Augmented reality for students and learning enthusiasts

A Major Project Report Phase-1

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Session: 2022 – 2023

DECLARATION BY THE CANDIDATE

We the undersigned solemnly declare that the Major project phase – I report entitled **"*AUGMENTED REALITY FOR STUDENTS AND LEARNING ENTHUSIASTS*"** is based on our own work carried out during the course of our study under the supervision of ***Mr. Yogesh Kumar Rathore.***

We assert that the statements made and conclusions drawn are an outcome of the project work. We further declare that to the best of our knowledge and belief that the report does not contain any part of any work which has been submitted for the award of any other degree/diploma/certificate in this University/Deemed university of India or any other country.

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CERTIFICATE BY THE SUPERVISOR

This is to certify that the Major project phase – I report entitled **"*AUGMENTED REALITY FOR STUDENTS AND LEARNING ENTHUSIASTS*"** is a record of project work carried out under my guidance and supervision for the partial fulfillment of the award of degree of Bachelor of Technology in the faculty of Computer Science & Engineering of Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.) India.

To the best of my knowledge and belief the report

i) Embodies the work of the candidate himself
ii) Has duly been completed
iii) Fulfills the partial requirement of the ordinance relating to the B-Tech. degree of the University
iv) Is up to the desired standard both in respect of contents and language for being referred to the examiners.

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CERTIFICATE BY THE EXAMINERS

The project report entitled **"*AUGMENTED REALITY FOR STUDENTS AND LEARNING ENTHUSIASTS*"** has been examined by the undersigned as a part of the examination of Bachelor of Technology in the faculty of Computer Science & Engineering of Chhattisgarh Swami Vivekanand Technical University, Bhilai.

_____ _____

Internal Examiner **External Examiner**

Date: **Date:**

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List of Symbols

Token	Name
( )	Parentheses
[ ]	Square brackets
,	Comma
" ", ' '	Inverted Commas
:	Colon
-	Hyphen
/	Slash
λ	Lambda
r	Radius

List of Abbreviations

VR	Virtual Reality
AR	Augmented Reality
IT	Information Technology
SRS	Software Requirements Specification
SDLC	Software Development Life Cycle
DFD	Data Flow Diagram

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Chapter – I

Introduction about Project

1.1 Introduction

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 delivered via technology. It is a growing trend among companies involved in mobile computing andbusiness applications in particular.

The primary value of augmented reality is the way in which components of the digital world mix up into a person's perception and thinking of the real world, notas a simple display of data or projection, but through the integration of immersivesensations, which are perceived and considered as natural parts of an environment.

Augmented reality has been applied in various fields, including military training, education, engineering, industrial design, arts, and entertainment etc. Augmented reality is used to enhance natural environments or situations and offer perceptually enriched experiences. With the help of advanced AR technologies (e.g. adding computer vision, incorporating AR cameras into smartphone applications and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulated. Information about the environment and its objects is overlaid on the real world. This information can be virtual. Augmented Reality is any experience which is artificial and which adds to the already existing reality.

1.1.1 Technologies for AR

Augmented reality and virtual reality employs the same hardware technologies and share many elements, such as computers. The distinction between them is that virtual reality produces virtual scenes, 3D objects, and interactivity. In AR part of the surrounding environment is 'real' and just adding layers of virtual objects to the real environment. On the other hand, in VR the surrounding environment is completely virtual and computer generated.

Displays, computers, input devices, and tracking devices are the primary augmented reality hardware. The two main types of displays used in augmented reality are see-through and monitor-based.

1.1.2 AR in Education

AR has been applied to a variety of industries, including the military, medicine, engineering, robotics, telerobotics, manufacturing, maintenance, and repair applications, consumer design, and psychological therapy (Azuma, Baillot, Behringer, & Feiner, 2001). A person can engage with the real environment in ways that have never been feasible before when information is displayed using virtual objects that the user cannot immediately notice with his own senses. By using interaction techniques that augmented reality provides, we can alter the location, form, and/or other graphical aspects of virtual objects. We can control both virtual and actual physical items in the real world with the use of our fingers or hand movements made with handheld devices, such as shaking and tilting.

By improving a user's perspective of and interaction with the real environment, augmented reality can be used for education, amusement, or edutainment. Like a genuine object, the user can move around the three-dimensional virtual image and observe it from any angle. Users are able to do tasks in the actual world thanks to the information the virtual items give. Interactive Surface One effective technique to increase learning is through metaphor. This feature enables simple real-card movement to manipulate three-dimensional virtual objects without the assistance of a mouse or keyboard.

Collaborative projects can potentially benefit from the usage of augmented reality. Innovative computer interfaces can be created to improve in-person and remote cooperation by fusing the virtual and physical worlds. These claims suggest that real-world applications resemble in-person interaction more than screen-based interaction (Kiyokawa, et al., 2002).

Despite the popularity of internet and web technologies, many people still prefer reading books over staring at screens, and textbooks are still frequently utilised. A fascinating use of this technology is in textbooks that incorporate augmented reality. These books are printed regularly, but when a webcam is pointed at them, designed interactions and visualisations appear. This is accomplished by utilising a website, installing particular software on a computer, or using particular mobile applications. With the use of this technology, any existing book can be converted into an augmented reality edition once it has been published. The most effective technique to connect the two isolated worlds is through simulations with various forms of interactions, 3D objects and vistas, and other inventive and diverse media.

Chapter-II
Literature Review & Problem Identification

2.1 Literature Review

Augmented reality gives a view of the real world where elements are superimposed by computer generated files such as graphics, sounds, videos, ordigital information. Augmented reality (AR) is a new way to integrate virtual reality into the real world, and it will be helpful for increasing student's overall performance.

According to research, most of us are visual learners which means we learn and understand concepts best when provided with visual cues. Augmented reality is therefore a great technology that produces rich learning experiences, enhances skills and knowledge, and improves collaborative learning. This has encouraged researchers to integrate this technology into the fields like biology, chemistry, mathematics, medicine, history, engineering etc. They have examined the potential of AR technology and its effectiveness on the learning experience with a comparison with other traditional learning methods. (Zainab H. Majeed and Huda A. Ali, 2020). A systematic review of a decade of using AR in education (2008–2018) has revealed that augmented reality is "increasing motivation (24%) and facilitating interaction (18%)."[11]

Handheld Displays

The type of device used to overlay graphics onto the real environment is Handheld Displays. These are small computing devices with a display that the user can hold in their hands. The two main advantages of handheld Augmented Reality are the portable nature of handheld devices and ubiquitous nature of camera phones. The disadvantages are the physical constraints of the user having to hold the handheld device out in front of them at all times as well as distorting effect of classically wide-angled mobile phone cameras when compared to the real world as viewed through the eye (Feiner, 2011). Smart-phones, PDAs and Tablets with cameras, digital compasses, GPS units for their six degree of freedom tracking sensors and fiducial marker systems used as a handheld display in augmented reality as shown in figure 2.1. (Mehmet Kesim, Yasim Ozarslan, 2012).[10]

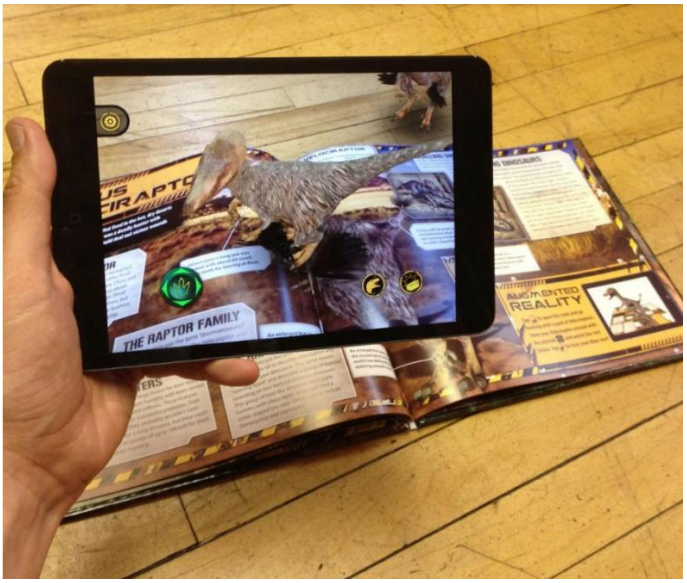

Figure 2.1 A handheld AR system displaying a three dimensional model of dinosaur

2.2 Problem Identification

A student's life includes studying, yet not everyone finds studying enjoyable. The students become disinterested due to the lengthy sentences and boring material. To tackle this issue, we suggest switching from the traditional approach to learning to a new one that makes use of augmented reality (AR) as a learning tool. To assist pupils acquire new ideas, some literary works have included augmented reality technology. The real and digital environments can be combined to make studying more enjoyable for pupils. cited the ScienceDirect study in order to assess the efficacy and outcomes of utilising AR in teaching. We can infer from their paper that employing AR as a learning tool aids students in learning certain subjects more successfully.

