

Developing Augmented Reality Application for Booths in Event using Natural Feature Tracking as a Marker

¹Indrawan, ²Desi Ramayanti

^{1,2}Universitas Mercu Buana, Meruya Selatan, Kembangan, West Jakarta

Abstract

This paper presents an approach of using Information Technology as a tools that could attract larger audience for booths in certain event. By using Augmented Reality, this paper try to ease the problem that businesses faced on event, that is to give information to visitor about their products or company profile. In this paper, we use NFT (Natural Feature Tracking) as main marker. It's easier for layman to use AR if the marker is NFT. Even though on testing state, we found out that using NFT have a problem in distance from camera to marker. If the camera too far from the marker, the virtual data won't show up on the screen. On testing phase, if the marker on the screen of laptop or computer, we have at maximum 2 meters until the virtual data won't show up on our phone screen, while if the marker was printed on the A4 paper, we could scanned the marker at maximum 3, 5 meters. The result of this paper is application that easy to use for user and businesses could create their own content to their own application.

Keywords

Event, Mobile Applications, Augmented Reality

1. Introduction

Smartphones are becoming the integral part of our society. It has been sold for more than 1500 billion in 2016 alone [1]. It began to rise in 2012 when the number of sales going up twice than what have been sold in 2011. That's why it's not surprising that many developers start to develop more for mobile than desktop.

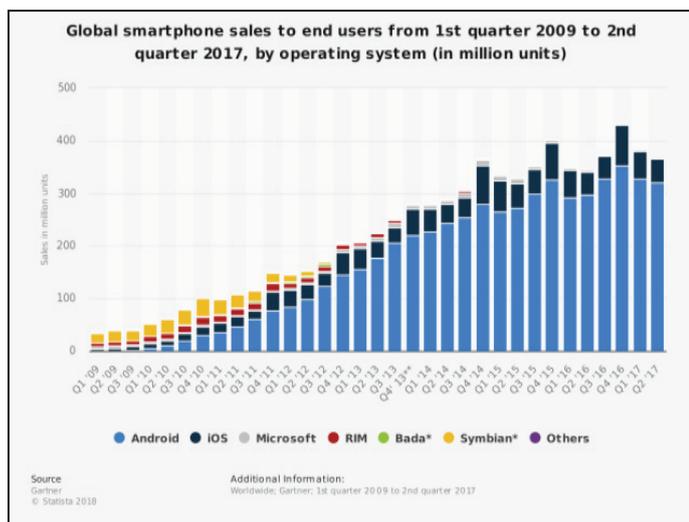


Fig. 1: Global Smartphone Sales Since 2009

International Data Corporation (IDC) Worldwide quarterly Mobile Phone Tracker researched that smartphone market share dominated by Android in 2017 with 85% market share [2]. With spike sales rate of Android, interest in developing application are increase as well. That's why since 2012, there are 25 million application have been downloaded from Google Play, and it reached 50 million in 2013. That means just within one year, number of apps downloaded from google play increase twofold.



Fig. 2: Worldwide Smartphone OS Market Share

Applications on Google play also have diverse type that user could choose from. From educational to business, game to utility tools, user could choose apps that could help them. Recently, as smartphones support more state of the art technology such as Augmented Reality, GPS or virtual reality, it helps developer to have more room to experiment and get user to use latest application of their smartphones capabilities. Even though Augmented Reality is not popular enough in Indonesia, the ease and fluid accessibility of Augmented Reality or Virtual Reality could help developer to gear up their creativity.

Augmented Reality (AR) is a real-time view of physical world, be it direct or indirect view, that has been enhanced with virtual data. AR simplified user's life by bringing virtual data to his/her immediate surroundings and also indirect view of the physical world, such as video or images. That is main difference between Augmented Reality and Virtual Reality, as Virtual Reality completely bring user to the virtual world without seeing the physical world. Augmented Reality on the other hand, augment the sense of reality by adding virtual information to real world in real time [3].

