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Interactive Voice controlled 3D Holographic Display

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Abstract

At present the 3D holographic projection and their controls can be done manually or with gesture detection. In this paper, we are proposing an idea of interactive voice-controlled 3D holographic display by using a pyramidal arrangement. The proposed model, not only can project the 3D holographic image, but also can be controlled by voice command. This can be achieved by the following steps: Step 1: Creation of 3D image with specific voice commands. Step 2: Controlling of the image by voice command with the help of a software. Step 3: The projection and controlling of 3D holographic image in the transparent pyramidal arrangement. This proposal confirms, the system can function as an interactive projection of 3D holographic image with the voice command.

Keywords: 3D Holographic Display, Pyramid arrangement, Voice Recognition and Control

1. Introduction

The usage and application of voice recognition as a tool to control an object or a system has been increased in numbers since the introduction of voice recognition. Voice recognition has gained prominence and use with the increase of AI and intelligent assistants, such as Amazon's Alexa, Apple's Siri and Microsoft's Cortana.

Now using this voice recognition as a part of our project, we present an interactive voice-controlled 3D holographic display which can receive voice commands from the user to control the 3D hologram. The 3D hologram presented in this 3D holographic display used a principal called as Peppers Ghost holography method which uses a frustrum-shaped device made of transparent material used to project 3D image from a 2D surface.The peppers ghost illusion method can be understand stood by the image shown in Fig.1.

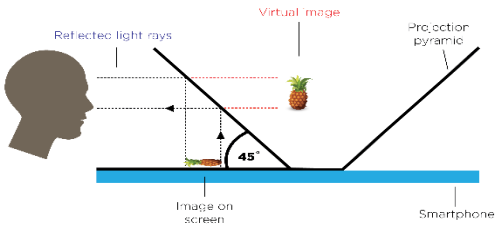


Fig.1 Peppers Ghost Illusion method

This paper is divided into the following sections: Section 1 here is the introduction. Section 2 describes the work related to the interactive 3D hologram. Section 3 discuses about the design concepts of the model. Section 4 describes the construction of the model. Section 5 is about the final result obtained. Section 6 is about the application it is used for and Section 7 is the conclusion.

2 Related Work

In this section, we introduce the related works concerning the display of 3D objects in space and 3D object manipulation.

A. 3D Hologram Object Projection in Mid-Air

There are two kinds of the aerial projection techniques: the first is 3D Holographic and Interactive Artificial

Intelligence System and the second is aerial projection using parabolic mirror.

3D Holographic and Interactive Artificial Intelligence System

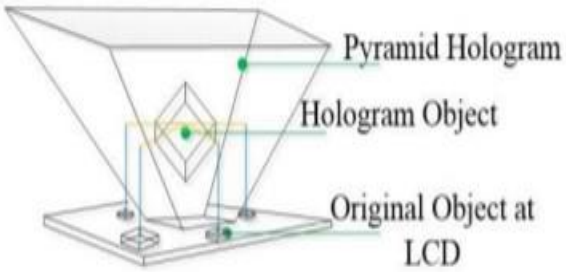
This system is a combination of 3D holography and AI which presents out using peppers ghost pyramid projection method. The 3D holographic output projected using this technique appears to be floating in the air. The 3D holographic output can be interacted by performing various hand gesture in the air which are supported using gesture detection module integrated in the system. To perform basic AI operations, the system uses Natural Language Processing to understand and provide answer to the user queries with the accuracy of 80%. Also, the system uses Motion Machine Learning (Motion ML) to make man-machine interaction natural by adding various non-verbal communication cues. 3D Holographic and Interactive AI system finds its application in the field of education, medical, home automation and many others. Fig.2. Prototype of 3D Holographic and Interactive Artificial Intelligence System

