

AR APPLICATION FOR LEARNING KIDS

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in
Computer Science and Engineering.

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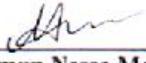
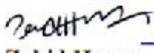
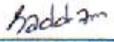
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APPROVAL

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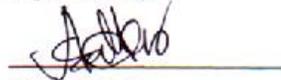
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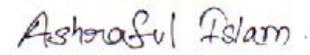
We hereby declare that, this project has been done by us under the supervision of **Abdus Sattar, Assistant Professor, and Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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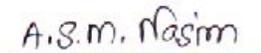


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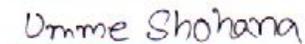
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ABSTRACT

Augmented Reality (AR) is an interactive experience or a combination of real-world and digital data. It simplify and enhances user knowledge of interaction with physical world by imposing virtual images on real ones. This is the new way of manipulating how we interact with that world, without replacing the real world. Augmented Reality has manifested in various fields today like Education, Navigation, Games, Industry, Medical, Advertisements and Architecture. AR in education will soon affect the conventional learning process. Our approach has the potential to speed up the design of 3D views of view of objects related to that letter and help kids to learn and realize concepts in a better and interactive way. The idea presented in this report is to show how AR can be used to enhance the learning experience of kids on NCTB book. It is a process which makes NCTB books easy, interactive, informative, enjoyable and interesting to the kids. The app can be used to reduce irreverence of kids who not interesting to learning.

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CHAPTER 1

Introduction

1.1 Introduction

Learning is an alternative behavior and ideas by gathering experiences and earning knowledge. In the class kids don't understand what they learn? What's the thing is it those the word actually mean. Augmented reality (AR) improves client discernment and experience, and enables clients to see furthermore, experience this present reality with virtual substance installed into it. Also, AR permits collaboration continuously. Thus specialists just as instructors have been anxious to investigate improving material for instructive purposes with the assistance of AR innovation.

1.2 Motivation

The technological revolutions having occurred in many areas also had an impact on books, and electronic books emerged. However many problems have emerged in the availability of electronic books, and users have started to return to books that are tangible, with pages of which they can physically turn. Augmented reality books are prepared by enhancing these books attractively by introducing interactive and immersive properties into the superficial and interaction-free characteristics of printed books. Books have been augmented with various visualizations, such as 3D graphics and animations, and sound. Adding these elements to books is believed to stimulate a broader set of input channels for the user, thus motivating the reader and enhancing the user experience. It has also been suggested that the use of augmented books may support collaboration among users. .

1.3 Objectives

We submitted an AR application for learning kids with flowing objectives.

- To help kids to actively interact in books.
- To make them learn by playing.
- To make users comfortable.
- To help kids easily to teach.
- To make focusing on improving their learning skill.

1.4 Expected Outcome

Make children easily to teach by playing. They do not waste of money for home tutor. They can familiar with many objects, animals, flowers etc.

1.5 Research Questions

In order to provide a thorough answer to the overarching research question, some areas of children's interaction need to be explored at more depth. Therefore the following more specific research questions will be explored:

- How do children interact with the physical elements of AR books?
- Do children understand how to interact with AR books?
- How do children experience interaction with AR books?
- Does the use of AR books stimulate cooperation between users?

1.7 Report Layout

We have organized our report as follows.

In Chapter 2, we introduce the background overview of our project. In this part we also briefed about the Literature Review of the project including with different type of AR applications in the present day world and realize their activities or key role in our life.

In chapter 3, we specified the development requirements tools. In this part we will show how easily we create an AR application by using Unity, Vuforia and other tools in our project.

In chapter 4, we exhibited the implementation of the whole project, like coding part, 3D model view of the molecules and how they reacts with each other.

In chapter 5, we specified the result and discussions of our project.

In chapter 6, we designated about conclusion and the scope for future work of the project. At last of all, give some related reference to ensure that the information in report are must be correct.

CHAPTER 2

Background

2.1 Introduction

The augmented reality (AR) technology has come to remain and changing the way how we interact with the environment that encompasses us. Adding digitally created objects to the real-life environment through the smart devices can potentially changing every industry, from education, navigation, marketing and healthcare to entertainment and gaming. At the age of modern science the term Augmented Reality (AR) is used to describe a combination of technologies that enable real-time mixing of computer-generated content with live video display. Augmented Reality enhances a user's feeling and interaction with the real world. The virtual objects display information that the user cannot directly detect with his own senses. The information conveyed by the virtual objects helps a user perform real-world tasks. AR is a specific example of what Fred Brooks called Intelligence Amplification (IA): using the computer as a tool to make a task easier for a human to perform

2.2 Literature Review

In this paper we identified at least 8 Unique Classes of AR application state. These classes contain well-established state like education, medical, military, entertainment and games, robotics, marketing, navigation and architecture.

Over the past two decades, a lot of research has been done in AR field. The new prospect of education and education given by AR has been increasingly recognized by educators. Tolerance of virtual objects and practical environments allow students to imagine complex local relationships and abstract ideas, expertise events that is not probable in the real world , combine with two and three dimensional artificial objects in the mixed reality , develop important practices that can't be applied and develop other technologies to develop advanced environments. These educational benefits have made AR one of the innovative technologies for education over the next five years. AR application and its mentioned systems are exposed and used in different educational fields. For example: chemistry, mathematics, biology, mechanical designing and others.

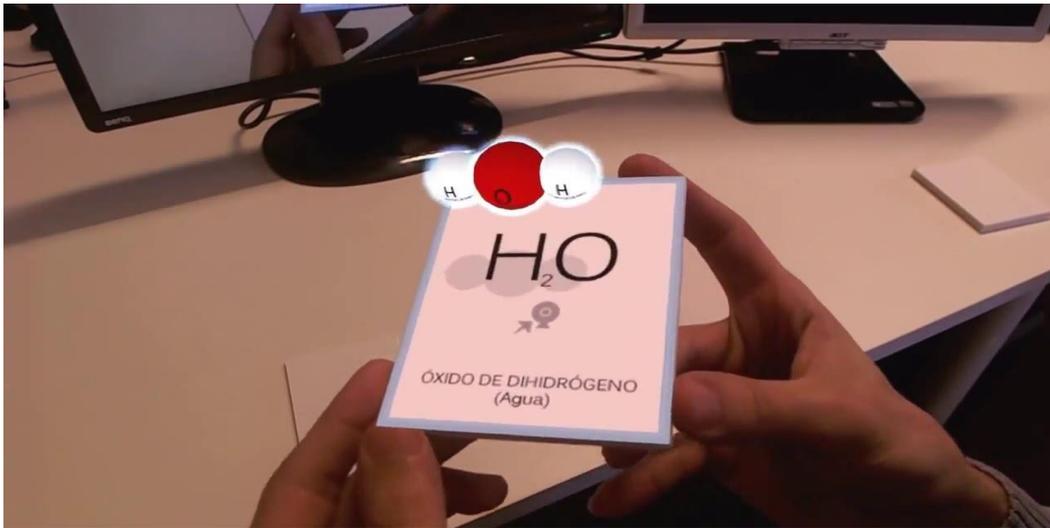


Figure 2.2.1: AR application in education

Past few decade technological progresses have serious changed in healthcare industry. Augmented reality in the medical science makes a revolution in the present world. The augmented reality is applied to medical education and training, surgical simulation, neurological rehabilitation, psychotherapy and telemedicine medicine. Augmented reality can improve traditional medical care losses, reduce medical problems caused by uneducated operations, and reduce medical education and training costs. Moreover, the application has enhanced the efficiency of medical education and training, has increased the level of diagnosis and treatment, improves patient's patient relationships and increases the efficiency of the treatment process. Medical augmented reality takes its original motivation from the need to visualize the patient between medical information and the same physical space. An application for augmented reality in medical domain is in ultrasound imaging. Ultrasound technicians using an optical view through the display can see a voluminous rendered image of fetal volts on the pregnant woman's womb. More recently, Wen et al. directed by hand gestures and offers a cooperative surgical system supported by an augmented reality-based surgical field. In the future, there is a high probability of AR applications in healthcare and medicine. In nursing and medical health care services it can increase the effectiveness and efficiency.