AR technology has been used by many organization and businesses like IKEA and Google. It's use to engage customer and increase sales. For example IKEA, they make an application called "IKEA Catalogue" using AR technology to help customer measure furnitures that they will buy. Therefore, by engaging with their

customer this way, IKEA give their customer a promise that it will be easy to buy products from them while consequently make the user buy their product.

In the same vein of those big corporation, many small and mid-size company also begin to think digitally in their engagement effort to their customers. One of key thing that they can do is to increase awareness by hosting or participating in businesses event. In Indonesia, there are many opportunities for that. Those kind of event typically hosted by government or 3rd party promoter [4], so you could buy a slot for your booth. In those kind of event, the biggest selling point are attraction and ease of access for interested customers to know which company that they could use of their services. That's why engagement is the key for potential buyer to visit your booth. Especially in an event that hosted many booths. It's a plus thing if your booth present who you are with creativity and easy to understand technologies. Using AR, we could accomplish both of the idea easily. Developing apps that could interact with your booth could determined your potential buyer because they will have easier and faster access to your company information and products.

We focus more on in interactivity and presentation of the booth that use this AR technology. This means, we are not focusing on design pattern but the definitions, approaches, advantages and disadvantages of AR will be presented, followed by our prototype implementations.

II. Augmented Reality

Augmented Reality could be defined by a fusion of digital or virtual information with physical world, to augment real life experience with digital approach [5]. Features that could be found on almost all Augmented Reality technology are "Sense properties about the real world; process in real time; output (overlay) information to the user; provide contextual information; recognize and track real-world objects; be mobile or wearable" [6]. Important thing to note about Augmented Reality technology is POI (Point of Interest). POIs are defined and associated with visual assets that is if the viewer access or explores a space where POIs are located then the information could be accessed [7]. This POIs determined the approach of AR technology, as the images are lean to structural approach of image recognition [8]. For example, location-based AR outputs information by its user's position that act as its POIs [5, 7, 9]. While vision-based AR functions by using markers or pattern in the physical world environment that could be tracked and identified by computer vision peripheral (such as camera) [10]. Such patterns are called fiducials (visual markers [11]). Between those two approach, vision-based AR is the most sensible choice for Augmented Reality technology that will be use for businesses that need to promote their brand or product in an event. Such event will be held on closed space that will hinder location-based AR to work as it need precise location of user to work. Vision-based AR on the other hand, work fine on closed space but user need to make sure the fiducials are not damaged and venue must have adequate lightning [10].

A. Marker in Augmented Reality

Marker in Augmented Reality technologies is a defining factor of how best we use AR technology for something. As it turns out, each application of AR need to use different marker to achieve the best result. Markers are visual cues that serve as POI (Point of Interest) that trigger the display of virtual information to augment

the reality. Usually, markers are normal images but it could have been GPS position, RFID tag, and so on, which set beforehand in apps, so it could be recognize later [12]. After the marker is recognize, its position, scale and rotation are depend on the position of the camera and the visual cues will transferred the virtual information to the readers. AR marker consist mostly of 2 type, marker based AR and markerless AR.

1. Marker Based

Marker based AR mostly using images and small 3d object. Typically, marker based AR use a black and white graphic images or pattern (fig. 3) as it's easier to separate marker from background by using black and white pattern [13]. Today, marker based AR could use more than black and white image. Natural Feature Tracking (NFT) use standard images, photos and other design material as a marker for AR.

