3D Holoscopic Imaging as a modality for 3D TV and displays

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3D Holoscopic Video Technology

- 3D Holoscopic imaging methodology uses the principle of “Fly’s eye” and hence allows natural viewing of objects (i.e. fatigue free viewing);
- Uses incoherent radiation and forms an image that is a sampled representation of the original object space, to scale and in full colour;
- The 3D content is captured using a single aperture camera in real-time
- A flat panel display for example one using LCD technology is used to reproduce the captured intensity modulated image and a microlens array re-integrates the captured rays to replay the original scene in full colour and with continuous parallax in all directions;
- The 3D content can be viewed by more than one person and independently of the viewer’s position;

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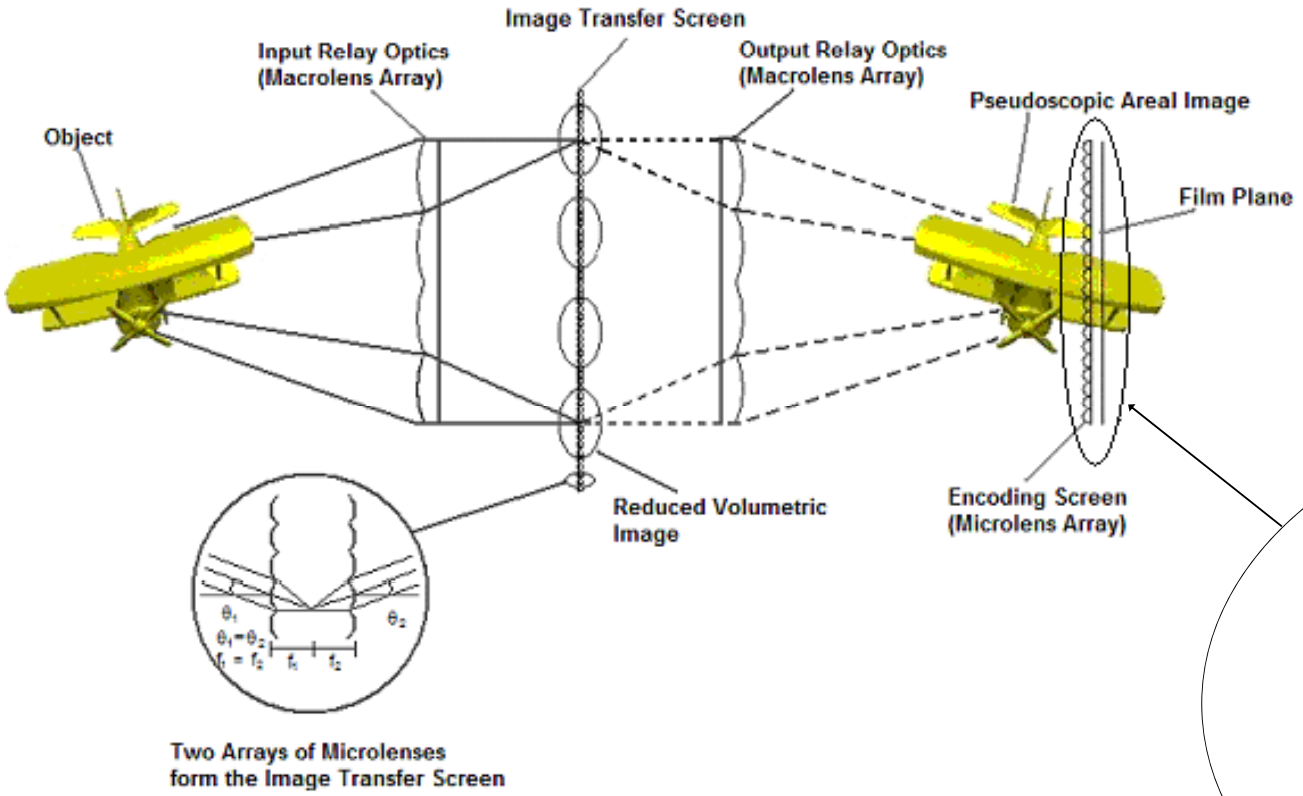
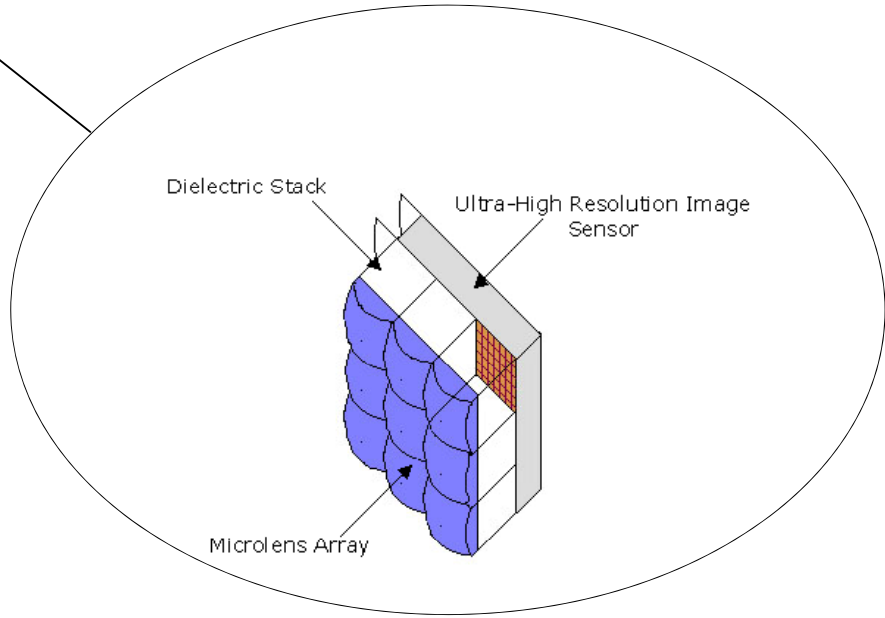
3D Holoscopic Imaging Camera (Designed and Constructed by 3D VIE research group).





