International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 12 Issue: 03 | Mar 2025 www.irjet.net p-ISSN: 2395-0072

Enhancing Jewellery E-Commerce Experiences: Integrating Augmented Reality (AR) with MyWebAR, and Virtual Reality (VR) with Three.js Library

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Abstract - *In this paper, we propose an innovative approach to enhance e-commerce experiences by integrating Augmented Reality (AR) using MyWebAR and Virtual Reality (VR) with Three.js, with a specific focus on jewelry items. By leveraging these technologies, our platform facilitates virtual trials of products, bridging the gap between online shopping and real-world experiences. Augmented reality and virtual reality offer promising avenues for immersive online trials, thereby improving user engagement and confidence in purchasing decisions. Furthermore, the integration of Web-based AR allows users to visualize products in their real environment, fostering interactive shopping experiences. Additionally, we introduce csm.ai, an AI-driven solution for automating the creation of 3D models from jewelry photos, making our approach innovative and accessible to sellers without requiring extensive technical expertise*

Key Words: Augmented Reality; Virtual Reality; online trials ; E-commerce; Web-based AR; MyWebAR; Jewelry; Three.js; csm.ai;

1.INTRODUCTION

In e-commerce, the challenge persists: photos and details of the product may be serving as the essential information about the product but these are not enough for providing customers with the confidence required to make more accurate decisions at the time of purchase[2][8]. As customers desire for more immersive and interactive experiences, the integration of Augmented reality and Virtual reality into e-commerce will be most promising solution[1].

Research highlights the importance of arousing emotions of the customer to stimulate satisfying cognitive state, by which customer behaviour and purchase intentions can be influenced. By integrating AR and VR, e-commerce platforms can create emotionally engaging environment that enhance customer satisfaction and also influence purchase decisions[13].

Incorporation of 360-degree view feature of product further improves the customer experience. This enables the detailed view of the product in each and every angle using Virtual Reality. Customers can view 3D design of jewellery item in our e-commerce platform and get detailed view of the product.

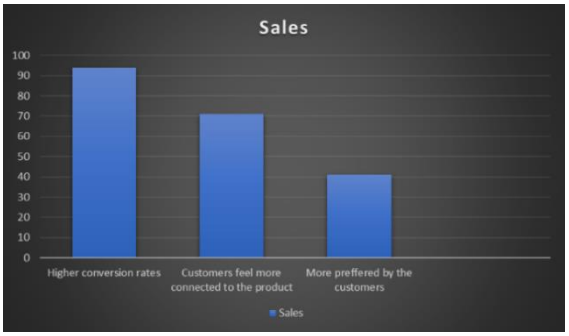

Fig - 1: Sales using AR/VR

2. Related Work

Lenskart's AR and VR

Lenskart's Augmented Reality (AR) technology transforms the eyewear shopping experience for consumers by offering an engaging and interactive platform. By utilizing sophisticated computer vision algorithms, Lenskart's AR feature enables users to virtually try on glasses from the convenience of their homes[5]. The process commences with users selecting a pair of glasses from Lenskart's vast catalogue on their online platform. Once a frame is chosen, the AR technology superimposes a virtual image of the glasses onto the user's face in real-time through their device's camera. This allows users to visualize how the glasses suit them before finalizing a purchase, boosting their confidence in selecting the ideal pair.

AR and VR in Snapchat

Snapchat utilizes a combination of computer vision, deep learning, and real-time image processing algorithms to create captivating experiences for its users through Augmented Reality (AR) technology. At the core of Snapchat's AR functionality lies the implementation of SLAM (Simultaneous Localization and Mapping), an advanced technique that enables the app to simultaneously track the position of the user's device and generate a detailed map of the surrounding environment in real-time. By employing SLAM, Snapchat analyzes the visual data captured by the device's camera, identifying significant features such as surfaces, objects, and spatial landmarks. This spatial comprehension empowers Snapchat to seamlessly integrate virtual elements into the user's perspective, effectively merging digital content with the physical world.

3. Proposed work /methodology

MyWebAR

During the implementation phase of our research, we have successfully integrated MyWebAR software into our e-commerce platform to transform the virtual try-on experience for jewellery. MyWebAR plays a crucial role in converting complex 3D jewellery designs into immersive augmented reality (AR) experiences that customers can access through their webcams. This innovative approach allows users to virtually test the jewellery in real-world settings, eliminating the need for traditional, time-consuming return processes. By offering customers the opportunity to "try before they buy," our goal is to enhance satisfaction, reduce post-purchase dissatisfaction, and build stronger customer loyalty and trust in our e-commerce platform.

