

Augmented Reality on Android Platform

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Abstract— This document is a proposal for Augmented reality application on the Android platform. Augmented reality makes the user sees the real world but with the addition of computer generated images which are overlaid on various objects within the real world. They are still aware that they are in the real world which means 3-D virtual objects are integrated into a 3-D real environment in real time .Previously though there are many methods designed for augmented reality it is hard to bring augmented reality application to real life due to the performance constraints of the mobile devices. Now a days due to advancements in the mobile technology and the presence of strong mobile platforms, it is now possible to use the revolutionising augmented reality technology in mobiles especially on android smartphones. This paper discuss the solution of the online trial check by using Augmented reality on Android platform.

Index Terms— Augmented reality, Android,3-D,smartphones, virtual reality,virtual objects,mobile technology

1 INTRODUCTION

Augmented reality has been studied for a long time and has been used in different areas. Most of the augmented reality applications have to consider the real time performance. It's study is severely restricted the scope by the device performance. However in the last few years there has been a significant evolution in the mobile devices hard ware capabilities this evolution is very important as it allows for more complex applications and services to be developed for this kind of devices . Platforms like Android (mobile operating system developed by open handset alliance Google Inc. leadership) are the examples of the platform that were developed. This include a set of tools that enable one to take advantage of the hardware capabilities of the new mobile devices . Augmented reality application on android smart phones is not new, In this paper we describe the concepts and key issues that were arise when developing an augmented reality system in online trial check application for android smartphones and offer solution to some of the online trial check problems. We present available tools that used in smartphones and implement augmented reality on android platform . In this we review the concept of the augmented reality on android platform based on the online trailing including requirements ,design and working .

2 AUGMENTED REALITY

2.1 Definition:

Augmented reality enhances the real world with virtual(computer-generated) objects that appear to co-exist in the same space as the real world . Augmented reality offers an easily understandable and natural means for people to navigate and work effectively in the real world-links real and virtual worlds.

Augmented reality has to combine three features.

- Combining real and virtual reality.
- Interactive in real time.
- Registered in 3D.



2.2 The Beginning of the Augmented reality

The first application of the augmented reality is in the field of the army , in the cockpit of the plane or in the helmet of the pilot, he can see several pieces of information ,overlaid on the current view. Then, some medical applications appeared, helping doctors to understand some phenomena, or helping with high risk and surgery operations .

Another application that is quite old and famous, is the overlaying of line and information onto the sport grounds, such as in American football or ice hockey



We can see that before the smart-phones era, augmented reality was either reserved to experts (doctors) or not controlled by the final user(watching a sport match)final user (watching a sport match).

2.3 Different augmented reality degrees

We can distinguish three different way of doing augmented realit.

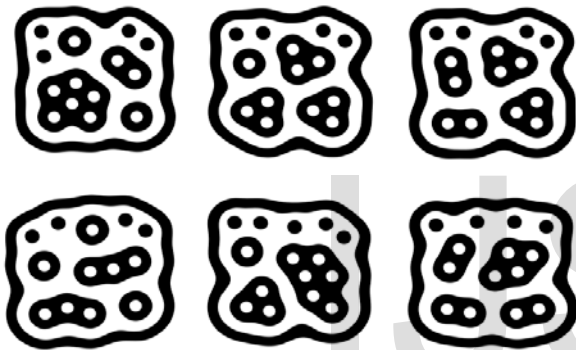
2.3.1 Using positioning information

The application mixes information relative to where the user is or at the place the user is looking at. It overlays the information it can retrieve on the screen, concerning his position. Using this technique, it is hard to make the reality and the virtual elements match, the application has no idea of where exactly the pointed object or building is on the user's screen. for example with the GPS system, the accuracy is about 15 m. Of course, depending on the application, this could be sufficient. However, the time limitation is well respected with these solutions, so we can speak of real time applications.

