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Patient Setup Aid with Wireless CCTV System in Radiation Therapy

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Purpose: To develop a wireless CCTV system in semi-beam's eye view (BEV) to monitor daily patient setup in radiation therapy. Materials and methods: In order to get patient im-ages in semi-BEV, CCTV cameras are installed in a custom-made acrylic applicator below the treatment head of a linear accelerator. The images from the cameras are transmitted via radio frequency signal (~2.4 GHz and 10mW RF output) at the frame rate of 5 per second. An expected problems with this system are (1) radio frequency interference (RFI), and (2) radiation damage to cameras. These problems are solved utilizing RF shielding with Cu foils and minimum radiation shielding from the scattered radiation from the treatment head. The images of a patient from 2 sets of cameras are input to the computer via RF relay, which is installed in the walls of the treatment room. The images are analyzed by our custom-made software running on a personal computer. In the soft-ware, three anatomical landmarks in the patient surface are indicated by a user, then automatically the 3 dimensional structures are obtained and registered by utilizing a localiza-tion procedure consisting mainly of stereo matching algorithm and Gauss-Newton optimization. This algorithm is applied to phantom images to investigate the setup accuracy. Results: More than 80% of the camera noises from the linear accelera-tor are eliminated by wrapping the camera with copper foils. The accuracy of the localization procedure is found to be on the order of 1.5±0.7 mm with a point phantom and sub-millimeters and degrees with a custom-made head/neck phan-tom. Conclusion: The wireless CCTV camera system is the novel tool which can monitor daily patient setups. We are going to develop special image processing tool to correlate CCTV images and 3D images set reconstructed from CT im-ages.

Keywords : IGRT, Patient Setup Aids, Wireless CCTV