One of the main benefits of using MyWebAR is its user-friendly interface and intuitive functionality. Through its drag-and-drop feature, users can easily upload images, videos, 3D models, and other assets to their AR scene without requiring specialized technical skills or a professional developer team. This democratization of AR creation empowers users from all backgrounds to create engaging and interactive virtual experiences tailored to their preferences. By simplifying the creation and launch process, MyWebAR allows for the quick deployment of AR content, ensuring a smooth and efficient integration into our e-commerce platform[3].

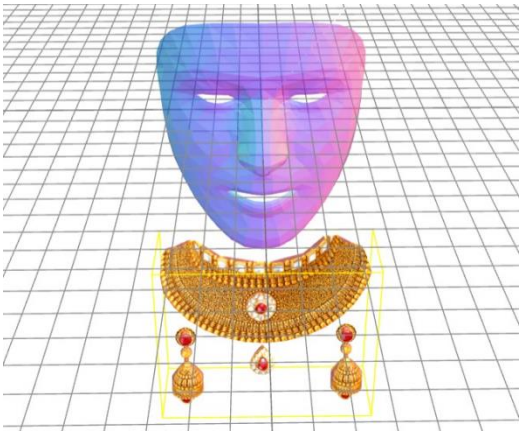

Fig - 1: Positioning jewellery in MyWebAR

Additionally, the Try AR feature integrated into our platform allows customers to access the AR experience with a simple click, enabling them to visualize the jewellery in their own environment effortlessly. This seamless user experience enhances engagement, promotes exploration, increases user interaction, and ultimately leads to higher conversion rates. By providing a more immersive and personalized shopping journey, MyWebAR improves the overall user experience and establishes our e-commerce platform as a pioneer in the adoption of AR technology in the jewellery industry.

Through MyWebAR, we enable individuals to explore their creative potential and envision new possibilities, enabling them to become active participants in crafting their personalized online shopping journeys. This inclusive strategy cultivates a feeling of belonging and empowerment within our customer community, reinforcing brand allegiance and fuelling enduring progress in the dynamic e-commerce sector[10].

In the domain of augmented reality (AR), the calibration matrix plays a crucial role in seamlessly incorporating virtual objects into the physical environment. The calibration matrix, often denoted by K, is a fundamental component in augmented reality (AR) applications, facilitating the accurate rendering of virtual objects in the real-world environment. It encompasses the intrinsic characteristics of the camera, such as focal length (fx, fy), optical center (cx, cy), and skew (s), capturing the geometric attributes of the camera lens and sensor [15].

The calibration matrix is typically represented as follows:

$$K = \begin{bmatrix} f_x & s & c_x \\ 0 & f_y & c_y \\ 0 & 0 & 1 \end{bmatrix}$$

where:

fx and fy are the focal lengths of the camera in the x and y directions, respectively.

cx and cy represent the optical center coordinates, indicating the principal point where the optical axis intersects the image plane[4].

s denotes the skew coefficient, which is typically zero for most cameras due to their symmetrical design.

Additionally, the calibration matrix incorporates the intrinsic parameters necessary for correcting lens distortions, such as radial and tangential distortions. These parameters are often represented as k1, k2, p1, and p2, and are used to refine the accuracy of the calibration matrix.

After the calibration matrix has been determined during the calibration process, it is utilized to convert the 3D coordinates of virtual objects into 2D image coordinates in relation to the camera's perspective. This conversion is essential for AR applications to accurately superimpose virtual content onto the real-world environment, ensuring correct alignment and perspective[14].

Upon completion of the calibration process, the calibration matrix is utilized to convert the 3D coordinates of virtual objects into 2D image coordinates relative to the camera's viewpoint. This conversion is crucial for AR applications to precisely overlay virtual content onto the real-world scene, ensuring accurate alignment and perspective. In the context of MyWebAR, the calibration matrix plays a critical role in displaying AR jewellery in the real environment. When a user activates the AR try-on feature, the physical camera captures the user's surroundings, while the virtual camera showcases the chosen jewellery item on the screen. By utilizing the calibration matrix, MyWebAR guarantees that the virtual jewellery aligns with the user's perspective and seamlessly integrates into the real-world setting[7].

Furthermore, MyWebAR utilizes advanced computer vision algorithms to constantly enhance and adjust the calibration matrix in real-time. This adaptive calibration process responds to variations in camera placement, lighting situations, and environmental factors, guaranteeing a steady alignment and reliability of the AR content. Through the seamless integration of the calibration matrix within its structure, MyWebAR provides an engaging and realistic AR encounter that mesmerizes users and enriches their interaction with virtual jewellery in their physical environment.

