A Project Part-1 Report

Mobile Application for Augmented Books using Vuforia and Unity

Submitted in partial fulfillment of the requirements for the award of degree

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

By

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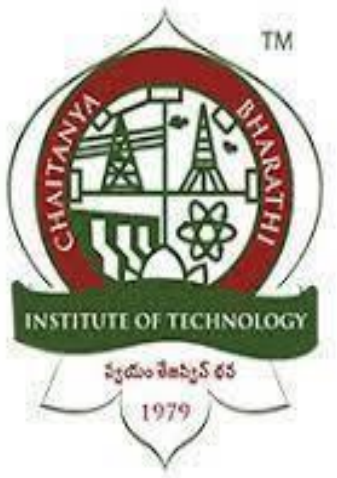

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COMMITTED TO RESEARCH, INNOVATION AND EDUCATION 44 years

CERTIFICATE

This is to certify that the project titled **"Mobile Application for Augmented Books using Vuforia and Unity"** is the bonafide work carried out by **Akshith Reddy (160119733145) and Sathwik Reddy B (160119733169)** students of B.E(CSE) of Chaitanya Bharathi Institute of Technology(A), Hyderabad, affiliated to Osmania University, Hyderabad, Telangana (India) during the academic year 2022-2023.

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DECLARATION

We hereby declare that the project entitled **"Mobile Application for Augmented Books using Vuforia and Unity"** submitted for the B.E.(CSE) degree is our original work and this project part - 1 has not formed the basis for the award of any other degree, diploma, fellowship, or any other similar titles.

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ABSTRACT

The integration of cutting-edge technology in field trips and classrooms to create augmented reality in education gives students a unique and comprehensive learning experience. AR in education is the real-time integration of digital material with the surrounding environment of the student. It develops future leaders and gets them ready to handle the demands of the future.

Benefits of augmented reality in education One benefit is that it makes things more interesting, which enhances user interaction. Because a learner may access content using a mobile device, it encourages greater engagement. Students can examine a computer-generated picture that leads to a conceptual understanding with a few links to the digital assets using their mobile device to scan augmented reality content.

Future educational applications of augmented reality will greatly assist in raising student engagement, intellectual curiosity, content engagement, knowledge base, and learning interest. In addition to increasing engagement, interactive AR apps and on-premise AR implementation in education give students a sense of independence and control over the learning process.

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INTRODUCTION

1.1 What is Augmented Reality (AR)

Augmented reality (AR) is an enhanced version of the real physical world that is achieved through the use of digital visual elements, sound, or other sensory stimuli and delivered via technology. It is a growing trend among companies involved in mobile computing and business applications in particular. The use of augmented reality is expanding and becoming increasingly common across a diverse variety of applications. Since the technology's inception, marketers and technology companies have struggled to fight the idea that augmented reality is merely a promotional tool.
There is evidence, though, that consumers are starting to get real benefits from this technology and anticipate it in their purchasing decision. Unlike virtual reality which completely replaces reality, Augmented Reality only adds or completes reality. Augmented reality technology has the goal of creating a system in which users cannot distinguish between the real world and virtual augmentation. As data gathering and analysis become more prevalent, one of augmented reality's main objectives is to draw attention to certain aspects of the real world, deepen understanding of those aspects, and generate clever, approachable insight that can be used in practical contexts. Augmented Reality is used in entertainment, military training, engineering design, robotics, manufacturing, and other industries. This technology began to color the world of technology in the last decade and is also able to attract the attention of experts, researchers, and IT developers with the technology models offered namely making real virtual objects.

1.2 How can Augmented Reality be blended with Education

The future of augmented reality is promising because it allows for improved interaction between the real and virtual worlds in previously unthinkable ways. It represents a novel method of interacting with the user interface. There are countless opportunities to explore as augmented reality continues to develop. We intend to provide educational augmented content that adheres to institutes' teaching methods and curricula.

Our augmented books can be used in this way by institutions to teach their curriculum. Since visualizations are so useful for children with learning difficulties, we intend to leverage this technology to their advantage. The goal of interpersonal and physical engagement is to firmly imprint the experience on the guest. The goal of the free learning experience is to pique interest, foster a favourable attitude toward the subject, and include the visitor in an engaging encounter that sparks conversation long after it is experienced.
AR can be used in a variety of educational settings, from teaching young children their alphabets to teaching post-graduate students about various body parts. We may perceive locations that are inaccessible in real life using augmented reality. After pupils visualize how a mathematical formula is stated, learning it becomes very simple for them.

1.3 Scope of the project

It has not been investigated thoroughly how Augmented Reality (AR) can be used to promote educational inclusion. The current state of adopting augmented reality as an instructional tool that takes into account the requirements of all students, including those with disabilities, is described through this system. Children with exceptional needs need special education. The use of AR technology can help children who have developmental difficulties, physical disabilities, emotional and behavioral issues, learning challenges, and communication disorders. It breaks the barrier of language as an image can be understood by everyone.

