Freehand acquisition of unstructured scenes
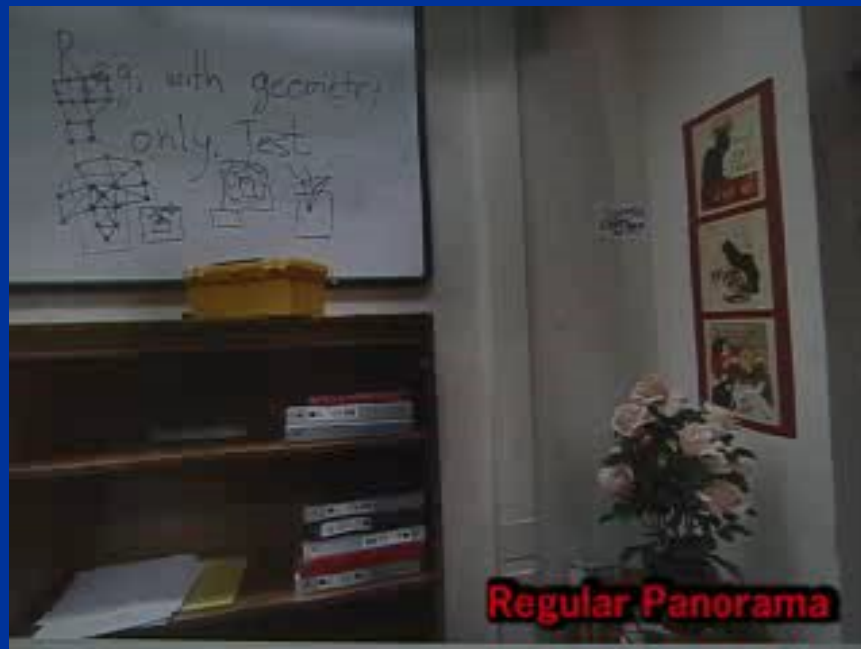
Presented by Mihai Mudure

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Goals

- Acquire interactively approximate models of unstructured scenes

- Inside-looking-out modeling case

- Freehand

Unstructured scenes

- Scenes that contain many small surfaces
  - Leafy plants, messy desks, coats on a rack