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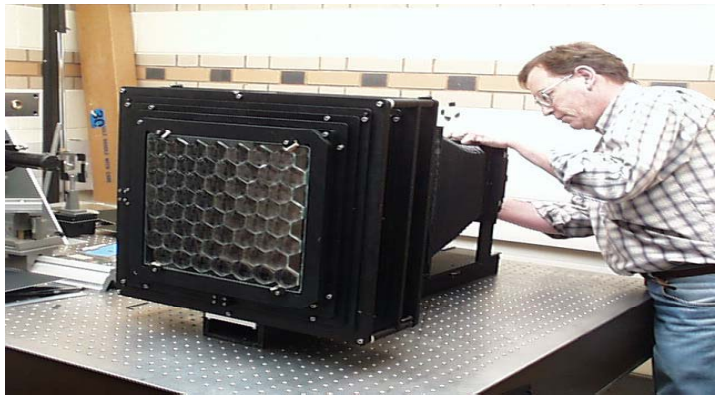
3D Holoscopic Photographic Camera.



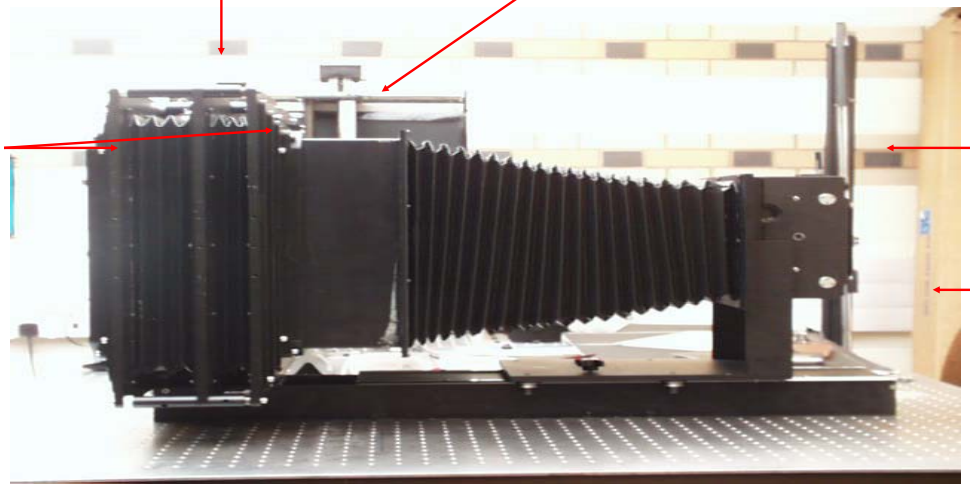
Front View

Back View

Micro lens transmission screen

Fresnel lens

Macro lens arrays



