Vocaloid Concert with Augmented Reality

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Abstract—**Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. Augmented Reality become popular in the past 3 years. Up until now, people use Augmented Reality only to build games. However one can make something bigger than that using Augmented Reality, for example music concert or application for election. The basic of Augmented Reality is creating an image target and then we recognize it with simple image recognition. If the image target is found, then we show the model or do specific action to the user. From this principle and computer science background, the author created a simple vocaloid concert with augmented reality using Hatsune Miku as the model. The work in this paper is about augmented reality for modeling a music concert and from this paper, the author wants to inspire the reader about future use of augmented reality.**

Keywords—Augmented Reality; vocaloid; image target; image recognition.

I. INTRODUCTION

Music Concert usually held onsite and the audience must pay the ticket in order to watch it. In Japan, there are 2D characters that can perform the music concert from the monitor screen in the stage using a special sound synthesizer called vocaloid. Vocaloid concert is very popular especially in Indonesia and Japan itself. Many people pay a large amount of money in order to watch it. Now, what if vocaloid concert can be augmented using augmented reality. Audience can see the singer lively not from the screen in the stage, this may give a delightful experience for those people. From this statement, the author decided to make a simple vocaloid concert with augmented reality and see if this approach works.

Augmented Reality read the data from its environment and based on that, the software manipulate object to be appear in the scene. For this paper, the author using Vuforia SDK for Unity to manage the image target. For modeling the concert and event handler, the author use Unity 5 as the engine. Many developers and engineers around the world already do this method, but most of it, is only to make a game. In this paper, the author will show his work at this topic and hopefully will inspire the reader about future use of augmented reality.

II. LITERATURE STUDY

A. Augmented Reality Terminology

According to Sanni Siltanen (2012, p. 16), Augmented Reality combines real world and digital data. At present, most AR uses live video images. In other words, the system augments the image with digital data. The term Augmented Reality first introduced by Tom Caudell in 1992. He is a researcher at aircraft manufacturer. The term Augmented Reality applied to a head-mounted display that guided workers in assembling large bundles of electrical wires.

First presentations about Augmented Reality appears in the special issue of *Communication of ACM,* July 1993. So far, there are 3 strategies to augment something :

1. **Augment the user**

   The user wears device that can capture and augments the physical object.

2. **Augment the physical object**

   Physical object is changed by embedding input, output or computational devices on or within it.

3. **Augment the environment around user and physical object**

   Collect information from the environment, display the information onto objects and capturing information about user interaction with them.

(Wendy E. Mackay, n.d.)

B. Marker Based Tracking

A simple Augmented Reality (will be abbreviated as AR from now on) consists of : image target, computational unit and a camera. Simply said, the camera captures the image target and send it to computational unit. Computational unit then augments virtual objects on the top of that image target as the result.
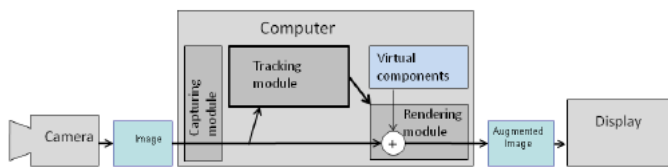
Figure 1 Augmented Reality Process

The core of the process is the Tracking Module, it calculates six degrees of freedom of the camera in real time, i.e the rotation and transformation. After that, the rendering module will draw the image onto the virtual camera. This is the trick of AR. Instead of projecting the 3D model to the real camera, it projected into virtual camera. Virtual camera is a camera that identical to the real camera, the process to make it mimic the real camera is called camera calibration. Camera calibration can be part of AR or in the separate process of AR. There are many tools and library out there that can help us to do the calibration, ex : OpenCV, Matlab, Vuforia (the author use it), ARToolkit, etc.

