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3D Virtual Character Design to Enhance YouTube Viewer Attention Using Motion Capture Techniques

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Abstract

In today's era of technology development, video as entertainment is popular among various groups of people; such videos can be watched from platforms such as YouTube. But some YouTube video creations require the video creator to show their face to make the video more interesting. In this study, the author aims to design a virtual character as a substitute appearance for the content creators who feel embarrassed to show their faces and as a measurement to prevent doxxing (privacy violations) that occurs to tons of video content creators. For the Vtuber (virtual YouTuber) movement process, the author plans to apply motion capture techniques. The motion capture technique itself is a technique where the computer captures movements that later will be converted into data by the computer, and the data then will be applied to move the character. With the existence of technology called Vtuber, the author wants to show that someone can create video content without having to show themselves to many people and overcome embarrassment and also as a prevention against doxxing.

Keywords: *Doxxing*, *Motion Capture*, *Vtuber, Osc/Vmc Protocol.*

1. Introduction

Currently in todays age and time, video content is quite popular for many people, both as a job or entertainment. The various videos often varies with different types of genre such as cooking, dancing, playing a game, and others. with this development, many people aspire to be video creators. However, some people do feel embarrassed to show their faces in front of the camera and expose themselves due to shyness and fear of their privacy being compromised.

A person's fear of appearing online is initially triggered by doxing, which comes from the word "dox," an abbreviation for "documents." Doxing is an internet-based action to research and publicly disseminate personal information (including private data) about an individual or organization [1]. The rapid development of society presents challenges related to privacy due to the increasing need for self-disclosure at both interpersonal and organizational levels. But we need to know that in reality, privacy data on the internet can pose a criminal threat to ourselves and our families [2], such as extortion or stalking.

Since 2020, the Virtual YouTuber or Vtuber trend has started to become popular in Indonesia. A Vtuber is a YouTuber who uses a virtual avatar created with computer-generated imagery (CGI) technology. Initially, this trend originated in Japan in the mid-2010s, with the majority of Vtubers speaking Japanese and live streaming on YouTube using anime-inspired avatars. The popularity of Vtubers has increased globally due to a growing number of fans. [3] A famous example of a Virtual Youtuber from Indonesia is Kobo Kanaeru. A virtual character doesn't need to reveal their true identity to their audience and can use virtual animation as a substitute for themselves. In Indonesia, public interest in virtual YouTubers is currently increasing dramatically. With the presence of these virtual characters, people who want to create are able to present themselves in the form of content or streaming without fear of their personal privacy being exposed.[2]

The virtual characters used can be 2D or 3D, and the applications used in virtual character models are also diverse depending on how they are created. [4] Virtual characters can be created using applications like Blender or Vroid Studio. However, the movements tend to be static. So there was a case of a Thailand vtuber named dacapo who held a concert performance using virtual characters, which drew criticism from the general public. This event impact the psychological state of the person behind the character.

Therefore, the author intends to use motion capture techniques or a human motion capture system. To make character movements less stiff, motion capture technology is now widely used in various fields such as military, medical applications, robotics, game design, animation, and visual effects (VFX) filmmaking. In the film industry, motion capture means recording the actions of human actors to animate digital

characters into 2D or 3D computer animation models, including faces and fingers, or capturing subtle expressions known as Performance Capture [5].

2. Motion Capture

Motion capture (mocap) is a technology that records the movements of objects or human bodies and converts them into digital data. This data can then be used in animation, film, video games, or various other applications, allowing digital character movements to become more natural and realistic.

Mocap itself is gaining popularity in the entertainment world, especially since the emergence of Virtual YouTubers who create interesting and unique content using 3D animated characters as the main actors. The number of Virtual YouTubers, or Vtubers is increasing over time [5]. Motion capture is used to simplify animation creation, and it also reduces time and cost compared to manual animation. This makes mocap an important technology in the entertainment industry.

Types of Motion Capture:

1. Facial Motion Capture: A motion capture technique specifically used to record facial expressions from models, typically used in films or video games to portray emotions or expressions in characters more deeply. With the technology using face tracking as a link for live streaming activities or creating content that can display emotions and expressions for entertainment, even in different dimensions. [6]
2. Optical Motion Capture: A motion capture technique that uses cameras to capture the position of markers on the model's body in three-dimensional space with lighting and background colors that don't blend with the model. This data is then processed to generate accurate and realistic movements in a digital environment. This technique uses cameras to record the movements and reflective markers are attached to the model's costume. This technology is commonly used in film production.

