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Augmented Reality based Car Parking Application for Android

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Abstract

Today, Augmented Reality plays a vital role in the tech industry. This paper is based on Augmented Reality car application and is an important topic in R&D. This application, enables to place and drive virtual cars in the real world. This paper briefly, discuss about introducing Augmented Reality application for "Android", because not everybody can afford for an iPhone which has tons of AR applications. This is the reason why this optimised AR car application is made only for Android. It enables to place cars in real world with exact dimensions. The tools used to build this application are "UNITY" and "VUFORIA". So, it gets easier to see whether a car can fit into a particular place or not, we can see how many cars can fit in a particular place and also, we can drive a car virtually to see whether it is possible to park a car in a congested place. It clearly shows that it saves time to park a car when compared to manual work. The result examined that real world interaction of car using Augmented Reality was successfully executed by placing multiple cars and in the mere future, there will be an update to move the car in all possible directions. It will play a major role in AR based research and also will be very useful for car buyers and also for the car companies.

Key-words: Augmented Reality, Android, UNITY, Car Parking.

1. Introduction

Augmented Reality is a technology which helps us to view the 3D models in the real world. The AR gives us an interactive experience of the real world, objects and the virtually enabled 3D models. It has been a hot topic in digital technology, but it is getting renewed focus and attention with the release of Google Glass product and other AR gadgets. There are 3 types of AR, they are Marker based AR (Image target will be used to place the 3D model), Marker less based AR (No image target will be used to place the 3D model, it will be placed anywhere on the ground or air) and Superimposition based AR (It displays superimposed 3D model on top of the real-world subject). It offers much potential to improve our lives in different ways. Due to massive technology developments around companies, every concern wants to create a different technique. To experience AR, you will need a handheld device (smartphone) with a decent specification or a heads-up display.

The examples of the heads-up display are Microsoft HoloLens and Meta 2. The heads-up is way more expensive. The HoloLens costs around $3000 and the Meta 3 costs around $1500.But the handheld devices are cheaper than heads-up devices. But it is mandatory that the smartphone should have significant processing power, that is, it must have good CPU, GPU and RAM. The smartphone should also contain a camera sensor, GPS sensor, accelerometer sensor and compass sensor. The heads-up devices also contain these sensors. So, it is a very different technology which gives lots of possibilities.

The researcher “Thomas Caudell” done research in augmented reality, for helping factory workers with the diagrams and devices which can able to mark. This can showcase digital information in the real-world, through a digital camera, creates a Mixed Reality, with the intent of providing useful information. Advancement in mobile technologies and in online applications has made AR possible to provide potential to revolutionize the tech industry in the way of presenting more information to the people virtually. AR is said to be a technology that combines real world objects with the virtual objects in a real environment, and aligning of real and virtual objects with each other on the environment, and also shows the real-time interaction. AR has the ability to create hybrid learning environments that can combine real and virtual 3D models.

The raise of data set and testing, one of augmented reality’s key goals is to highlight explicit features of the physical world, increase understanding of that explanation, and obtain smart and accessible close by that can be applied to real-world applications. Such big data can lend a hand inform companies management and gain insight into customer spending practice, among others. Augmented reality’s settlement might extend to the healthcare division, where it could engage in

recreation to a great extent better role. One way would be during apps that enable users to see extremely detailed, 3D imagery of diverse body system when they hover their mobile tool over an end image. For example, augmented reality could be an authoritative learning tool for health check professionals through their guidance. Nowadays we observe that the margins between digital and physical worlds are blurring. AR is rapidly advance into a new period of enabling a context-rich consumer understanding that combines sensors, wearable compute, the IOT, and artificial intelligence. That probable is a distinctive occasion of value creation. Augmented Reality technology will bring momentous alteration to a lot of areas of our economies in terms of efficiency, competitiveness as well as the condition of new and inventive forces for end-partners. There is a side street array of AR applications. These applications need to be deployed at different balance and may be used both inside and external with large differences in radiance. Some AR applications may use marker or data recitation to a pre-scanned setting, using dissimilar resources for geo-localization.

