Magic Eyewear

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April 29, 2021

Table 1: Document version history

Proposal Version	Date	Reason for Change
1.0	25-April-2021	Proposal First version's specifications are defined

GitHub: https://github.com/yaraamrsalah/Magic-Eyewear.

Abstract

Magic Eyewear is a smart mirror (virtual try-on software) implementation that allows customers to virtually view glasses on themselves. This web application tackles the issue of needing to personally visit a physical store to purchase suitable glasses. A key challenge of this project is implementing a perfectly smooth software that can satisfy all ends. The development process will mainly rely on three.js with the help of Figma. The web application should offer a smooth and easy user experience.

1 Introduction

Online shopping has recently become an almost essential necessity, especially with the presence of the Covid-19 pandemic. As helpful as it is, it can put a barrier between the customer and having a real-life experience of the product. That is where virtual try-on softwares offer a helping hand.

1.1 Background

When it comes to purchasing apparel, eyewear, accessories, etc. it can be difficult to figure out which item will be most suitable. Hence why some E-Commerce websites are starting to implement aforementioned softwares as they provide an-almost hands-on experience of desirable items as well as the ability to try a variety of products. Within this context, eyewear is especially complicated and risky to buy online because to find a pair of glasses that perfectly fits the face, a person has to personally see how they look on them to decide whether they are suitable. Several international eyewear websites, such as EyeBuyDirect, have already adopted a smart-mirror to allow customers to try glasses on before purchasing them. However, as for now, there are not any Egyptian stores that offer such a tool, making Eyecare Optics the first optics company in Egypt to provide customers with the ability to try-on glasses without the hassle of going to the physical store.

1.2 Problem Statement

There are countless physical eyewear shops. Nonetheless, visiting an on-ground store has become more of a hassle rather than helpful. It can be a waste of time to visit shops without the certainty of finding a suitable pair of glasses. And even with online shopping, more often than not, photographed products may not match the customer's expectations upon delivery, which wastes money -minimally the delivery fees-, and waiting time for the product to be delivered. This project aims to save time -and possibly money- by providing a virtual try-on software and ultimately making the users' online shopping experience a lot easier. In addition to making glasses more accessible without the obstacle of being unable to visit the store.

1.3 Motivation

1. This is an intriguing problem since despite it being so common, there has not yet been any solutions offered by Egyptian eyewear stores to fix it.
2. This issue occurs when people would like to buy glasses but they do not want to go through the trouble of traditional shopping or are not sure if the glasses they buy online will suit them.
3. The current solution is an at-home try-on option by Happy Vision. The customer can choose up to three frames to try them on at home.
4. A more convenient solution is introducing the Egyptian optics market to virtual try-on softwares, and eventually encouraging all companies to provide more attainable products.

2 Project Description

Our web application mainly targets those looking to buy glasses, allowing them to try different types of glasses through their laptops to know which glasses suit them the best without going to the store. Also, this feature will benefit the client and users by applying social distance, especially in this pandemic.

