

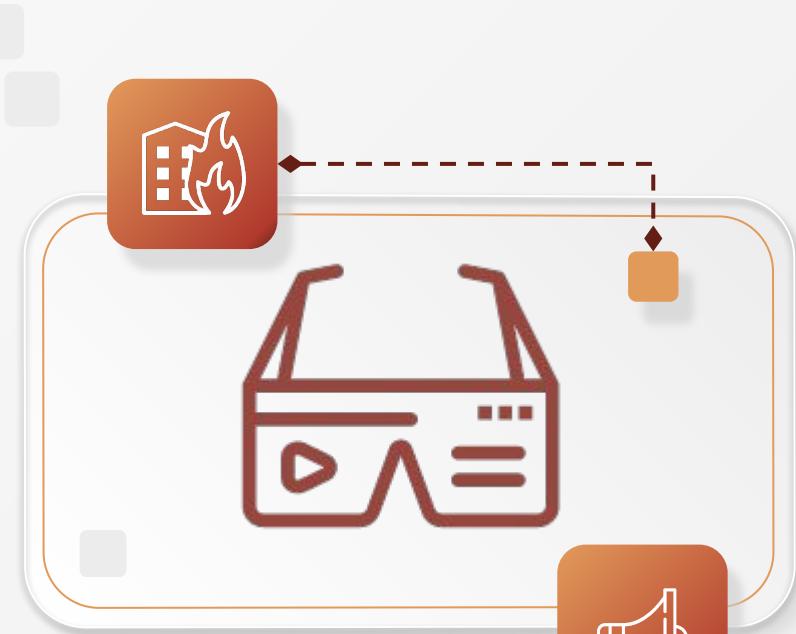


Conceptualizing the Design and Use of Augmented Reality Within a Common Operating Picture for Incident Command Systems

Final Presentation

May 3rd, 2022

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OVERVIEW



01

THE PROJECT

The project definition & introduction

02

KEY FINDINGS

Research methods and key results

03

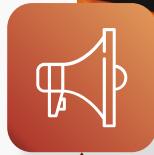
PROTOTYPE

Early concepts realized with a web-based 3D interface

04

RECOMMENDATIONS

Progressing further research, design, and development



01

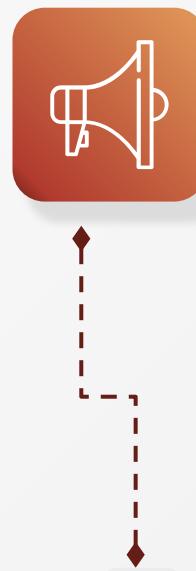
THE PROJECT

The Indiana University Crisis Technologies Innovation Lab (IU CTIL) is exploring the design of an augmented reality system that will help both incident commanders and other first responders.

Our team was tasked to investigate and research past, present, and future design systems that may influence user experience and expectations in a command and control application during times of crisis.



RESEARCH GOALS



Define the value of real-time location tracking and asset management during emergency incidents

Discover how AR can improve **situational awareness** and decision making

Provide future product **feature requirements** and design recommendations that can achieve success in the short and long term





02

KEY FINDINGS

Conceptualizing the Design and Use of Augmented Reality Within
a Common Operating Picture for Incident Command Systems



RESEARCH METHODS

Conduct interviews with subject matter experts (SMEs)

These SMEs had a background in incident command and AR technology.

Site visit at IMPD Command Center

Real-world example of current Incident Command workflows and communication patterns.

Affinity Mapping

Highlighted themes about ICs personalities, work habits, needs, values, and goals



Empathy Mapping

Created to focus our comprehension of future user concerns





RESEARCH METHODS

Persona Development

Developing the personas of potential ICs helped us better understand their needs and goals

Scenario and Storyboard Development

Helped to better visualize use cases for the AR IC technology

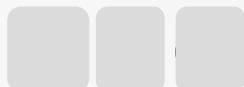


3D Prototype

Conceptualized a design system for AR based on the cumulative research

Informal Evaluation of 3D Prototype

Demoed the prototype with a working Incident Commander to gather feedback on the current progress





