

Immersive Visualization Technologies for eResearch

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Immersive Visualization/Analytics

Troves of big data are invaluable to all sectors of society, but require interdisciplinary effort and next generation technologies, specifically interactive environments that can immerse the user in data and provide tools for data analytics

- Developing applications to investigate the usability of new immersive visualization technologies for eResearch
- Explore combinations of 2D and 3D representations of data
- Investigate the broader value of immersive visualization for different domains

Immersive Technologies

- Multi-screen display walls
 - Digital “lens” to big data
 - Collaborative environment
- Augmented reality
 - Blending of real and virtual world
 - Contextual information superimposed on surrounding environments
- Virtual reality
 - Completely virtual reconstruction of the real world
 - Can visit environments that are not easily accessible

Immersive Tiled Display Walls with SAGE2



<http://sage2.sagecommons.org/>

Augmented Reality (AR)

Pokemon Go



Microsoft Hololens



iOS11 support for AR



Virtual Reality (VR)

HTC Vive



Oculus Rift



Google Cardboard



Google Daydream



Virtual Reality (VR)

Monash CAVE2™



VR Applications for eResearch

Two use-cases:

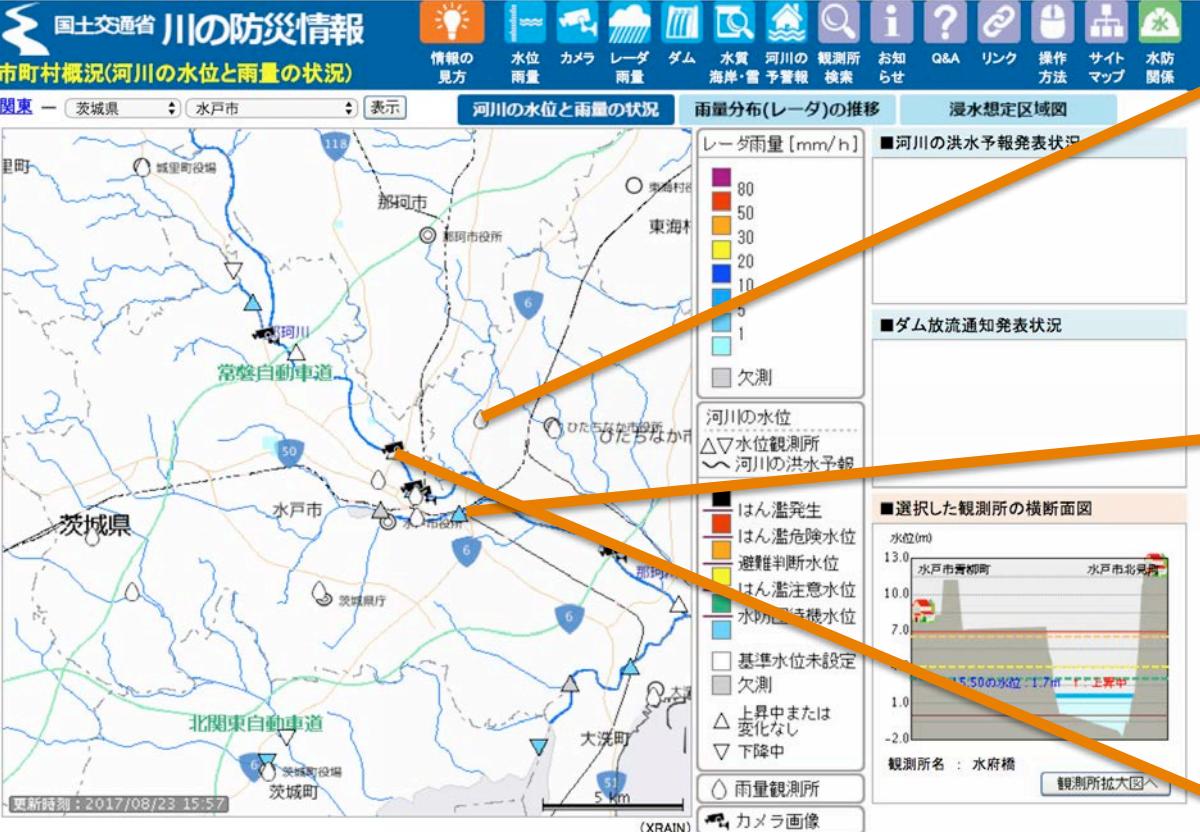
- Natural disaster management
- Multi-player collaborative virtual environment for scientific data