Unstructured scenes

- Detailed modeling requires
  - Huge time investment

  - Expensive acquisition hardware

- Most inside-looking-out applications do not require detailed models

Applications

- Virtual training

- Simulations

- Architectural walkthrough

- Virtual tourism

Depth acquisition
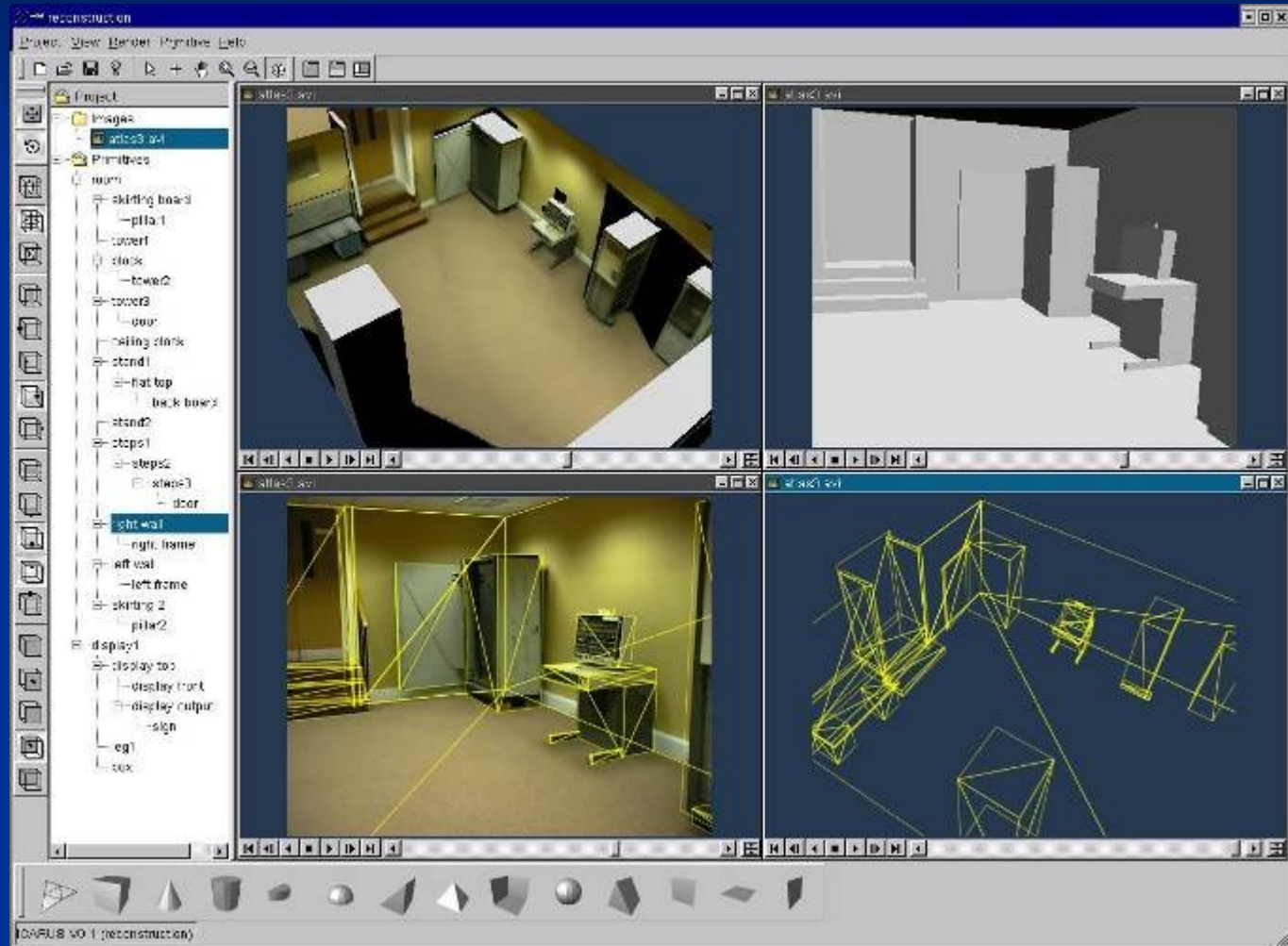
- **Dense**

David Luebke

Scanning Monticello

http://www.cs.virginia.edu/Monticello/

Depth acquisition

- **Dense**
- **Manual**

http://aig.cs.man.ac.uk/research/reveal/icarus/index.html

Depth acquisition

QuickTime VR

No depth

http://www.mediapiculture.net/360days/index.php?id=29

Challenges

- **Data acquisition**
  - Acquire depth information from many viewpoints

- **Interactivity**
  - The operator must be able to get feedback during data acquisition and guide the scanning

Challenges

- Tracking the acquisition device

- Modeling

Our solution

- Use the ModelCamera for acquisition
  - Acquires color frames enhanced with 45 depth samples

  - Evolving model is a colored point cloud

  - Point cloud displayed as we scan

Our solution

- **Tracking**
  - Previous approach: we used calibrated features (checkers)
    - Not very robust for long sequences
    - Operator had to concentrate on maintaining registration

  - ModelCamera mounted on a mechanical tracking arm

Our Solution

- **Modeling**
  - **Disconnected representation**
    - Splatting

  - **Connected representation (triangle mesh)**
    - 3D Delaunay triangulation of the point cloud
    - Keep only small triangles
    - Use the color from acquired frames

Results
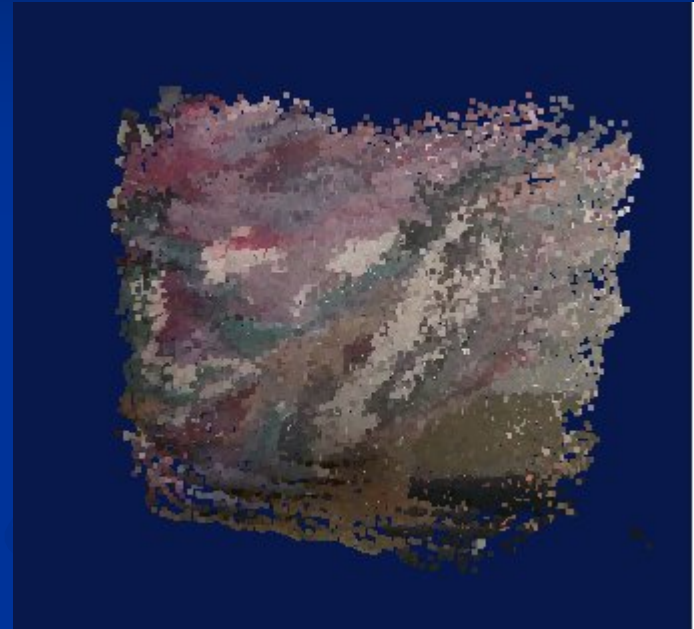
Results

Results

Future work

- Eliminate some of the post-processing

- Use our solution to improve depth enhanced panoramas

- Use some knowledge of the scene to help in modeling the scene

Thank you