Ground View from Underground Space using 360 image

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Underground Space is more and more complicated. Underground space is un-visible from ground space, so if you're there, you have to rely on sign system, maps, or digital devices. However, display technology is developing, for example, projection mapping and digital signage. We can use these devices, instead of conventional tools. Then, I suggest method of ground-space-expression by making 360 merge photo image.
There are some Ground-space-expression method, for example, ground map for cell or floor in underground space, and side view for internal surface. Reduction or default image is available. We can choose expression methods and display space.
Next, considering underground space user, expression scene is considerable. There are 2 expression scenes, stand and sequence scene. Stand scene means that people see fixed landscape, but sequence scene, people are walking and seeing sequence landscape. We can choose 2 expression method, expression a space or expression along isle or underground space entirely. Here I show stand scene that is more imageable, because information is collected. I made merged 360 image, and considered ground-space-expression method.
Research target is Shibuya station, where is recently redeveloped. Target underground space is blow-by space of platform of Tokyo Metro Fukutoshin Line and Tokyu Toyoko Line, which is the deepest space in Shibuya. The depth of the platform is average 30m[1], this blow-by space is under of Meiji Street, and is just infront of Shibuya Hikarie, a big shopping building, referring to Yahoo Map. Then, projecting ground-space view on the cell of the blow-by space is considered. The skyway from Shibuya Hikarie is just above of Blow-by space, I displaced view point a little bit southern side. Then, expressing surround buildings, including the skyway and Shibuya station, and the top of Shibuya Hikarie, super wide view photo is desirable. But even if you have fish-eye camera, as there are many barrier for taking low angle photo, you wouldn't be able to take photo those building. And you can make 360 image by your own camera, but you can't enter center of roadway on your foot, Meiji street, only you can do is taking photo from curb side, then one side building is expressed big, the other side is small. Carside 360 view is needed, so I used Google Street View.
Eight parts capture of Google Street View 360 degree, horizontally close, from the same point, were taken. These parts are merged to an oblong image by image processing software. Next, I converted the image as rectangular coordinate to polar coordinate. The image became like daunt, but height was so reduced. Then, spherical correction was applied, the height was larger.
But the top of Shibuya Hikarie was lacked, so I repeated this method more high angle, and merged the image to the previous image. The 360 image was completed.
The 360 image itself has no space-image-ability. So I merged the completed image to the photo of the blow-by space. Shibuya Hikarie is role as a landmark and surround buildings make positional relationship clear, but there are some barrier. Especially, buses near Shibuya station are expressed too large. The too large buses make positional relationship complicated. Size balance have to be considered.
To aware space image for the user of underground space, detail of ground space is unnecessary, only high-image-ability expression is needed. We don't have to dwell on the real, we have to consider image-ability at the center, unnecessary detail have to be considered. We have to consider method of deleting noise and large balance.

Bibliography
[1] Kajima Construction HP
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図1　地上表現画像

Fig.1 Ground expression at Shibuya Station

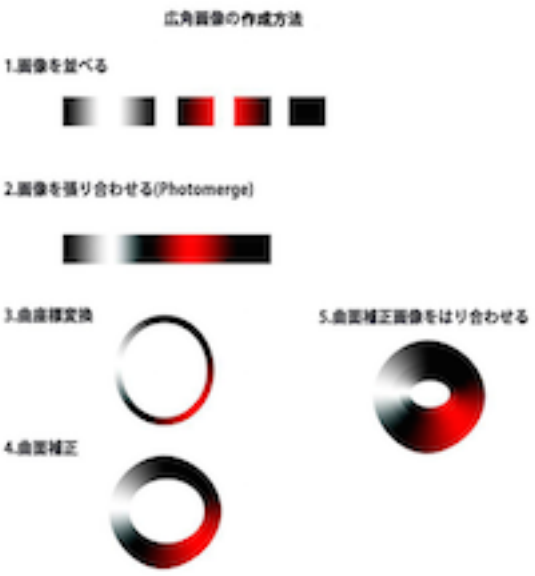

図2　画像作成手順

Fig.2 The order of processing

図3　実空間画像との合成

Fig.3 Merging to Real Space Image