See live demos at Booth 22

VR Application for River Disaster Management

- Based on a public website from Ministry of Land, Infrastructure and Transport (MLIT), Japan
- >17,000 different sensors
 - Rainfall, river height, snow, shoreline, water quality, dam
- Data production varies
 - 10min to every hour
- Unity development platform
 - Cross device compatibility

MLIT Website – Traditional Webpages



国土交通省 川の防災情報

市町村概況(河川の水位と雨量の状況)

関東一 茨城県 水戸市 表示

河川の水位と雨量の状況 雨量分布(レーダ)の推移 浸水想定区域図

● 河川の洪水予報発表状況

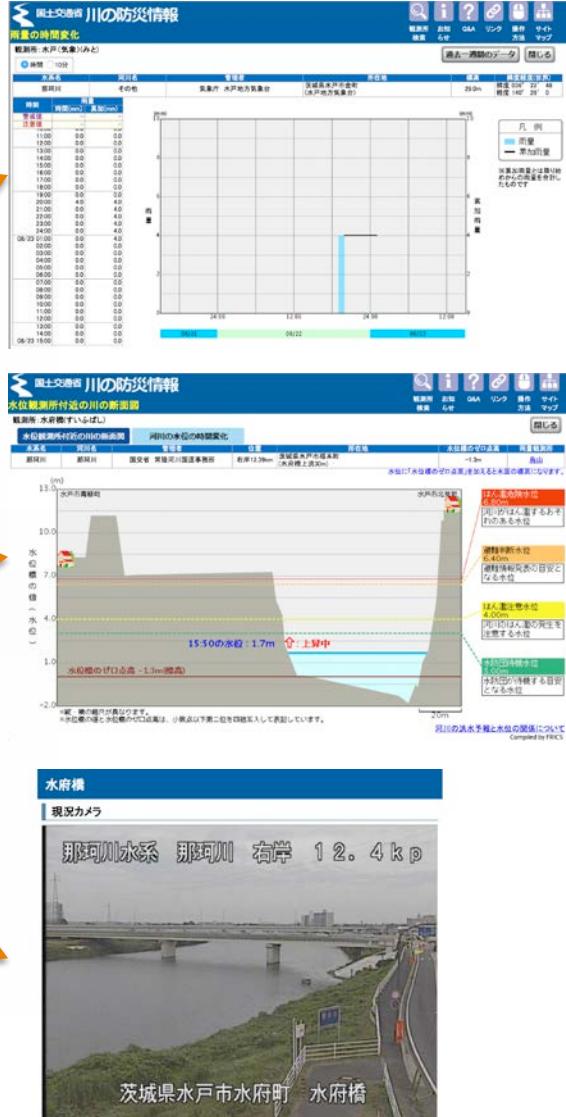
● ダム放流通知発表状況

● 選択した観測所の横断面図

● 水位観測所付近の川の断面図

● 水府橋

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国土交通省 川の防災情報

雨量の時間変化

観測所: 水戸(気象)(みどり)

時刻: 09:00 08:00 07:00 06:00 05:00 04:00 03:00 02:00 01:00 00:00 23:00 22:00 21:00 20:00 19:00 18:00 17:00 16:00 15:00 14:00 13:00 12:00 11:00 10:00 09:00 08:00 07:00 06:00 05:00 04:00 03:00 02:00 01:00 00:00

