JAIN
DEEMED-TO-BE UNIVERSITY

FACULTY OF
ENGINEERING
AND TECHNOLOGY

A Report on

"Hologram Implementation"

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND SYSTEMS ENGINEERING

(Cloud Technology & Mobile Applications)

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2022-2023

CERTIFICATE

This is to certify that the pcl project work titled **"HOLOGRAM IMPLEMENTATION"** is carried out by **S.Yaseen (22BRCF027), N.Vinay Kumar Reddy (22BTRCM015), G.Uday Kiran Reddy (22BTRCM003), Darshan (22BTRCM002), B.Pavan Kumar (2BTREC007),** a Bonafede students of Bachelor of Technology at the Faculty of Engineering & Technology, Jain (Deemed-to-be) University, Bangalore in partial fulfilment for the award of degree in Bachelor of Technology in Computer Engineering – Mobile Application & Cloud Technology, during the year **2022-2023**

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DECLARATION

We, **S.Yaseen(22BRCF027),N.Vinay Kumar Reddy(22BTRCM015), G.Uday Kiran Reddy (22BTRCM003), Darshan(22BTRCM002), B.Pavan Kumar (22BTREC007)** are students of third semester B.Tech in **Computer Science & Engineering**, at Faculty of Engineering & Technology, **Jain (Deemed-to-be) University**, hereby declare that the PCL project titled **"HOLOGRAM Implementation "** has been carried out by us and submitted in partial fulfilment for the award of degree in **Bachelor of Technology in Computer Engineering- Mobile Application & Cloud Technology** during the academic year **2023-2024**. Further, the matter presented in the project has not been submitted previously by anybody for the award of any degree or any diploma to any other University, to the best of our knowledge and faith.

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ACKNOWLEDGEMENT

It is a great pleasure for us to acknowledge the assistance and support of a large number of individuals who have been responsible for the successful completion of this pcl project work.

First, we take this opportunity to express our sincere gratitude to Faculty of Engineering & Technology, Jain Deemed to be University for providing us with a great opportunity to pursue our Bachelor's Degree in this institution.

In particular we would like to thank ***Dr. Hariprasad S A***, ***Director,*** *Faculty of Engineering & Technology and* ***Dr. Geetha Ganesan, Program Head****, Department of Computer Science and Engineering, Jain (Deemed-to-be) University for their constant encouragement and expert advice.*

It is a matter of immense pleasure to express our sincere thanks to ***Dr. Sonal Sharma****,* ***Program Coordinator****,* ***Computer Science & Engineering - MACT****, Jain (Deemed-to-be) University****, for providing the right academic guidance that made our task possible.*

We would like to thank our guide ***Dr. Vijay Kumar A****, Professor,* ***Department of Computer Science & Engineering - MACT****, Jain (Deemed-to-be) University, for sparing his/her valuable time to extend help in every step of our pcl project work, which paved the way for smooth progress and fruitful culmination of the pcl project.*

We would like to thank our PCL Coordinator ***A.Vijay kumar, Assistant Professor*** *,* ***Department of Computer Science & Engineering - MACT****, Jain (Deemed-to-be) University, and all the staff members of Computer Science & Engineering for their support.*

We are also grateful to our family and friends who provided us with every requirement throughout the course.

We would like to thank one and all who directly or indirectly helped us in completing the PCL Project work successfully.

Signature of Students

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Abstract

Significant progress has been made in the use of ICT in learning environments. Because of the benefits that ICT provides in this sector, most educational institutions have integrated ICT services into their departments. Scientists are working hard to develop advanced technology that will benefit them in a variety of ways. One of the most inventive of these solutions is 3D Hologram Technology (3DHT).In this paper, the researcher presents essential information about 3DHT in order to comprehend the significance of this technology in our lives, particularly in the learning environment. He also assesses the effectiveness of 3DHT as an educational tool by identifying its strengths and weaknesses as a teaching tool technique.The recent introduction of novel acquisition devices such as the Leap Motion and the Kinect enables a very informative description of the hand pose to be obtained, which can then be used for accurate gesture recognition. This paper proposes a novel hand gesture recognition scheme that is specifically designed for Leap Motion data. In order to recognise the performed gestures, an ad hoc feature set based on the positions and orientation of the fingertips is computed and fed into a multi-class SVM classifier. In order to improve recognition performance, a set of features is extracted from the depth computed by the Kinect and combined with the Leap Motion ones.Sign recognition systems are intended to assist deaf people in communicating with society. We proposed our own concept of sign language recognition in this paper, which is based on a co-operative deep learning neural network, a text input prediction algorithm, and user feedback. We highlighted the complexities of Russian sign language and devised fingerspelling recognition. The method makes use of the natural properties of fingerspelling to improve accuracy and recognition performance by predicting the next letter.In the related works, we also provide a detailed review of data acquisition. In terms of hardware, we recommend using a Leap Motion controller.