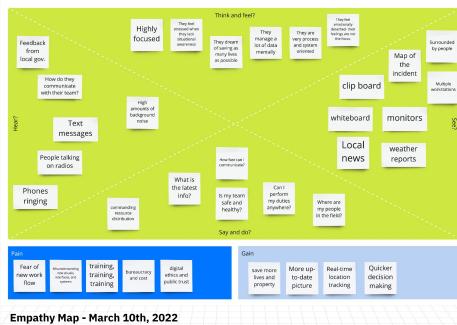
THE PROJECT

KEY FINDINGS

PROTOTYPE

RECOMMENDATIONS

RESEARCH ARTIFACTS



Empathy Map - March 10th, 2022

Oliver The "Old Dog"

Goals:

- Don't want to be phased out before retirement
- Highly confident so they continue to lead their teams
- Passionate about saving lives and property

Motivations:

- Wants to make sure the safety of their team
- Wants to protect the residents
- Wants their team to trust them and to understand what they are doing
- Cares about saving lives and leading within the community he serves

Personalities:

- Composed
- Decisive
- Powerful
- Honest
- Honest to a fault
- Respectful

Frustrations:

- Thinking he's a computer system will allow them down or cause him if they make a mistake
- Driven by one technology. Not convinced it's accurate, stable, or reliable
- Wishes he could learn more so he knows how he's function should the new technology crash

Approach to Work:

Individual	Facile
Procedure Oriented	Result-Oriented
Single-minded	Multi-headed
Thoughtful	Responsive

Needs:

- Technology that creates possibilities, like live feeds
- Want to be part of the team
- Want to be part of the community
- Want to be part of the team
- Want to be part of the community

Values:

- Proven track record
- Highly experienced
- Reliable
- Consistent
- Accurate

Affinity Map - March 3rd, 2022

Norm The "New Guy"

Goals:

- Maximize harm among civilians
- Communicate effectively across domains
- Acquire optimum situational awareness
- Use resources as efficiently and effectively as possible

Motivations:

- Desires to grow their skills and advance in their career
- Wants to acquire advanced tools and technologies to increase their response time
- Using any means possible to save as many lives as possible

Personalities:

- Lead-level
- Highly skilled
- Alert
- Competent
- Appreciative
- Innovative

Frustrations:

- Does not always feel listened to by higher-ups
- Higher-ups who fails communication to gain a clearer picture of an emergency scenario
- Horror of the well-established procedures as they're proven successful
- Other officers who may always trying to tell them what they're not listening

Approach to Work:

Individual	Facile
Procedure Oriented	Result-Oriented
Single-minded	Multi-headed
Thoughtful	Responsive

Needs:

- Advanced technology - tools that utilize the latest technology to enhance situational awareness
- Open Communication - seconds wasted on occupied radios can cost lives
- Resource management - resource management

Values:

- Respectful
- Wants to earn their achieve high standards through technology
- Wants to be the best officer he can be
- Wants to do everything he can for the people he is trying to help

Officers

- Allison, K. Captain Landmark Center - Floor 5
- John, D. Captain Landmark Center - Floor 5

Vehicles

- LD14 Ladder Truck Fire Staging Zone
- LD23 Fire Truck Landmark Center - Main Entrance
- DR100 Video Drone The Landmark Center

Other

- DR100 Video Drone The Landmark Center

Fire

Police

Medical

Public Works

Conceptualizing the Design and Use of Augmented Reality Within a Common Operating Picture for Incident Command Systems



Define the value of real-time location tracking and asset management during emergency incidents



- Allows for commanders to remain aware of situational data that often changes **rapidly**
- Current reliance upon audio data for asset management is **inefficient**
- Knowing **resource and responder proximity** to incident enables commanders to create efficient and **comprehensive strategy**





Discover how AR can improve situational awareness and decision-making



- AR can enable incident commanders to see where resources and responders are on an **X, Y, and Z axis**
- Operations don't always go according to plan as incidents can include **unexpected variables**
- AR could support remote collaboration, enabling commanders to form a **common operating picture remotely**





03

PROTOTYPE

Our research findings and understanding of current pain points led us to develop a dynamic prototype.

This hi-fidelity prototype helps conceptualize our proposed design system and the features necessary to help incident commanders accomplish their goals in a timely manner.



