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Markerless Augmented Reality Implementation Using Computer Vision

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Abstract
A real world and a virtual or computer-generated one are combined to create augmented reality. It is accomplished by enhancing real-world photographs with computer-generated ones. There are four different types of augmented reality: marker-based, marker-less, projection-based, and superimposition-based. It has a wide range of practical applications. Numerous industries, including healthcare, education, manufacturing, robotics, and entertainment, use augmented reality. The category of mixed reality includes augmented reality. It might be viewed as the opposite of virtual reality. Both of them share certain similarities and distinctions. The COVID-19 pandemic has brought concern in people's mind to shop outdoors resulting in massive innovation in technology related to enhancing online retail experience. One such idea is using AR to enhance e- commerce visually. Our aim is to help people by showing product by 3D vision in online so that customers will get satisfy to buy the product. people will get real world experience by seeing product online. we demonstrate how real time performance is possible with platform specific optimization.

Keywords:- AR technology, Feasibility study , Android Virtual Device, Augmented Reality.

INTRODUCTION

The system and technique for extracting feature points from an image and generating augmented reality utilising a projective invariant of the feature points are disclosed here. A set of feature points meeting a plane projective invariant is derived from the feature points by tracking them in two photos taken while shifting the position of an image acquisition device, and augmented reality is then given using the set of feature points. Accordingly, a separate marker is not required because the set of feature points fulfils the requirements of a marker. Additionally, because augmented reality is offered based on the collection of feature points, less computation is required overall, making augmented reality delivery more effective.

OBJECTIVE

Before deciding to make a purchase, ecommerce buyers can preview goods or use services in their own environment and at their own pace thanks to augmented reality (AR). The objectives of the projects are as follows:

- To develop a visual tool to understand the basics of any subject emphasizing on the internal details of the object under investigation.
- We can use our application for future engineering purposes in different fields which can be useful for understanding the topic easily.
- Using AR, your Customers who have access to product previews are more likely to choose the proper item the first time.

- AR can generate more conversions and helps customers shop online and in stores.

PROPOSED SYSTEM

The proposed system for AR-Ecommerce is developed using a 3- D Video Game developing software called Android Studio. **Markerless AR** as the term indicates, it requires no visual markers for a camera to augment an image into a physical space. AR technology enables customers to walk through a store or a property before paying a physical visit to the location. The use of augmented reality enables them to get a feel of the place and learn about the essential details beforehand. Users should the smartphone and know how to operate android mobile cameras. The first and the main component in the project is to get the real- Time data for location from various Sources like GPS system etc. Then this data is to be merged with Markerless AR. The technology combines data from cameras, gyroscope, haptic sensors, accelerometer, 3D-Images from GPS and LPS system with software, audio, and video graphics in the real world. Markerless AR detects objects without any prior knowledge of the environment, such as structure, design, system with software, audio, and video graphics in the real world.

LITERATURE SURVEY

Koller, Hermann and Bowden's" [4] work shows a novel perspective to learning a classifier which is on the basis of frames on poorly differently marked sequence data by combining a Convolution Neural Net in an Expectation Maximisation algorithm. This permits the C.N.N. to be trained on a big set of trial images even if limited sequence level knowledge is available for the source videos This method is explained in situation related to hand shape detection, it could be of a wider use to any video based recognition task which doesn't have frame-level labelling. The discriminative ability of C.N.N is used by E.M. algorithm to iteratively refine the frame level mappings and further training of the C.N.N. The C.N.N. can be easily trained on a million hand images by merging the classifier within E.M. architecture. They show that the output classifier model generalises over sets and entities. Data comprising 60 distinct classes of 3000 manually labelled hand pose images is used for evaluation. Instead of using 2 stage architecture pipeline consisting of localizing hand and mapping landmarks, Pose Anchor [6] presents a single effective network architecture for hand landmarks detection. An end-to-end C.N.N. is trained on a newly proposed pose anchor network, which is based on RPN in Faster Region-based C.N.N [4]. Instead of manually designing hand pose anchors, they are generated using K-means clustering based on OKS[4], in a data driven way. Using this technique, we can obtain numerous representative pose anchors with different angles, hand signals, and scales. The main reason for using pose anchors is to mitigate occlusion to some extent by using the prior knowledge of hand pose/structure Experiments conducted on (LSM-HPD) and NZSL were used to show the robustness and feasibility of the architecture. This study showed that satisfactory performance hasn't yet been achieved by most of the methods, due to the complexity of the problem. Most of the existing information driven methods cannot completely utilize the depth information because they firstlty regress 3D hand pose from depth image. estimation is proposed. The point cloud which is In this paper, they a novel multi-view CNN-based approach for 3D pose estimation is proposed. The point cloud which is generated from the query depth image is projected onto multiple views of two projection settings for better exploitation of 3D information. Multi-