1.Literature Survey

[1] Significant advancements have been made in the area of ICT use in educational settings. The majority of educational institutions have integrated ICT services into their departments as a result of the benefits ICT offers in this field. Scientists are putting a lot of effort into developing cutting-edge technologies that will help them in a variety of ways. One of these methods that stands out among the rest is 3D Hologram Technology (3DHT).In order to comprehend the significance of 3DHT in our lives, and specifically in the learning environment, the researcher provides key facts on 3DHT in this work. In order to assess the success of 3DHT as a teaching tool, he also lists its advantages and disadvantages.A poll was conducted to fully comprehend the phenomena in order to: The questionnaire has been used as a method of data collection because a survey on a sizable sample of UK teachers has been conducted in order to fully grasp the phenomena.The findings also show that the primary obstacles to incorporating 3DHT into educational settings are a) the expensive cost of installation and b) the necessity of a high-speed Internet connection.

[2] The construction of optical wavefronts from numerically specified objects using computer-generated holograms.New applications, such as three-dimensional computer output displays, synthetic prototypes for interferometric testing, and filters for various optical data processing procedures, have been made possible by the lack of an actual object. Our computer holograms have several advantages over conventional holograms despite having a binary transmittance range, which makes them different from conventional holograms in terms of construction of general wavefronts and images. Experimental work demonstrating the reconstruction of two- and three-dimensional images is presented, along with recent advancements that simplify the creation of binary holograms and enhance their performance.

[3] This study presents several applications of digital holograms for 3-D display and 3-D information processing.First, it was necessary to recollect the fundamentals and characteristics of digital holography, such as the ability to recreate different angles of the captured objects. The use of these characteristics for 3-D imaging was then covered. It was proven that digital holograms allow for optical or digital reconstruction of the three-dimensional object. Digital holograms must also be transmitted and stored, in addition. Therefore, a number of methods for compressing and encrypting 3-D data in the form of digital holograms were presented. It was demonstrated that the unique characteristics of holograms necessitate the adaptation of the conventional compression techniques used for ordinary images. First, it was necessary to recollect the fundamentals and characteristics of digital holography, such as the ability to recreate different angles of the captured objects. The use of these characteristics for 3-D imaging was then covered. It was proven that digital holograms allow for optical or digital reconstruction of the three-dimensional object. Digital holograms must also be transmitted and stored, in addition. Therefore, a number of methods for compressing and encrypting 3-D data in the form of digital holograms were presented. It was demonstrated that the unique characteristics of holograms necessitate the adaptation of the conventional compression techniques used for ordinary images. Additionally, a number of encryption techniques use phase masks

[4] Leap Motion and Kinect, two revolutionary acquisition tools that were just released, enable for the gathering of an extremely detailed description of the hand position that can be used to reliably identify gestures. The innovative hand gesture detection method that is explicitly aimed at Leap Motion data is proposed in this research. To identify the gestures made, a multi-class SVM classifier is provided with an ad-hoc feature set based on the positions and orientation of the fingertips. In order to enhance the performance of the recognition system, a set of features from the Kinect's depth computation are also taken and mixed with those from Leap Motion. Results from experiments compare the accuracy that may be gained from the two devices on a selection of the American Manual Alphabet and show how, by combining the two features sets, it is possible to achieve a very high accuracy in real-time.

[5] A new tool for hand gesture-controlled user interfaces with claimed sub-millimeter precision is the Leap Motion Controller. However, its capabilities up to this point in real-world settings have not been studied. As a result, this paper presents a preliminary investigation into a leap motion controller. The examination of the accuracy and repeatability is the key area of focus. A novel experimental setup was created using an industrial robot and a reference pen with a 0.2 mm position accuracy in order to conduct an appropriate evaluation. Thus, a variation of less than 0.2 mm between a desired 3D position and the average measured positions was achieved for static settings, whereas a deviation of more than 1.2 mm was found for dynamic setups.
The analysis' findings can be used to enhance how applications for the Leap are created. Leap Motion controller in the field of Human-Computer Interaction.

