

Augmentum-3D Viewing Application

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Abstract - Augmented reality is the process of adding information typically in the form of dynamic graphics to 3D on the system. *Augmentum* is the registration of projected computer-generated images over a user's view of the physical world. With this extra information presented to the user, the physical world can be enhanced or augmented beyond the user's normal experience. The added dimension of visualization gives life-like insight into the design details which can't be achieved through a 2D image or even the current uses of 3D models. By the use of this will be able to visualize the design after building it.

Keywords - 2D image, 3D model, conversion, augmented, process, design.

I. INTRODUCTION

Augmented reality (AR) is a variation of virtual environments (VE), or virtual reality as it is more commonly called. VE technologies completely immerse a user inside a synthetic environment. While immersed, the user cannot see the real world around him. In contrast, AR allows the user to see the real world, with virtual objects superimposed upon or composited with the real world. Therefore, AR supplements reality, rather than completely replacing it.

The interaction between humans and the context through ubiquitous technology has been given more attention. One of the means to enrich this interaction is augmented reality (AR) in which virtual content is placed on top of a real world camera view. AR can provide additional contextual information and enable more realistic interaction experience with virtual content. At the moment of writing this paper, Many researches have been conducted on augmented reality in the fields such as tourism[1], shopping[2], education[3], entertainment[4] Ideally, it would appear to the user that the virtual and real objects coexisted in the same space. Some researchers define AR in a way that requires the use of head-mounted displays (HMDs). Augmented Reality This research is based on Augmented Reality (AR) study. Therefore, this section covers the basic idea of AR technology. According to the references, AR is defined as a variation of Virtual Environment (VE), or Virtual Reality as it is more commonly called. VE technology completely immerses a user inside a synthetic environment. While immersed, the user cannot see the real world around him. In contrast, AR allows the user to see the real world. Therefore, AR supplements reality, rather than completely replacing it. Using this idea, the applications of AR are under study in various fields, such as medical, manufacturing and repair, annotation and visualization,

robot path planning, entertainment, military aircraft, and so on.

A basic design decision in building an AR system is how to accomplish the combination of real and virtual world. There are two ways to accomplish the augmentation: optical or video technologies. A see-through HMD is one device used to combine real and virtual. Standard closed-view HMDs do not allow any direct view of the real world, whereas a see-through lets the user see the real world, with the virtual objects superimposed by optical or video technologies. Optical see-through HMDs work by placing optical combiner in front of the user's eyes. In contrast, video see-through HMDs work by combining a closed-view HMD with one or two head-mounted video cameras. The video cameras provide the user's view of the real world. For another option, a monitor-based optical configuration is also possible. A user does not wear the monitors or combiners on his/her head. Instead, the monitors and combiners are fixed in space, and the user positions his/her head to look through the combiners.

II. EXISTING SYSTEM

Early AR applications required the user to carry a computer and a Head Mounted Display (HMD) but in this study we focus on mobile augmented reality (mobile AR) which is enabled by handheld devices such as smartphones. Mobile AR enables unobtrusive gathering, managing and utilizing contextual information and providing AR-enhanced services based on the user's context.

A. Early Augmented System used HMD - Augmented Reality Systems In early augmented reality systems the users carried a computer and/or some form of Head-Mounted Display (HMD). MARS, Studierstube, AR Quake, AR Pacman are examples of such early AR systems. MARS (Mobile Augmented Reality Systems)[5] consist of a computer with 3D graphics acceleration, GPS, See-through HMD, wireless LAN and other components. Studierstube[6] is wearable augmented reality system that makes user to interact with the augmented object. Challenges in AR Development and Use Past augmented reality systems suffered from limitations of mobile technology and IT infrastructure. These limitations cause the developers and users to experience several challenges as described below. Firstly, using special AR hardware such as HMD has some problems.

HMD disrupt the view of vision and may cause inconvenience to the user. In addition, if HMD has low resolution, it causes difficulties to recognize augmented object and distortion of the sight that differ from real world. Moreover, special hardware is less accessible than common

