VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

Mini Project Report on

"3D HOUSE"

Submitted in the partial fulfillment for the requirements of Computer Graphics & Visualization Laboratory of 6th semester CSE requirement in the form of the Mini Project work

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CERTIFICATE

This is to certify that the Project work entitled **"3D HOUSE"** is a Bonafide work carried out by **M SHASHANK(**1BY20CS101), **NANDAN N KOPPLU(**1BY20CS122) AND **NITHEESH M S** (1BY20CS128**)** in partial fulfillment for *Mini Project* during the year 2022-2023. It is hereby certified that this project covers the concepts of *Computer Graphics & Visualization*. It is also certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in this report.

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Name of the Examiners	Signature with Date
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2. _____	_____

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4. Identify and provide solutions for sustainable environmental development.

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ABSTRACT

The project aimed to utilize computer graphics techniques to design and render a visually appealing and realistic bedroom scene.

The project employed various methodologies, including 3D modelling, texturing, lighting, and rendering. Through the use of software tools and techniques, a virtual bedroom was constructed, complete with furniture, décor, and realistic lighting effects.

The results of the project showcased a highly detailed and immersive 3D house environment. The furniture and objects within the scene were accurately modelled and textured, creating a sense of realism and presence. Careful attention was given to lighting and shading, resulting in visually pleasing and realistic lighting effects.

The analysis of the project's outcomes highlighted the potential applications of 3D computer graphics in interior design, virtual reality experiences, and architectural visualization. The project also provided valuable insights into the challenges and considerations involved in creating realistic virtual environments.

The significance of this project lies in its potential applications. 3D computer graphics has revolutionized industries such as interior design, architecture, and real estate by providing an efficient and cost-effective means to visualize and communicate design concepts. Additionally, the project explores the use of computer graphics in virtual reality experiences, where users can navigate and interact with virtual environments in a more realistic and intuitive manner.

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Chapter 1

INTRODUCTION

COMPUTER GRAPHICS

Graphics provides one of the most natural means of communicating with a computer, since our highly developed 2D and 3D pattern-recognition abilities allow us to perceive and process pictorial data rapidly and efficiently. Interactive computer graphics is the most important means of producing pictures since the invention of photography and television. It has the added advantage that, with the computer, we can make pictures not only of concrete real world objects but also of abstract, synthetic objects, such as mathematical surfaces and of data that have no inherent geometry, such as survey results.

Using this editor you can draw and paint using the mouse. It can also perform a host of other functions like drawing lines, circles, polygons and so on. Interactive picture construction techniques such as basic positioning methods, rubber-band methods, dragging and drawing are used. Block operations like cut, copy and paste are supported to edit large areas of the workspace simultaneously. It is user friendly and intuitive to use.

OpenGL(open graphics library) is a standard specification defining a cross language cross platform API for writing applications that produce 2D and 3D computer graphics. The interface consists of over 250 different function calls which can be used to draw complex 3D scenes from simple primitives. OpenGL was developed by silicon graphics Inc.(SGI) in 1992 and is widely used in CAD ,virtual reality , scientific visualization , information visualization and flight simulation. It is also used in video games, where it competes with direct 3D on Microsoft Windows platforms.OpenGL is managed by the non-profit technology consortium, the khronos group, Inc

OpenGL serves two main purpose :

- To hide the complexities of interfacing with different 3D accelerators, by presenting programmer with a single, uniform API

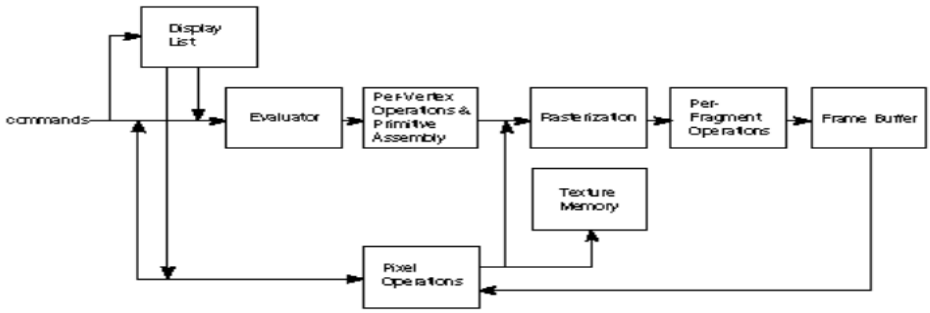
- To hide the differing capabilities of hardware platforms, by requiring that all Implementations support the full openGL, feature set.

OpenGL has historically been influential on the development of 3D accelerator, promoting a base level of functionality that is now common in consumer level hardware:

- Rasterized points, lines and polygons are basic primitives.
- A transform and lighting pipeline.
- Z buffering.
- Texture Mapping.
- Alpha
- Blending.

