Image-Based Rendering Engine for Mobile Games

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Outline

- Problem Statement
  - Motivation
  - Problem
  - Goal
- Prior Work
- Our Approach
- Demo & Future Work

The Motivation

- Mobile games will be the killer application of wireless network
- Hardware limitations of mobile and handheld devices
  - Small memory
  - Short battery life
  - Weak CPU power
  - Graphics hardware is not strong enough

The Problem

- How to render large scale synthetic environments on mobile devices?

East Tower

The World Expo Garden

The Goal of Our project

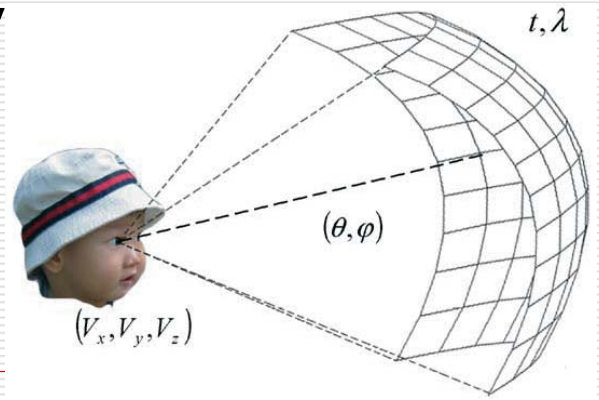
- Generating photorealistic images of large scale synthetic environments on mobile devices in Real time
- Mobile games (driving games, virtual touring games, etc), Location-based services, MPEG-3DAV

Prior work

- Geometry based rendering system
  - Geometry+Texture+GPU shading
  - Squeezing the games running on PC/Game console to mobile platform
  - Render high quality image in real time is difficult

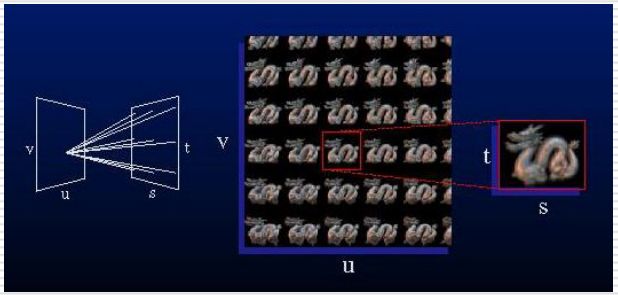
Prior work

- Image-based Rendering(IBR)[Shum03]
  - Take images as input
  - Reconstruct the continuous representation of plenoptic function[Adelson91], then resample it during rendering[McMillan95]
  - Rendering speed is independent of the scene's geometry complexity



Prior work

- Classic work of image-based rendering
  - QuickTime VR [Chen95],Plenoptic Modeling [McMillan95]
  - LightField/Lumigraph[Levoy96][Gorter96]
  - Concentric Mosaics[Shum99][Kang03]

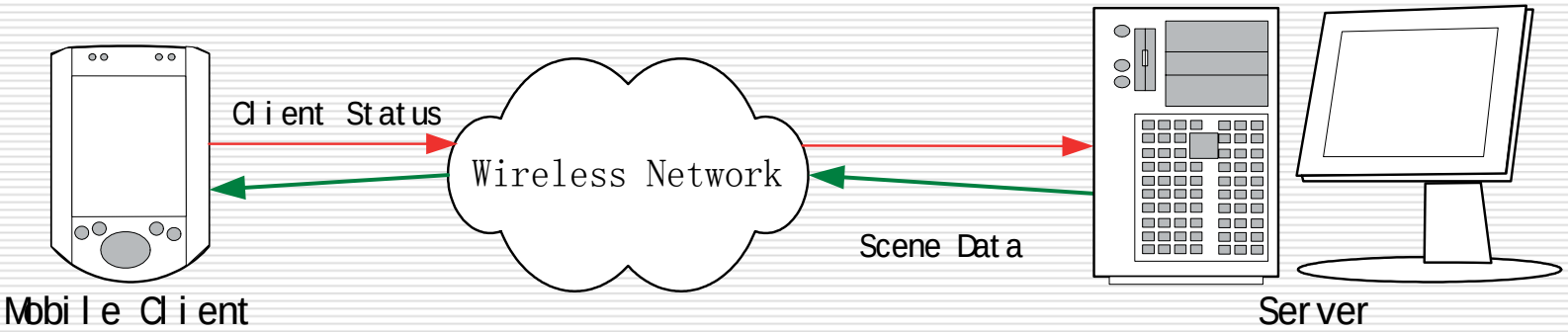


Prior work

- Rendering on mobile devices
  - Server streams rendering result to clients[Noimark03]
  - Using scene simplification techniques to squeeze large data size on mobile devices [Blackhurst04]
  - Both methods can not render large scale scene in real time