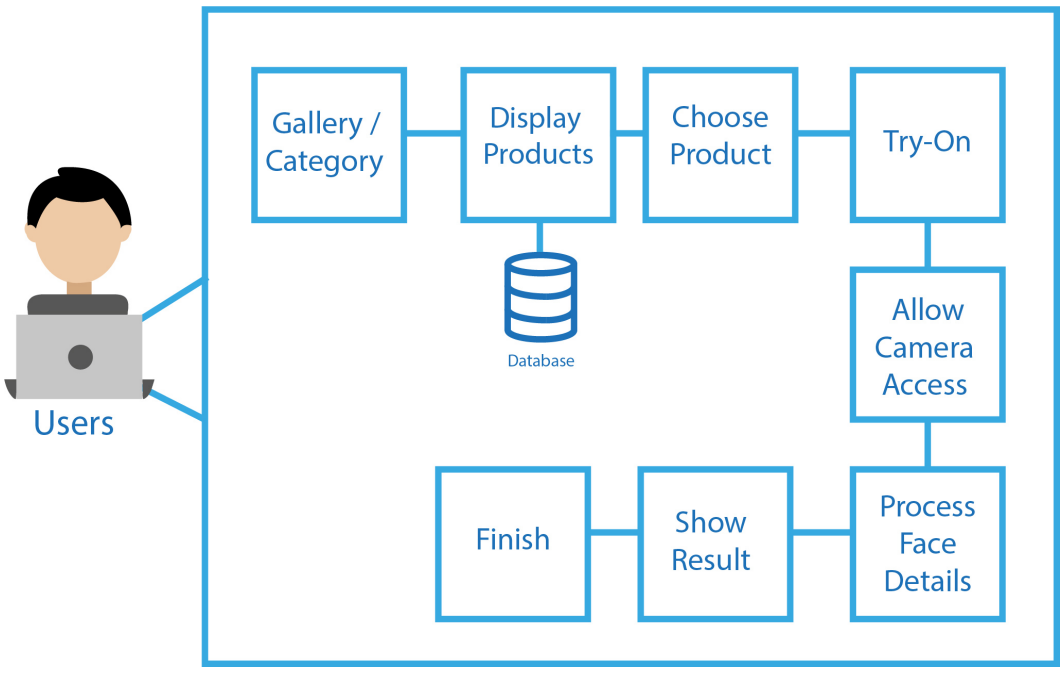


Figure 1: Magic Eyewear architecture

2.1 Objectives

- To help users find a suitable pair of glasses through virtually trying them on.
- To make finding specific glasses easier, the Navigation bar will have categories like women's glasses, men's glasses, kids' glasses, a guide to choose the right glasses based on the user's face shape, and About us.
- To reduce the time of searching, we will add filters to be easier for the user to reach the glasses he wants.

2.2 Stakeholder

2.2.1 Internal

Team Leader: Yara Amr

Team Members:
- Samiha Hussein
- Ragaa Moustafa
- Farida Hesham

*Final roles are yet to be determined.

2.2.2 External

- Client: Eyecare Optics.
- End-Users: Anyone interested in buying glasses.

3 Similar System

3.1 Academic

In the paper "A virtual try-on system for prescription eyeglasses.", Zhang, Qian, Yu Guo, et al. discussed the issue of how eyeglasses frames are likely to look different after being equipped with prescribed lenses. [1]

1. **Main Problem Statement**

   The problem statement of this journal is that the displayed frames in stores are equipped with demo lenses that do not have corrective power, hence, do not accurately deform the eyes due to refraction like glasses with corrective lenses would, which leads to customers often not liking the glasses when trying it on post fitting in the prescribed lenses.

2. **Researchers Contribution to Solve the Problem**

   The researches aimed to solve this issue through **three** main solutions:

   - Generating a 3D representation of corrective lenses that fit the user's eyeglasses prescription and chosen frame

   - Describing an image-based rendering technique for virtually inserting prescription glasses into the input video while taking into count the effects of refraction, reflection and shading

   - Performed a user study that highlights the importance of refraction and reflection in the perceived realism of virtual try-on results

3. **Dataset Used**

TABLE I
EXAMPLE OF AN EYEGLASSES PRESCRIPTION.

	Sphere	Cylinder	Axis	PD
OD	-4.25	-0.75	160	64
OS	-4.50	-	-	

Algorithm 1 Shading Estimation

Input: intersection points p between camera rays and face geometry; color $I_{\text{noGlasses}}(\text{p})$ from RGB image.
for each point p **do**
  $S_{\text{noGlasses}} = (0, 0, 0)$;
  $S_{\text{withGlasses}} = (0, 0, 0)$;
  Sample the hemisphere at p with weight w_i;
  for each sample point q_i in the hemisphere **do**
    ray direction $\vec{\text{d}}_i = (\overrightarrow{\text{pq}_i}) \,/\, \|\overrightarrow{\text{pq}_i}\|$;
    $\text{S}_i = \text{w}_i * \text{EnvMap}(\vec{\text{d}}_i)$;
    $S_{\text{noGlasses}}$ += S_i;
    if ray $\overrightarrow{\text{pq}_i}$ does not hit eyeglasses frame **then**
      $S_{\text{withGlasses}}$ += S_i;
    end if
  end for
  $I_{\text{withGlasses}} = (S_{\text{withGlasses}} \,/\, S_{\text{noGlasses}}) * I_{\text{noGlasses}}$;
end for
Output: color $I_{\text{withGlasses}}(\text{p})$ at each intersection p.