OPEN-GL

OpenGL serves as an interface between software applications and graphics hardware, enabling developers to harness the full potential of the underlying graphics processing unit (GPU). It offers a comprehensive set of functions and commands for tasks such as geometry transformations, lighting and shading, texture mapping, and rasterization. These capabilities empower developers to create highly realistic and immersive graphics environments across a wide range of platforms, including desktop computers, mobile devices, game consoles, and embedded systems. The flexibility and extensibility of OpenGL have led to its adoption in various industries and applications



Creating realistic and visually appealing 3D environments is a fascinating aspect of computer graphics. One popular application of 3D graphics is the design and visualization of interior

spaces, such as bedrooms. This report explores the process of creating a 3D house environment, utilizing computer graphics techniques to bring virtual spaces to life.

The design of a bedroom involves careful consideration of elements such as furniture placement, lighting, materials, and aesthetics. With the help of 3D graphics, designers and architects can create virtual representations of bedrooms that provide a realistic preview of the final space. This allows for experimentation with different layouts, colours, and styles, enabling informed decision-making and effective communication with clients.

In the realm of computer graphics, the creation of a 3D house environment involves several key components. These include 3D modelling, which involves the creation of virtual objects and furniture that populate the bedroom scene. Texturing adds visual details and materials to these objects, enhancing their realism. Lighting plays a crucial role in setting the mood and atmosphere of the bedroom, replicating the behaviour of light sources in the virtual environment. Finally, rendering techniques are employed to generate the final high-quality images or animations of the 3D house scene

.

The utilization of computer graphics in the design and visualization of bedrooms offers numerous advantages. Designers can experiment with various layouts and configurations, exploring different furniture arrangements and colour schemes to achieve the desired ambiance. Clients can also visualize their future bedrooms in a realistic manner, providing them with a tangible understanding of the design concepts and aiding in the decision-making process. Additionally, 3D house visualizations offer a cost-effective alternative to physical prototypes or full-scale room mock-ups. By utilizing virtual environments, designers can explore various design options, experiment with different styles and configurations, and iterate quickly without incurring substantial expenses.

Moreover, 3D house visualizations can provide a platform for immersive experiences. Virtual reality (VR) technology allows users to step into a virtual bedroom, where they can interact with objects, change materials, and experience different lighting scenarios. This immersive approach provides a unique and engaging way to showcase bedroom designs to clients or potential buyers.

1.2 MOTIVATION

The motivation behind undertaking a 3D house computer graphics project stems from several factors and objectives. These motivations drive the exploration and implementation of computer graphics techniques to create a visually appealing and realistic virtual bedroom environment. The following are some key motivations for embarking on such a project:

1. **Visualization and Design**: The primary motivation is to provide a means for visualizing and designing bedroom spaces in a virtual environment. By utilizing computer graphics techniques, designers, architects, and homeowners can explore different layouts, furniture arrangements, colour schemes, and lighting options.
2. **Realism and Immersion**: Creating a 3D house environment allows for the incorporation of realistic details, textures, and lighting effects. The motivation is to achieve a high level of realism and immersion, providing an experience that closely resembles the physical space
3. **Cost and Time Efficiency**: Utilizing computer graphics for bedroom design offers a cost-effective and time-efficient alternative to traditional methods. The motivation is to streamline the design process, as physical prototyping and iterations can be time-consuming and expensive..

1.3 SCOPE

The scope of the 3D house computer graphics project encompasses the creation and visualization of a virtual bedroom environment using computer graphics techniques. The project focuses on the following key areas:

1. **3D Modelling**: The project involves the creation of 3D models of house elements, including furniture, fixtures, architectural features, and decorative items. The scope covers modelling techniques such as polygonal modelling, spline-based modelling, or procedural modelling to accurately represent the geometry of the bedroom components.
2. **Texturing and Materials**: The project includes the application of textures and materials to the 3D models to achieve a realistic and visually appealing appearance. The scope encompasses techniques such as UV mapping, material creation, and texture mapping to accurately simulate the surface properties of bedroom elements, such as wood, fabric, metal, or glass.

1.4 PROBLEM STATEMENT

3D Home Architect is a property designing program. Harneet's guide to 3D

Home Architect comes in three designs for specific purposes: Home and Landscape Design Suite, Home Design Deluxe, and Landscape Design Deluxe. Home Design Deluxe simulates home designs, Landscape Design Deluxe simulates landscape designs, and Home and Landscape Design Suite is used for both.

3D Home Architect was introduced by Broderbund in the 1990s and was a scaled down version of a professional home design application called Chief Architect, made by Advanced Relational Technology (ART) Inc. (now renamed to Chief Architect, Inc.). After version 4.0, the agreement between Broderbund and ART Inc. was terminated, and 3D Home Architect 5.0 and later versions are based on a similar professional application called Cad soft Envisioned.

1.5 PROPOSED METHODOLOGY

The system will consist of the following key components:

1. **3D Modeling and Design**: The system will incorporate advanced 3D modeling techniques to create accurate representations of bedroom elements, including furniture, fixtures, and architectural features.
2. **Lighting and Rendering**: The system will incorporate advanced lighting techniques to simulate realistic lighting conditions within the virtual bedroom environment. Designers will have the ability to place light sources, adjust their properties, and observe the resulting illumination effects in real-time.
3. **Real-time Visualization**: The system will offer real-time visualization capabilities, enabling instant feedback and exploration of design changes. Designers and clients can observe the impact of modifications to the layout, materials, lighting, and other design elements in real-time.
4. **Design Customization and Iteration**: The system provides a range of design customization options to facilitate design exploration and iteration. Users can experiment with different furniture arrangements, color schemes, and decor choices in real-time.