Encoding Micro lens & image plane

Sliding focus platform

Side View

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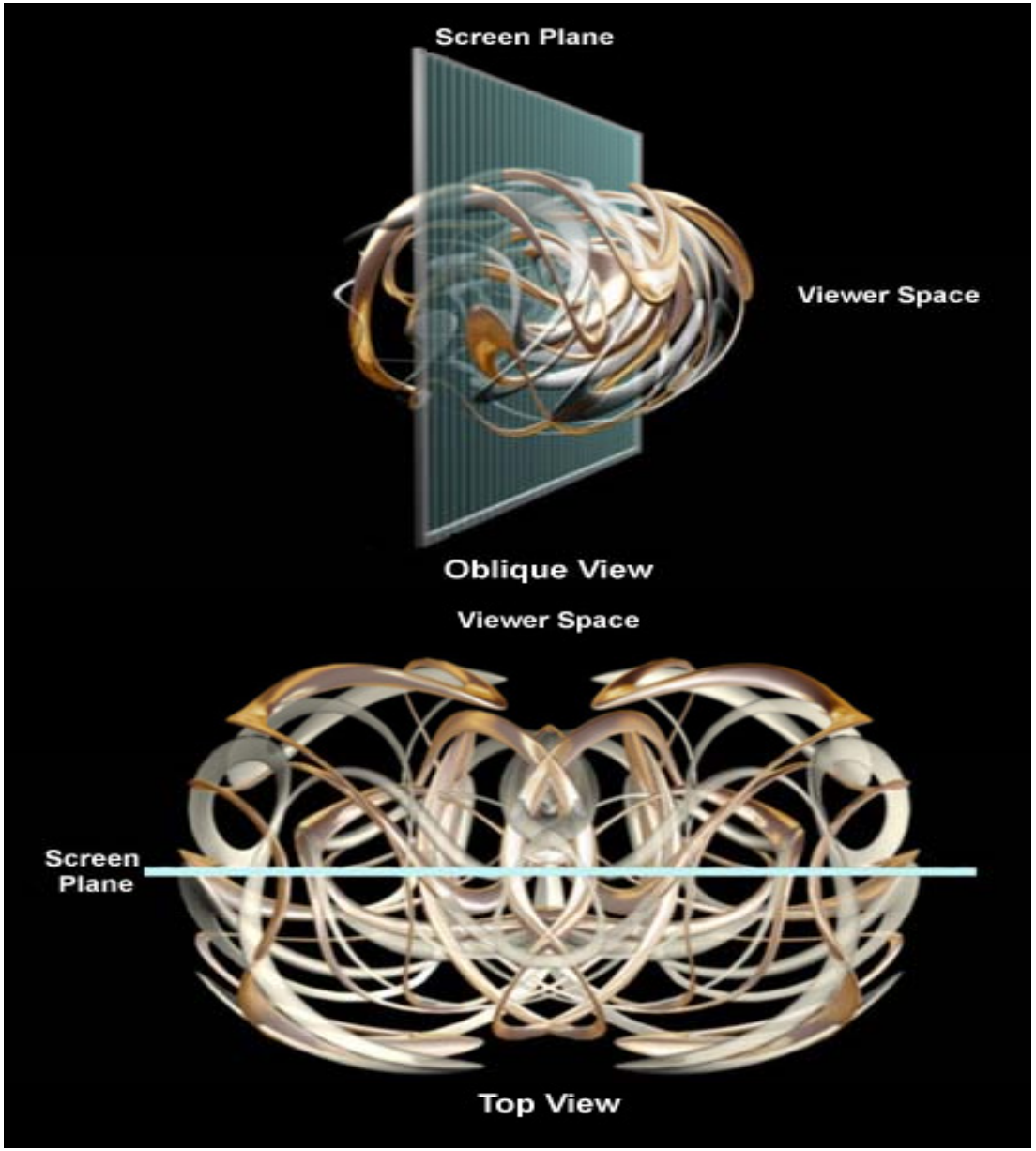
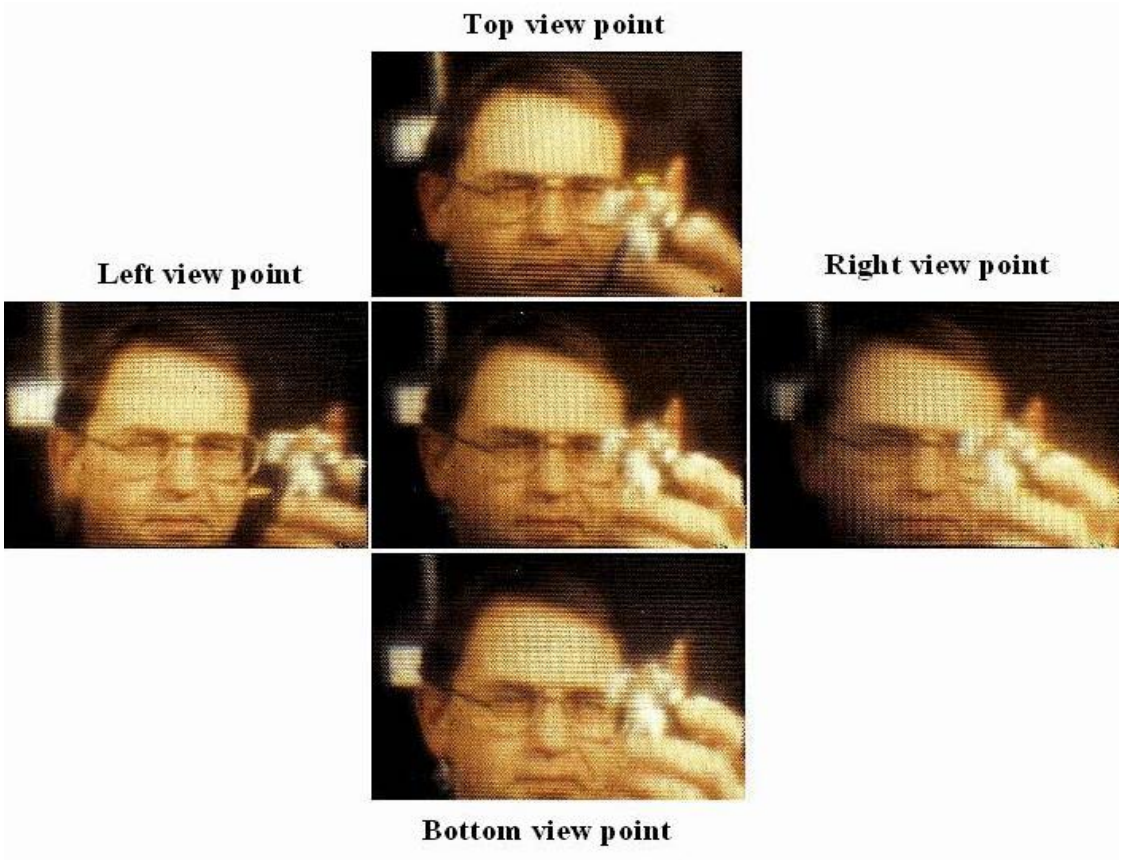
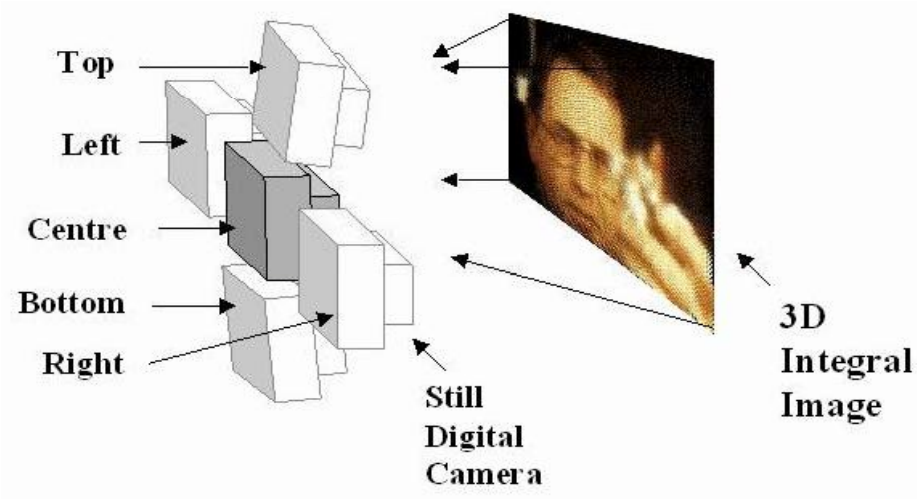
3D Holoscopic image (optical model) display



