

# Panacea's Glass: Intelligent Dashboard for Augmented Reality based Co-ordination for Mass Casualty Disaster Triage



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## Problem Overview

When working with critical-care patients, doctors and nurses face many co-ordination challenges

- Augmented reality based technologies can help to stay updated on the status of patients and care levels

Need is even more critical in a natural disaster scenarios

- Large volume of patients with varying states of injuries
- Effective co-ordination of limited medical staff and supplies

**Delayed/missed triage may cause loss of lives!**



Figure 1: Mercy Hospital in Joplin MO, After tornado impact in 2011

## Panacea's Glass: Intelligent Dashboard Solution

- Provides an effective way for incident commanders to communicate with first responders in an incident or natural disaster
  - Works without dependence of any scene infrastructure
- Easy-to-use interactive interface
  - Incident management
  - Patients status tracking
  - Supplies replenishment
  - Responder co-ordination

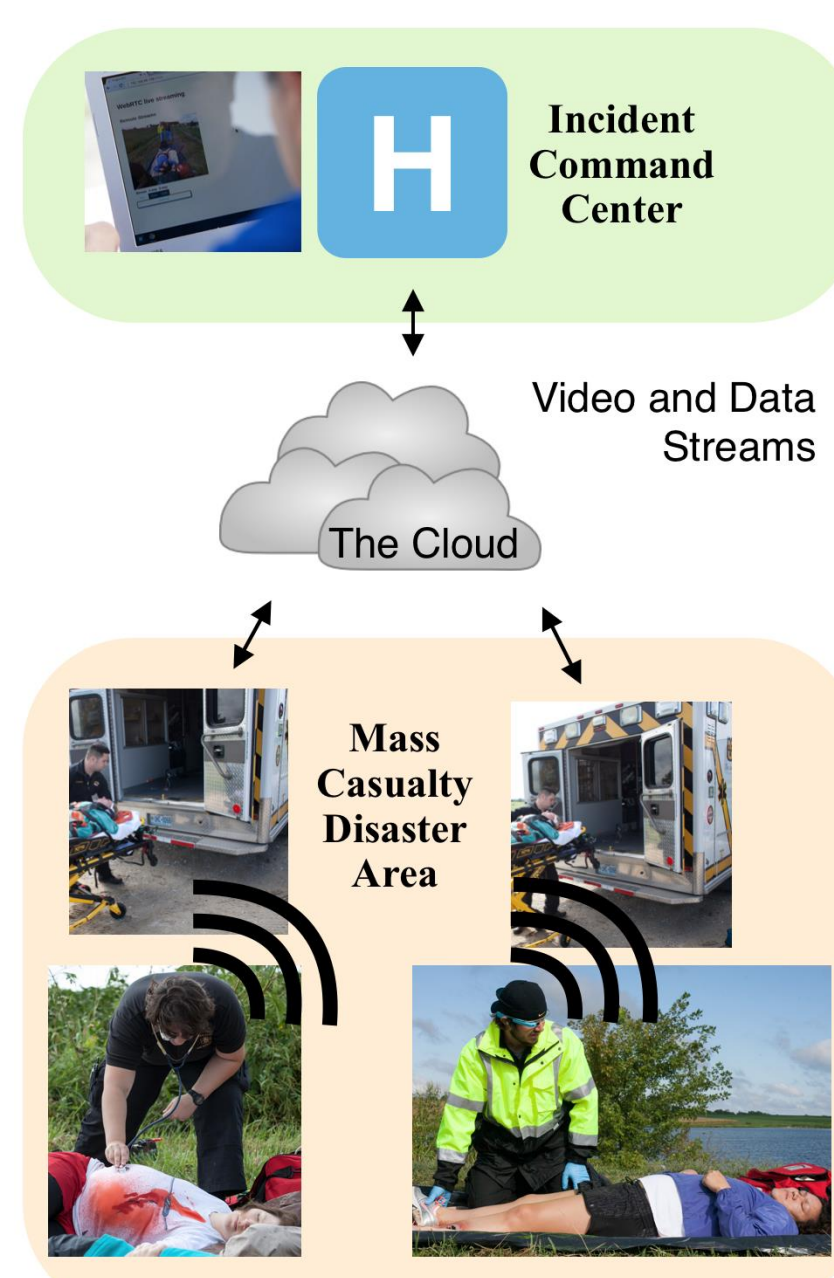


Figure 2: Incident Scene needing Situational Awareness

- Incident Commander can quickly access any part of the Dashboard and give aid to staff on the scene
- Incident Command System (ICS) applications with integration of Internet of Things (IoT)

