EYE TRACKING-BASED 360 VR FOVEATED/TILED VIDEO RENDERING

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ABSTRACT

To increase the sense of immersion of 360 virtual reality (VR) images, this paper proposes and implements the foveated rendering technology through precise region-of-interest (ROI) detection using eye-tracking-based head-mounted display. It uses HEVC tiled video-based image-decoding and -rendering method, which results show high rendering speeds and high-quality textures.

Index Terms— Eye-tracking, 360 video VR, tiled video

1. EYE TRACKING-BASED 360VR STREAMING

The field of view (FOV) needs be detected for foveated rendering based on eye tracking. To do this, the eye tracking coordinates (x, y, z) in 3D space were extracted using an HMD device that supports eye tracking. The implemented player supports the MPEG-DASH standard, and it receives eye-tracking coordinates through the HMD, detects the ROI, and defines the FOV based on the ROI. The adaptation set is constructed with two high-definition and low-definition tiles for the FOV and non-FOV areas, respectively. Then, the segment file of the corresponding adaptation set is received by sending requests to the MPEG-DASH media-streaming server. If no MPD file has already been received, the MPD file is received before ROI detection is performed. The process and implementation results of the 360 VR player are shown in Fig. 1, 2, and 3. The FOV was set to 90 degrees to check the result of foveated rendering applying multi-resolution in HMD device.

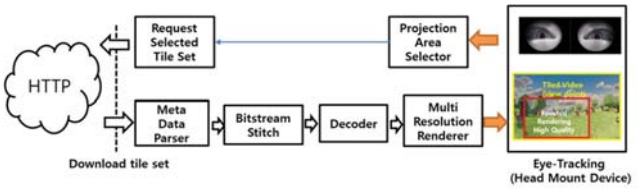

Fig 1. Tiled streaming and foveated rendering.

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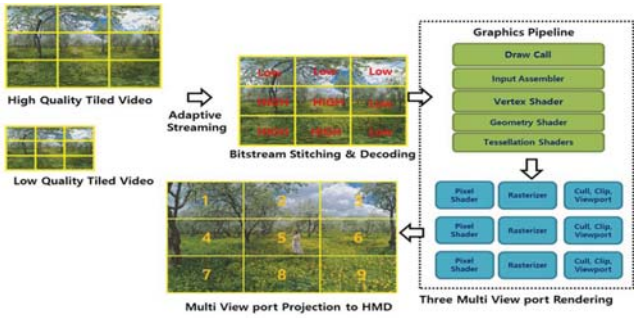

Fig. 2. 360 VR foveated rendering player structure.

Fig 3. Implemented demo client.

2. EXPERIMENTAL RESULTS

To optimize the rendering performance, the shader density of the region corresponding to the FOV was tested by comparing each of three videos at ratios of 1.0, 0.5, and 0, respectively. The performance of the texture rendering framerate in frames per second (FPS) was improved by 10–15% on average compared with the case of applying only the existing tiled streaming technology, and the rendering performance was improved by up to 18% depending on the eye-tracking coordinate detection and timing.

3. DEMO PLAN

Implemented server, client (player), and the HMD that supports eye-tracking will be placed on demo desk. The demo will show prompt FOV adaptation while 360 VR streaming according to the head movement of users.