This is primarily accomplished by seeing abstract ideas as 3D objects. As a result, AR can be utilised to help students understand the fundamentals of abstract ideas. Students also find AR to be intriguing, which inspired them to study more. Due to the more engaging experience, the pupils may readily recall and remember information. Because students can view the replicas of real objects while learning and practising, AR is generally a more effective learning medium.[12]

Chapter-III
System analysis: Requirement analysis, SRS

3.1 System Analysis

3.1.1 Requirement Analysis

The application's primary goal is to display information about the images that the phone camera has obtained from books.

The application will detect the image after it has been captured or simply by aiming the phone camera in its direction, and viewing options for 3D models and video will then be presented.

a. The target audience

The app's target audience are students, and it provides materials for the NCERT 12th Physics course. Additionally, this application can be used by those who are passionate to learn about models. This project has been implemented under the guidance of collegeprofessors.

b. Project scope

The purpose of AR in Education system is to enhance students learning experience and to create a convenient and easy-to-use application for students.The application is developed in two stages.

In the first stage, the AR system and the assets (3D models and videos) were developed, and during the second stage, the deployment of these assets weredone. Software such as blender, vectary, unity and android were used to implement the AR system. Above all, we hope to provide a comfortable user experience.

3.1.2 System Development

a. Teaching Materials

Images from NCERT physics class 12th are gathered, and a corresponding video to the model is obtained in order to create course material utilizing AR. Learners can obtain in-depth knowledge of the model by using AR and zoom and rotate functions, which would help in offering interactive learning to users.

b. Planning and Developing the System

This study was conducted in two stages. In the first stage, the AR system and teaching materials were developed and during the second stage, deployment ofAR system and teaching material is done. Software such as blender, vectary, unity and android were used.

c. Developing the 3D Models

During the modeling phase, only required number of faces, edges and vertices are added to the object to accelerate computation and execution. Models are made using blender and vectary, and the most of them are animated to aid with learning and encourage interaction.

3.1.3 Unity Software

Multiplatform deployment is made simple and effective by the game creation engine Unity. It includes a powerful rendering engine, high-quality games and interactive content, and a graphical integrated development environment that make it possible to create games that can be easily deployed to consoles like the PS4, Xbox One, PC, Mac, and Linux as well as the Web, iOS, Android, and Linux.

In order to help users cut down on the amount of time needed for game design as well as the complexity and expense of Unity software developers efforts, Unity offers a wealth of documentation, projects, and tutorials.

a. Constructing the System Using Unity

To meet the needs of learners for learning and observation, the system interactions in this study were created in accordance with the necessary functions. Numerous resources, including a camera, image converter, tracker, application code, video background renderer, device databases, and user- defined targets, are offered by the VuforiaSDK for unity.

The Target Management System, which is hosted on the developer site, and the Vuforia Engine make up the platform.

For the target that we wish to track, we upload the input image. The device can then access the target resources. First, we should open the Target Manager we then download the targets in unity editor format to match our development option.

Then, we import the targets unity package into unity project; arrange the targets in a scene, and put virtual buttons and game objects in the targets.

Additionally, the Unity Inspector panel was utilized to modify object settings, configure component characteristics, public variable values, and establish relationships between objects. The teaching materials that uses augmented reality were also controlled in mobile mode, allowing exporting to smart phones.

3.1.4 SRS

a. Safety requirements

The recovery method restores a previous copy of the database that was backed up to archival storage and reconstructs a more current state by reapplying or redoing the operations of committed transactions from the backedup log, up to the time of failure if there is extensive damage to a wide portion of the database.

b. Security requirements

Like many other applications, security systems require database storage. Vendors must, however, make a careful choice in terms of their database partner due to the unique requirements of the security sector.

c. Functional requirements

Most Important and Basic feature: Being able to point the camera to an image and seeing information floating over it.

Overview of Functional requirements (Modules)-

Start Camera: By opening the application, user first get access to camera. The camera in work is back camera for performing the application's AR features.

Detect Object: The camera will point towards the object and detect it.

Gather Information: After detecting the object, all the related information should be loaded.

Collect Sensor Data: When the object is getting detected, the mobile will store the sensory data from the mobile.

Create AR objects: Based on the object detected it will create an AR object and will show on the screen.

Place AR objects: According to the collected sensor data, the object is shown over the image after doing the following check accordingly.

Video Player option: The user has the option to "show video player" on the application's left side. In front of the camera, it will show the video.
By selecting this option, users can access the play, pause, and reset buttons on the right side of the application's screen.

Toggle option: The user can switch between AR camera and 3D model viewing screen. The screen provides separate view of 3D model, so users can view, zoom and rotate accordingly.

d. Performance requirements

The capability of the device depends on the performance of the software. The app should be able to handle any quality input provided to the RAM and also to check for other device specifications like spaces, as insufficient space may create problem in installing the application or after installing it may create problem for loading or detecting the image because it will create logs but in that case the history logs can be paused. This would depend on the availability of memory space on the device.

e. Project requirements

DEVELOPER

Software's Required (With Versions duly mentioned)

- Google AR core API
- Android min SDK version
- Android 7.0 and unity 2021.3.4f1
- Vuforia 10.7

Hardware's Required

- Nvidia Geforce RTX 2070 Super
- CPU with a minimum clock speed of 3.5Ghz
- SSD with 256GB storage
- 8GB Ram

END USER

Software's Required (With Versions duly mentioned)

- Android 7.0
- IOS 9

Hardware's Required

- Any modern smartphone with camera

3.1.5 Overall description

PRODUCT PERSPECTIVE

A augmented reality application in education system provides the following information:

- **3D model:**

Included is a 3D model that hovers over the 2D image and provides an interactive vector model.

- **Video player:**

Included is a video player that may be accessed by pointing the camera in the direction of the video. It has the Play, Pause, and Reset buttons.

3.1.6 User class and characteristics

Users of the system should be able to retrieve 3D models via camera indirection over the image. The 3D models comprises of animation and labels to make visuals more interactive and informative.

Along with this a video player is provided with all the general play, pause and reset features. This system supports one type of user privileges, learners.

Learners will have access to these features. The learners should be able to do the following functions:

- Get 3D model
  - Rotate
  - Zoom-in
  - Zoom-out
- Get video player
  - Show player
  - Play
  - Pause
  - Reset
- Toggle between 3D model viewer and AR camera

3.1.7 Operating Environment

Operating environment for the augmented reality in education system is as listed below:

- Operating system: Android 7.0 / iOS 9 or above
- Vuforia 10.7 or above
- Android min SDK version
- Android 7.0 and Unity 2021.3.4f1

3.2 Type of SDLC Model

Incremental Model

The incremental process model is also known as the Successive version model.

