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Leveraging AR for 3D Modeling

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***Abstract*:- This paper is all about integrating engineering graphics in normal engineering curriculum with Augmented Reality (AR). Our aim is to improve the understanding of 3D models that are being used in sophisticated engineering studies. We intend to apply the power of visual representation by implementing the new fast growing field in computer science, Augmented Reality, so that we can enhance the models more efficiently. Normally, students are introduced to different 3D models in engineering graphics in printed form which is usually an inefficient method to convey the shape of the model. In order to bring in a new, more efficient method of conveying the shape of 3D models that we are portraying, we are introducing AR technology. By using AR we hope to improve the situation by projecting the required shape in 3D in any mobile/PC devices.**

In the proposed project of leveraging AR for 3D modeling, as an additional feature which could help deeper understanding of the 3D model, we intend to introduce cross sectional figures of the given 3D shapes such as cube, cuboid, cone and sphere. Both the cross sectional and 3D whole view will be given the additional functionality of viewing the shapes in accordance to the user's viewing desires such as top view, front view etc.

Keywords: Augmented Reality, 3D modelling, Cross-platform play, Unity

1. INTRODUCTION

The technology of Augmented Reality was introduced by the US Air Force department in the 1990s. AR started to see significant growth since 2015 since the launch of Meta 2, a head-mounted display headset which was introduced at a TED conference. Later in 2016, Niantic launched "Pokemon Go", an augmented reality based Android/iOS game which exponentially popularized the concept of reality distortion using hand held devices such as a smartphone. There after technology giants such as Apple and shopify started to Roll out AR based products. Ikea, a swedish group that designs and sells ready-to-assemble furniture, kitchen appliances and home accessories, developed an app that enables users to experience all the furniture's that Ikea sells in their own room itself using AR technology.

The project leverages the growing technology of Augmented Reality to enhance the understanding of basic 3D models that are usually portrayed in 2D dimensions which may lead to difficulty in learning about the accurate shapes of the given figures. Unity, a 3D game engine offers most of the tools that are required to implement the project. Blender is a free and open-source 3D computer graphics software tool set used for creating 3D models, interactive 3D applications and video games, is used in the project for creating the cross sectional and the whole 3D view perspectives of the given figures such as the cube, cuboid, cone and sphere. Wix, allows users to create HTML5 websites and mobile sites through the use of online drag and drop tools is used in the project to develop the front end and user interface components. itch.io, a website for users to host, sell and download indie video games is used for hosting purposes of the unity WebGL files.

Section one deals with related works of augmented reality briefly describes about transformation of 2D image to 3D and use of Unity in AR. Section two describes the architecture of our proposed work shows how the 3D models can be viewed in AR, use of blender software to make cross-sectional view of 3D objects and for enabling cross-sectional play the webGL files are hosted in itch.io followed with description of tools used in 3D modeling .Last section includes the conclusion and future scope.

2. RELATED WORK

[1] Proposed an application to generate 3D model of any object. The proposed application will take a few 2D images from various angles of the object using mobile device and it will consequently change it into a 3D model. This approach will reduce the time taken for the generation of 3D model. The proposed application can be implemented in many fields like gaming, machine modeling, architectural modeling, medical, E-commerce etc. The conversion of 2D images to 3D model makes the object look more realistic.

[2] Organized with a brief introduction on 3D GIS modeling standards, description of project area and unity 3D game engine as project implementation platform. This paper also deals with advantages and limitations of using Unity platform. The Unity 3D game engine itself is the most high quality game engine available in the market, easy to use and shorter rendering duration are mostly suite for game developer and companies.

