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Augmented reality marker-based technology for augmenting newspaper advertisement

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ABSTRACT

In this research, we describe an augmented reality android-based idea in which we utilize augmented reality marker-based technology for augmenting newspaper advertisement with electronic information that does not modify the format of the newspaper document and remains exactly the same, substantially improves the utility of paper by reducing the portion of the printed Ad on the newspaper. An implementation on a camera phone is discussed that lets users retrieve data and access links from newspaper advertisements to electronic data. We carefully examined over twenty people of different ages and occupations who participated in the newspaper-based AR and we got a significant overall response. Further analysis implies that this may assist students in understanding the complex 3D objects, which they can manipulate, learn tasks and improve skills.

KEYWORDS: Augmented reality, 3D models, newspaper based AR.

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INTRODUCTION

In this digital era, the use of smartphones has never been like this before. In every aspect of our daily events, we are somehow dependent on our smartphones. Besides making a phone call, we are able to listen to songs, watch videos over the internet, get the latest news and so on. Even though we are able to get the latest news, any time we like, the need for newspapers has not been affected. The newspaper that we buy do provide us with the most recent news around the world, but along with a large mass of printed advertisements. Even though this method of advertisement is much more flexible, reaches more customers and effective for target audience, this possesses some threats to the environment. Some of the active threats that the paper industry possess for the environment are listed on the next page: 40% of the world's commercially cut timber is used for the production of paper; pulpwood plantations and mills endanger natural habitats; over 30 million acres of forest are destroyed annually; the life cycle of paper is damaging to the environment from beginning to end. It starts off with a tree being cut down and ends its life by being burned – emitting carbon dioxide into the atmosphere. And finally, paper production uses up lots of

water. It is noted that an A4 paper requires 10L of water per sheet (The World Counts, 2014).

RELATED WORK

Augmented reality (AR) is a new technology that involves the overlay of computer graphics in the real world. An introduction to this topic would provide a starting point for anyone interested in researching or using augmented reality (Silva *et al.*, 2003).

The AR technology uses technology namely, scene generator used for rendering the scene, tracking system to align objects with respect to each other, and obviously a display. Most of the medical applications that deal with image-guided surgery provided the surgeon with the necessary view of the internal anatomy. Another application for AR in the medical domain is ultrasound imaging. The uses in robotics and telerobotics include how telerobotic operator uses a visual image of the remote workspace to guide the robot.

The field of AR has existed for just over one decade, but the growth and progress in the past few years have been remarkable. In 1997,

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the first author published a survey (based on a 1995 SIGGRAPH course lecture) that defined the field, described many problems and summarized the developments up to that point. Since then, the field has grown rapidly. In the late 1990s, several conferences specializing in this area were started including the International Workshop and Symposium on AR, the International Symposium on mixed reality and the designing AR environments workshop. Some well-funded interdisciplinary consortia were formed that focused on AR, notably the Mixed Reality Systems Laboratory in Japan and Project ARVIKA in Germany. A freely available software toolkit (ARToolkit) for rapidly building AR applications is now available.

Based on an ongoing research project, an application has been developed in which the developers used ARToolkit to help teach undergraduate geography students about earth-sun relationships and concepts of rotation/revolution, solstice/equinox and seasonal variation of light and temperature (Shelton & Hedley, 2002).

Another paper focuses on the application of augmented reality in the field of engineering through examples and on sight as a human sense that needs to be augmented with virtual 3D models (Pejić *et al.*, 2014).

Another project in the field of augmented reality deals with an electrically augmented paper-based book that keeps the affordances of paper books while adding electronic augmentation deliberately and the application has been named “The Listen Reader” (Singh & Pandey, 2014).

With the integration of augmented reality and wearable technology, a body-worn computer that can assist the user more intelligently, and is comprised of two parts their user interface that collects information about the user and sends the information to the search engine, was developed at the Massachusetts Institute of Technology (Yuen *et al.*, 2011).

Augmented reality in the various fields of advertising and marketing, architecture and construction, entertainment, medical, military, travel and finally in education (i.e. AR books, AR gaming, discovery-based learning, object modeling, etc.) possess new possibilities in each of the respective fields (Kečkeš and Tomičić, 2017).