Three.js

During the implementation phase of our research, we have utilized the capabilities of Three.js, a versatile JavaScript library and API that is compatible with all major web browsers. By integrating Three.js into our e-commerce platform, we have enhanced the visualization of jewellery by creating stunning 3D computer graphics directly within the web browser. This breakthrough technology eliminates the need for additional browser plugins, ensuring seamless compatibility across different devices and browsers.

In order to render VR jewellery designs on a web browser, we have successfully incorporated various essential mathematical concepts and techniques. These include the Perspective Projection Matrix, Viewport Transformation, and 3D Transformation and Projection. These components are vital in the development of an immersive and authentic VR experience for users, enabling them to engage with virtual jewellery pieces in a realistic setting.

The Perspective Projection Matrix is utilized to precisely project the 3D coordinates of virtual jewellery models onto the 2D screen space. In Three.js, this matrix is defined through the PerspectiveCamera object, which allows us to set parameters like field of view, aspect ratio, and near and far clipping planes. By adjusting these parameters correctly, we guarantee that virtual objects are displayed with accurate perspective and depth, thereby enriching the realism of the VR environment.

The perspective projection matrix, often denoted as P, is used to perform this transformation. It converts 3D coordinates (x, y, z) into 2D coordinates (x', y') on the screen.

$$P = \begin{bmatrix} \frac{2n}{r-l} & 0 & \frac{r+l}{r-l} & 0 \\ 0 & \frac{2n}{t-b} & \frac{t+b}{t-b} & 0 \\ 0 & 0 & \frac{-(f+n)}{f-n} & \frac{-2fn}{f-n} \\ 0 & 0 & -1 & 0 \end{bmatrix}$$

Where n and f are the near and far clipping planes, and l, r, t, b represent the coordinates of the viewing frustum.

The Viewport Transformation is used to match the projected 2D coordinates with the screen space, considering the dimensions and aspect ratio of the user's display device. This transformation is internally controlled by the Three.js renderer, which automatically tweaks the viewport settings to align with the user's screen resolution and aspect ratio. Consequently, virtual jewellery items are accurately displayed within the user's field of vision, regardless of the device they use to access the platform.

$$\text{xscreen} = \frac{w}{2} \times (x'+1) + \text{xoffset}, \qquad \text{yscreen} = \frac{h}{2} \times (y'+1) + \text{yoffset}$$

Where w and h are the width and height of the screen, and xoffset and yoffset are the offsets for centering the image.

Moreover, virtual jewellery models within the VR scene are positioned, oriented, and scaled using 3D Transformation and Projection techniques. With the utilization of Three.js, we make use of transformation matrices to perform precise translation, rotation, and scaling operations, enabling us to manipulate the position and appearance of virtual objects. Furthermore, perspective projection matrices are employed to project virtual jewellery models from 3D world space to 2D screen space, considering the perspective of the virtual camera and the user's viewpoint.

By incorporating these mathematical concepts and techniques into our VR-enabled jewellery e-commerce platform, we guarantee a seamless and immersive user experience. Through the accurate projection, transformation, and rendering of virtual jewellery models, users can interact with products in a realistic and captivating manner, enhancing their shopping experience and driving increased engagement and conversion rates.

With the inclusion of Three.js, our customers can now explore jewellery from every angle with exceptional detail and realism. The user-friendly interface provided by Three.js allows users to effortlessly interact with and manipulate 3D models of jewellery, providing them with a comprehensive understanding of the product before making a purchase decision. This immersive experience not only increases user engagement but also instills confidence in the quality and design of the jewellery, ultimately leading to higher conversion rates and customer satisfaction.

Furthermore, Three.js enables us to go beyond traditional 2D imagery and present jewellery in a dynamic and captivating manner. By animating and manipulating 3D objects in real-time, we create a compelling shopping experience that captures and retains the attention of our customers. The interactive features of Three.js allow users to zoom, rotate, and inspect jewellery in intricate detail, creating a sense of excitement and anticipation during the purchasing process.

In addition, the utilization of high-level libraries like Three.js simplifies the development process, reducing the time and resources required to create complex 3D computer animations for web display. This efficiency allows us to focus on enhancing the user experience and refining the presentation of jewellery, ensuring that our e-commerce platform remains at the forefront of innovation and technology in the jewellery industry [6].

CSM.AI

In our strategy for implementation, we have integrated csm.ai software into our e-commerce platform to streamline the process of generating 3D models for jewellery items. Through the utilization of artificial intelligence (AI), csm.ai allows us to efficiently convert jewellery photos into high-quality 3D models. This innovative method eliminates the necessity for manual 3D modelling by skilled designers, leading to significant reductions in time and costs related to 3D asset production. Additionally, the user-friendly interface of csm.ai does not require coding knowledge, making it accessible to a wide range of users, including sellers without technical expertise in 3D modelling.