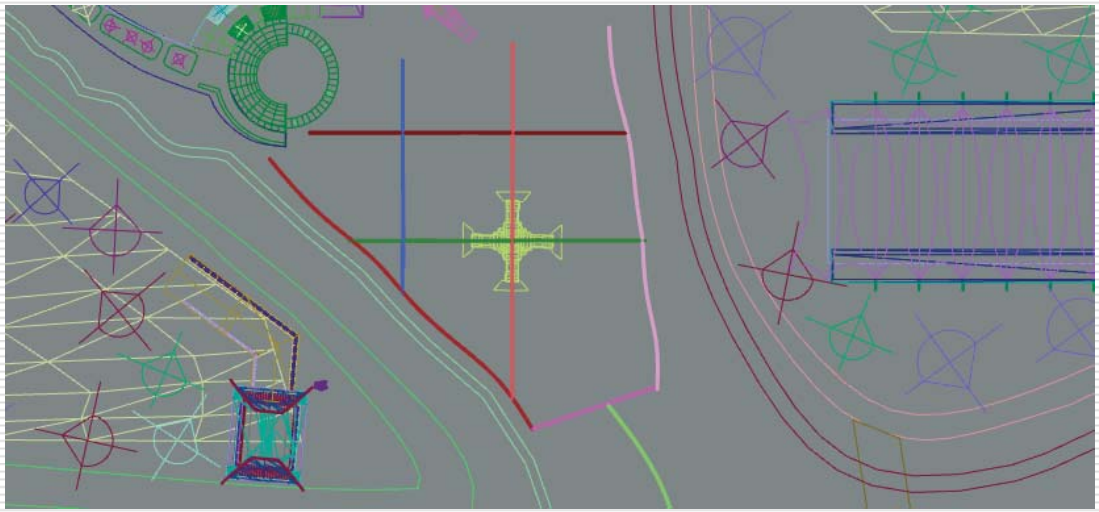
Our approach(1)

- Belong to Image-based rendering category
- Client-Server Architecture



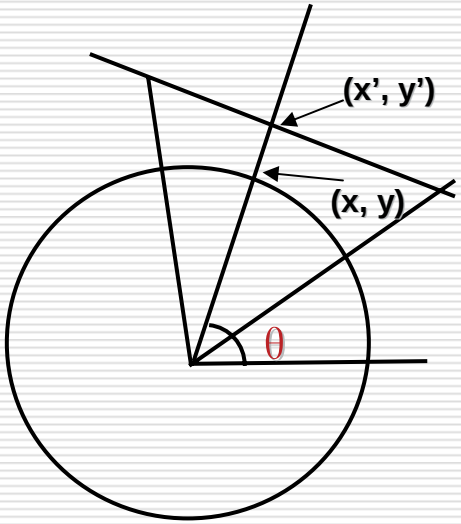
Our approach(2)

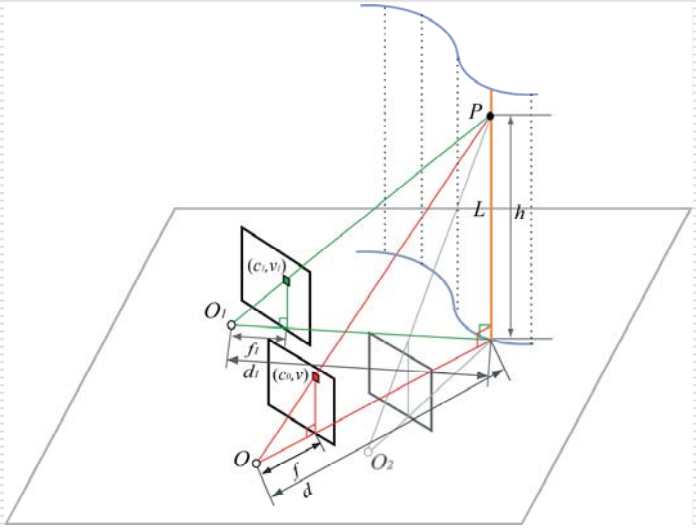
- Use panoramic video (PV) as the plenoptic primitive for representing the scene



