Data Acquisition for Virtual Reality

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Virtual reality does not have to use only computer graphics data but can use data from real environment as well. The contribution of CMP is in the design of methods which allow to capture real data and present them to a user moving in a virtual space. Viewer motion, that is changing of a viewpoint requires correct display of close objects. The system allows applications like photo-realistic virtual museum tour or simulating a window into virtual world.

The principle of visualization is in computing of stereo-images as if captured by virtual cameras from the points, where observers eyes are located. Virtual views are composed by selection of proper rays from captured images and their correct arrangement into images.

Acquisition system with a rotating camera

Currently, there are two basic setups. In the first, images are captured by a rotating camera with a fish-eye lens. This scenario allows the user to look all around in the virtual space and move within a circular region of the space. The previous figure shows image capture setup used to virtualize a part of a ground-floor of National Technical Museum in Prague.

The accurate knowledge about the parameters of projecting system is needed for realistic and geometrically accurate modeling of scene. This information obtained by calibration allows to assign a ray in the space to each pixel in the image.

In the second setup, the camera is moved along a straight line. The user can then observe the environment through a virtual window.

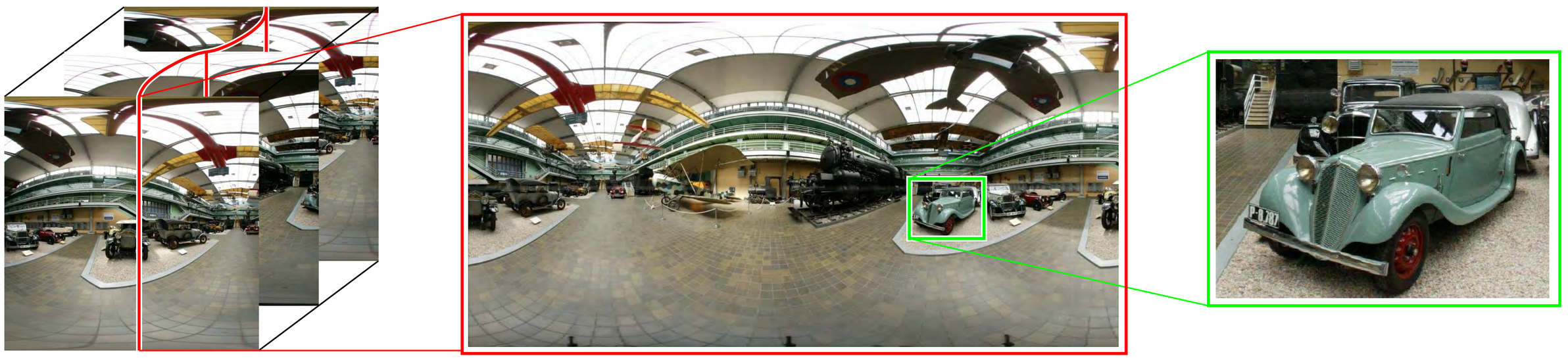
The camera captures images, which cover more than a half-space ($183°$). The camera itself rotates so it is capturing a set of rays rich enough to allow wide selection of optically proper rays for generating stereo images.

Single image provides visual information about the whole surroundings but unlike in other systems the real contribution of the method is that data allows on-line generation of stereo images to the user.

The almost perspective images such as a detail shown in the bottom figure are projected stereoscopically to the user's head mounted display, giving a full 3D impression.

Single input fish-eye image covers whole half-space in front of a viewer. As the camera moves, individual fish-eye images are unwarped and stacked into an image volume.

Presentation on Cebit 2005: The augmented door frame divides two virtual worlds. The viewer can look and walk though the door from one world to another. The door frame is augmented both physically and virtually.



Synthesis of virtual view: a slice through the image volume corresponds to the position of the viewer and creates a panoramic image. This image captures all viewing directions from a single point in space. An image presented to the viewer is only a subset of this panoramic image corresponding to the field of view of the visualization device.