

# Virtual Reality's Effect on Educational E-learning Platforms

Reem Sulaiman Salim Muslem Al Mahrizi, Azhar Hilal Zahir Mohammed Al Ismaili,  
and Mohamed Ruknudeen Rafi

## ABSTRACT

Students now rely more on online learning than on-campus instruction. As a result, we intend to create a project that will assist students in understanding topics through the use of augmented reality (AR). The only aspect of e-learning being studied at the moment is knowledge transmission online. We want to upgrade e-learning with AR due to time restraints and other technological issues. In order to virtualize the notion for students studying three-dimensional geometry, our objective is to create an e-learning framework for three-dimensional geometry. Students may quickly understand the idea visually with the aid of modern mobile phones by placing their phones on the actual QR code readers. Using AR, it will provide a clear and visual explanation of the idea. For instance, if the student holds up his phone in front of the switch or router, it will clearly explain the components. Then, it may be used in any subject or industry. We want to employ Vuforia and UNITY 3-D software to accomplish our aim. The software development kit (SDK) for augmented reality (AR) on mobile devices called Vuforia facilitates the development of AR apps. It recognizes and tracks planar pictures and 3D objects in real time using computer vision technologies. Games and other visuals in both 2D and 3D may be made with Unity.

**Keywords:** VR, AR Augmented Reality, SDK, E-learning, Educational .

**Published Online:** September 14, 2023

**ISSN:** 2736-5492

**DOI:** 10.24018/ejcompute.2023.3.4.108

**R. S. S. M. Al Mahrizi \***

Department of Information Technology,  
University of Technology and Applied  
Sciences, Oman

(e-mail: 36J1918@ict.edu.om)

**A. H. Z. M. Al Ismaili**

Department of Information Technology,  
University of Technology and Applied  
Sciences, Oman

(e-mail: 36S1712@ict.edu.om)

**M. R. Rafi**

Department of Information Technology,  
University of Technology and Applied  
Sciences, Oman

(e-mail: mohdrafi@ict.edu.om)

\*Corresponding Author

## I. INTRODUCTION

Owing to the demanding circumstances, institutions are moving toward distant learning or e-learning, people/students are having a hard time managing their time, and businesses want their staff to be up to date on information while performing their regular duties. They receive knowledge from this program, which also serves to digitally educate them with clear explanations. The three-dimensional virtual image may be moved around and viewed from any angle by users.

### A. Background of the Project

Due to present needs, the pandemic, and other external factors, people are unable to spend more time in the normal classroom. As a result, people may study from home using the current technology they currently own (such as mobile phones, tablets, etc.). Vuforia and UNITY 3-D will both be used for this project. The creation of AR applications is made easier by the Vuforia software development kit (SDK) for mobile devices. Using computer vision techniques, it tracks and detects planar images and 3D objects in real time. Unity may be used to create 2D and 3D graphics for games and other applications. The language that's used in Unity is **C# (C-sharp)**. All the languages that Unity operates with are object-oriented scripting languages [2].

Vuforia is a software development kit (SDK) for creating Augmented Reality apps. Developers can easily add advanced computer vision functionality to any application,

allowing it to recognize images and objects, and interact with spaces in the real world [1]. Due to the current situation, the pandemic and other technical problems, we plan to blend e-learning with AR. Our plan is to develop an e-learning framework for three-dimensional geometry, which makes use of Augmented Reality to virtualize the concept to the students with three-dimensional geometry. With the help of advanced mobile phones students can easily learn the concept visually by keeping their phones on the physical devices of QR codes. It will explain the concept clearly and visually using AR. For example, if the student shows his phone over the switch or router it will give a clear explanation about the devices. Then it can be expanded to any course or domain. This project will be implemented through software UNITY and Vuforia.

### B. Existing System

- In the current system in UTAS, e-learning is performed through the internet without the AR implementation. The students get only information about the topics, they can't feel the lab experience or real time experience.

## II. LITERATURE REVIEW

At the moment, mobile phones are required for all types of job. Students can therefore utilize the old device without having to buy a new one. When compared to educational video games and printed materials, virtual reality in particular has been demonstrated to be noticeably more entertaining and

easier to concentrate on. Participants in pilot research we conducted said they were substantially more satisfied with their learning after using VR than they were after using conventional learning techniques. It also makes people feel more valued. In the study, 90% of participants said they would feel valued by an innovative organization if they received VR training – clear evidence that immersive learning technologies and methods can be impressive methods to attract and retain talent. [3].