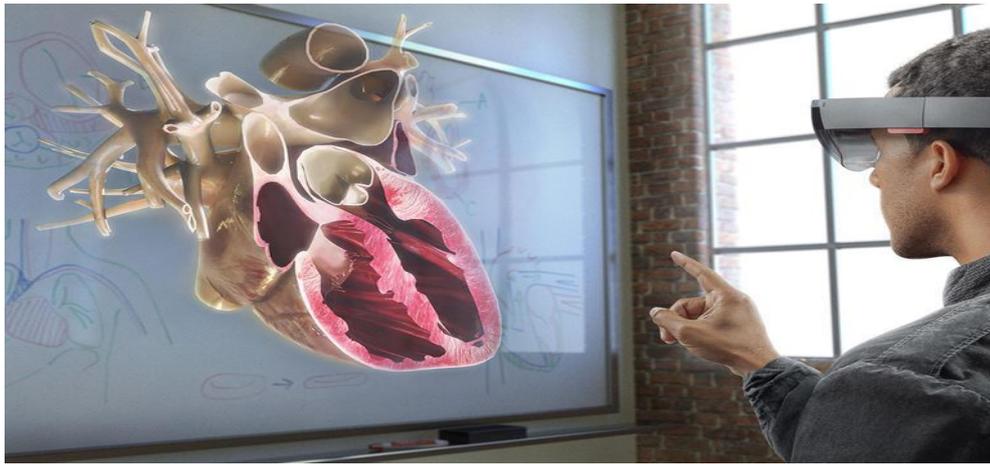


Figure 2.2.2: AR application in medical science

The military sector has always been advancing using technological advances raised for training and development of war. Augmented reality can be used to show true battlefield scenes and increase it with annotation information. Hybrid Optical and Internal Tracker Using Small MMS (micro electro-mechanical systems) Sensor, Cockpit was developed for helmet tracking. Special privileges for military users can be practiced in real-time enemy action like the reality of the training and wartime Augmented reality system at large battlefields. Tactical augmented reality helps to reduce the number of devices that the device should run, and may help reduce the efficiency of our enemies more effectively, to improve the battlefield awareness of the soldier's troops.



Figure 2.2.3: AR application in military

Augmented Reality has been used in video gaming and media entertainment for a long time to show a real picture interacting with one made from computer graphics. Most fundamental ideas of Augmented Reality have been used in the film and science fiction like as RoboCop ©Daffodil International University

(1987) and Terminator (1984). AR can provide advertisers to show virtual advertisement and product placement. Augmented reality has been used to create games in the entertainment industry. Augmented reality gaming is still now a new concept. The first popular AR games on mobile are Pokémon Go and Ingress. More than 25 AR games are released for iOS and Android (such as Army of Robots and Zombie GO, ARrrrrgh, WallaMe, Temple Treasure Hunt etc.) . AR games are able to fight aliens, capturing fantastical animals, protecting the real world kingdom. Augmented Reality is also applied to life swim action, Snooker ball trajectories, annotate racing cars etc.



Figure 2.2.4: AR application in entertainment & game

Augmented Reality Tool for Operators Support, where people and robots share a shared millennium in the workplace. Provides system visualization, video and text based instructions, and visualization of production status. This tool enhances the safety of the operator and hybrid assembly environment through the immersion capabilities of AR technology. Augmented Reality is a norm stage for human-robot collaboration. Robotics has greatly helped the augmented reality. Microsoft was leading leader here in the implementation of AR technology to robotics. The cartographer was opened in 2016 and the standard path packages have become a distinguished 2nd and 3rd mapping solution for robots from Marble suppliers, lift Level 5 Lab Automatic Driving Car.



Figure 2.2.5: AR application in robotics

Augmented Reality Navigation Features seem to be made for retailers in many ways. Navigation is one of the most sensational parts of retail where it can be easily applied. AR is surely made its way in the business world and around the world. One of the ways it is available its practical application is in navigation and maps. In the last year's I/O developer's conference, Google has shown a new augmented reality feature for Google Maps, which will provide real-time guidance to people from our phone camera. The AR display at the museum is one of the reasons for the expansion of navigational applications, due to the amount of equipment it needs. Navigating through seas of different summit and conference events is always a challenge. However, an easy AR solution can strengthen domestic navigation through a pavilion and it can walk in a park instead of running through the jungle.

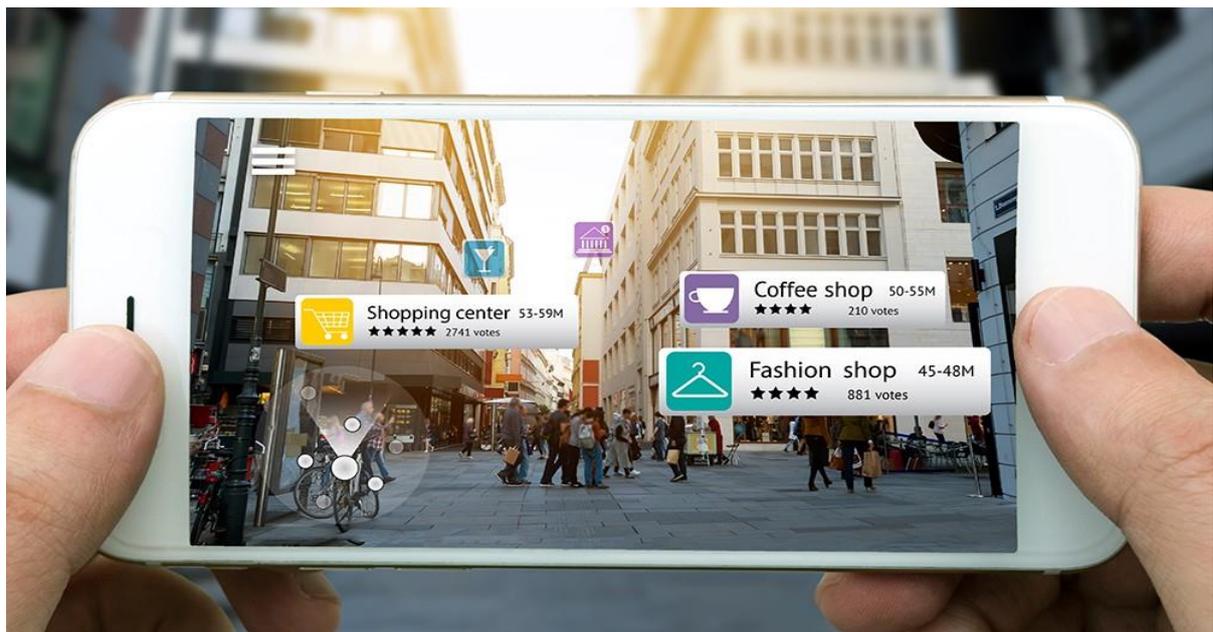


Figure 2.2.6: AR application in navigation

The augmented reality of construction and architectural projects has established a 3D model of an existing space using a mobile device and 3D models. AR architecture and interior design are the way to support a decision. Before the construction begins, an architect can use the AR application to show its model to engineers and manufacturers, and they can point out potential problems when they are easy to fix and correct the mistakes. It was developed to use AR systems to improve the structure, construction and renovation of the architectural structure in Figure 2.2.7. A prototype system was created to use AR for architectural appeal for skill management and maintenance. Examples of real-time augmented reality visualization service for architectural models are ARki. It incorporates AR technology into masonry by providing 3D models with multiple equality of interactivity for both design and presentation motives. ARki can be used on any iOS/Android device.



Figure 2.2.7: AR application in architecture

AR is straight from science fiction, it is one of the amazing technologies that highlights the world and receives the notice. The use of augmented reality within marketing is a new industry. It is used in advertising in automotive art. In 2018, the augmented reality of brand marketing is one of the hottest issues. All major technology companies, including Google, Apple and Facebook add new AR ability to their platforms. Now it is time to exhibit creative and marvelous AR marketing experience that roods our lives. By 2022 AR increased to \$ 35.22 billion industry. Augmented reality is so versatile that it can find out the implementation of all kinds of industries. Restaurant chains are no exclusion. Pizza Hut has found a very creative way to enhance the menu through AR technology. Augmented reality makeup "looking glass" has been a fixture of Sphere and other cosmetics retailers for different years.