Fig.2. Prototype of 3D Holographic and Interactive

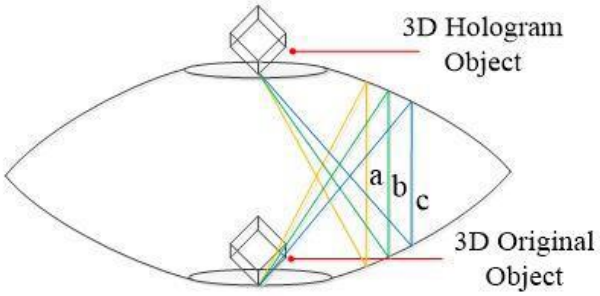
Artificial Intelligence System

Interactive Aerial Projection of 3D Hologram Object

The hologram object projected using pepper ghost projection is confined within the pyramidal glass. This research focuses on the projection of hologram in the air. The research advances the pepper ghost projection by placing the pyramid frustum inside two parabolic mirrors. Pepper ghost pyramid is placed on one mirror and then covered by another mirror on top. The top mirror has a hole which is whose focal point is aligned with the focal point of the pepper ghost pyramid. By the process of internal reflection, a hologram appears in the air through the hole. Fig. 3(b) shows the working of this device. The hologram, however, appears to be diminished than the original formed using pepper ghost.



(a)



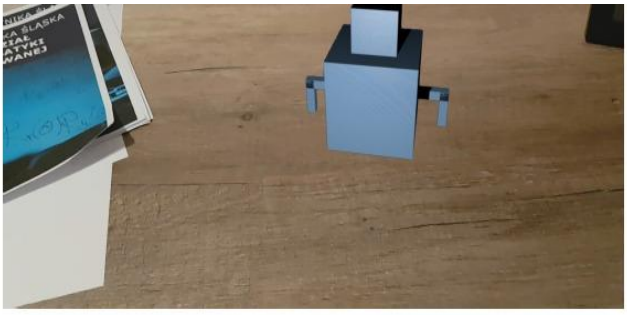
(b)

Fig 3. (a) 3D Object reconstruct ion device (b) Aerial project ion device

3D Object Manipulation

Voice in Mixed Reality

In this system the user can manipulate object in augmented reality using his/her voice. The user can make the object to perform by using some pre-programmed commands. The output of this system is based on the voice processing and artificial neural network. In this proposed system two simple commands where tested. Fig 4 shows the tested output.



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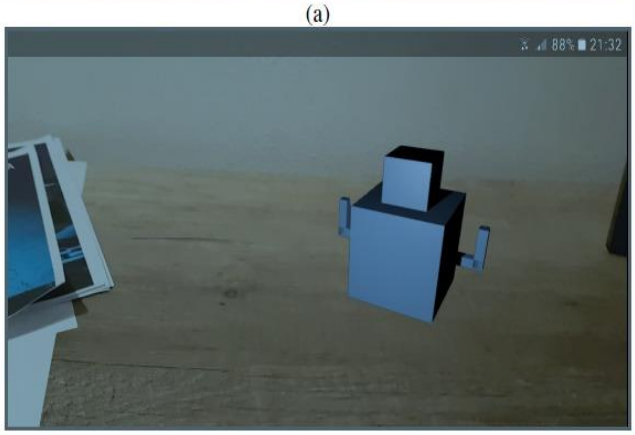


(b)

Fig 4. Screenshots of the application's operation – (a) object in the initial state, (b) object after executing the sound command "UP".

3design Concept Of Interactive Voice Controlled 3d Holographic Display

This section explains about the design concept of interactive voice-controlled 3D holographic display. This section contains two sub sections: the requirement and the design principle.

3.1. Requirement

The requirement the interactive voice-controlled 3D holographic display is dived into two categories. The first requirement is reconstruction of 3D image from the 2D surface. The second requirement is the user's interaction with the 3D image through voice commands. It means that the purpose of this system not only to create 3D hologram but also to give the user to interact with it using voice commands

3.2.. Design Principle

1) 3D Hologram Image Reconstruction

To reconstruct the 3D hologram image pyramid hologram is used. Pyramid hologram is a simple arrangement which is made by cutting transparent acrylic sheet into a pyramid frustrum. The pyramid hologram creates an illusion of 3D image for the user and makes an object appear in mid-air. Fig. 5 shows the working principle of the pyramid hologram presenting a 3D hologram object