[6] This essay offers an early investigation into the Leap Motion controller's appropriateness for Australian Sign. Auslan language recognition Testing revealed that the controller can accurately track hands and fingers as well as movement. When the hand moves into a position that limits the controller's field of view, for as when the hand turns and is perpendicular to the controller, this detection becomes less accurate. When certain parts of the hands are brought together, such as fingers, the detection also fails. Both of these situations prevent the controller from reading or tracking the hand. The Leap Motion API needs to be further developed, however there is potential for using this technology to recognize Auslan.

[7] The advent of computing and the most recent hardware developments made it possible to communicate with computers naturally. One of the most well-known types of natural contact is gesture-based communication. Due to their complexity, hand motions in virtual environments (VEs) need substantial calculations that have a direct impact on interaction performance and realism. In this research, we present a novel interaction method for VEs that makes use of single-fingertip motions. The study's goals are to maximise performance, minimise computational cost, and enhance usability. Navigation, object selection, translation, and release are all part of the interaction. To achieve this, we suggest a low-cost camera-based system that recognises motions as quickly and precisely as possible by using a coloured fingertip. In addition, we used leap motion.We compare the suggested system with the Leap Motion controller in this gesture recognition comparative analysis and performance. In order to conduct experiments, a VE was created. Additionally, we thoroughly analysed two distinct

identification systems, including a video camera and a Leap Motion sensor. Task accuracy, interaction volume, update rate, and spatial accuracy distortion were the main analysis criteria. For system usability examination, we employed the Standard Usability Scale (SUS). In comparison to the Leap Motion sensor, the testing showed that the camera implementation had better performance, less spatial accuracy distortion, and a larger interaction volume. Additionally, we discovered that the suggested interaction method was quite practical in terms of user happiness, friendliness, learning, and consistency.

[8] The medical industry is being impacted by developments in virtual and augmented reality (AR) in areas like surgical simulation. The enhancement of surgical simulation will give students and residents more training and assessment options. This is especially crucial for routinely performed operations by residents like the endoscopic third ventriculostomy (ETV). Simulators like NeuroTouch have been created to help with the training necessary for this surgery. The authors compare the usability and training efficiency of their affordable and accessible ETV simulator to that of the current NeuroTouch. Unity, Vuforia, and the leap motion (LM) for an AR environment were used to create this simulator. 40 aiming tasks were given to the participants, 16 newcomers and 2 experienced neurosurgeons. Performance was determined using the trajectory log files and the times taken to accomplish each task. The speed and accuracy statistics obtained from the novices and experts are compared, and they analyse the training's actual effectiveness in terms of each system's speed and accuracy of targeting.

[9] Holographic sensors are still in their infancy as technologies. Holographic sensing offers considerable advantages over other diffraction grating-based sensors in terms of three-dimensional image capabilities and compatibility with laser manufacturing. However, they share the limited selectivity of other hydrogel-based optical sensors, which makes it difficult to create products that can compete with molecular dye-based and electrochemical sensing platforms.
Therefore, it is important to place more attention on selectivity so that holographic sensors can develop into a mature platform for making practical goods.All of these developments will result in multiplexed assays that can detect or quantify a wide range of analytes with only moderate sensitivity. By using microfluidic technology, it is possible to miniaturise devices, use fewer reagents, and create low-cost, high-throughput devices. 234 Making disposable environmental monitoring devices will be possible thanks to the development of holograms that are responsive to environmental stressors.Other significant contributions to the field will be brand-new strategies for whole-cell and amplicon detection without the use of any instruments. These sensors can be used to check for a person's genetic susceptibility to certain diseases. The sensing mechanism needs to undergo a lot of work to become a highly reproducible platform. Potential trials must show that scaling up is both feasible and cost-effective.

[10] Today's information and communication technologies (ICT) are continually changing and having a significant impact on a variety of human endeavours, including higher education. ICT allowed for the transition of university education from conventional teaching and learning methods to e-Learning. Specifically, giving education to the student via technology, such as computer-mediated platforms based on synchronous video conferencing, independent of the learner's location or time. Synchronous holographic communication between users is now possible thanks to the next generation of computer-mediated

communication tools. However, in order for these technologies to be successfully incorporated into the e-Learning paradigm, they have not been specifically built for the field of university education and have not taken user demands into account.In order to better understand how professors and students in higher education feel about the possible employment of holographic ICT tools in the context of e-Learning, as well as what they would like to see in such tools, this master's thesis study investigates their perceptions. An interpretive qualitative ethnographic study was carried out for this. Data were gathered using the Thinking Aloud technique, focus groups with carefully chosen university lecturers and students, and passive observations. Thematic examination of the data obtained led to the identification of seven themes that summarise the study's findings. The research objectives, research questions, and theoretical framework, which included the user-centered design methodology, were all discussed in relation to these research findings.