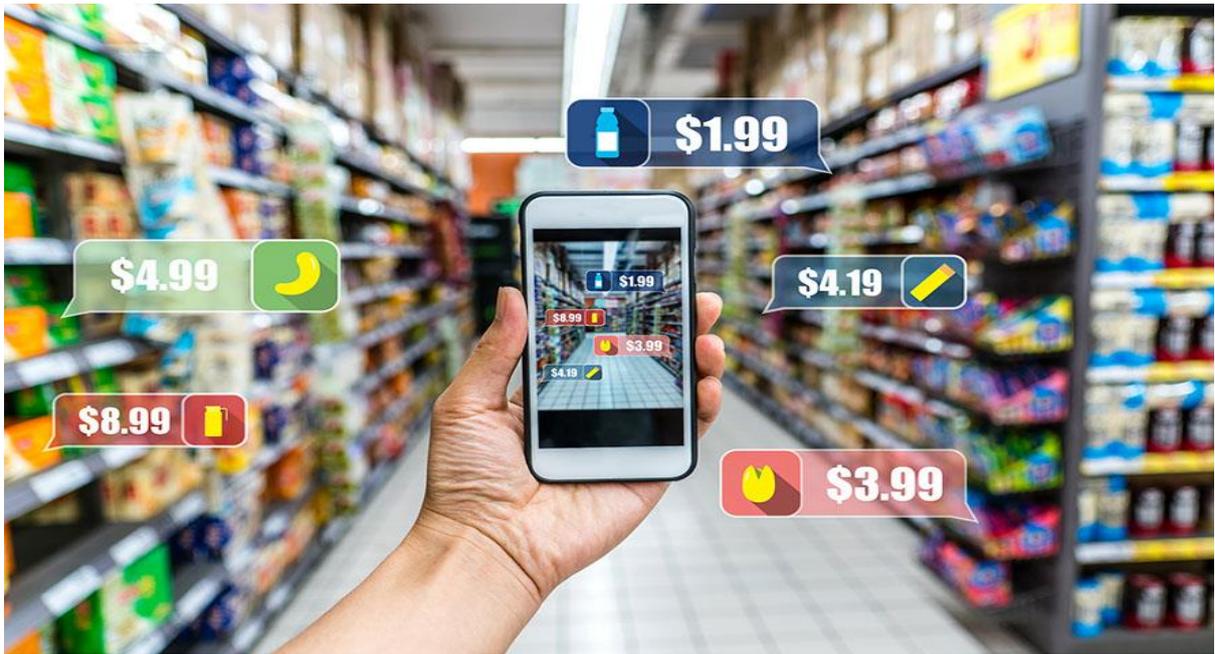


Figure 2.2.8: AR application in marketing

CHAPTER 3

Development Requirements and Tools

3.1 Hardware Requirements

PC Configuration:

For making a gaming project, a pc must need a minimum hardware requirement. There is a Figure 3.1 about hardware requirement which is shown below.

System	
Processor:	Intel(R) Core(TM) i3-4005U CPU @ 1.70GHz 1.70 GHz
Installed memory (RAM):	4.00 GB
System type:	64-bit Operating System, x64-based processor
Pen and Touch:	No Pen or Touch Input is available for this Display

Figure 3.1.1: Hardware Configuration

Processor: Intel Core i3

CPU: 1.70 GHz

RAM: 4.00 GB

We face several problems while render the project for low configuration.

Device Configuration:

Android Version: Up to 6.00 (Marshmallow- Pie)

RAM: 2GB

ROM: 150MB

CAMERA: 5MP

This is the minimum device configuration

3.2 App Requirements

In order to fully appreciate the requirements of an App developing system, it is important to have details on the following:

- Current methods used in industry for developing App.
- An understanding of the formats available.
- Implementation details of the methods used in App development.

The first thing to ask is why is it necessary to develop a App accurately?

Because one can usually satisfy by using this App for the first time. Comparing with the other Apps one can easily see the difference to fascinate a user easily.

3.3 Unity Project Creation

At first we create an account in unity to start a new project. For starting a unity project developer should set a project name. Our project name is ‘**AR BOOK**’. As our App is 3D, so we choose 3D platform. After that clicking on “create project” button created our project in our selected direction. There is a Figure 3.2 about project creation which is shown below.

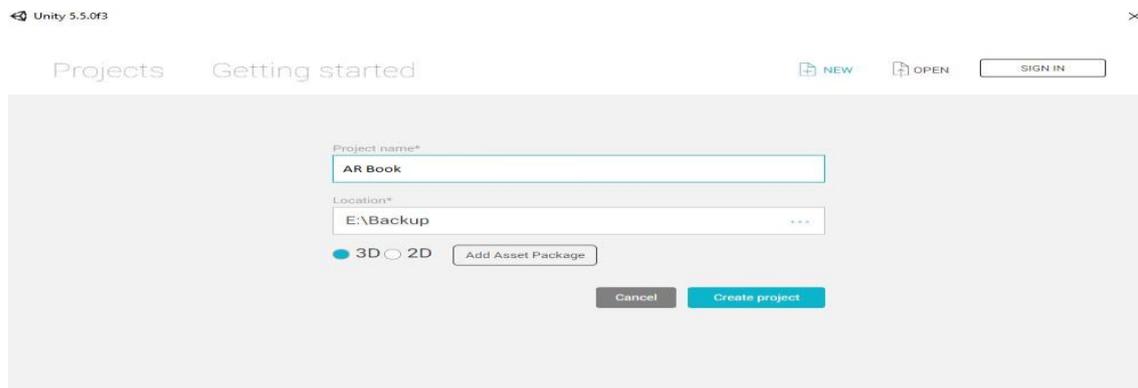


Figure 3.3.1: Creating project in unity

3.4 Organizing Project

The good practice of handling a project is get organized stuffs before get started. While we created our project in our location we have noticed that there is a built-in folder named assets. Here we put all of our different stuffs in an organized folder view. An App contains of too many contents like animation, audio, scripts, scenes, materials, particles, sdk etc. The benefits of we had done this is while we want to find something we will get it on its named place. Because management of time is very necessary. Project organizing Figure 3.3 is shown below.