They require for apparent and dependable interworking amid different AR components is key to the successful roll-out of such services. There is vast difference in Augmented Reality applications but atlas digital information with the real world implies the use of a set of common mechanism present functionalities such as: tracking, muster, pose opinion, localization, 3D modernization, records inoculation. Augmented reality applications are written in particular 3D programs that permit the developer to attach animatronics or appropriate digital information in the workstation program to an augmented reality "indicator" in the real world. When a computing device's Augmented Reality app or browser connects receives digital information from a recognized indicator, it begins to implement the marker's code and layer the correct image or images. Augmented Reality applications for smart phones usually include global positioning system (GPS) to identify the user's locality and its range to detect device direction. Complicated AR programs used by the armed for guidance may include engine vision, object detection and motion recognition technologies. The software’s used to build this application are UNITY and VUFORIA. UNITY and VUFORIA together helps the developers to bring the 3D models on the real world. These two are the most used software’s to build the augmented and virtual reality applications.

The AR applications were implemented mostly on the iOS devices. The reason behind this is, the iPhones have more powerful SoC’s (also “expensive”) than android. The recent iPhone (iPhone 12) has a LiDAR sensor which has the capability of scanning the real world, objects and then placing them, but the android phones doesn’t have this feature yet. This is because that android phones will have lesser RAM and slower processing speed in previous years which leads to throttling issues or

application crash. So, many developers don't show interest on building the augmented reality application for android.

This paper speaks about AR car application made only for android. With the analysis of introduction about AR, it surely gives an interest to AR research scholars and students, also it will be very useful in terms of accuracy, time saving and digital technology development. Unity and Vuforia were integrated along with the android Software Development Kit to build the AR application and it is shown in figure 1.

Figure 1 - Integrated Software's

2. Literature Survey

The technological revolutions having occurred in several areas additionally had an effect on books, and electronic books emerged. but several issues have emerged within the availableness of electronic books, and users have begun to come to books that AR tangible, with pages of that they'll physically flip. increased reality books AR ready by enhancing these books beautifully by introducing interactive and immersive properties into the superficial and interaction-free characteristics of written books. whereas increased reality books maintain the benefits and philosophy of written books, they introduce associate innovative approach to written books with a static and non-interactive structure by adding varied sensory interactions. The aim of this study is to seek out and analyse all increased reality books of educational nature ready within the field of education through the literature review technique. Firstly, the term increased reality is outlined and therefore the reflections of the increased reality applications within the field of education AR reviewed. Then the categories of the increased reality books AR determined and every one the increased reality book studies gift within the literature and of educational nature AR listed. whereas the books AR listed, organized by year and therefore the

technologies used are known. it's seen that no such classification has been created within the literature before this study. Through this original study, all the previous studies AR tabulated so as for it to be guiding for alternative researchers during this field and therefore the gift state of affairs is unconcealed within the context of development of those books [2].

Augmented-reality options area unit most useful for things wherever aesthetics or different physical traits, like size, area unit primary factors driving the acquisition call. Home decoration and article of furniture area unit high candidates to urge the AR treatment, as individuals need to make sure that this stuff would slot in their house and match their overall vogue. the flexibility to preview the item in AR takes away a number of the uncertainty of searching on-line, and a number of other participants commented that they felt additional assured that they'd not got to bear the effort of returning their purchase. for instance, one participant searching for a table lamp on the Target mobile app declared, "It's extremely useful as a result of I purchase a concept of what it will seem like within the house that it needed it to travel, versus obtaining it home and it'd not look right."

The AR expertise was most useful for beauty merchandise that were opaque instead of sheer, as these were additional visible. Even though' not all physical things enjoy associate degree AR capability, the presence of associate degree AR feature isn't prejudicious (unless it's tough to use). giant appliances, like refrigerators or laundry machines, didn't seem to profit a lot of from AR, as these area unit 1st and foremost purposeful merchandise — the options and school specs area unit the first differentiating factors. Yes, size is important, as they need to work into an outlined house within the user's home, however that's simple to inform from the product's written description, and would truly be laborious to measure from AR alone, because the technology to calibrate and accurately scale the item to the user's surroundings isn't quite there nevertheless. However, as a result of these area unit expensive purchases, any further info was seen as useful and users did still appreciate seeing however well the finishes matched their house. One participant additionally mentioned that she would have likable to move with the icebox — for instance by gap the doors to ascertain whether or not it'd hit a close-by cupboard [3].

