Team #37 Dental Health Monitoring System

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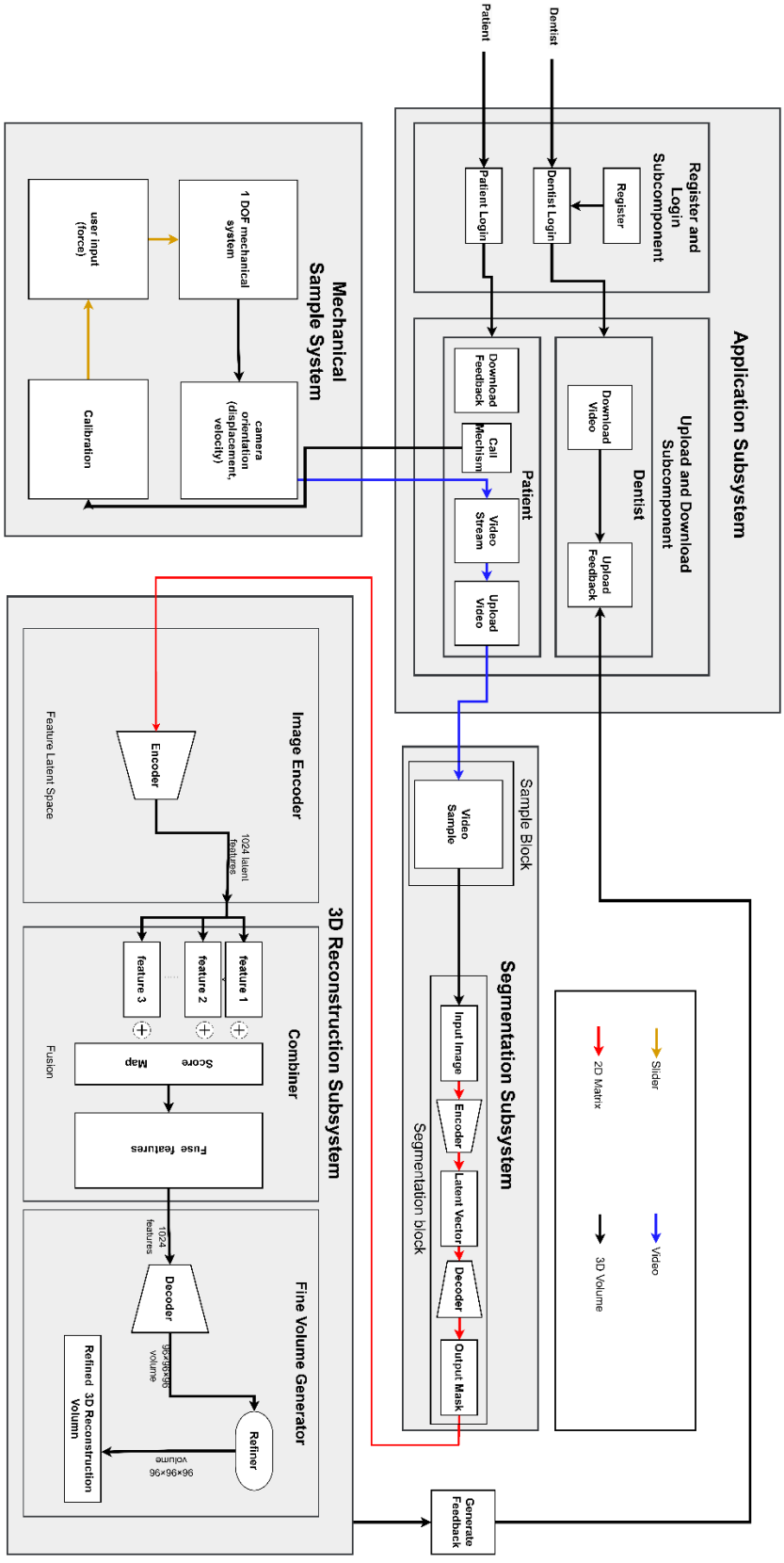
1 Block Diagram



2 High-level Requirements List

Requirement 1. For the physical part, the total mass of the system should be around 500g to make the user easy to hold; the force required for user to adjust the system should not be larger than 1 Newton to make the use convenient. The structure must have a safety factor of at least 10, which is calculated from the largest von mises stress in FEA analysis.

Requirement 2. The segmentation algorithm obtains the accuracy better than that directly applied to nature image processing algorithm.

Requirement 3. The 3D reconstruction algorithm obtains the accuracy better than that directly applied (by the baseline).

3 Points Summary Table

Mechanical Sample Subsystem

Requirements	Verifications	Points
1 degree of freedom	From certain orientations, rotate the threads 20 times clockwise and 20 times counterclockwise, test if the final orientation is the same as the initial orientation	4
Correct location of the placement of the system	For 4 members in the group, we install the matcher into our face, and use centimeters to test the accuracy of the placement of the system. A desirable situation is that the centerline of the system is within 1mm the centerline of human face.	4
Self-locked system orientation	As we use threads to control the orientation of the system to the mouth. An easy way to test is to first make the threads vertical, and then install a nut on the threads. If the nut does not slip down, the requirement is satisfied	1
Invulnerable to shaking	For the steel rods, it will be tested as a cantilevered beam. We give an approximately 1Nm*s impulse on the free end of the beam, which will typically cause the beam to vibrate. When the maximum amplitude of the response is within 1mm, the requirement is satisfied. Also, when the phone is installed on the crab, the phone is locked by springs. We will put the system on a soft material to prevent falling, and then start shaking the mechanical system. The objective is that we want to make sure the phone will not fall due to shaking of human hands.	4

Segmentation Subsystem

Sample

Requirements	Verifications	Points

1. Sample part should successfully sample video.	1. a. The code must execute without bugs 2. visualize the images to test whether we successfully slice the video.	5

Segmentation

Requirements	Verifications	Points
1. Segmentation should make pixelwise predictions with high accuracy. 2. Segmentation should successfully extract teeth from background which means it should combine the mask with original images	1. a. The code must execute without bugs. b. When tested by test set, the metric IoU of teeth must above 50. 2. a. visualize the output from segmentation part to show it can combine mask with original images.	10

3D Reconstruction Subsystem

Requirements	Verifications	Points
1 generate the Final refined 3D model of its origin 2D feature with mAP>0.5 (at IoU=0.4), and final loss < 0.05	1. A. Input the test dataset images B. Calculate the averaged 3D mAP of outputs C. Calculate the loss function D. Observe the shape of loss curve and the final level value of it	10

Application Subsystem (This is the extra subsystem we made after the design document, so no RV table at that time.)

Requirements	Verifications	Points
Have register and login function	Everyone can register patient account but cannot register dentist account. Everyone can login successfully by providing correct account and password.	4
Upload and download function for patient	The patient can upload the video to the cloud server and can download the feedback from the cloud server by inputting correct id.	4
Upload and download function for dentist	The dentist can download the video from the cloud server by inputting correct id and can upload the feedback to the cloud server.	4