

Furniture Arrangement Using Augmented Reality

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Abstract - Augmented reality aids people with visual effects that relate to the environment of the space and with this concept people can view the furniture in the room without actually placing it in the area. The user interactively moves furniture piece using our application without actually having to arrange the furniture which is a highly tedious task. We develop an interactive system for furniture arrangements which includes translation, rotation and scaling of the 3D objects, as per the choice of the user. Thus, the user can experience different furniture arrangements through our application which minimizes the user's time and effort.

Keywords: Augmented Reality, furniture, interior design, three-dimensional spacing, rendering.

1. INTRODUCTION

Furniture arrangement in house or in office can be a tedious work if there are too many furniture to be placed in the room or simply people don't have any idea how to do layout of the furniture. People can either draw up the room and furniture in paper or use computer applications that assist people or they can just arrange furniture right away to see how it looks and fits in the room. In our proposed system, we will use the concept of AR to help people view the furniture in their room without actually placing it in the area. We present an interactive furniture layout Android application that helps users arrange their furniture by simple actions like sliding, pinch-in, pinch-out, etc. This will greatly minimize the user's time and effort.

2. THEORY

Augmented Reality (AR) allows virtual objects to be combined with a real world representation. The three key characteristics of AR have been identified to be: (1) combining real and virtual images, (2) the virtual imagery is registered with the real world, and (3) real time interaction of both virtual and real objects. During the last decades, research in AR focused on the development of techniques to provide such a user experience. Applications of AR can now be found in various domains such as medicine or games [14]. With the sophistication of mobile devices the new field of mobile AR has emerged with its own challenges.

The main limitations of current mobile devices for AR are the limited input/output options, the screen size and the graphical/computational power. AR has often been opposed to pure virtual reality (VR) mainly in the domain of medical training and has shown to lead to a better perception of the task especially when coupled with haptic feedbacks. An AR based approach has recently been used as a new interaction technique to increase safety for industrial robots: the user can pre-visualize the moves of a robotic arm and display information regarding the current state of the motors using a head-mounted display.

Vuforia is an Augmented Reality Software Development Kit (SDK) for mobile devices that enables the creation of Augmented Reality applications. It uses Computer Vision technology to recognize and track planar images (Image Targets) and simple 3D objects, such as boxes, in real-time.

Image Targets represent images that the Vuforia SDK can detect and track. Once the Image Target is detected, the SDK will track the image as long as it is at least partially in the camera's field of view. Vuforia first detects "feature points" in your target image and then uses the data to compare the features in target image and the receiving frame from camera.

3. METHOD

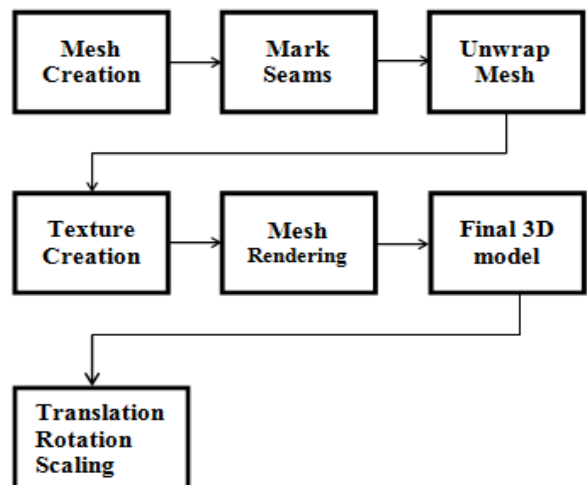


Fig -1: Block diagram

3.1 Mesh Creation

Desired furniture model is created.

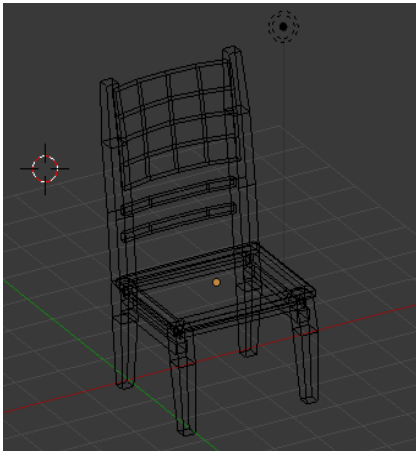


Fig -3.1: Mesh

3.2 Creation of Seams and Mesh Unwrapping

A seam is where the ends of the image/cloth are sewn together i.e. we mark seams on our 3D mesh according to which the mesh is cut [13]. Cutting of the mesh model according to the seams marked results in various flattened-out pieces of the mesh which makes the process of texture creation easier. According to the seams marked, mesh is unwrapped for texture creation.

