Smart Library Using Augmented Reality

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Abstract - As emerging development platforms, augmented reality is a relatively new area of technology that has only recently gained popularity. Augmented reality, like most other well-established innovations, can be applied to almost every aspect of daily life. The attraction of augmented reality is its simplicity; most AR applications are so easy to use even an infant can use them without any difficulty. In this paper, we suggest an integrated application framework that can be used to improve library accessibility. This application can be created in two sections one section acts as a server that holds information of every book available in library and second section is a mobile application that can access this database. This application should be installed in every library user’s phone. The phone camera can be used to see the AR interface in the library, phone application can scan different visual markers in different parts of the library. This scanning result will show the type of books in that section of the library in details, this is more convenient compared to a note that can only give little information. This result will also contain a list of all books available in that section. If the user want browse through books if he/she not looking for a particular book, then user can scan the cover of a book to just get all the information about the book online and offline. This application will significantly facilitate the role of managing a library.

Keywords - Augmented Reality, 3D, API, Unity

I. INTRODUCTION

In the modern world, the library is similar to a prototyping and experimentation facility. In the field of libraries, virtual reality ar is breaking new ground. It is a new technology that creates a composite perception is one that is produced by overlaying a computer provided image on top of a user's realistic idea. It's an enhancing technology that allows mobile users consumers to see the critical world in a technologically impressive manner. Augmented Reality is used in conjunction with headphones and/or portable gadgets such as laptops, devices, and even personal computers. Application, sensors, and digital projectors make up the systems, which support multiple representations to be reflected onto everyday objects. The potential of augmented reality to improve what truly occurs makes it a perfect match for libraries. Library practitioners must commit the novo to working with virtual reality technologies more accurately and reliably underneath the library's security binary, bearing in mind the daily demands of library users. It is often regarded as both a digital database for locating articles in a library and a full-fledged augmented reality application that assists the user in recognising the desired book. Upon each book that are contained in the library, not only from the author, title, International standard book number, year of publishing, and additional keywords, as well as the genre and physical location on the book case are considered to its databases. The system then augments a book's location on the library shelf, giving users a direct and reliable solution to the successors of book checking. There are two primary user on the system.
II. PROPOSED ALGORITHM

2.1 Marker Based AR algorithm -

In most cases, this entails observing a sensor against a two dimensional texture pattern, but it may also mean targeting a 3D model. A stationary picture, also known as a stimulus image, that and user can scan with their smartphone with an augmented reality app is required for interactions. The device scan will cause significant material, such as video animations in 3D or other material, to display on top of the indicator. A marker-based AR system looks around the globe for a specific image source and then recreates virtual images on behalf of it. As a result, the AR device's sensor will give strain the data and perform marker — image classification before creating the structure and placing the digital objects. The simulated object's configuration will be determined by the marker's orientation and location. The virtual entity becomes lost if the computer loses sight of the goal, and it is replaced until it shows up.

![Figure 1. Marker Based AR algorithm Diagram](image)

2.2 Marker Less AR algorithm -

It uses software framework that overlays simulated three-dimensional objects onto a scene and holds it to a single focal point without requiring expert understanding of the user's location. Instead of placing markers, it places three dimensional objects in the physical world depending on the surrounding environment, which helps people. For augmented reality, modified truth without markers is the preferred image recognition process. The simulated object is placed in the structure created by the slam approach to achieving and visualization, which integrates the captured image and creates a 3D mesh of the universe for the machine to perceive as a 3D Model. As a result, if a virtual object is set in its location, so in its three-dimensional model. As a result, even though the object lacks its focus when it returns, the simulated image will still be located in the very same place.