device such as smartphone. The latest example of special hardware for AR is Google Glass, which is wearable computer with an optical head mounted display. Although its technology is sophisticated and design unobtrusive, Google Glass is currently too expensive to normal users. Another problem of Google Glass is that the current version cannot be used by people who wear ordinary glasses. Secondly, implementing augmented reality and building mobile computing interfaces require much time and effort from the developers. In the past, memory and data processing capabilities of mobile devices were significantly lower than today. As shown in AR Phone system, high data processing tasks can be delegated to an external server which performs necessary computations. This issue requires developers to build an infrastructure for external data processing and communications which, in turn, inflict latency to user experience. Because of these limitations smartphones containing a camera, high performance processing unit, high resolution display and context sensing capabilities have emerged as potential platforms for implementing mobile augmented reality. Yet, implementation of AR can still be a complex task. Today there are many AR libraries, such as Qualcomm's Vuforia, to alleviate this problem but they often lack direct support for processing of and interacting with virtual objects for the purpose of gaming. This, in turn, can increase time required for the development of mobile AR games. In next section, we introduce a mobile AR exergame Calory Battle AR that overcomes the aforementioned limitations. Additionally, in second iteration of the development process we explore the combination of Unity 3D game engine with AR to speed up the development and enrich 3D environment.

B. Augmented in virtual reality - This definition allows other technologies besides HMDs while retaining the essential components of AR. For example, it does not include film or 2D overlays. Films like "Jurassic Park" feature photorealistic virtual objects seamlessly blended with a real environment in 3D, but they are not interactive media. Two-dimensional virtual overlays on top of live video can be done at interactive rates, but the overlays are not combined with the real world in 3D. However, this definition does allow monitor-based interfaces, monocular systems, see through HMDs, and various other combining technologies. Virtual Reality: Virtual reality (VR) is a computer technology that uses virtual reality headsets, sometimes in combination with physical spaces or multi-projected environments, to generate realistic images, sounds and other sensations that simulate a user's physical presence in a virtual or imaginary environment. A person using virtual reality equipment is able to "look around" the 18 artificial world, and with high quality VR move around in it and interact with virtual features or items. The effect is commonly created by VR headsets consisting of head-mounted goggles with a screen in front of the eyes, but can also through specially designed spaces with multiple large screens. VR systems that include transmission of vibrations

and other sensations to the user through a game controller or other devices are known as haptic systems.

This tactile information is generally known as force feedback in medical, video gaming and military training applications. Virtual reality also refers to remote communication environments which provide a virtual presence of users with through telepresence and telexistence or the use of a virtual artifact (VA). The immersive environment can be similar to the real world in order to create a lifelike experience grounded in reality or sci-fi. Augmented reality systems may also be considered a form of VR that layers virtual information over a live camera feed into a headset, or through a Smartphone or tablet device.

C. Various tools for Building an application - Vuforia augmented reality toolkit was used for AR marker recognition and OpenGL and Unity 3D for rendering the 3D models. Using Unity3D to facilitate Mobile Augmented Reality Game Development [13]. Paper describes the comparison between the two different software used to build the 3D Game. The two software's are Unity3D and Vuforia. It shows the challenges faced during the development process and which software application is a better option for building the application. This paper explains that Mobile AR was a better option than the early augmented reality systems. As the users carried a Computer and/or same of HMD. The HMDs disrupt the user view of vision and may cause inconvenience, it has low resolution and causes difficulties to recognizes augmented object and distortion of the sight that differ from real world. Image Based 3D Modeling of Campus by using Sketch up [14]. The paper focused on the importance of 3D Modeling and how to create 3D model by software like sketch map. In this a paper a study of area of campus is done and the area can be visualized by 3D Modeling. The model is created of the 2D image by using Sketch up software. The simulation of Building escape System based on Unity 3D [15]. The system used 3Ds Max and Esri City Engine to generate 3D Modeling and animation. These models are imported into Unity 3D to simulate the escape scene. The result of the simulation can be displayed and interacted by virtual reality head wear equipment named Oculus Rift DK2. The simulation provides users with direct feelings and experience about the proposed escape system.

Marker Based Viewpoint Recognition for Interactions with Virtual Objects [16] Augmented Reality (AR) is a powerful tool to build a Virtual Environment. However, several drawbacks are recognized for practical applications as pointed out in references. The target of this study is to present new industrial products to general customers as mentioned in the introduction. Here is the scenario of this research. The customers are expecting to review the products as if they are having it in front of them. The customers expect to freely review them. However, a user's viewing position is fixed at the video camera position in the environment built with AR Toolkit. The virtual object is linked to the position and orientation of the video camera.

D. Using Tool With Customize Coding In Various Languages - A New Method Of Virtual Reality Based On Unity 3D [17] Unity3D is one of the most famous virtual reality tools, it is cross-platform game development software, and now besides Mac OSX, Unity3D can fully support WindowsXP/Vista/7, Unity3D supports three scripting languages: JavaScript, C#, and a dialect of Python called Boo. All three are equally fast and interoperate, and can use the underlying .NET libraries which support databases, regular expressions, XML, file access and networking. Scripting is frequently thought of as limited and slow, but in Unity3D scripts are compiled to native code and run nearly as fast as C++. So this paper explains how Virtual Reality can be achieved with the help of Unity 3D.