2.3.2 Using markers

(a) Fiduciary markers

A fiduciary marker is a simple shape, strongly compare in such a way to see difference. Usually, one can use a simple black and white figure. Squares are often used, but not exclusively.



These markers are easily and quickly recognized by a computer and camera. These markers are easily and quickly recognized by a computer and a camera. Here, the applications can localize the tracked objects, and then integrate the information on it, in real time. The only problem here is that you cannot put such a marker on each object for instance.

2.3.3 Using image recognition

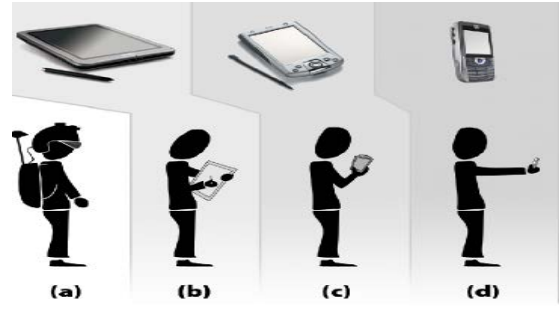
The difference between marker and image recognition is bit difficult to understand and explain exactly. For example, a lot of facial detection applications use the eyes as markers. It is very easy to recognize eyes on some bodies face because it is two zones darker. Image recognition use a camera and a computer to extract the main features from a picture, and compare it to some other data that we acquired earlier. Of course, this way one can know exactly where the object is, without having marked it before. The problem here is the time required for a computer to recognize an object. Further, this

recognition can be harder depending on the camera angle, or the light conditions.

2.4 AUGMENTED REALITY ARCHITECTURE

Augmented reality needs less equipment .It needs only three devices.

- Camera : To capture the real environment
- Display : To see the end result.
- Devices providing some computational power .There are so many devices to fulfill the requirements .They are shown in the below figure



PC with HMD(head mounted display) , b) Tablet pc , c) PDA(personal digital assistance) , d)Smartphone

3 WORKFLOW:

Take an image from the camera, after that separate the marker from the rest of the image. Then the outline of the marker is extracted. From the outline you can calculate the translation matrix for the virtual object. You apply the matrix and display the object above image acquired in the first step.

3.1 ANDROID

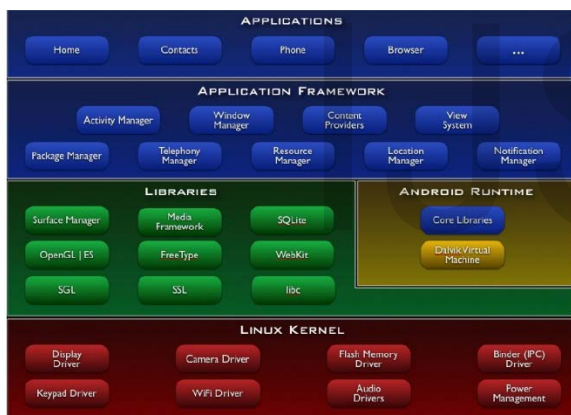
Android is a Linux based operating system designed especially for touch screen mobile devices and smart phones and tablet computers .This project is Initially developed by Android, Inc., which [Google](#) backed financially later .android was unveiled in 2007 along with the open handset alliance: an association of [hardware](#), [software](#), and [telecommunication](#) companies devoted to advancing [open standards](#) for mobile devices. Android is a platform for software development kit (SDK) an application frame work and key applications.