### A. Objectives

The software Vuforia and UNITY will guarantee the realistic feel in virtual mode education, and the suggested system will build the learning environment with the virtual display employing AR.

The process involves the following stages:

1. *Project requirements:* Determining the project's requirements and goals is crucial before starting the development process. The project's scope, target platform, target audience, and other elements that will affect the development process are all defined here.
2. *Project plan:* The next task is to build a project plan after the requirements have been identified. Timelines, resource needs, milestones, and other critical info that will direct the development process should be included.
3. *Development environment:* The development environment needs to be set up before starting the development process. Installing Unity 3D and Vuforia, making a project, and setting up the essential parameters are all included in this process.
4. *Design the user interface:* The project's user interface needs to be designed next. Designing screens, buttons, and other interactive features that will let people engage with your product falls under this category.
5. *Application development:* The essential functionalities of the application can now be developed after the user interface design is complete. This requires integrating Vuforia, writing scripts, and performing other development activities.
6. *Test, debug, and deployment:* The application needs to be tested and debugged after development is complete. This includes checking that all features operate as intended, locating, and correcting any problems, and improving the performance of the program. Finally, the application is uploaded.

### B. Block Diagram

The importance of our project E-Learning using Augmented Reality for UTAS, helps students and other people who find difficulties in normal e-learning. For them, it would be a good gift for them to learn virtually using their mobile devices and it also it will give real time experience through the virtually.

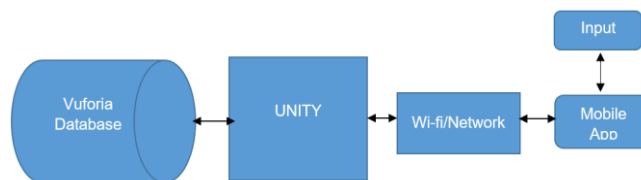


Fig 1. Block Diagram.

In the block diagram, the graphical images are stored in the database according to the courses. The mobile application reads the input from the physical device or QR image than through the wifi network transferred to the system. Then the system transferred the input to the database. According to the input the matched output will be displayed on the mobile device.