THE CONCEPT ART

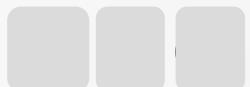
The application interface includes the following elements:

- LIVE** button in the top left.
- Allison, Kenneth** (Captain) profile picture and name in the top center.
- 97% full** (Oxygen level) in a green circle.
- 99.8° fahrenheit** (Body Temp) in a red circle.
- 110 bpm** (Heart Rate) in a yellow circle.
- O₂ Oxygen** status indicator.
- Status**: In Building.
- Location**: X, Y, Z.
- Closest Unit**: Dunn, T.
- Time Deployed**: 31 mins.
- On call with:** Allison, Kenneth.
- Icons for **Wi-Fi** and **Phone**.



Unit Pop-up

- Live video feed from unit to help commanders see through their responders eyes
- Responsive biometric data which draws attention to key information
- Detailed status and location information
- Capabilities which facilitate communication





THE CONCEPT ART

The Landmark Center
Building Layout

Sort by

Ground Floor

2nd Floor

3rd Floor

4th Floor

5th Floor

6th Floor

Allison, K
Fire - Captain

Building Layout

- Unit Locations
- Individual Floor View
- Dropdown Menu Unit Details
- Additional Building Details





THE CONCEPT ART

FIRE EMERGENCY

Allison, Kenneth's body temperature is getting dangerously high.

[click to view](#)



Notifications

- Emergency Data Popup
- Responsive Department Icons
- Short Issue Descriptions
- Click to Focus

Unit Status

- Responsive Colors and Icons
- Popup Labels

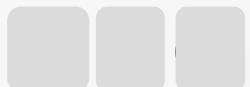




THE FEATURES

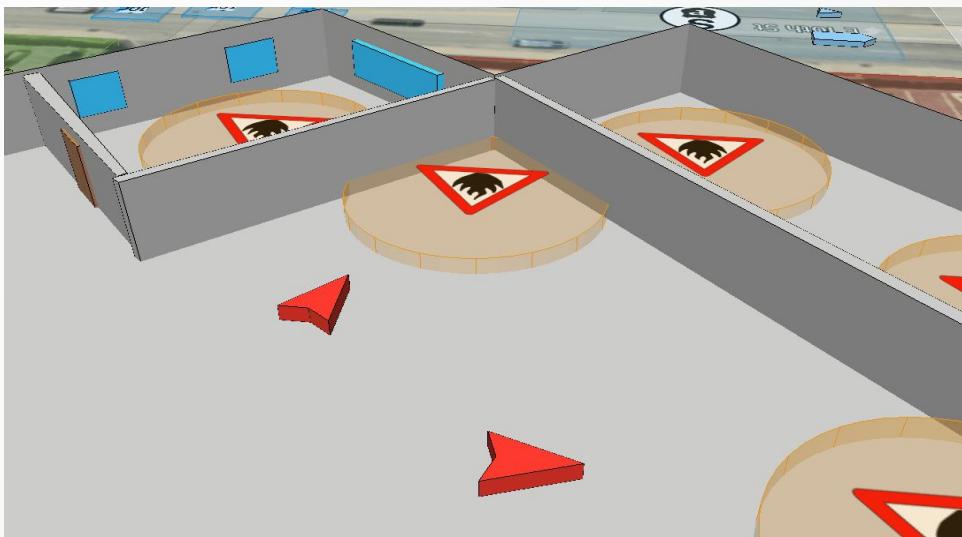
Resource Collection Area

- View all available resources within a common operating picture in one place
- Resources are categorized into organizations and then type
- Each resource has a status indicator to help the operator identify and act upon any troubles with certain personnel, vehicles, or areas





THE FEATURES



3D Representations of Resources, Areas, and Structures

- Embrace the “digital twin” concept to give a better picture and overall situational awareness to incident commanders
- Both personnel and vehicles’ models utilize pointer systems to include their current heading and possibly provide the commander with an idea of where they are facing in real time
- Structures and areas of interest can be seen by those making decisions with the usage of accurate models from publicly provided data that is accurate and up-to-date





THE FEATURES



Area Command Post



Barrier (Checkpoint)



Barrier (Emergency)



Barrier (Red)



Barrier (Security)