METHODOLOGY

Our research has been designed based on mainly three categories of people and they are newspaper readers, students of different ages and finally advertisement makers.

Following discussion emphasis on how we selected the users for our application and how it will be greatly benefited to them and natural resources as well.

A. Newspaper readers

This is true that we are in the modern era, able to get the latest news update through online newspaper anytime we desire. But the demand for newspapers has not been affected by this. As many people prefer holding up a cup of tea with

the morning newspaper rather than staring at the 5.5’ display for a long time.

Here comes the fact, the advertisement portion of the newspaper takes up a huge portion of it and so to reduce the loss of natural resources we are launching this AR marker-based app. It will be attractive and useful to the newspaper readers because in the modern era, most of them have a smartphone or tablet or any kind of device in their hands and they would like to get different categories of advertisements from one specific source rather than to install different applications and waste their device memory space for different advertisements. In the context of Bangladesh, it may be an advertisement from Eid special offer from brands like Walton, Aarong or an advertisement of Grameenphone vacancy or maybe an advertisement of admission test detail of North South University. Whatever the category of the advertisement is; all they can get from one authentic source which will reduce their pain of searching various categories of advertisements from different sources and it will be attractive and faithful to them as well as this app will be directly linked to government approved daily newspapers.

So, our first target audience is the newspaper readers.

B. Students

This application will be easy and colorful, interactive for kids and students to engage them in learning. Even it will also make students assist in realizing the complex three-dimensional objects and many more. So, our second target audience is students of different ages.

C. Advertisement makers

The goal of the advertisement makers is to reach their products and services to the largest section of people but at the same time, they also try to achieve the goal of promoting their products at a low cost.

The advertisement portion of the newspaper takes up a huge place with lots of images and text which causes of wastage of natural resources almost every day and to take place in this huge portion of the newspaper the advertisement makers also need to pay a huge amount of money to the newspaper company.

Through our AR marker-based application; only the specific marker will be taken place in the newspaper for specific advertisement which will take a very little portion of the newspaper and thus the advertisement makers also have to pay very little compared to the previous condition. So, they will find it smarter, attractive and economically useful for them.

That’s why our final target audience is none but the advertisement makers.

DEVELOPMENT

A. Marker based AR

- One method for an AR system to recognize elements of the physical world is through the use of so-called ‘markers’ that,

when processed through the camera, alert the system that relevant information for overlay can be downloaded from the Internet.

- A marker, generally a “pattern” is used by the app on the smartphone as a placeholder for “augmented information” to be displayed.
- With the advent of the internet-enabled smartphone and accompanying camera, apps have been developed to allow the wider public to scan these codes and access further information.

The software related to the application which will be used in developing the project has been mentioned below:

B. Unity 3D

Unity gives users the ability to create games in both 2D and 3D, and the engine offers a primary scripting API in C#, for both the Unity editor in the form of plugins and games themselves, as well as drag and drop functionality (Wikipedia, 2021a).

In manuscript class (Figure 1) it will load all the menus of this application. Quit class (Figure 2) is used to terminate the program and eventually it will close the application. In Simple cloud handler class (Figure 3a and 3b) it will connect with the cloud where all the components and images were stored. It will track the object and get the search result. The image result will be shown in the targeted area.

C. Vuforia

Vuforia is an augmented reality software development kit (SDK) for mobile devices that enables the creation of augmented reality

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class menuScript : MonoBehaviour {

    public void changeMenuScene(string scenename) {
        Application.LoadLevel(scenename);
    }

