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Survey of Augmented Reality and Its Improvement

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***Abstract*: Augmented Reality is an area of research that aim to enhance real world by overlaying computer generated data on top of it. Augmented reality is a live view of physical and real world environment whose element are augmented by computer input such as sound, video, graphics, or GPS data. The key technology of Augmented reality includes displaying, registration and tracking, interactive, etc, among them , registration and tracking is most important technology. In this paper, we will demonstrate 1) how to improve efficiency of registration and tracking, 2) how to render virtual image correctly.**

Keywords: Augmented Reality; Registration and tracking

I. INTRODUCTION

Augmented Reality is research area which is in progressive stage and focuses on wearable technology like goggles, contact lenses which will be commonly used in future.

The three characteristics of Augmented reality system are[1]:

- Combine real and virtual environment
- Real time interaction
- Registered in 3D

The basic goal of Augmented reality system is to enhance the user perception of and interaction with real world through supplementing the real world with 3D virtual objects that appear to coexist in some space as real world. Registration of an image refers to accurate alignment of real and virtual object, without registration the illusion that virtual object exist in real environment is severely compromised[2].

Augmented reality 2.0 describes how recent development in mobile and web technology allows Augmented Reality application to be deployed on global scale and used by thousands of people at same time.

Augmented reality 2.0 = Augmented reality + Web 2.0

Here, Web 2.0 represents the world wide websites that uses the technology beyond static page of earlier web sites. It does not refer to any technical update in websites but refers to the change in way the web pages are made and used. Example: Social Networking sites, Blogs, Wikis, Video Sharing sites, etc.

II. BACKGROUND AND RELATED WORKS

Augmented reality allows the user to get the superimposition of real world with virtual object. So Augmented reality supplements or add feature to the reality in place of removing it. There are some differences between virtual reality and an augmented reality which will be cleared by a reality-virtuality-continum (RV-continuum) is used[3].

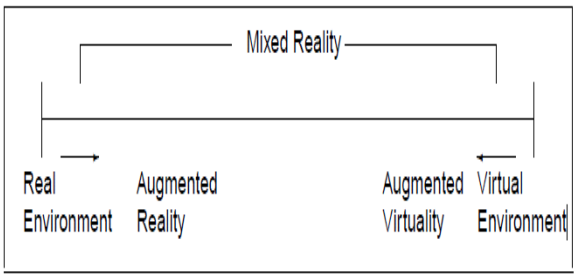

Figure 1: RV-continuum

An artificial environment developed by computer in which ones action partially defines that what would happened in a real environment via computer generated stimuli is known as virtual reality, whereas Augmented virtuality is virtual reality with some real world objects .For example: In whatsapp chatroom we send a voice messages to our friends in this virtual environment is augmented with real voice generated by chatters, augmented reality is same as augmented virtuality, only there is difference in ratio between real/virtual environment

III. BASIC FLOW IN AUGMENTED REALITY

Flow of Augmented reality is divided in following four steps[4]:

- A real world information is obtained through input devices.

- Use image recognition technology to analyze the real world and camera position information.
- Generate a virtual model with graph system.
- Finally integrate virtual model into video display on terminal display.

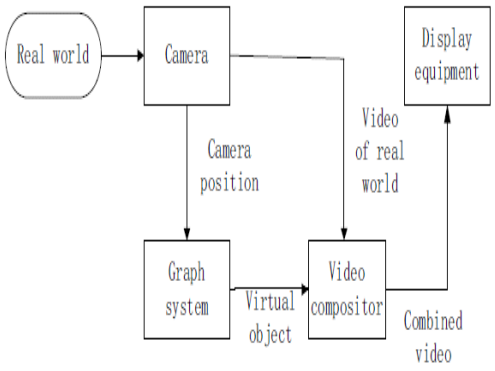

Figure 2: Workflow of Augmented Reality

IV. REGISTRATION AND TRACKING

The biggest job of Augmented reality is to track the user's viewing orientation and position. The appearance of the target changes by two components i.e. target representation and localization. Object tracking can be divided into two main streams: marker based tracking and a marker-less based tracking.

General tracking technology includes time of flight, special scan, inertial sensing, mechanical linkages, phase difference sensing, and direct field sensing[6], they may contain signal noise, degradation, and interference sources. Active tracking system requires calibrated sensors and signal source in prepared and calibrated environment, whereas passive tracking is done by computer vision methods which determine poses as well as detect, measure and reduce pose tracking errors.