The smooth integration of csm.ai with our e-commerce platform enables sellers to easily upload photos of their jewellery items, which are then processed by the AI algorithm to produce precise and detailed 3D models. This automation simplifies the onboarding process for sellers, allowing them to promptly showcase their products in an engaging and immersive manner on our platform. By eliminating entry barriers and simplifying product addition processes, we empower sellers to utilize our platform as a robust sales channel for their jewellery items.

By leveraging AI capabilities, we not only accelerate 3D model creation but also enhance the overall user experience for both sellers and customers. Sellers benefit from reduced costs and streamlined workflows, while customers have access to a broader range of jewellery items displayed in realistic 3D models. This integration of AI-driven technology underscores our commitment to delivering advanced solutions that enhance value and competitiveness in the jewellery e-commerce industry[12].

4. CONCLUSION

To summarize, the strategic integration of MyWebAR, Three.js, and csm.ai software has completely transformed the landscape of jewellery e-commerce. By utilizing MyWebAR's seamless AR conversion capabilities, we have given customers the ability to virtually try on jewellery items, creating a stronger connection and confidence in their purchasing decisions. The immersive 3D visualization provided by Three.js has taken the browsing experience to new heights, allowing users to explore intricate details of jewellery from every angle. Additionally, the efficiency of csm.ai in generating 3D models has streamlined processes for sellers, reducing costs and speeding up product listings. Together, these technologies have not only improved user engagement and satisfaction, but have also positioned our platform as a leader in innovation and accessibility within the competitive jewellery e-commerce market.

5. Scope of work

Collaborating with industry leaders such as Amazon and Flipkart offers a promising opportunity to utilize our innovative approach to jewellery e-commerce and achieve

mutual benefits through strategic partnerships. By integrating our AR-enabled virtual try-on technology with their established platforms, we can provide customers with a seamless and immersive shopping experience, thereby increasing engagement and driving sales for all parties involved.

Amazon and Flipkart, with their extensive customer base and wide reach, provide an ideal platform to showcase our AR-powered jewellery try-on feature to a larger audience. By offering this unique functionality, we can differentiate their platforms from competitors and attract discerning customers who appreciate immersive shopping experiences. Additionally, our collaboration can serve as a competitive advantage, positioning Amazon and Flipkart as pioneers in adopting innovative technologies in the e-commerce industry.

Furthermore, our collaboration can extend beyond the implementation of AR technology. By sharing data and insights on customer preferences and behavior, we can collectively optimize product offerings, pricing strategies, and marketing campaigns to better meet the needs and expectations of consumers. This collaborative approach fosters a synergistic relationship where all parties benefit from shared knowledge and resources, ultimately driving growth and profitability in the jewelry e-commerce sector[9].

Moreover, by integrating our AR-powered solution with Amazon and Flipkart's existing infrastructure, we can streamline the implementation process and reduce friction for sellers interested in adopting this innovative technology. This simplified onboarding process makes it easier for sellers to leverage our platform and showcase their jewelry products to a global audience, thereby expanding their reach and driving sales.

To summarize, the partnership between our AR-powered jewellery e-commerce platform and renowned industry leaders such as Amazon and Flipkart offer a valuable chance to improve the online shopping experience, boost sales, and encourage innovation in the e-commerce sector. By utilizing the strengths and resources of each party, we can generate value for customers, sellers, and platforms alike, ultimately establishing a mutually beneficial situation for all stakeholders involved.

6. Future work

In our future endeavours, we envision the creation of a React application that seamlessly integrates the tools and technologies mentioned above, thereby enhancing the overall jewellery e-commerce experience. By leveraging React's component-based architecture and extensive ecosystem, our goal is to develop a user-friendly and dynamic platform that fully utilizes the potential of MyWebAR, Three.js, and csm.ai software.

Through the utilization of React's capabilities in building interactive user interfaces, we intend to optimize the integration of MyWebAR for virtual try-ons. This will enable customers to effortlessly visualize jewellery in their real-world environment. Additionally, by making use of React's state management features, we aim to enhance the dynamic rendering of 3D models using Three.js, providing users with an engaging and immersive browsing experience.

Moreover, the development of a React application will allow us to seamlessly incorporate csm.ai's automated 3D modelling capabilities into our platform. By integrating their API and effectively managing data, we will streamline the process of generating and displaying high-quality 3D models of jewellery items. This will empower sellers to efficiently showcase their products to a global audience.