Types of Optical Motion Capture:

1. Marker-Based: Uses reflective markers attached to the model's body, which are recorded by cameras.
2. Markerless: Does not use markers but instead uses computer algorithms to track body features directly from video.
3. Non-Optical Motion Capture: This type of motion capture technology does not require cameras to record movement. This technique uses sensors or other devices attached directly to the subject's body to track movement. Non-optical motion capture is often used because it is more flexible, does not require a strictly controlled room, and can work without data loss due to visual interference. This technique typically uses sensors like IMUs (Inertial Measurement Units) to track movement without requiring cameras.

Non-Optical Motion Capture Types:

1. Inertial motion capture: Uses Inertial Measurement Unit (IMU) sensors, which detect rotation, acceleration, and orientation to track body movement without requiring cameras.
2. Electromagnetic motion capture: Using an electromagnetic field, this method employs sensors attached to the model's body to track their position and orientation. This method is very sensitive to magnetic interference.
3. Mechanical motion capture: Using mechanical devices such as exoskeleton frames/external skeletons attached to the body to record physical movements.

How Motion Capture Works:

1. Sensor or Marker Placement: The actor wears a special suit equipped with sensors or reflective markers at various points on the body, such as joints. These markers accurately track movement.
2. Motion Recording: Cameras or sensors capture the movement of the marker. The system records the position and orientation data of the marker in three-dimensional space.
3. Data Conversion: The recorded motion data is processed by software to generate the appropriate animation. This data is typically applied to 3D digital character models.
4. Integration: The recorded motion is applied to the digital character within the software to produce a moving character.

3. Research Methods

3.1 Analysis

Based on the analysis conducted by the author, the ideas and concepts are as follows:

1. The designed characters have a backstory.
2. Virtual characters have a mixed concept of humans with objects/animals.
3. The designed characters can move and express themselves.
4. The designed characters have personalities/traits.

These points will be used in the pre-production stage for character design, aiming to make a lasting impression on the audience both in terms of personality and visually/appearance, with the storyboard depicting the characters' backstories.

3.2 Design

The following is the initial character design that will be created in the form of a hand-drawn image as a reference for making the character 3D as well as the background story for the character and a storyboard for introducing the character to the audience.

Fig. 1: Vtuber Candy Character Design

Background story for the creation of the character candy:
on the top corner of the candy store's highest shelf, there was an old glass jar that keep gathering dust. Inside the jar there was one remaining piece of candy with the word "candy" written on its wrapper.
Strawberry and mint-flavored candy watched her friend left the store one by one with happy children every day, but not a single child chose her. she began to wonder if there would ever be a day when she could leave the shop and make the children happy, and she feel happy just by imagining it.
Days turned into weeks and weeks into months. Candy felt forgotten and none of the child would want to choose her. Candy began to think this was because of the mint flavor she had, which gave a cold and spicy sensation that made children dislike her.
Therefore, Candy was determined to make herself sweet so that children would like her.
At night, Candy saw a shooting star outside the store and wished she didn't want to be stuck in a glass jar forever, waiting to melt or be eaten by ants. She said, "I won't give up! I'll show everyone how sweet I am!" In the morning, Candy found herself waking up not in an old and dusty glass jar, but in a strange world called the digital world, with a human appearance and no longer sticky wrappers.
Candy adapted to the digital world and concluded that she had to become a VTuber to show the world how sweet and unique she is. Candy's character is depicted as having childlike, innocent, sweet, never-give-up, and also cute behaviour.