Several different approaches for object tracking exist. Comaniciu[7] proposed a new approach towards the two components in visual tracking of non-rigid objects. According to him the target is represented by a histogram are regularized by spatial masking with an isotopic kernel. Oron[8] proposed an algorithm for a multi object tracking method for video images, it is mainly based on motion estimation and image difference technique.

Now we'll define the fully tested implementations including the following components:

- Video tracking engine.
- Video tracking techniques.

We describe these components in detail.

Video Tracking Engine

Video tracking engine supports different tracking algorithms and provides two services: (1) tracking video object with different accuracy and performance level, and (2) automatic rendering of computer animated virtual images.

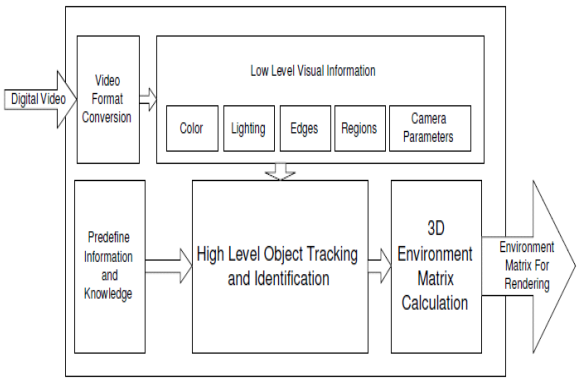

Figure3: Architecture of Video tracking engine

When we input the digital video ,the video format converter accepts the various digital video input formats. Now visual information like color, lighting, edges, regions and camera parameters are extracted and analyzed. Now these informations are added with the predefine information and knowledge and forms a high level object tracking and identification, now a 3D environment matrix is generated representing the binary form of image i.e 0 and 1 . Now via this matrix a image is generated at the display devices.

Video tracking techniques

To perform a video tracking an algorithm analyzes sequential video frames and output the movement of targets between the frames, there are variety of algorithms. Two major components of visual tracking system: target representation and localization, as well as filtering and data association. Target representation and localization methods gives a variety of tools for identifying a moving object. Some of the Target representation and localization algorithms are blob tracking (segmenting object interior), Kernel-based tracking(iterative localization procedure based on maximization of similarity), Contour tracking(deal with the detection of object boundary).

Blob detection technique

It is useful for identifying human movement. It refers to the mathematical methods that are aimed at detecting regions in digital image that are differing in properties such as color, brightness, compared to area surrounding those regions.

Two main method of detecting blob are:

- **Differential method**: It is based on derivative of function with respect to position of object

Common blob detector is based on Laplacian of Gaussian . Given an input image f(x,y) , this image is involved by Gaussian kernel

$$g(x,y,t) = \frac{1}{2\pi t^2} e^{-\frac{x^2+y^2}{2t^2}}$$

at certain scale t a scale space representation

L(x,y;t)=g(x,y,t) * f(x,y)

Then Laplacian operator

$$\nabla^2 L = L_{xx} + L_{yy}$$

Straightforward way to obtain a multiscale blob detector with automatic scale selection is considered the scale normalization Laplacian operator

$$\nabla^2_{norm} L(x,y;t) = t(L_{xx} + L_{yy})$$

- **Local extrema method**: It is based on finding local maxima and minima of function.

The simultaneous selection of interest point $(\hat{x}, \hat{y})$ and scale $\hat{t}$ is performed according to:

$$(\hat{x}, \hat{y}; \hat{t}) = \text{argmaxminlocal}_{(x,y;t)}(\nabla^2_{norm} L(x,y;t))$$

AUGMENTED REALITY APPLICATION

- Medical visualization:
  - Virtual internal organ can be overlaid with real images for pre-surgical planning and diagnostic
  - Medical readings such as blood pressure.
- Maintenance and repair:
  - Assembling parameter such as voltage and current can be presented in the view of engineers to free their hands for other work
  - Virtual object illustration by overlaying on top of real objects
- Navigation System:
  - Traffic information can be presented in the view of driver aligned with heat motion
- Education
- Entertainment
- Military
- Aerospace Industries:
  - Robot path planning
  - Pilot training
  - Aircraft Manufacturing

V. CONCLUSIONS

We foresee that Augmented Reality is area of research that aims to enhance real world image by overlaying virtual object over it via superimposition technique .In this paper we proposed the flow of augmented reality which derives that how a augmented virtual image is formed by capturing an image by camera or other device and superimposing a virtual environment over it, and we discussed a huge problem i.e. problem in registration and tracking ,we also discussed about the video tracking engine which takes an image as input and provide a combination of real and virtual image by 3D matrix generation method.

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