

Medical Extended Reality Clinical Decision Support Triage – MXR-CDS Triage

David Luellen MBA, BS¹, Nicole Caldwell MA, RN¹, Sidney Cox MS¹, Alicia Williams MD¹, Maria Serio-Melvin MSN, RN¹, Jose Salinas PhD¹, Sena Mike MS¹
¹US Army Institute of Surgical Research, JBSA, San Antonio, TX

Introduction

- In mass casualty scenarios, healthcare workers face challenging triage decisions, sometimes with limited resources and personnel.
- Mixed reality (MXR) offers enhanced visualization via holographic overlays, visual cues, and situational guidance for executing manual procedures, along with hands free, voice enabled control.
- Under these circumstances, clinical decision support (CDS) and mixed reality (MXR) tools can help fill knowledge and skill gaps, improving patient care and reducing cognitive burden for caregivers.

Capability Description

- Our team developed a mixed reality clinical decision support triage application, coined MXR-CDS Triage, that has semi-automated triage categorization, patient tracking and monitoring, and resource guidance tools. (Fig. 1)
- The application operates on a hands-free, heads-up display, which interfaces with a Program of Record military documentation system (e.g. BATDOK™), to provide triage guidance and patient monitoring from near real-time vitals streaming and patient documentation.

Technical Approach

- MXR-CDS Triage currently runs on the Microsoft® HoloLens 2™. Clinical content includes a novel triage algorithm that was developed using a modified Delphi consensus research study of triage subject matter experts.
- MXR-CDS Triage connects with BATDOK™, streaming real-time vital signs through Bluetooth from wearable sensors (Fig. 2).
- Two additional custom applications interface with MXR-CDS to facilitate parsing of real-time data streams, manual vitals entry, and data collection.
- TITOS (The Input to Operation Software): The Android application developed to enable reporting of BATDOK™ data and Med Entry application patient updates. It correlates data from BATDOK and Med Entry to present the current state of patient information stored in a SQLite database.
- Med Entry (Fig. 3): The Android application that allows for manual entry of vitals directly to TITOS to test triage algorithm output.

Results



Figure 1: MXR-CDS Triage screens. Displays multiple casualties with color-coded triage categorizations. Patient vitals and treatment details are displayed and movable within real world space.