Here is the storyboard for the candy character:

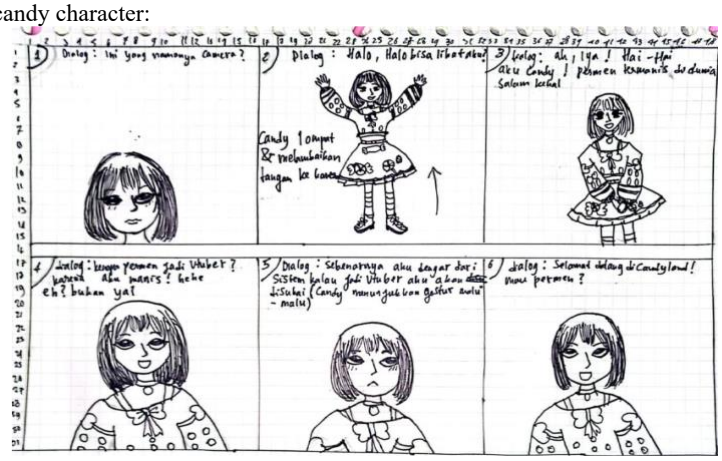

Fig. 2: Storyboard for candy

Here is the character candy's storyboard for her debut teaser as a Vtuber:
1. The video begins with Candy asking if the object in front of her is what is called a camera.
2. This is followed by scene 2, where Candy tries to show her whole body to be recorded by the camera by jumping around and asking if people can see her.
3. In scene 3, Candy introduces herself shyly.
4. Candy explains why she became a Vtuber in scenes 4 and 5.
5. In the final scene 6, Candy welcomes viewers to her YouTube channel.

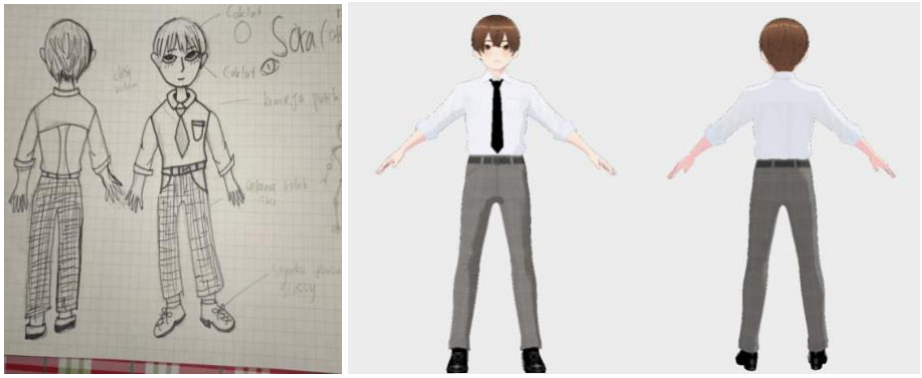

Fig. 3: Vtuber sora Character Design

Background story for the creation of the character Sora:
Sora is an office worker who has only been working for a few months at a game company. In that office, Sora feels the competition among employees is very intense, with pressure from superiors.
Sora kept repeating the same things everyday such as waking up, getting ready, commuting to work crammed in a bus, working overtime, and getting yelled at by her boss. he spent his weekends resting, he repeated this cycle for several week and it turns to months.
Sora felt stressed and tired until one day while he was on the bus, he saw a student watching a video stream of an animated character called a vtuber who was playing a game enthusiastically. Without realizing it, Sora found himself drawn to this vtuber thing. One day, Sora made a mistake in his work that should have been done by his supervisor, causing the company having to perform big maintenance/repairs on Sora's game server. Sora was reprimanded and fired from the company.
On the way home, he thought to himself that he work in a gaming company all this time but had never tried playing any games. Sora thought that he wanted to become a VTuber and that he wanted to try all the existing games and start his career in the VTuber world.
Sora is depicted as having a clumsy, stiff, and nervous personality.

Here is the storyboard for the character Sora:

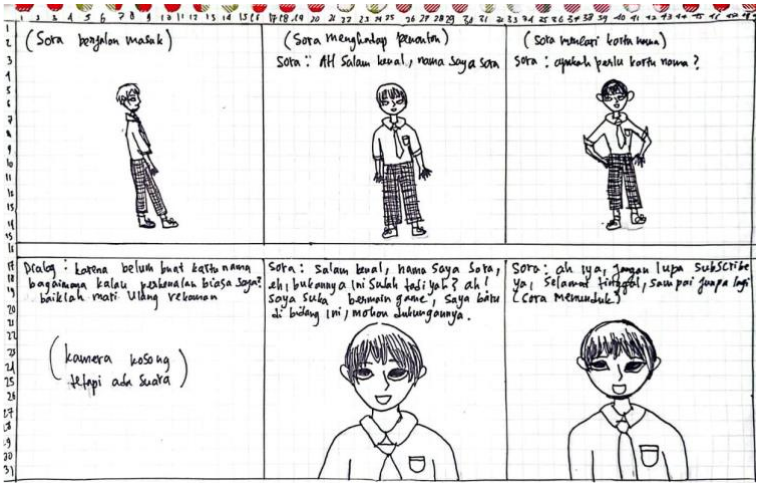

Fig. 4: Storyboard for sora

Here is the storyboard for Sora's character debut teaser as a Vtuber:
1. The video begins with Sora walking into the camera.
2. This is followed by the second scene, where Sora introduces himself.
3. In the third scene, Sora looks for a business card to introduce himself.
4. Scene 4 is empty because Sora forgot to create new business cards for himself as a VTuber and wants to reintroduce himself.
5. In the fifth scene, Sora reintroduces himself.
6. In the sixth scene, Sora says goodbye.

3.2 Motion Capture Implementation

for the implementation phase In VTubing, the Virtual character that's ready to use will be imported into the VSeeFace and ThreeDPoseTracker applications for motion capture.
VSeeFace functions as a display menu that will be recorded and shown to the audience. For the facial expression tracking we will use V See Face, so the parts that are checked are the application general settings will be expressions, eyes, and chin.

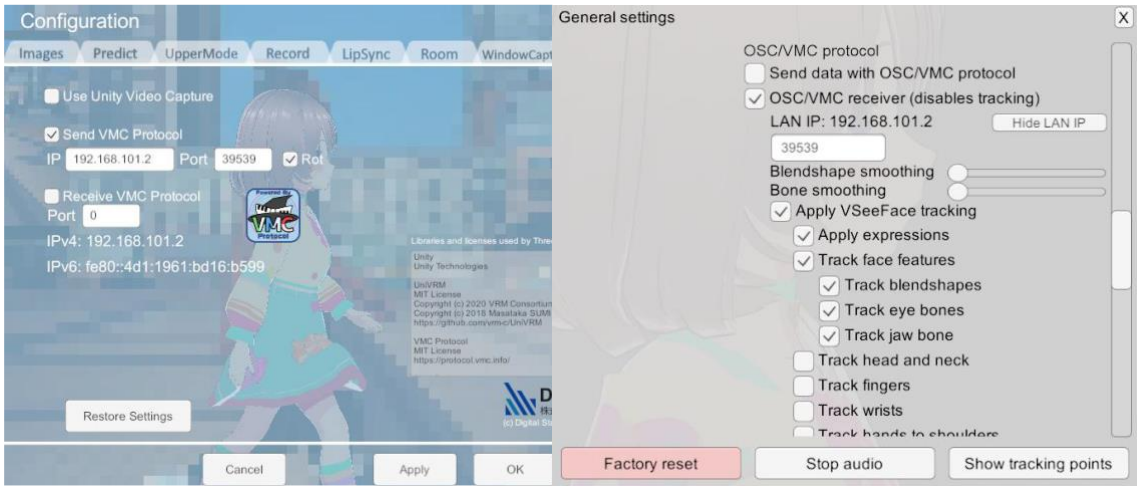

Fig. 5: VSee Face dan Three D Pose Tracker Settings

In the general settings section of the VSee Face application, check the OSC/VMC receiver and match the IP address with the port in VSee Face and 3D pose tracker in the others menu. This is very important because the movement of the video or camera used in 3D pose tracking will be displayed in the VSeeFace.

