RESEARCH ARTICLE

A Novel Approach to Virtual Business Cards through Augmented Reality

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ABSTRACT

As augmented reality (AR) technology rapidly progresses, its application in mobile environments has witnessed extensive growth. This research project introduces an AR mobile application based on AR Foundation, with the objective of popularizing the AR lifestyle and allowing users to revel in the immersive fun of AR experiences. The main focus of this paper revolves around the utilization of the Vuforia Engine Database for scanning specific image targets uploaded by users. Upon successful recognition, virtual objects are superimposed onto the designated image targets. Users can then engage in functional operations by simply tapping the corresponding buttons displayed on their mobile phone screens, enabling logical transformations. Moreover, this project encompasses a web application that combines A-Frame and MindAR integration. For instance, when users interact with a particular social media icon on their mobile screens, they are seamlessly redirected to the respective person's social media account. The core intention behind this project is to present resumes in a modernized manner, departing from conventional approaches. Furthermore, this application greatly enhances the online and offline shopping experiences by providing users with a three-dimensional (3D) view of products, facilitating a more comprehensive understanding of the multi-dimensional development of intelligence.

Keywords: Virtual Networking Cards, Immersive Technology, Marker-based Interactive AR, Unity Engine, Vuforia Development Kit, Readyplayerme Avatar SDK, A-FRAME Development, MindAR Integration.

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INTRODUCTION

Augmented Reality is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory. Augmented reality (AR) is the integration of digital information with the user's environment in real time. Unlike Virtual reality (VR), which creates a totally artificial environment, AR users experience a real-world environment with generated perceptual information overlaid on top of it [1]. Virtual business cards are digital versions of traditional business cards that can be easily shared and accessed on electronic devices such as smartphones, tablets, and computers. They offer a more convenient and modern approach to exchanging contact information, and have become increasingly popular in recent years due to their many benefits.[2]. Virtual business cards can include all the standard information found on a traditional business card, such as the individual's name, job title, company name, phone number, email address, and website. Some virtual business card applications even allow for additional features such as links to social media profiles, videos, and personalized branding.

With virtual business cards, professionals can easily and quickly share their contact information with others through a simple tap or scan of a QR code. This eliminates the need for physical business cards and makes networking more efficient and environmentally friendly. Virtual business cards are also easy to update and can be personalized to suit individual needs and preferences. Overall, virtual business cards are a modern and practical solution for professionals who want to streamline their networking efforts and present themselves in a more professional manner.Sure, here is another example of an introduction to virtual business cards. In today's digital age, virtual business cards are becoming an increasingly popular and effective way to exchange contact information. With the rise of smartphones and other mobile devices, people are looking for more convenient and efficient ways to network and stay in touch with others. Virtual business cards offer a solution to this problem by providing a simple and effective way to share contact information electronically.

Virtual business cards are not only more convenient than traditional business cards, but they are also more environmentally friendly. By eliminating the need for physical cards, virtual business cards helps to reduce waste and save natural resources. Additionally, virtual business cards are more cost-effective in the long run since they can be easily updated and don't require the expense of printing and shipping physical cards. As more and more professionals rely on technology to conduct business, virtual business cards have become an essential tool for networking and building relationships. With their ease of use and customization options, virtual business cards provide a modern and effective way to exchange contact information and make a lasting impression on potential clients, partners, and colleagues.

The objective of the paper are as follows:
- To improve the marketing features online
- To ease the business owners and professionals in facilitating their networking processes where a creative environment is offered to increase the traders' brands awareness
- To provide a business card in modern way as well as to reduce amount of money their spending for printing and designing their business cards
- To reduce the no. of demo mobiles phones or other products to produce for spending money
- To analyse and implement new way of business card sharing with additional features and functions by recognizing the markers on the card for enhancing the process of business card sharing

Problem Statement
The issue with the traditional business cards is that the people do not even retain the card's owner details, and for spending huge amount of money for printing business cards. Some persons (i.e. some persons are may be freelancers, working professionals, product sellers and etc…) want to create more engaging and interactive way for

professionals and sellers to share their information. Traditional business cards can be lost or forget, and don't provide a memorable or dynamic experience. I believe that augmented reality technology can provide a more immersive and innovative way to share their business cards in modern way.