view CNNs learn to associate projected pictures with heat maps Introduction Applying Markerless-AR Using CV which reflect the probability distributions in each view. After these maps have been fused to estimate optimal three dimensional pose with learned pose priors, a view selection method is used to suppress all the unreliable information. The results showed that this proposed method is better than the best methods on two challenging datasets. Furthermore, a cross-dataset experiment was carried out which validated that their approach had good generalization ability.

E-commerce is developing at a fast movement, which is apparent in the measurements expressing that over a billion Web clients bought products through internet business sites in 2013. Truth be told, retail online business deals added up to $1.85 trillion every 2016, and eretail incomes are extended to develop to $4.50 trillion out of 2021. This emotional shift in the fast-growing customer base of the advanced retail industry has given internet business companies a strong incentive to stand out from their competitors and build creative strategies that consider their customers.

FEASIBILITY STUDY
A feasibility study is a preliminary study which investigates the information of prospective users and determines the resources requirements, costs, benefits and feasibility of proposed system. A feasibility study takes under consideration varied constraints at intervals that the system should be implemented and operated. this stage, the resource required for the implementation like computing equipment, manpower and prices are estimated. The estimated available compared with out their resources and a price profit analysis of the system is formed. The feasibility analysis activity involves the analysis of the matter and collection of all relevant data with

reference to the project. the most objectives of the feasibility study are to see whether or not the project would be feasible in terms of economic feasibility, technical feasibility and operational feasibility and schedule feasibility or not. it's to make sure that the computer file that are needed for the project are available. Thus, we evaluated the feasibility of the system in terms of the following categories:
- Technical feasibility
- Operational feasibility
- Economic feasibility
- Schedule feasibility

Technical feasibility: Evaluating the technical feasibility is the trickiest part of a feasibility study. This is because, at the point in time there is no any detailed designed of the system, making it difficult to access issues like performance, costs (on account of the kind of technology to be deployed) etc. A number of issues have to be considered while doing a technical analysis; understand the different technologies involved in the proposed system. Before commencing the project, we have to be very clear about what are the technologies that are to be required for the development of the new system. Is the required technology available? Our system is technically feasible since all the required tools are easily available. Anaconda navigator, google co lab and Flask framework makes the system more user and developer friendly and although all tools seem to be easily available there are challenges too.

Operational feasibility: Proposed project is beneficial only if it can be turned into information systems that will meet the operating requirements. Simply stated, this test of feasibility asks if the system will work when it is developed and installed. Are there major barriers to Implementation? The proposed was to make a simplified web application. It is

simpler to operate and can be used in any webpages. It is free and not costly to operate.

Economic feasibility: Economic feasibility attempts to weigh the costs of developing and implementing a new system, against the benefits that would accrue from having the new system in place. This feasibility study gives the top management the economic justification for the new system. A simple economic analysis which gives the actual comparison of costs and benefits are much more meaningful in this case. In addition, this proves to be useful point of reference to compare actual costs as the project progresses. There could be various types of intangible benefits on account of automation. These could increase improvement in product quality, better decision making, and timeliness of information, expediting activities, improved accuracy of operations, better documentation and record keeping, faster retrieval of information. This is a web-based application. Creation of application is not costly.