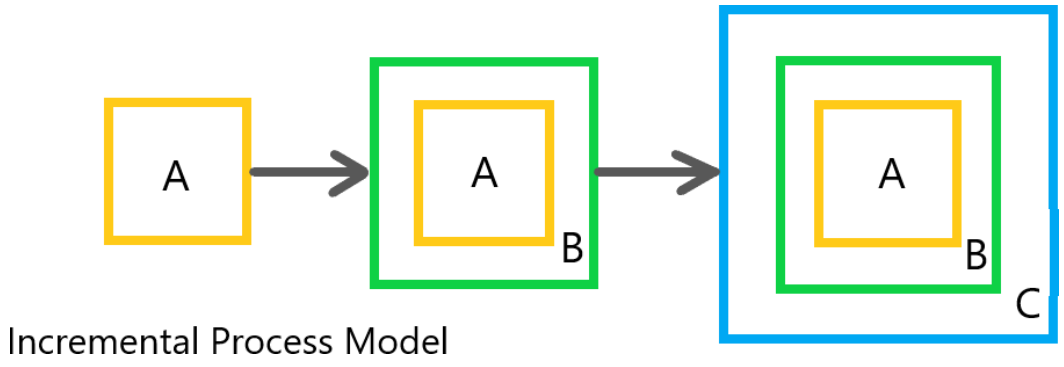

Figure 3.1 Incremental Process Model

Figure 3.1 shows a simple working system implementing only a few basic features and then that is delivered to the customer. Then thereafter many successive iterations/ versions are implemented and delivered to the customer until the desired system is released. Incremental Model is a process of software development where requirements divided into multiple modules of the software development cycle as shown in figure 3.2. In this model, each module goes through the requirements, design, implementation and testing phases.

Once the core features are fully developed, then these are refined to increase levels of capabilities by adding new functions in successive versions.

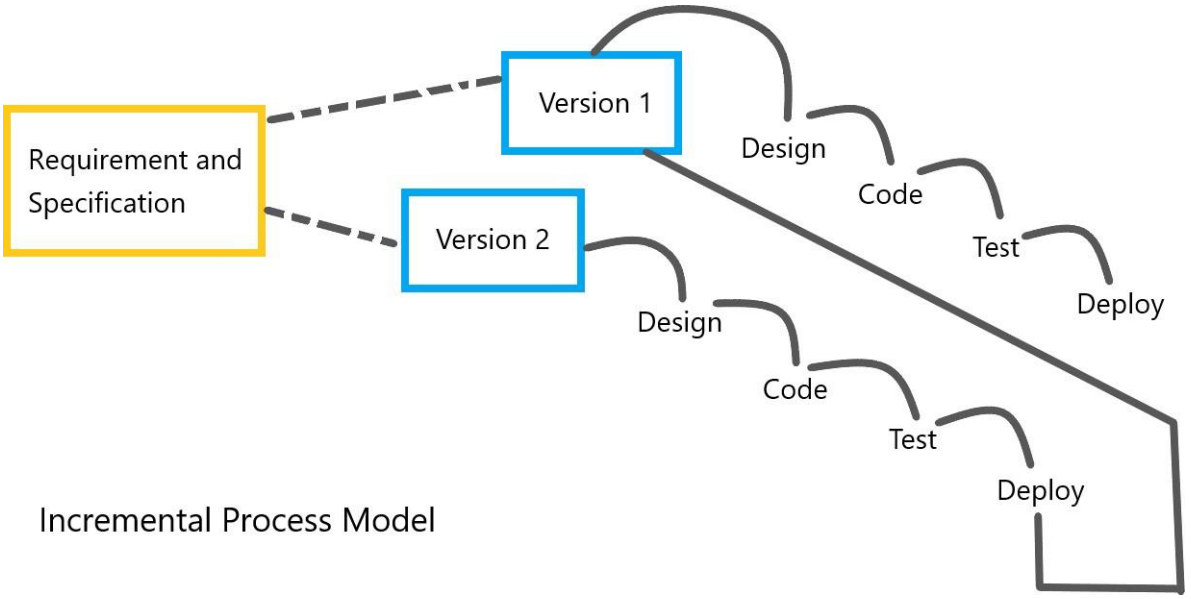

Figure 3.2 Incremental Process Mode

3.3 Data Flow Diagram

A Data Flow Diagram or (DFD) is a way of visual representation of a flow of data in a certain process or system. The data flow diagram can provide information about the process, inputs, and outputs of each entity.

3.3.1 DFD 0

Context DFD is the entrance of a data flow model. It contains one and only one process and does not show any data store. This diagram is also known as context diagram. As in the figure 3.3, context diagram is supposed to be an abstract view, with the mechanism represented as a single process. This DFD for the system depicts the overall structure as a single bubble. It comes with incoming/outgoing indicators showing input and output data.

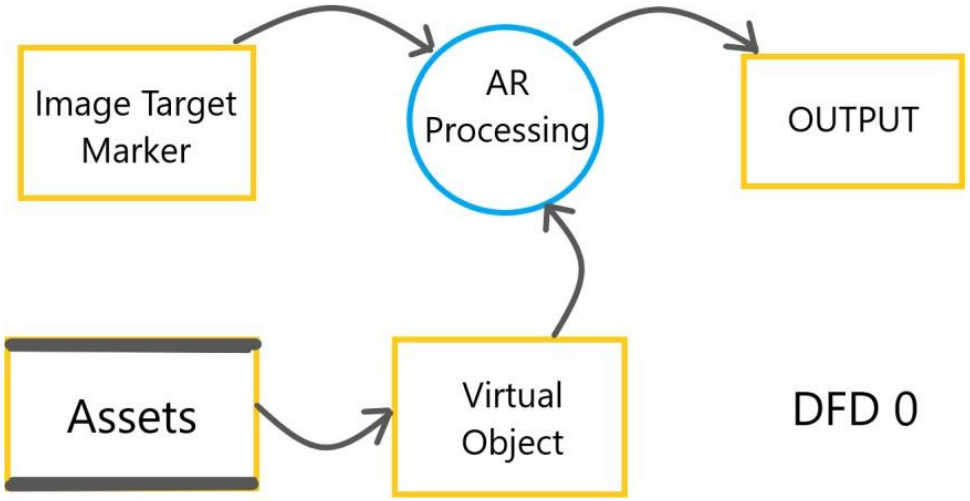

Figure 3.3 DFD 0

3.3.2 DFD 1

Next to the context diagram is the level 1 data flow diagram. The content of augmented reality in education is broken down into 6 sub processes shown in figure 3.4. In this level, the system must display or reveal further processing information. And the actors that are going to use this system are students.

With being knowledgeable about DFD level 1, user will know its broaden context terms. In addition to that, this may also serve as user reference on how the inputs or data fed on the system. Then user will also be informed about the outputs that the system gives.

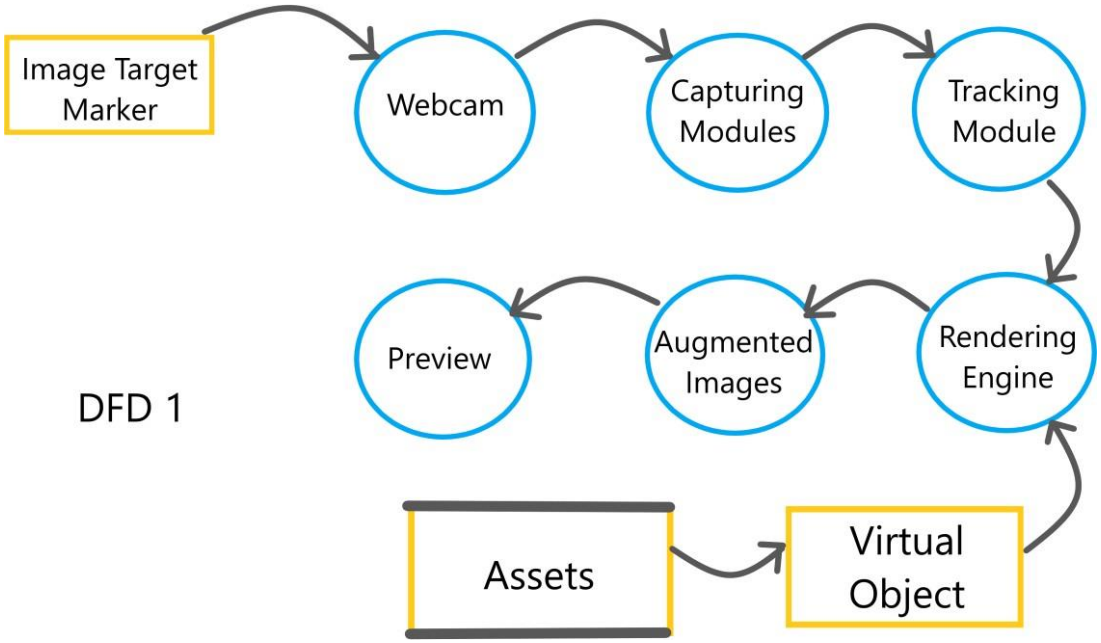

Figure 3.4 DFD 1

3.3.3 DFD 2

2-level DFD goes one step deeper into parts of 1-level DFD. The Level 2 DFD for the augmented reality in education should represent the basic modules as well as data flow between them as shown in figure 3.5. The DFD level 2 is the highest abstraction level and it can be used to plan or record the specific/ necessary detail about the system's functioning. The presented level gives user precise destination of the data that flows in the system along with showing user the detailed processes of system. In this the Target management system is used.