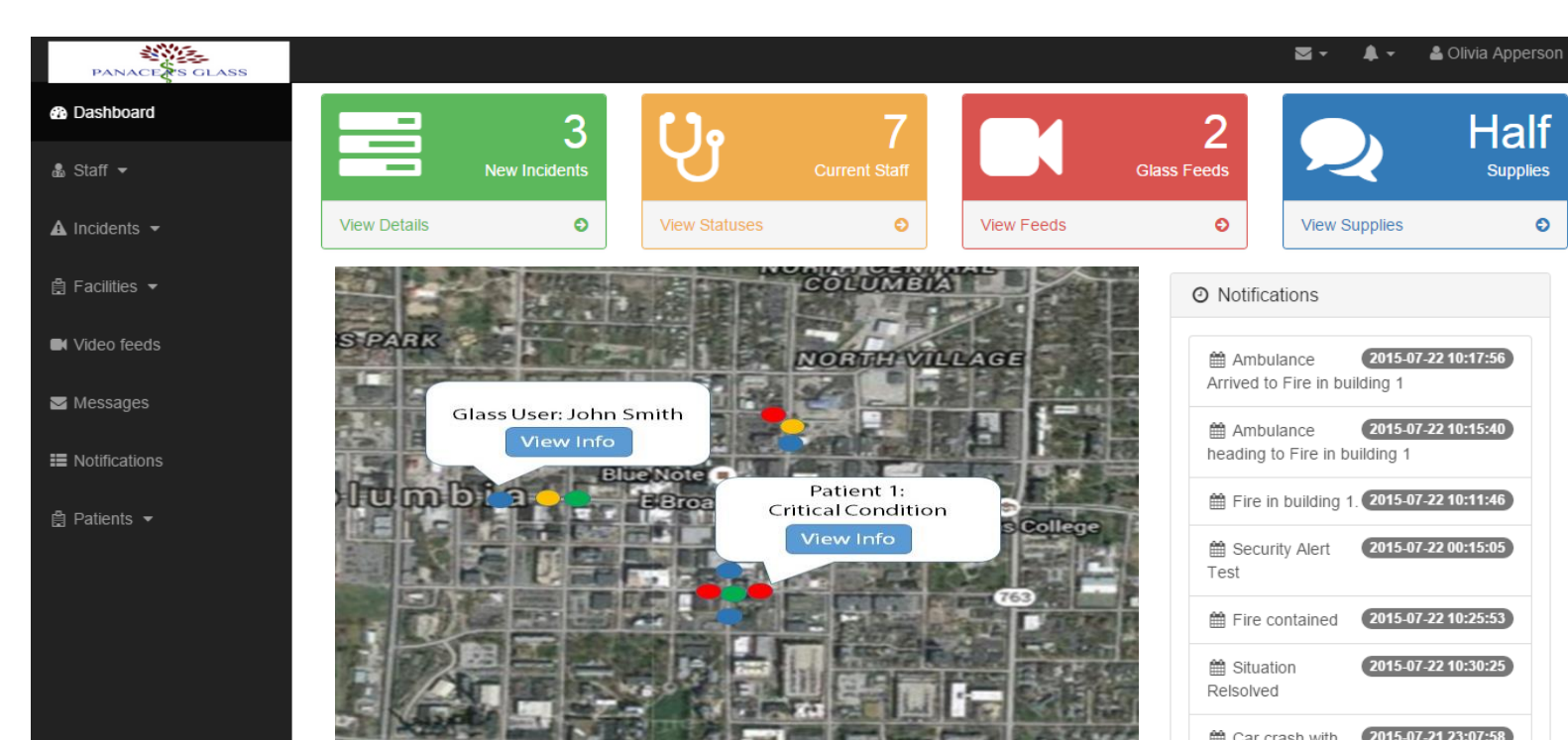


Figure 3: Screenshot of Panacea's Intelligent Dashboard

## Co-ordination Scheme for Resource Prioritization

- Based on handling the prioritization of personnel and medical supplies between responder stations
- Recommends actionable intelligence for major Incident Commander actions
  - Active:** orchestration of video feeds between the Incident Commander and First Responders at the scene; ambulance routing tasks
  - Passive:** Dynamic tracking and replenishment of medical supplies; logging of response activities