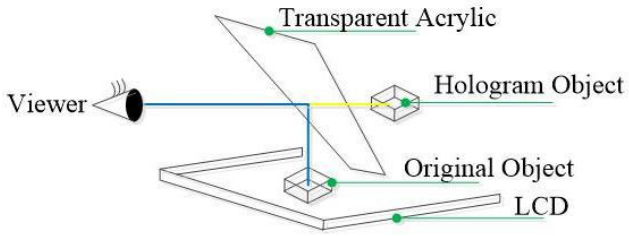


Figure 5. Working Principle of Pyramid Hologram

Three symmetrically opposite variations of the same object in LCD display are projected on the three faces of the pyramid. By means of this projection, each side of the object falls at the centre of the pyramid.

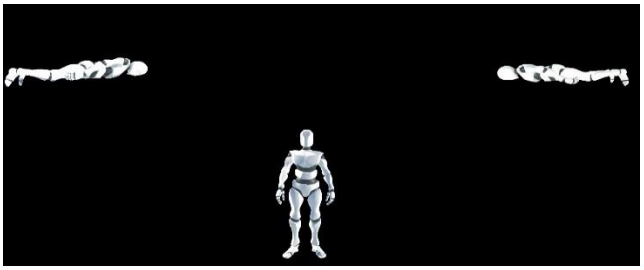
2. Interactive 3D Hologram

After the 3D hologram is created by using pyramid hologram, the interactive voice-controlled 3D hologram can be done. In this section we describe about the processes used to provide voice control to the 3D holographic display.

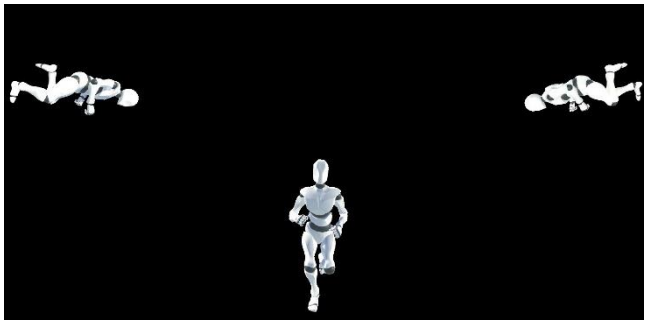
a. Interactive 3D model Manipulation

This part describes about the 3D model reconstruction and manipulation of the 3D holographic display. The 3D model/image is created by using Unity Asset programming with C# programming language to control the 3D model. Initially the computer gets the voice input form the user, then the computer recognises the users voice input and convert it into text and then matches the text with the pre-programmed commands. If a match is obtained the command is triggered and the command is executed.

we made three scene objects in one view position, which are three symmetrically opposite variations of the same object and they are projected on the three faces on the LCD. After that, the three faces are projected at the pyramid hologram. Fig.6. (a) show the output before giving voice command and (b) shows the executed output.



(a)



(b)

Fig. 6. (a) 3D model before giving voice command, (b) executed output for the voice command "run".

4. Construction Of Interactive Voice Controlled 3d Holographic Display

A. Appearance of the Interactive Voice Controlled 3D Holographic Display System.

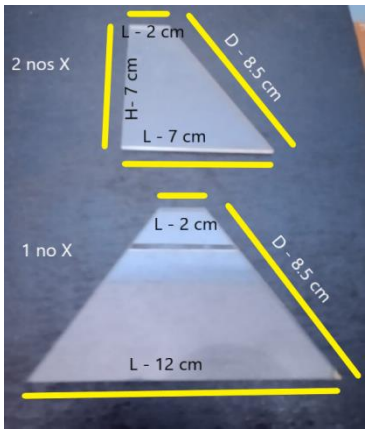
This section explains about the construction of the interactive voice-controlled 3D holographic display. This section is divided into three sub sections: Pyramidal Frustrum, Wooden figure, Appearance of the whole system.