Schedule feasibility: If a project takes too long to complete before it is beneficial, it will fail. This usually entails calculating how long the system will take to create and determining whether it can be finished in a specific amount of time using techniques like payback period. The project's timetable's feasibility is evaluated by looking at the schedule is. Are the project timeframes fair given our level of technical expertise? There are certain projects that are started with deadlines. The question of whether the deadlines are required or preferred must be answered. A minor deviation can be encountered in the original schedule decided at the beginning of the project. The application development is feasible in terms of schedule.

System Architecture
System architecture is conceptual design that defines the structure and behaviour of a system. An architecture description is a formal description of a system that is set up to facilitate analysis of its structural characteristics. It specifies a system component and offers a strategy for developing systems that will integrate with one another to implement the whole system.

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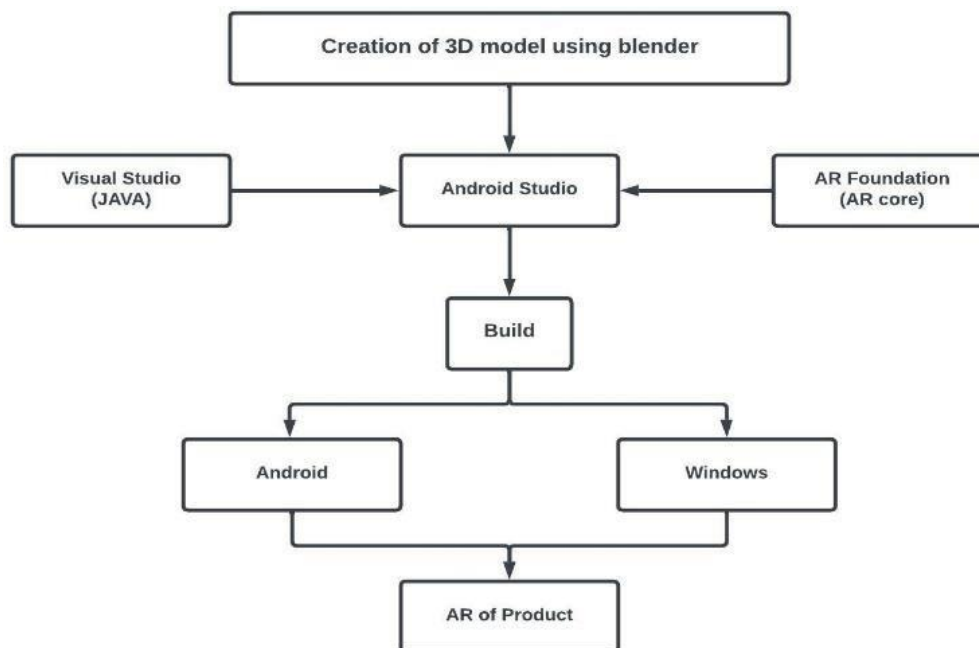
FLOW OF SYSTEM
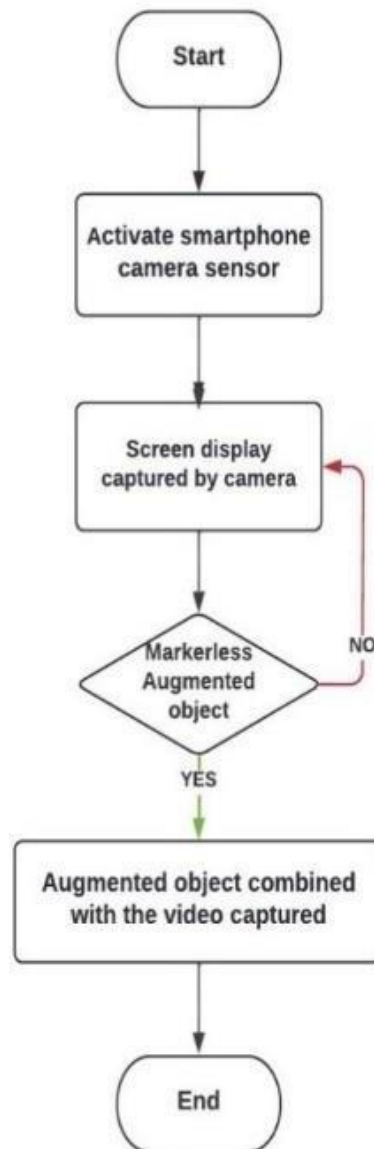
SYSTEM REQUIREMENT