4. **Main Results Reached**

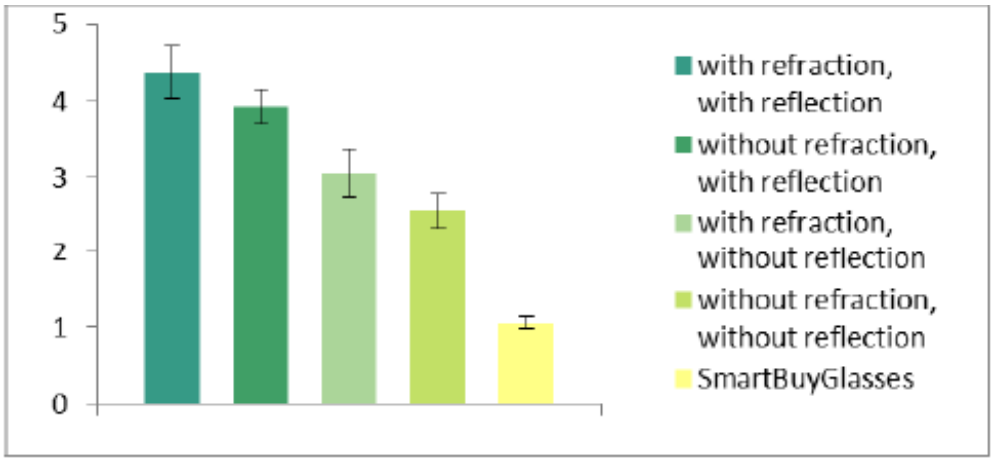


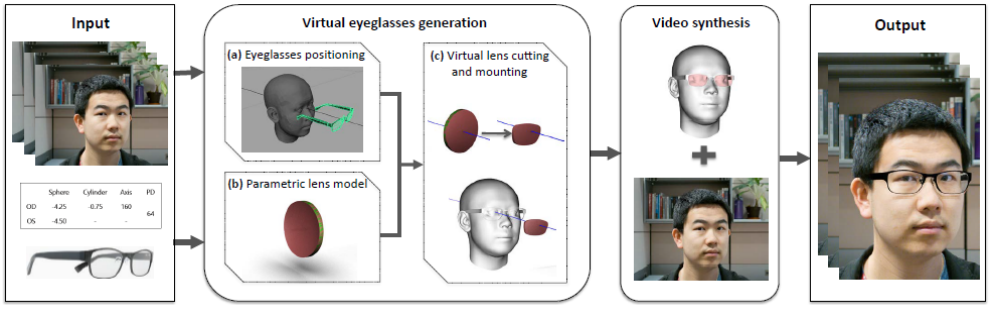
TABLE II
VOTING RESULTS FOR VIRTUAL TRY-ON VIDEOS.

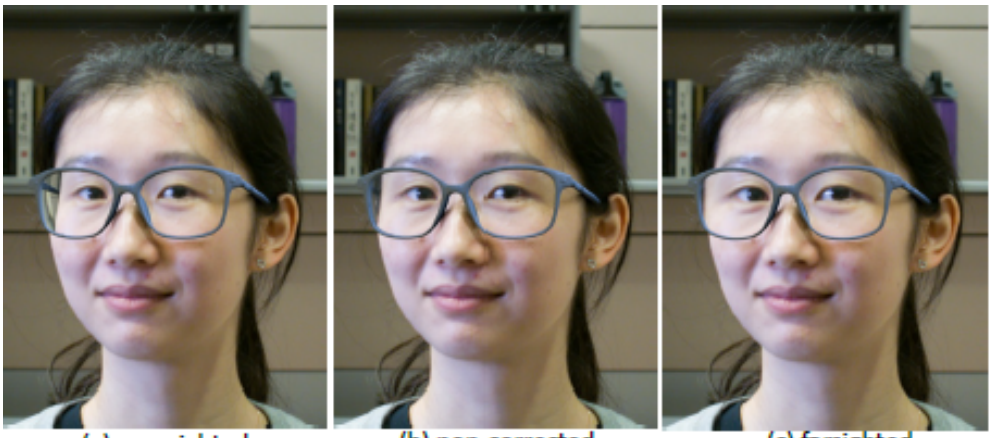
Preferences	with refraction, with reflection	without refraction, with reflection	with refraction, without reflection	without refraction, without reflection	SmartBuy-Glasses
with refraction, with reflection	-	62.50%	86.67%	87.50%	99.17%
without refraction, with reflection	-	-	74.17%	89.17%	100.00%
with refraction, without reflection	-	-	-	66.67%	97.50%
without refraction, without reflection	-	-	-	-	98.33%
SmartBuyGlasses	-	-	-	-	-