Android is an open source. Most parts of the Android application code is released by the Google under apache license . This open source code and permissive license make users allow to modify the soft ware and is distributed by the device manufactures , and also allows to built new versions of android . one of those modified versions called Cyanogen mod. The first commercially available phone to run android was HTC dream .To run cyanogens mode on it the maximum CPU frequency required is 384 MHZ to 528 MHZ

3.1.1 1.Architecture of android :

The architecture of the android is based on the Linux kernel that provides memory management , process management , a driver model ,network management , a security model , power management . It very much differs from the kernal distributions even though it is based on the Linux Kernal unlike meamo developed by Nokia .Everything above the kernel has been replaced, e.g. udev , glibc and X11 are missing. So that you can't run standard Linux applications on android smartphones. An attempt to push the Android kernel into the Linux code base failed recently. Android kernel can't be used with the standard Linux kernel, as some new interfaces inside the kernel were introduced. Above the kernel there are the native libraries, represented by the green block in figure

. Android is used to borrow many already existing open source projects for those. For example WebKit for HTML rendering, which is also used in the Safari web browser. Other libraries provide things like media playback and data storage. They can not be accessed directly, but through Java APIs.



4DESIGN OF THE AUGMENTED REALITY ON ANDROID

4.1 Software requirements

4.1.1 Android SDK

The Android SDK provides the API libraries and developer tools necessary to build, test, and debug apps for Android. For a new Android developer, it is recommend to download the ADT Bundle . It includes the essential Android SDK components and a version of the Eclipse IDE with built-in ADT (Android Developer Tools) to streamline Android app development.

ADT bundle includes the following

- Eclipse + ADT plugin
- Android SDK Tools
- Android Platform-tools
- The latest Android platform
- The latest Android system image for the emulator

The entire application written on Android may not consists

of the native code(programming code that is configured to run on a specific processor) . Most parts of the Android API can be accessed through only java code. We need java skeleton for invoking the native functions .These functions can be invoked only through JNI(Java native interface) .JNI allows you to load shared C/ C++ libraries into Java applications at run time .In the application body you have to specify the signature of the methods with out their body. The method has to be marked with a native keyword if it is not implemented in java, but in native code.

4.1.2 Augmented reality toolkit

University of Washington developed AR toolkit(augmented reality tool kit) for marker based augmented reality which is an open source library. It is used for developing many AR related projects , as it is distributed under GPI(general public license). There is also a commercial license available for purchase, though. It is written in portable C code

Single camera position/orientation tracking.

Tracking code that uses simple black squares.

The ability to use any square marker patterns.

Easy camera calibration code.

Fast enough for real time AR applications.

SGI IRIX, Linux, Mac OS and Windows OS distributions.

Distributed with complete source code.

Augmented reality tool kit is the foundation for the augmented reality framework.

It not only bothers tracking markers but also calculation of the translation matrices .

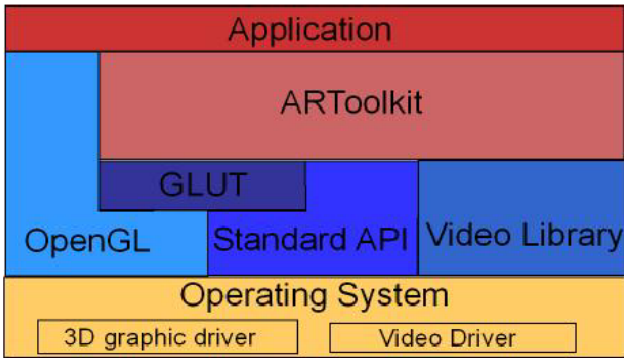
Initialization	1. Initialize the video capture and read in the marker pattern files and camera parameters.
Main Loop	2. Grab a video input frame.
	3. Detect the markers and recognized patterns in the video input frame.
	4. Calculate the camera transformation relative to the detected patterns.
Shutdown	5. Draw the virtual objects on the detected patterns.
	6. Close the video capture down.

The basic architecture of the augmented reality toolkit is shown in the below figure.It based on OpenGL(open graphic library) for translating , GLUT(graphic library utility toolkit) to create

OpenGL Window , hardware dependent video library and a standard API.

The toolkit consists of three different modules

- AR module : core module with marker tracking routines, calibration and parameter collection.
- Video module: a collection of video routines for capturing the video input frames. It is a wrapper around the standard platform SDK video capture routines.
- Gsub module: a collection of graphic routines based on the OpenGL and OpenGL ,Utility Toolkit(GLUT) libraries.