Using Marker Based Augmented Reality and Natural Interface for Interactive Remote Experiments [18] In this paper, a method to directly integrate the NUI devices with Augmented Reality is discussed where the users physical location and orientation can manipulate the virtual objects as well as the real objects at a remote location.

III. BACKGROUND

A User Study Trends in Augmented Reality and Virtual Reality Research[1]. This paper was introduced to address the question of how AR and VR research have been conducted to meet their users' needs. The main idea for the question was to review AR and VR research papers published in major AR and VR conferences and find a trend. The field of AR and VR research is primarily for human use as it is augmenting or simulating the real world. User studies are crucial in AR and VR research as it represents how users respond to stimuli in the research and helps to match more closely to user needs and requirements that improve the effectiveness or efficiency[11] of the research Learning to create 3D models via an Augmented Reality smartphone interface [12] The paper introduced the user interface design and functional operations of 3D Modelling application. In this system the camera captures the real scene and identifies the printed AR markers. Marker represents different primitive shapes. This tool measures distance and estimates the orientation of the markers.

Research has been done to address these. A set of evaluation techniques especially in the AR research was introduced [13]. It was a literature survey based on over hundred AR related papers that addresses user study approaches and methods as well as user evaluation types. A structured collection of usability design and evaluation guidelines were presented that synthesized information from a literature survey with many different sources[3]. Specific usability techniques for the VR research has been introduced [4, 5]. In the research, established across a number of fields of research. For instance, the significance of considering individual differences was emphasized to be taken into account in conducting research. These include user's experience levels, physical capabilities and limitations and technical aptitudes [6-9]. A tutorial about conducting experiments with human subjects in the field of AR and VR

research were given in the 2004 IEEE VR the practical significance of identifying and accommodating individual differences has been conference and it is being held almost every year of the conference [10]. This implies the practical significance of integrating the user study into the field of AR and VR research.

IV. EXISTING TOOLS

A. UNITY 3D - Unity is a cross-platform game engine developed by Unity deprecated which is primarily used to develop both three-dimensional and two-dimensional video games and simulations for computers, consoles, and mobile devices. First announced only for OS X at Apple's Worldwide Developers Conference in 2005, it has since been extended to target 27 platforms. Six major versions of Unity have been released. Some list of game made in unity: Temple Run, Monkey Quest, Shadowrun Returns, RimWorld, Electronic Super Joy.

Unity is a multipurpose game engine that supports 2D and 3D graphics, drag-and-drop functionality and scripting using C#. Two other programming languages were supported: Boo, which was with the release of Unity 5 and JavaScript which started its deprecation process in August 2017 after the release of Unity 2017.1.

Preset Libraries contain user created data and persist between sessions. They are integrated into the Color Picker, Gradient Editor and Curve Editors. A preset is e.g a color, gradient or an animation curve that is saved by the user. A preset library is a collection of presets saved into one file. Preset libraries contain personal data or project data. They can be saved either in the user preferences folder or in 'Editor' folder in the assets folder. Project preset libraries can then be added to revision control for easy sharing between users on a project and added to Asset Store packages.

(i) Unity Asset: An asset is representation of any item that can be used in your game or project. An asset may come from a file created outside of Unity, such as a 3D model, an audio file, an image, or any of the other types of file that Unity supports

(ii) Managed Plugins: Usually, scripts are kept in a project as source files and compiled by Unity whenever the source changes. However, it is also possible to compile a script to a dynamically linked library (DLL) using an external compiler. The resulting DLL can then be added to the project and the classes it contains can be attached to objects just like normal scripts. It is generally much easier to work with scripts than DLLs in Unity. However, you may have access to third party Mono code which is supplied in the form of a DLL. When developing your own code, you may be able to use compilers not supported by Unity (F#, for example) by compiling the code to a DLL and adding it to your Unity project. Also, you may want to supply Unity code without the source (for an Asset Store product, say) and a DLL is an easy way to do this.

B. BLENDER - Blender is a professional, free and open-source 3D computer graphics software toolset used for

creating animated films, visual effects, art, 3D printed models, interactive 3D applications and video games. Blender's features include 3D modeling, UV unwrapping, texturing, raster graphics editing, rigging and skinning, fluid and smoke simulation, particle simulation, soft body simulation, sculpting, animating, match moving, camera tracking, rendering, motion graphics, video editing and compositing. It also features an integrated game engine.