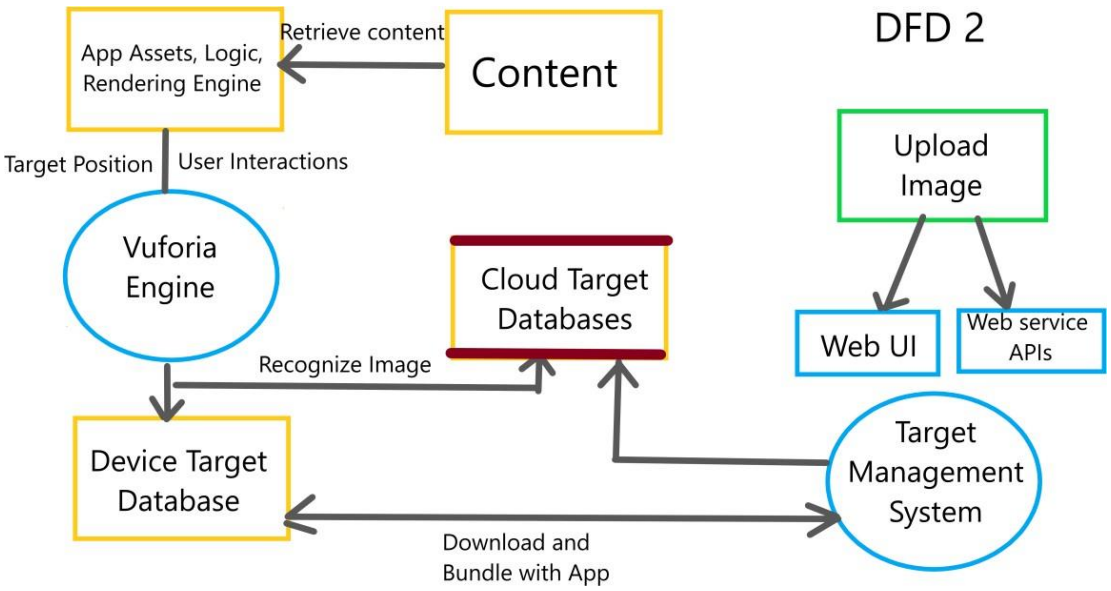

Figure 3.5 DFD 2

3.4 Workflow Diagram

The workflow model for augmented reality in the educational system is displayed in figure 3.6. Targeting a book image is the first step; if the image is found, the 3D model is then rendered and two additional options are displayed as Video Player and 3D View. The former option includes controls for Play, Pause, and Reset, while the latter one includes Rotate, Zoom-in/Zoom-out, and an AR View option for going back to the target search. If the book image cannot be located, the search will carry on as long as the camera is aimed.

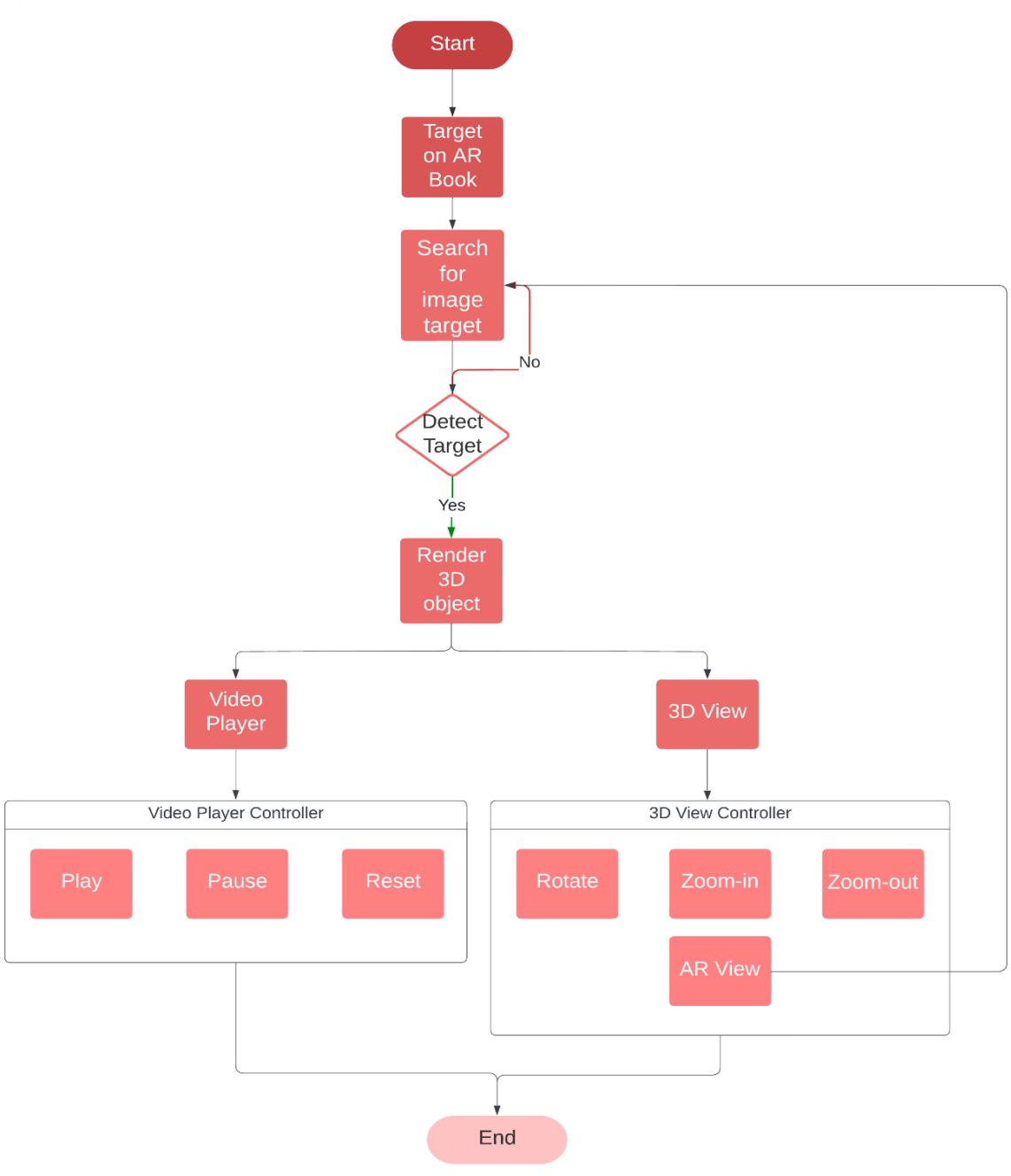

Figure 3.6 Work Flow Diagram

3.5 Use Case Diagram

Use-case diagrams give a system's high-level operations and domain. These diagrams show how the system's actors interact with the system. Use-case diagrams' use cases and actors describe what the system does and how the actors use it, but they not describe how the system functions internally.

The students are portrayed in figure 3.7 as actors interacting with AR app options such as the Start AR option to view the 2D book image in 3D, the Show video player option to view the corresponding video of the 3D model alongside that model, and the 3D Model Viewer option to view the 3D model separately with multiple options.