An interesting truth concerning retail is that despite on-line looking and M-commerce obtaining additional precedence day by day, seventy-one of the customers (buyers during this case) would love to expertise VR in a very store than in their good devices. That's what increased Reality will, keep folks of each worlds happy [4].

According to a Nielsen world survey from 2019, customers listed augmented and virtual reality because the prime technologies they're seeking to help them in their daily lives. In fact, simply over 0.5 (51%) same they were willing to use this technology to assess product. I totally expect that

interest has since soared as we've seen AR shift from being generally gimmicky to currently finding real pain points for purchasers, particularly amid the pandemic. In fact, e-commerce company Shopify recently discharged new information that interactions with product having AR content showed a ninety-four higher conversion rate than product while not AR.

Retailers are starting to use AR technology to reimagine the digital searching expertise with virtual store fronts. Physical retail should evolve in response, and AR has established that it will add monumental price for customers within the searching journey. now's the time for business leaders and makes to not solely re-imagine retail, however to catapult these immersive searching experiences into the longer term [5].

Unity makes easier to insert AUGMENTED REALITY, by: Dean Takahashi, Released: JUNE 17,2019 apps into native mobile apps. Unity Technologies has launched associate degree update that produces it easier to insert increased reality options into native mobile apps and games.

The update for Unity 2019.3 comes once Unity declared its AR Foundation tool that permits game developers to quickly produce AR software package which will run on each golem and iOS devices. Unity 2019.3 has other support for victimization Unity as a library controlled by native Android/Java and iOS/Objective C apps thus developers will simply insert AR and alternative Unity options. This means that developers will currently insert options steam-powered by Unity, like increased reality (AR), 3D/2D period rendering, second mini-games and additional, directly into native mobile apps [7].

The below the font settings wherever it says colour gradient check, that to see that and that we currently set up a colour for each the highest left and right and also the bottom left and right however rather than doing that in here since that would like all of my components to share an equivalent gradient, It can able to produce a colour gradient quality to move to the professionalness right click go Crete text mesh pro and let's choose colour gradient. To rename this quality to gold and currently it has been outlined therefore, coloured and that it should have therefore me colour codes at the prepared here so it's going to merely paste these in about to be victimisation an equivalent one for the highest left and right so for very cheap left and right we'll select another one a touch darker now so that is some nice yellow and orange colours.

Currently choose our text object and scroll to the gradient half. currently involve the gold object into the gradient predetermined and there it has a tendency to go. It also has the tendency to currently have a pleasant gradient to the text. To show this into a button. to try to that let's right-click on our canvas, move to UI and make a button. Begin by scaling this close up and move it up additionally for the image here and create that fully black. For now, it will simply act and disable.

Under the button, it has a tendency to notice a text object and this can be what we would like to switch with the play text that we simply created, So, delete this text object. Instead of involve the play text, simply rename this to text. Instead, rename the button to play button.

Now, the 2 menus as choices menu additionally because the main menu all that is left is to feature practicality to those 2 menus and begin with the play, however ton of this can be found below the most menu object but rather than add a separate script for the play button itself let's add a script to the most menu object which will have practicality for all of the menu buttons [8].

However, technology is progressing. In explicit, increased Reality (AR), Associate in Nursing rising Human-Computer Interaction technology, that aims to combine or overlap computer-generated 2nd or 3D virtual objects and alternative feedback with real world scenes, shows nice potential for enhancing e-commerce systems. Unlike VR, that replaces the physical world, AR enhances physical reality by integration virtual objects into the physical world. The virtual object becomes, in a sense, Associate in Nursing equal a part of the natural atmosphere. This chapter presents a new kind of e-commerce system, AR e-commerce, that visually brings virtual product into real physical environments for user interaction. The new approach offers customers a likelihood to “try" a product at home or in another use atmosphere. The chapter presents development of a paradigm AR e-commerce system and a user study of the developed paradigm. Experiment results and knowledge each validate the new AR e-commerce system and offer suggestions for improvement. Overall results of the study show that the AR e-commerce system will facilitate customers create higher getting selections [11].