[11] The most significant and ground-breaking use of holography is holographic interferometry. It is a development of traditional interferometry measuring methods in which a hologram is used to reconstruct at least one of the interfering waves. This accurate method, unlike non-destructive testing, can measure all different kinds of complex items without causing mechanical disruption. Off-axis holography makes opaque objects' diffused reflections appear to be superimposed by interference fringes, which may indicate the object's deformation, displacement, or rotation. Similar to opaque objects, transparent objects can also generate fringe patterns that reveal variations in refractive index or object thickness. Therefore, the hologram was employed in the Holographic Interforometry to record the wavefront of diffused objects and then compare with complex wavefront.Measurements on optically polished and reflecting plane or spherical surfaces with a short path length difference were the only ones that could be made using the classical interferometry of Michelson. The path lengths and vector displacement of diffusely reflecting surfaces with complex geometries can now be measured using holographic interferometry. Holography offers numerous techniques, including Time-Average Holographic Interferometry, Double-Exposure Holographic Interferometry, and Real-Time Holographic Interferometry. In addition to this method, non-destructive testing of opaque objects can be used to identify production flaws such as fractures, voids, vibration analyses, inhomogeneous material properties, residual stress unsatisfactory fittings, and mismeasured measurements.

2.About the Problem

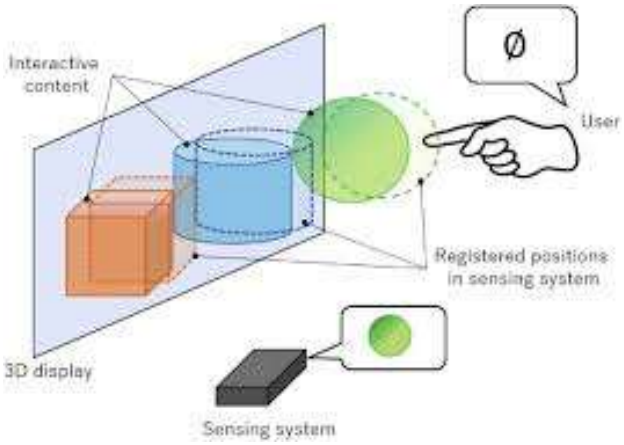
- With the advent of computing and the most recent hardware developments, it became natural to communicate with computers. Gesture-based communication is one of the most well-known types of natural contact. Hand motions in virtual environments (VEs) require significant calculations due to their complexity, which has a direct impact on interaction performance and realism. We present a novel interaction method for VEs that makes use of single-fingertip motions in this study.
- Using computer-generated holograms, optical wavefronts are constructed from numerically specified objects. The lack of an actual object has enabled new applications such as three-dimensional computer output displays, synthetic prototypes for interferometric testing, and filters for various optical data processing procedures.

3.The primary reason to choose this topic

- Today's information and communication technologies (ICT) are constantly evolving and impacting a wide range of human endeavours, including higher education.
- Education delivered to students through technology, such as computer-mediated platforms based on synchronous video conferencing, regardless of the learner's location or time.
- To gain a better understanding of how professors and students in higher education feel about the potential use of holographic ICT tools in e-Learning, to improve the performance of the recognition system, features from the Kinect's depth computation are combined with those from Leap Motion.
- As the technologies are evolving around Auto Chat bot system, we could implement this in our hologram to give a better experience to the end user with interaction features.
- In India, there is a great scope for hologram and 3D reality which will be widely use in near future.
- Holographic technologies can be easily combined with other technologies

4.The main objective of the project.

- To improve use of hologram in every area.
- To implement leap motion technology in 3D hologram so it will be easy to work and better understanding in educational purpose.
- There is a holographic system for every location, occasion, or purpose. The important thing to remember is to conduct a thorough pre-briefing to ensure that all parameters have been considered in order to create a 3D hologram that is perfectly coordinated to each individual product.



5.Scope of the Project.

