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Development of a mobile augmented reality device for bed-side guidance of EVD insertion

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Introduction: When placing an EVD in small ventricles, for example, after a trauma to record ICP, the accuracy is lower than expected (Toma 2009). Furthermore, the procedure is usually done by junior residents rather than by senior residents or consultants. We present a system for improving the targeting performance using mobile device augmented reality.

Methods: We have developed a guidance system, which consists of a mobile device as well as a pair of tracked glasses that are placed on the patient during the procedure. The glasses are far away from the surgical field and therefore do not require to be sterile. The mobile device utilizes the Vuforia software development kit, developed by Qualcomm, to achieve image-based tracking required for augmented reality. Our design was implemented on the Android platform.
In order to obtain the visual and spatial information, the system requires a CT image of the patient's head to be segmented and registered within the augmented scene. In addition to the AR application, we have developed a user interface to perform the segmentation of a patient's ventricles and skull, and to facilitate the initial coregistration.

Results: The pilot study showed that users targeted more accurately while under AR guidance for two dimensional localization tasks when compared to externally guided tasks using spatial reasoning.

Conclusion: Our mobile device-based augmented reality system can be used to train residents and to guide drain placement procedures at the bedside with minimal equipment. The system provides image-guidance for neurosurgical tasks, specifically the placement of an external ventricular drain. The application was developed in conjunction with a quantitative methodology for assessing targeting performance, and as such can be used to assess the reduction of targeting error caused by catheter misplacement, and ultimately reduce complications in the procedure.