

CS2310 Course Project Final Report

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Emotional Body Visualization

In this project, I implemented a gesture based health care system to enhance current home care system by automatically monitor patient health status. Based on predefined gestures, the system will identify pain on different part of the body, then argument the camera image by virtual objects. Different degree of pain is recognized and visualized by changing the color and size of the objects.

I. Motivation

Home Care is health care or supportive care provided in the patient's home by healthcare professionals. To monitor the health status of patients, traditional approaches need either ask professionals to monitor the patient which introduces high overhead or only provide the patient some ways to notify emergency event which is not efficient when the patient is not able to make notification, e.g. the patient faints. Thus, we proposed natural gesture based health care system, which automatically identify body pain of the patient, and augment the camera image to notify professionals. The professionals then can use the webcam to monitor the patient and tell whether he/she is in good status by check the virtual object.

II. Methodology

Challenge	Solution
Visualize pain	Use colored virtual object
Visualize location of pain	Draw different part of body
Visualize degrees of pain	Change size and color
Pain may disappear	Color fade out
Pain is disappeared	Cancel gesture

Table 1. Challenges and Solutions

The table above shows the challenges needed to handle to implement the system and the solutions we implemented. We use colored virtual object draw on a particular part of the body to represent pain at there. For different degree of pains, we change the color and size of the object. If the pain becomes severe, the object becomes larger and its color turns to be red. Otherwise, the object becomes smaller and its color turns to green and then disappears eventually. If the patient found the pain disappears, he can issue a cancel gesture to remove the virtual object instead of wait it to disappear.

III. Implementation

OpenGL is used to make the visualization happen. OpenGL is a standard specification defining a cross-language, cross-platform API for writing applications that produce 2D and 3D computer graphics. By using its APIs we are able to draw 2D or 3D graphics onto our screen.

Two classes is implemented HeadacheRenderer, ChestpainRenderer. The former is responded for render headache and the latter is responded for render chest pain.

The visualization logic goes like this,

1. Obtain camera image data from Kinect device
2. Obtain gesture detect state from our detection module
 - a. Obtain target location to argument
3. Draw virtual object onto the image
 - a. Draw a GL_QUADS by specify the coordinates of its 4 vertexes
 - b. Color this Object use texture
 - i. Read the texture
 - ii. Set its color
 - iii. Combine the texture and the color, then draw on the surface of the object

The color is set using RGB vector below,

```
< alpha>0.5?alpha:1 , 1-2*abs(0.5-alpha), 0, alpha>
```

In which alpha represent the degree of pain, so the color will change according to the degree of pain.

Then the texture and color are combined through

```
m_rctx->shaderMan->
```

```
UseStockShader(GLT_SHADER_TEXTURE_MODULATE, m_rctx->
```

```
transform.GetModelViewProjectionMatrix(), color, 0);
```

```
glBindTexture(GL_TEXTURE_2D, m_colorTextureID);
```

IV Demo

You could find online demo on [Youtube](#). I'll also put some screenshot below.



The figures above show effects of the headache rendering. We can see the color from white, change to small green and large red.



These figures show the effects of chest pain rendering. The color again changes from white to small green and large red.

If the patient stops the identified gesture, the color will fade away automatically. The patient can also remove the color manually by up one of its hand.

V Future Works

The power of 3D visualization is now fully displayed on current implementation. To augment the system with 3D feature we need to

1. Draw 3D object by specifying the coordinates of all its vertexes.

2. Render texture (color) onto the surface of the 3D object

3. Projection that object to the camera view (matrix transformation)

In the future version of the system, we'll use 3D objects to represent pain, and make the object grow in 3 dimensional to represent degree of pain.

VI Conclusion

In this project I implemented a gesture based health care system to enhance current home care system by automatically monitor patient health status. Using this system the professionals can easily tell whether there is a pain in the patient's body by the visualized image. This will make patient monitor easier and more efficient.