1.6 LIMITATIONS

1. **Modeling Constraints**: The system's modeling capabilities may have limitations in terms of the complexity and level of detail that can be achieved. Users may encounter challenges when creating highly intricate or organic shapes.
2. **Texture and Material Realism**: While the system supports the application of textures and materials, achieving a high level of realism in materials may be challenging. Simulating complex material properties, such as subsurface scattering or intricate material patterns, may require advanced texture mapping techniques or additional external software.
3. **Rendering Time**: Generating high-quality renderings or real-time visualizations may require significant computation time, especially for complex scenes with intricate lighting and materials.
4. **System Stability and Bugs**: Like any software application, the proposed system may encounter stability issues or bugs that could affect its performance or functionality. Regular updates and bug fixes may be necessary to ensure a smooth and reliable user experience.

CHAPTER 2

LITERATURE SURVEY

Computer graphics started with the display of data on hardcopy plotters and cathode ray tube (CRT) screens soon after the introduction of computers.

Computer graphics today largely interactive, the user controls the contents, structure, and appearance of objects and of displayed images by using input devices, such as keyboard, mouse, or touch-sensitive panel on the screen. Graphics based user interfaces allow millions of new users to control simple, low-cost application programs, such as spreadsheets, word processors, and drawing programs.

OpenGL (Open Graphics Library) is a standard specification defining a crosslanguage, cross-platform API for writing applications that produce 2D and 3D computer graphics. The interface consists of over 250 different function calls which can be used to draw complex three-dimensional scenes from simple primitives. OpenGL was developed by Silicon Graphics Inc. (SGI) in 1992 and is widely used in CAD, virtual reality, scientific visualization, information visualization, and flight simulation. It is also used in video games, where it competes with Direct3D on Microsoft Windows platforms (see Direct3D vs. OpenGL). OpenGL is managed by the non-profit technology consortium, the Khronos Group.

In the 1980s, developing software that could function with a wide range of graphics hardware was a real challenge. By the early 1990s, Silicon Graphics (SGI) was a leader in 3D graphics for workstations. SGI's competitors (including Sun Microsystems, Hewlett-Packard and IBM) were also able. In addition, SGI had a large number of software customers; by changing to the OpenGL API they planned to keep their customers locked onto SGI (and IBM) hardware for a few years while market support for OpenGL matured to bring to market 3D hardware, supported by extensions made to the PHIGS standard. In 1992, SGI led the creation of the OpenGL architectural review board (OpenGL ARB), the group of companies that would maintain and expand the

OpenGL specification took for years to come. On 17 December 1997, Microsoft and SGI initiated the Fahrenheit project, which was a joint effort with the goal of unifying the

OpenGL and Direct3D interfaces (and adding a scene-graph API too). In 1998 HewlettPackard joined the project.[4] It initially showed some promise of bringing order to the world of interactive 3D computer graphics APIs, but on account of financial constraints at SGI, strategic reasons at Microsoft, and general lack of industry support, it was abandoned in 1999[8].

Many opengl functions are used for rendering and transformation purposes. Transformations functions like glRotate (), glTranslate (), glScaled () can be used.

OpenGL provides a powerful but primitive set of rendering command, and all higherlevel drawing must be done in terms of these commands. There are several libraries that allow you to simplify your programming tasks, including the following:

OpenGL Utility Library (GLU) contains several routines that use lower-level OpenGL commands to perform such tasks as setting up matrices for specific viewing orientations and projections and rendering surfaces.

OpenGL Utility Toolkit (GLUT) is a window-system-independent toolkit, written by Mark Kill guard, to hide the complexities of differing window APIs.

To achieve the objective of the project, information related to the light sources is required with OpenGL we can manipulate the lighting and objects in a scene to create many different kinds of effects. It explains how to control the lighting in a scene, discusses the OpenGL conceptual model of lighting, and describes in detail how to set the numerous illumination parameters to achieve certain effects. This concept is being obtained from.

To demonstrate the transformation and lightening, effects, different polygons have to be used. Polygons are typically drawn by filling in all the pixels enclosed within the boundary, but we can also draw them as outlined polygons or simply as points at the vertices.

This concept is obtained from.

The properties of a light source like its material, diffuse, emissive, has to mention in the project. So to design the light source and the objects, programming guide of an OpenGL is used.

