Source	**Poznań University of Technology (Poznan),**
	Electronics and Telecommunications Research Institute (ETRI)
Status	**Input**
Title	**Proposed test materials for 3DoF+ or Omnidirectional 6DoF**
Authors	**Olgierd Stankiewicz (1), Krzysztof Wegner (1), Adrian Dziembowski (1), Mateusz Lorkiewicz (1), Gwangsoon Lee (2), Jeongil Seo (2), Marek Domański (1)**

(1) – Poznań University of Technology, Chair of Multimedia Telecommunications and Microelectronics, Poland.

(2) – Electronics and Telecommunications Research Institute, Korea.

1. Introduction

Omnidirectional video formats are currently considered within MPEG in the context of prospective Omnidirectional 6DoF/3DoF+ video technology. As it has been shown in previous documents [1,2,3] it is possible to use Depth Image Based Rendering (DIBR) pipeline, previously considered in the context of 3DTV and Free Viewpoint Television. Further research is however hindered by the lack of test materials. Therefore in this paper we provide four new 3D scenes created in Blender [4]. The scenes are developed order to provide the visual material to render rectangular flat view images and omnidirectional images.

2. Scenes

All of the test scenes has been prepared with the use of Blender software [4.2] in version 2.79. Whereas the geometry of the objects is kept inside the Blender ".blend" file, the textures are kept outside in relative path, e.g. "\textures\". The scenes that we have prepared are composed of:
- Objects,
- Lights,
- Preliminary setting of the cameras (center, left, right, panoramical omnidirectional 360 camera),
- Node-graph for rendering of image and depth.

We have prepared 4 test scenes: "Space 360", "House 360", "People 360", and "Blocks 360". Using the Blender scene description we have rendered exemplary images that are presented in Figs. 1-4. Of course, additional views may be also rendered, e.g. as required for particular needs during next stages of the standardization project.

The **"Space 360'** scene consists of background (distant stars) and simple disjoint objects in the foreground. One of these objects is a white rocket with red elements and with yellow wire in behind. The other objects are just asteroids drifting in the space. The objects do not interact with each other, so therefore this scene should be relatively simple to analyze and to use with various 3D scene representations. Therefore, this is bottom-line example in which most of tested 3D representations should give satisfactory effects.
The size of the whole source data (".blend" Blender file and textures) related to this scene is about 40 MB.

The **"House 360"** scene is an outdoor view. In the main view there is a house standing next to a three. In the very front of the scene there is a carpet surrounded by two plants. The ground is covered with some grass. On the sky, which is blue, there are some white clouds.
The size of the whole source data (".blend" Blender file and textures) related to this scene is about 300 MB.

The scene **"People 360'** is placed in a meeting room, in which there are some people.
The room has tiled floor and white ceiling covered with lights. One of the walls is from bricks and the others are white-painted and covered with paintings.
The main focus of the scene is on two people who are standing in the middle of the room and shaking hands. These people are at slightly different distances from the cameras and are connected by shake of their hands. Other people are standing around, except for one lady who is sitting on a stool in corner of the room.
The size of the whole source data (".blend" Blender file and textures) related to this scene is about 150 MB.