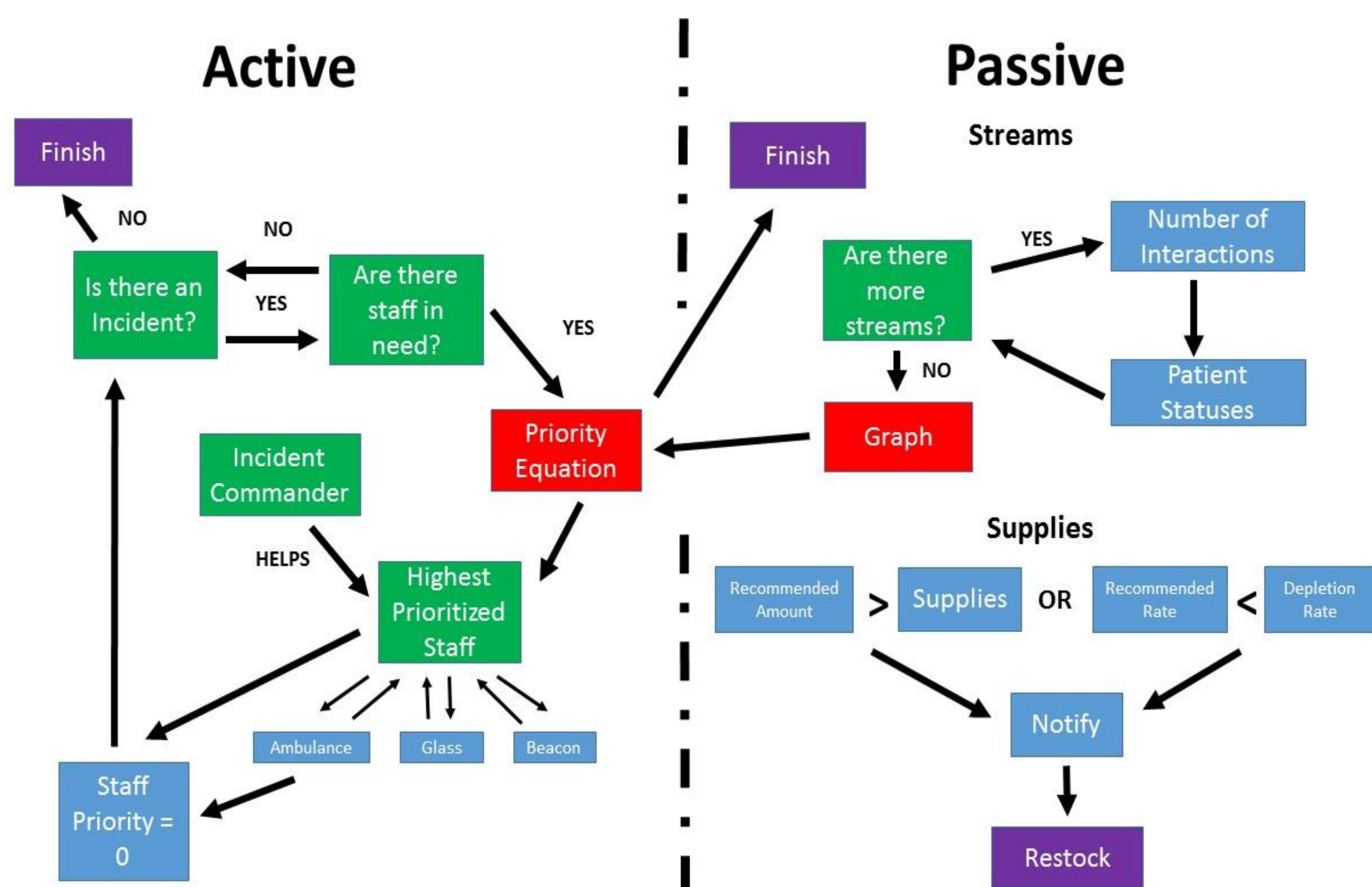


Figure 4: Active and Passive Co-ordination Interplay during Incident Response

## Integrated IoT Applications

- Audio/Video Communication: Heads Up Displays (HUD) utilized to provide the Incident Commander with a live feed of the incident

