

# Hologram with Haptic Feedback

*A literature review report submitted in partial fulfilment of the requirements for  
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**CERTIFICATE**

This is to certify that literature review report for the project entitled “**Hologram with Haptic Feedback**” is a bonafide report of the project presented during VII<sup>th</sup> semester (CS451 - Seminar and Project Preliminary) by **Mohit Rajan E**, in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology (B.Tech) in Computer Science & Engineering.

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## **ABSTRACT**

This paper is intended to analyze and discuss the developments made so far in the field of holography and holographic projection, it discusses the feasibility and the possibilities in the area of touchable holograms, which can be interacted using hand gestures. In this paper, first we will discuss some rudimentary matters about what a hologram is and a short description of how they are created. Then we will move on to how we can make a hologram move as per our hand gestures and provide haptic feedback. In this paper the focus is on the feasibility study of some methods and the analysis and consequences of these methods. We will see some challenges in the whole process and then some discussion about future scopes of this technology and where this technology can lead us.

## **Contribution by Author**

Author Contribution Goes Here

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## ACKNOWLEDGMENT

Your Acknowledgement Goes Here

Student 1

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# Chapter 1

## Introduction

### 1.1 Overview

We describe our work on haptic holography, a combination of computational modeling and multimodal spatial display, which allows a person to see, feel, and interact with three-dimensional free standing holographic images of material surfaces. In this paper, we combine various holographic displays with a force-feedback device to render multimodal images with programmatically prescribed material properties and behavior.

A method to present haptic objects in the air using spatial modulation of ultrasound is proposed. Methods of airborne ultrasonic tactile display are based on vibrotactile radiation pressure and sensor feedback systems, which result in low spatial receptive resolution. The proposed approach produces a spatially standing haptic image using stationary ultrasonic waves that enable users to touch 3D images without depending on vibrotactile stimulation and sensor feedback.

### 1.2 Problem Statement

In the current education system students are taught to learn formulas and how to use them but not to reason or understand the logic behind them, causing them to forget it in a short period. It is a typical longitudinal learning approach. Our brain system is not just longitudinal in learning process, but much more complex. Current education system evolved on the basis of visual and auditory senses and their application leads to memorizing the content of learning rather than creating a holistic perception. It is observed that the current education system uses mainly audio methods to teach students. In India around 10% of students suffer from some form of learning disability[1]. Research also points to the fact that visual working memory is better in students with learning disability rather than auditory working memory[2]. It can be inferred that a modern method of learning should be developed in order to increase the efficiency of learning process.

To address this issue we propose a system which uses a holographic display with haptic feedback by the interaction of using hand gestures. This project will focus on developing a system as described above to introduce a new approach to learn basic geometry.

## 1.3 Objective

To create a system which also includes somesthetic senses to learning. To achieve this a holographic display with haptic feedback is proposed. The proposed system can be used to project objects in mid-air which can be interacted by using the hand gestures to view new objects, change or modify its properties like size, view etc.

## Chapter 2

### Literature Review

The world population is the sum of all humans on Earth. As of today, it is estimated to number 7.004 billion by the United States Census Bureau. The USCB estimates that the world population exceeded 7 billion on March 12, 2012. According to a separate estimate by the United Nations Population Fund, it reached this milestone on October 31, 2011. The world's population is unevenly distributed,

Rank	Country	Population	Percentage
1	China	1,347,350,000	19.24%
2	India	1,210,193,422	17.28%
3	United States	313,269,000	4.47%

Table 2.1: World Population Table

with six of Earth's seven continents being permanently inhabited on a large scale. As of 2012, Asia is the most populous continent, with its 4.1 billion inhabitants accounting for over 60% of the world population. The world's two most-populated countries alone, China and India, constitute about 37% of the world's population. Africa is the second-most-populated continent, with around 1 billion people, or 15% of the world's population. Europe's 733 million people make up 11% of the world's population, while the Latin American and Caribbean regions are home to 589 million (9%).

## Chapter 3

### Design

The proposed system consist of three sub-systems

- Display
- Haptic feedback
- Hand gesture regonazing system.
- Software compontent ? (is this required?)

#### 3.0.1 Display

Hologram was selected as the method of display. Since previous research has shown learning gemotry with hologram is better than tradional methods[3].

#### 3.0.2 Haptic feedback

Haptic feedback is added to add a somesthetic senses to learning. And also as a response to convay the previous commanf by the user has been registred.

#### 3.0.3 Hand Gesture

Hand Gestures are used as the input to the system and will be used by the user to intract with the system. Required bellow part? The hand geuster is proccess using Google MediaPipe libaray.

### 3.1 Proposal

In mathematics, Stirling's approximation (or Stirling's formula) is an approximation for large factorials. It is named after James Stirling.

The formula as typically used in applications is:

$$\ln(n!) = n \ln n - n + O(\ln(n))$$

# Chapter 4

## Work Plan

Our work plan have different phases . Our work will progress through these phases.

- Holographic projection
- Ultrasonic phased array for tactile feedback.
- Hand Gesture recognition

### 4.0.1 Holographic Projection

The first step of our work is to make holographic projection of our an input image. There are different methods to achieve this.

- Thin Amplitude Hologram
- Thin Phase Holograms
- Volume Hologram
- Reflection Hologram

The decision to choose a method depends upon the efficiency of the display.

### 4.0.2 Tactile feedback

In this phase, An array of ultrasonic sensors are used to provide tactile feedback. Phased array creates adisturbance in the air that the user can feel whenthey pass their fingertips across it.

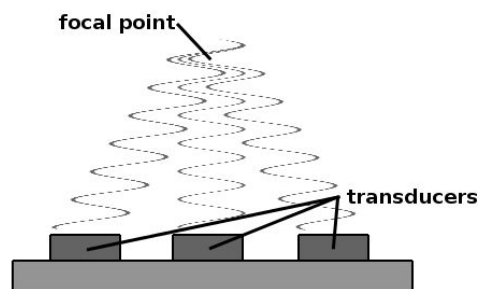


Figure 4.1: Tactile Feedback

### **4.0.3 Hand Gesture recognition**

For hand gesture recognition, Machine learning techniques are used. Different hand sign are trained using a machine learning model. A model is selected selected based on the accuracy of the model. The live image of hand is captured using a camera and detected using machine learning. Based on the sign, The image is classifed and the change is reflected real-time.

## **4.1 Budget**

## Chapter 5

### Conclusion

An intrusion detection system (IDS) [1] is a device or software application that monitors network and/or system activities for malicious activities or policy violations and produces reports to a Management Station.

Donald Ervin Knuth [2] is a computer scientist and Professor Emeritus at Stanford University. He is the author of the seminal multi-volume work The Art of Computer Programming. Knuth has been called the "father" of the analysis of algorithms

## Bibliography

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