CHAPTER 3

SYSTEM REQUIREMENTS

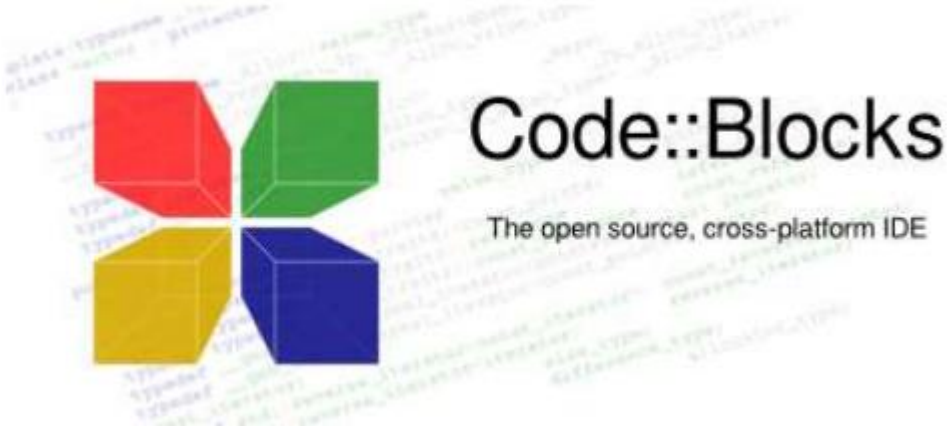
HARDWARE REQUIREMENTS

- **Operating System**: Unix, Linux, Mac, Windows etc.
- **Processor**: Pentium or Higher.
- **RAM:** 312MB or Higher.
- 14”monitor
- **Keyboard and mouse**

SOFTWARE REQUIREMENTS

- **Programming language**---C/C++ using OpenGL
- **Operating system** – – Windows/Linux
- **Compiler** – C/C++ Compiler
- **IDE** – Code blocks