5. **Critique of the Paper**

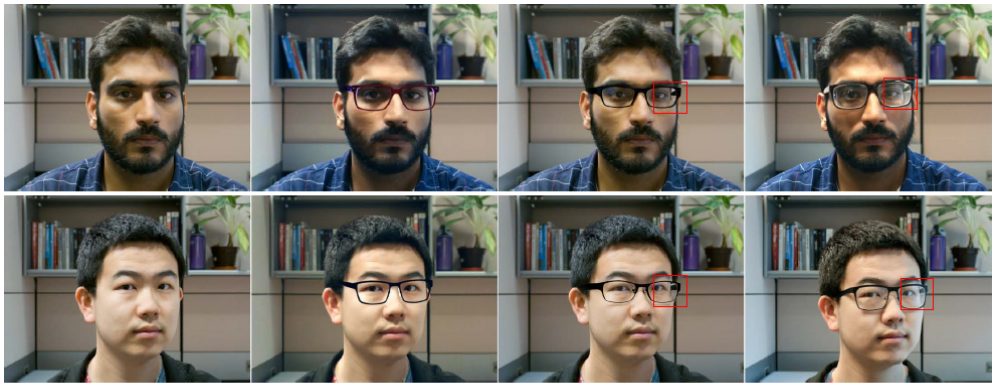
   The journal is not very informative and detailed, but it is also simply written, making it easy to understand despite not having prior knowledge about the topic. It covered one of the issues that face glasses wearers when purchasing a new frame, which is the lenses problem. That said, a limitation is that it only covered one side of the problems that face people who wear glasses. To explain, it did not discuss how their software can save both time and money by allowing users to try glasses from the comfort of their own home, which also fixes the accessibility problem.

6. **Figures**





(a) nearsighted (-5.00D) (b) non-corrected (0.00D) (c) farsighted (+3.00D)



(a) Input image (b) Result from online eyeglasses store (SmartBuyGlasses) (c) Our result: with refraction, with reflection. (d) Real reference image