The existence of the native knowledge ought to be taken under consideration in developing the ideas of a cultural-based technology. when a few years of grand coming up with of analysis program, the laboratory of LCI is finally focused on the event of computer-cultural-based education media. one in every of main focuses of computer-based cultural researches is increased reality application of collection of creative and cultural objects that AR developed in mechanical man package. Based on the info from Statista (The data point Portal), in 2014, the estimation of number of smartphone users in Indonesia AR concerning thirty-eight million users. They use smartphone technology for many reasons, like looking varied forms of information, accessing social media, and additionally doing on-line transactions. consistent with data from the Stat Counter international Stats, mechanical man leads the world smartphone market, with59.91 %. Based on the on top of background, this project aims at the event of associate augmented reality story book that specializing in Balinese Myths and Legends [12].

Wearables alter the method you listen to your atmosphere Digital smell and style augment the method you share and receive info New approaches to storytelling immerse and interact users additional deeply Users will augment their bodies with electronic textiles, embedded technology, and brain-controlled interfaces Human avatars will learn our behaviors and act on our behalf[13].

Augmented reality contains a ton of sensible uses, like telling you wherever to run or material possession you visualize what a bathroom or Ikea piece of furniture would possibly seem like in your front room. however, what concerning having a bit fun? AR allows you to do this, too, with games! To some extent.

3. AR Car System

Augmented reality is becoming the future in the tech world. Apple company announced its entry into AR market in the year 2017, and this technology is increasing its need really fast. Augmented reality applications have the potential to show any 3D models, which can be placed on the environment.

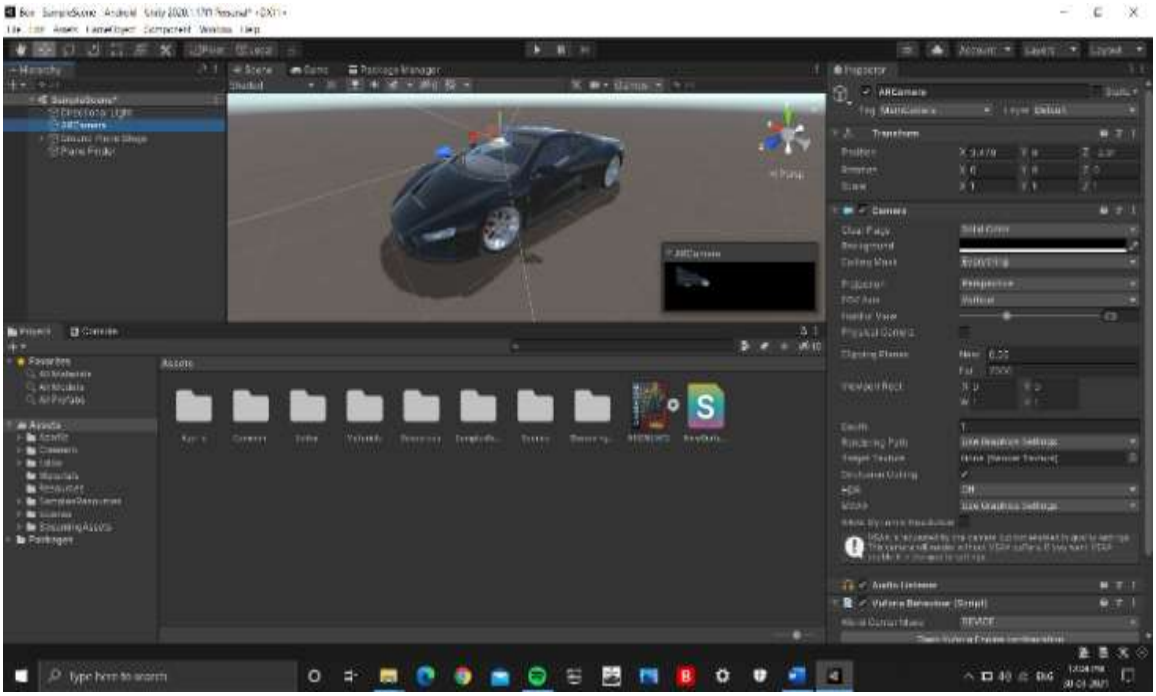
This application is intended only for android and the systematic procedure for making this application is explained. The android LOGO in shown below in figure 2.