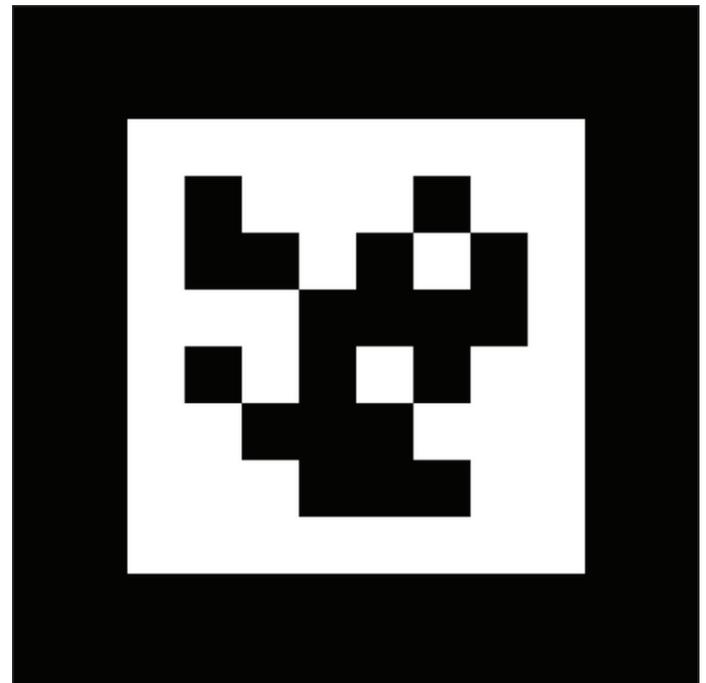


Fig. 3: Example of AR Marker

Using a camera (usually camera on smartphone) with AR software will enable it to detect Augmented Reality markers and show its digital data visually on the screen. Although marker based AR are easier to use and fix for error correction, detection of digital asset will depend entirely on software that being used [13]. Using camera will be difficult if surrounding object obstructing view from camera to marker.

2. Markerless

Markerless AR doesn't need "real" marker to work. In fact, it doesn't need a marker (hence markerless) to work at all. It doesn't need any pre-knowledge of user's environment [14]. Most of markerless AR applications use GPS as a "marker" so to speak. Markerless AR application tend to more attractive than marker based AR. Google Tango is a good example of markerless AR.

B. Calculation of Marker

Extracting data from marker could be difficult especially if the markers are not black and white colour image marker. Using black and white marker is easier than using other kind of marker because contrast between black and white separate marker from

background pattern of the image. The problem is image could be distorted if applied in real world. It means the marker could be difficult to read. That's why we need image unwrapping when recognizing this marker. Image unwrapping is extracting information from existing marker [13]. Here is the calculation of image unwrapping: this calculate the four corners of the markers that acquired after detecting grabbed frame. Those four corners are also positioned in real worlds and calculated as . This parameter will be calculated as follow:

$$\begin{bmatrix} hx_c \\ hy_c \\ 1 \end{bmatrix} = H \begin{bmatrix} x_m \\ y_m \\ 1 \end{bmatrix} = \begin{bmatrix} N_{11} & N_{12} & N_{13} \\ N_{21} & N_{22} & N_{23} \\ N_{31} & N_{32} & N_{33} \end{bmatrix} \begin{bmatrix} x_m \\ y_m \\ 1 \end{bmatrix}$$

III. Application Showcase and Analysis

A. Environment for Application Development

The development for this application were designed for Android. To develop application that utilize AR would require a system design environment. That's why Unity and Vuforia SDK that complement each other with the best quality of markerless AR development was employed as the system design environment. The software is summarized below.

- Unity 3D is a game developing engine that could realize and process 3D entity modeling that used for Augmented Reality technology. It was used as basis for 3D marker modelling and augment it into desirable locations.
- Vuforia SDK is a tools for developing AR application that supported by Qualcomm. It is integrated in Unity3D, that's a plus point as the development only need one software to make an apps. It used for registering the marker for marker-based Augmented Reality. It also used for augmenting virtual objects to the marker.

B. Developing Applications of AR

The development process make the final product of the application utilize most of AR functions. Fig. 5 show us the flow process of the application. First you need to scan the possible marker via the apps, after that the application will show you the virtual data that stored in the marker.