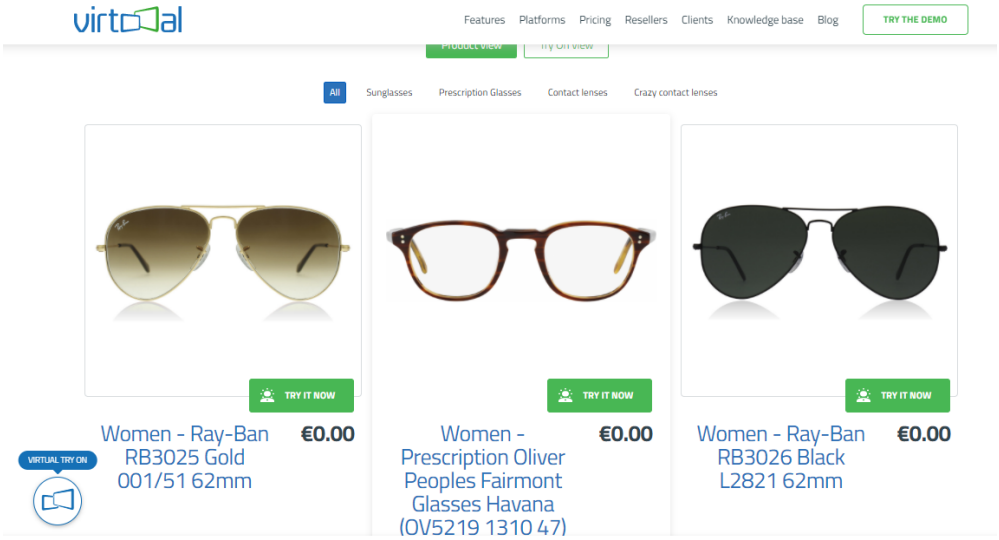
3.2 Business Applications

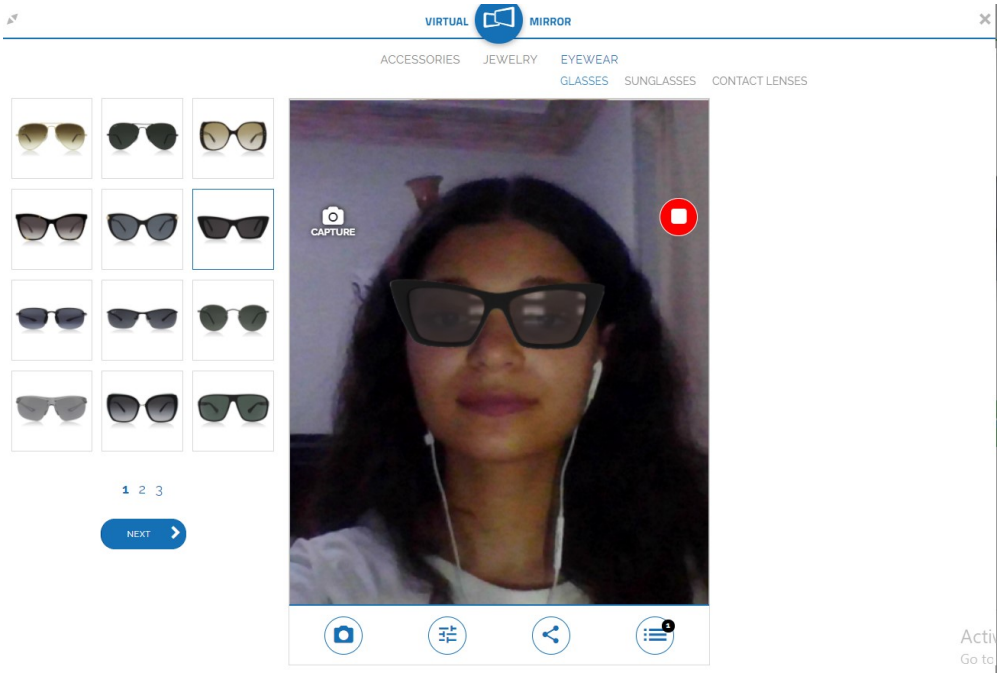
There are multiple applications in the software market that aim to provide the virtual eye-wear try-on experience, some of which are sophisticated, and others are of simpler structure;

Advanced Software Examples:

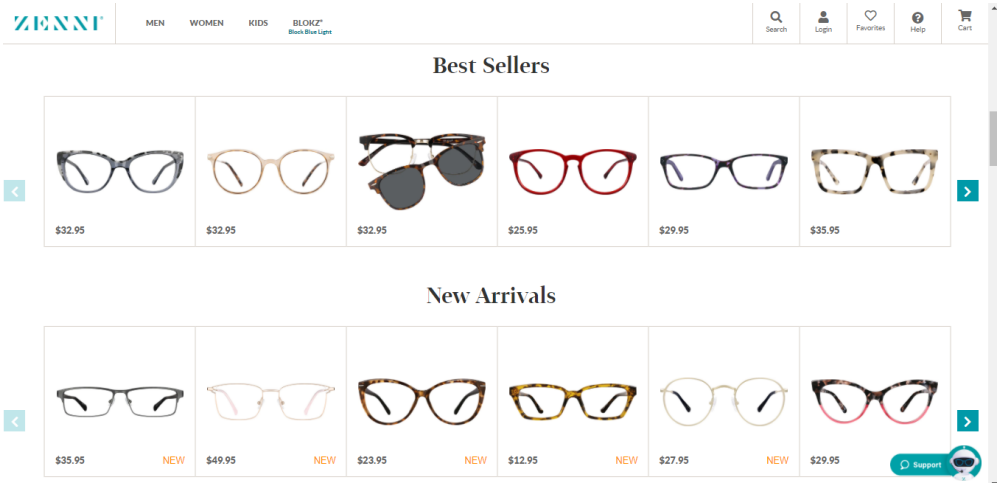
- Virtooal

  Virtooal is a virtual try-on software for different wearables, one of which is eyewear. It displays the available products, each having a 'Try It Now' button to enable virtually trying them on.