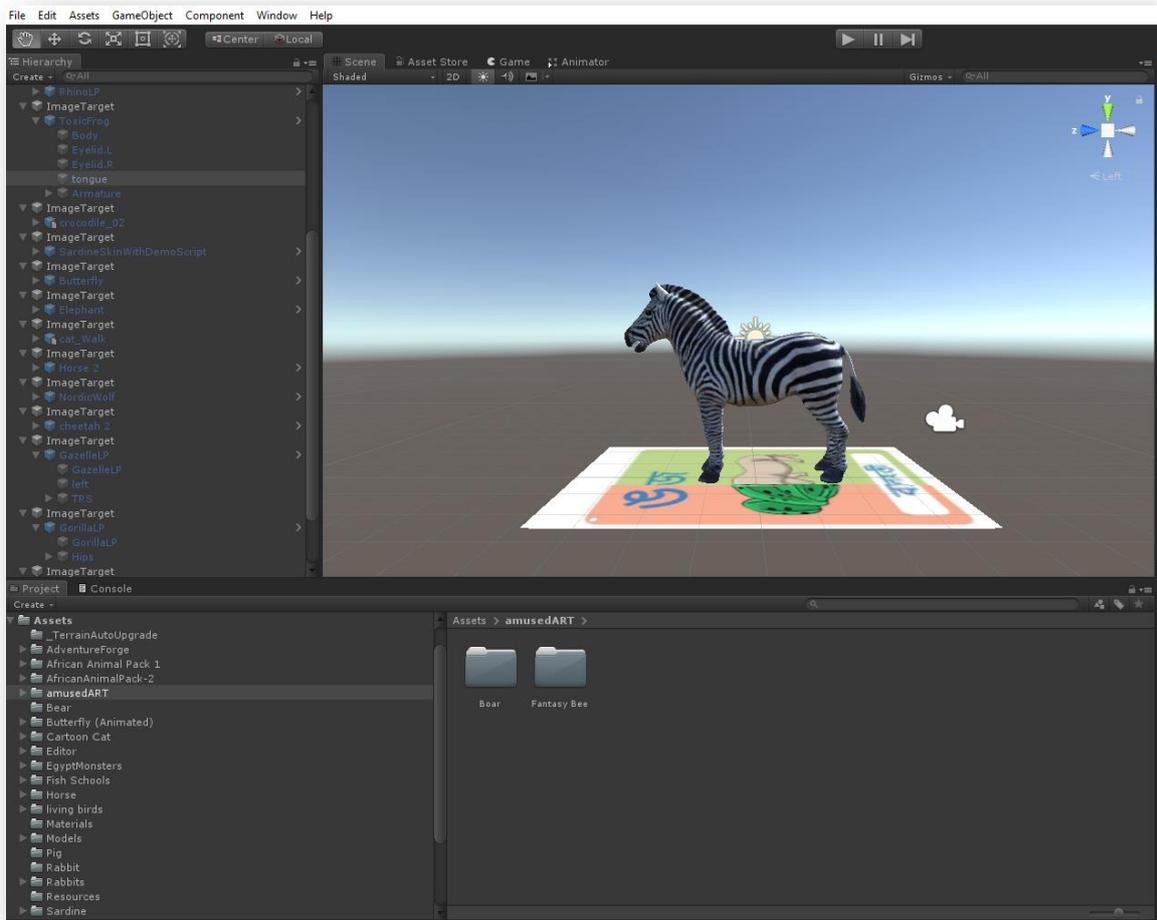


Figure 3.4.1: Organizing Project

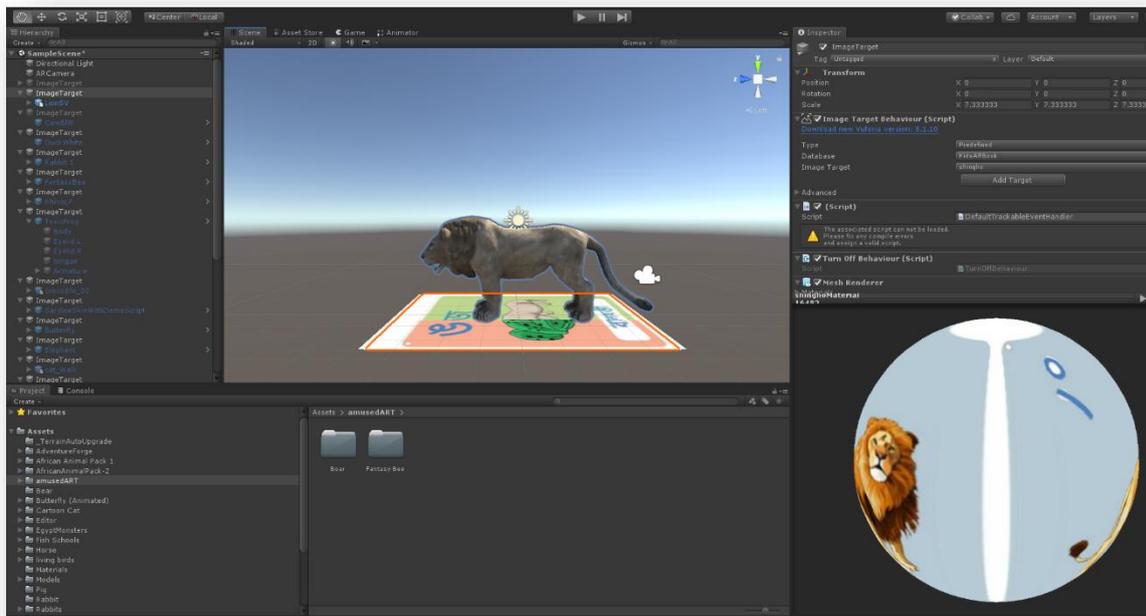


Figure 3.4.2: Organizing Project

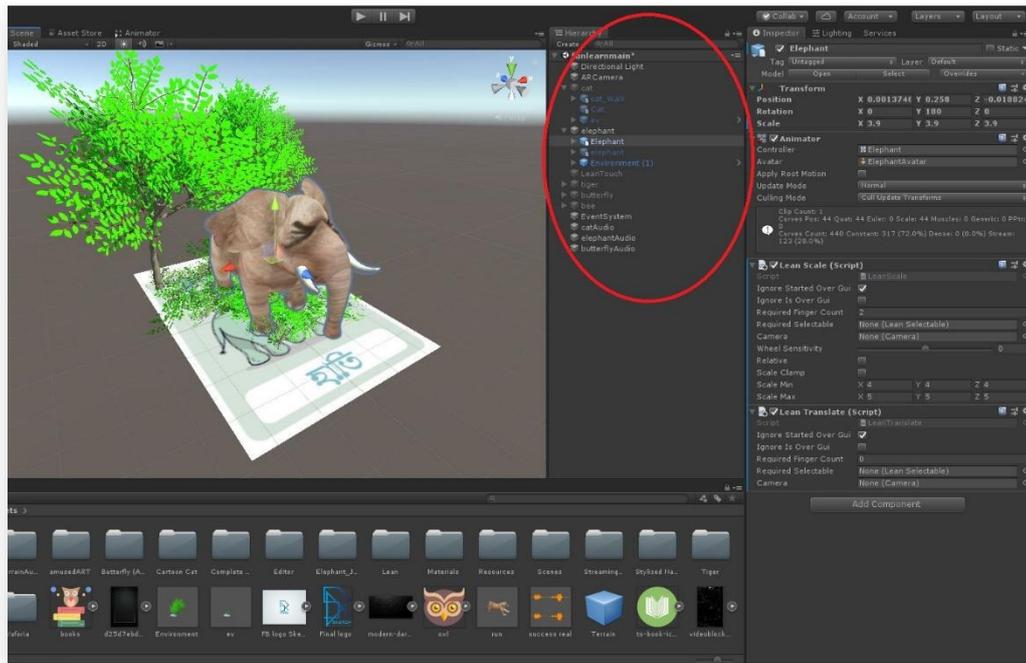


Figure 3.4.3: Organizing Project

```

17  #region UNITY_MONOBEHAVIOUR_METHODS
18
19  protected virtual void Start()
20  {
21      mTrackableBehaviour = GetComponent<TrackableBehaviour>();
22      if (mTrackableBehaviour)
23          mTrackableBehaviour.RegisterTrackableEventHandler(this);
24  }
25
26  protected virtual void OnDestroy()
27  {
28      if (mTrackableBehaviour)
29          mTrackableBehaviour.UnregisterTrackableEventHandler(this);
30  }
31
32  #endregion // UNITY_MONOBEHAVIOUR_METHODS
33
34  #region PUBLIC_METHODS
35
36  /// <summary>
37  /// Implementation of the ITrackableEventHandler function called when the
38  /// tracking state changes.
39  /// </summary>
40  public void OnTrackableStateChanged(
41      TrackableBehaviour.Status previousStatus,
42      TrackableBehaviour.Status newStatus)
43  {
44      m_PreviousStatus = previousStatus;
45      m_NewStatus = newStatus;
46
47      if (newStatus == TrackableBehaviour.Status.DETECTED ||
48          newStatus == TrackableBehaviour.Status.TRACKED ||
49          newStatus == TrackableBehaviour.Status.EXTENDED_TRACKED)
50      {
51          Debug.Log("Trackable " + mTrackableBehaviour.TrackableName + " found");
52          OnTrackingFound();
53      }
54      else if (previousStatus == TrackableBehaviour.Status.TRACKED &&
55              newStatus == TrackableBehaviour.Status.NO_POSE)

```

Figure 3.4.4: Organizing Project Code

3.5 Vuforia

In this project we use Vuforia SDK. It is a Software Development Kit (SDK) for creating AR application. It uses Computer Visualization system to track an images and a 3D objects in real time. It allows putting virtual 3D objects is related to real-world objects at the camera screen. For implementation we use Vuforia Engine in version 7.5. We develop an android application of kids learning by using Vuforia.

3.6 Working with Vuforia

First we need to Login for Vuforia developer platform by using vuforia user account & password.