Proposed Solution

However, I will create an android and web application that named as Virtual Business Cards that uses augmented Reality technology to display a digital business card when viewed through a smartphone, tablet or other computing devices. The Virtual Business Card will be customizable, allowing user to add their contact information, Social media profiles, Videos, Images and any other relevant information are added in single virtual business card. And also, this paper covers marketing features too means suppose a person want to buy a phone from mobile shop and that sellers shows the demo model as based on availability. So, my paper helps to reduce the demo models production cost. That means we can saw the model in 3D (3-Dimensional) view via our application with changeable models.[4]

Result Achieved

This paper deliberates the business perspective. Now, more peoples are using smart phones and they are active on social media platforms. Virtual business cards have not only made networking more efficient, but they have also provided a platform for individuals to showcase their personal brand. With customizable design options, professionals can create virtual business cards that reflect their unique style and personality. By including personalized branding, such as a company logo or a distinctive color scheme, virtual business cards can help individuals stand out from the competition and make a memorable impression on potential clients or partners. Additionally, virtual business cards can include multimedia elements such as videos or links to social media profiles, which can provide additional context and give recipients a deeper understanding of the individual's expertise or business offerings. Virtual business cards have also made it easier to manage and organize contact information. Virtual business card applications allow users to save and organize contact information in one place, making it easier to keep track of important contacts and follow up with them in the future. In addition, virtual business cards have become an important tool for remote work and virtual events. With more people working remotely and attending virtual events, virtual business cards offer a way to exchange contact information and stay connected in a digital setting. Overall, virtual business cards provide a versatile and customizable solution for networking and personal branding in the modern digital age.

Background Study

Before moving on further let's understand the basic concept of how augmented reality works? What are the methodologies is used to project a 3d object? And etc… The augmented reality basically uses Recognition, Tracking, Image unwrapping and etc. for rendering a 3D object. we will discuss one by one. Recognition is nothing but the identification of any object/media, such as a barcode, our devices has software's to scan & recognize a barcode, similarly recognition of human faces through security systems. Tracking in Augmented Reality (AR) finds for a specific pattern or image that an AR application can recognize. Once the application finds the pattern, it constantly tracks the position of the pattern in real world space. So that the application can accurately place a digital object onto the marker that is being tracked.[3].

Markers are generally square shaped and many people make use of black bordered image inside the main frame with white colour inside of it. It basically helps to separate marker from the background frame. Internal graphics of the marker are often displayed distorted or pixelated. Image unwrapping is a process to unwrap a part of the image. When recognizing the images, it is necessary to apply image unwrapping. Black and white image or grayscale image is very efficiently wrapped. Marker-based Augmented Reality works by scanning a marker which triggers an augmented experience (Whether an object, text, video or animation) to appear on top of the image target in the device. Fig.1 shows the Marker-Based Augmented Reality Application workflow. Virtual business cards can be traced back to the early days of electronic business cards, which were first introduced in the 1990s as a digital alternative to traditional business cards. These early electronic business cards were typically exchanged via email or file transfer and lacked the convenience and ease-of-use of modern virtual business card applications. However, with

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the advent of smartphones and mobile devices, virtual business cards have become more prevalent and sophisticated. Today, there are numerous virtual business card applications available on various platforms such as Android, iOS, and web-based services, each offering unique features and customization options. The rise of virtual business cards can be attributed to several factors, including the need for more efficient and environmentally friendly networking practices, as well as the increasing reliance on technology in the business world. With more people working remotely and attending virtual events, virtual business cards have become an essential tool for staying connected and building professional relationships in a digital setting. Furthermore, virtual business cards have also become a platform for personal branding and self-promotion, with customizable design options and multimedia elements that can help individuals stand out from the competition. In conclusion, virtual business cards shows that they have evolved from early electronic business cards to modern digital tools for networking, personal branding, and contact management. Their popularity can be attributed to the need for more efficient and environmentally friendly networking practices, as well as the increasing reliance on technology in the business world.