The AR module can be used without any modifications.

The video module cannot be used as the video API (application programming interface) of Android is the only available from java code.

The Gsub module cannot be used without any modifications because it relies on the GLUT (graphical library utility toolkit) which is not available on Android. For this reason most of the OpenGL parts had to be rewritten. The only function used of this module is one that creates a transformation matrix that can be loaded directly into OpenGL. In OpenGL only loads float arrays but not double arrays, so that this function has to be slightly modified.

4.2 Hardware requirements.

Android needs a hardware requirements of 64 MB of RAM at a minimum. In that

case, the most of the RAM will be used by the system and there will only be around 20

MB left, which all other applications will share with each other. The smart phone should have 192 MB of RAM. Memory is a main resource on this phone, too. Not only the amount, but also the bandwidth of the memory which is not comparable to

PC hardware. It's common that CPU, GPU (graphics processing unit) and the camera share the same memory, which will limit the available bandwidth even more.

Augmented reality speed up application processing by using threads, because there are many IO(input output bounds in them), even though parallel execution is not allowed on embedded processor's CPU. The smart phone does not contain the FPU(floating point units).due to the restriction in size and power consumptions of the embedded processors, then the operations have to be emulated by the software instructions.

OpenGL(open graphical libraries)

Android supports OpenGL ES currently in version 1.0. OpenGL ES is a 3D API

specially for embedded devices. These features of OpenGL that are

really needed are included. In the case of the OpenGL ES 1.x supports both fixed-point and floating-point at the API

level, the OpenGL pipeline itself is defined to be fixed-point based. OpenGL ES2.0 is the only version supports floating point. The difference to the standard OpenGL is that the glBegin/ glEnd entry points are completely missing. specify each vertex one by one, by providing references to arrays of vertexes. The textures(a graphic design process which contains two dimensional surface) must be square, with the size being a power of two. This restriction is applicable for not only to the embedded version of OpenGL, but also to the standard edition until

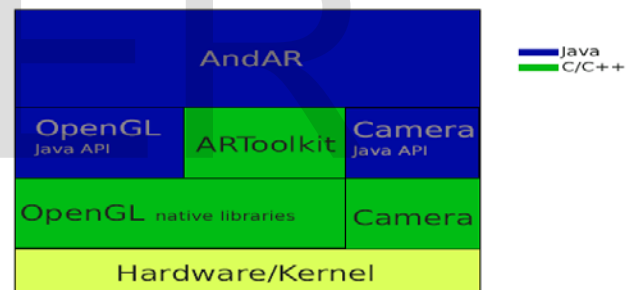
version 1.3, as stated by the API documentation. However this applies

only to the function glTexImage2D, which is used to initially transfer the texture

image data can be transferred to the OpenGL driver by using glTexImage2D. Images of any size can be provided by updating the texture through the function glTexSubImage2D. The embedded edition of OpenGL does not need other characteristics for this paper.

4.3 Implementation of the Augmented reality on Android

Augmented Reality applications on Android. offers a object oriented, pure Java API, hiding all the native library calls. It uses the Java API to access the camera and retrieve a video stream from it. The images are then in turn handed to the AR toolkit library.



The images will be converted to an appropriate colorspace by using multithreading and synchronization. Transformation matrix for the 3D object is calculated inside the library. The converted image will be loaded as a OpenGL texture, 3D object is drawn by applying transformation matrix. Augmented Reality application combines 2D (video stream) and 3D graphics. Android has an API for both use cases. There is an official way to combine them is by drawing the images on a rectangle as a OpenGL texture

with the size of the screen. This means just using 3D API that is the camera API is not only designed to just provide a raw stream of byte arrays. It always has to be connected to a surface on which it can directly draw the video stream. If no preview surface was set Android smart phones will not provide video stream. Android smart phone have to register a callback method in order to get the video stream. Every time when a new frame arrives, providing the image this method has to be called as a byte array. The formats that might be supported by the camera hardware is YCbCr 4:2:0 SP, is defined by the Android compatibility program which is default,

but the emulator uses YCbCr 4:2:2 SP by default.