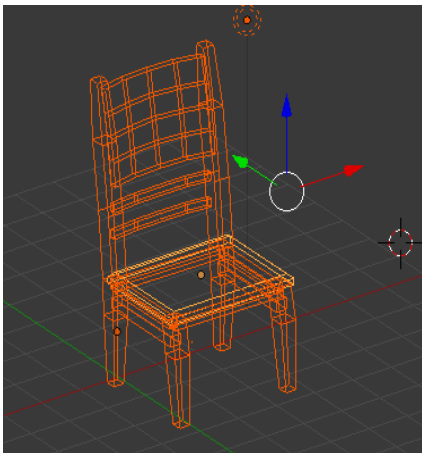


Fig -3.2.1: Seams marked

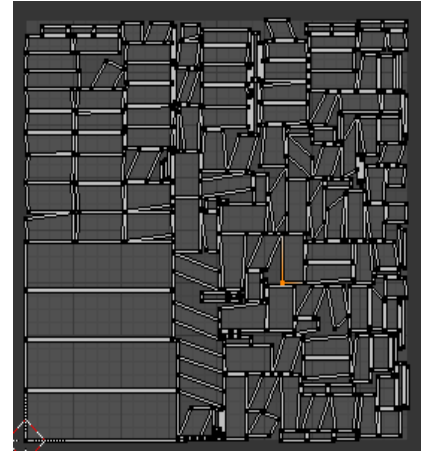


Fig -3.2.1: Unwrapping mesh

3.3 Texture Creation

Texture creation extends the known parts of the image to the unknown ones, and copies pixels of known regions to unknown ones [2]. Once the 3D shape of the furniture in the 2D image has been recovered in the view of camera, the mesh is re-projected onto the image plane. We then can apply the generated texture to the 3D shape and produce the final 3D model which is ready to be rearranged using scaling and rotation.

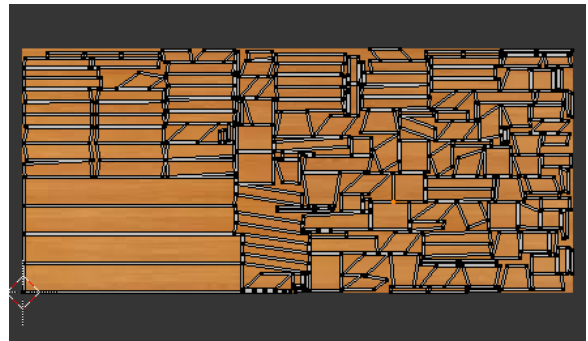


Fig -3.3: Texture creation

3.4 Mesh Rendering

Once the texture has been applied, the UV maps are wrapped together to get the 3D model [5]. Now the final 3D model is ready to be rearranged using translation, scaling and rotation.



Fig -3.4: Final 3D model



Fig -3.5.1.1: Before translation

3.5 Translation, Rotation, Scaling

We compute translation vector in virtual 3D space in such a way that the drag amount is consistent with the displacement of the object on display [1].

3.5.1 Translation

In translation mode, the object can be displaced by swiping.

```
// Get the fingers we want to use
```

```
var fingers = LeanTouch.GetFingers(IgnoreGuiFingers, RequiredFingerCount);
```

```
// Calculate the screenDelta value based on fingersvar screenDelta = LeanGesture.GetScreenDelta(fingers);
```

```
// Perform the translationTranslate(screenDelta);
```



Fig -3.5.1.2: After translation

3.5.2 Rotation

In the rotation mode, the object rotates by dragging as making a circle around the center.

```
var fingers = LeanTouch.GetFingers(IgnoreGuiFingers, RequiredFingerCount);
```

```
// Calculate the rotation values based on these fingers
```

```
var center = LeanGesture.GetScreenCenter(fingers);
```

```
var degrees =LeanGesture.GetTwistDegrees(fingers)
```

```
Rotate(center, degrees);
```



Fig -3.5.2.1: Before rotation



Fig -3.5.2.2: After rotation



Fig -3.5.3.1: Before scaling



Fig -3.5.3.2: After scaling

3.5.3 Scaling

In scaling mode, the object expands or reduces by the operations of pinch-in or pinch-out using two fingers.

```

var fingers = LeanTouch.GetFingers(IgnoreGuiFingers, RequiredFingerCount);
var scale = LeanGesture.GetPinchScale(fingers, WheelSensitivity);
var screenCenter = LeanGesture.GetScreenCenter(fingers);
Scale(scale, screenCenter);
    
```

4. RESULTS

Steps to follow:

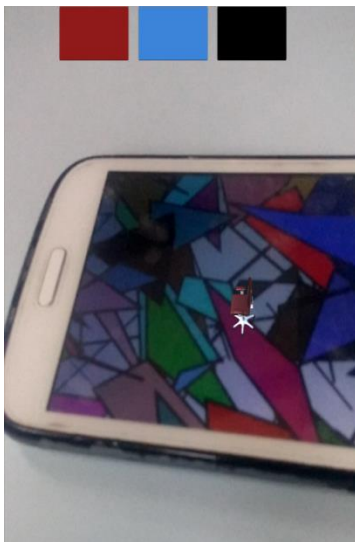
1. Open the application on an android device.



1) Office chair



2. Select the desired furniture from the list view.
3. Point the camera to the target image to view the furniture.



2) Stacking chair



4. Pinch-in, pinch-out, slide, etc. to move the furniture as per the requirement.

3) Wooden chair



5) Glass top table



4) Wooden table



5. CONCLUSION

Augmented reality is becoming more and more common in real life. Game engine Unity 3D and some AR development platforms provide possibility for us to apply augmented reality to more and more applications. The application proposed in this paper allows user to view 3D furniture models in real time. The main advantage of this application is that it reduces the cost and provides the multimedia augmentation of high vivid simulations for user in real time. In addition, it allows the customer to understand the concept of the project and thus enable them to achieve the customized requirements and better design affection.

6. REFERENCES

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