### C. Tools

#### 1) Software Tools

- Unity Engine
- Vuforia

#### 2) Sample code for E-Learning Using AR

```
using Unity Engine;
using UnityEngine.Events;
using Vuforia;
/// <summary>
/// A custom handler that implements the
ITrackableEventHandler interface.
///
/// Changes made to this file could be overwritten when
upgrading the Vuforia version.
/// When implementing custom event handler behavior,
consider inheriting from this class instead.
/// </summary>
public class DefaultObserverEventHandler :
MonoBehaviour
{
public enum TrackingStatusFilter
{
Tracked,
Tracked_ExtendedTracked,
Tracked_ExtendedTracked_Limited
}
/// <summary>
/// A filter that can be set to either:
/// - Only consider a target if it's in view (TRACKED)
/// - Also consider the target if's outside of the view, but the
environment is tracked (EXTENDED_TRACKED)
/// - Even consider the target if tracking is in LIMITED
mode, e.g. the environment is just 3dof tracked.
/// </summary>
public TrackingStatusFilter StatusFilter =
TrackingStatusFilter.Tracked_ExtendedTracked_Limited;
public bool UsePoseSmoothing = false;
public AnimationCurve AnimationCurve =
AnimationCurve.Linear(0, 0, LERP_DURATION, 1);
public UnityEvent OnTargetFound;
public UnityEvent OnTargetLost;
protected ObserverBehaviour mObserverBehaviour;
protected TargetStatus mPreviousTargetStatus =
TargetStatus.NotObserved;
protected bool mCallbackReceivedOnce;
const float LERP_DURATION = 0.3f;
PoseSmoother mPoseSmoother;
```

```

protected virtual void Start()
{
    mObserverBehaviour =
    GetComponent<ObserverBehaviour>();
    if (mObserverBehaviour)
    {
        mObserverBehaviour.OnTargetStatusChanged +=
        OnObserverStatusChanged;
        mObserverBehaviour.OnBehaviourDestroyed +=
        OnObserverDestroyed;
        OnObserverStatusChanged(mObserverBehaviour,
        mObserverBehaviour.TargetStatus);
        SetupPoseSmoothing();
    }
}

protected virtual void OnDestroy()
{
    if(VuforiaBehaviour.Instance != null)
    VuforiaBehaviour.Instance.World.OnStateUpdated -=
    OnStateUpdated;
    if (mObserverBehaviour)
    OnObserverDestroyed(mObserverBehaviour);
    mPoseSmoother?.Dispose();
}

void OnObserverDestroyed(ObserverBehaviour observer)
{
    mObserverBehaviour.OnTargetStatusChanged -=
    OnObserverStatusChanged;
    mObserverBehaviour.OnBehaviourDestroyed -=
    OnObserverDestroyed;
    mObserverBehaviour = null;
}

void OnObserverStatusChanged(ObserverBehaviour
behaviour, TargetStatus targetStatus)
{
    var name = mObserverBehaviour.TargetName;
    if (mObserverBehaviour is VuMarkBehaviour
vuMarkBehaviour && vuMarkBehaviour.InstanceId !=
null)
    {
        name += " (" + vuMarkBehaviour.InstanceId + ")";
    }
    Debug.Log($"Target status: {name} {targetStatus.Status} --
{targetStatus.StatusInfo}");
    HandleTargetStatusChanged(mPreviousTargetStatus.Status,
targetStatus.Status);
    HandleTargetStatusInfoChanged(targetStatus.StatusInfo);
    mPreviousTargetStatus = targetStatus;
}

protected virtual void HandleTargetStatusChanged(Status
previousStatus, Status newStatus)
{
    var shouldBeRendererBefore =
ShouldBeRendered(previousStatus);
    var shouldBeRendererNow =
ShouldBeRendered(newStatus);
    if (shouldBeRendererBefore != shouldBeRendererNow)
    { if (shouldBeRendererNow)
    { OnTrackingFound();
    }
    Else {
    OnTrackingLost();
    }}
}

```

### III. RESULTS AND DISCUSSIONS

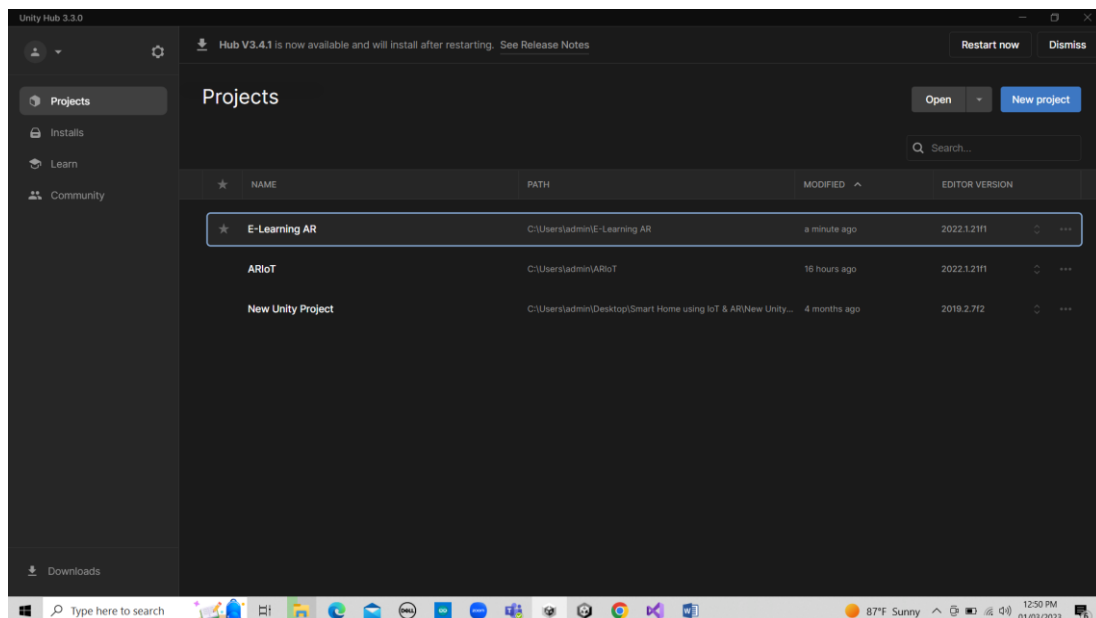


Fig. 2. Unity Project Setup.