Our approach(3)

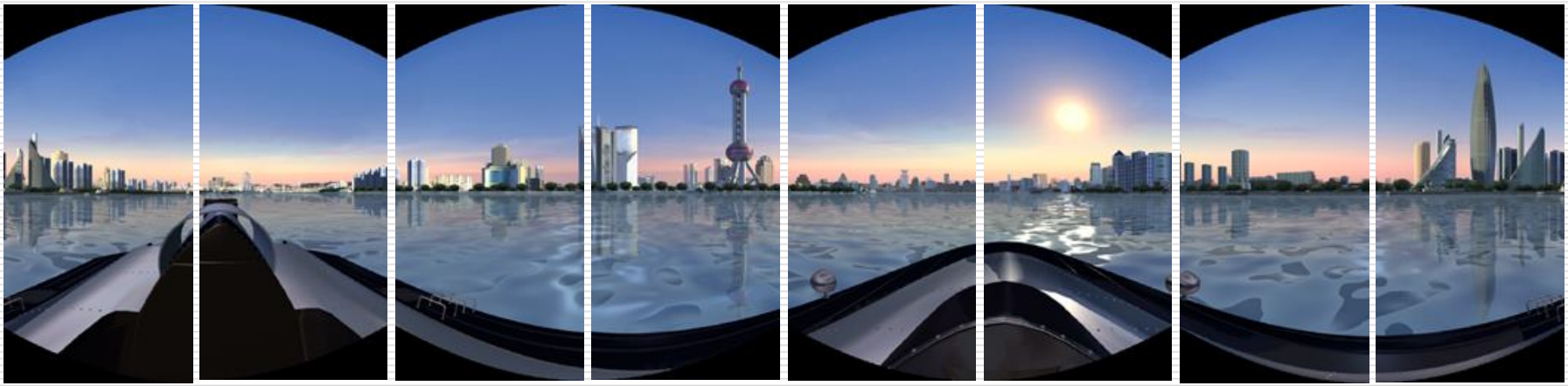
- Use simple geometric proxy for depth correction during rendering process





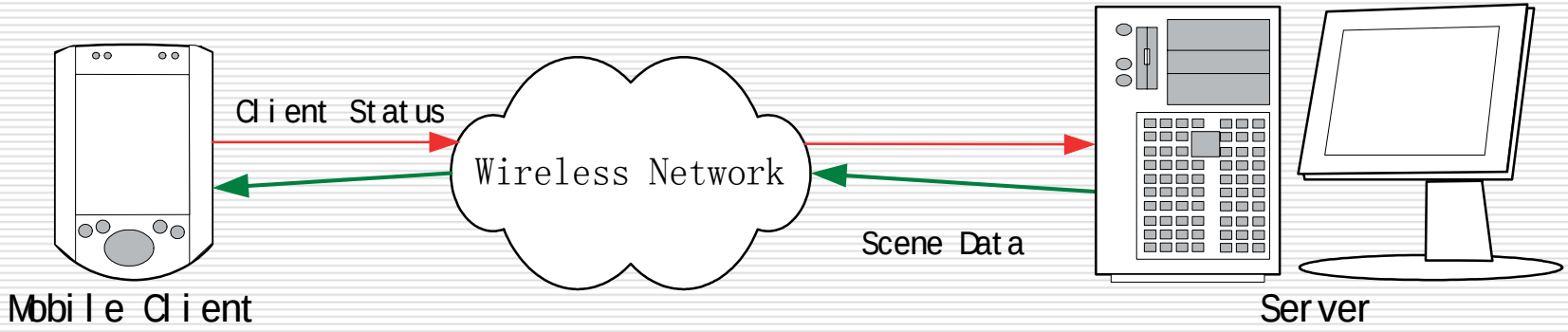
Our approach(4)

- Panoramic Video Compression
  - Partition the whole dataset into small ones
  - Compress small segment using motion JPEG /JPEG(2K) [Taubman02]
  - MPEG like coding method



Our approach(5)

- Data Streaming
  - Server computes the required data for rendering novel view of client, then send them to client
  - Client decodes and caches them
  - Local rendering is carried out on client side