雨量

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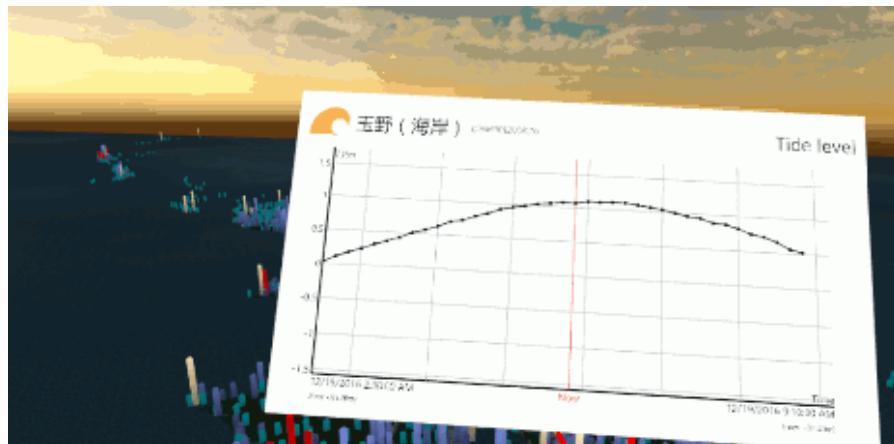
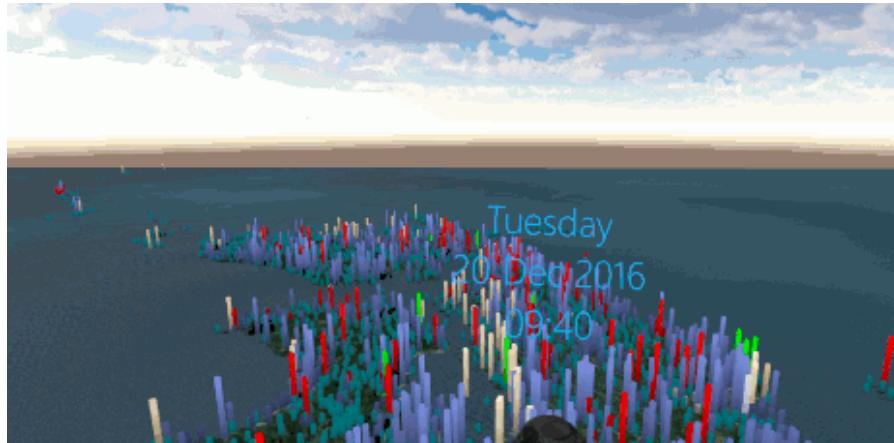
● 水府橋

