Arbitrary Viewpoint Visualization for Disaster Response Robots

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Abstract. We propose an arbitrary viewpoint visualization system for disaster response robots. The system can prevent operability reduction when teleoperating. The cause of operability reduction is to operate by several monitors. Therefore, we integrate several images to one bird eye view. In addition, the system can move the viewpoint to a position easy to operate and synchronize the robot CG model with the real robot pose. In experiment, we confirmed to synchronize and to display around the robot. The proposed system improved operability reduction.

Keywords: Arbitrary Viewpoint Visualization, Disaster Response Robot, Teleoperation

1. Introduction

Since the Great East Japan Earthquake and Tsunami, Japan has reminded the entire the importance of disaster risk management. As risk management, rapid life-saving and lifeline restoration are most important to protect people life and property. However, there are also disaster areas where personnel cannot be immediately devoted due to the fear of secondary disaster. Therefore, disaster response robots are devoted in disaster areas instead of people.

With the progress of AI technology, autonomous travelling robots are increasing as of 2018. However, in disaster areas because of unexpected situation, teleoperating is mainly adopted. When teleoperating, operaters need to monitor. So, the operator monitors displays from cameras or panoramic camera set the robot and operates while confirming its safety [1]. However, operability reduction because of blind spots, fixed viewpoint and failure of cameras has emerged as a problem. So, several camera image integrate to one large image [2]. However, wide angle of view is needed for using in disaster areas.

Therefore, we propose arbitrary viewpoint visualization method for prevention of operability reduction using fisheye camera when operating disaster response robots.

2. Arbitrary Viewpoint Visualization

In this chapter, we explain the proposed method. The robot is set 4 fisheye cameras (Fig.1). However, each camera has blind spots. Therefore, each images are integrated to a bird eye view for eliminating blind spots. After the distortions of fish eye images are corrected, Each image is projected to a hemispherical 3D model as the bird eye view. An arbitrary viewpoint visualization is expressed by moving a position the viewpoint in the 3D model (Fig.2). We

can move to an arbitrary position the viewpoint using trackballs or mouses. The operetor needs to monitor the robot itself for operating. Therefore, the robot CG model is arranged at center of the hemispherical 3D model. Moreover, the robot model arms and bodys angle are synchronized with the real robot using angles sent from the robots. The system updates the scene every 30ms in average.

Fig.1 The disaster response robot

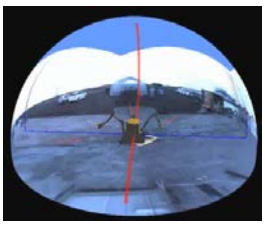

Fig.2 The Arbitrary Viewpoint Visualization

3. Experiments of Arbitrary Viewpoint Visualization

The experiment was performed using the robot made by Komatsu in Fukushima robot test field (Fig.1). The robot can rotate 2 arms through 360 degrees. We confirmed the pose of .the real robot synchronizes with the robot model (Fig.3). The 4 pylons set around the robot (Fig.4). We counted the number of pylons in the bird eye view (Fig.5). 100 frames in 100 frames was showed the 4 pylons.

Fig.3 The model pose

Fig.4 Around the robot

Fig.5 Pylons in the bird eye view

4. Conclusion

We proposed the arbitrary viewpoint visualization for teleoperating. We confirmed Op-eretator can operate by the proposed system. As a result, we showed the effectiveness of the proposed system for preventing operability reduction. In the future, we will improve to the update delay.

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