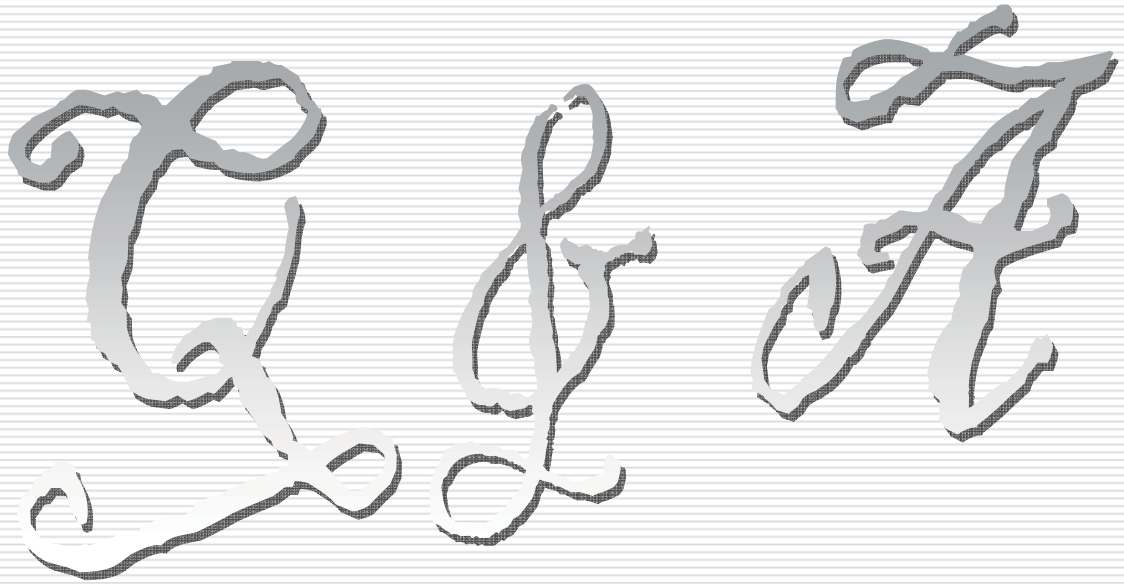


Our approach(6)

- User Interface
  - Mapping user action to buttons
  - Quick response using separated command and data channels

Current Progress

- One panoramic video streaming system under 802.11b



The End

Thank you!

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References

- [Adelson91] E. H. Adelson, J. R. Bergen. The plenoptic function and the elements of early vision. Computational Models of Visual Processing, M. Landy and J. A. Movshon, editors, MIT Press, Cambridge, MA, pp.3-20, 1991.
- [Blackhurst04] J. Blackhurst. Less is More? Design for Mobile Games. Game Developer Conference, March, 2004.
- [Chen95] S.E. Chen. QuickTime VR-An Image-based Approach to Virtual Environment Navigation. Proceedings of SIGGRAPH 1995, pp. 29–38, August 1995.
- [Gortler96] S.J. Gortler, R. Grzeszczuk, R. Szeliski, M.F. Cohen. The lumigraph. Proceedings of SIGGRAPH 1996, pp.43–54, August 1996.
- [Kang03] S.-B. Kang, M. Wu, Y. Li and H.-Y. Shum. Large Environment Rendering Using Plenoptic Primitives. IEEE Transactions on Circuits and Systems for Video Technology, 13(11):1064~1073, 2003.
- [Levoy96] M. Levoy, P. Hanrahan. Light field rendering. Proceedings of SIGGRAPH 1996, pp.31–42, August 1996.
- [McMillan95] L. McMillan, G. Bishop. Plenoptic modeling: An image-based rendering system. Proceedings of SIGGRAPH 1995, pp.39–46, August 1995.
- [Noimark03] Y. Noimark, D. Cohen-Or. Streaming Scenes to MPEG-4 Video Enabled Devices. IEEE Computer Graphics and Applications, 23(1):58–64, 2003.
- [Shum03] H.-Y. Shum, S. B. Kang, S.-C. Chan. Survey of Image-Based Representation and Compression Techniques. IEEE Transactions on Circuits Systems for Video Technology, 13(11):1029–1037, 2003.
- [Shum99] H.-Y. Shum, L.-W. He. Rendering with concentric mosaics. Proceedings of SIGGRAPH 1999, pp. 299–306, August 1999.
- [Taubman02] D. Taubman, M. Marcellin. JPEG2000: Image Compression Fundamentals, Standards and Practice. Kluwer Academic Publishers, Boston, 2002.