REFERENCES

[1] M. A. Kodandarama and S. Chandrashekar, "Augmented Reality Solution for Retail Using Visual Commerce Engine," 2016 IEEE International Conference on Cloud Computing in Emerging Markets (CCEM), Bangalore, India, 2016, pp. 173-175, doi: 10.1109/CCEM.2016.041.

[2] X. Li and D. Chen, "Registration Correction for Augmented Reality in E-Commerce," 2009 International Conference on Management and Service Science, Beijing, China, 2009, pp. 1-4, doi: 10.1109/ICMSS.2009.5303794.

[3] X. Zhang, N. Navab and S. . -P. Liou, "E-commerce direct marketing using augmented reality," 2000 IEEE International Conference on Multimedia and Expo. ICME2000. Proceedings. Latest Advances in the Fast Changing World of Multimedia (Cat. No.00TH8532), New York, NY, USA, 2000, pp. 88-91 vol.1, doi: 10.1109/ICME.2000.869552.

[4] X. Li and D. Chen, "Augmented reality in e-commerce with markerless tracking," 2010 2nd IEEE International Conference on Information Management and Engineering, Chengdu, China, 2010, pp. 609-613, doi: 10.1109/ICIME.2010.5478308.

[5] M. Atalar and M. Özcan, "New augmented reality application in E-commerce and M-commerce," 2017 International Conference on Computer Science and Engineering (UBMK), Antalya, Turkey, 2017, pp. 332-336, doi: 10.1109/UBMK.2017.8093403.

[6] W. J. Yun and J. Kim, "3D Modeling and WebVR Implementation using Azure Kinect, Open3D, and Three.js," 2020 International Conference on Information and Communication Technology

Convergence (ICTC), Jeju, Korea (South), 2020, pp. 240-243, doi: 10.1109/ICTC49870.2020.9289518.

[7] N. T. Singh, S. Singh, S. Singh, A. Arora, A. Dhaundiyal and A. Narang, "Transforming E-Commerce: Augmented Reality (AR) and Virtual Reality (VR) Integration for Interactive and Immersive Shopping Experiences," 2023 7th International Conference on Electronics, Materials Engineering & Nano-Technology (IEMENTech), Kolkata, India, 2023, pp. 1-5, doi: 10.1109/IEMENTech60402.2023.10423551.

[8] VR/AR Application in E-commerce: a Literature Review: https://aisel.aisnet.org/whiceb2022/56/

[9] M. Riffat, A. Yasir, I. T. Naheen, S. Paul and M. T. Ahad, "Augmented Reality for Smarter Bangladesh," 2020 IEEE Green Technologies Conference(GreenTech), Oklahoma City, OK, USA, 2020, pp. 217-222, doi: 10.1109/GreenTech46478.2020.9289699.

[10] R. Timchenko, O. Grechnyev, S. Skuratovskyi, Y. Chyrka and I. Gorovyi, "Augmented Reality in Web: Results and Challenges," 2020 IEEE Third International Conference on Data Stream Mining & Processing (DSMP), Lviv, Ukraine, 2020, pp. 211-216, doi: 10.1109/DSMP47368.2020.9204240.

[11] B. E. Singgih, L. Yudistira, H. Wijaya and M. S. Anggreainy, "Implementation of Augmented Reality in E-Commerce Applications," 2021 2nd International Conference on Innovative and Creative Information Technology (ICITech), Salatiga, Indonesia, 2021, pp. 136-139, doi: 10.1109/ICITech50181.2021.9590104.

[12] M. Lu, J. Zhang, L. Tang and H. Wei, "Parametric 3D Visualization Modeling of the Human Body Based on 2D Photos," 2021 IEEE 2nd International Conference on Big Data, Artificial Intelligence and Internet of Things Engineering (ICBAIE), Nanchang, China, 2021, pp. 609-612, doi: 10.1109/ICBAIE52039.2021.9389918.

[13] AUGMENTED AND VIRTUAL REALITY IN E-COMMERCE – A SURVEY: https://web.archive.org/web/20220809171114id_/http://www.icicel.org/ell/contents/2021/11/el-15-11-12.pdf

[14] ARSC: Augmented reality student card An augmented reality solution for the education field: https://www.sciencedirect.com/science/article/abs/pii/S0360131510003040

[15] D. Gasques, W. Liu and N. Weibel, "The Virtual-Augmented Reality Simulator: Evaluating OST-HMD AR calibration algorithms in VR," 2022 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW), Christchurch, New Zealand, 2022, pp. 702-703, doi: 10.1109/VRW55335.2022.00202.