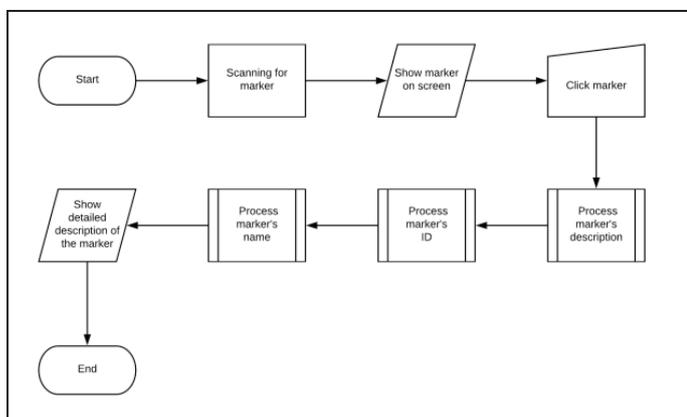


Fig. 4: Flow of Application Design

C. Application Showcase

An image (Universitas Mercubuana Logo) was used as a marker and the virtual information is UMB profile video. Fig. 7 shows

how to use the apps and scanning the marker. Camera track the marker, obtain the data and show it to user. It show the data by rendering the 3D object and video on it's internal data. The key for AR application to work is image recognition, that's why we use NFT image as a marker [15]. From the testing we know that as long as you already scan the marker and the virtual data already showed up on the screen of the mobile phone, you can move as far as you could, provided the camera still pointed at the marker, and you still can see the virtual data stored in the marker.

When we test the marker and try to scan it, we found that the marker could only be scan 2 meters at maximum distance if the marker on the screen of laptop or PC, but if printed on A4 paper, we could scan it for 3,5 meters maximum. After the marker was scan by the apps, there's no need to worry about distance, as long as the camera pointing to the marker, the virtual data will keep showing up on the screen. But the farther you are, the smaller virtual data will become. This is happen because the virtual data stored in the marker will show up depend on the size of the marker.



Fig. 5: Example Marker

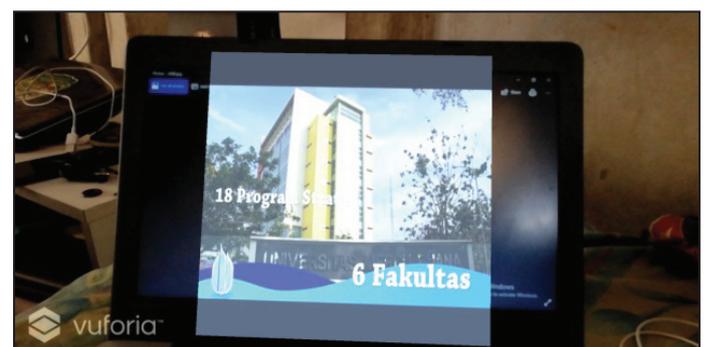


Fig. 6: In App Test of AR Feature

IV. Conclusion

Augmented Reality is a technology that has been used for many purposes on diverse subject such as medical, military, navigation and so on. AR also used in many platform, one of the platform that easiest to use AR is mobile phone. In this paper, we analyzed the usage of AR technology on mobile phone especially on Android for promoting businesses. One of the prominent way to promote business, at least in Indonesia, is via booth in certain event. We used Natural Feature Tracking (NFT) approach as it's the easiest

to use for businesses. NFT is a good, easy to scan marker as long as the image isn't damage in any way. On the other side, NFT could only be scan at certain angle, it will be a constraint if used on booth that have many visitors. In the future research we have to work on multi angle of the marker by using another marker such as markerless (GPS) or 3D physical object

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Indrawan is an undergraduate student in Mercu Buana University. Currently he is interested in researching in Mobile Application Development, Artificial Intelligence and Mixed Reality.



Desi Ramayanti received his B.S. degree in Computer Science from Universitas Putra Indonesia "YPTK" Padang, the M.T. degree in Electro from Sekolah Teknik Elektro dan Informatika (STEI) Institut Teknologi Bandung (ITB), Bandung, Indonesia. He was a lecturer at STMIK Indonesia Padang in 2003, AMIK Tri Dharma in 2005 and Universitas Mercu Buana since 2010. She lectured Basic Programming, Database Algorithm, Computer Architecture and Operating System. At present, she is engaged in researching Artificial Neural Network.