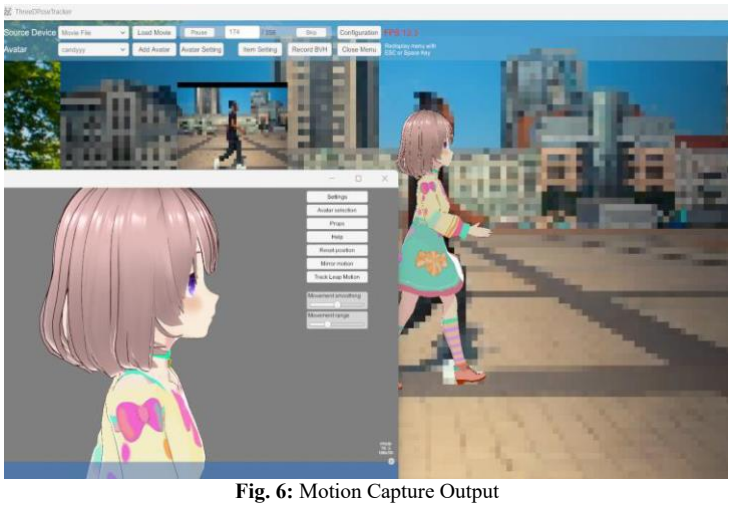

Fig. 6: Motion Capture Output

The OSC/VMC receiver (Open Sound Control receiver/Virtual Motion Capture Protocol) is a motion avatar communication protocol for virtual motion capture, enabling applications such as VSee Face, Three D pose tracking, and DSS Tractor to send/receive movement data for display. In this case, VSee Face functions as the receiver of data from other applications and displays the processed results in the application in the form of movement.

4. Results and Discussion

4.1 Results

4.1.1 Results of the Vtuber candy character introduction video

The introduction video for the Vtuber candy character was created using motion capture techniques through pre-recorded video.

Fig. 7: Candy Introduction Video

4.1.2 Vtuber Sora Character Introduction Video Results

The introduction video for the Vtuber character Sora was created using motion capture techniques applied to pre-recorded video.

Fig. 8: Sora Introduction Video

4.1.3 Number of viewers on each Vtuber character's YouTube account

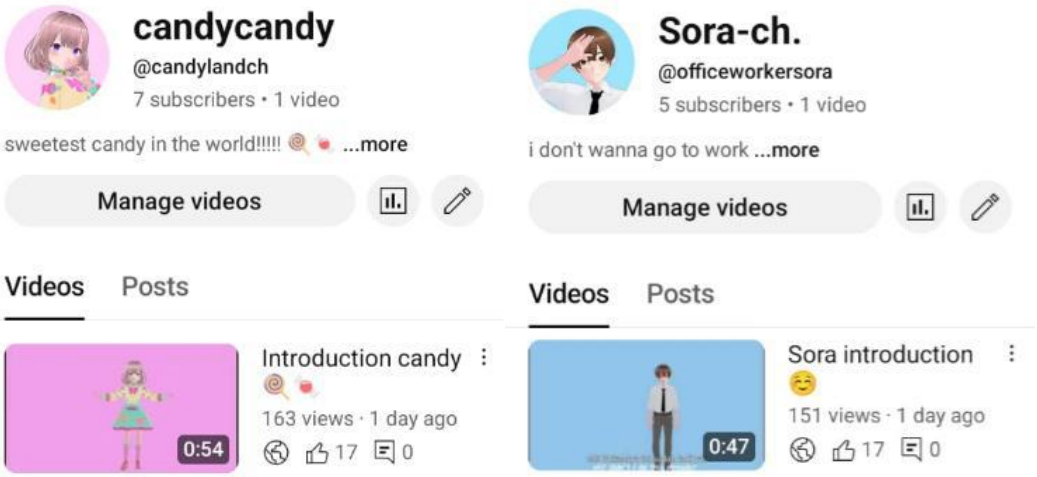

Fig. 9: Youtube Viewers

In 1st day of teaser release, viewers for candy went to 163 views and sora's viewers went to 151 viewers.
The video result can be watched via youtube and here's the link :

4.2 Discussion

The following are the strengths and weaknesses recognized by the author while conducting the research. Here are the strengths and weaknesses of this study.

Advantages:

1. The researcher successfully created a virtual character to replace someone in front of the screen to protecting privacy and overcoming shyness about showing their face to the camera (camera shy).
2. The character is designed according to the author's wishes in terms of both appearance and personality.
3. The implementation of motion tracking through a camera without the need for additional body tracking tools, thus incurring no extra costs during the research.

Disadvantages:

1. Because the motion tracking uses pre-recorded video, it's necessary for the actor to record the movement repeatedly to achieve satisfactory results.
2. Tracking of facial features is still imperfect because laptop cameras have unsatisfactory resolution.
3. At times, the movement looks strange and the body can penetrate clothing if the movements are not done carefully.

4. Conclusion

1. Through the results of the audience survey, the majority of respondents agreed that the use of virtual characters in videos is quite interesting.
2. Through the results of the audience survey, the majority of respondents agreed that the use of virtual characters can prevent doxxing/privacy violations.
3. Using virtual models to create video content can boost confidence in appearing in front of the camera.

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