VIRTUAL MIRROR
ACCESSORIES
JEWELRY
EYEWEAR
GLASSES
SUNGLASSES
CONTACT LENSES
CAPTURE
1 2 3
NEXT

- Zenni


ZENNI
MEN
WOMEN
KIDS
BLOKZ
Search
Login
Favorites
Help
Cart
Best Sellers
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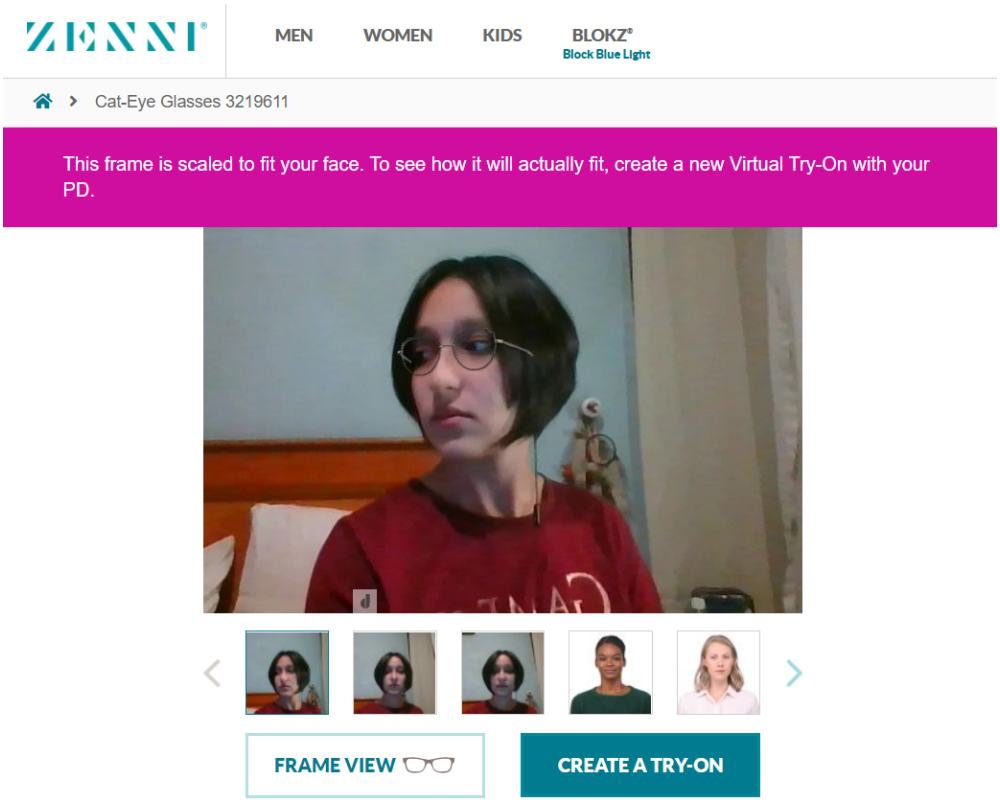
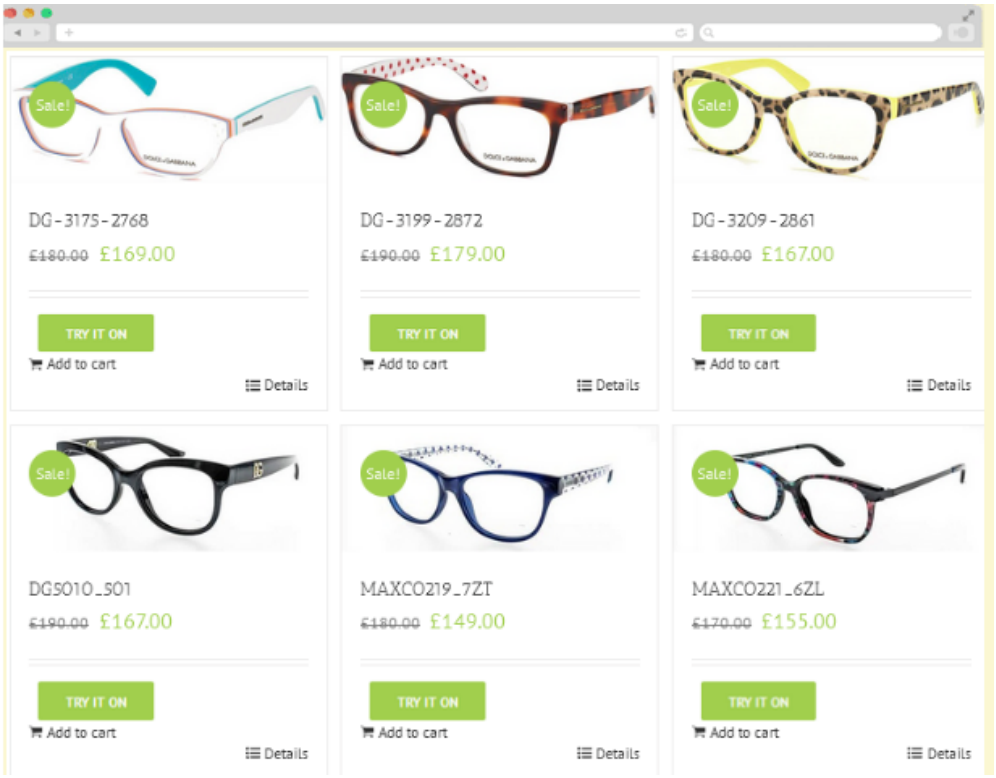
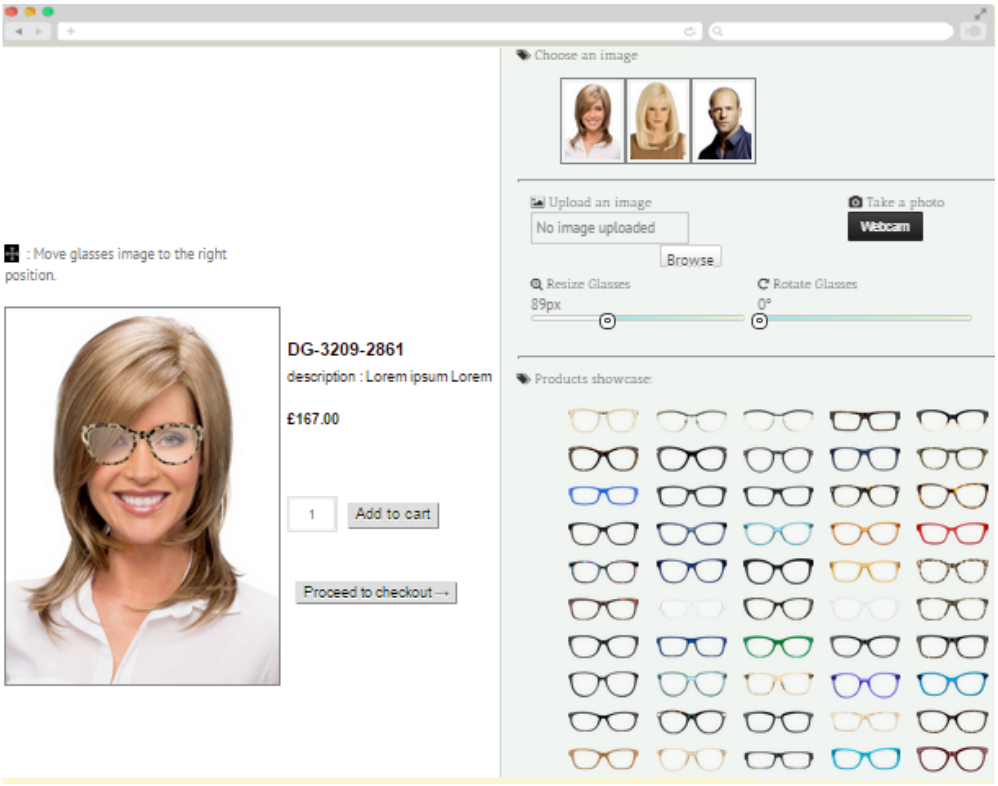