Parallax Information at Extreme Viewpoints of a 3D Holoscopic Image





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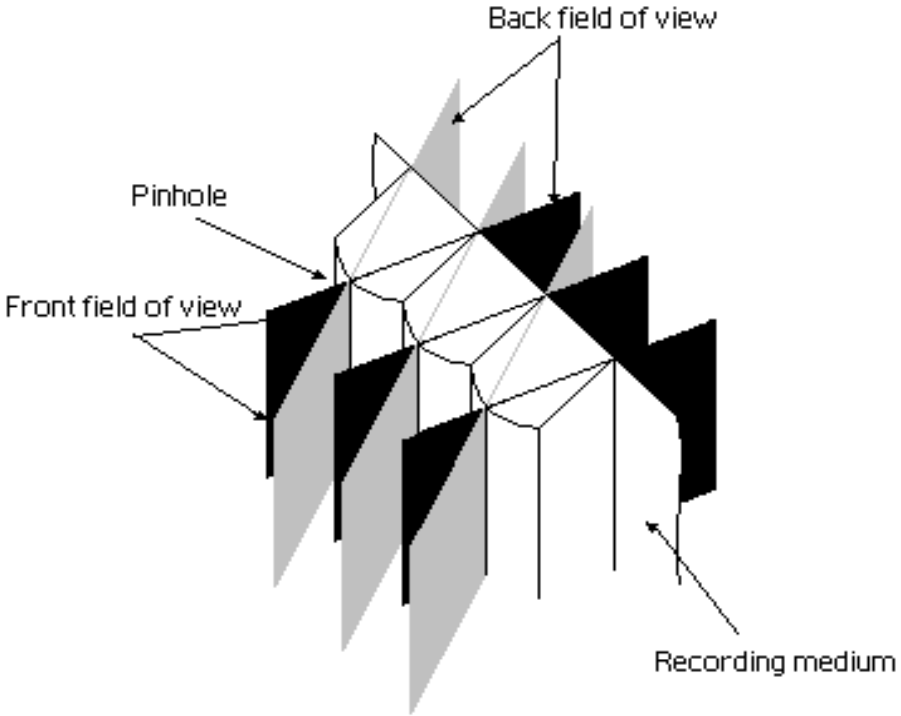
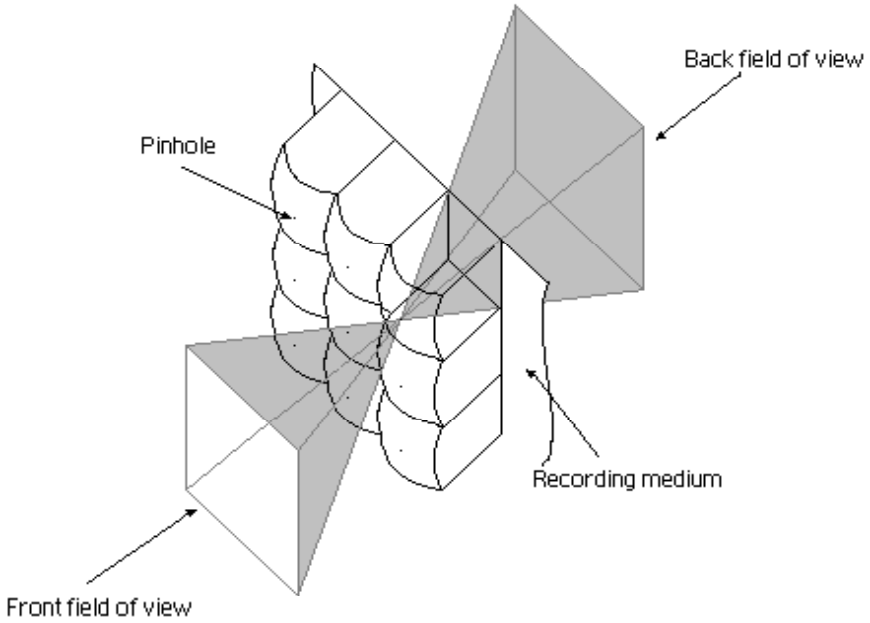
Microlens Arrays