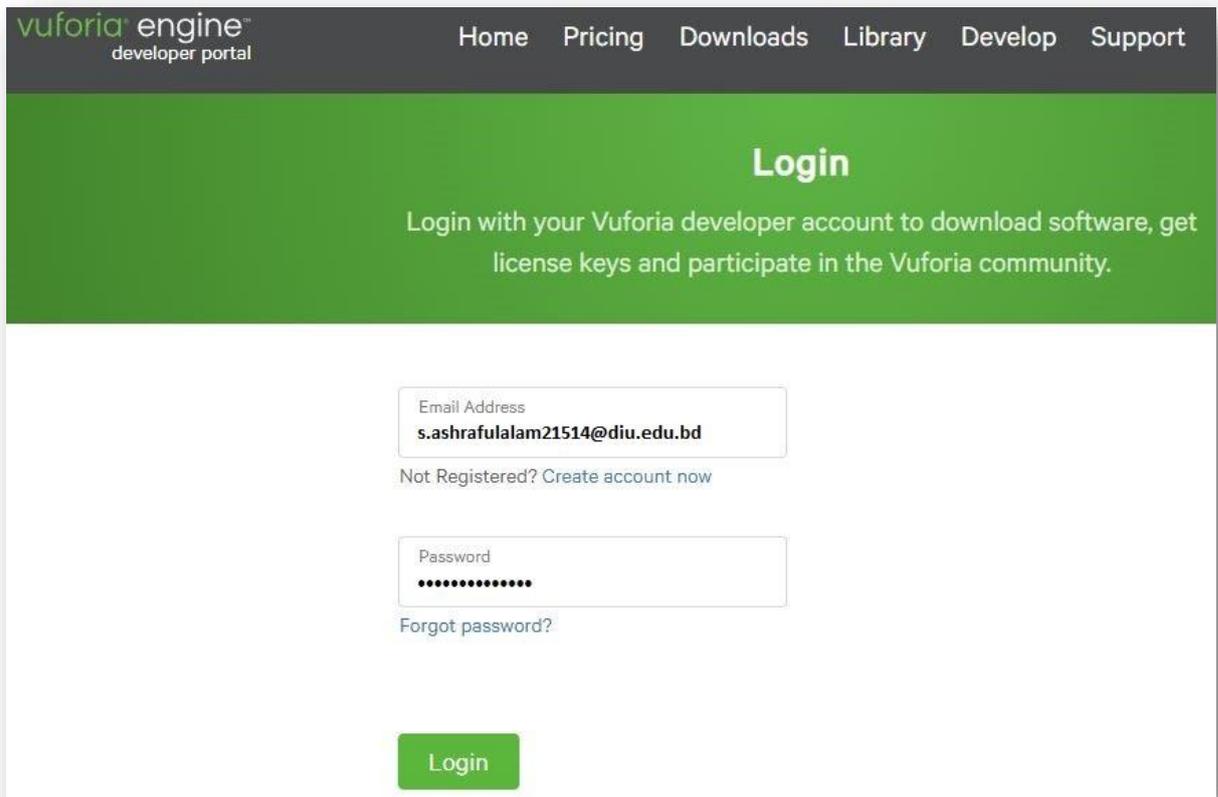


Figure 3.6.1: Vuforia Login

Select Develop tab and press Get Development Key button. Create a new project and when it appears on the list, go into project details. We have to copy the license key of the app. It is required by Vuforia to work.

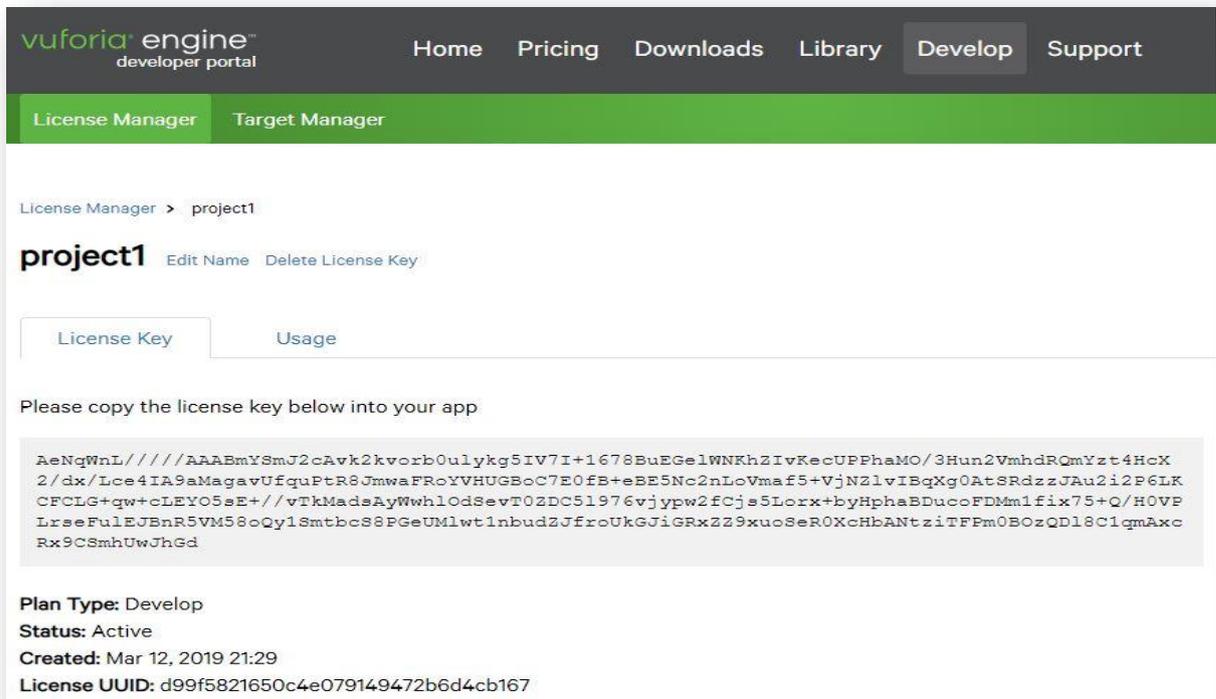
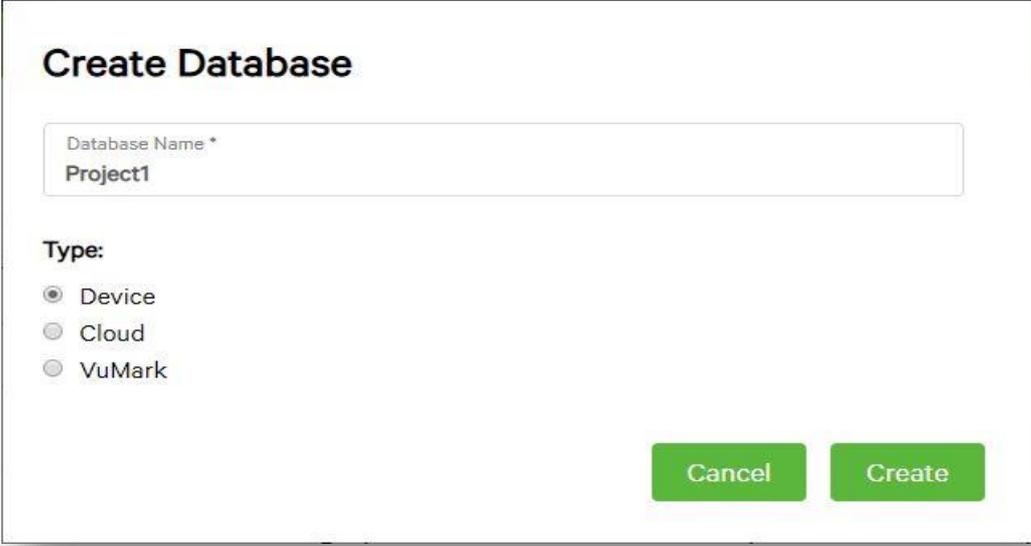


Figure 3.6.2: Vuforia License Manager Key

Next, in the Develop tab, we select the Target Manager subtab. There we create a database of objects that Vuforia able to recognize. There are 3 types of databases: Device, Cloud, VuMark. We select the Device option (it is the only possible option in the free version of Vuforia) we download it and import it into Unity.

3.7 Create Database



Create Database

Database Name *
Project1

Type:

- Device
- Cloud
- VuMark

Cancel Create

Figure 3.7.1: Create Database

After setting our database, we have to go into its details. We add a new target. A target is an object that recognized by Vuforia and work with. There are 4 types of targets:

- Single Image (that is our pick)
- Cuboid
- Cylinder
- 3D Object

At the next, we upload an image file, input its width and name it.

Add Target

Type:



Single Image



Cuboid



Cylinder



3D Object

File:

Browse...

.jpg or .png (max file 2mb)

Width:

Enter the width of your target in scene units. The size of the target should be on the same scale as your augmented virtual content. Vuforia uses meters as the default unit scale. The target's height will be calculated when you upload your image.

Name:

Name must be unique to a database. When a target is detected in your application, this will be reported in the API.

Cancel
Add

Figure 3.7.2: Add Target

After adding the target, it take place on the target list. It is worth to pay attention to the ranking of targets. The higher is the better. It means that an image or object with higher ranking has more specific points for Vuforia to recognize it. In our case, the image has the highest possible ranking.

When we add all of our targets, we choose which ones we want to have in our Unity package. After this, we press the Download Database button. We must choose Unity Editor as a development platform.