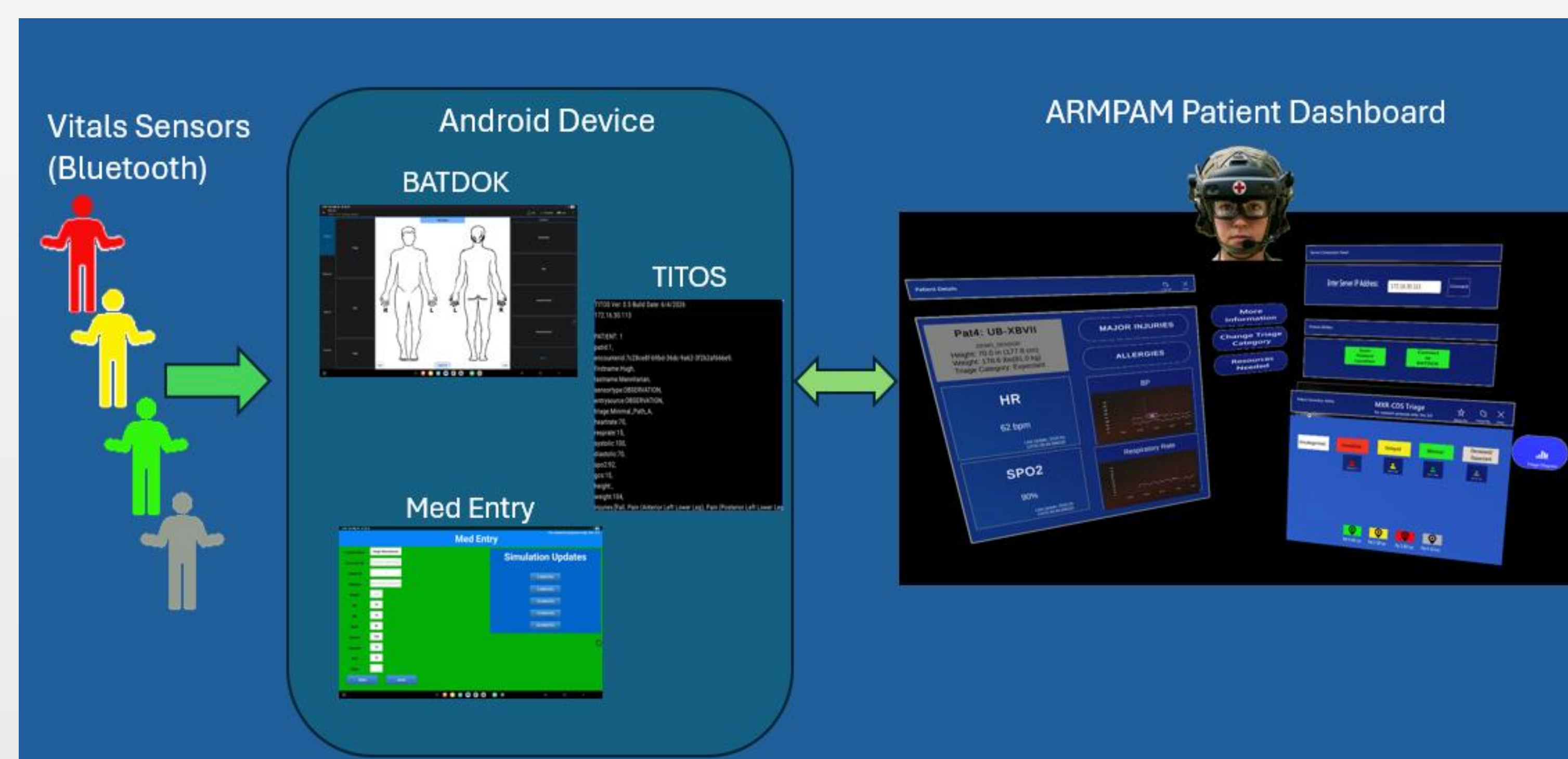


Figure 2: Comprehensive System: Patient sensors feed to BATDOK. TITOS receives BATDOK data and triages patients. Med Entry manually updates patient vitals on TITOS. ARMPAM receives triage and vitals from TITOS and sends patient assessment to TITOS.

Figure 3: Med Entry: An Android backup application that allows manual entry of patient vital information into TITOS, in case BATDOK™ is unavailable.

Results

- MXR-CDS application development features include (Fig. 1):
 - Patient command and control dashboard
 - Semi-autonomous triage categorization with manual override capability
 - Static and trending vital sign visualization
 - Alerts to changes in patient condition, triage category, and network disconnection
 - Patient location tracking
 - Resource requirements for injury type

Applicability to Medical Roles of Care

- Advanced military capability to support medical triage from point of injury to Role 1 or Role 2 environments.
- May be deployed by non-medical personnel during MASCAL events.

Impact to the Warfighter/Significance

- MXR-CDS Triage has the potential to advance combat casualty care as a force multiplier by decreasing the number of personnel needed to perform triage and patient management.

Developmental Status of the Technology

- Current TRL level is 3 with anticipated TRL 6 upon completion of planned testing. Future development includes improved data flow from between technologies and transition to other MXR glasses and future tactical headsets.
- Future Directions:
 - This application will undergo usability and validation testing.
 - Additional testing will be conducted in realistic field test environments.
 - Anticipate a higher TRL level upon completion.
 - Integration into future soldier born mission command headsets

Acknowledgements

Funding provided by the Combat Casualty Care Research Program: #CO240060



To learn more, visit:
<https://usaisr.health.mil>