Android version will run on any newer version that was released. , if you want to maintain backward compatibility you may not use any of the new features

.There are basically two kinds of a new features:

- A completely new class was introduced.
- A class was extended by a new method.

Every Android application consists of one or more Activities. An Activity is a visual user interface, targeted to a single purpose. Only one may be active at a time. In

order to write an Augmented Reality application, one has to extend the abstract class

This class already handles everything Augmented Reality related,

like opening the camera, detecting the markers and displaying the video stream. The application would run already, by just doing that. However it would not detect any markers.

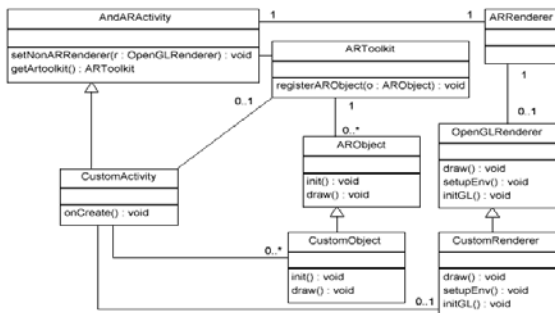
In order to do so, you have to register AR Objects to an instance of AR Toolkit.. The AR Object class itself is abstract. This means, it has to be extended, too. It expects the file name of a pattern file in it's constructor. This file must be located in the assets folder of the Eclipse project. In order to draw a custom object, the

method draw has to be overridden. Before this method is invoked a transformation

matrix will already have been applied. This means the object will be aligned to the

marker, without any further steps. This method will not be invoked, if the marker

belonging to this object is not visible.



5 MY IDEA:

Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions. Authors are strongly encouraged not to call out multiple figures or tables in the conclusion—these should be referenced in the body of the paper.

Augmented reality on android is not new . There are many applications developed based on this technology in various fields. This paper discuss the application developed to overcome the trailing problem that occurs in online shopping.

problem:

In online shopping we order things that may be dresses ,accessories, Jewelleryif we like them. After the things got delivered if they doesn't fit us we can also return them and select another item. It is going to take long time .The main problem here is online trailing is not allowed.

solution:

By using the application Augmented reality on android platform we can make online trail check possible

5.1 By using android

How it will work

For example if you are buying a dress in online follow the process that mentioned below

- Select a dress that you like it
- To trial it there will be two options YES or NO with question asked, want a try.
- If you press YES there will be a camera that will be opened automatically
- Camera will take your image and the image will be stored in the gallery
- The image will be set by the dress you have been selected by adjusting your image
- The zoom in and zoom out positions will be made automatically
- Then you can decide which one you like rather than waiting for a long time

For this process the soft, hardware requirements mentioned for Augmented reality on platform is needed.

advantages:

- 1.If we don't like the thing it don't take a long time to return and select another one
- 2.Time will be reduced.
3. we will select the suitable item



*Whether it suits for us or not,if it is ok then buy the dress,

Otherwise select the another dress. Continue the same process.



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CONCLUSION

This paper provides a description of the augmented reality on the android smart phones .The capabilities of the Android smart phone by using Augmented reality has been presented. The design considerations of the Augmented reality onAndroid smart phone has been presented. The hardware, software requirements has been discussed. The architecture of the Augmented reality has been discussed .The implementation of the augmented reality on the android has been discussed. The solution to overcome the problem of the online trial check has been presented

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Fig :c

The dress in the fig a has been selected ,if the person in the fig b want to try it .

The trial is shown in the figure c

Some of the pictures as examples for trialing is shown below

5.2 By using augmented:

*First select the item ,that item contains a code,that related to the item.

*That automatically displays the item ,we can adjust the zooming positions to the particular person.

*Then save the image.

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