Functional Requirement – <GL/glut.h>



CHAPTER 5

INTERPRETATION OF RESULTS

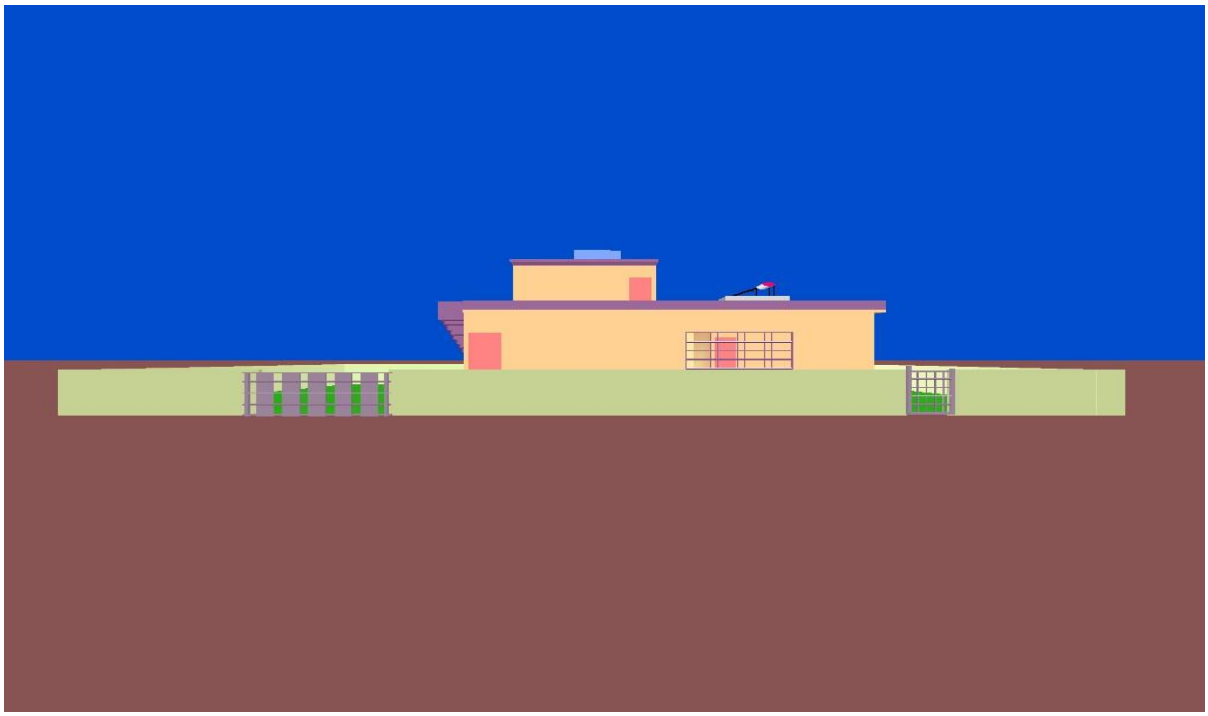


Figure 6.1 After Run the Code

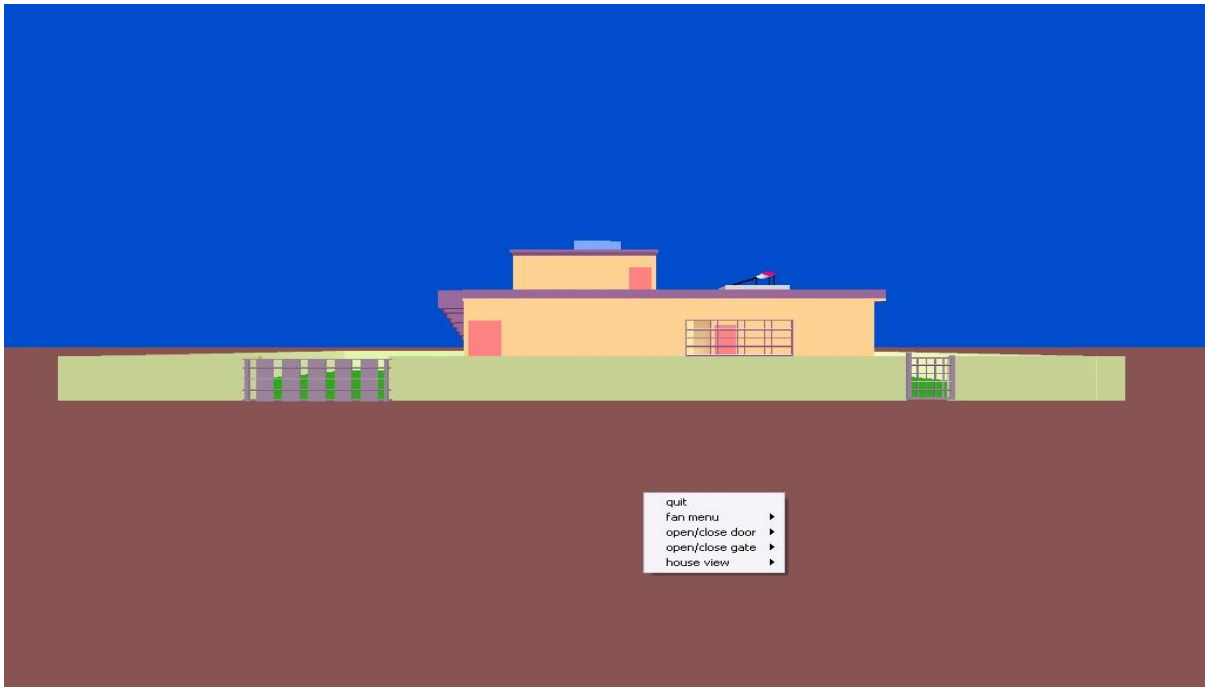


Figure 6.2 After Right Click it's Showing options

Figure 6.3 After Selected inner view of house

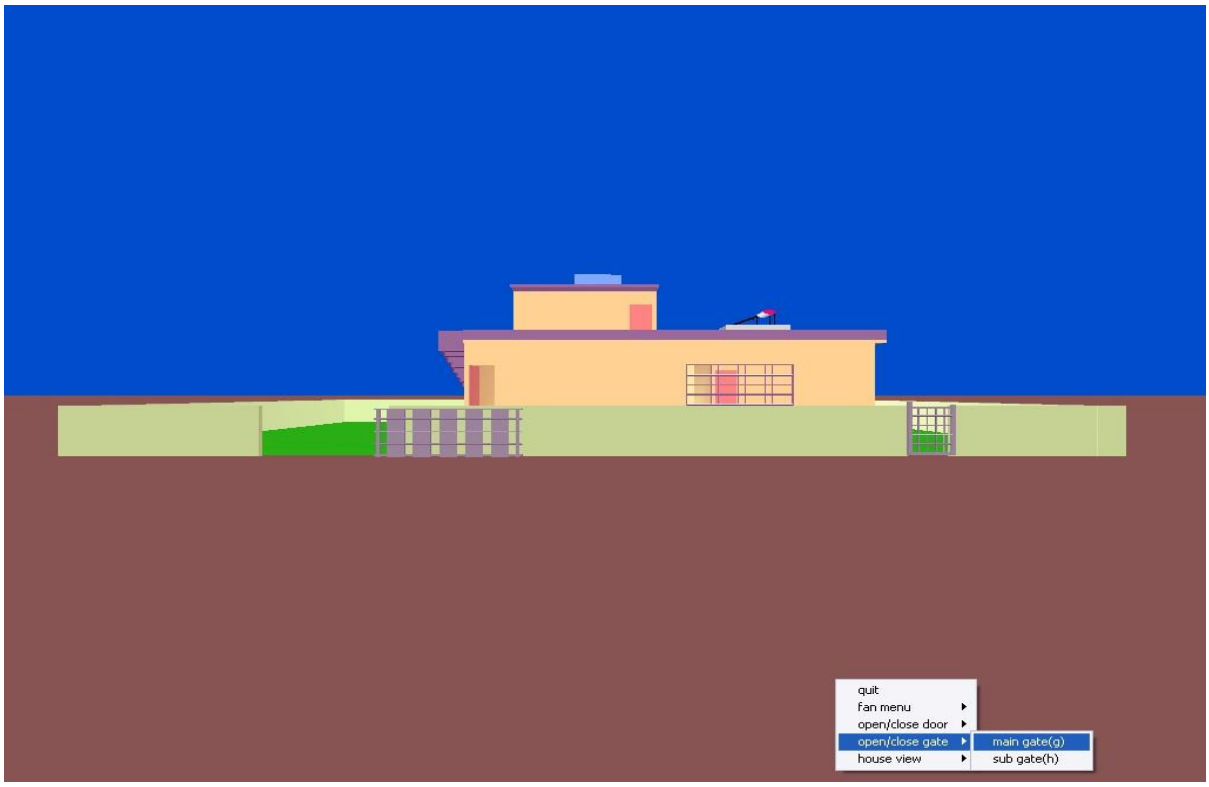


Figure 6.4 Selecting Main door to open

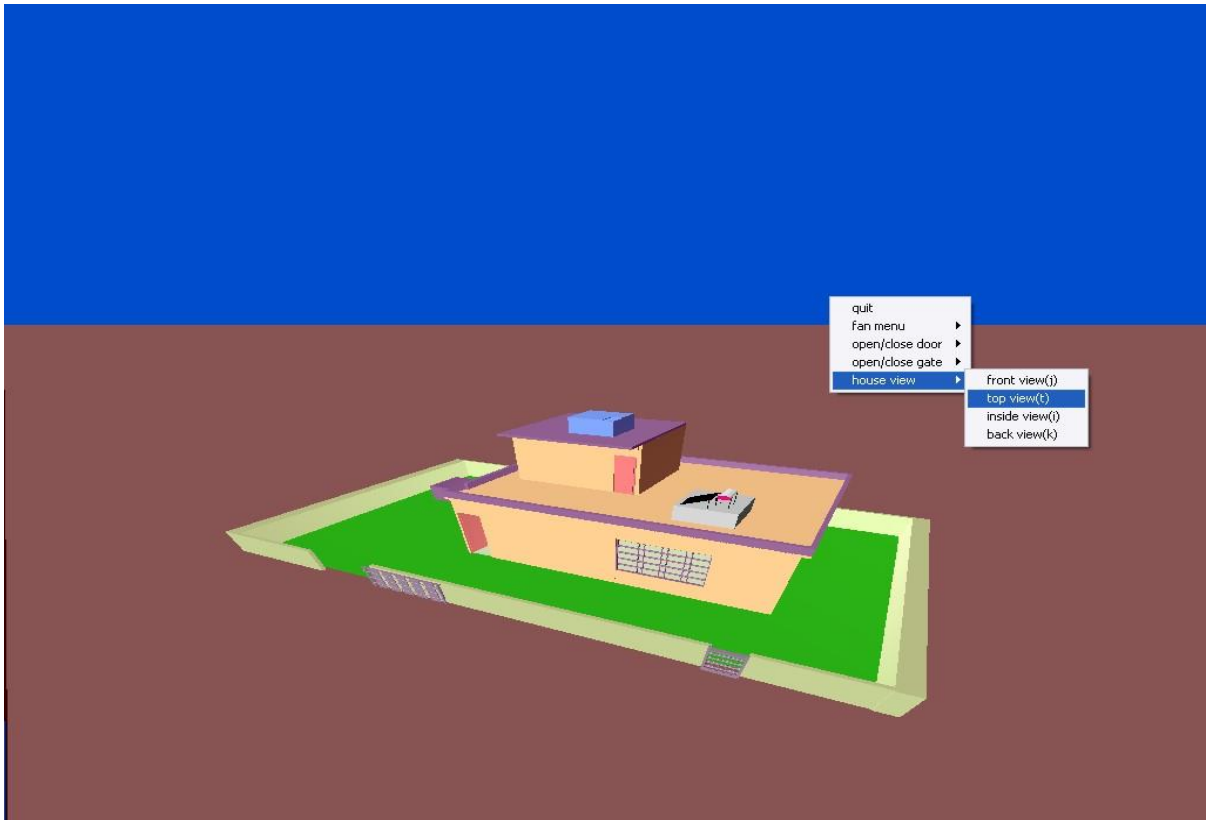


Figure 6.5 House Top view is showing

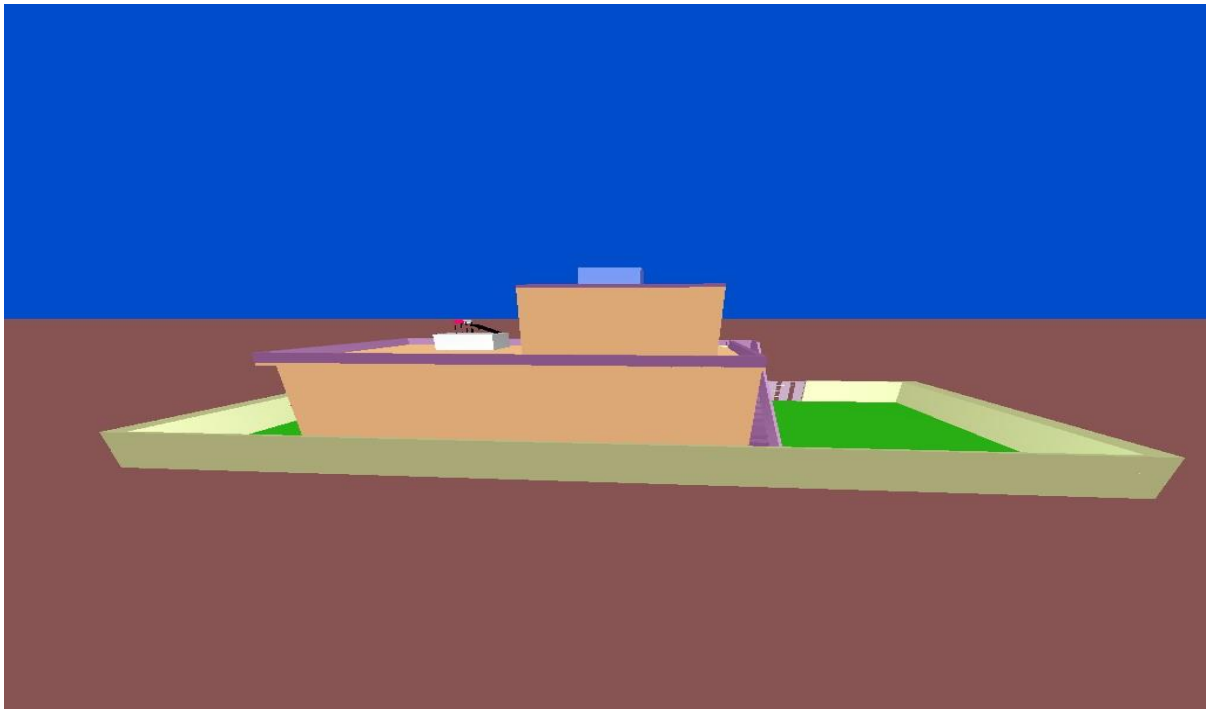


Figure 6.6 Back View of HOUSE

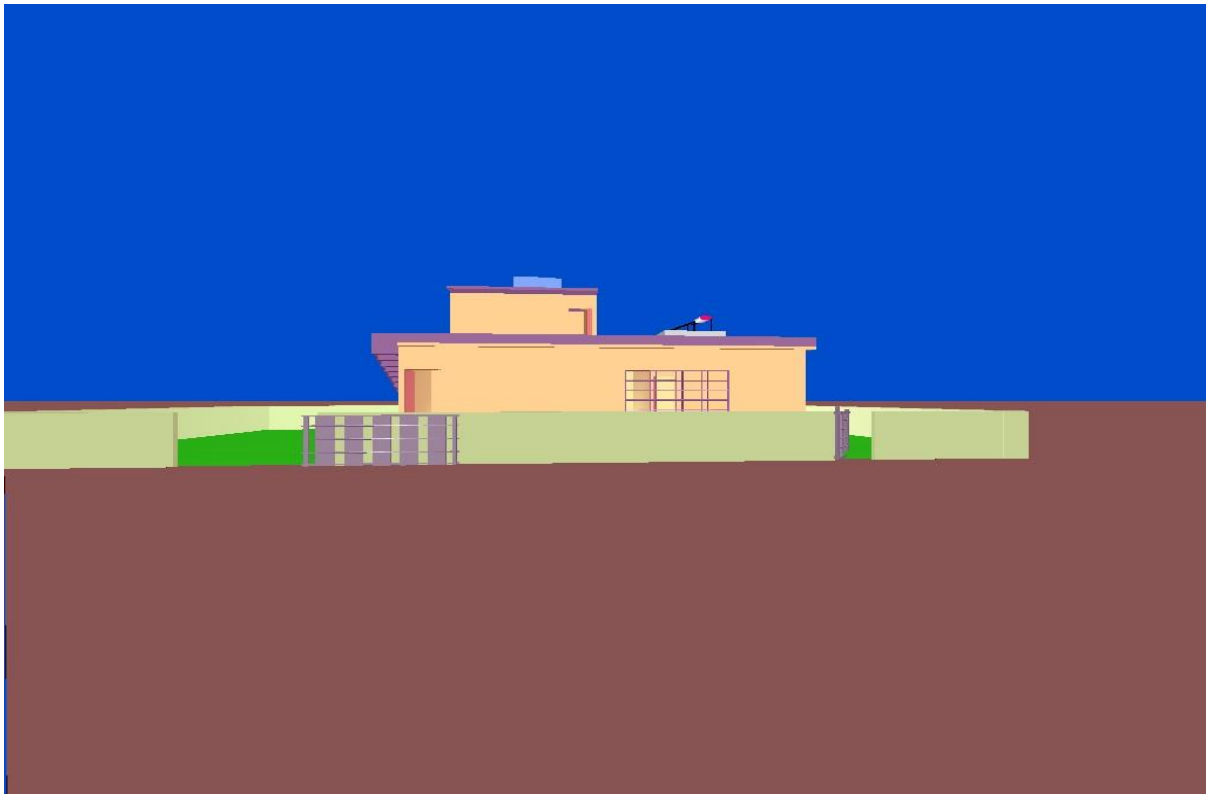


Figure 6.7 All the door's opened

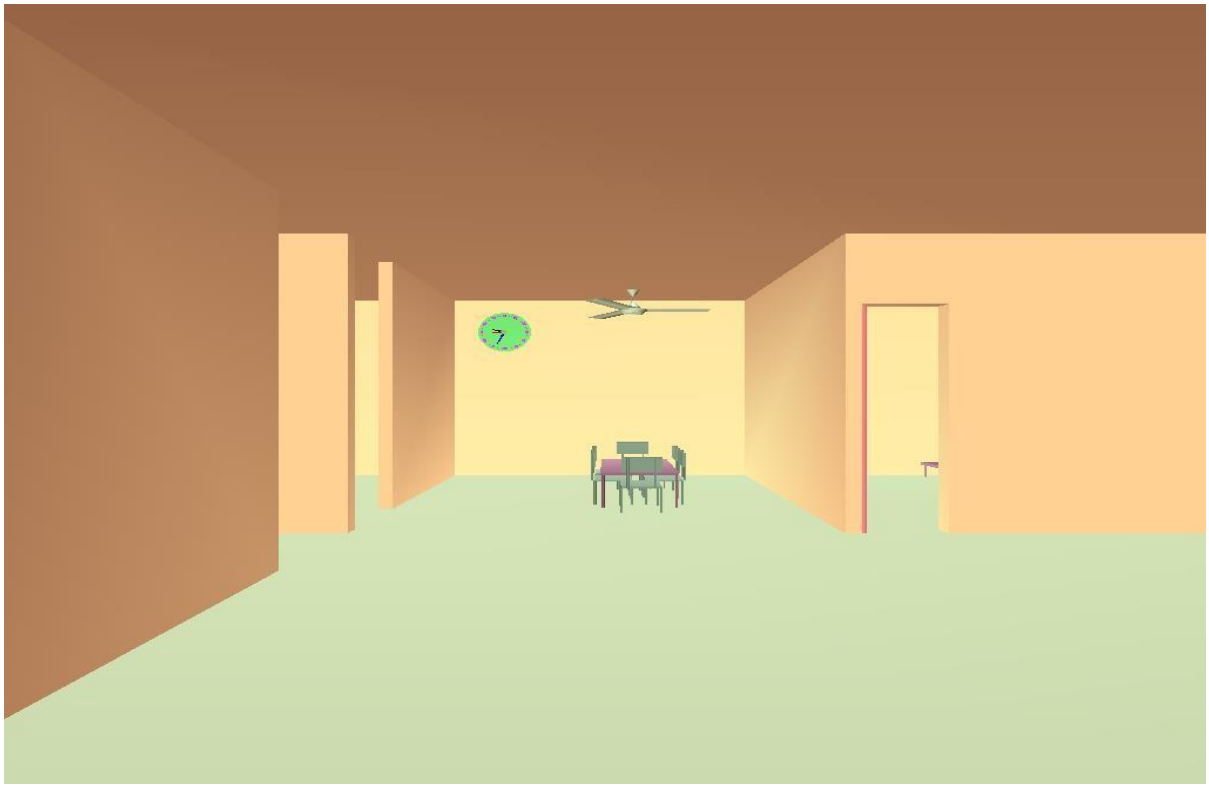


Figure 6.7 Inside Door open & it's showing time

Chapter 7

CONCLUSION

In conclusion, the 3D room design system offers a compelling solution for creating and visualizing room designs in a virtual environment. Throughout this project, we have explored the motivation behind developing such a system, its scope, problem statement, and proposed solution. We have also discussed the system's limitations and conducted a literature survey to gather relevant information and insights.