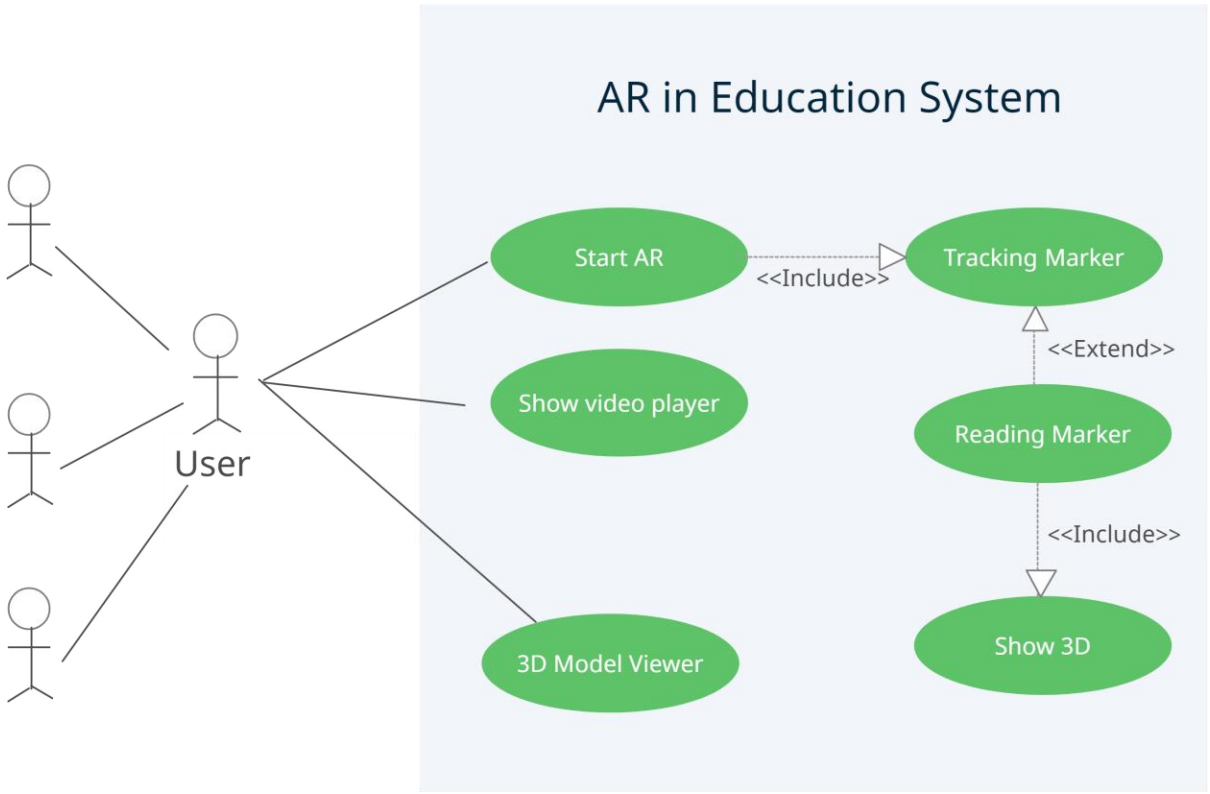

Figure 3.7 Use Case Diagram

3.6 Sequence diagram

A sequence diagram depicts the flow of messages between objects during an interaction. A series of objects are represented by lifelines in a sequence diagram, together with the messages they exchange during the course of an interaction.

The communication path between items is depicted in a sequence diagram. There are five main objects in figure 3.8: the user, the image target, the 3D model, the video player, and the 3D viewer. Various communication sequences are set up between these objects to show the flow of messages between them. Here, three main communication chains are shown, primarily for the three options of displaying the 3D model, showing the video player, and showing the 3D model viewer.

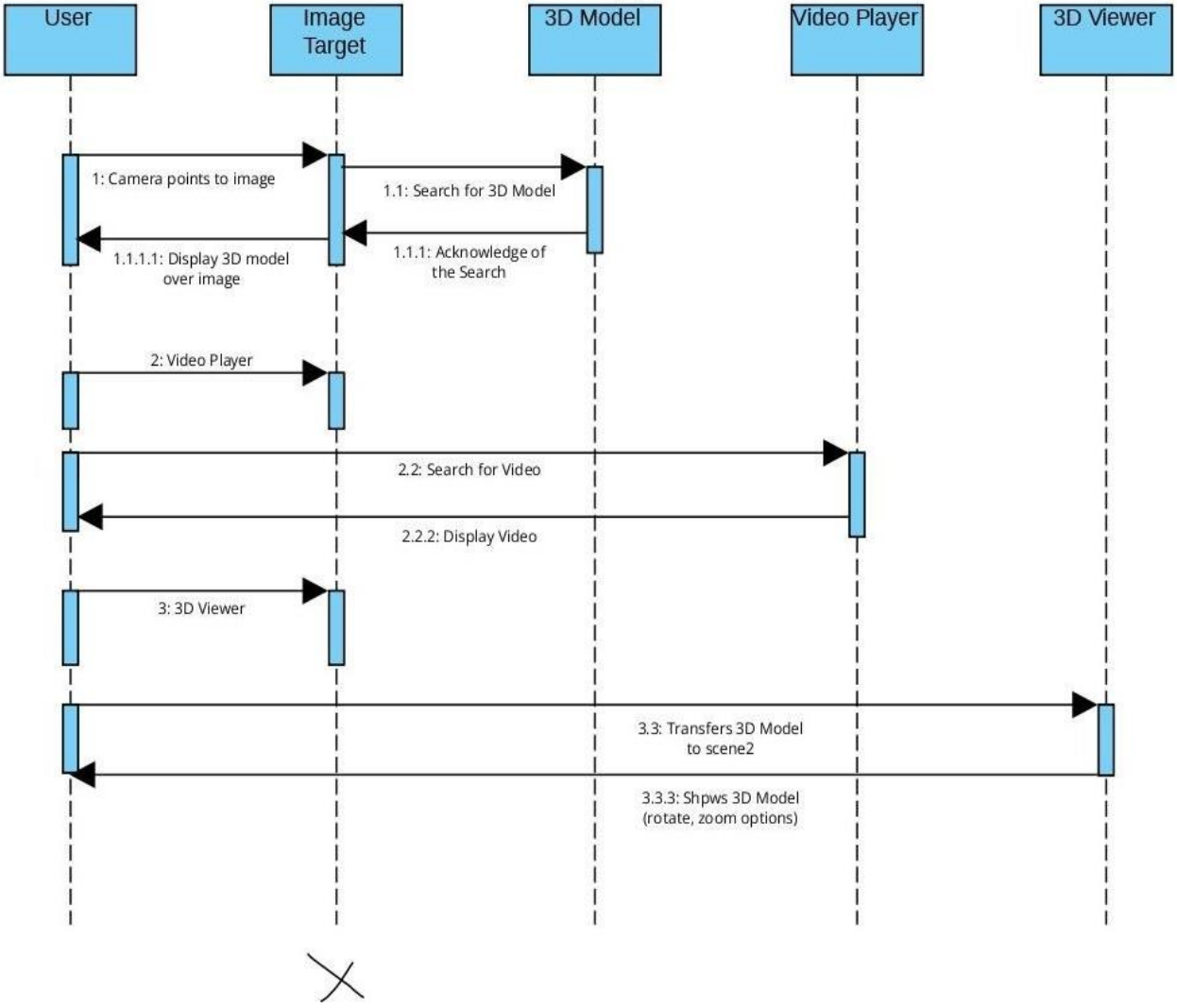

Figure 3.8 Sequence Diagram

3.7 Activity diagram

In essence, an activity diagram is a flowchart that illustrates how one activity leads to another. The activity diagram is shown in figure 3.9 along with the circumstances and order in which the activities take place. Here, the process of targeting an image and building a 3D model in response to it happens first. After that, another activity sequence with the options to Show Video Player and 3D Model Viewer became accessible. The activity diagram is then concluded with the option to Close AR Camera.