C. Vocaloid Augmented Reality Applications

AR technologies is beneficial in many areas, especially for visualization, trainings, assembly and multimedia. For music concert especially vocaloid concert, AR can be used to display the singer in the 3D space. Recent works nowadays have been able to do that but there's no publication about it, people only shows what they make and not share it public. Also for the model, many people actually just use Unity-chan (one of the asset in Unity that models the idol singer) that already have all kind of animation for concert.
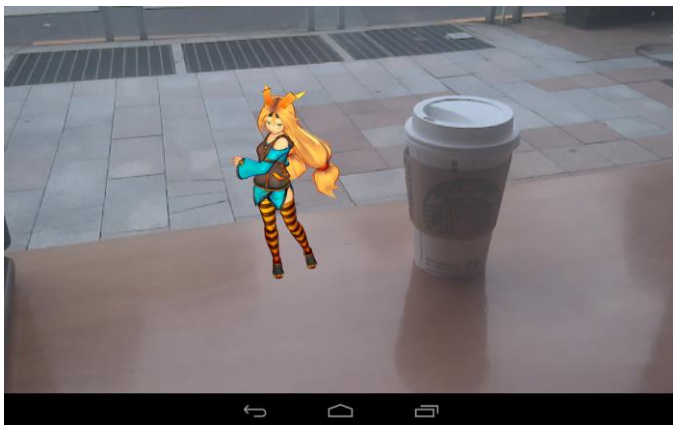

Figure 2 AR using Unity-chan

III. THE PROPOSED METHOD

The method use in this works, involved converting 2D image into an MMD (3D Object for Hatsune Miku that can embedded by animation and audio source). After that we create an image database using Vuforia, and then load it to the Unity. The last thing to do is map the image target with the 3D model that we create in the first step.

A. Converting into MMD

In this work, author doesn't use Unity-chan or another pre-build asset. This work simply using Hatsune Miku as the model. So, it starts with converting 2D model of Hatsune Miku into MMD (Miku-Miku Dance) model. We convert it to the MMD model because recently this is the only way to convert our 2D model into 3D model humanoid. The model created in this process can be embedded by animation file and audio source.

B. Creating an image target database

Next step, we need to define the image target for the system in order to recognize and augment our Hatsune Miku model. We can do this by visiting Vuforia developer sites and register our projects there. After register and get the license key from there, we can define our image database. We can add as many as image target to the database and after that we can download it as asset package.

C. Map the image target

The final and the most important step is to load the image target and map it with the Hatsune Miku model. The goal of this process is to make the rendering module works and produce the augmented image to the display. Select the image target from previous step and add Hatsune Miku object onto it. Now the model is ready and what left is to calibrating camera. Calibrating camera also make sure the virtual camera can render and read the data from tracking module.

IV. RESULTS

After build the application for about 3 days, the result given is quite good. Although there's some error and build failure in the process because of android settings in Unity that obsolete, the AR technology itself still works very well. Author also create some button to make easier for user to navigate through the application. The buttons in this application most likely for reset the concert, exit application and play songs. In this beta version, only one song can be played by Hatsune Miku. In the future, author will expand it by using songs database.
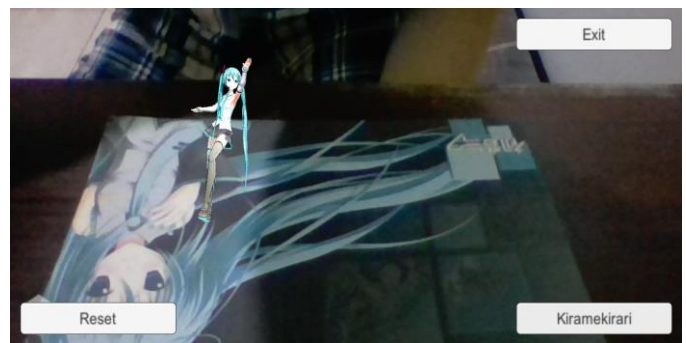

Figure 3 Hatsune Miku AR Concert

To start the concert, user simply just press the song button and then Hatsune Miku will appear and sing that song. If user wants to reset the concert, just simply press the reset button and the concert will stopped, Miku then will be disappeared.

CONCLUSION

In this paper, author already show his work against Vocaloid Concert using Augmented Reality. The concert plays smoothly and bug free, this give a unique and new experience for audience.

The future work for author is to implement database for songs, so Miku can play more than one song in concert.

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STATEMENT

I hereby declare that the paper I wrote is my own work. It is not a copy nor a translation of someone else's paper, and not a plagiarism.

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