FirstModulAR: Designing and Integrating Augmented Reality User Interface Modules for First Responders

Executive Summary

The Problem: First responders are increasingly gaining access to vast and complex real-time data. Unfortunately, this can be overwhelming to responders who often must make tough decisions and act quickly in situations where mistakes can be deadly. Information overload can potentially backfire resulting in decreased situational awareness and delayed reaction times instead of the intended result of improving understanding and decision making in critical incidents. To benefit from the additional data, intuitive and non-obtrusive user interfaces need to be developed that allow first responders to increase situational awareness and interact effectively with data, without inducing cognitive overload.

Objectives: We propose **FirstModulAR**, a public safety Augmented Reality (AR) design project to accelerate the adoption of AR UIs by first responders. Our overall goal is **to identify, based on existing data as well as systematic collaboration with first responders, areas where AR can most benefit public safety and investigate how to solve for challenges through a modular design approach**. Our objectives are:

1. Identify public safety use cases and define a taxonomy of AR patterns;
2. Design, implement, and evaluate a collection of AR UI modules relevant to Public Safety Operations;
3. Integrate AR UI modules into public safety use cases;
4. Evaluate AR public safety use cases with first responders.

Approach: We will achieve our objectives by working closely with first responders, as part of the research team as well as the larger public safety community, through four distinct phases that correlate with the objectives listed above.

We will utilize agile methodologies, collect qualitative and quantitative data, and formally evaluate the modules and use cases. This will include a minimum of 3 ride-alongs, 3 training observations, 30 semi-structured interviews, 12 focus groups, 100 questionnaires, and 6 user studies.

Anticipated challenges: Although AR has significant potential for improving first responder operations, the technology still poses significant challenges. Current AR hardware is not yet robust enough for deployment in real-world incidents. Our team has been successful in incorporating VR into public safety *simulated* scenarios with current technology. We will work with first responder consultants and public safety organizations who will assist us in recreating realistic conditions where we will be able to successfully prototype new AR modules and use cases. We will focus our research on AR usage instead of system artifacts and generalize our software to be hardware independent and reusable to enable integration into new AR hardware that becomes available, thus reducing technology-adoption barriers.

Benefits and Impact: The results of this research will build awareness among public safety stakeholders regarding the benefits of AR technology, eventually leading to **decreases in the time, costs, and risks associated with first responder operations**. First responders will be presented with actionable information in an intuitive manner that fits the context of their environmental conditions, personal protective equipment, and communications systems. The evaluation and refinement of the patterns will serve **as guidelines for identifying future interfaces** and the **user interface modules will be capable of being integrated into a broad range of use cases** beyond those that we implement, resulting in an **acceleration of beneficial AR UIs by first responders** This will ultimately lead to **increased performance, transferability, and deployment of AR to field operations**. **The impact of this work will be transformative in the way public safety operations is more effectively conducted and will lead to a set of verified AR UIs that increase situational awareness, reduce uncertainty, and improve decision making among first responders**.

Team: FirstModulAR brings together two successful XR teams with complementary strengths and experiences joined by a network of first responders, where the strengths of each will be combined to ensure the delivery of high-quality first responder AR UIs. The IRLab at UNCG is a leader in the design and research of XR UIs while NextGen Interactions is a leader on the industrial design of XR applications. This combination of scientific, technical, and public safety expertise makes the team uniquely poised to successfully achieve the objectives of FirstModulAR.