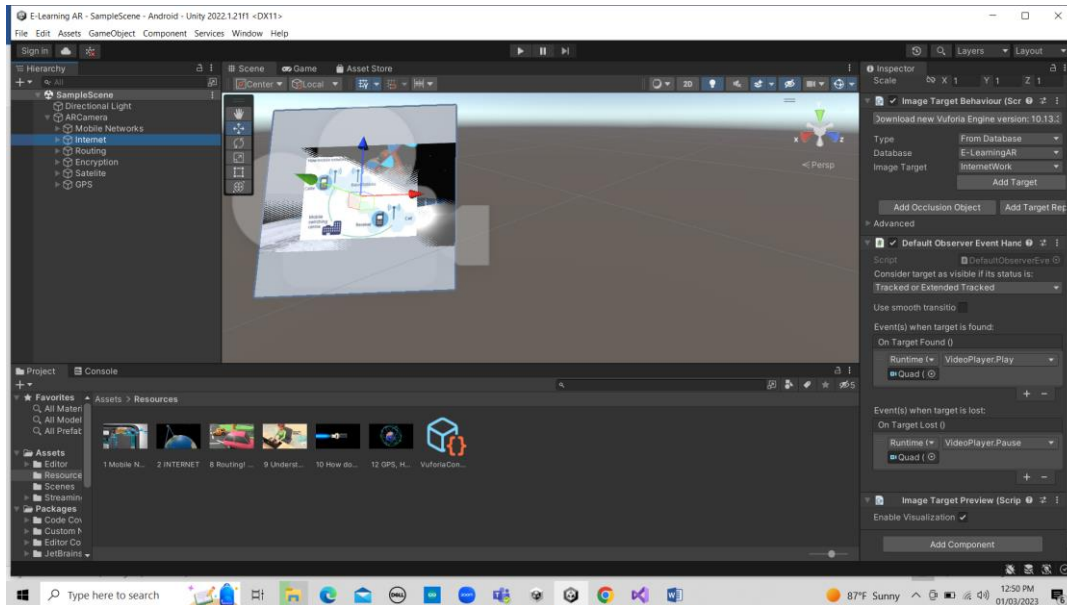


Fig. 3. Adding target images to Unity.

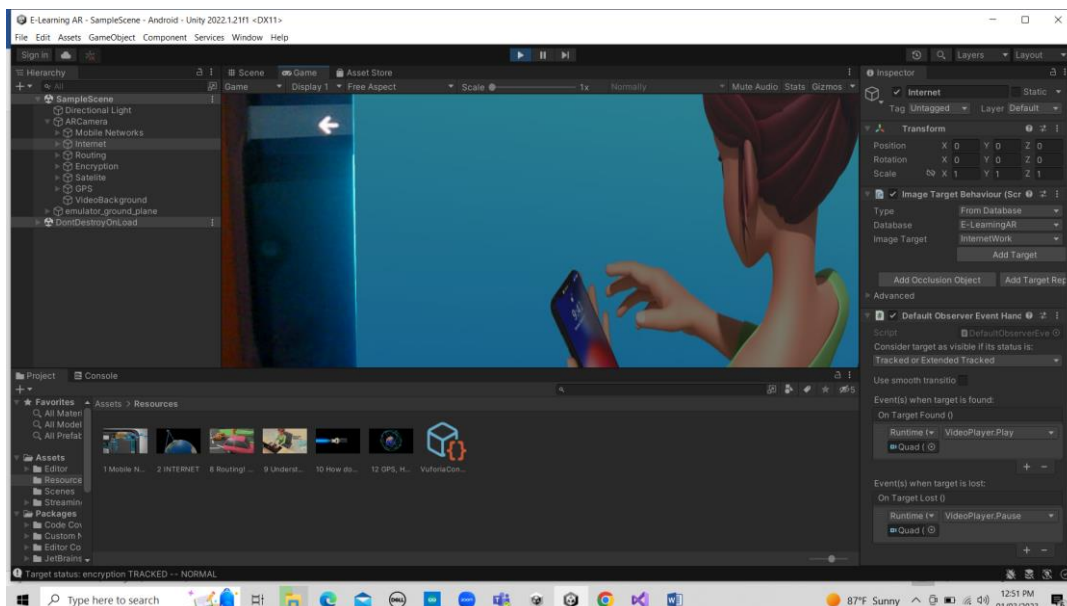


Fig. 4. Augmented video execution.