METHODOLOGY

Traditional business cards have been a staple of professional networking for many years, but they have several disadvantages compared to more modern alternatives. One major disadvantage is that traditional business cards can be easily lost or misplaced. A study by statistic brain found that about 88% of business cards are thrown away within a week of being received, and only 9% are kept for longer than a year. This can make it difficult for people to follow up with contacts or remember important details from the meeting. Overall, Virtual business cards created through augmented reality offer several advantages over traditional physical business cards. They provide a more increased interactivity, improved information retention, are easily customizable, are portable, and are environmentally friendly. To develop an interactive Virtual Business Cards using marker based augmented reality that consists of buttons, Video players and etc. below procedure must be followed.

Procedure to be followed
- Firstly, download unity hub, recent unity version and Android studio. Create an account on Vuforia Developer portal. After that, create a new database in vuforia and upload the business card image target on vuforia developer portal.
- After that, download the Vuforia SDK (Software Development Kit) and download the database unity package too.
- Create a new unity project in unity hub and open it in unity. After that, delete the main camera and import vuforia SDK in unity. Then add the AR camera inside the sample scene.
- After that import the downloaded vuforia database package inside a scene. To add the license key in AR Camera properties panel. The license key available on vuforia developer portal.
- When we upload the image target in vuforia engine developer portal, based on the image the vuforia engine provides ratings. If rating is more than 3/5 the tracking done by more faster.
- After that we select the appropriate image from database inside a project and developing further user interface.
- When we finished the user interface, we use some c sharp to make animation and other working functionalities like when user click the particular button, they redirect to the appropriate location.
- For making better attractiveness we add some avatars using readyplayerme SDK.
- Finally, Build APK file using unity and android studio to install an application on android phone.
- Then we open that android application and place target image in front of the camera to see a final result.
- The android application works was done. Now, move on web application procedures.
- It's very easy in web application using normal html and JavaScript.
- Using AFRAME we create a 3D models effortlessly and using Mind AR (The JavaScript framework combined with three.js) this helps to provide augmented reality features.
- For our better user attractiveness we create an attractive user interface to get target images and other additional details of the user.

- For the dynamic experience, we use php server side scripting language for performing compiling options and other tasks and MySQL for database to store data.

Result Formulation

In this paper, the implementation of 3D Virtual Business Cards android application using unity, Vuforia SDK and Readyplayerme SDK provided results presented in the subsections below. Also, the alterations that need to be done while designing the card are specified in the subsections.

Project Creation

The very first step to creating a virtual business cards is to create a 3D project in unity after that delete the normal camera and import the vuforia SDK. After that, firstly change platform to Android by default it is windows. Then we add the AR camera inside the project.

Target Image upload in Vuforia Developer Portal

In the Virtual Business cards we using marker-based augmented reality technology. So, we need to upload image target into the database in Vuforia Developer portal. The very first step is to create an account in this portal and go to developer options and create a new database. For each database the vuforia developer portal generate a unique license key. Inside the database we upload image and it is providing star rating based on image classification (Fig.2). It uses Edge Detection Techniques generate pattern. For creating pattern they use lots of techniques that are the image is converted into gray scale, Image unwrapping and other algorithms. The rating must between 3/5 because more than 3 star rating provides better tracking features. It uses '+' sign for pattern creation(Fig.3). This is called feature points. After that we can able to download the database unity package and import the file into the project.[5]

User Interface Creation

After importing Vuforia database unity package we select the image target from the package and ready to design the buttons, adding avatars, Video players and etc. Using Readyplayerme SDK to add avatar on top of the image target. To add a rotation c sharp script (in Fig 4) into avatar object. This script helps to rotate the avatar. To create video player using build in functionalities we add a simple buttons for play, pause and stop performing the actions.