現況カメラ

茨城県水戸市水府町 水府橋

※カメラ画像は、機器類の点検等により表示されない場合があります

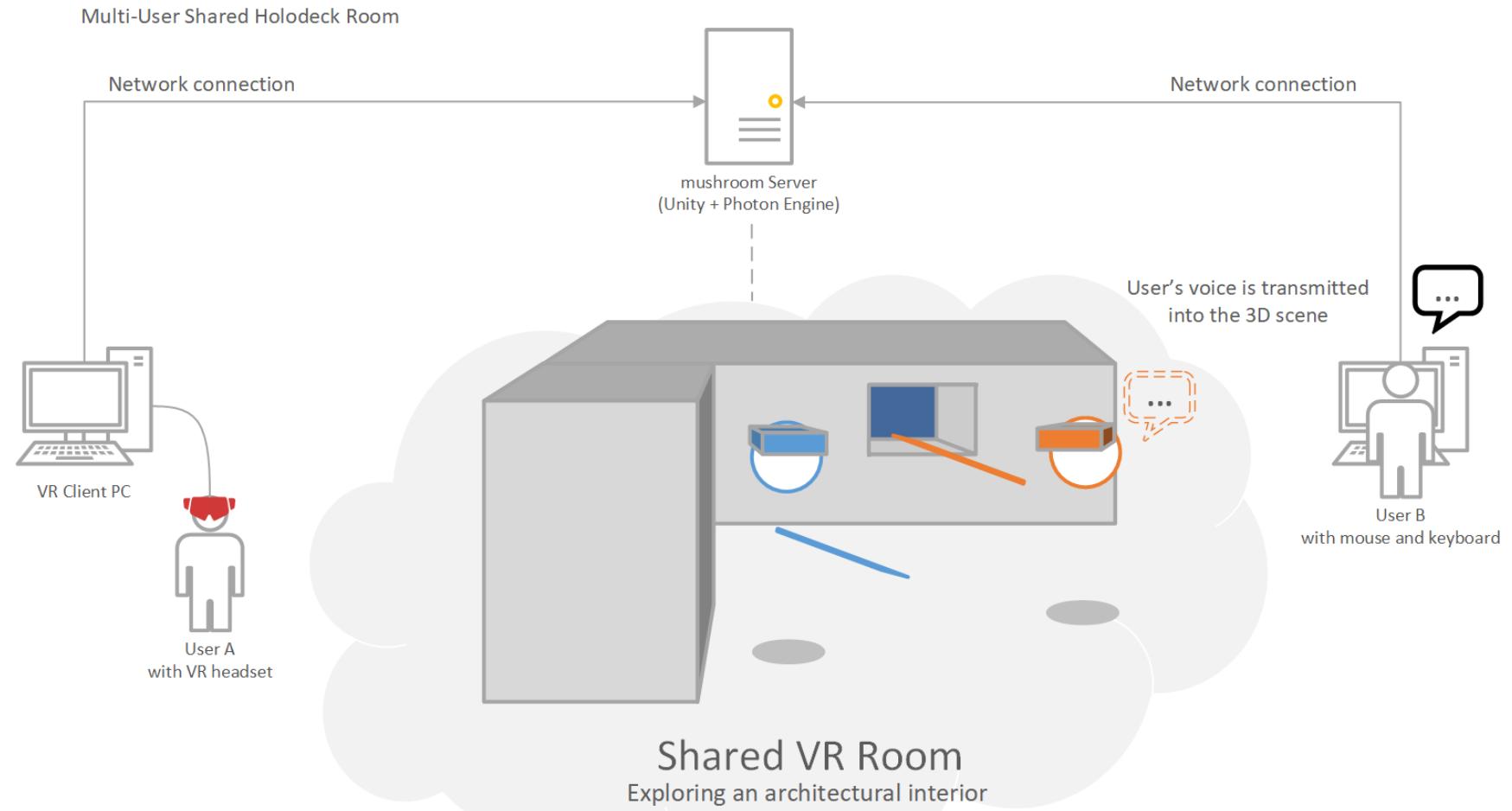
VR Application for River Disaster Management



