A Drink in Mars: an Approach to Distributed Reality

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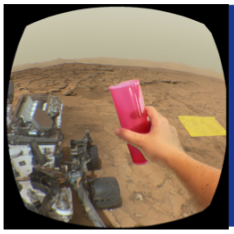
ABSTRACT. We have developed A Drink in Mars application as a proof of concept of Distributed Reality, a particularisation of Mixed Reality which combines a reality transmitted from a remote place (e.g. live immersive video stream from Mars) with user interaction with the local reality (e.g. drink their favourite beverage). The application shows acceptable immersion and local interactivity. It runs on Samsung GearVR and needs no special green room for chroma keying, thus being suitable to test different use cases.

Distributed Reality (DR)

Mixed Reality with two real-life environments:
- Remote Reality: live stream of remote place
- Local Reality: self-perception and local objects

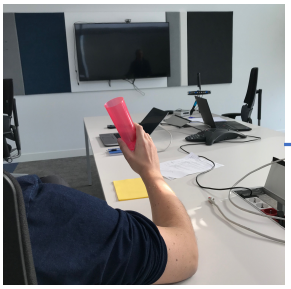
"Reality" → no CGI model

A Drink in Mars

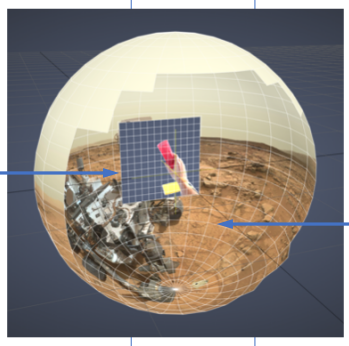


Wearing a GearVR headset, take a drink while immersed in live VR experience (Mars surface)

Local Reality (LR)

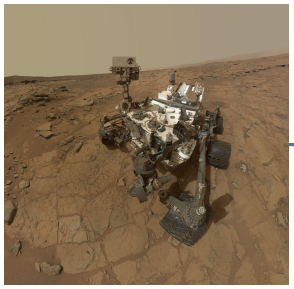


- Captured by phone camera + fish-eye lens
- Rendered in front of the user gaze
  - (0, 0, -z)
  - Attached to virtual camera rig



$$\alpha(Cr) = \begin{cases} 1 & \text{if } Cr \geq C_1 \\ (Cr - C_0)/(C_1 - C_0) & \text{if } C_0 \leq Cr < C_1 \\ 0 & \text{if } Cr \leq C_0 \end{cases}$$

Remote Reality (RR)



- Captured by 360VR camera
- Live streaming using MPEG-DASH
- Rendered in sphere around user

NOTE: Mars streaming is simulated using images from NASA MSL

Red Chrominance Alpha Blending

- Simple skin colour detection.
- No need for green background: deployable in meeting room with neutral tones.
- Local elements easily to introduce: red and yellow objects.

Fully Local Mode

$$\alpha(Cr) = 1 \ \forall Cr$$

- Interact with reality without removing HMD.
- Manual FLM: touchpad
- Automatic FLM based on Android sensor activation:
  - Linear accelerometer (5 seconds)
  - Step detector (15 seconds)

Conclusions and Future Work

- Effective framework to test DR concepts:
  - LR: easy to deploy and add elements
  - RR: live 360VR video player
- Test bed for DR use cases: bidirectional communication, remote car driving…
- Benchmark for implementation improvements: deep-learning hand segmentation, stereo local camera…

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