4.1 Pyramidal Frustrum

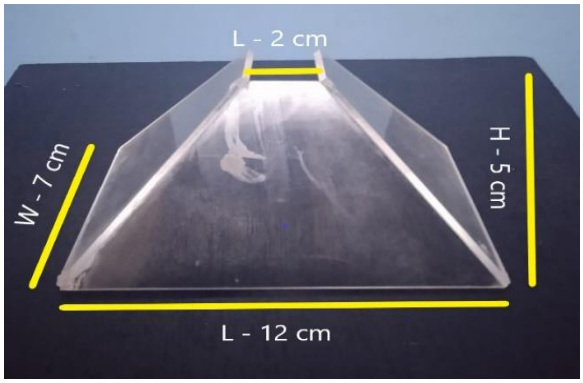
The recognition of the 3D hologram completely depends on the construction and type of material used for it. Different refractive material can be used for the construction like glass, acrylic sheet and so on. But in this model, we use transparent acrylic sheet as frustum material. The size of the pyramidal frustrum depends on the size of the display used and the inclination of the frustrum and the display. In order to attain perfect reflection, the inclination between the display and the frustrum is kept at 45^0 angle. If angle of inclination changes the 3D image will not appear at the centre of the pyramidal frustrum. Table 1 shows the specification of the pyramidal frustrum.

Material	Transparent acrylic sheet
Length	Upper side 2 cm
	Bottom side 12 cm
Hight	5 cm
Width	7 cm

We made a pyramidal frustrum as show in the Fig. 7.



(a)



(b)

Fig.7. (a) Dimensions of different faces, (b) Appearance of the transparent pyramidal frustrum.

4.2. Wooden Structure

To hold the display and the pyramidal arrangement we have designed a structure made of wood. The constructional size of the wooden structure will vary according to the size of the display used and size of the pyramidal arrangement used. The angle of inclination also should be considered while designing the wooden figure.

Fig.8. shows the design of our wooden structure. It consists of two rectangular wooden boards and four supporting columns. One rectangle board is used to mount the display and other is used to keep the pyramid. The four supporting columns are kept at four different side.

Fig 8. Model of Wooden Structure

4.3 Appearance system of The Interactive Voice Controlled 3D Holographic Display

The combination of the pyramidal structure, computer, LCD display with wooden structure makes the Interactive Voice Controlled 3D holographic Display. Fig 9 shows the appearance of the model.

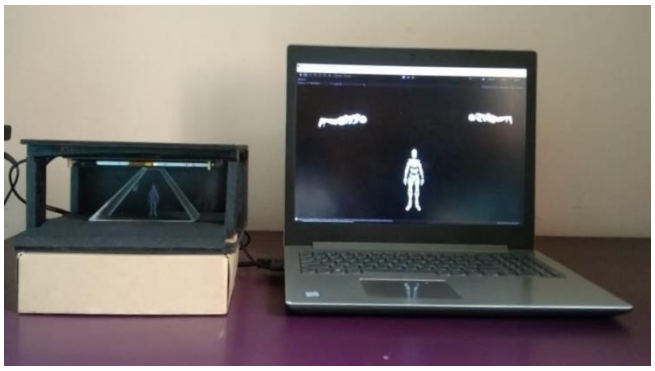


Fig. 9 Appearance of The Interactive Voice Controlled 3D Holographic Display

4.4. System Function of Interactive Voice Controlled 3D Holographic Display

The Interactive Voice Controlled 3D Holographic Display has two main functions: The reconstruction of 3D image form 2D surface and the interaction with the 3D hologram.

1) Reconstruction of 3D hologram

The 3D image presented in the display is the original image, but is seen inside the pyramidal arrangement as if it is real. Fig 10 shows the reconstructed 3D image inside the pyramid.