The last of prepared scenes – **"Blocks 360"** - focuses on a set of blocks placed on a table. The blocks have different colors and letters imprinted on them. Some of them re placed on top of others. The area of 3DoF+ motion is designed so that the viewer is able to see the blocks from the lefty side and from the right side.
Apart from the blocks on the table, there are also some chairs, doors and paintings on the walls of the room. Also behind the viewer, there are windows allowing to look on some skyscrapers.
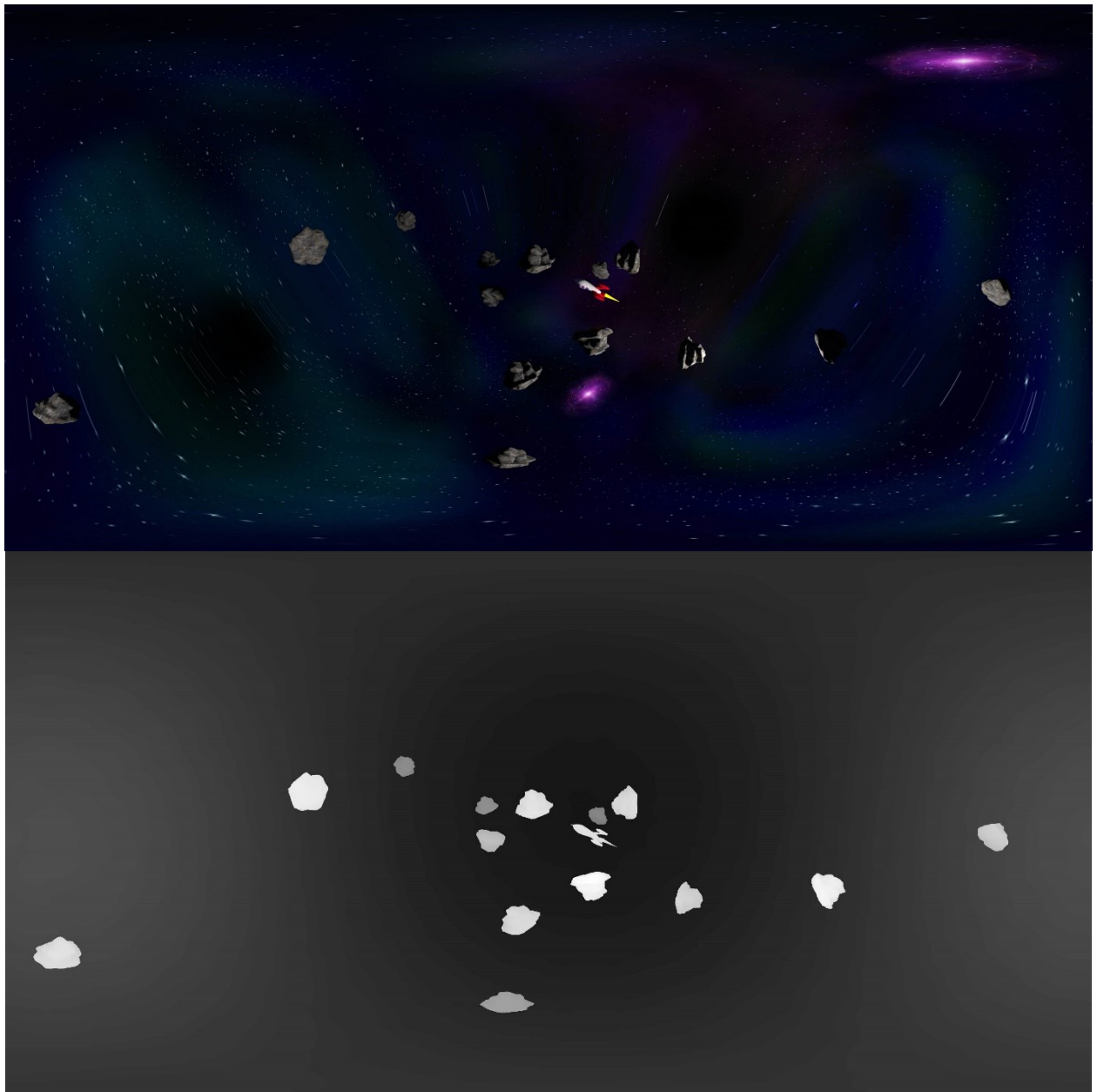The size of the whole source data (".blend" Blender file and textures) related to this scene is about 80 MB.
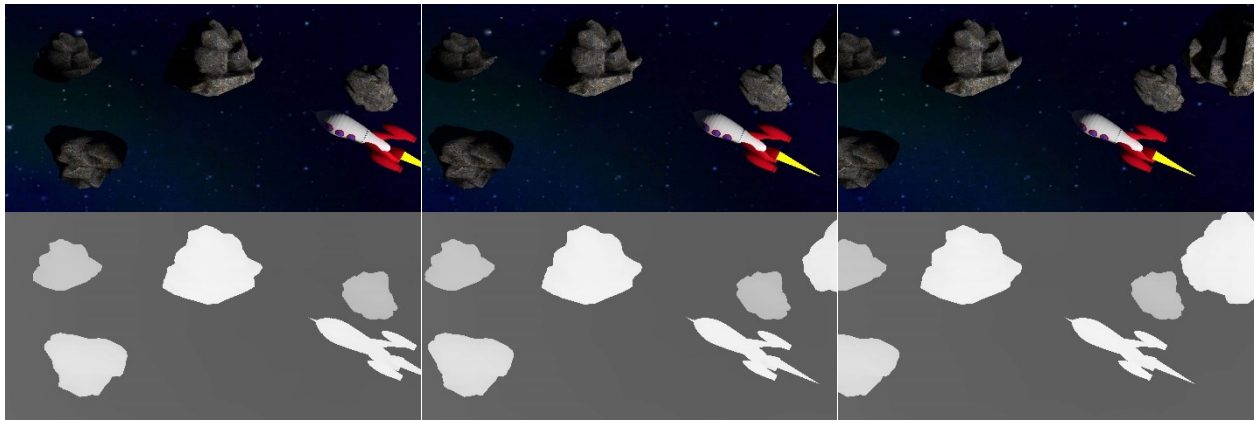
Left Perspective Camera   Center Perspective Camera   Right Perspective Camera