}
```

Figure 1: Manuscript class

```
using UnityEngine;
using System.Collections;
using UnityEngine.UI;

public class QuitApplication : MonoBehaviour {

    public void quit() {
        Application.Quit();
    }

}
```

Figure 2: Quit class

applications. It uses computer vision technology to recognize and track planar images (Image Targets) and simple 3D objects, such as boxes, in real-time (Wikipedia, 2019).

The SDK file for Unity can be found at - <https://developer.vuforia.com/downloads/sdk>.

Vuforia provides different types of services: developer, classic, cloud among which the using developer service provides free development for testing purposes.

D. Blender

Blender is a professional, free and open-source 3D computer graphics software toolset used for creating animated films, visual effects, art, 3D printed models, interactive 3D applications and video games (Wikipedia, 2021b).

E. Adobe illustrator

Adobe Illustrator is a vector graphics editor developed and marketed by Adobe Systems (Wikipedia, 2021c).

Using Adobe Illustrator, the user interface was designed initially.

In user interface our users will see the Home page (Figure 4) of this application where all the menus are shown. After clicking the camera button user needs to put the camera on the newspaper then all the advertisements will pop up on the screen (Figure 7). In About (Figure 5) some basic information is given to make it more user-friendly. The working module is described in Manual page of the app (Figure 6).

DISCUSSION

AR is continuously growing and improving every day and using the feedback or evaluation of different people allows us in developing to incorporate these helpful tips to improve users' experience. Our survey result shows only 71.4% of our participants is a regular newspaper reader (Figure 8a), among which 10.7% relies on Newspaper Advertisement (Figure 8b).

Our targeted audience had issues keeping the AR superimposed images in the right position; they could not select an image as well as they would have liked and sometimes the image was a bit shaky which could ultimately lead the program to lose the image altogether. Another one reported that when using AR technology, the audience had to hold the mobile device in order to complete the activity which limited the users' maneuverability and also caused for feeling stress on vision after completing the AR simulation.

However, technology developers are already working on a more user-friendly AR technology called Google Glass. Researchers are working on expanding this technology to include bionic eyes that function without the glasses and would have far-reaching potential for audiences with visual impairments.

```

using System;
using System.Collections;
using UnityEngine;
using UnityEngine.UI;
using Vuforia;

public class SimpleCloudHandler : MonoBehaviour, ICloudRecoEventHandler
{
    private CloudRecoBehaviour mCloudRecoBehaviour;
    public ImageTargetBehaviour ImageTargetTemplate;
    private bool mIsScanning = false;
    private string mTargetMetadata = " ";
    // private static readonly string address = "";
    // Use this for initialization

    void Start()
    {
        // register this event handler at the cloud reco behaviour
        mCloudRecoBehaviour = GetComponent<CloudRecoBehaviour>();

        if (mCloudRecoBehaviour)
        {
            mCloudRecoBehaviour.RegisterEventHandler(this);
        }
    }

    public void OnInitialized()
    {
        Debug.Log("Cloud Reco initialized");
    }

    public void OnInitError(TargetFinder.InitState initError)

```

Figure 3a: Simple cloud handler class

```

// Here we handle a cloud target recognition event
public void OnNewSearchResult(TargetFinder.TargetSearchResult targetSearchResult)
{
    //Check if the metadata isn't null
    if (targetSearchResult.MetaData == null)
    {
        return;
    }

    // do something with the target metadata
    //mTargetMetadata = targetSearchResult.MetaData;
    //url = targetSearchResult.MetaData;
    // stop the target finder (i.e. stop scanning the cloud)
    mCloudRecoBehaviour.CloudRecoEnabled = false;

