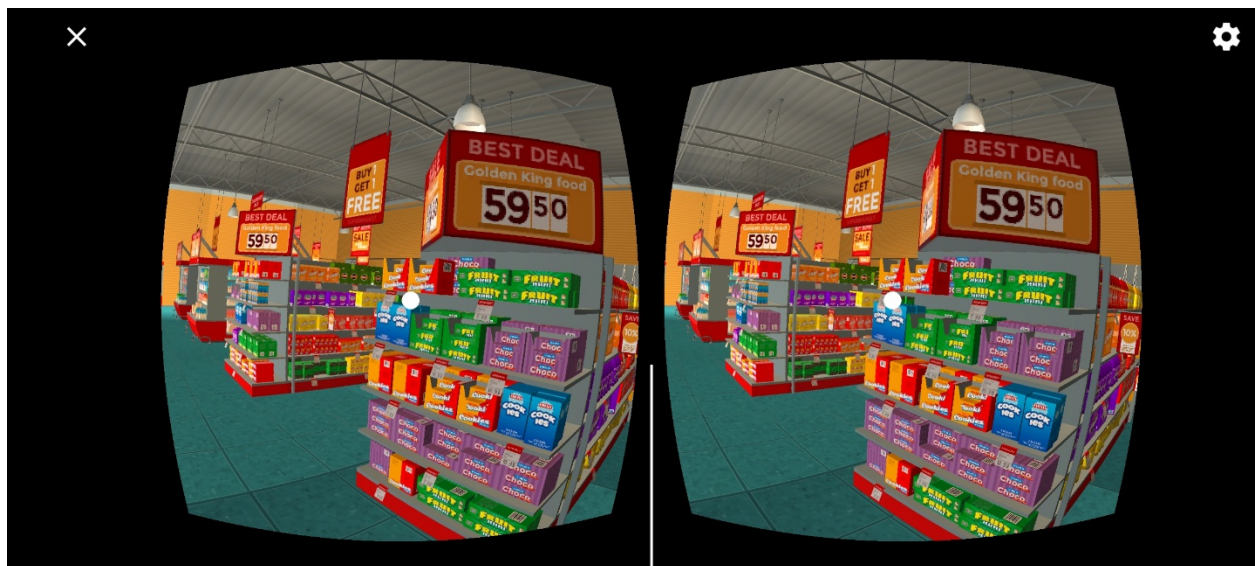
**Figure. 5 Object detection**

In Unity, a Ray cast function projects a Ray into the scene and returns a Boolean result if a target is successfully struck. When this occurs, information about the hit, such as the distance, location, or a reference to the object's Transform, can be saved in a Ray cast Hit variable and used later. Ray casting is extremely useful for getting information about other objects, conducting ground checks, and doing anything else that needs two things to be in line of sight.

## 5. Implementation

### 5.1 Software

The building, landscape, and shop interiors are initially sculpted in Autodesk 3Ds Max before being exported as .fbx files to Unity 3D for additional modifications. Various scenes were made in Unity 3d to transform a simple 3D model into a full-fledged game. Those scenes were then combined into a single file while building the application and generating the .apk file on mobile.



**Figure. 6 V-Mart model as seen through a virtual reality headset**

## 5.2 Hardware

This Unity application is compatible with a laptop or PC equipped with an Intel Core i3 CPU and 8MB of RAM (with additional virtual memory allocated because 3Ds Max consumes a lot of memory resources). The operating system is Windows 10.



**Figure. 7 SVR device**

While the suggested approach for showing a smartphone in VR may be done using practically any HMD, we choose to start with devices that allow for distant tests(For example Cardboard VR or any device having just a button mounted on the HMD) during the COVID-19 epidemic. Typically, such gadgets have limited interaction possibilities. As a result, our existing approach necessitated the usage of a the SVR(Smartphone for VR) device which is basically a Head-mounted device which can contain a smartphone inside it.

## 5.3 Backend and website programming

The database is built with the MongoDB database engine and has two tables that store user-related information such as profile tracking and order history. And keeping track of the store's inventory. Nodejs is used to provide backend

API services. It will submit a request to the backend, retrieve the data, and provide the necessary information to the frontend. The website was built with Bootstrap, HTML, CSS, jQuery, and Java Script.

## 6. Conclusion

Analysts predict that COVID-19 and other pandemics will persist in the coming decade. So, with the present circumstances of the covid-19 epidemic in mind, we planned and constructed a Virtual Reality-based retail mall called "V-Mart". This V-Mart prototype will be able to provide users with the in-person interactivity with products, inspection of retail items, walk and browse-through quality of a traditional brick-and-mortar store with the benefits of e-commerce websites such as search and navigation functionality, relevant recommendations, availing coupons/discounts, secure payment, and, most importantly, the convenience of shopping from home using only a low-cost VR headset and mobile. Anyone with an internet connection will be able to enjoy this immersive shopping experience through the V-Mart application. With the available technology and our V-Mart prototype implementation, we believe that 3D retail apps are feasible.

## References

- Glazer, E., Hobson, C., Deming, E., Royer, C., & Fehlhaber, J. (2010). *Virtual reality shopping experience*.
- Helena Van Kerrebroeck, Malaika Brengman, & Kim Willems. (2017). Escaping the crowd: An experimental study on the impact of a Virtual Reality experience in a shopping mall. *Computers in Human Behavior*, 77. doi:10.1016/j.chb.2017.07.019
- Lin-hendel, C. (2017). *System and method for constructing and displaying active virtual reality cyber malls, show rooms, galleries, stores, museums, and objects within*.
- Maas, M., & Hughes, J. (2020, 03 14). Virtual, augmented and mixed reality in K-12 education: a review of literature. *Technology, Pedagogy and Education*, 29(2), 231-249. doi:10.1080/1475939X.2020.1737210
- Peukert, C., Pfeiffer, J., Meißner, M., Pfeiffer, T., & Weinhardt, C. (2019). Shopping in virtual reality stores: *Journal of*, 36(3), 755-788.
- Puspo, D. D., Yusuf, M. H., Mohd, H. M., & Rury Nugraheni. (2020). LEVEL OF USE AND SATISFACTION OF E-COMMERCE CUSTOMERS IN COVID-19 PANDEMIC PERIOD: AN INFORMATION SYSTEM SUCCESS MODEL (ISSM) APPROACH. *Indonesian Journal of Science&Technology*, 5(2).
- Walczak, K., Sokołowski, J., & Dziekonski, J. (2018). *Configurable Virtual Reality Store with Contextual Interaction Interface*. IEEE. doi:http://dx.doi.org/10.1109/HSI.2018.8431351