Basic Software Examples:

- Virtual Eyewear Try-on

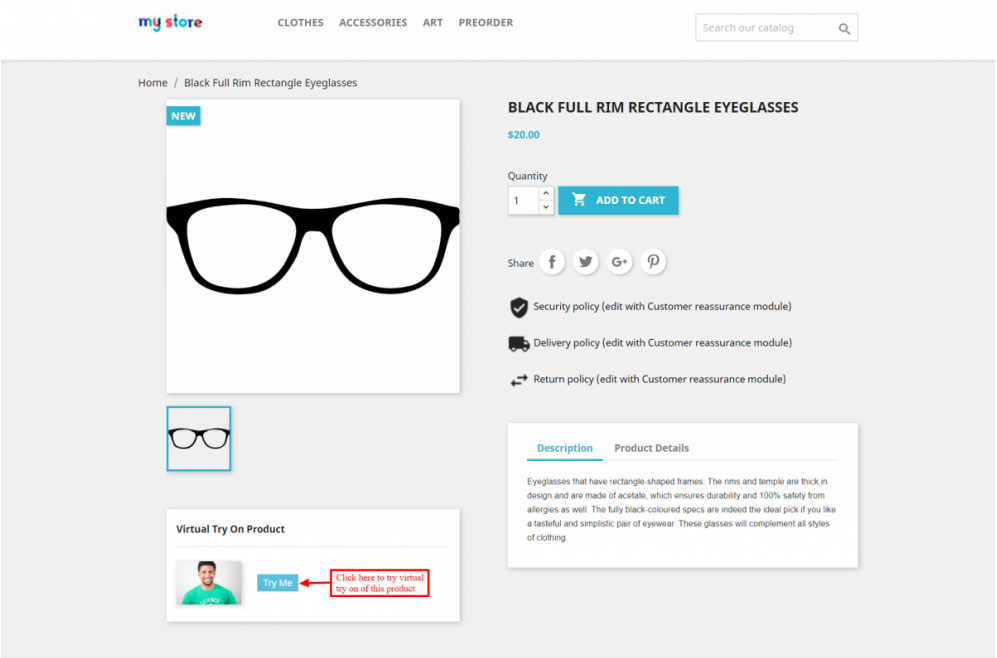
  This is a plugin for WooCommerce/Wordpress. It has less features and is not visually as pleasing. It is also quite simple, both in design and functionality.