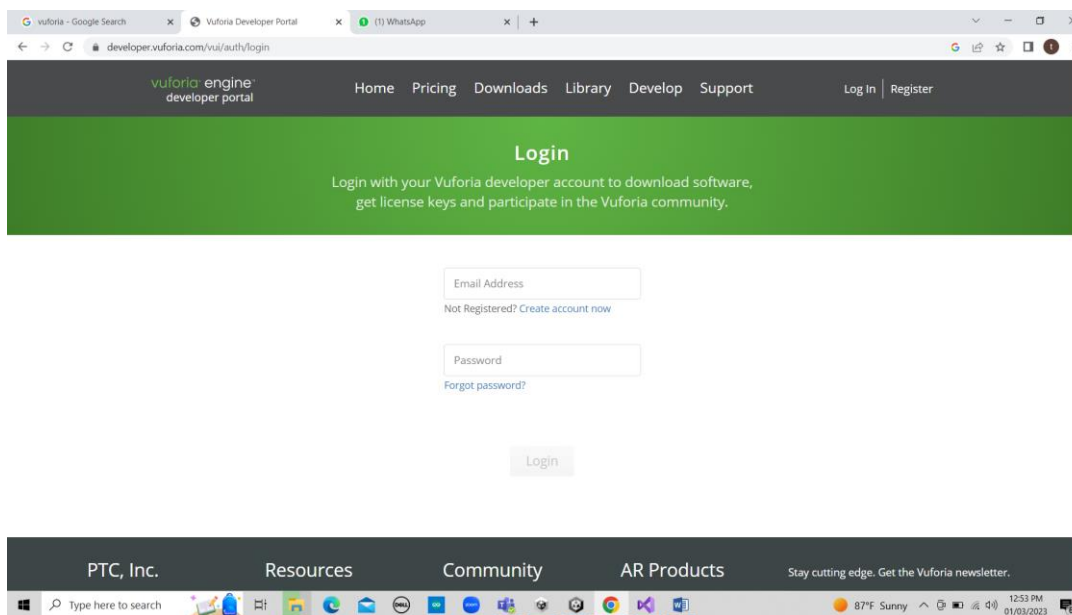


Fig. 5. Vuforia Login.

