Title:	Disparity Based Omnidirectional 3D Reconstruction Using Convex Mirror Pair
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Abstract:

The goal of this work is to create a three dimensional texture and geometric information of a real world scene from a two dimensional image. As computers and cameras have made a remarkable progress in the recent years, a large number of methods for reconstructing 3D scene from images have been proposed. The majority of the methods use multiple images to reconstruct a 3D view, whereas very few methods use single image for 3D reconstruction. To the best of our knowledge, no 3D scene reconstruction method has been developed by using convex mirror. In this thesis, we present a new approach towards omnidirectional 3D reconstruction from a pair of convex mirrors by using a single image. The advantage of using convex mirror is that it gives a wide viewing angle and thus covers a larger area of the room. We designed a hardware setup that consists of a pair of convex mirrors attached to the ceiling of the room and a Nikon 3300 digital SLR camera used for capturing an image of the reflection from the convex mirrors. To remove the disparity in the shape of the mirrors, we first create a shape model for each of the mirror by computing the point cloud of the mirrors and fit a curve that represents the shape of the mirror. After we obtain the shape, we propose an algorithm for computing the 3D reconstruction of the scene viewed in a mirror from a single image. Results obtained were very close to the actual location of the object. Our algorithm has more than 95% accuracy for a depth of about 2 metres. We have also shown reprojection errors at various heights and at wrong pixel selection in our thesis.


Figure 1.1: Convex mirror used in our experimental setup

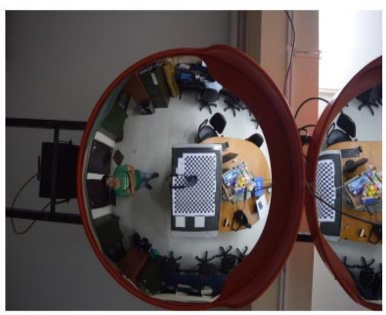
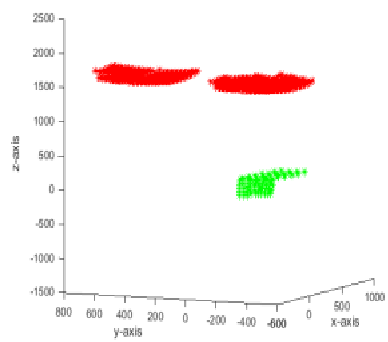


Figure 3.3: Checkerboard used in our experimental setup



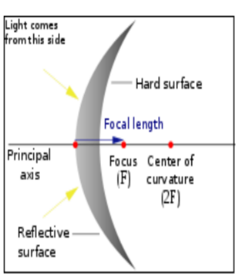


Figure 1.2: A convex mirror diagram showing the focus, centre of curvature, principal axis, etc (Source: Wikipedia)

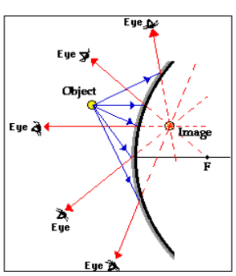


Figure 1.3: Formation of image (Source: Wikipedia)

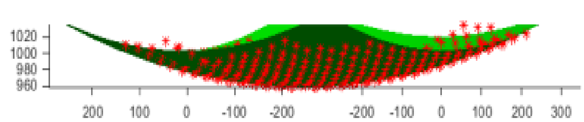
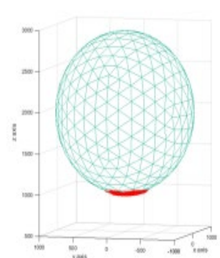

(b) Closer view of spherical curve

Figure 3.9: Spherical curve fit


(a) Spherical curve fit