Panoramical omnidirectional 360 camera

Fig. 1. Examples of images rendered from "Space 360" scene provided by the authors.
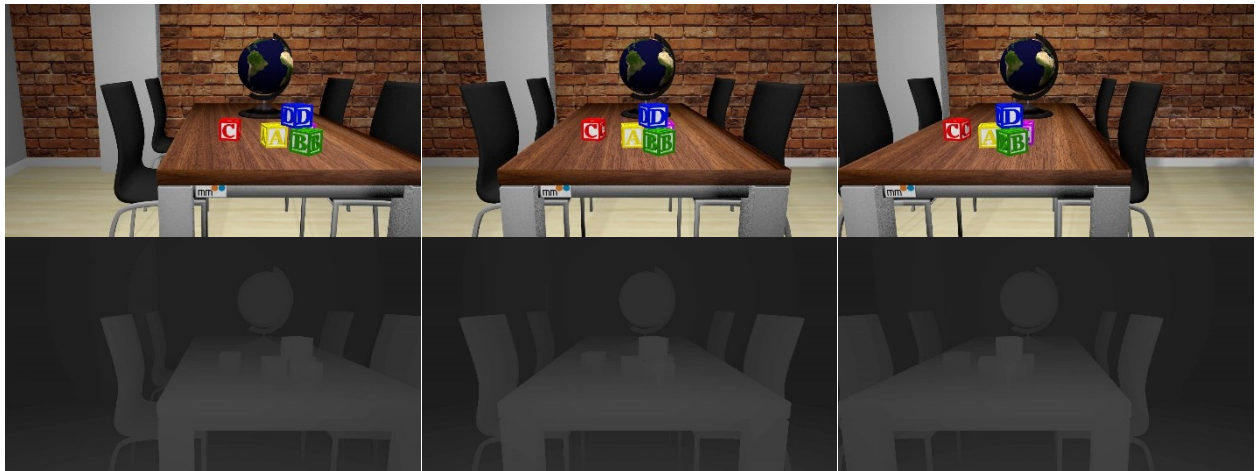
Left Perspective Camera   Center Perspective Camera   Right Perspective Camera
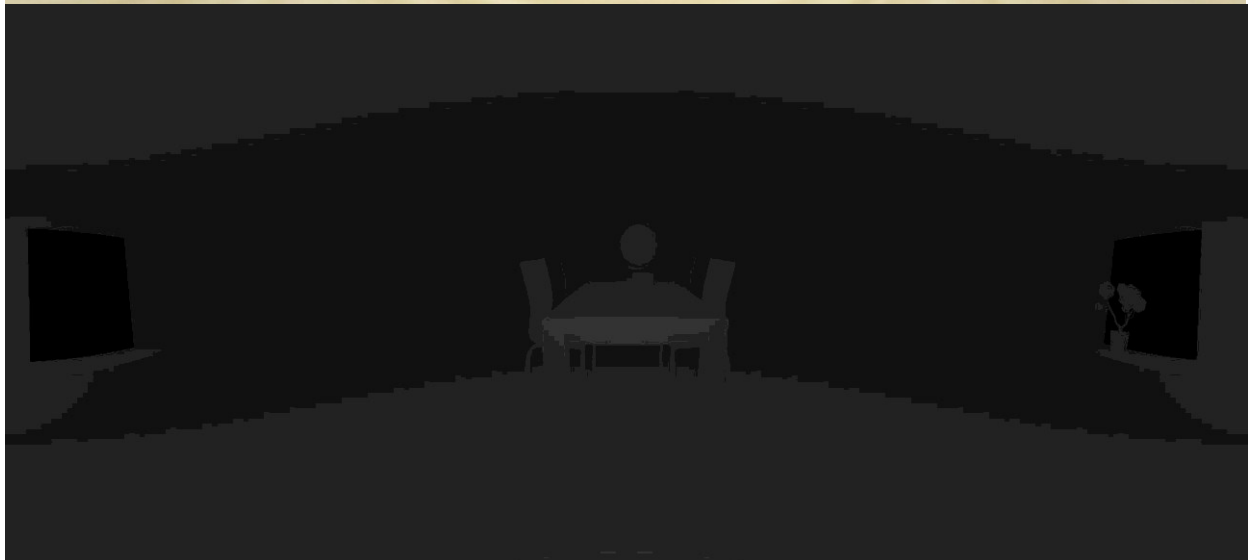

Panoramical omnidirectional 360 camera

Fig. 2. Examples of images rendered from "House 360" scene provided by the authors.