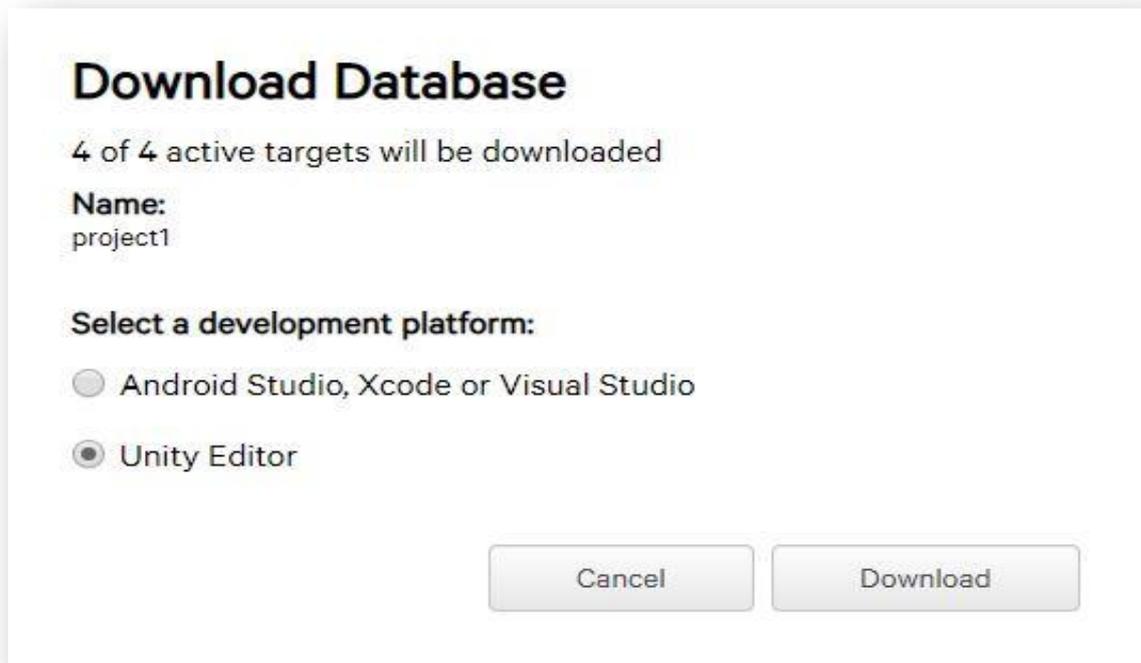


Figure 3.7.3: Download Database

3.8 Using Vuforia in Unity

Now, we import our database to the Unity project. We can do this by choosing Assets->Import package->Custom package and picking our file. To work Vuforia we use a special camera object called AR Camera. We have to delete the standard Unity camera and then, from our assets, we must choose AR Camera and place it on the scene. In the scene hierarchy, click a right button of the mouse and from the menu bar that is appear, at first select Vuforia and after AR Camera.

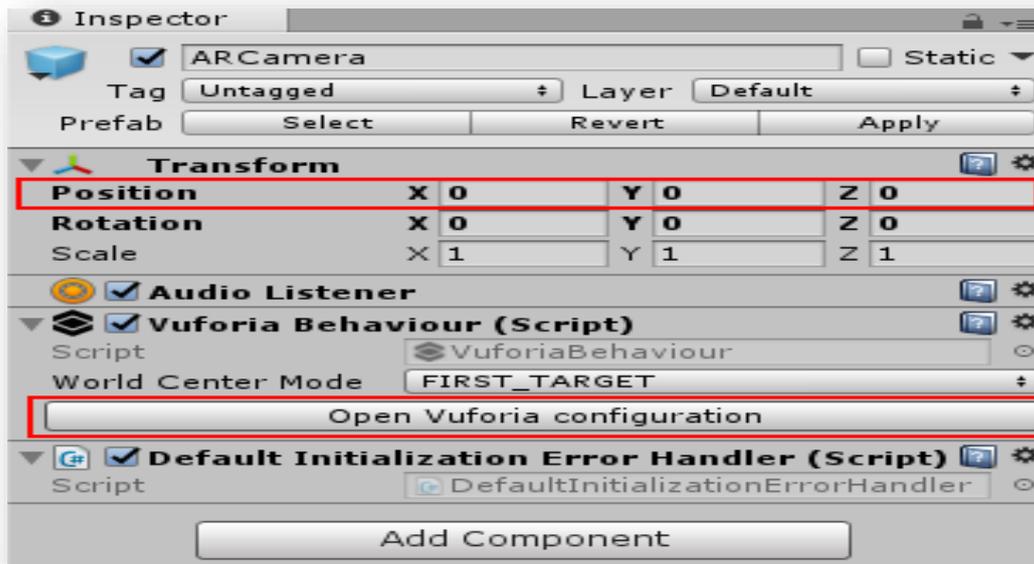


Figure 3.8.1: AR Camera

Now, we have to add the license key in Vuforia configuration.

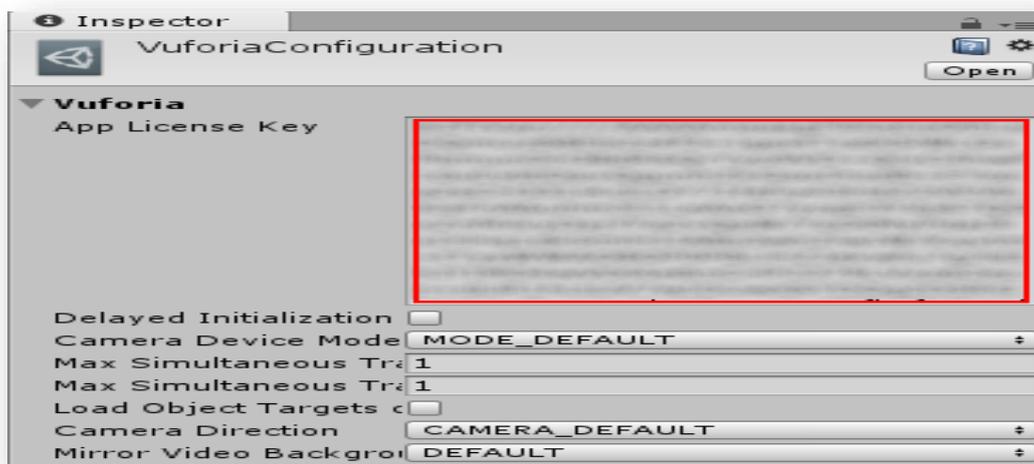


Figure 3.8.2: Vuforia Configuration

If our app wants to recognize the objects in the real world, we have to add these objects to the scene. An object that represents a Single Image is called simply an Image. We can find Images in the same menu as AR Camera. After adding it to the scene set its position to 0, 0, 3 and in the Image Target Behavior script of this object set a database and image target to the corresponding element. From now on Vuforia is recognize our image in the real world.