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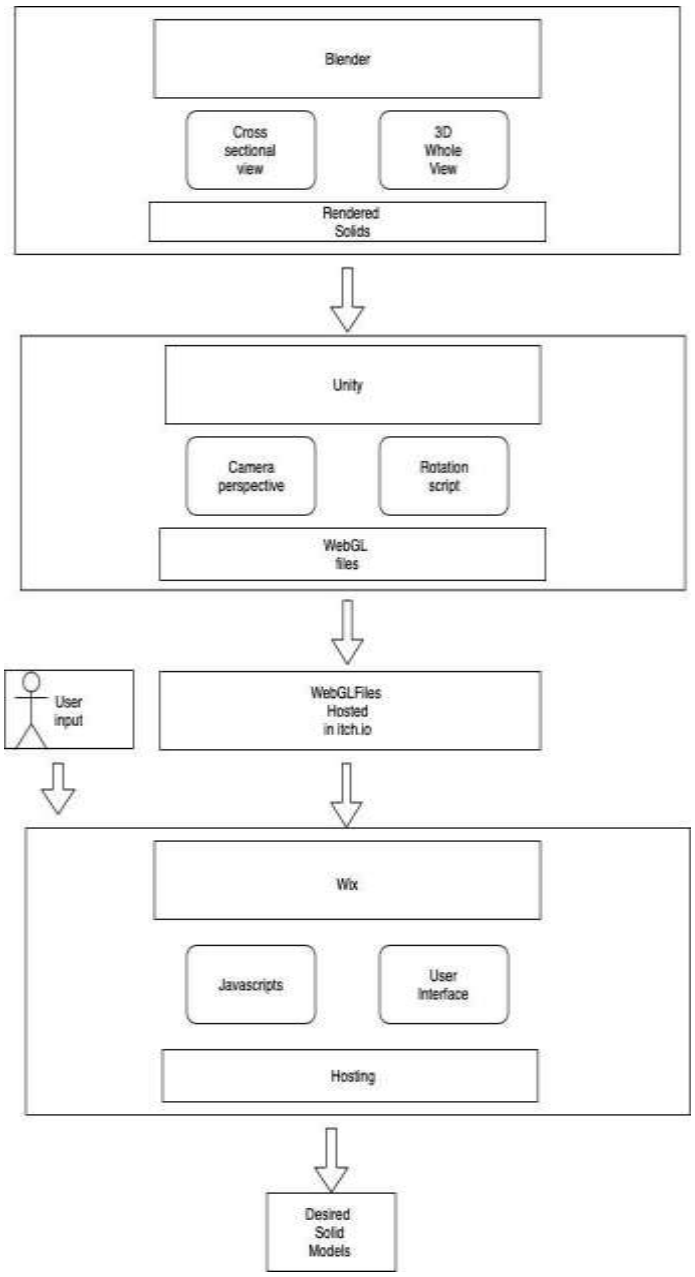
3. PROPOSED WORK

The project is about using the technology of augmented reality to enhance the understanding of the given 3D objects such as cube, cuboid, cone and sphere. It also emphasis on the deployment of cross sectional views of the corresponding solids. Additional feature of rotation of the 3D objects is also integrated in the project. Unity game engine is used as the back end, blender is used for creating 3D models and wix is used for creating proper user interfaces.

3.1 ARCHITECTURE



System consist of three parts. First, the 3D models are rendered, another part were game engine is being set up and finally another part were the user interface and the files are hosted.

The section of the system were the creation of cross sectional and 3D whole views of the proposed solids are being rendered is the first section, using a tool called blender. The rendered files are exported for further uses.

The game engine which is used to add rotational features and different camera perspectives is Unity. The output is exported as webGL files for cross platform play purposes. Unity gives users the ability to create games and interactive experiences in both 2D and 3D, and the engine offers a primary scripting API in C#, for both the Unity editor in the form of plugins, and games themselves, as well as drag and drop functionality.

The webGL files are hosted in itch to achieve cross platform play feature.

The user interface part of the system is integrated by using platform known as Wix, which is a drag and drop website creation platform.

3.2 BLENDER

Blender is an open-source 3D computer graphics software used for creating animated films, visual effects, art, 3D printed models, interactive 3D applications and video games. In the proposed project, blender is the most suitable tool for creating 3D real-world like object models and its corresponding cross sectional views.

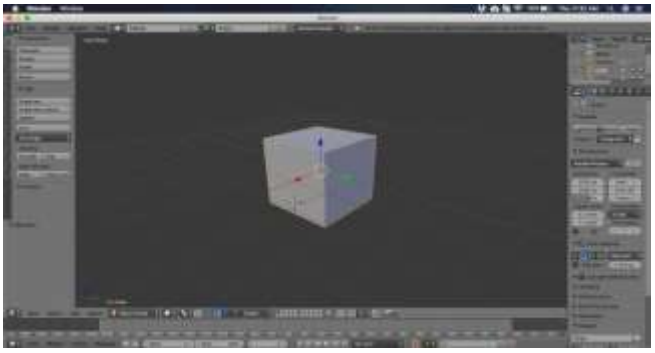


Fig 1. Cube's whole view in Blender

The shapes that are rendered in blender are the 3cm, 5cm and 7cm dimensional figures of both the whole view and cross sectional views of cube, cuboid, cone and sphere. The whole view of all the required figures are available directly in blender. Cross sectional views of the respective shapes can be created by using the "Knife" tool or by "Selection" tools that are available in blender.

Fig 2. Sphere's cross sectional view in Blender

After rendering both cross sectional and whole views of the required objects, the environment is saved as a ".blend" file so that it can be directly imported to Unity's environment.