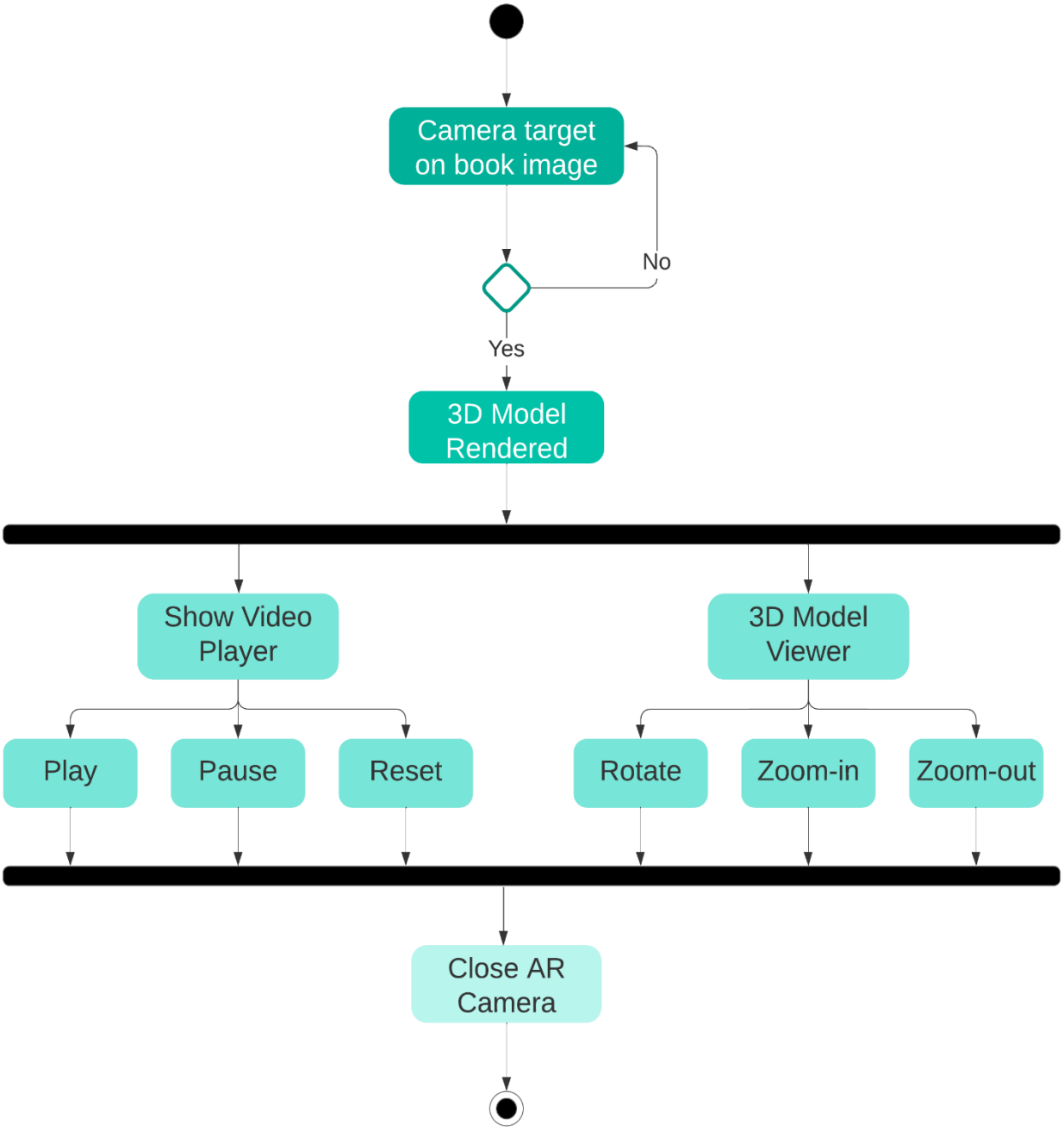

Figure 3.9 Activity Diagram

3.8 Collaboration diagram

In the Unified Modeling Language, a collaboration diagram—also called a communication diagram—illustrates the connections and interactions between software elements. The functions of the objects: Image Target, 3D Model, Video Player, and 3D Viewer are defined in figure 3.10 along with the dynamic behaviour of a particular use case for each item. Here, the students are the actors, and the figure shows how the application of augmented reality in education works logically through message flow and relationships between objects that are represented by arrows.

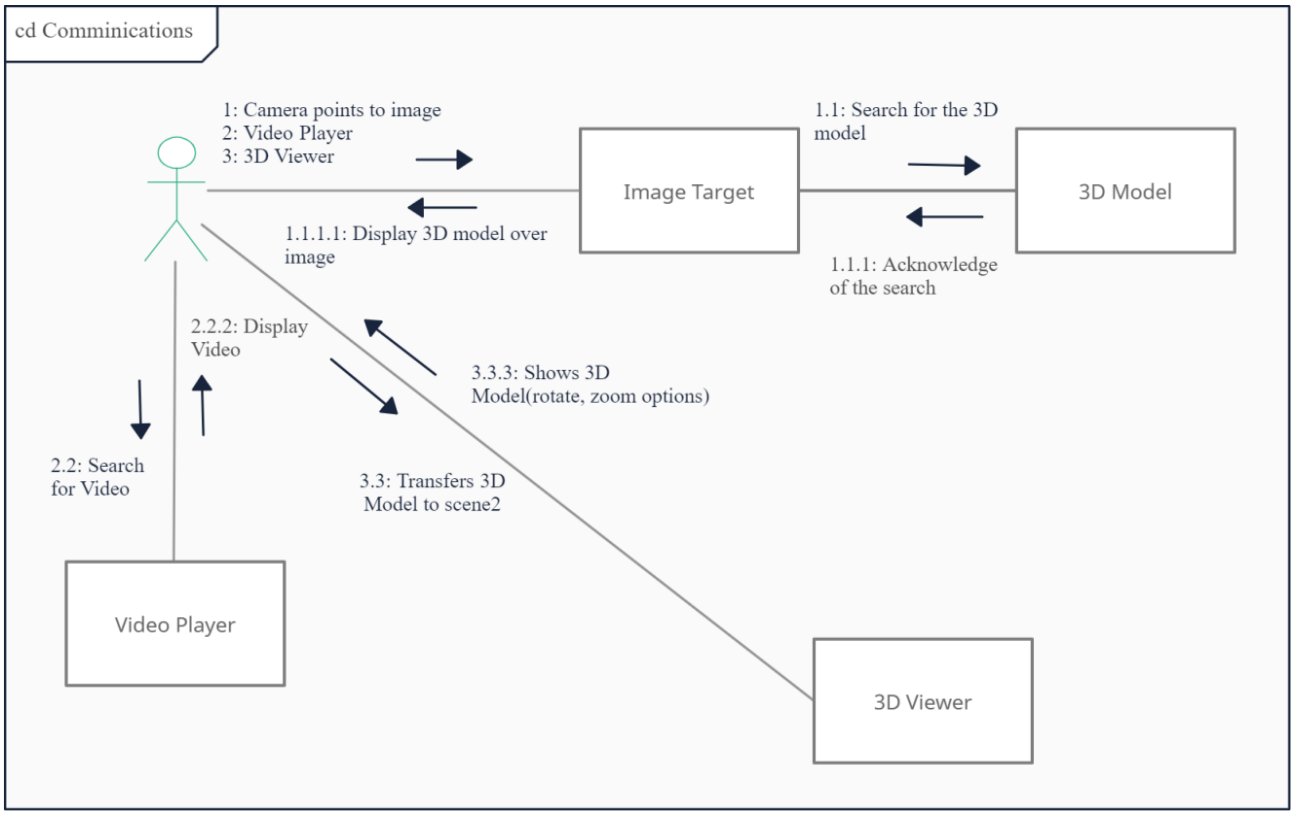

Figure 3.10 Collaboration Diagram

3.9 Class diagram

In figure 3.11, following classes are identified:

1) ButtonController
2) FlyThroughCam
3) ImageTargetHandler
4) NotDestroyGameObject
5) ThreeD_Viewer
6) Unity3DViewerScene
7) MouseOrbit
8) Zoom