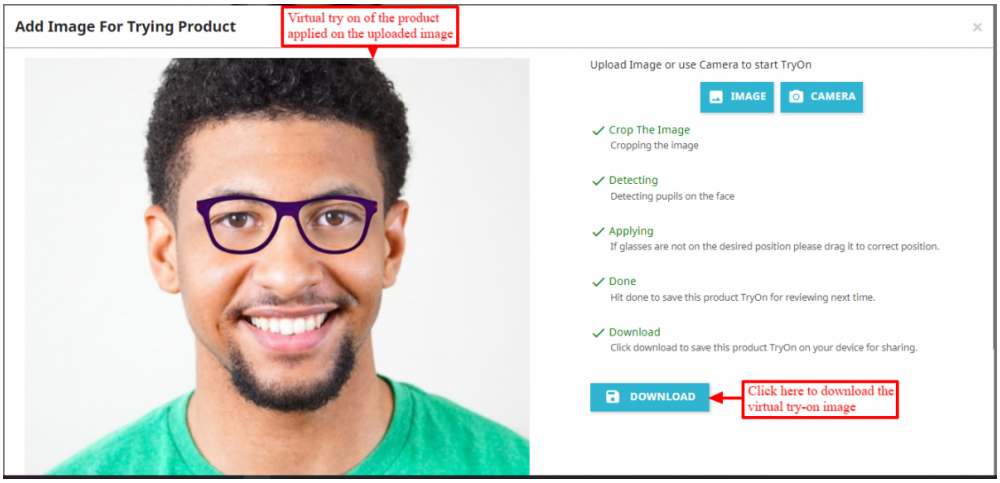




- Prestashop Virtual Try-On

  Prestashop also offers a simple virtual try-on. It has limited features and the glasses may not fit properly.





4 Project Management and Deliverables

4.1 Deliverables

- A smart mirror that allows users to try on different eye-wear products.
- An interactive website that displays the client's products.
- A detailed guide on how to use the web application.
- Brief market research documentation.
- Feedback from client (post-publication) .
- User experience survey (post-publication).
- Web application will be published online.

4.2 Tasks and Time Plan

Temporary Timeline

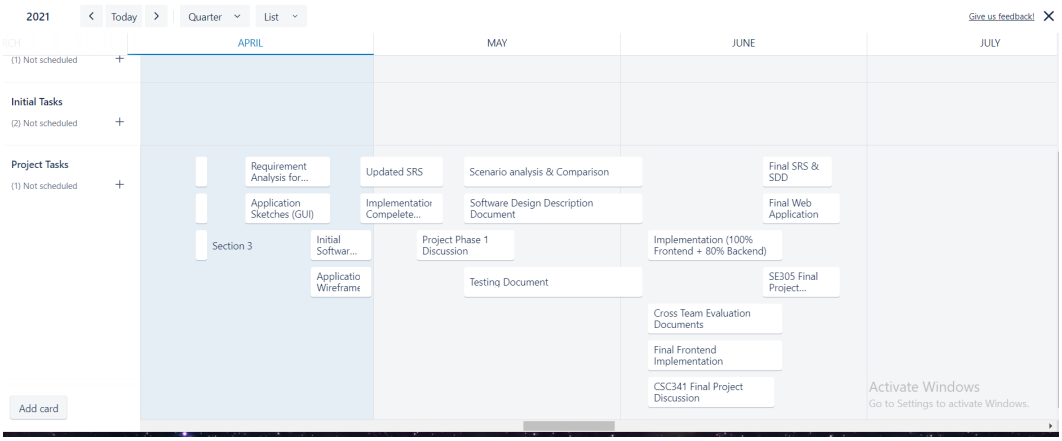


Figure 2: Project time plan

References

[1] Qian Zhang et al. “A virtual try-on system for prescription eyeglasses”. In: *IEEE computer graphics and applications* 37.4 (2017), pp. 84–93.