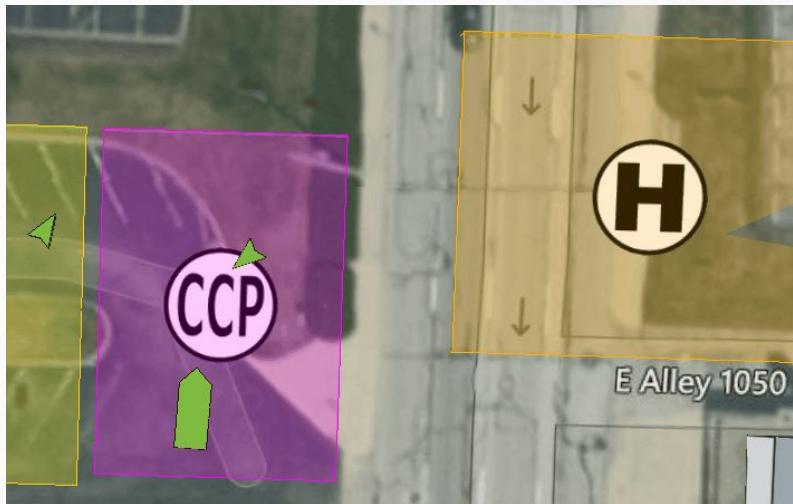
Standardized Symbology and Iconography

- Some incidents require a larger hierarchy of leadership and organizations across multiple jurisdictions
- Using a standardized and accepted icon library to rely on for symbols can provide a shared mental model that is accepted and understood by all who interface with this system
- This concept was taken from the military's use of standard symbols when planning and viewing geographical maneuvers, especially in an international effort





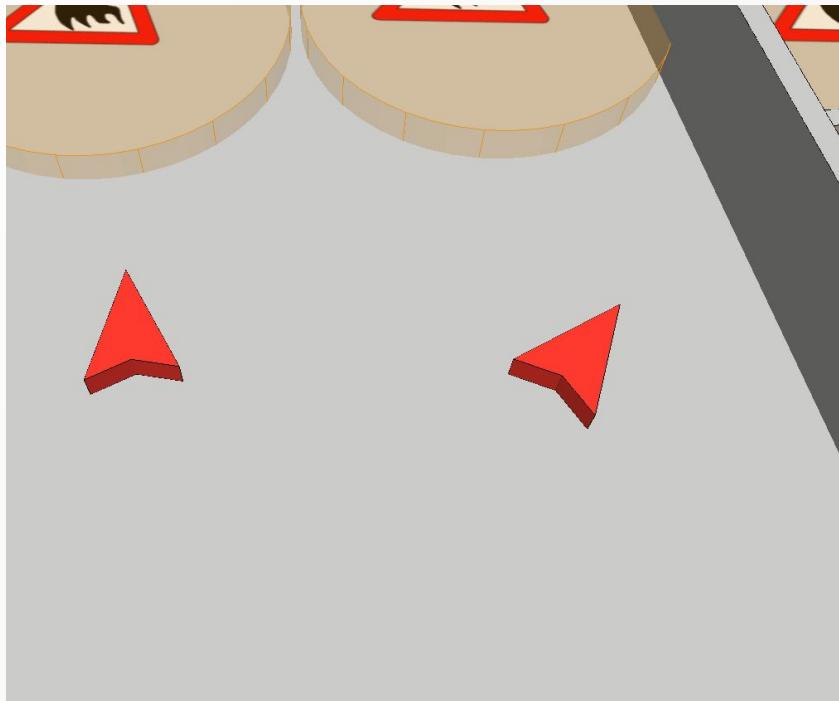
THE FEATURES



Operator Creation of Areas and Graphics

- Giving operators the ability to create areas and graphics on the fly can provide them with easily setting up areas for staging, breaching, or other incident specific collection points
- These graphics can then be customized per their function and be assigned to a specific organization or resource





THE FEATURES

Individual Resource Details & Information

- Condensed bites of data from resources can be fed to the incident commander to help make decisions
- This data can come in the form of biometrics, sensors, and even live streaming video of what the resource is seeing
- The details window can also provide some means of communication with the commander, whether through chat messages or calling the resource directly
- From this window, the operator can understand the resource's situation and base future actions off what is going on



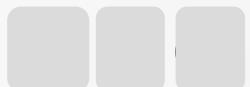


THE FEATURES



Incoming Alerts and Notifications

- Feeding the incident commander alerts and notifications can help them direct their attention to things that matter
- Simply clicking on these notifications or alerts will give the commander instant access to the resource or item that needs attention
- This functionality will be crucial to commanders who are passively viewing an incident and will need notified of important updates as they come in



