E-Convocation Website using VR

Amrutha V Deshpande
Dept. of Computer Science and Engineering
K S Institute of Technology
amruthadeshpande292@gmail.com

Chaitra
Dept. of Computer Science and Engineering
K S Institute of Technology
chaitrasharanayya@gmail.com

Lakshmi Prasanna B
Dept. of Computer Science and Engineering
K S Institute of Technology
bodireddylakshmiprasanna@gmail.com

Karthik T. C
Dept. of Computer Science and Engineering
K S Institute of Technology
karthikchandu934@gmail.com

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Abstract - Due to COVID-19 restrictions, the better way of attending graduation is by VIRTUAL GRADUATION where students and staff members from various colleges can attend the annual convocation in their VR models. While the students are not physically present at the dais, they could be seen getting on dais and receiving their graduation degrees with the same enthusiasm.

Key Words: *Virtual Reality, Face Detection and Face Swap*

1. INTRODUCTION

Across the country, due to Covid-19 situations, all the colleges are being forced to do multiple frameworks such as planning from budgets, calendar of events, online learning and more. Casting the graduation ceremony that has to occur on the front end of all that.

Some colleges are planning to cancel or postpone the graduation ceremony. But the math of social distancing doesn't add up to even delayed events being a good solution.

In this pandemic time even if colleges plan to arrange graduation ceremonies offline then there would be huge amount of health risks.

Sanitizing the environment and maintaining the social distancing, and wearing masks. Does everyone tend to wear the masks? Also, few colleges are planning to conduct graduation ceremonies through video conferencing platforms, but to what extent will the students be satisfied? All these would create uncertainty for the students, parents, teachers and other staffs.

Keeping all the above-mentioned points in the mind, we have come up with a solution where colleges can deal with the graduation ceremonies virtually based on Virtual Reality.

Thus, in this pandemic period that uses the technology in hand, our virtual graduation ceremony using VR can be more efficient and progressive.

This project aimed to establish a platform for ceremonies to happen virtually, which is a website for virtual graduation ceremony.

Tools and Technologies used were Python, its frame work Django and Blender tool. This tool was used to create male, professor female 3D models with a stunning graduation attire with an amazing gesture and animation.

Python and Django are used for the backend and frontend of the website. The personalized 3D model of each graduate accepts the degree certificate from the personalized 3D model of the professor on the stage. It would provide the student with the same experience as an in-person event despite the restrictions posed by the pandemic.

2. Methodology

We have built a website where the credentials of all the students are collected and entered into the website such as details of the professor (name, passport size photo and gender) and the students (name, USN, passport size photo and gender).

And then the uploaded passport sized photo is utilized for face-swapping in the rendered Blender 3D male and female animation models based on the gender which depicts exactly same as the student receiving the degree certificate from the professor with the graduation attire. The face swapped video of the 3D models collecting the certificates from the professor will be uploaded back to the website and also can be downloaded by each one of the students of a college.

Here, we had extracted the face from an image, and reconstruct one with similar features in the 3D video. Imagine you had an image of two people and the celebrities dancing and you had to manually edit to make it look like those people in the images are dancing with same surroundings as the celebrities. The complexity of such a task largely depends on how different the two faces should be, without swapping same face to both the individuals at a time.

Firstly, the images of each and every student and the professor should be uploaded separately on the website, then the face detection happens.

For our project we will be using Computer Vision technology (open cv library) and D-lib library. We are using Pygame platform to play the output video along with the audio. The algorithms and models that we will be using for our project are **Shape_predictor 69 points landmark model** to locate the points on the face and **Frontal Face Detector algorithm** for face detection**.** A "Shape predictor 69 points landmark" is trained with iBug 300w dataset which consist of 135 images with highly expressive faces, difficult poses and occlusions. For face detection we will be using Frontal Face Detector algorithm to perform face detection. We are also using **Object Storage** here to store the images and videos in order make the increase the performance of the system. That will be consisting of two 3D model video (male & female 3D model videos). Initially, a user will create a username and upload the images and the details such as USN, Name, Gender and Image of the Student is supposed to be uploaded. After uploading the details such as(USN, name and gender) will be stored in normal database and the image will be stored in the object storage. After that the backend API will go through the details of particular username and look through the details such as gender. After that the API will extract the image and if the gender is male, it will extract the male 3D model video or if it is female, then it will extract female 3D model video. Next, the image and the target video will be sent as an input to the **Job Scheduling**. The job scheduling basically creates jobs. So here our job is face swap. When the image and the target video is sent to job scheduling it stands in a queue which performs in FIFO order. So, the image and video will be sent to the job which gets created and perform face swap. After that, the output video will be sent back to the object storage which creates a URL of the output video and that will again be fetched by the database and will be saved in that particular username, so that the user can download individual video from the URL.