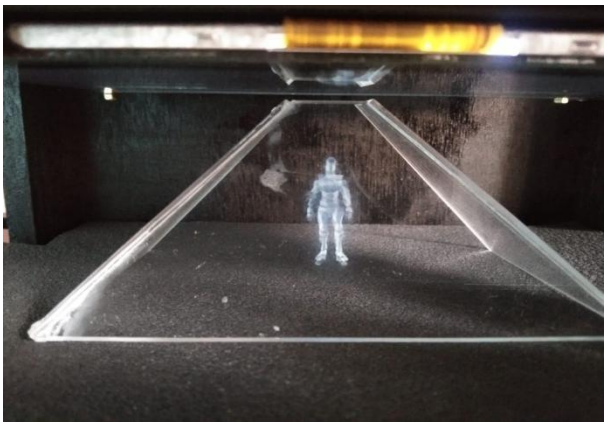


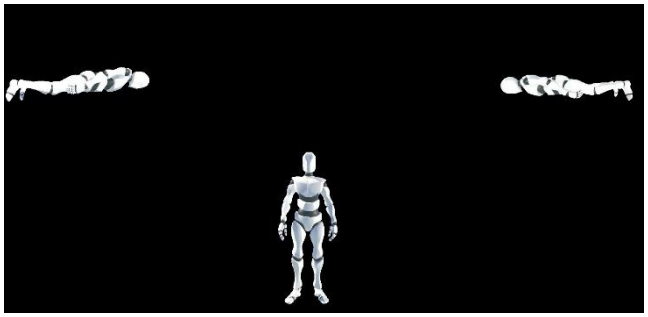
Fig.10. Reconstructed 3D image

4.5. Interaction of 3D Hologram

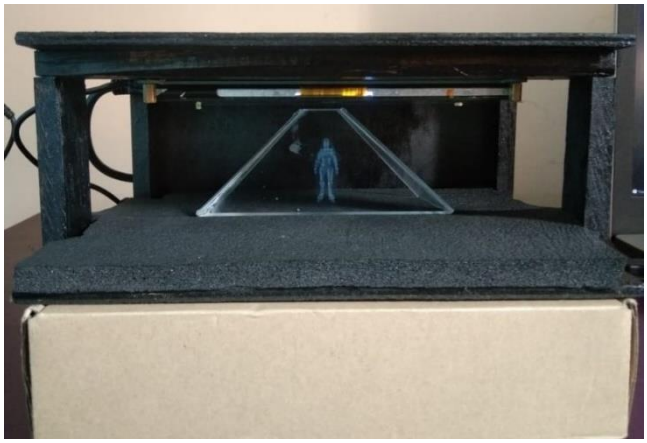
In Fig 10 the 3D hologram is produce at the centre of the pyramid. When there is any change in the original image in the display the image inside the pyramid also changes. As explained in the design concepts the user gives the voice input the computer recognises it and triggers the specific command and executes the corresponding action to be performed by the 3D model with the help of the Unity software.

5.. Result

Fig 11(b) shows the prototype of the Interactive Voice Controlled 3D Holographic Display which was successfully completed based on the realization of the proposed systems design concept and construction. Fig 11(a) show the final output of the simulation.



(a)



(b)

Fig 11. (a) Final output of the Simulation, (b) Prototype of the Interactive Voice Controlled 3D Holographic Display.

6. Applications

This proposed model finds its application in various fields. However, we mentioned few those application in this section.

6.1.. Medical Science

In the field of medical science, the doctors can use this model to control the 3D model through voice commands. And can also be used a tool to teach medical students.

Realtime 3D controlling of a human anatomy can be used for training medical students instead of a real one.

6.2.. Education

This model can be used has an interactive learning tool for learning and understanding of tough concepts with ease. It also gives students an interactive learning experience. Teachers can use 3d model of different objects like human, animal, astronomical objects and son on to teach students, which make learning fun and interesting.

6.3.. Product Display

We can use this model for displaying or showcasing of products. It attracts the consumer and there by tempting him to by the product.

6.4.. Architecture

Once the 3D model of a construction such building, parks etc., is build it can be imported into this system and then can be controlled by voice commands.

By using this model, the consumer can see how the building will look form inside to out by controlling them.

All the mentioned application can be implemented by making few changes to the system programming according to the application it is used for.

7.Conclusion

Form the above concept we have successfully created and controlled an interactive voice-controlled 3D holographic display and discussed the design and construction of this model. This system has used the peppers ghost illusion technique to produce the 3D image. We have added voice control to manipulate the 3D image. As a result, we have achieved making an interactive 3D holographic display that can be controlled trough voice commands.

In future we planned to enhance the technology of this holographic model and extend the scope of applications for this model to a greater extend in all fields

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