- It can be use in Entertainment sector
- Can be use in Advertisement
- Can be use in educational purpose
- Can be use as Auto Chat Box

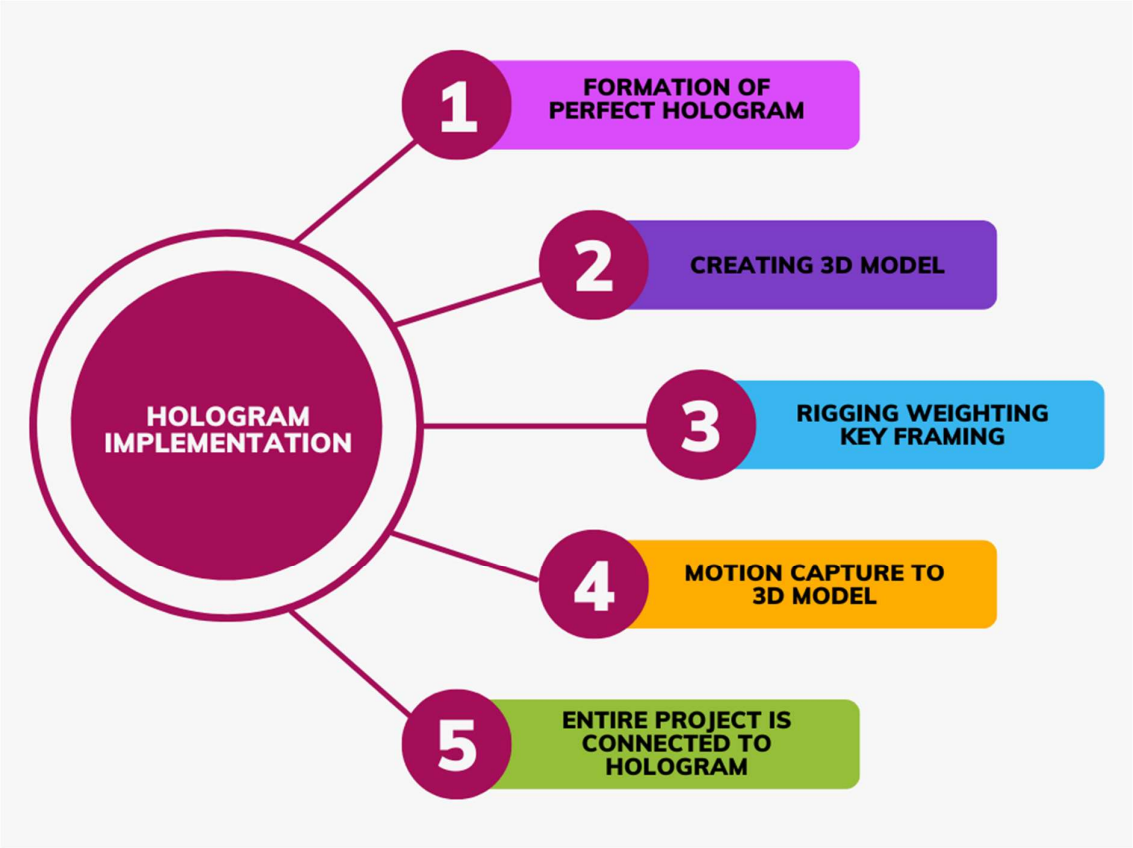
6.Details about the Software or technologies that will be used.

- Holographic Sensors: Three-Dimensional Analyte-Sensitive Nanostructures
- Design and evaluation of an augmented reality simulator using leap motion
- Fingertip Gestures Recognition Using Leap Motion and Camera for Interaction with Virtual Environment
- The Leap Motion controller: A view on sign language
- Hand gesture recognition with Leap Motion and Kinetic Devices
- Three-Dimensional Imaging and Processing Using Computational Holographic Imaging

7.Limitations of the system proposed.

- It has higher production cost compare to 2D projection.
- Hologram seems to be inefficient in bright lighting conditions and needs a proper lighting environment for its better experience.
- Leap motion is a complex concept for understanding as well as coding point of view.
- Chances of ambiguity increases when the number of user exceed the required number of user.

8.Timeline.


HOLOGRAM IMPLEMENTATION
1
FORMATION OF PERFECT HOLOGRAM
2
CREATING 3D MODEL
3
RIGGING WEIGHTING KEY FRAMING
4
MOTION CAPTURE TO 3D MODEL
5
ENTIRE PROJECT IS CONNECTED TO HOLOGRAM

Reference

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[8] Design and evaluation of an augmented reality simulator using leap motion, (Trinette Wright, Sandrine de Ribaupierre, Roy Eagleson)

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[10] Improving the Design of Holographic, (Konstantin Tcykin)

[11] holographic interferometry, (H.R. Pratheep,Dr. V. Vadivelan,,Dr.BChandar Shekar)