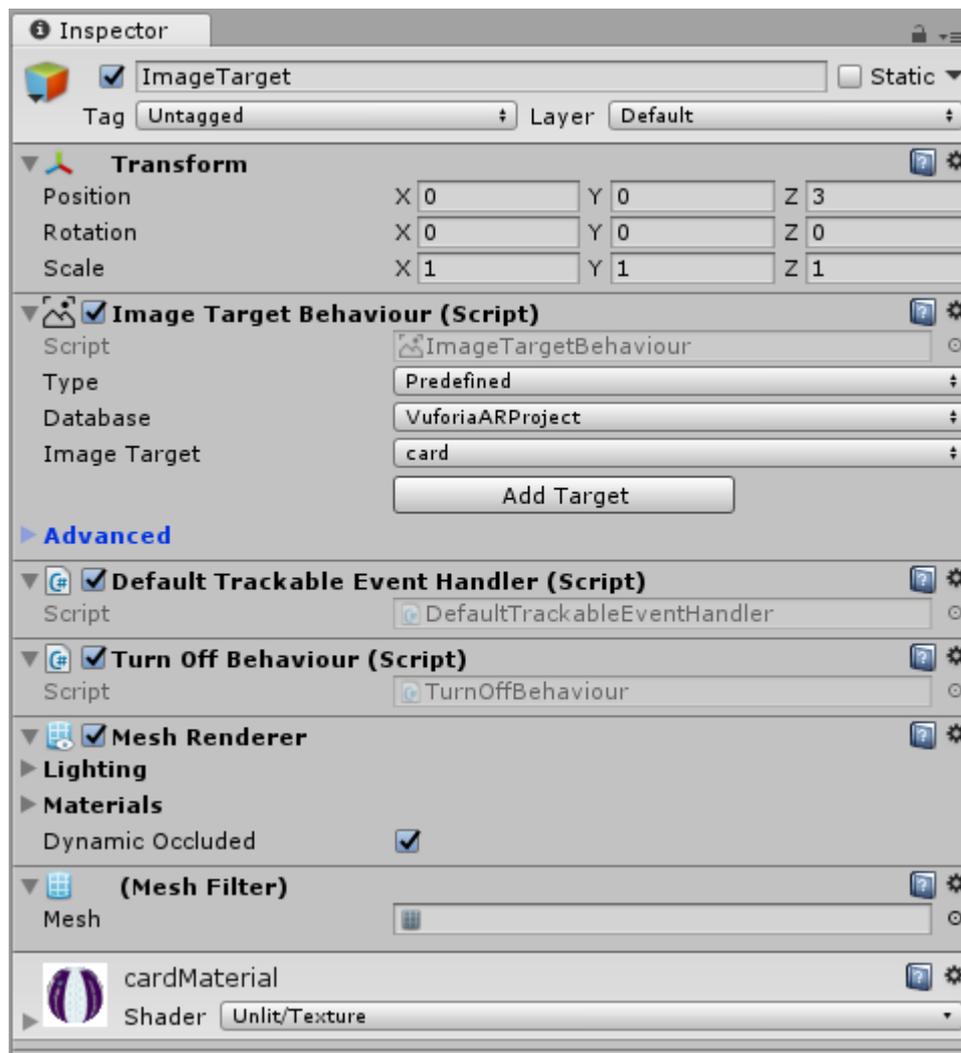


Figure 3.8.3: Image target

The last thing to do is to add a 3D model as a child object of the Image and set its position to 0, 0, 0. Now go back to Vuforia Configuration, set Dataset for our database and activate it.

And that's all. Now we have to simply build a project into apk file and install it on an Android device. To do this go to **File->Build Settings** and press **Build** button. In the app all we have to do is point our camera to the chosen image and our model will appear.

3.9 Use Case Modeling and Description

A utilization case is a rundown of activities or occasion steps that characterizes the connections between and performing artist and an engine to accomplish an objective. In AR application building it is essentially called use case demonstrating. According to the Unified Modeling Language, the client is called a performing artist, in this application, the user will be performer and the application will give all the idea how they can use it.

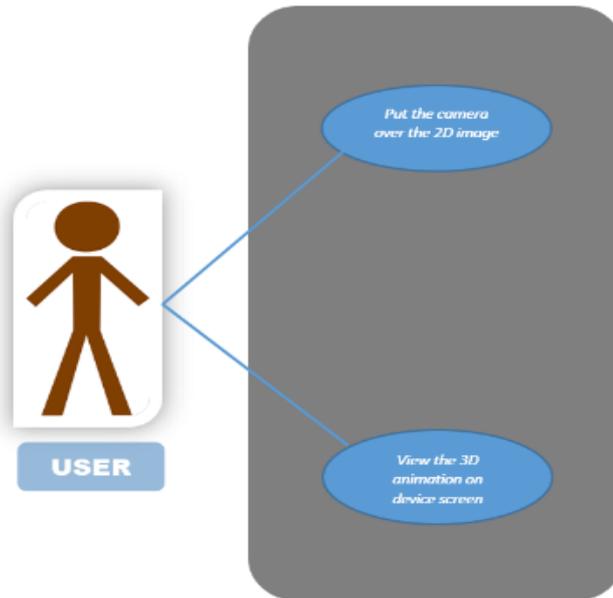


Figure 3.9.1: Use case diagram

Use Case Description:

Use case: Access AR Book App.

Primary Actor: Users

Precondition: Open Camera

Event Flow: Show different content from the book and visualize 3D animation.

Exit Condition: Press the back button twice and exit.

3.10 Logical Data Model

An entity relationship diagram (ERD) shows the relationships of entity sets stored in a storage. An entity in this context is a component of data. In other words, ER diagrams illustrate the logical structure of databases.

The relationship of the entity sets of the storage and cloud is shown by the entity relationship diagram (ERD). It can be said that, the logical structure of a storage is illustrated by the ER diagram. It goes deep to the database as much as possible and describes the data model. All the entities and relationship among them are included in the diagram. In the following figure we have given the ER diagram of the application.

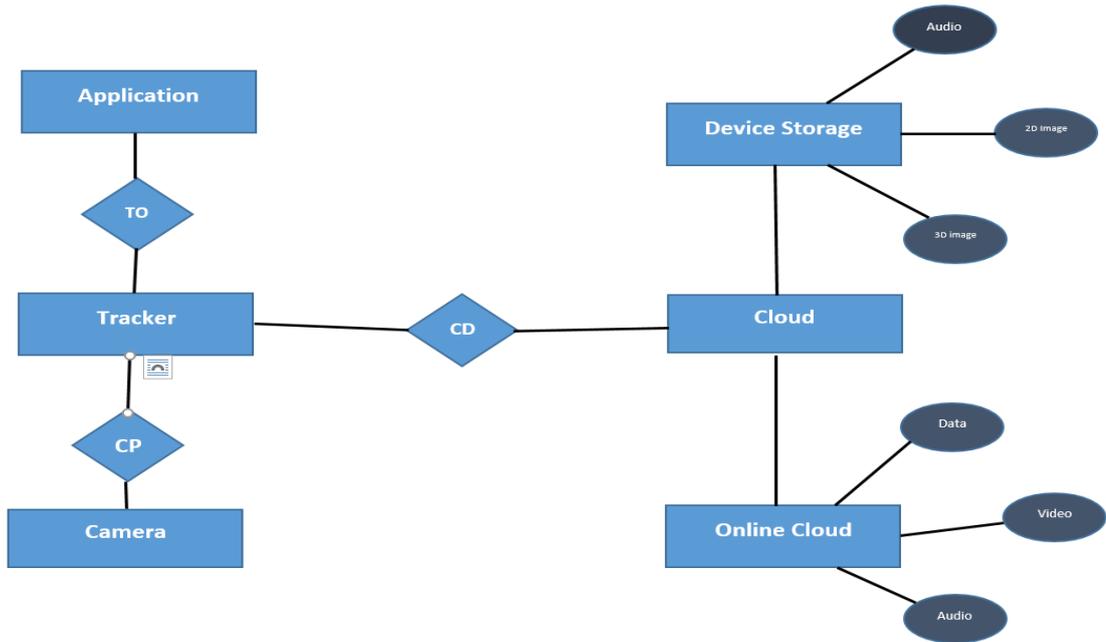


Figure 3.10: ER diagram

3.11 Use Characters:

We use these characters for designs.