Blender was initially developed within an animation studio, by its own users, and based on requirements that fit with the daily practice of art creation within commercial projects; with picky clients and impossible deadlines. It has a strictly organized 'Data Oriented' structure, almost like a database, but with some Object Oriented aspects in it. It was entirely written in plain C. In designing Blender, an attempt was made to define structures as uniformly as possible, for all the possible 3D representations and for all the universal tools that perform data(base) work. The structure was meant to allow both users and programmers to work quickly and flexibly; a work method that well suited to developing an in-house 3D design and animation package. Although some jokingly called Blender a 'struct visualizer', the name is actually quite accurate. During the first months of Blender's development, we did little but devise structures and write include files. During the years that followed, mostly tools and visualization methods were worked out.

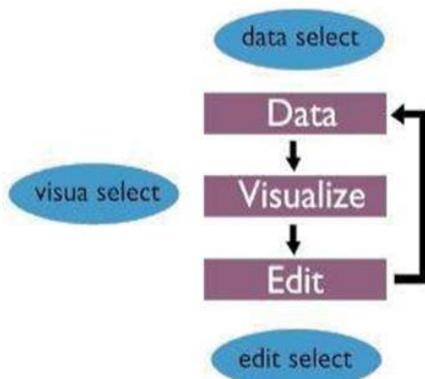


Figure1: Blender mechanism

This diagram depicts Blender's most basic structure. The "data-visualize-edit" cycle is in its core, and separated from the GUI (blue) which works on three distinctive levels.

(i) Data Select - A user selects 'data'. That means that the user specifies the part of the 3D database he wishes to work on. This is organized in a sort of tree structure. The basic level of Blender's Data system resides in the files, which directly maps on how it's arranged in memory. Blender data can contain multiple 'scenes'; each scene consists in turn of the 3D objects, materials, animation systems and render settings.

(ii) Visual Select - The specified data can be displayed in windows as a 3D wireframe, rendered using a Zbuffer, as buttons or as a schematic diagram. Blender has a flexible window system for this purpose, a window system that

permits any type of non-overlapping and non-blocking layout.

(iii) Edit Select - Based on the visualization chosen, the user has access to a number of tools. Editing is always performed directly on the data, not on the visualization of the data. This seems logical, but this is where a lot of software fails in terms of interactivity and intuition. Partially, it is a speed problem; when visualizing in 3D, it can take a while before the user sees the impact of an edit command. It is also an 'inverse correction' problem: the user is only aware of the visualization, not of the actual structure that is depicted. This can be quite irritating if you attempt to do something and the results turn out to be the exact opposite of what you intended.

Sometimes you may want to utilize files that either came from other 2D or 3D software, or you may want to use the things you have made in Blender and edit them in other software. Luckily, Blender offers a wide range of file formats (e.g. OBJ, FBX, 3DS, PLY, STL, etc.) that can be used to import and export.

These formats can be accessed from the menus: File Import and File Export. Popular formats are enabled by default, other formats are also supported and distributed with Blender, these can be enabled in the User Preferences through the use of Add-ons.

Linked Libraries - These functions help you reuse materials, objects and other data-blocks loaded from an external source blend-file. You can build libraries of common content and share them across multiple referencing files.

Append and Link

Reference

Mode: All Modes

Menu: File Append or Link

Hotkey: Shift-F1 or Ctrl-Alt-O

a) Link: it creates a reference to the data in the source file such that changes made there will be reflected in the referencing file the next time it is reloaded. Whereas, Append makes a full copy of the data into your blend. You can make further edits to your local copy of the data, but changes in the external source file will not be reflected in the referencing file. In the File Browser navigate to the external source blend-file and select the data-block you want to reuse.

b) Hotkey Ctrl-L: Links objects between scenes or data-blocks of the active object to all selected objects. In some case (i.e. Object Data, Modifier) the target objects must be of the same type than the active one or capable of receiving the data. The existing data-block of which will be unlinked from them.

c) Objects to Scene: Lets you create links to the selected objects into a different scene than the current one. A scene name must be chosen other than that of the current one. The Link Objects to Scene Operator panel lets you choose between scenes. This makes the same object exist in two

different scenes at once, including its position and animation data. The object's origin will change its color.