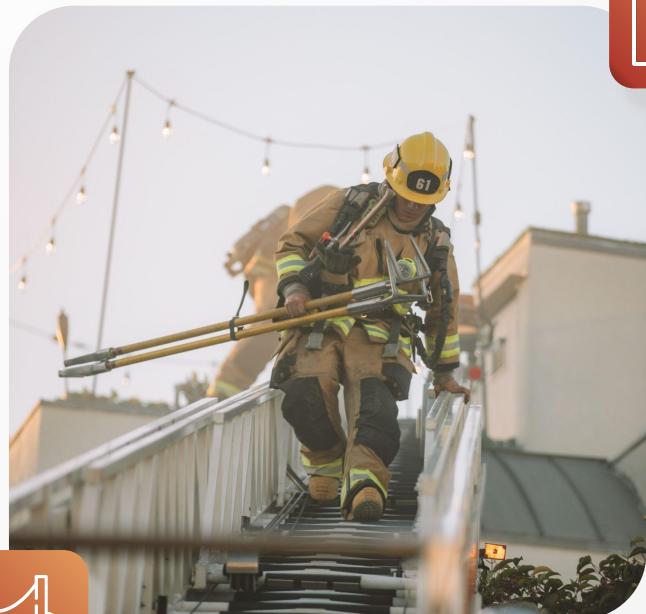


CHECK IT OUT!

The prototype is publicly available @
<https://h561project1.netlify.app>

Recommend viewing on a
desktop or laptop computer and with
Google Chrome or Microsoft Edge

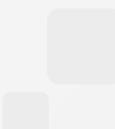




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RECOMMENDATIONS

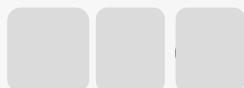
As the team started to finish the last project deliverables, we have developed some final recommendations based on information discovered throughout the project





Future product feature requirements and recommendations

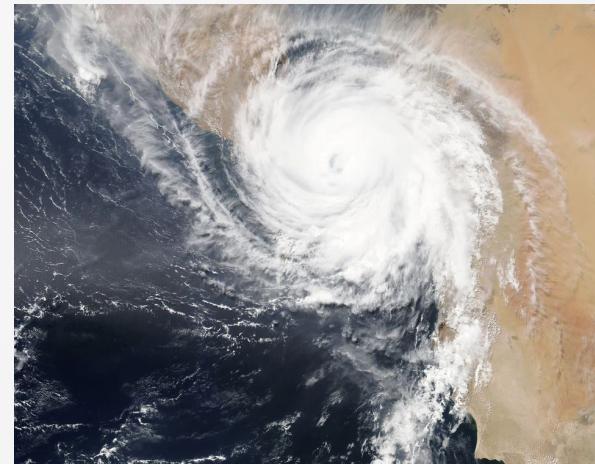
- Visually display a **3D map** of a common operating picture to demonstrate the distribution of threats, field workers, resources, and civilians.
 - This can include using the **X, Y, and Z-axis** in order to provide the operators with situational awareness of the incident
- Provide details about particular **resources**, such as individual **units, vehicles**, and even air assets like **helicopters or drones**
- If available, **live streaming video** attached to a unit can help the incident commanders place themselves at the scene

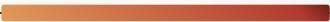




Future product feature requirements and recommendations

- Reflect updates in **real-time** from data gathered at the incident
- Provide the ability to visually show **thermal mapping**
- Display **weather data**
- Provide **indoor-location data**
 - Identify where resources and sensors are located
 - Identify dangerous areas or threats
- Enable **remote collaboration**
 - Multiple users can collaborate in the same environment without needing to be in the same room
 - Users must have the ability to see exactly what another user is seeing from their perspective to facilitate a **common operating picture**





Future product feature requirements and recommendations



- Support users in **mapping out plans** before executing
 - Placing staging areas, barricades, and tasks forces
 - Allow multiple users to collaborate on the same plan
 - Promote map drawing capabilities with lines, graphics, and simple polygons
- Provide **direct messaging** and **group messaging** to prevent overloading audio-based communications such as radios
- Support **benchmarking** during operation execution
 - **Visually signify** completed and pending benchmarks to help maintain a clutter-free, simple, and easy to read interface
 - **Filtering views** may be necessary to achieve this, so all data isn't visible at one time



THANKS FOR LISTENING!