A software requirements specification document that describes what the software will do and how it will be expected to perform. It also describes the functionality the products needs to fulfil all stakeholders needs.

SUPPORTABILITY

Maintainability: Maintainable software is easy to extend and fix, which encourages the software's uptake and use.

Portability: This system can be run in any android system/desktop.

Compatibility: This project can be run in any Android Phone/ Desktop.

Flexibility: The software updates the location data of the user as they keep moving along.

Instability :The software can be installed on any android devices, although running the software requires AR Core component.

DESIGN CONSTRAINTS

• The clarity of the images in the Application may be subject to the devices.

• The UI/UX might not look good in smaller size screens.

- The application shall guide the user's 3D model entirely.
- The Application shall display information to the users when triggered.

INTERFACES

All the interactions of the project with users, hardware and other software are specified here. The 'Base.apk' application is simple and easy to understand as well as to use.

User Interfaces:

• The system provides a user-friendly interface.

• Appropriate functions are performed when a user clicks an option.

• Appropriate messages are generated when user triggers an interactive object.

Hardware Interfaces:

• Processor: Android (Snapdragon 435, MediaTek MT6752) / Windows 2.4 GHz

• RAM: Android 2GB / Windows 1GB.

• Hard disk : Windows 2GB /Android 500 MB

•

• I/O Parts : Monitor , Mouse, Keyboard.

• Android smartphone with enabled ARCore component. Software Interfaces:

• Operating System : Windows 10 (x86 based processor). Implementation Language : JAVA

• Engine/Framework : Android Studio

• IDE : Visual Studio Code.

• Editor : Android Studio (version: 2020.3.3).

• Tools : Android SDK, Gradle, AR Core Minimum

• API level : Android 7.0 'Nougat' (API level 24).

• Target platform : Android

DESIGN PART

A Use Case diagram is a representation of a user's interaction with the system software that the relationship between the user and the different use cases the user can interact with. A Use Case diagram describes the different use cases the user will interact with and will often be displaying other interactions as well.
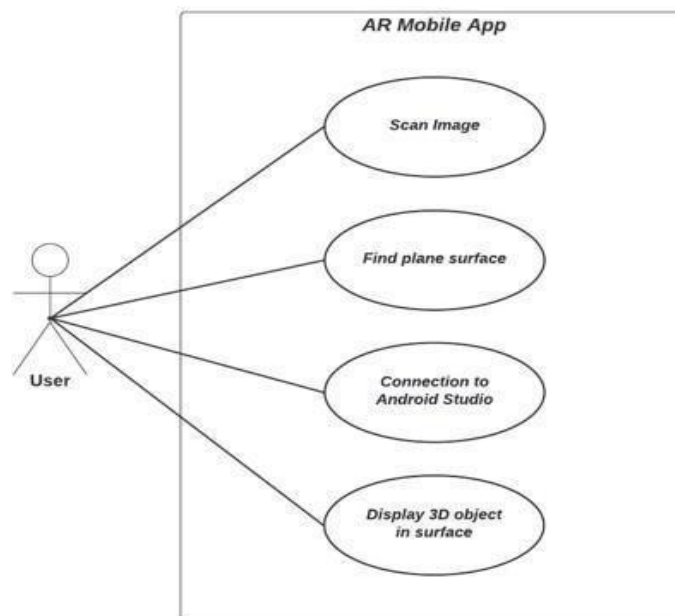

Fig.1:- Use Case Diagram

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• Free, a fully-featured IDE for individual developers, open-source projects, and students.