1D Array of Cylindrical lenses to record Unidirectional Integral Images



2D Array of microlenses to record Omnidirectional Integral Images

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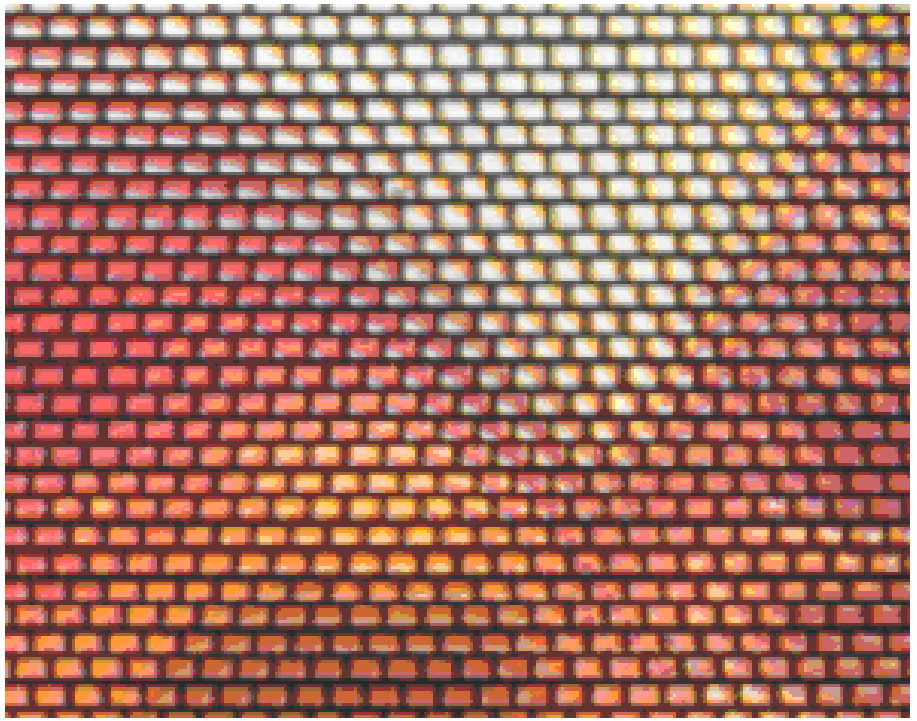
An electronically captured Omni directional 3D Holoscopic image

3D Holoscopic Image



Magnified Section

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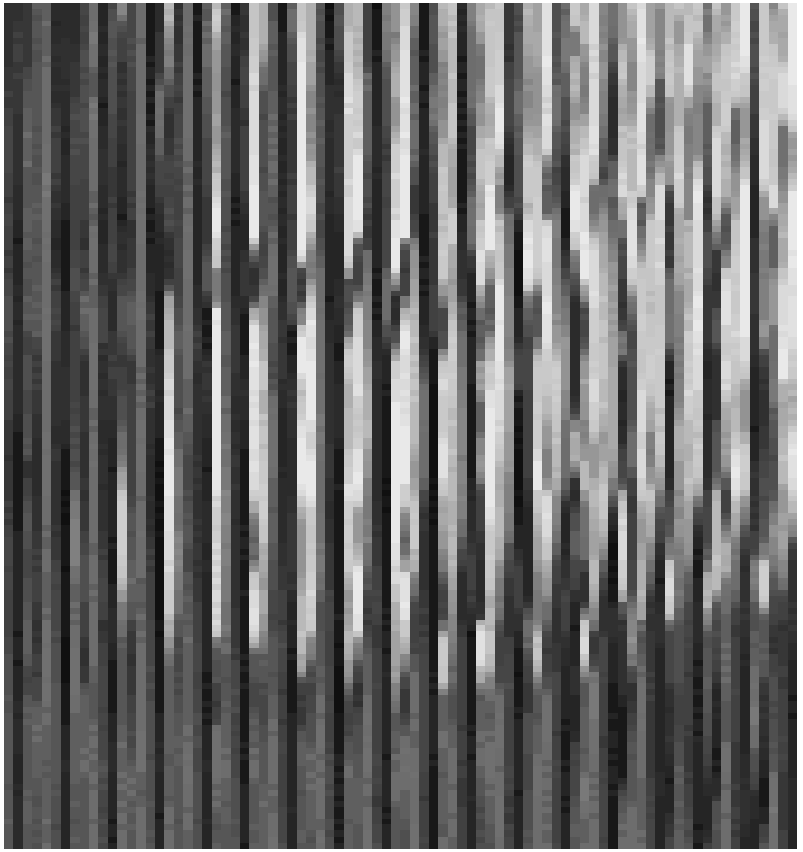
An electronically captured unidirectional 3D Holoscopic image

3D Holoscopic Image



Magnified Section

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Research Themes

- Live Capture of 3D Content (Optics and Electronic)
- Real-Time Computer Generation of 3D Holoscopic Content
- 3D Games
- 3D Video Coding
- 3D Virtual Studio For Mixed 3D Content Generation
- 3D Digital Cinema: Large Scale 3D Video Projection
- 3D feature extraction and recognition
- Medical Imaging
  - 3D Medical Visualization
- Surveillance and Security:
  - 3D Face Recognition