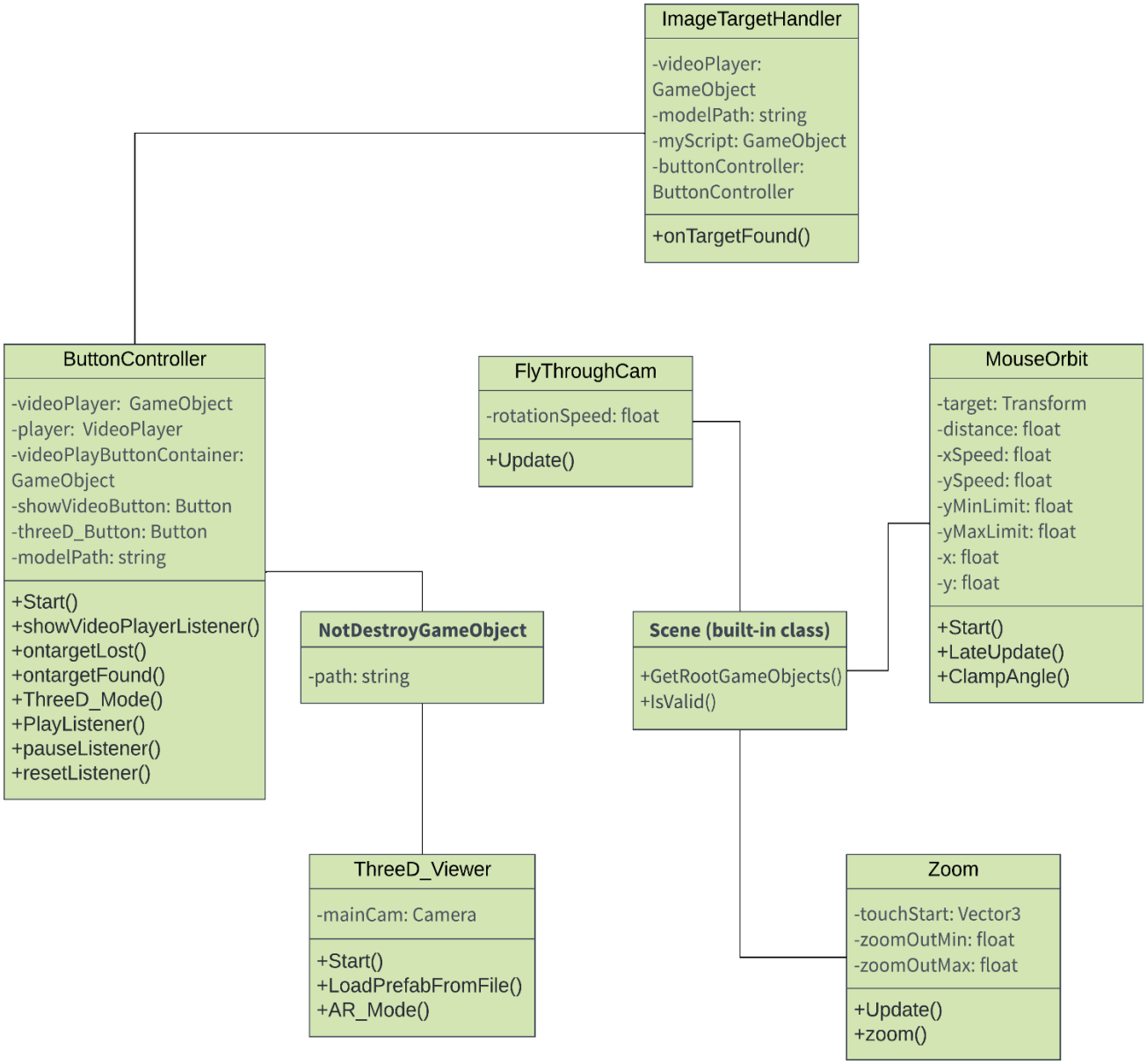

Figure 3.11 Class Diagram

Chapter-IV
Snapshots

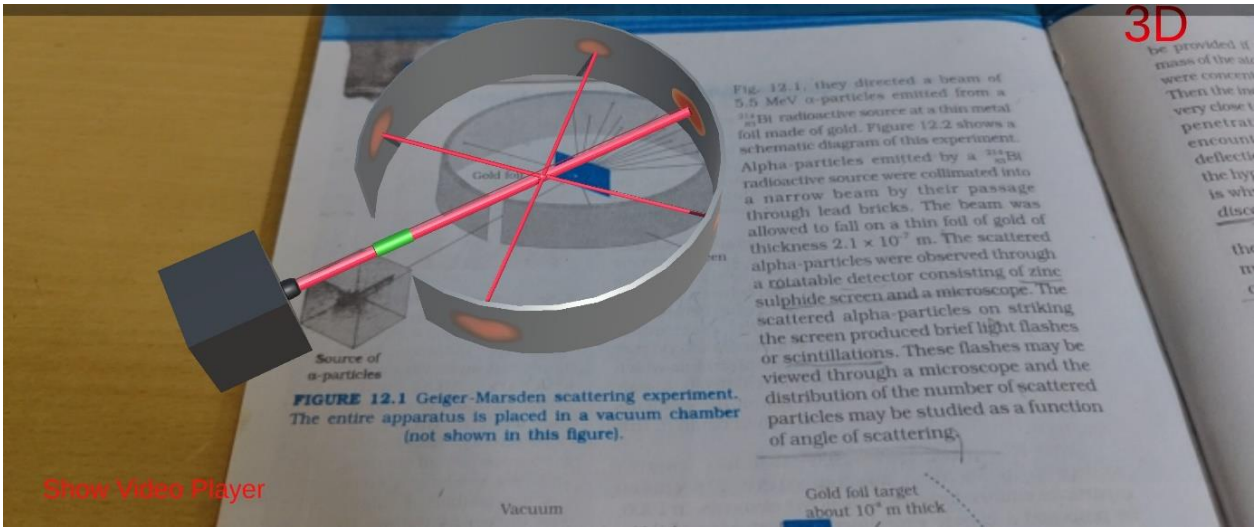

Figure 4.1

In figure 4.1 a three dimensional representation of Rutherford model is displayed over its 2D image alongwith following two options:

- Show Video Player – Upon click, the associated video will be displayed
- 3D – The model will be displayed individually together with rotate, zoom-in, zoom-out, and back to augmented reality mode via changing the scene.

Figure 4.2

In figure 4.2 video corresponding to the Rutherford model is shown along with the following options:

- Show Video Player – Demonstrates the model's floating video player
- Play – The video will begin to play
- Pause – Pauses the video that is currently being played
- Reset – The video will restart when reset

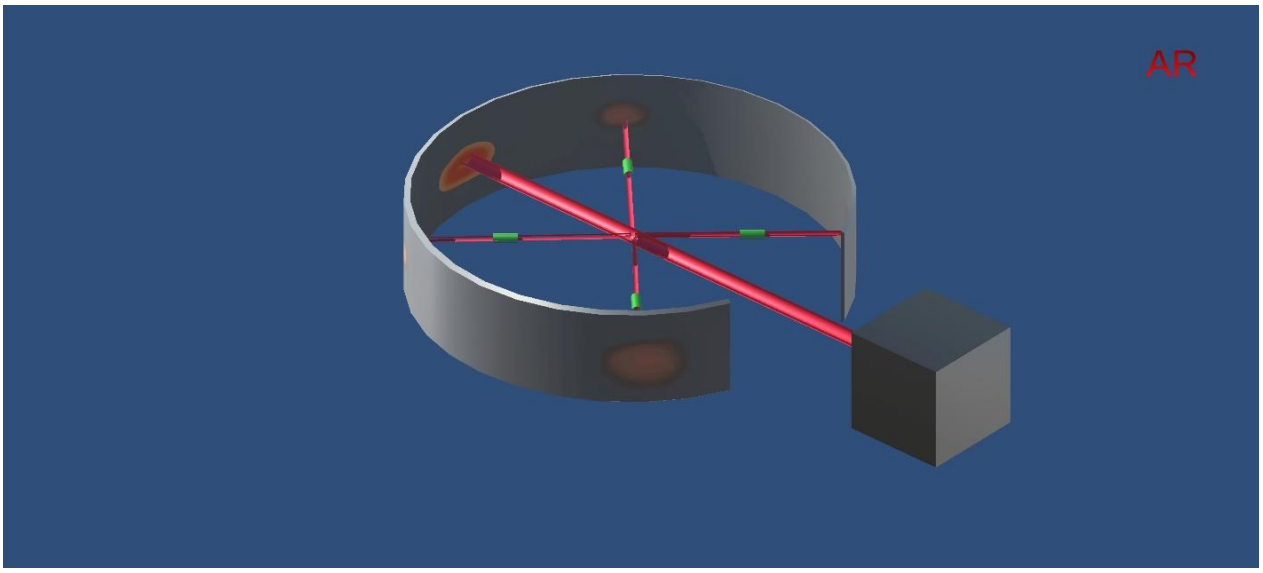

Figure 4.3

In figure 4.3 a three dimensional representation of the Rutherford model is provided alongwith