Left Perspective Camera   Center Perspective Camera   Right Perspective Camera

Panoramical omnidirectional 360 camera

Fig. 3. Examples of images rendered from "People 360" scene provided by the authors.

Left Perspective Camera   Center Perspective Camera   Right Perspective Camera

Panoramical omnidirectional 360 camera

Fig. 4. Examples of images rendered from "Blocks 360" scene provided by the authors.

3. Licensing

During the preparation of the test scenes, we have used free 3D models available on turbosquid.com [6] website. All of these 3D models are usable for commercial usages (Royalty Free License - All Extended Uses). The detailed list of the materials used is summarized in Table 1.

Table 1. 3D models used form creation of test scenes.

3D model name	Internet link
Baby block	https://www.turbosquid.com/3d-models/baby-blocks-3ds-free/300212
Carpet 3D area rugs	https://www.turbosquid.com/3d-models/3d-area-rugs-7-model-1243705
Low Poly Grass	https://www.turbosquid.com/3d-models/grass-ready-terrain-3d-model-1309955
House	https://www.turbosquid.com/3d-models/free-scotish-house-3d-model/464428
Tree Oak	https://www.turbosquid.com/3d-models/free-oak-season-3d-model/459531
Stool	https://www.turbosquid.com/3d-models/free-3ds-model-stool/670230
Retro Rocket	https://www.turbosquid.com/3d-models/free-c4d-model-retro-rocket/687319
Rock 06	https://www.turbosquid.com/3d-models/free-obj-mode-rock/1016934
Woman FutureScan #1	https://www.turbosquid.com/3d-models/free-max-mode-human-rig-female-gigapixel/847088
Woman FutureScan #2	https://www.turbosquid.com/3d-models/free-max-model-human-gigapixel/886664
Man FutureScan #3	https://www.turbosquid.com/3d-models/free-scans-3-3d-model/1025703
Patrick	https://www.turbosquid.com/3d-models/human-male-3d-model/504883
Eric Rigged 001 3D	https://www.turbosquid.com/3d-models/eric-rigged-people-3d-1310834
Formal Woman	https://www.turbosquid.com/3d-models/free-max-model-women/1064471
Realistic Male Avatar	https://www.turbosquid.com/3d-models/eric-neuman-3d-1252037

The test materials remain the property of Poznan University of Technology but they are licensed for free use within ISO/IEC JTC1/SC29/WG11 (MPEG) for the purposes of research and the development of standards. These sequences can be also freely used for research purposes outside MPEG. Any other use is prohibited unless an explicit permission is given by Poznań University of Technology, Chair of Multimedia Telecommunications and Microelectronics and/or Electronics and Telecommunications Research Institute.

Acknowledgements are appreciated if the material was used in research and are required if the material is to be used in publications. The acknowledgement should use the reference to this document.

The abovementioned test materials can be made available upon request or uploaded to MPEG repository.

4. Acknowledgement

5. References

[1] Krzysztof Wegner, Olgierd Stankiewicz, Tomasz Grajek, Marek Domański, "Depth estimation from circular projection of 360 degree 3D video", ISO/IEC JTC1/SC29/WG11, MPEG2017/m40596, Hobart, Australia, April 2017.

[2] Y. Ye, E. Alshina, J. Boyce, Algorithm descriptions of projection format conversion and video quality metrics in 360Lib, Joint Video Exploration Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11 6th Meeting: doc. JVET F-1003, Hobart, Australia, 31 March – 7 April 2017.

[3] T. Senoh, K. Yamamoto, R. Oi, T. Mishina, M. Okui: Consideration of depth format. ISO/IEC JTC1/SC29/WG11 MPEG m15047, Antalya, Turkey, Jan. 2007.

[4] G. Bang, G. S. Lee, N. Ho H., "Test materials for 360 3D video application discussion", ISO/IEC JTC1/SC29/WG11 MPEG2016/M37810 February 2016, San Diego, USA, 2016.

[5] https://www.blender.org/, online Oct. 2018.
[6] https://www.turbosquid.com, online Oct. 2018.