3.3 UNITY

The cross-platform game engine was developed by Unity Technologies, got released in June 2005 at Apple Inc.'s Worldwide Developers Conference as an OS X-exclusive game engine. Later, the engine has extended to various platforms.

In the project, Unity is used as the base platform to view the given objects in an augmented or virtual environment. An additional feature of rotating the respective shapes in accordance to the user's wish is also co-operated in unity screens. It may represent top view and front views of the real-world entities.

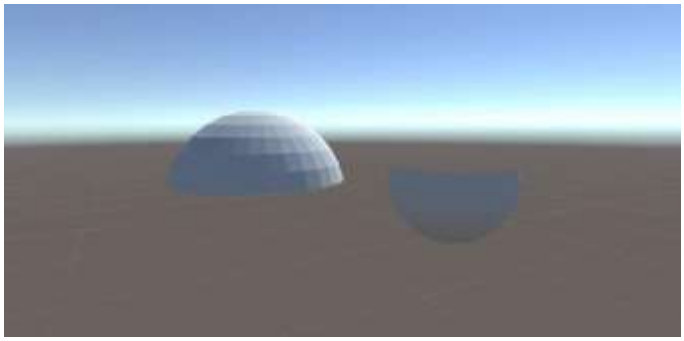


Fig 3. Sphere's cross sectional view in Unity

Unity has three important components:

- A game engine: This allows the games to be created, tested and played in different environments.
- An application where the design or the user interface is put together with a graphics preview option and control play function.
- A code editor: The IDE provides a text editor to write code. However, a separate text editor is often used to avoid confusion

Apart from the environment that unity provides, it provides a code editor where the rotation script can be implemented. After all the objects are processed and the rotation script is compiled, the Unity project is exported as "WebGL" version so that it can be hosted in any 3rd party game hosting service providers such as itch.io.

3.4 WIX

Wix allows users to create HTML5 websites and mobile sites through the use of online drag and drop tools.
For better user interface and ease of portability, Wix is used as the platform for creating the website for hosting most of the required tools of the project.

The home screen of the proposed website with the domain "AR3DModelling.com" consists of four buttons for user to select the required figure.

Fig 4. Home page on Wix

In the second page, users are given the option to select the the required dimension and the needed view of the previously selected shape.

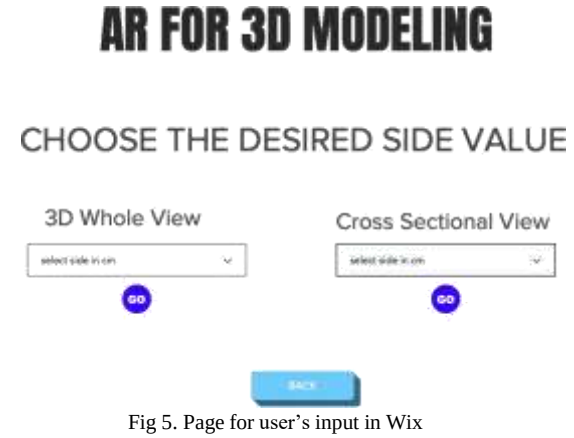


Fig 5. Page for user's input in Wix

Using "Wix code" java script is being used for redirection to the required page in accordance to the user's inputs.

```
aexport function button3_click(event) {
    var x = $w('#dropdown1').value;
    //console.log(x);
    if (!x.localeCompare("3cm")) {

        wixLocation.to("https://arfor3
dmodeling.com/mysite-1/3cm-whole-view-
of-cube");


    } else if(!x.localeCompare("5cm")) {
        wixLocation.to("https://arfor3
dmodeling.com/mysite-1/5cm-whole-view-
of-cube");
    }
     else if(!x.localeCompare("7cm")){
         wixLocation.to("https://arfor
3dmodeling.com/mysite-1/7cm-whole-view
-of-cube")
     } }
```

Fig 6. Javascript for page redirection in Wix

3.5 ITCH.IO

Itch.io is a website for users to host, sell and download video games. It is used in the project for hosting the "WebGL" files of the exported Unity project. From wix, the pages are redirected to itch's hosting locations.

Fig 7. Loading Unity's WebGL files from itch

The shapes will be displayed in from itch's servers where the Unity's WebGL files are hosted and is loaded from.

4. CONCLUSION

We can precisely observe the given 2D model if it is represented in 3D model. Our project can be implemented in many fields like gaming, machine modelling, architectural modelling, medical, E-commerce etc. The conversion of 2D images to 3D model makes the object look more realistic. With our project young students could easily understand different solids like cone, cuboid, sphere, cube. Our project uses augmented reality to project the 3D models of the solids. It is easy to implement and the user interface is simple and efficient. In the future more 3D models could be added to our project.

5. ACKNOWLEDGEMENT

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