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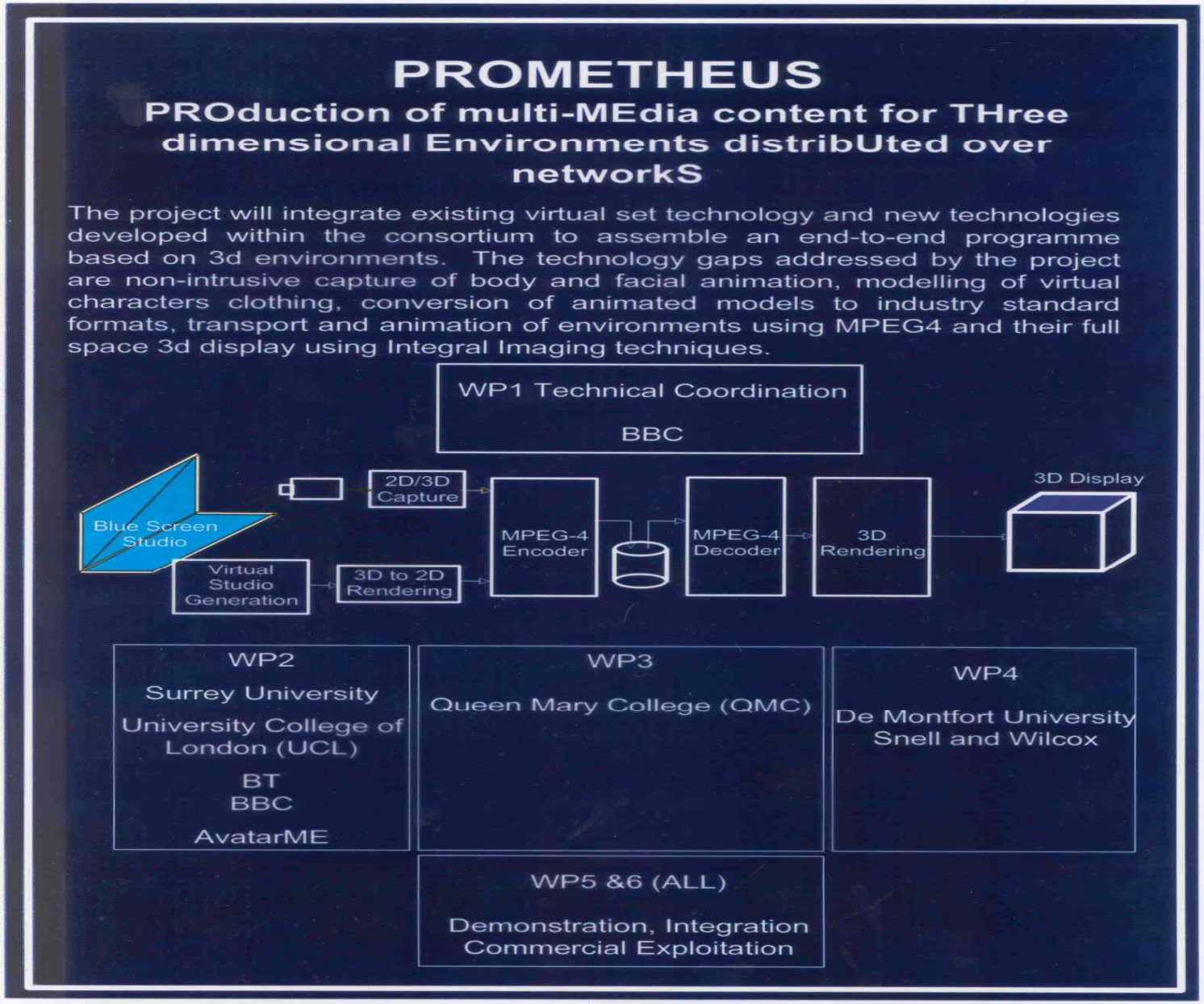

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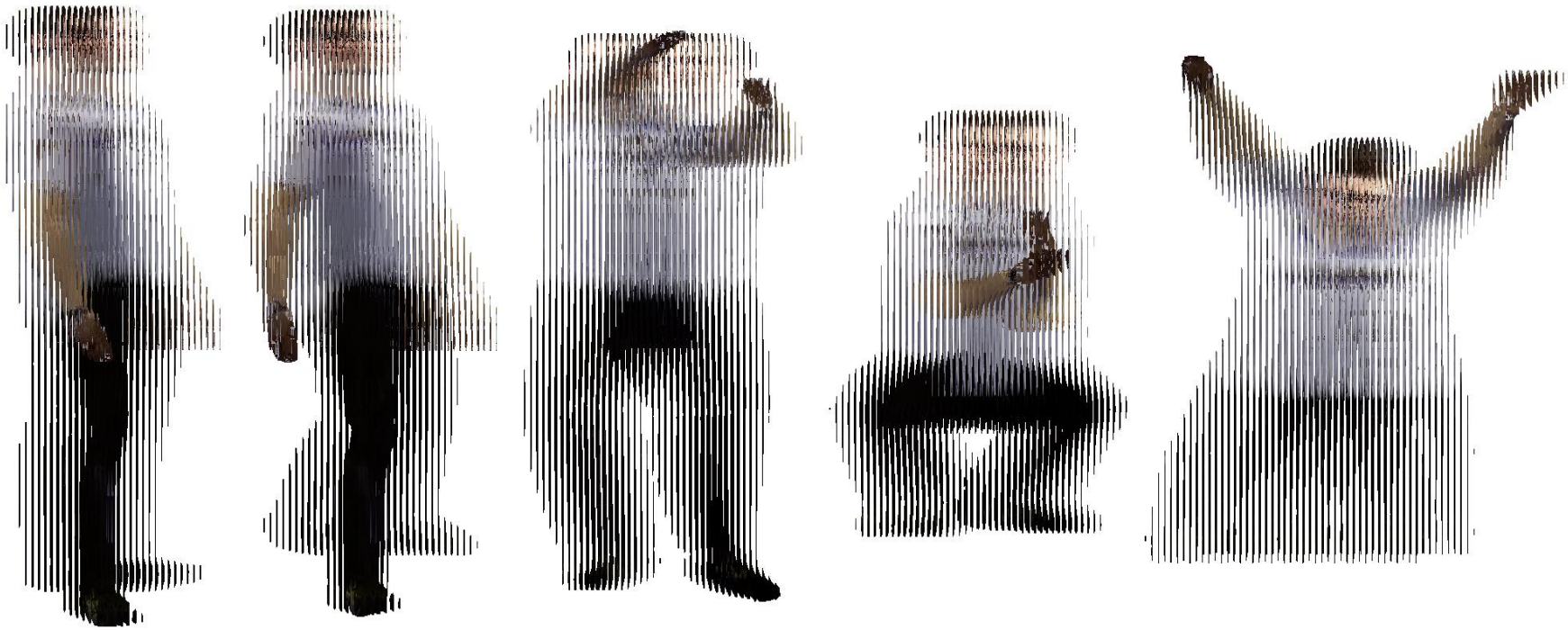
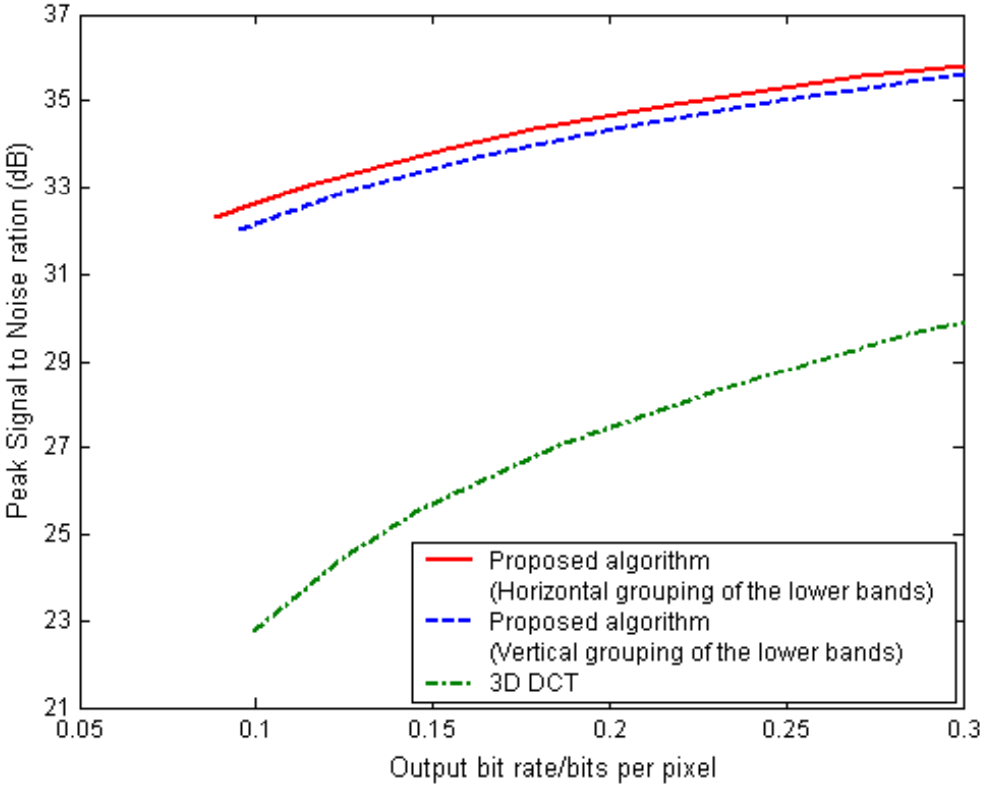
Low Resolution displays