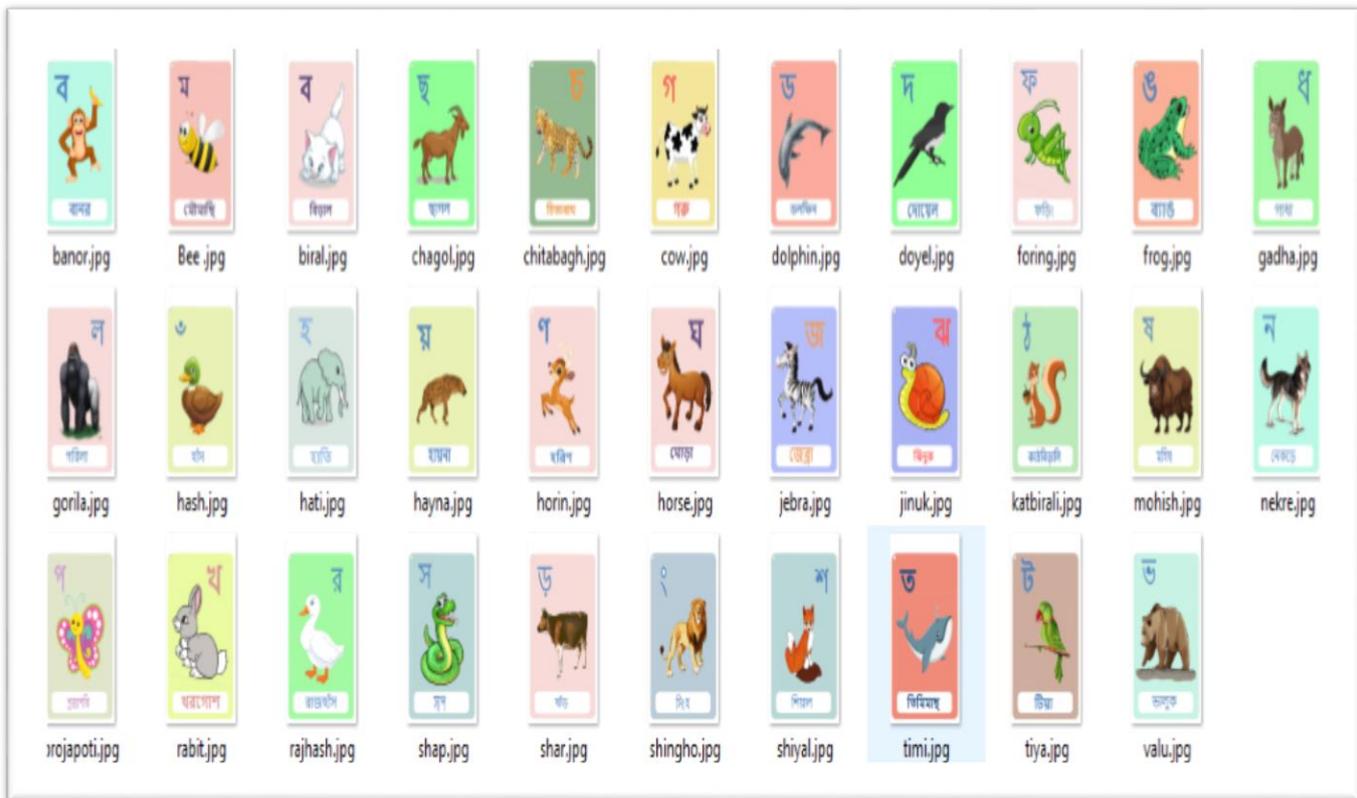


Figure 3.11: Use Characters

CHAPTER 4

AR Application Implementation

4.1 Introduction:

Implementation means a set of idea, plan, practices and informed-policies in real-world services. Implementation of interaction is common task for all development projects. Now-a-days technology has leading in an amazing way and the tendency is to occur faster. Now technology offering many advanced product and services, which makes our day to day life easier and comfortable. In this paper our aim is to develop an application for chemistry lab by using Augmented Reality (AR).

4.2 Working Procedure:

For implantation our project at first we install unity3D editor. At next we create an account in unity. Then we create a new project here we insert project name, location, select model & then create project.

After that go to file> build settings and then select android platform & then click player settings, XR settings, & click Vuforia Augmented Reality supported then build and save this scene.

Then we go to Asset tools, Vuforia, AR camera & insert this & delete main camera. In AR camera inspector (Open Vuforia configuration, Vuforia, app license key).

For app license key & unity package we login Vuforia engine (for login we have a Vuforia account).

After login go to Develop tools > license manager create a license & name this project1. Then go to target manager & create database for unity package.

To create database, name this database Project1 & type to device and click on **create** button. Then type Single target image, insert file, Width (300) & name click on **Add** button.

If we show this database, target manager > click > Project1 (Show features for camera detection point on image) & for download this database > select Unity Editor > click on Download.

Now we again open Unity3D > AR camera > Inspector > Open Vuforia configuration > vuforia, app license key (paste the license key provided by Vuforia).

Asset > Vuforia > Image

Asset > Vuforia > 3D object > sphere

Project > Asset > Vuforia > Script > click right button > create C# > name > CollisionDetector.

Double click on collisionDetector > open Visual Studio > Write C# code for 3D object physical movements of selected molecules & save.

Finally, we use this code for our selected 3D object/ molecules just drag & drop C# code on 3D object Inspector.

At next we click file > Build setting > Android/iOS/others > select scene > build > name the apk > Save.

4.3 Project Implementation:

Here are our project outcome steps.

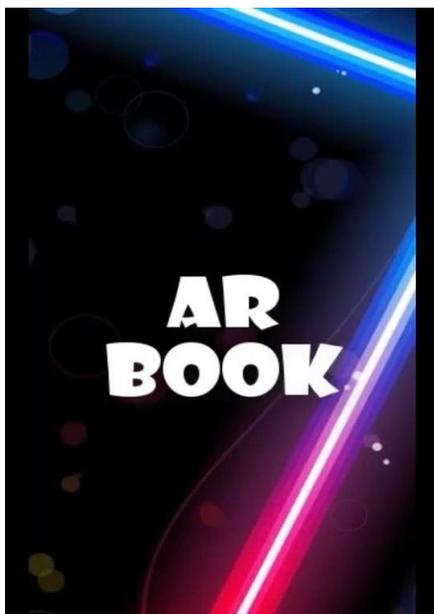


Figure 4.3.1: Project start

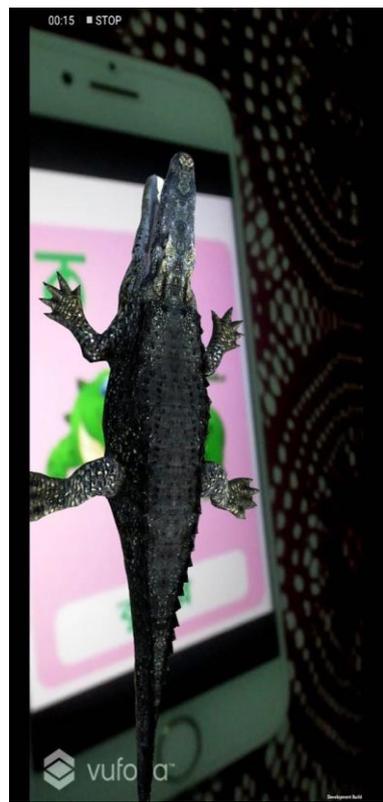
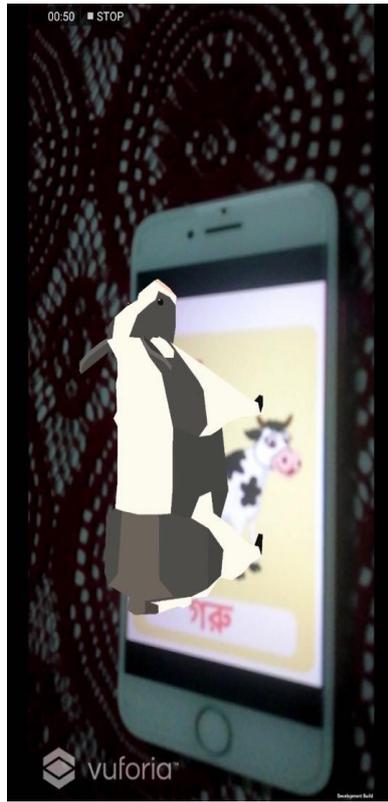


Figure 4.3.2: Project Outcome

CHAPTER 5

Result & Discussion

5.1 Result & Discussion

Every project needs an output as a result. Result are the main concern of our project. Bengali is the mother language of the Bangladeshi people, the children are not getting enough exposure to the Bengali language compared to English in their early childhood. This “AR BOOK” app can help to bridge that gap. It will be possible to familiarize the kids their native Bengali alphabets with this application in an entertaining way without parental supervision with a significant amount of improvement compared to the traditional way. This app is children friendly as the children are learning in a playful way using Augmented Reality. The AR application was used as a teaching method; the kids were amazed and learnt in a playful manner. One of the teacher’s comments regarding this AR application is noted below.

CHAPTER 6

Conclusion and Future Work

6.1 Conclusion

In recent, efforts have been made to use augmented reality as a device for education. We are trying to cover full kids NCTB book. Also we are try to implement storybook.

6.2 Scope for Future Work

Augmented reality gives us to show how chemical reaction by using a virtual model. And the response of the experiment is qualifying by reserving user's history. Bengali is the mother language of the Bangladeshi people, the children are not getting enough exposure to the Bengali language compared to English in their early childhood. This “**AR BOOK**” app can help to bridge that gap. It will be possible to familiarize the kids their native Bengali alphabets with this application in an entertaining way without parental supervision with a significant amount of improvement compared to the traditional way. This app is children friendly as the children are learning in a playful way using Augmented Reality. The AR application was used as a teaching method; the kids were amazed and learnt in a playful manner. One of the teacher's comments regarding this AR application is noted below. We are trying to cover full kids NCTB book. Also we are try to implement storybook.

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