The proposed system aims to provide users with a user-friendly interface for designing and customizing rooms in a 3D space. By leveraging the power of computer graphics and rendering techniques, users can visualize their room designs with realistic lighting, textures, and other visual effects. The system also includes features for managing and manipulating 3D objects, integrating with external resources, and generating outputs in various formats.

While the system offers numerous benefits and possibilities, it is important to acknowledge its limitations. These may include constraints in terms of hardware requirements, rendering performance, or the availability of external resources. Addressing these limitations and ensuring a smooth and efficient user experience will be key considerations for the system's development and future enhancements.

In summary, the 3D room design system holds great potential in transforming the way users envision, create, and experience room designs. By providing an intuitive and immersive platform, users can unleash their creativity and explore various design options. The system's robust architecture, coupled with the integration of advanced graphics and rendering technologies, paves the way for realistic and visually stunning room designs.

FUTURE ENHANCEMENTS

There are several potential future enhancements that could be considered for the 3D room design system. These enhancements can further improve the user experience, expand functionality, and incorporate emerging technologies. Here are some ideas for future enhancements:

1. Enhanced Realism: Continuously improving the rendering engine to achieve even more realistic visuals, including advanced lighting models, global illumination, and realistic material simulations. This can create more immersive and lifelike room designs.

2. Virtual Reality (VR) Integration: Integrating virtual reality technology into the system, allowing users to experience their room designs in a fully immersive VR environment. This can provide a more interactive and immersive design experience, enabling users to navigate and interact with their designs in a more natural and intuitive manner.

3. Augmented Reality (AR) Support: Adding support for augmented reality, enabling users to overlay virtual room designs onto real-world spaces using their mobile devices or AR headsets.

4. Machine Learning and AI: Leveraging machine learning and artificial intelligence techniques to automate repetitive design tasks, provide intelligent recommendations, and learn from user interactions to improve the overall user experience and design outcomes.

5. Customization and Personalization: Offering more customization options for users to personalize their room designs, including customizable textures, patterns, colors, and lighting settings. This allows users to create designs that reflect their unique preferences and styles.

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[5] https://learnopengl.com/