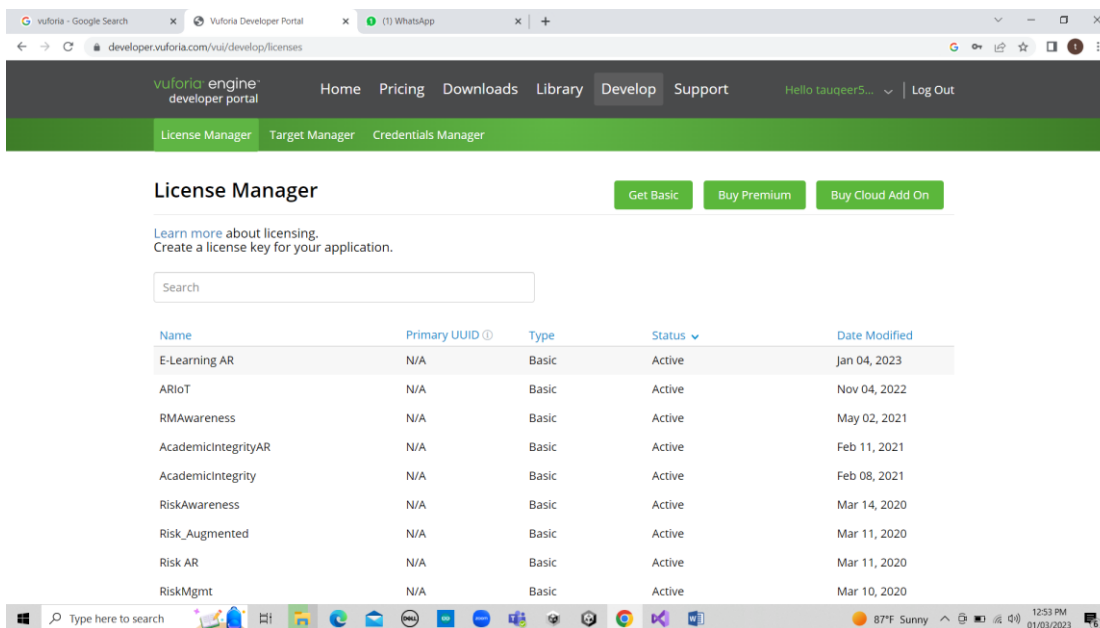


Fig. 6. Vuforia License Manager.

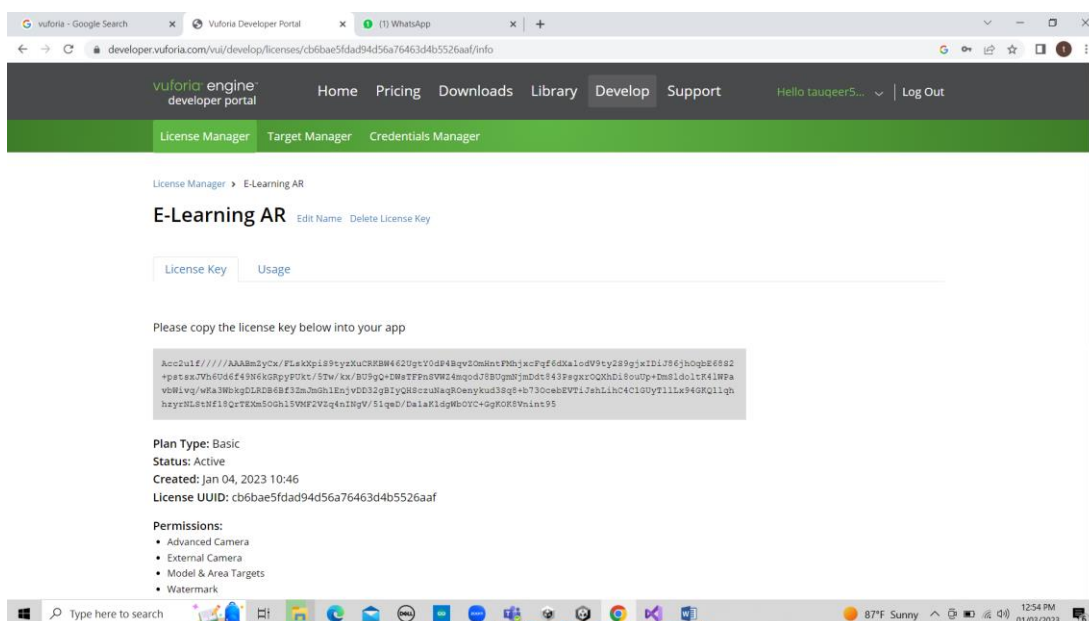


Fig. 7. Vuforia License Generation.