- Rotate
- Zoom-in
- Zoom-out
- Back to AR mode options

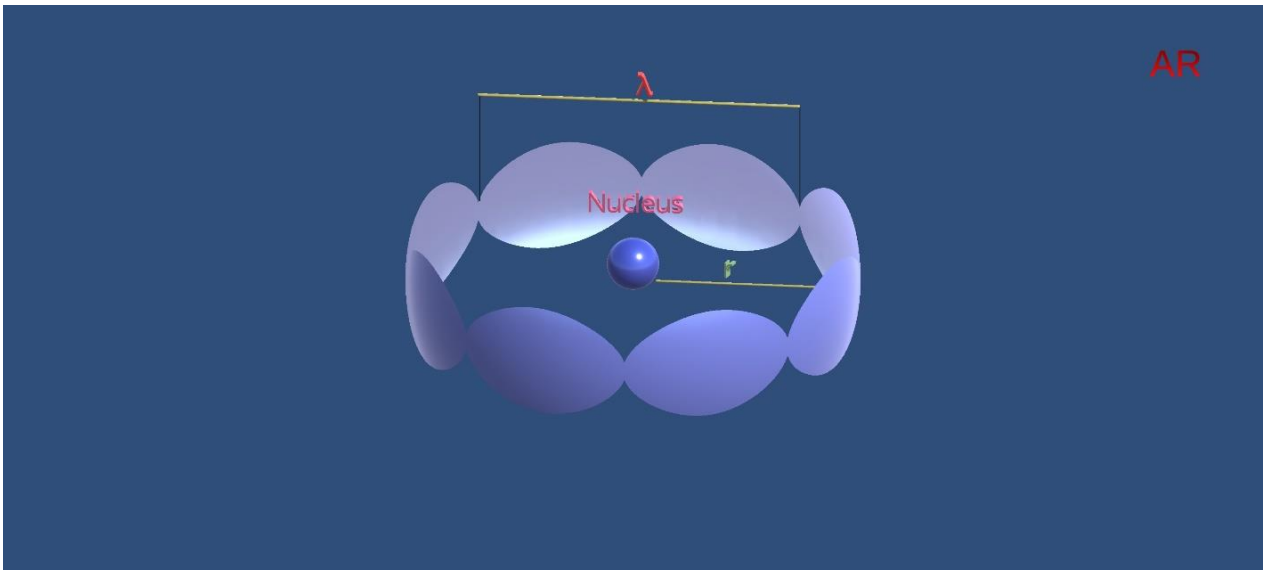

Figure 4.4

In figure 4.4 a three dimensional model representing a standing wave on a circular orbit where four de Brogile wavelengths fit into the circumference of the orbit is provided alongwith

- Rotate
- Zoom-in
- Zoom-out
- Back to AR mode options

Chapter-V
Conclusion

5.1 Conclusion

AR allows teachers to assist students in grasping complex topics. Teachers may enrich classroom experiences, teach new skills, encouragestudent minds, and get students enthused about pursuing new academic interests by utilizing the engagement and experimentation that AR technology provides.

Because AR allows lecturers to display three dimensional representation of topics and incorporate interacting components which makes textbook materials more interesting, our institute will be remarkable and more engaging.

Through the use of the application developed students will get a better interacting way of learning and memorizing information.

Chapter-VI
Future Scope

6.1 Future Scope

Augmented reality might alter how people utilise computers. A lot of unrealized potential exists for augmented reality in education. Interfaces for augmented reality enable seamless interaction between the real and virtual worlds. Using augmented reality technologies, students engage in natural interactions with the 3D information, objects, and events.

According to data from a national survey, 90% of instructors concur that virtual reality (VR) and augmented reality (AR) technologies are extremely efficient at giving pupils unique and individualised learning experiences. One of the biggest challenges teachers have is getting and keeping students' attention. AR and VR technology will not only help teachers do this, but also help them teach in a more interesting, effective method that also makes the students' learning experience easier and more enjoyable.

There is rising interest in classes that have included VR and AR into their curriculum. Studies also show that the majority of students, 97%, genuinely said they would attend a class or course with AR. Many regard AI, AR, and VR as the future of education, especially in light of the COVID-19 situation, when students were required to learn from home, as well as the unavoidable need to overhaul the educational system.[8]

According to Fact, most MR's recent market analysis, the global market for augmented reality in education was worth about US$ 1.5 billion in 2020 and is expected to grow at an enormous CAGR of 80% to reach US$ 85 billion by 2031. The demand for AR in K–12 is anticipated to grow at a CAGR of 75% from 2021 to 2031.[9]

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Augmented reality for students and learning enthusiasts

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***Abstract* — Augmented reality (AR) is an evolving technology that has the potential to revolutionize how we learn and understand complicated concepts. AR combines real-world objects with virtual information to create a hybrid world in which technology meets reality. This allows pupils to study complicated concepts in a more pleasant and simple manner. Our application facilitates the understanding of complicated schematics by using 3D models and accompanying video explanations. The software also has interactive features that allow learners to effortlessly connect with the application. This makes learning more fun and engaging, while also helping pupils to better understanding the concepts that they are studying.**

Keywords—augmented reality, education, camera, videos, 3D models.

I. INTRODUCTION

Augmented Reality (AR) is an enhanced version of the real physical world that has been achieved through the use of digital visual, sound, or other sensory stimuli, which has been delivered via technology. Augmented reality uses computer generated images to augment what a person sees in their physical environment. This technology is mainly used for entertainment purposes and gaming, but there are also some examples of augmented reality in education. In AR, the part of the surrounding environment is 'real' and just adding layers of virtual objects to the real environment. The primary augmented reality devices are to display through mobile, VR and AR head sets.

II. AR APPLICATIONS IN EDUCATION

Augmented Reality is the next revolution in the world of education. It has been introduced for students and learners as a way to get a better understanding of concepts that are difficult to understand through traditional methods.
Some benefits of augmented reality in education are as follows:

- Learning resources are available at all times and from any location. Books, object models, posters, and textual guides might all be replaced with augmented reality. It offers mobile and low-cost learning resources. Education becomes more portable and accessible as a result.
- There is no requirement for specialised equipment. As many of all teenagers have own smartphone. The majority of the target population can use AR technology right away.
- AR learning that is interactive and user friendly can have a big beneficial influence on learners. It maintains students' interest throughout the course and makes learning enjoyable and simple.
- AR gamification attempts to enhance the overall learning process of youngsters with intellectual disability. It provides a game-based learning system with three levels (training, iterative design and class evaluation).

III. PROBLEM IDENTIFICATION

A student's life includes studying, yet not everyone finds studying enjoyable. The students feel uncomfortable because of lengthy sentences and boring material. To tackle this issue, we suggest switching from the traditional approach of learning to a new one that makes use of augmented reality (AR) as a learning tool. To assist pupils acquire new ideas, some literary works that have been included in augmented reality technology. The real and digital environments can be combined to make studying more enjoyable for pupils. According to the ScienceDirect, the study in order to assess the efficacy and outcomes of utilizing AR in teaching. We can infer from their paper that employing AR as a learning tool aids [13].

This is primarily accomplished by seeing abstract ideas as 3D objects. As a result, AR can be utilised to help students to understand the fundamentals of abstract ideas. Students also find AR to be intriguing, which inspired them to study more. Due to the more engaging experience, the pupils may readily recall and remember information. Because students can view the replicas of real objects while learning and practising, AR is generally a more effective learning medium.

IV. PROPOSED WORK

In this paper, we have completed the work related to the NCERT physics 12th standard book.

The AR software starts with the camera, which recognises the image in the book by pointing the smartphone camera in its direction, followed by the presentation of a 3D model and viewing choices for the 3D model and video. AR app's 3D model-zoom and rotate-features, as well as video-play, pause, and reset-features, would assist in providing interactive learning to users.

The application is being created in two stages.

- The AR system and assets (3D models and videos) were produced in the first stage.
- The assets were deployed in the second stage.

Software such as blender, vectary, unity and android were used for the creation of application.

A. System Requirment

1) DEVELOPER

Software's Required (With Versions duly mentioned)