• Visual Studio gives the Unity game engine a top-notch debugging experience. Debug your Android games in Visual Studio to find errors quickly— Determine variables and complex expressions, set breakpoints, and evaluate variables and complex expressions

• Provides great microservices support including popular frameworks, container tooling, and cloud integration.

• Supports many other languages, not just Java.

A sequence diagram shows object interaction/ns arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Additionally, VS Code interfaces with frameworks and tools including Maven, Tomcat, Jetty, and Spring Boot. By utilising Visual Studio Code's capabilities, Java developers receive a fantastic tool for both speedy code editing and the entire debugging and testing cycle.

You can use Visual Studio Tools for Android to debug your Android project's editor and game scripts using that program's robust debugger. use IntelliSense and other code-aware editing capabilities to increase your efficiency.

Your routine programming activities can now be enhanced with advanced editing, debugging, and customization thanks to Visual Studio. As you programme, Visual Studio can assist you in swiftly diagnosing problems so you can be unblocked and resume developing and releasing your apps.Microsoft created Visual Studio as an Integrated Development Environment (IDE) to create GUI (Graphical User Interface), Additionally, VS Code interfaces with frameworks and technologies like Maven, console, Web, web, mobile, cloud, and other services. You can produce both managed and native code with the aid of this IDE.The first version of Visual Studio, called Visual Studio 97 and bearing version number 5.0, was launched in 1997. Visual Studio's most recent version, 15.0, was made available on March 7, 2017. It also goes by the name Visual Studio 2017. the encouraged. Newest versions of Visual Studio support Net Framework versions 3.5 to 4.7. Older versions of Visual Studio supported Java, however the most recent version doesn't include any Java language support. A user can also add windows by selecting them from the View menu as needed. The tool windows in Visual Studio can be altered by the user, who can also create new windows, close those that are open, or reposition them as necessary.

Java Core
Visual Studio IDE
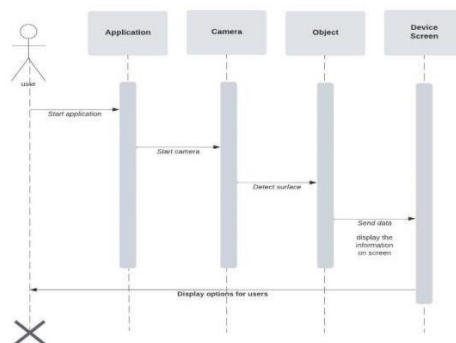
Fig2:- *Sequence Diagram*

A framework for creating application software and deploying it in a cross-platform computing environment is provided by Java, a set of computer software and specifications created by Sun Microsystems, which was later acquired by the Oracle Corporation. Java is utilised in a wide range of computing systems, including supercomputers, embedded devices, and mobile phones. While they are less common than standalone Java applications, Java applets run in secure, sandboxed environments to provide many features of native applications and can be embedded in HTML pages.

The IDE used in this project is Visual Studio Code which is an integrated development environment from Microsoft. It is used to develop computer programs, as well as websites, web apps, web services and mobile apps.

• VS Code offers helpful debugging and unit test support in addition to fundamental language capabilities like code completion, refactoring, linting, formatting, and code snippets. Writing in the Java programming language is the primary way to produce code that will be deployed as byte code in a Java Virtual Machine (JVM); byte code compilers are also available for other languages, including Ada, JavaScript, Python, and Ruby. In addition, several languages have been designed to run natively on the JVM, including Scala, Clojure and Apache Groovy. Java syntax borrows heavily from C and C++. However, Smalltalk and Objective-C are the models for object-oriented characteristics.