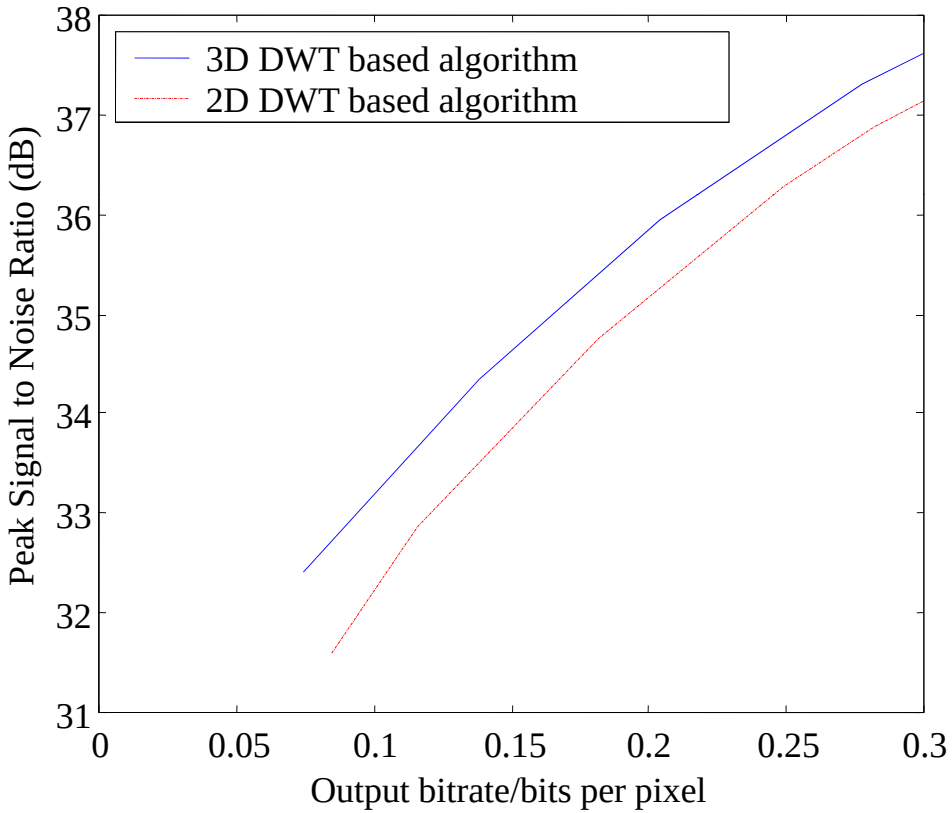


High Resolution displays

3D Holoscopic Image compression



Performance of the proposed compression algorithm and the 3D DCT scheme



Performance of a3D DWT based compression algorithm and a 2D DWT based scheme.