Final Result

After adding scripts, using canvas we create a button and to add other scripts to work the buttons efficiently. For creating video player we may create a plane and add the video clips on top of the image. Add the button that works play, pause and stop videos and use the default functions to that works. Fig.5 shows that the final result of virtual business cards. And another important thing is each 3D object and other components are child of the Image target. Because, when to tracking the target image only the child of the image target will be rendered as result. When the user clicks the appropriate buttons it is redirect to the user particular page. The output of the redirection shown in the Fig.6 and Fig.7. And the final result of virtual business cards android application marketing features are shown in Fig.8.

Usage of Virtual Business Cards

- With a virtual business cards, you don't have to carry around physical cards and worry about running out or losing them. You can easily share your contact information with others with just a few taps on your phone.
- Using virtual business cards is an eco-friendly way to exchange contact information. It reduces the use of paper and ink, which in turn helps to reduce your carbon footprint.
- Virtual business cards can be easily shared with people from all over the world. This makes it easier to network and build relationships with individuals who are not in your immediate vicinity.
- Printing physical business cards can be expensive, especially if you need to print large quantities or frequently update your information. Virtual business cards, on the other hand, are relatively inexpensive and can be easily updated as needed.

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- Using a virtual business card application can help you present yourself in a more professional manner. It shows that you are up-to-date with latest technology and are willing to adapt to modern business practices.

The usage of virtual business cards are Convenience, Environmentally friendly, Accessibility, Cost-effective, Increased professionalism and etc. Overall, Virtual business cards are a great tool for professionals who want to streamline the process of exchanging contact information and make a positive impression on their peers.

Web Application result
The virtual business cards web application also provide a same result of the android application. But comparatively web application provide dynamic experience to the users. The Web application is done by the following technologies HTML, CSS => for User Interface

PHP => for Server side scripting and user data management system
MySQL => for managing user data and virtual business card data
AFRAME => is used to creating 3D objects and 3D assets
MINDAR =>mindar help to work a web application using marker-based augmented reality.
Some of the code snippets of virtual business card web application are the following Fig.9 and Fig 10.

Login Page
This paper as mentioned earlier, Authenticate the web page is mandatory to create a virtual business cards. We are maintain the user's credentials as very secure. We use "Cryptographic hash function" to secure users password [6]. Before the user going to login page the user enter to welcome page with some welcome message. The welcome page of the virtual business cards web application in Fig.11. And login page of the virtual business cards shown the Fig.12.

Dashboard Page
If a user logs into the virtual business cards web application, they will be redirected to the dashboard page. Clicking the "Launch Dashboard" button grants the user access to create virtual business cards, with each user having their own allocated space. On this page, selecting the "Create New" button initially redirects the user to compile the target image using the open-source MINDAR image compiler. After completing the compilation process, the user can fill out a form with the appropriate details, resulting in the creation of a virtual business card on their page. Clicking the "Start" button for the virtual business cards prompts the webpage to request camera access from the user. Once access is granted, the user can display the target image in front of the camera, and the webpage will render the final output of the virtual business card.Fig.13 shows the dashboard page of virtual business cards web application.

Final Result
The above Fig.14 shows that the final output of virtual business cards web application.
All the users agreed that ARCards could benefits both the traders and companies. Besides, 86.7% of users rated ARCards in 5 stars. This indicates that the quality of ARCards is well approved by the users (Fig.15).[7]