Figure 2 - Android Logo

The reason why this Augmented Reality car application is intended only for android and not for iOS is because there are lots and lots of AR application is available for iPhones. The reason behind this is, the iPhones have more powerful SoC's than android in previous years, which led to run the AR application without any lags or throttling issues. But ***"not everybody can afford for an iPhone"*** and also by today standard there are lots of android phones coming out with a decent processor with 6GB of RAM, under Rs. 13000, which can easily run this optimised AR Car application without any lags or throttling issue.

This gives an AR experience for all the people who even have cheaper phones and this is the reason why it is only made for android. Real world interaction of car would be a great idea and a backbone for future digital technology. So, the application has been implemented. The **UNITY** and **VUFORIA** platform is used to design and implement the idea and then the application is built for android. And the screen shot of "SCENE" view is shown in the figure 3.

Figure 3 - Designing and Building the Application



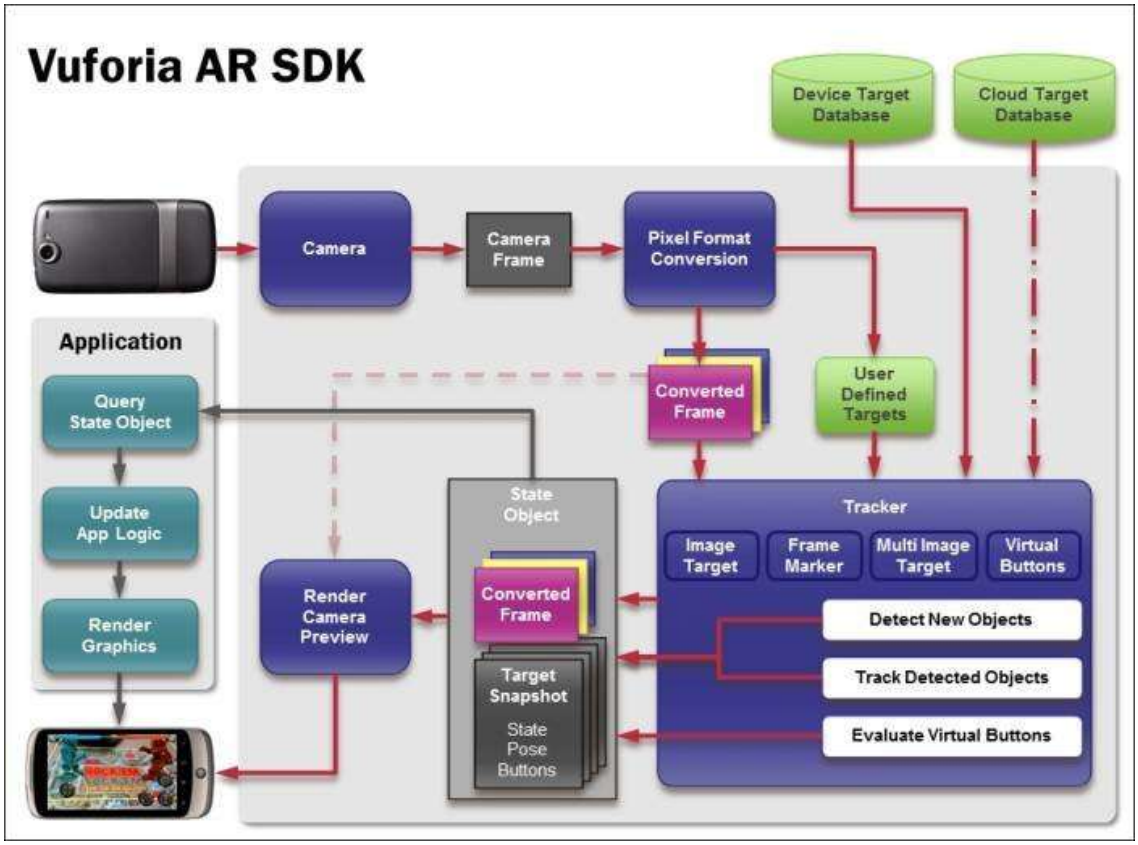
UNITY is a game engine platform to create, move and also make the 2D or 3D models to perform lots of actions. Vuforia, is an augmented reality (AR) software development kit (SDK) used for mobile or smartphone devices to enable the augmented reality applications on any device. It uses open CV (Computer Vision) technology to scan 2D images and 3D objects in real world. This helps developers to position the virtual 3D models, so that they can be viewed through the camera of a mobile device on the real-world environment. The "Programming language" used here is **C#** which helps to provide actions to the objects and also for making the User Interface (UI). Using, this two software's the application has been built. This can help to place the objects in the real world, environment. The diagram showing that both Unity and Vuforia integrated together to build the AR application is shown below in figure 4.

