

3D Based Augmented Reality for Structural Diagrams

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Abstract— A revolution in Computer Interface Design is changing the way we think about the Computer.AR is a system which maps the real world environment in a Virtual system deals with the combination of a real world & Computer generated data. This paper surveys the field of Augmented Reality in which 3D virtual objects are integrated into 3D real environment in real time. It describes the medical manufacturer, visualization, path planning, entertainment & military application that have been explored. This paper describes the characteristics of the augmented reality systems including a detailed discussion of the tradeoffs between optical & video blending approaches. This paper provides a starting point for anyone interested in researching using augmented reality. In this paper we present a prototype augmented reality for accessing abstract information in real world Computer fields & environment .This paper represents an overview of the basic concepts of the augmented reality (AR) & the main concepts of this technology. It describes the main fields in which AR is applied nowadays & important AR devices.

Keywords- Augmented Reality, Event Handling module,Rendering module, Virtual Reality,Marker Detection Module, Image Capturing &Preprocessing Module

1. INTRODUCTION

The use of smart phones has grown dynamically for the fast few years. Everywhere at each & every place the Smartphone's are used, the digital screen displays are being used for providing information. Augmented reality is a new concept which enhances a user's perception of and interaction with the real world.

The virtual objects display information that the user Cannot detect with his own senses. The information provided by the virtual objects helps a user perform real world tasks. AR is a specific example of what using the computer as a tool to make a task easier for a human to perform.

In this way augmented reality can be defined as a technology which allows computer generated virtual images to exactly overlay physical objects in real time. The first AR interface was developed by Sutherland in 1960's.A robot looks around scans his surrounding & detect humans. Using real time visual reports on the human vital biographical state, he identifies which one are enemies & efficiently deletes the threats. This is the scene from the movie terminator. It's the good example of augmented reality.

The feature of the augmented reality technology to enhance user's perception with the real world.This technology is used in many fields like medical visualization ,maintenance, repair ,annotation, robot path planning, entertainment ,military aircraft navigation & targeting etc.Linking the physical & digital world is the long standing goal of the augmented reality. The basic components of the augmented reality systems are scan generator, tracking system & display. Because of these systems the AR devices work efficiently. Augmented reality works because of two approaches marker based, location based. Markers work by having software recognize a particular pattern such as barcode or symbol .Location based application use the ability of a particular device to record its position in the world & then offer the data that's relevant to the location.

As the smart phones are used everywhere on Smartphone & tablets ,augmented reality feels like a magic window. Hundreds of augmented reality apps are available on iphone, ipad & android.AR is an amazing way for brands, retailers & publishers to get exciting newspapers,offers helpful real time information to customers on to the go.

2. WHAT IS TO BE DEVELOPED?

The goal of AR is to experience (to show) the magic of original(real) world.

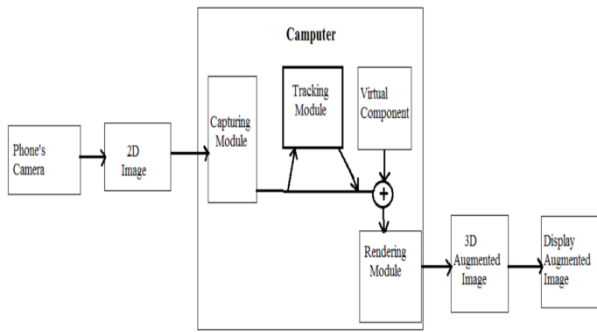


Fig 1. System Architecture

The given figure shows the simple augmented reality system.

It consists modules like capturing module ,tracking module, virtual components, rendering module. The application is placed between camera & display device. Capturing module captures the image then tracking module track the object, keeping background as it is [1]. In tracking module it calculates the location & orientation for virtual overlay. Then rendering module combines the original background & virtual object using calculated pose& renders the augmented image on the display.

The tracking module plays very important role in augmented reality system. It is used for position calculation in real time. The easiest way to calculate position is to use marker. The rendering module is used to superimposed the real image & virtual image. There are two types of augmented reality systems: Marker base AR, Marker less AR.

3. MARKER BASE AR

The figure of Marker pose represents how the 3rdDimensions of image should be calculated.



Fig 2. Marker

A marker is a image that a computer system detects using image processing, pattern recognition. Marker base tracking is nothing but defining correct state & position.

The goal of marker detection is to search the outlines of the potential markers. It also checks whether outlines form square/Then it confirms that it is really matter or not. Finally system calculates the pose using the information steps for marker detection.

1) Image Capturing

In this we perform image acquisition.

2) Processing

In Processing Captured Image is converted into grey scale & perform line fitting. Line fitting is performed to form corners.

3) Detection of Markers

In this step it performs fast acceptance rest for potential markers & discard non marker.