Additional to that there will be an option where the individual video can be merged and played one after the other.

1. The image that the user will upload should be a passport size image only in order to get good clarity face swap.

2. The face in the image should consist of frontal face (i.e., face facing forward).
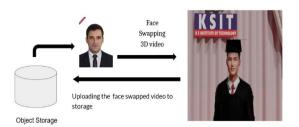
3. Image should not be blurry.

Fig -1: Designing process of the e-convocation project.

Techniques include: -

3.1. Django framework

We used Django as it is high-level Python Web framework, open source which encouraged rapid development and clean, pragmatic design. It also took care of much of hassle of Web development, so we focused on the reinvention and vital features required for the website.

3.1.1. Blender

We used the tool Blender as it is free and an open-source 3D creation suite. It supported in creation of the 3D pipelining, modelling, rigging, animation, simulation, rendering. It well suited for us and got benefit from its unified pipeline and responsive development process which is a cross-platform and runs equally well on Linux, Windows and the models developed are shown in the Figure 2.

Fig -2: Professor and Student 3D models

3.2. Face Detection

For Face Detection we have used dlib's Frontal Face Detector algorithm. This basically estimates the pose and detects the frontal face in the image that will be uploaded by the user and the video that will be sent as an input to the face swap. This will be performed for every frame in the video since a video is a collection of image frames.

The face detector is made using the classic Histogram of Oriented Gradients (HOG) feature combined with a linear classifier, an image pyramid and sliding window detection scheme. After face detection we need to locate the landmarks on the face in order to crop the face part in the image. So, for that here we have used dlib's shape_predictor_69_face_landmarks model to locate the landmarks on the face. The landmarks are the points on the face such as the corners of the mouth, eyebrows, eyes, and so forth.

3.3. Face Swapping

After detecting the face and locating the landmarks, the face swap takes place with the image and the selected video. Face Swapping is a type of activity in which a person's face is swapped with that of another human or animal.

3.3.2. Delaunay Triangulation

One of the steps in face swap is Delaunay triangulation. This will create a triangular mesh on the face by connecting all the points that's located by Shape Predictor 69 landmarks model. This creates smaller triangles on the face which allows us to divide the face into smaller parts.

3.3.3. Affine Warp Triangles

The next step in face alignment is to consider corresponding triangles between the source face and the target face, and affine warp the source face triangle onto the target face. Aligning the face and placing one face on top of the other hardly looks unnatural because of this method.

3.3.4. Alpha Blending

It's the process of merging a picture with a background to provide the impression of partial or complete transparency. It returns the result image which will be the sum of source image and frames captured from the destination video. And then, the face swap takes place with the video.

3.3.5. MinIO Object Storage

We employed it as an object storage system that separates data into smaller pieces and distributes them across numerous discs, providing redundancy and protection against disc failure. This is primarily used to store image and video files. We have used it in order to increase the performance of our system and not make the process slow. Since it is used only to store image and video files, we have also used it to store our 3D model videos and

images uploaded by the user. This creates a URL of an image and video and that will be extracted by the database on successful establishment of communication.

Here is the workflow of the project.

In the website, the user first needs to create a username. After successful creation of username the user must upload the details and image.
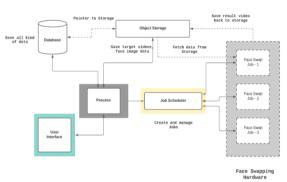

Fig -3: System Architecture of the e-convocation project

1. The User Interface includes creation of the username, uploading of the required details of the user such as USN, name, gender and image of a student and image of the professor which will be fixed.

2. The details such as USN, name and gender will be sent to the database by the use of backend API and gets stored in that particular username.

3. The image uploaded will be sent to the object storage and get stored there which creates a URL of that image. The database will extract the URL of the image and gets stored in database.

4. Next, the backend API will go through the details of the students (i.e., gender) and extract the image and depending of the gender mentioned it will extract the target video from the object storage.

5. The backend API will send the extracted data (image and video) as input to the job scheduling.

6. The job scheduling will create the jobs and performs face swap.

7. The output video will be sent back to object storage and that creates the URL and which will be sent to the database and gets stored.

8. The user will be able to download individual video by clicking on the URL.

9. There will also be an option to merge multiple videos to play each video back to back.

Fig -4: Face-swapped 3D models

3. CONCLUSIONS

Our project, a virtual graduation ceremony platform is certain in this pandemic period which utilizes the technology in hand, can be more efficient and progressive. This project accomplished to establish a platform for ceremonies to happen virtually along with the participation of each and every individual.

Colleges can arrange graduation ceremonies online, then there would not be huge gathering in this pandemic time.

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