Figure 4 - Unity & Vuforia

This app (AR Car) is used to place a car with exact dimensions in the real world, which will be very useful for analysing how much space is required to fit a car in a particular place for parking such as in lawn, garden, basement and garage.

The flow diagram for building the AR car application is shown below in the figure 5.

Figure 5 - Flow Diagram



4. Results and Discussion

The results were successful, in placing cars in any of the parking zones or free space, placing multiple cars and to find out how many cars can fit in a parking zone or in an empty area. The output

shows that multiple cars placed on the terrace and the screen shot of the empty parking zone image is shown below in figure 6. The figure 7 shows that “one car” has been placed on the terrace.

Figure 6 - Parking Zone;

Figure 7 - Placed One Car

The figure 8 shows that “few cars” has been placed on the parking zone. The figure 9 shows that “16 cars” has been placed on the parking zone.

Figure 8 - Placed Few Cars;

Figure 9 - Placed 16 Cars (Lamborghini)

It saves our time and also very interactive and interesting. So, the future updated version of this application is to include maximum possible cars with its exact dimensions with multiple colors. The table 1 provides the dimensions used for the car.

Table 1 - Dimensions of the Car

S. No	DIMESIONS	VALUE
1	Length	4.4 meter
2	Width	1.801 meter
3	Height	1.281 meter

The User Interface shown in this paper will help the user to navigate inside the application, for example when “START” is selected, it opens the camera to place the car and when “EXIT” is selected, it will quit the application. The screenshot the home page is shown below in figure 10.

Figure 10 - User Interface (UI);

Figure 11 - Navigation Buttons

The user can also come back to the home page after clicking the back icon which will be at the top left corner of the screen or the user can directly close the application by clicking on the power icon, which is at the top right corner. The screenshot of that is shown in figure 11. The user can also view the interior of the car and the screenshot of that is shown below in figure 12.

Figure 12 - Interior of the Car

These are all the results/output that can be seen using this AR car application.

5. Conclusion

AR CAR APPLICATION can replace manual work for measuring the dimensions of the car to see whether a car can fit in a particular place or not. AR car application saves time by generating a 3Dimensional model of any car with the exact dimensions of that particular car and then placing them on the real world. The future update for this application is that to make the car to move around in all directions, which will be helpful in finding out whether a car can move in a congested place or not and also, more 3D models of all possible cars from all possible car companies will be added.

As of now, this paper gives answers for the following questions:

1. Will this particular car can fit or parked in this particular place or parking zone?
2. How many cars can be placed in a particular area or zone?

So, to improve the app performance and usability more features and accessibility will be given in the future.

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