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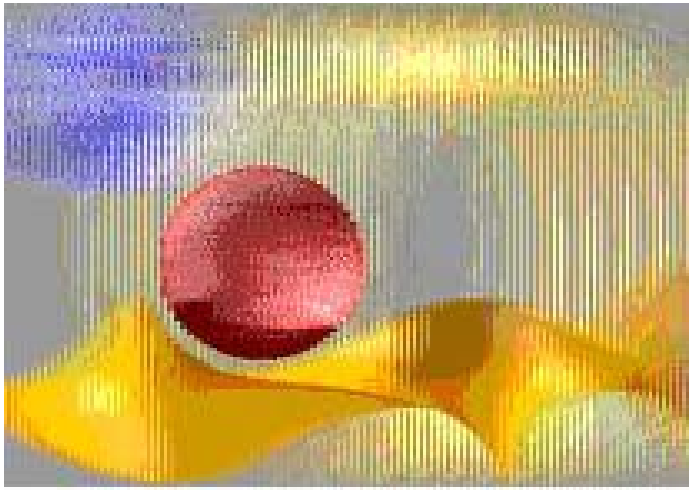
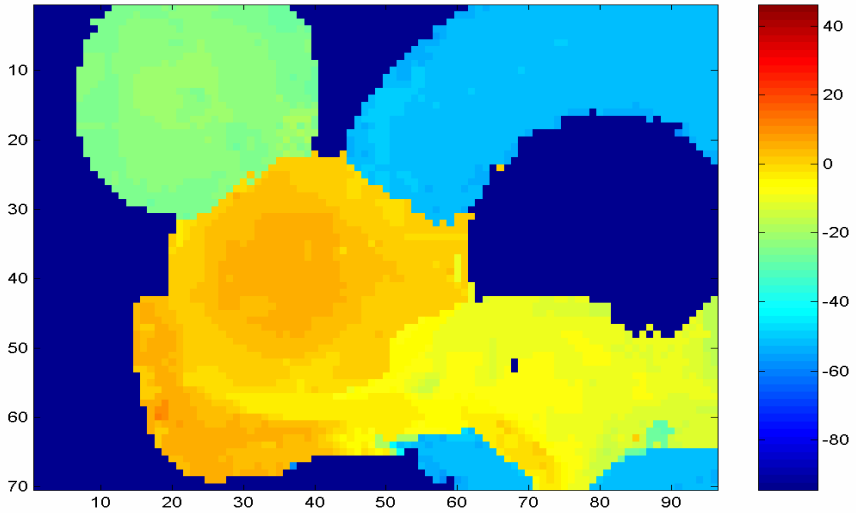
Depth Extraction



A unidirectional 3D Holoscopic image

A viewpoint image



The depth map

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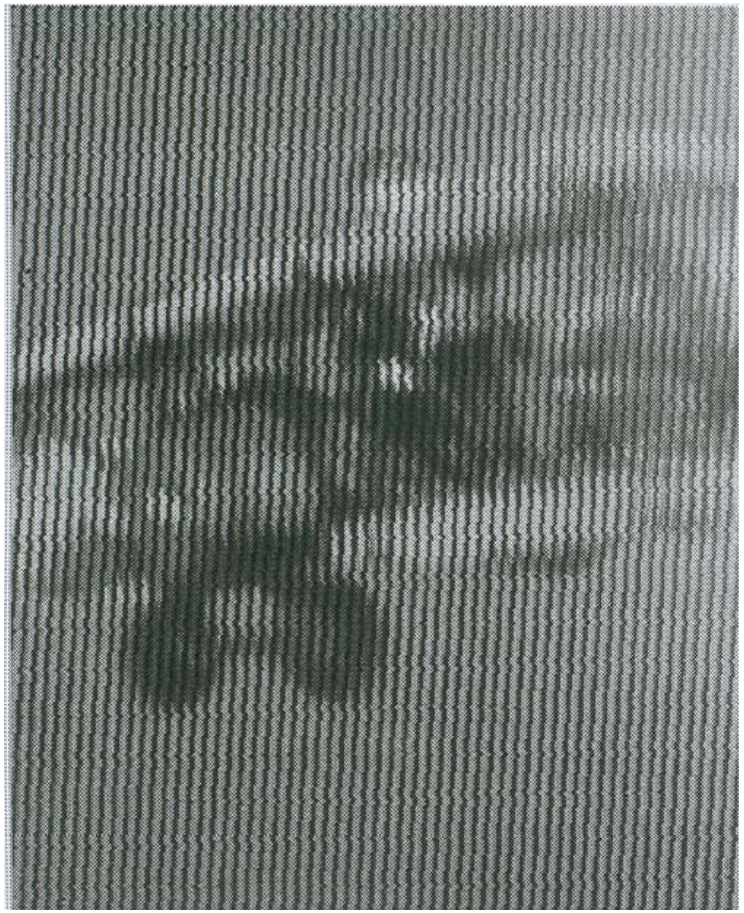
Correction of geometric distortions



Distorted 3D Holoscopic image

Corrected 3D Holoscopic image

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Conclusions

- 3D Holoscopic imaging technology is a candidate for consideration in terms of human factors, cost of conversion of studios , production of content, decoders and current cost of display technology;
- Compression algorithms with high ratios are possible;
- Computer generated content can be produced by other than ray tracing;
- Display technologies are advancing to a point where high contrast images of good depth can be displayed;
- Traditional Image processing tools applied directly or modified to accommodate the data structure and enhance the image quality and/or extract information about objects in the 3D world;

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