1.4 Problem Statement

It has not been investigated thoroughly how Augmented Reality (AR) can be used to promote educational inclusion. The current state of adopting augmented reality as an instructional tool that takes into account the requirements of all students, including those with disabilities, is described through this system. It is accomplished through the analysis of various elements, including the benefits of augmented reality (AR), its drawbacks, applications, difficulties, scope in the educational setting, the audience, and the positive or negative effects of its application in learning scenarios involving students with various educational needs.

2. LITERATURE SURVEY

This section of the report includes the existing methodologies and models used to perform the **TITLE**. It also elucidates the architectures of the models and how they are providing more optimized deliveries.

2.1 Existing Systems and Related works (Base papers)

Globally, augmented reality (AR) in education research is gaining traction. With regard to the investigation and creation of new technologies, this subject has been rapidly expanding over the past few decades.There are over 45 systematic literature reviews and meta-analyses in the topic of AR in education, as well as approximately 33 surveys and one bibliometric study. However, these assessments do not offer a comprehensive summary of all the studies that have been published in the area to show how it has changed over time. This study conducted a bibliometric analysis using the article information from a 27-year period (1995-2022). 3,475 studies in all were taken into consideration. The bibliometrix R package, the VOSviewer analytic tool, and the Scopus database were some of the tools we employed in this work. Based on the metadata, author, content, and citation data that were taken from the dataset, the literature was analyzed. Additionally, we concentrate on contrasting literature that has been published primarily in journals (articles, articles in press, and reviews) with that that has been published in other sources (conference papers, books, and book chapters). The findings of this study could be used by practitioners to guide their choices on the usage of AR tools in the classroom.

Around the world, a wide range of technologies and methods are employed in the field of educational technology to better support the teaching and learning processes. The technology of augmented reality (AR), which is one of these methods, is gaining popularity on a global scale. Research on augmented reality (AR) as a learning and teaching aid has been ongoing in the educational setting. The research community is very interested in AR because it offers distinctive learning opportunities that are not possible with conventional tools or methods.

The amount of papers on augmented reality in education is growing, and the area is taking off. The three top nations in terms of scientific output for the publication of research on AR in education are the United States, Spain, and Taiwan. The most significant publications for publishing research on augmented reality in education include Computers and Education, Interactive Learning Environments, and Computers and Human Behavior. Because some conferences publish their proceedings under this series, the majority of conference papers are published in lecture notes in computer science.

Special educational needs, Industry 4.0, narrative, 3D printing, mobile apps, and higher education are the current developing and rising research themes in augmented reality in education. These findings were supported by the findings of the analysis of the authors' keywords, which also revealed the significance of the ideas of "gamification" and "game-based learning" in studies on augmented reality in education. Designing augmented reality (AR) learning experiences for higher education is becoming more popular. The keywords also demonstrate that several recent studies have concentrated on examining the potential of augmented reality (AR) in medical education.

2.2 Base Paper-1

Implementation of Augmented Reality into the Training and Educational Process in Order to Support Spatial Perception in Technical Documentation

The technology of augmented reality with the use of projection has taken the lead in the manufacturing sector, and it is now regarded globally as a standard technology in many production companies. The widespread reality of controlling manual production processes with high accuracy and speed is made possible through the direct projection of the digital work surface onto the work surface as well as the provision of visual and audible challenges, direction advice, and staff guidance. This technology has the priceless ability to enhance and streamline manufacturing and quality control operations

SELECTION OF AUGMENTED REALITY SOFTWARES

1. The Vuforia Studio

The Vuforia studio is a high-performance and easy-to-use application that transforms applications and products into expanded reality experiences. Vuforia Studio transforms existing 3D CAD and IoT data into immersive, augmented reality instructions to help frontline workers get their jobs done quickly, accurately, and safely.

The Vuforia provides cross-platform Augmented Reality support for iOS, Android, and Windows. The main reason for choosing Vuforia it provides local storage and cloud-based storage capable of storing thousands of objects.

2. Unity

Unity provides powerful tools to make rich, deeply engaging augmented reality experiences that intelligently interact with the real world.

PREPARING THE AUGMENTED REALITY EXPERIENCE

1. Preparing the Technical Documentation and Assembly Parts

2. Creation of Sequences from Assembly Parts

3. Preparing experience in the Vuforia Studio

4. Accessing the Experience in Unity

2.3 Base Paper-2

The value of visual quality and service quality to augmented reality enabled mobile shopping experience

The term "visual quality" in the current study refers to a user's assessment of the level of representational richness of an object presented in a mediated environment. When viewed from the standpoint of the application, it is the capability of the app to deliver very realistic product displays.

The study considers the following research questions:

(1) What are the determinants of visual quality in an MAR retail app context?

(2) Do the visual and service quality of the MAR Retail app affect a customer's MAR App experience?

(3) Does the customer's app experience affect the intention to recommend the MAR retail app to others?

Here MAR stands for Mobile Augmented Reality.

Aesthetics: Aesthetics is a key construct in IS design research which refers to the visual appeal of the user interface of the App.