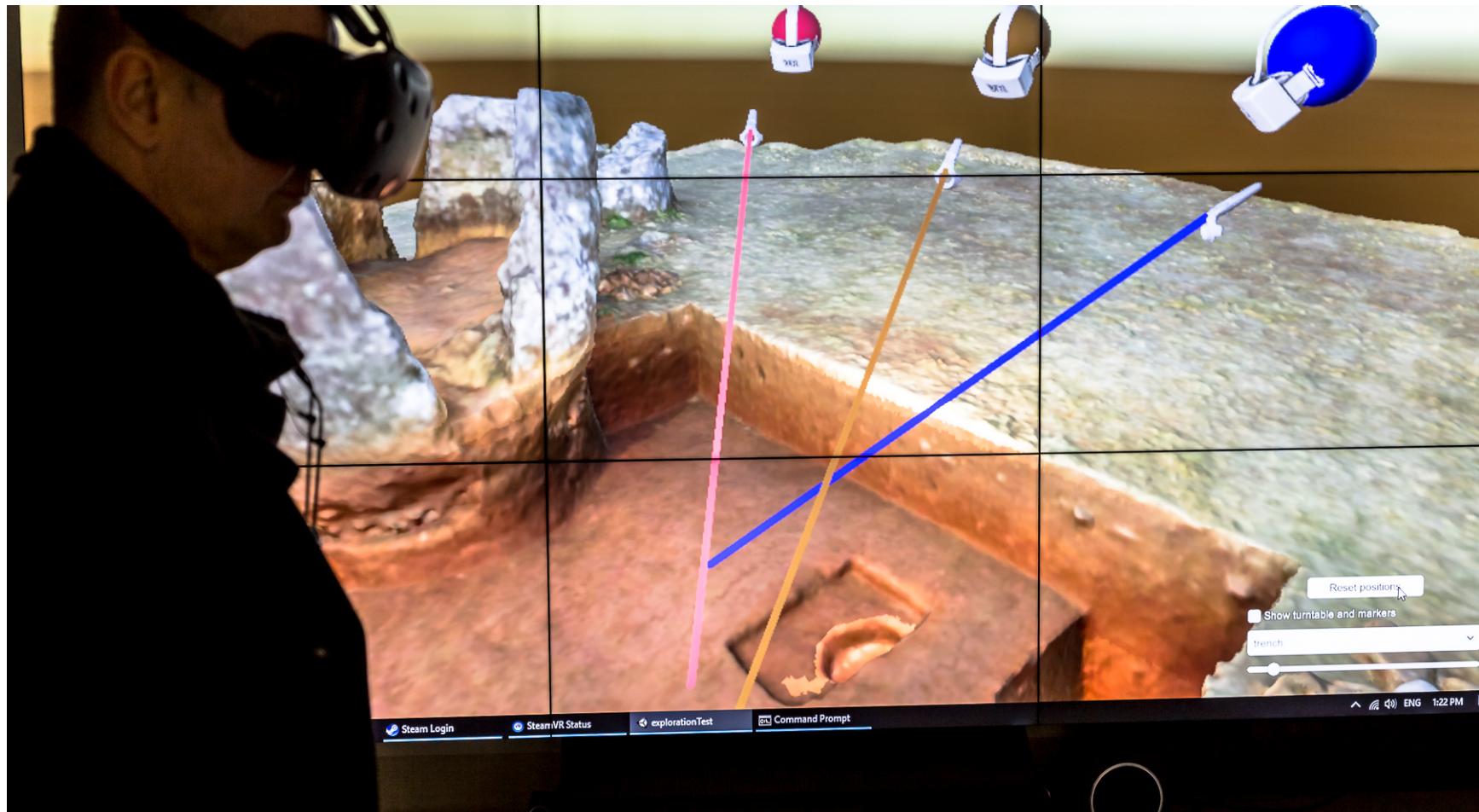
Mushroom – Multi-User Shared Holodeck Room

- A virtual room for viewing static or interactive 3D visualisations together with multiple users
- Simple virtual embodiment (“player” avatars) are visible by all users.
- Communication is with positional audio for voice chat and visually with virtual laser pointers
- Users on VR and non VR systems can join the same space together
 - HTC Vive VR headset
 - 'desktop mode' with mouse+keyboard+audio headset
- Current demo includes a kookaburra skeleton (with moveable parts), an archaeological site and a slice of an architectural interior

Mushroom – Multi-User Shared Holodeck Room



Mushroom – Multi-User Shared Holodeck Room



Transpacific Visualization Alliance

Bill Chang, Jason Haga, Jason Leigh, Fang Pang Lin, Whey-Fong Tsai

- Visualization is important for modern communication, research, and education
- Especially valuable for researchers situated at distributed centers in Pacific Rim countries for data intensive applications such as:
 - Environmental restoration and reduction in natural disasters
 - Climate change
 - Smart cities
 - Renewable energy grids
 - Sustainable water systems
 - Creative arts
- This alliance is designed to advance collaborative visualization research and education network in the Asia Pacific Region through regional partnerships in Hawaii, Japan, Taiwan, Australia



Summary

- Immersive technologies are rapidly approaching commodity level (hardware and software)
- The value of these technologies to eResearch is an active area of exploration
- Domain specific requirements will be important in defining the level of adoption and usability of these technologies

See live demos at Booth 22

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