An Augmented Reality C2 Sand Table Visualization atop An Advanced User Interface Display

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1 AN AUGMENTED REALITY C2 SAND TABLE VISUALIZATION ATOP AN ADVANCED USER INTERFACE DISPLAY

A U.S. Navy project explored the rapid production of high-fidelity user interface prototypes to be utilized by end users, researchers, designers, and engineers working together to develop and validate, new concepts of operations and emerging technologies. Key to this futuristic vision was the emphasis on the human-computer interfaces for collaboration. Initial designs were applied to large multitouch display devices to explore alternative UIs. Augmented Reality (AR) has presented itself as an emerging technology where collaboration amongst end users provides an interesting concept. The question asked by this work is, can both a large screen multi-user touch table be used in conjunction with an Augmented Reality overlay for additional collaboration within a virtual environment?

User Interface prototypes which focus on innovative concepts continue to progress through the efforts of processes such as User-Centered Design. This process addresses critical functions of situational awareness, decision making and control. The exploration of AR must follow a similar path to become a future Navy interface. The Navy has expressed interest in AR technology however, the practical application remains difficult. The current size, weight, fitment and calibration of AR head gear is an operational barrier, although these obstacles will become less of an issue as technology matures. Current efforts are directed more towards visualization, situational awareness, and scene understanding especially within a collaborative environment shared with multiple end users. AR provides individually tailored perspectives of the interface, along with the option to provide re-mote collaboration through virtual avatars, items not found in current dis-play technologies. Additionally, interesting human factors questions need to be addressed regarding overlaying AR on top of touch table interface.

Developing user interfaces for the Navy has provided the backdrop for this effort. While current AR technologies do not have the display quality and capability such as found in a 55" touch table they will improve over time. Some of the current research in AR has incorporated technologies such as ray tracing that allow AR objects to be almost indistinguishable from real objects within the view. While this is not the intention of this effort it does demonstrate that AR at some point will provide high quality graphics and capabilities yet to be found in the current technology.

AR interfaces and connections were made to Command and Control systems with the intent to display data into a virtual sand table and send commands through the network. Collaboration between users of differing classification levels were previously examined. This work will not address the comparison or utility of certain AR headsets over others but used the Magic Leap One headset system. A previous work connected AR to a human supervisory control system for multiple unmanned autonomous systems as a collaborative Command and Control sand table display. This work builds upon that concept by interfacing to the touch table system with the Next Generation Threat System simulator.

Adding an AR component provides the means to explore, analyze, develop and test this emerging technology that maximize the human interaction in collaborations. This permits the experimentation, testing and evaluation of AR for Navy use through a quick look at interfaces that collaboratively explore and validate AR as it impacts on the decision-making process. The data shared between the touch table application and the AR device include view orientation (position, rotation and camera zoom level) and heading of simulated entities. The determination if an AR view could be overlaid on top of an existing touch table view was prime objective. The AR view is offset from the touch table view however, still align in position and movement of touch table display elements. Size, position, orientation and other factors have to be synchronized correctly and efficiently across two independent and different views. This primary effort then allows a human-computer interface

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study to determine if this particular technique can be validated for effectiveness under operational use.

The technical approach has two main goals, first examine novel user inter-face for future Navy human-machine interfaces, and second the development of an AR prototype application which can be used collaboratively with other non-AR users of a touch table display given the equivalent information set.