    if (ImageTargetTemplate)
    {
        // enable the new result with the same ImageTargetBehaviour:
        ObjectTracker tracker = TrackerManager.Instance.GetTracker<ObjectTracker>();
        ImageTargetBehaviour imageTargetBehaviour =
            (ImageTargetBehaviour)tracker.TargetFinder.EnableTracking(
                targetSearchResult, ImageTargetTemplate.gameObject);
    }
}

```

Figure 3b: Simple cloud handler class



Figure 4: Home

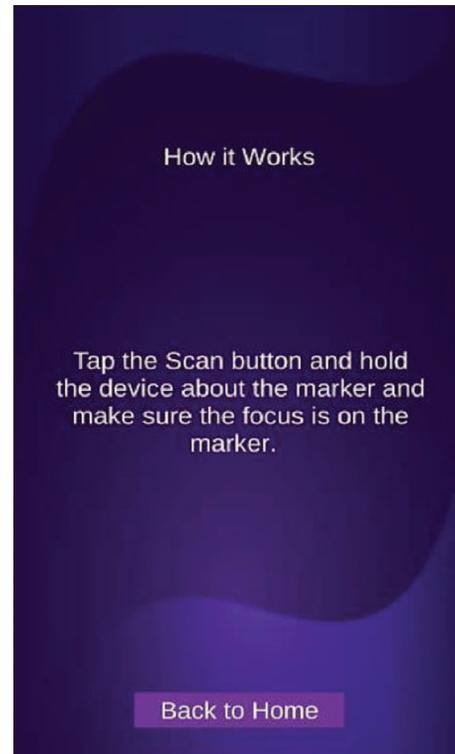


Figure 6: Manual



Figure 5: About



Figure 7: Sample output

We have also figured out that we should be aware in case of information being presented while developing. This can prevent

the brain from being fully loaded especially in the case of students' audience. When the user feels overwhelmed stress can arise

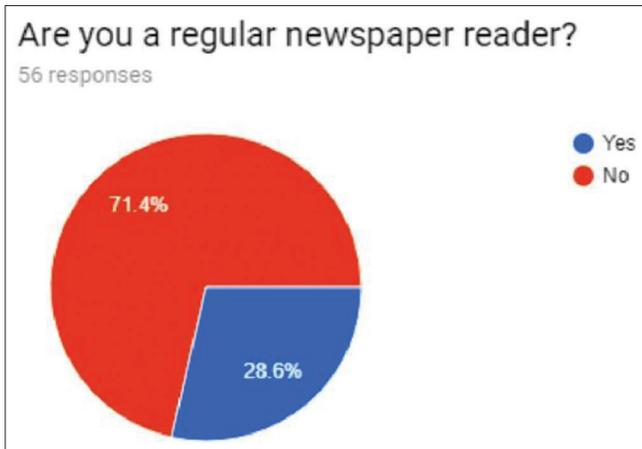


Figure 8a: Percentage (%) of regular newspaper readers among 56 participants

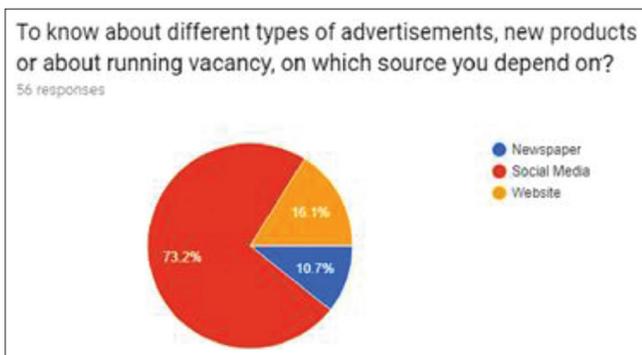


Figure 8b: Percentage (%) of participants relying on different mediums of advertisements

which will distract the audience from the objective of acquiring knowledge and going through advertisements of their interest.

Finally, not everyone owns a smartphone and there are some who can't use smartphone applications due to lack of knowledge, experience, interest and so on. They are not capable of using our application which can be noted as another limitation.

However, we have also an idea to implement which is providing promo codes with different advertisements of different products or services which will encourage our target people to purchase those products or services and at the same time, they will find the system attractive and interesting. Thus, our application will be spread out to the largest number of audiences.

In spite of having a few limitations, it has lots of positive parts that we proved from the targeted audience feedback and from some good quality comments. But some of their suggestions and negative comments are also important because we will be working on the project and extending the features and improving the system based on their valuable comments and on the ongoing research running on this field.

CONCLUSION

Our primary and major goal was working on such a project which is ICTD (Information and Communication Technologies for Development) based. As we discussed before, the advertisement portion of a newspaper takes up a major portion of the paper which is a wastage of natural resources and point to be noted; to produce each week's Sunday newspaper 50 lakhs trees must be cut down which is really alarming for us (The World Counts, 2014). So by launching our app we are going one step ahead to fulfill the dream of Digital Bangladesh and development.

By using our app, all types of advertisements will be allocated in one application, so you are getting everything you search for with less time and effort only from one specific source. At the same time, as the number of papers is reduced in the newspaper so the advertisement companies are greatly benefited as they have to pay very little only for the AR marker placed on the newspaper.

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