CONCLUSION

This paper presented a Virtual Business Cards, a 3D business card android application as well as web application to overcome the challenges people face using a traditional business cards. Virtual business cards android applications provide a modern and convenient way to exchange contact information. They offer several benefits, such as convenience, environmental friendliness, accessibility, cost-effectiveness, and increased professionalism. By using virtual business cards, professionals can present themselves in a more efficient and professional manner, while reducing their carbon footprint and saving money on printing costs. With the increasing reliance on technology in business, virtual business cards are becoming an essential tool for individuals who want to keep up with the latest
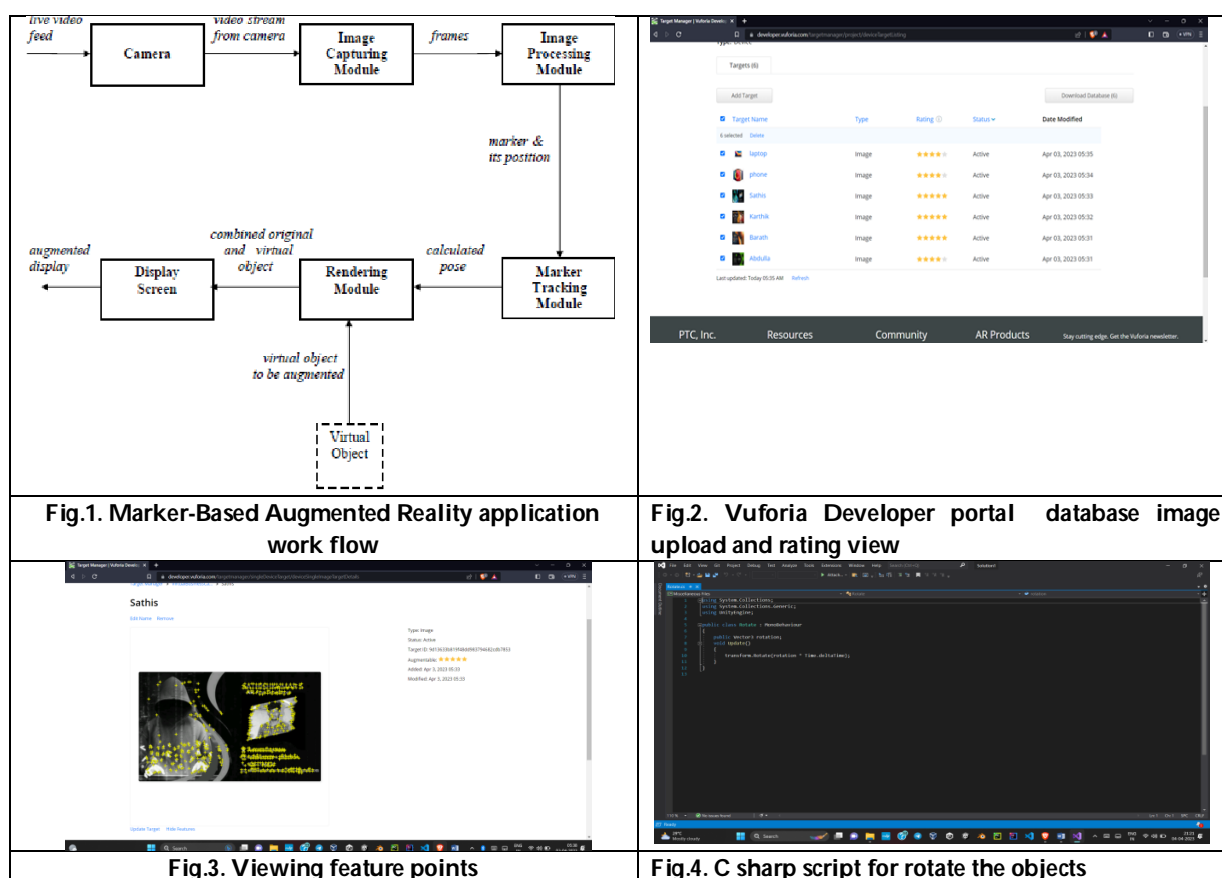
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trends and practices. Overall, Virtual Business Cards android application and web application are a useful and practical solution for professionals looking streamline their networking efforts and stay ahead of the competition.+

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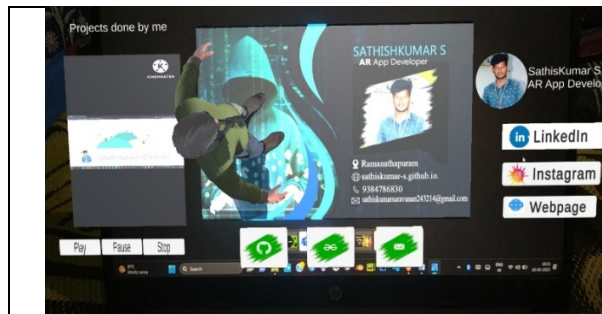
Fig.1. Marker-Based Augmented Reality application work flow

