A Study on Smart User Interface Platform of Industrial Equipment using Shader Effects

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Abstract. Techniques to develop and express of a user interface is diversified and developments for user interfaces are in process for PCs and MMIs for industrial devices. However, the common platform applicable to MMIs for PC based industrial devices is not formed, yet. Therefore, this study aims to design and to propose of a platform to apply such user interface technology to MMIs of industrial devices and to propose advanced user interface technology that applies the shader effect supporting the hardware acceleration.

Keywords: UI, Shade Effect, Industrial Equipment

1 Introduction

Introductions of smart phones and tablet PCs have changed the paradigm of software development from focusing on the simple function development to focusing on the user experience, that is, UX/UI. Following the improvement of the PC performance and the development of OS for industrial devices, the user’s demand for user interface is also increasing so that the responses from device makers become more faster. Especially, since touch panels are frequently used for HMI (Human Machine Interface) of industrial devices, touch panels would be an adequate environment to provide the convenience and the similar user environment with existing mobile platforms. In this study, the interface effect which has been complicated or impossible with existing development languages become possible to implement by applying the shader technology that is mainly used for image effects to such HMI’s user interface development.

2 The Transformation in User Interface

Nowadays, the technology to implement interesting user interfaces by applying various transformation effects to such software is developed. As the most
representative case, Microsoft’s WPF is used most universally [1]. And, Adobe’s Flash and HTML 5 are under development for the web based technology [2]. Such technologies provide libraries commonly to change user interface elements. Therefore, the Affine transformation algorithm is employed to implement such user interface transformation effect in industrial devices’ HMI as well. Affine transformation is a transformation for corresponding a vector space to other vector space, and is formed with the combination of the linear transformation and the parallel translation transformation. When it is assumed that A is a matrix, and x and b are vectors, the Affine transformation becomes as under:

\[ T(x) = Ax + b \tag{1} \]

If this transformation is used, translation, scale and rotation transformations become available and the transformation effect can be applied rapidly to the user interface.

In case of using such Affine transition, an effective transformation are available in a rapid speed. But, since it is limited to uniformed and simple effects due to the nature of this transformation, the method has the disadvantage interrupting user interface developers for free transformations. Therefore, various transformations which are impossible with Affine transformation are attempted by combining the shader effect to such Affine transformation.

3 Transformation based on shader

Shader is used to program the rendering pipeline available for the program of the graphic process unit mostly for the image processing or the special effects of game [3]. Since transformations can be applied freely with the Shader based on the desired algorithm, it has advantages to maximize the transformation effect when applied to the transformation of the user interface. Therefore, existing developers provide such Shader technology. However, it is a little heavy and has a limit on application to apply to HMIs for industrial devices. Therefore, in this study, the shade technology is made to be available to user interface elements following the flow as shown in figure 2.

This flow has advantages for the possibility of rapid and immediate transformation since the heavy control based transformation is transformed to image and so this method is a suitable method to apply to industrial device HMIs.
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This example shows the implementation of animation effect using the blind effect to existing buttons by using the library implemented with such flow. The first button is separated as three areas according to the blind effect, and the areas are recovered to original shapes as time flows. With animation effect, interface effects inducing interests of users may be implemented.

Fig. 2. The Suggestion Flow for Shader Application

4 Combination of Affine transformation and Shader

Shader allows the application of free transformation. However, for the reduction and the rotation of screen, Affine transformation is somewhat more convenient to use so that if the two techniques are mixed, more various transformation effects may be
achieved. The following figure shows a mix of the rotation Affine transformation and the screen split Shader.

![Fig. 4. A Mix of Affine transformation and Shader for Screen Split]

5 Conclusion

Since HMI performs the role as the passage connecting users and industrial devices, various transformation effects of the user interface can become a measure to provide desired functions rapidly and accurately. Especially, many effects which have been applied to existing images in Shader, it is expected that various user interface transformation effects can be implemented by using Shader. Although it is a little simple, Affine transformation is expected for allowing various effects to the user interface if the three transformations of rotation, scale and transition are properly utilized. However, it is currently limited to simple controls such as buttons and images and is lack of various properties and functions which basically required for controls. In this study, the interface effect which has been complicated or impossible with existing development languages become possible to implement by applying the Shader technology that is mainly used for image effects to such HMI's user interface development.

References