4) Pattern Matching

Performs pattern matching for markers & just identifies which virtual components to be placed.

5) Pose Calculation

Performs pose calculation for camera.

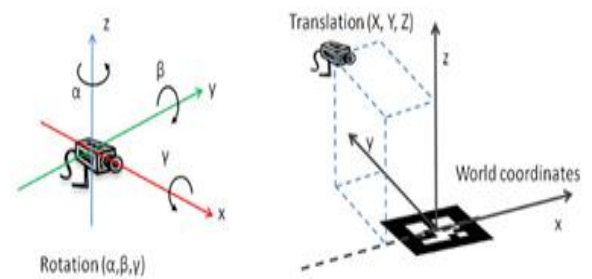


Fig 3. Pose calculation

The Alpha, Beta, Gyamma are the values which calculated when we change the position of camera.

In our project augmented reality ,we are developing a augmented book. In book we will have multiple images with markers. For each image there is a unique marker. We will have already defined data store in which a collection of already defined markers will be stored. In this we will hold a camera before a image & the markers will detect that image & try to match the particular image with the pattern defined in the databases. If the pattern is matched with the image ,then we will render it i.e. add virtual reality to that image & display it through the display device. This is our augmented reality application.

4. MATHEMATICAL MODEL

Set Theory Analysis

- Let 'S' be the "3D based augmented reality"

$$S = \{ \dots \dots \dots \}$$

Set S is divided into 5 modules

$$S = \{S1, S2, S3, S4, S5\}$$

S1= Image Capturing & Preprocessing Module

(ICP)

S2= Marker Detection Module (MD)

S3= Virtual Component Builder Module (VCB)

S4= Rendering Module (R)

S5= Event Handling Module (EH)

1. Identify the inputs.

Inputs = {X1, X2, X3,Xn}

X1= Video frame with marker

X2= Video frame without marker

Identify the output as O.

Outputs = {Y1, Y2, Y3,Yn}

Y1= 3D Augmented View

Y2= Texture Augmented View

a. Activity I

User Image Capturing.

Let S1 be a set of User's parameters for Capturing.

S1= {video_frame, image_quality}

Where, video_frame : Actual video frame

image_quality: Quality of the image

Condition/Parameter	Operation/Function
If image_quality == good	f1:Proceed()
Else..	Discard image

If image quality is valid then proceed Else discard the image

b. Activity II

Accept the frame, and search for markers in the image.

Lets S2 be a set of search parameters:

S2={video_frame_id,bin_video_frames, no_of_objects, marker}

Where,

video_frame_id: Id of incoming video frame

bin_video_frame: gray image of actual video frame

no_of_objects: No of objects found in video frame

marker: Marker data if marker found

Condition/Parameters	Operation/Function
no_of_objects	f1:SearchObject();
If (no_of_words ==1)	f2:readObjects() ;
Find marker	F3:findMarker();
Else, try next video frame	

Search in the binary image for all possible objects and keep count as no_of_objects.

If number of objects is greater the 0 then, find for marker in those objects.

c. Activity III

Calculation of marker pose in real time

Let S3 be the set of parameters to calculate pose.

S3:{video_frame_id, video_frame, marker}

Where,

video_frame_id = id of that video frame

video_frame = input video frame

marker = marker whose pose need to be calculated

Condition/Parameter	Operation/Function
Marker	F1:calculatePose()
	F2:storePosePerFrame()

Here the marker pose is calculated so that we should understand what will be Z axis in X, Y (2D) image.

d. Activity IV

3D objects Rendering.

Let S4 be a set of parameters required for rendering.

S4:{video_frame, marker_pose, object}

Where,

video_frame: input video frame

marker_pose: marker position and orientation

object: virtual object to be render

Here the 3D object will be render on marker pose

5. APPLICATION

- Create Art like real world
- Simulate construction project.
- In Army
- In medical system
- Marketing

6. FUTURE SCOPE

In this project we are using singler marker at-a-time but in future we will try to do multiple marker detection from single view. Also we are trying to do marker detection from dull image also we will try to add voice. Suppose in future structural diagrams in books changes then to automatically augment the changed diagram we will try to do this project dynamic.

7. CONCLUSION

Smartphone provide sophisticated service & functionalities to the users .On smart phones & tablets augmented reality feels like a magic window.Hundereds of augmented reality apps are available on iphone,ipad

& android. Our study the report which we have present clearly shows that, how the augmented reality is discovered ,developed & used in various intensive applications. The use of augmented reality will significantly bring the changes in current technology that is used in computing environments.

8. ACKNOWLEDGEMENT

We sincerely express our gratitude to everyone who have directly or indirectly helped & supported us. We also thank our teachers & parents for their constant support & encouragement

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