Fig.2. Vuforia Developer portal database image upload and rating view

Fig.3. Viewing feature points

Fig.4. C sharp script for rotate the objects

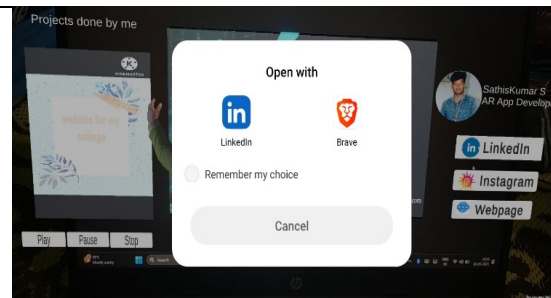**Fig.5. Part of the project output**

Fig.6. When user clicks LinkedIn Button

Fig.7. When user clicks Webpage Button

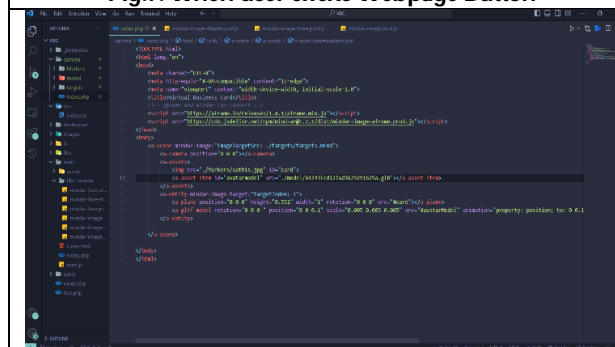**Fig.8.Final result marketing features output**

Fig. 9. Virtual business cards web application code snippet

Fig. 10. MindAR framework code snippet for image tracking
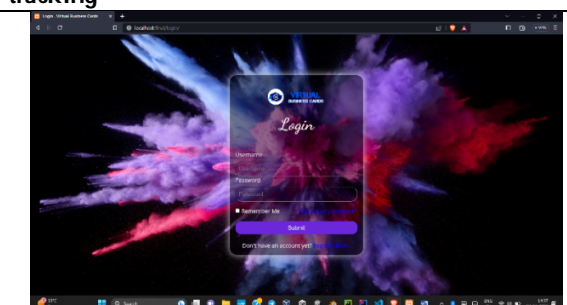

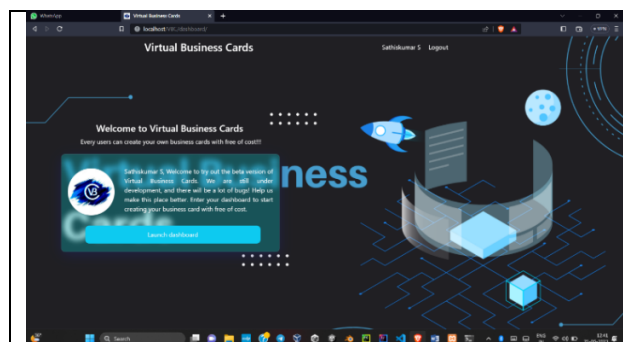**Fig.11. Welcome page of Virtual Business Cards Web Application**

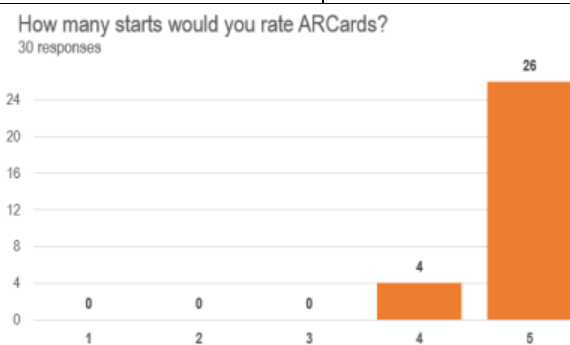**Fig. 12. Login page of Virtual Business Cards Web Application**

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Fig. 13 Dashboard page of Virtual Business Cards Web Application

Fig.14 Final Result of Virtual Business Cards Web Application

Fig.15. Bar chart of star rated virtual business cards