![Figure 2. Marker Less AR algorithm Diagram](image)
2.3 Marker Less with Geometric Environment Understanding algorithm

We strive for dense 3d reproduction of the environment in relation to classifying the camera, despite the fact that the compounds we retrieve are not labeled. They can now, for example, make a character wander from around location, “hide” behind the same couch, and plot a plausible navigation course that avoids obstacles. The concept "markerless augmented reality" refers to a device interface that integrates 3-d models into a scene and keeps it at a set depth without requiring expertise of the device’s framework. The conversion from picture or QR application detections to markerless augmented reality interactions is now complete. Markerless ar is now accessible on tens of millions of phones.

![Diagram](http://www.paideumajournal.com)

Figure 3. Marker Less with geometric environment understanding algorithm Diagram

### III. EXPERIMENT AND RESULT

All gaming in Unity takes place in scenes. All components of your game, including gaming levels, the main screen, options, and cut scenarios, occur in scenes. A new Image in Unity comes with a Camera object named the Main Camera by design. Multiple cameras can be added to the scene, but we’ll only focus on the main cam for now. The camera produces or "captures" what it sees in a space called the viewport. For the player, everything that enters this zone appears visible. By moving your pointer from inside environment view and clicking to zoom out the environment view, you could see this window as a grey rectangle. (Alternatively, you may drag Right-click while holding Alt.) Drag your content on top of such target to make it a child of the target. This may be a normal Cube created by going to GameObject -> 3D Object -> Cube, or you may use content from Unity's Asset Store or even the Ice Cores, as seen above.

This section presents the results and examples of the use of augmented reality library. The examples were defined with their order to exemplify the development of an application developed using only augmented reality.

1) **Create a window**: The most basic of the features present in the library is window management, which serve as a screen for the application. A window is created from the instantiation of the Window type object, with the following parameters: window size, width and name. It should be remembered that, due to the limitations of Kinect, the maximum resolution of a window must be 640x480. After creating the object, a loop is created to manage the window. This loop must be active while the window is open. Inside the loop there are two functions that are essential in any application created:

   i. **Clear**: the window needs to clean everything that is drawn in the previous table. In addition, this function also is responsible for restarting some internal elements for ideal standard values for each iteration. Is black-box function; and is
ii. Update: analogous to the clear function, but must be called as soon as the iteration comes to an end, that is, all processing of any created application must happen between these two functions. Eventually, to use the function `CleanAndDestroyWindow()`, additional black box method that controls everything to be cared about in regard to the screen, all memory must be cleared.

2) Render polygons: Another elemental feature for whatever application created using augmented reality is the ability to render polygons. Thus, providing an example proves to be relevant and useful. It is noteworthy that importance that you need to create a window first.

i. Define vertices of the polygon: for the positions, the 4vectors must be between the coordinates -1 and 1, where the center of the polygon is defined by the coordinate (0, 0, 0). The fourth dimension is only for OpenGL, should always be 1.0f;

ii. Create Shader: provide the address for the two code sources for the `Shader()` function. `nullptr` would be the source code for the `geometry shader`, which is optional. The last two parameters to create a shader are the resolutions of the created window;

iii. Create Mesh: create the `mesh` based on the set of vertices defined in the polygon and the desired `shader`;

iv. Configure Mesh: use the `Push()` function to configure the `vertex`, depending on the attributes of the `Vertex` class. The configuration is made with the types of attributes and the number of them. In the example shown, the class `Vertex` has only one attribute, this being the type `glm::vec4`. Therefore, only one `push` is performed with the type and quantity (one - 1);

v. Build the Mesh: this instruction is necessary to allocate all data on the GPU. It’s where data are transferred from the CPU to the GPU; and

vi. Draw: the `Draw()` function receives only the `mesh` that you want to draw.