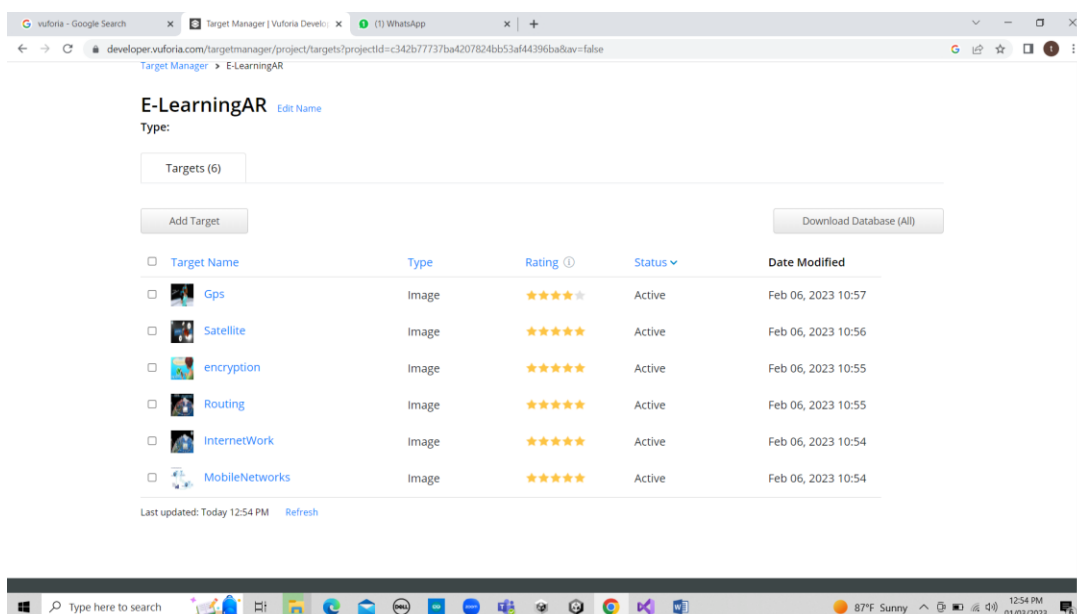


Fig. 8. Vuforia Target Images.



Fig. 9. Mobile Application Interface.

#### IV. CONCLUSION

The potential for augmented reality (AR)-based e-learning to enhance the educational experience of students is considerable. AR technology makes it feasible to create learning environments that can boost student engagement and knowledge retention. Also, it can provide children with the opportunity to experiment and explore in a safe online environment.

#### REFERENCES

- [1] Azuma RT. A survey of augmented reality. *Presence-Teleoperators and Virtual Environments*, 1997;6(4):355-385.
- [2] Bacca J, Baldiris S, Fabregat R, Graf S and Kinshuk. Augmented reality trends in education: A systematic review of research and applications. *Educational Technology & Society*, 2014;17(4):133-149.
- [3] Billinghurst M and Duenser A. Augmented Reality in the classroom. *Computer*, 2012;45(7):56-63.
- [4] Bologna Declaration. The European higher education area. Joint Declaration of the European Ministers of Education, June 19, 1999, Bologna.
- [5] Botella CM, Juan MC, Baños RM, Alcañiz M, Guillén V and Rey B. Mixing Realities? An Application of Augmented Reality for the Treatment of Cockroach Phobia. *Cyberpsychology & Behavior*, 2005;8(2):162-171.
- [6] Arvanitis TN. *et al.* Human factors and qualitative pedagogical evaluation of a mobile augmented reality system for science education used by learners with physical disabilities. *Personal and ubiquitous computing*, 2009;13.3: 243-250.
- [7] Azuma RT. A survey of augmented reality. *Presence*, 1997;6.4:355-385.3.
- [8] Bajura M and Ulrich N. Dynamic registration correction in video-based augmented reality systems. *Computer Graphics and Applications, IEEE*, 1995;15.5:52-60.
- [9] Billinghurst M. Augmented reality in education. *New Horizons for Learning*, 2002;12: 60-65.
- [10] Bimber O and Ramesh R. *Spatial Augmented Reality*. ISMAR. 2004.
- [11] Díaz M. Augmented Reality Versus Virtual Reality: The Battle Is Real. *Techcrunch* 2016, 20. Available online:<http://techcrunch.com/2016/01/04/ar-vs-vr-the-battle-is-real/?ncid=rss> (accessed on 8 January 2016).
- [12] Barba R, Yasaca S, Manosalvas C. Impacto De La Realidad Aumentada Móvil En El Proceso Enseñanza-Aprendizaje De Estudiantes Universitarios Del Área De Medicina [Impact of mobile augmented reality in the teaching-learning process university students from the area of medicine.]. *Investigar Con y Para La Sociedad*; Bubok Publishing, S.L.:Cádiz, Spain, 2015.
- [13] Jamali S, Fairuz M, Wai K, Oskam CL. Utilising mobile-augmented reality for learning human anatomy. *Procedia Soc. Behav. Sci.* 2015;197:659-668.
- [14] Fonseca D, Redondo E, Valls F. Motivación y mejora académica utilizando realidad aumentada para el estudio de modelos tridimensionales arquitectónicos [Motivation and Academic Improvement Using Augmented Reality for 3D Architectural Visualization]. *Educ. Knowl. Soc. EKS* 2016;17:45-64.
- [15] Han J, Jo M, Hyun E, So H. Examining young children's perception toward augmented reality-infused dramatic play. *Educ. Technol. Res. Dev.* 2015;63:455-474.