Professor Jaroslaw Damian Kasprzak (EUD ID : 40265)
Medical University Of Lodz
Chair And Dept. Of Cardiology
Bieganski Hospital
91-347 - Lodz Poland
Phone : +48 422516075 - Fax : +48 426539909
Email : kasprzak@ptkardio.pl

Edit Information

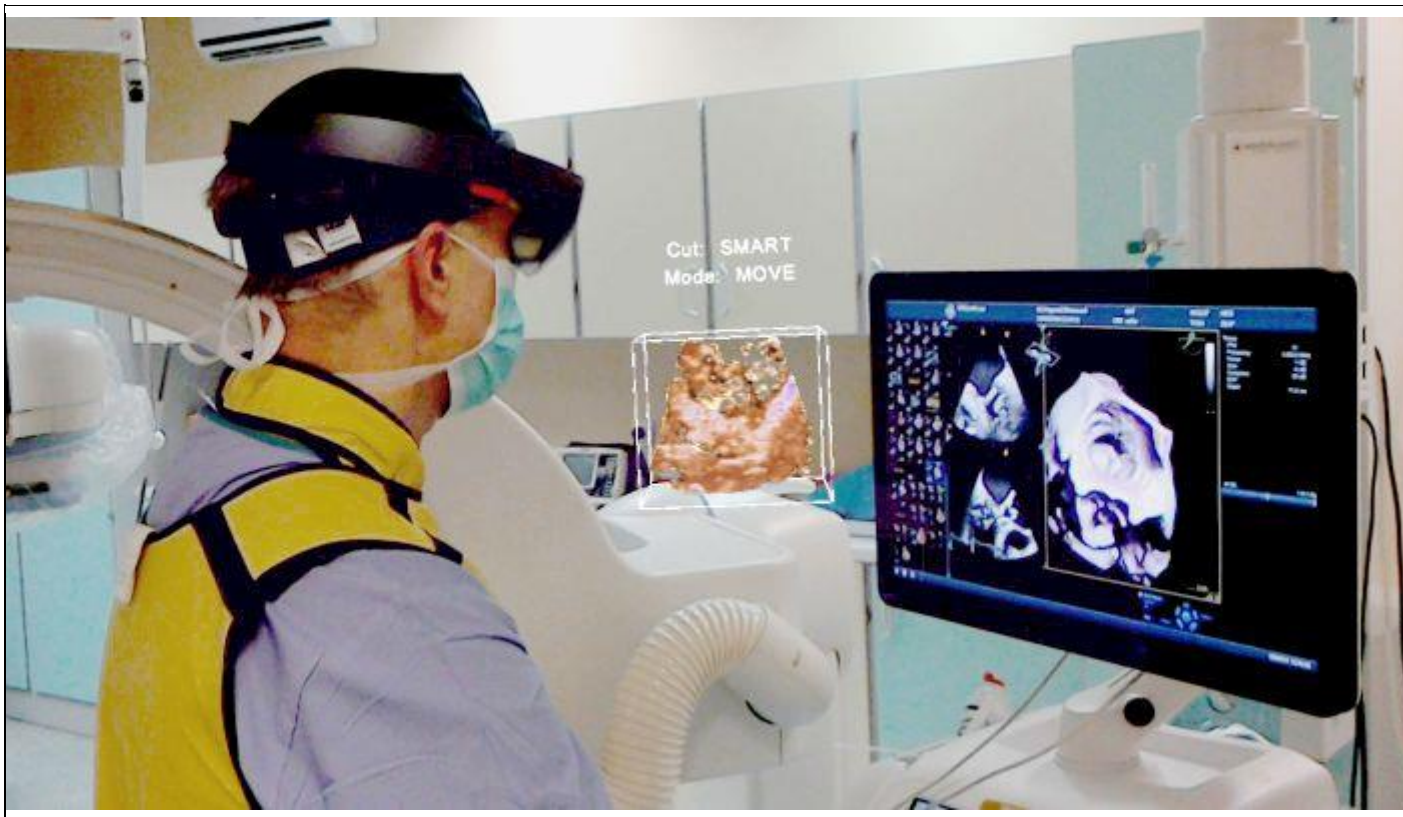
Title: Development of mixed reality interactive visualization for three-dimensional echocardiography.
Topic: 3.99 - Imaging - Other
Category: General
Option: No Options

Edit Author

J. Pawlowski[1], K. Janc[1], U. Kaczor[1], J. Kaminski[1], JI. Kasprzak[1], M. Kierepka[1], B. Machura[1], J. Witowski[1], D. Zebrowski[1], K. Wdowiak-Okrojek[2], P. Lipiec[2], JZ. Peruga[2], R. Krecki[2], JD. Kasprzak[2] - (1) MedApp SA, Krakow, Poland (2) Medical University of Lodz, Lodz, Poland

Edit Content

Aim. Use of three-dimensional (3D) information for optimal understanding of complex anatomy and reliable quantification has become a preferred standard in cardiac imaging. However, displaying 3D information on standard computer monitors limits access to important content. We report on development of innovative mixed reality technology for navigating 3D echo datasets displayed in HoloLens - mixed reality head-mounted wireless device.
Methods. In initial stage, clinical collection of transthoracic and transesophageal 3D echo datasets converted to Carthesian DICOM has been used to test the feasibility of mixed reality: head-mounted device overlying holographic image of cardiac data onto real-world viewing by operator. Later, the option of live streaming of 3D echo data was explored.
Results. We developed a dedicated software pathway for files conversion, real-time Wi-Fi streaming of 3D rendering from PC to device and manipulation of spatial data including multiuser interface for data sharing. This custom software proved successful for advanced visualization of 3D echo (also CT, 3DRA, MR), allowing volume rendering with advanced postprocessing. All 3D echo datasets were successfully converted and displayed in mixed reality as a holographic image. The quality of visualization was diagnostic without content loss in >90% of datasets as judged by operator, based on datasets with valve disease, congenital disease/percutaneous occluder and cardiac masses. Volume-rendered and maximum intensity views were successfully tested. Later, raw 3D echo data stream in native resolution was transferred resulting in successful HoloLens display with 80 ms delay interpretation of stream in average. This culminated in successful, first-in-man test of real-time augmented reality display during percutaneous balloon commissurotomy. Navigation in dataset was accessible via hand gestures and voice commands, including 3D manipulation (translation, rotation, scale) and volume cropping. Touchless user interface for head-mounted display was practical for use in interventional theatre without compromising sterility. Figure shows the idea of mixed reality interactive visualization of intraprocedural 3D echocardiography.
Conclusions. Mixed reality display using head-mounted device is feasible and shows promise for fully volumetric, intuitive display and navigation in spatial datasets obtained with routine three-dimensional echocardiography. First-in-man experience with mixed reality, voice-controlled display of real-time 3D echo data using touchless visualization control proved feasibility in interventional scenario. Cooperation of GE Healthcare teams Poland and Horten, Norway is to be gratefully acknowledged - credits to Gunnar Hansen, Eigil Samset, Katarzyna Olszowska-Pawluczuk, and Tomasz Ogonowski. Computer demonstration is planned as a presentation add-on.



Mixed reality display of PMC 3D echo

Euroecho 2018