3) Moving a textured polygon: To texture and move a polygon it is necessary to instantiate two new classes: Texture and `Object`. Something to be aware of is the configuration of the `Vertex` class according to the application in question. To texture the polygon, it is necessary to add another property, the texture coordinates. They should be between the values 0.0 and 1.0, in both dimensions. Mapping is done automatically from that. Follows the sequence of the necessary steps:

i. Create Texture: using the Resource Management, it is necessary to load an image in a format common, such as png or jpeg, to be used as texture for the generated `mesh`. The parameters are the path to the image;

ii. Create Object: the object defines the behavior of a polygon relative to the application. So, a new object is instantiated;

iii. Move object: once created, it is possible to move the object project to the desired position with the `Move()` function, as also resize it using the `Size()` function, passing as two parameter `floats` with the values desired. Placing function calls within the `loop`, where they will be modified, it can be rendered with the coordinates, varying slightly each iteration, giving the impression of movement; and

iv. Draw: for `Draw()` function they are passed as parameters the `mesh` created and the object, which contains the position information and the texture with the image loaded. In this way, the polygon will be designed with the intrinsic characteristics defined by the mesh (if it is a square, triangle, trapezoid, among others), the temporary ones (position, rotation, and size) defined by the object and the applied texture.

5) Tracking books: Tracking books is essential functionality for the library. To do the crawl book tracking only takes a few steps additional:

i. Initialize NiTE: with the Kinect function called `initNiTE`, it is possible to do this easily. This function it has no parameters;

ii. Track books: call the function `Track books()` returns a vector of the books class, which is used to store all information about books tracked items. How Kinect can track more than user, it returns a vector of users. If not there are users tracked, the vector returned empty. THE called and this function needs to be inside the loop, because the positions need to be updated with each frame; and

iii. Draw books: information from books can be drawn on canvas, if necessary. Just build a mesh with the information removed of the books class, which are provided by the function `getbooks()`. From here, the produced mesh is passed as a parameter to the `Draw()` method, which is responsible for drawing the user's tracked books on top of the specified spot.
The program must extract actual world dimensions irrespective of camera and camera images, which is a crucial indicator of how effectively ar systems incorporate enhancements with the actual world. This procedure is known as object recognition, and it employs a range of digital image analysis, the majority of which are related to object detection. Many augmented reality image processing techniques are derived from digital odometry. An augogram is a machine image used to produce arrhythmia. The technology and technology process of creating augograms for arrhythmia is known as augography. Regardless of the fact that Augmented Reality technologies in universities provide a significant potential for increased exposure to paper and electronic library resources, the most of them are only in the process of being developed. AR apps can have a fun and engaging higher information. Graphical data-integrated applications are suitable with both in-library and off-site real-time collaboration of library materials. Mobile virtual reality apps have a lot of potential for integrating library services into users’ knowledge environments. Libraries will also broaden and extend their influence in this environment by investing in even more exploration and growth. Libraries will also broaden and enhance their library reach in this area through virtual reality technologies with further innovation and growth.
Since the program must obtain modern world dimensions irrespective of the device and device images, a key indicator of ar technology is how accurately they incorporate enhancements with the actual world. This procedure is known as image registration, and it employs a range of computer vision techniques, the majority of which are linked to video tracking. Several augmented reality image processing techniques are derived from visual odometry. A machine image called as an augogram that is being used to create scientific and technology practice of creating augograms for ar and typically, these procedures are divided into two sections. The very first task is to select connected components, fiducial marks, or optical flow in images captured. This step may employ feature detectors such as corner detection, blob identification, edge detection, or image segmentation, as well as other digital image processing. Many theories require objects with uniform thickness or fiducial points are aware that change in the stage 2, which restores a modern world reference frame from the data collected in the first stage. In many of these instances, the scene's three-dimensional form can be measured using three-dimensional computer graphics. 3D modelling is the method of using advanced software to create a graphical model of the layer of an immaterial or living entity in 3 components. A 3d model is the name of the item. A 3d artist or a 3d modeller are terms used to describe anyone who deals with 3d objects. A three-dimensional model may also be rendered into a two-dimensional object and used in a simulated world of natural processes.
IV. CONCLUSION

This paper proposes a method to digitize the library and makes an interaction library system with the customers. This project makes finding of the books easier compared to the conventional one. Augmented Reality increases the utilization of the application with attractive appearance. The objective of the project was successfully implemented.

REFERENCES