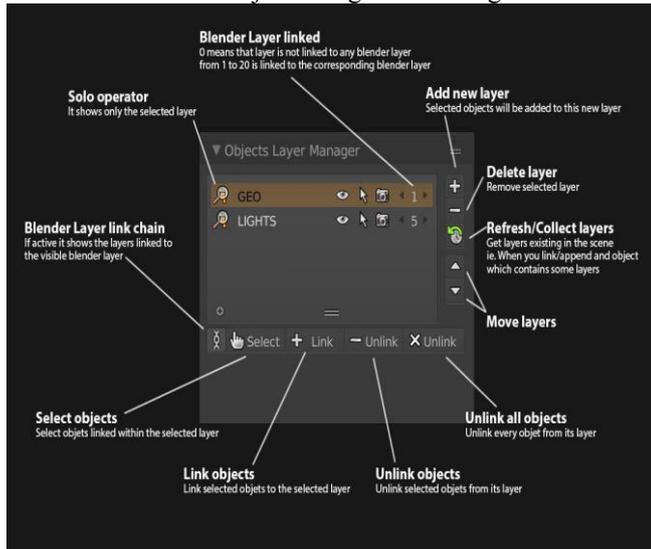


Figure2: Transfer UV Maps

The active UV map of the selected objects will be replaced by a copy of the active UV map of the active object. If the selected object doesn't have any UV maps, it is created. Objects must be of type mesh and must have the same number of faces (matching geometry).

V. PROPOSED SYSTEM

The idea that was proposed to create an application that would enable the users to view a 3D model of the building infrastructure for builders, architects and engineers and to have a clear idea of how it looks, without the individuals having to actually visit the site. Since, the paper design does not provide much information like the exact location of the building, how it will actually look at that site and inside etc. This makes it difficult for the individuals to locate the building and its visualization as the paper design only provides an image of the building. To solve these problems and to make it easier for the architects, engineers. As well it also provide overview of the infrastructure, the proposed system proposes to create an application named AUGMENTUM- A 3D Viewing Application.

VI. BLOCK DIAGRAM

The block diagram of proposed system has following main components shown in fig 3 that explains block level representation of the project. It shows how different modules will be interacting with each other and entire flow of the system. The system design has following main component:

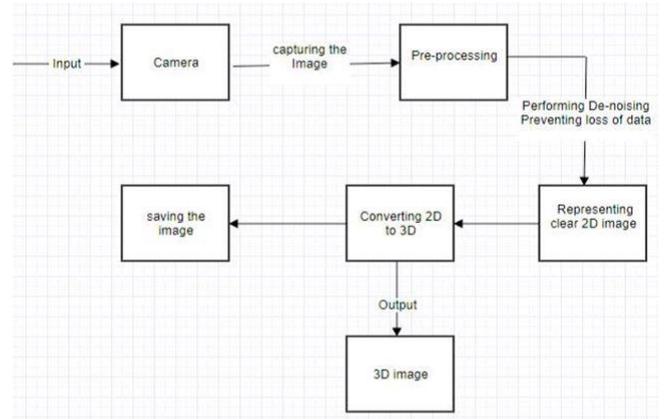


Figure3: Block Diagram

- (i) **Camera:** The input is taken from camera in the form of plain (2D) image.
- (ii) **Pre-processing:** Captured image are processed. Then it performs de-noising and prevention from data.
- (iii) **Representing 2D:** In this the clear processes 2D image is represented to augmentum application.
- (iv) **Converting 2D to 3D:** By applying conversion technique the image is converted into 3D.
- (v) **3D Image:** This will be the output of augmentum application in this the final 3D image display to the user.
- (vi) **Saving the Image:** If the user want to save the 3D image then image will be store in local database

Working of the proposed system: The following steps represents the working of proposed system:

1. It starts from taking the input from the user which is capturing image in 2D form.
2. After taking the picture it will run in augmentum application where the image is pre-processed.
3. All the de-noise and filtering technique will be applied.
4. In pre-processing it will perform de-noising and applying data loss method to create a good image for conversion.
5. Hence, will get the clear 2D image for further processing. After getting the clear image 3D conversion process will be take place.
6. The converted image will be displayed to the user.
7. If the user want to save the 3D converted image that image was stored in local database of the application

VII. CONCLUSION

The purpose of this Augmentum Application is an android application that displays a 3D model of the 2D image using MATLAB technology and gives the overview of the infrastructure. The primary objective of this system is to help the user to get more information about the infrastructure. To understand the dynamics of the proposed system, a basic idea about MATLAB to create 3D models and knowledge of android is needed. This report explains the entire working of Augmentum, along with minimum requirements needed to implement it. Hence, the users can easily use Augmentum to view a 3D model of 2D image.

The future scope of this application is that we can have the view of floors and its details and can have information about building that is converted into 3D.

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