Position relevance: In this research, position relevance refers to the level of concern that a potential customer has for positioning a product in their personal environment (e.g., home, office).

Visual Quality: This research refers to visual quality as the measure of the degree to which a user perceives the representational richness of an object displayed in a mediated environment.

Service quality: Service quality is defined as the difference between a customer's expectation.

2.4 . Performance Analysis of Augmented Reality Based on Vuforia Using 3D Marker Detection

In this study, augmented reality based on the Metaio Mobile SDK is used to detect and track natural markers in the room. The implementation of augmented reality intended for facility maintenance. The results showed natural markers have a high potential to support the maintenance of augmented reality-based facilities. The success rate of detection reaches 95% at a marker distance of 10 m. Markers can be detected up to an angle of 85° with a maximum distance deviation of 50 cm and a maximum angle of 20°.

Vuforia's performance in detecting objects is affected by the following variables:

- Camera focus mode
- Lighting conditions
- Target size
- Print quality (2D marker)
- Camera angle
- Object features

Targets are detected based on natural features extracted from the target image. The object features in the database compared with features in live camera images in real-time. Star ratings of targets range from 1 to 5 stars. The best detection results obtained with a 4-star or 5-star. However low quality targets (1 or 2-stars) can usually also be detected.

The below table displays where the object is detected or not in the given intensity of light, the distance from the camera, and the percentage of the surface of the object visible captured in different qualities of the camera.

Camera	*lx* (lux)	*c* (mm)	Surface (%)	Result
1	50	150	100	T
1	50	150	70	T
1	50	300	100	T
1	50	300	70	N
1	200	150	100	T
1	200	150	70	T
1	200	300	100	T
1	200	300	70	T

2	50	150	100	T
2	50	150	70	T
2	50	300	100	T
2	50	300	70	T
2	200	150	100	T
2	200	150	70	T
2	200	300	100	T
2	200	300	70	T
3	50	150	100	T
3	50	150	70	N
3	50	300	100	T
3	50	300	70	N
3	200	150	100	T
3	200	150	70	T
3	200	300	100	T
3	200	300	70	T

[a] T = Detected

[b] N = Not detected

lx- intensity of light source

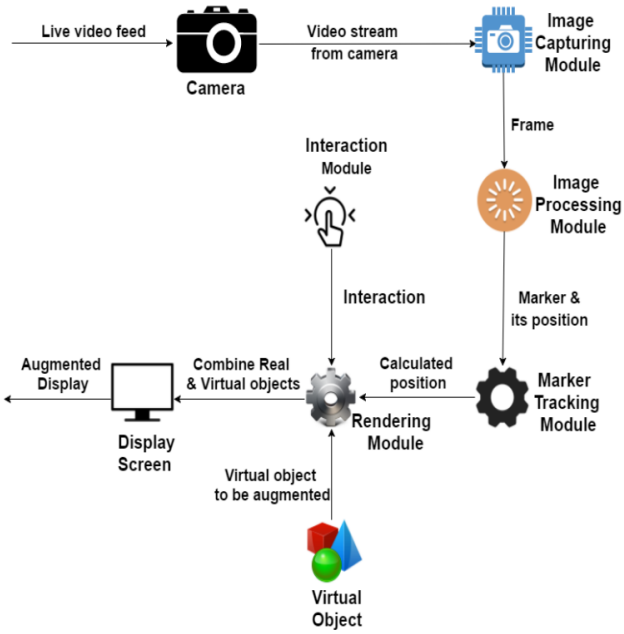
c- a distance of the object from camera

surface- Surface area of object

3. PROPOSED METHODOLOGY

3.1 ARCHITECTURE

All we need is a smartphone. The built-in camera detects live video from the surroundings and delivers it to the image capturing module, which frames the video and sends each frame to the image-processing module. Here, the marker is found by the image processing module, which then sends its location to the marker tracking module. The marker has now been located, and it is transmitted to the rendering module. A virtual item is matched to the marker in the rendering module and placed on the actual video scene. The enhanced video is then finally shown on the screen. Now, anytime a user interacts with virtual objects, a response is generated and displayed on the screen in accordance with the interaction.



3.2 Vuforia Studio

A platform called Vuforia Studio allows users to build, use, and share robust augmented reality experiences. Smartphones, tablets, or wearable technology can be used to see these augmented reality experiences. The use of AR across departments, cost savings for the company, and increased customer engagement are all benefits of Vuforia Studio's improved innovation. Vuforia Studio reduces development costs by allowing users with little or no coding experience to accelerate content creation using existing 3D CAD models.

5. CONCLUSION

Unquestionably one of the most practical tools for making complex topics concrete is lab experiments and demonstrations. However, many schools restrict the range of practical demonstrations that students are exposed to due to budget constraints, equipment availability, or safety risks. The traditional classroom experience is changing at an unprecedented rate. Technology has entered the classroom, enhancing the interactive and engaging components from which many kids are benefiting. Our software, which uses augmented reality, can be used in conjunction with conventional textbooks by students. With the use of this software, students will be able to see the object they are studying about in three dimensions.

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