Since every object in Java is allocated on the heap and all variables of object types are references, Java avoids several low-level constructions like pointers. The JVM performs integrated automated garbage collection to handle memory management.

Android

For mobile devices, the Android software stack consists of an operating system, middleware, and important applications. Android is a software platform and mobile operating system created by Google and the Open Handset Alliance that is based on the Linux operating system. It does not support programmes written in native code but enables developers to build managed code in a Java-like language using Google's Java libraries.

The establishment of the Open Handset Alliance, a group of 34 hardware, software, and telecom businesses committed to developing open standards for mobile devices, coincided with the announcement of the launch of the Android platform on November 5, 2007. The majority of the Android platform will be made accessible under the Apache free-software and open-source licence when it is released in 2008.

Google purchased Palo Alto, California-based Android Inc., a small start-up firm, in July 2005. Andy Rubin (co-founder of Danger), Rich Miner (co-founder of Wildfire Communications, Inc.), Nick Sears (formerly VP at T-Mobile), and Chris White were among the co-founders of Android who joined Google (one of the first engineers at WebTV). The only thing that was known at the time about Android Inc. was that they produced software for mobile phones.

The Open Handset Alliance was introduced on November 5, 2007, with the aim of creating open standards for mobile devices. Members of the alliance include Google, HTC, Intel, Motorola, Qualcomm, T-Mobile, Sprint Nextel, and NVIDIA. The Open Handset Alliance also launched its first product, Android, an open-source mobile device platform built on the Linux operating system, along with the formation of the OHA.

During least three Android prototypes were unveiled by Google on February 12, 2008, at the Mobile World Congress. Several elementary Google applications were exhibited on one prototype at the ARM stand. A 'D-pad' control zooming of items in the dock with a relatively quick response.

Android Virtual Device

The Android Virtual Device (AVD) is an emulator included in the Android SDK. The AVD lets a user to run, build and test an application without the need for any physical devices. AVD can be considered an exact replica of a real Android device, except that lacks a few features. The AVD cannot be used to make calls. The Android market is not accessible from the AVD. The applications that use sensor and Bluetooth cannot be tested in AVD. Except for this, testing an application in the AVD appears similar as in a physical Android device. Android mobile phones can also be used as emulators instead of using emulator provided by SDK. All the instruction sets required for using an Android device as an emulator can be found in the Android developer's official website. Also using an Android device as an emulator is faster compared to using AVD.

Using the graphical AVD Manager, which can be launched from Eclipse or the command line using the android tool, is the simplest approach to generate an AVD. The Android SDK's tools/ directory contains the android tool. The graphical AVD Manager is launched when the Android tool is executed without any settings

.

CONCLUSION

The goal of the project was to develop a Shopping App for the customer using Android Studio and Java. For customers, AR completely transforms the in-store and online shopping experience. Through AR, customers can get a true-to-life

understanding of products and 'tangibly' interact with them.. The project was successfully carried out and was completed within the schedule. Despite being available for use, the application has some bugs in it. Also, this project cannot be used on the phones without camera and Internet Connection. The phone should have the Android operating system.

LIMITATIONS

The AR Core component of the Android device has not been developed entirely to its full extent. Since Augmented Reality is a new and trending concept in this current age of time, many features are yet to be implemented and improved in the AR Core System. Hence, the application Markerless AR may occasionally glitch due to some incorrect camera movements.

- In addition to being expensive to produce, developing projects based on augmented reality technology and maintaining them is also expensive.
- The lack of privacy in AR-based apps is a worry.

FUTURE SCOPE

Augmented Reality in eCommerce is the future of a more immersive online shopping experience. The emerging technology of Augmented Reality (AR) has a lot to add to the eCommerce shopping experiences.

In a survey conducted by Google, 66% of the people showed interest in using Augmented Reality for shopping. Some renowned brands and retail eCommerce leaders already implement AR in eCommerce stores. It can provide customers with lively and immersive shopping experiences with 3d visualisations, virtual try-ons and product demos.

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