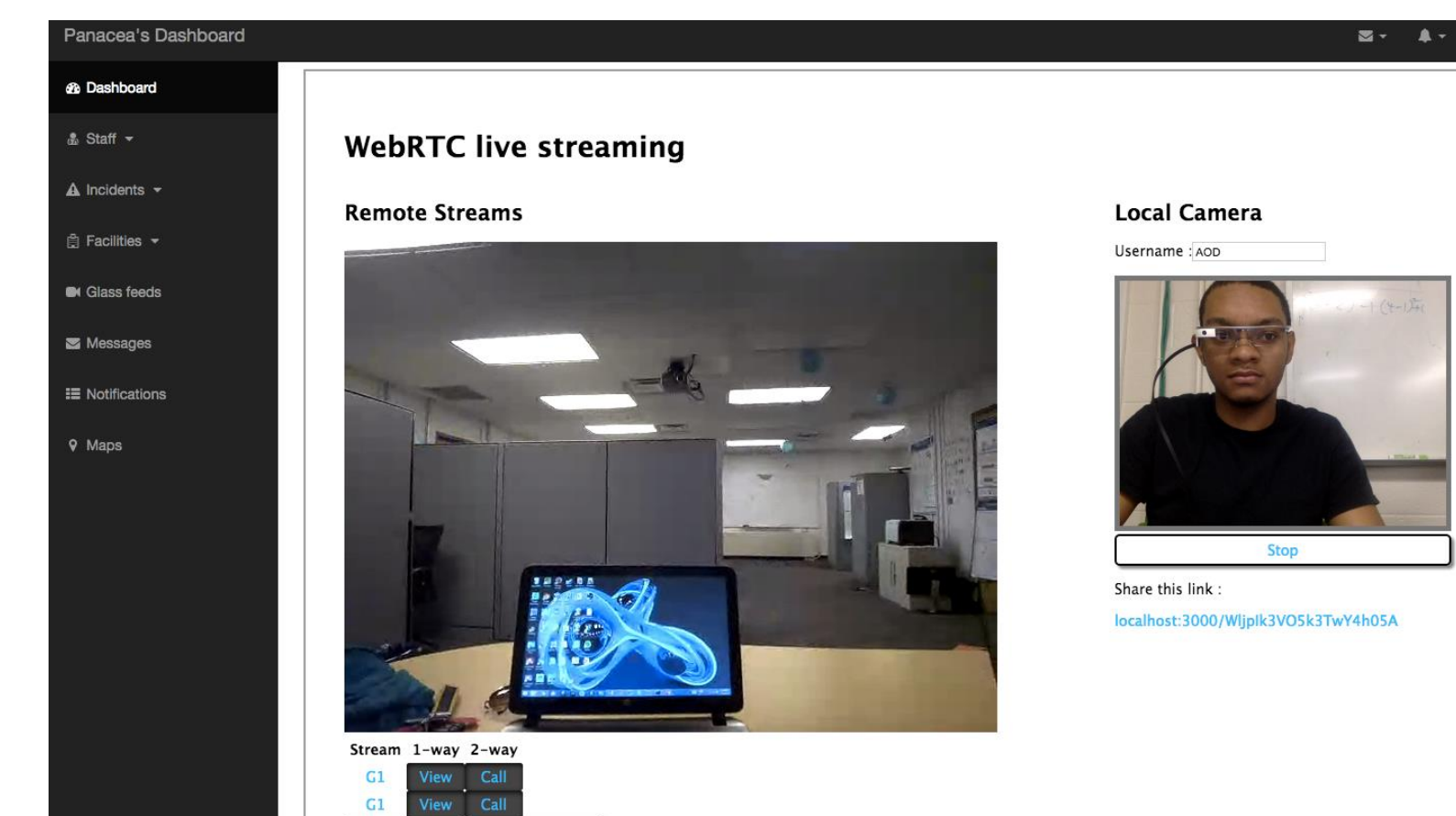
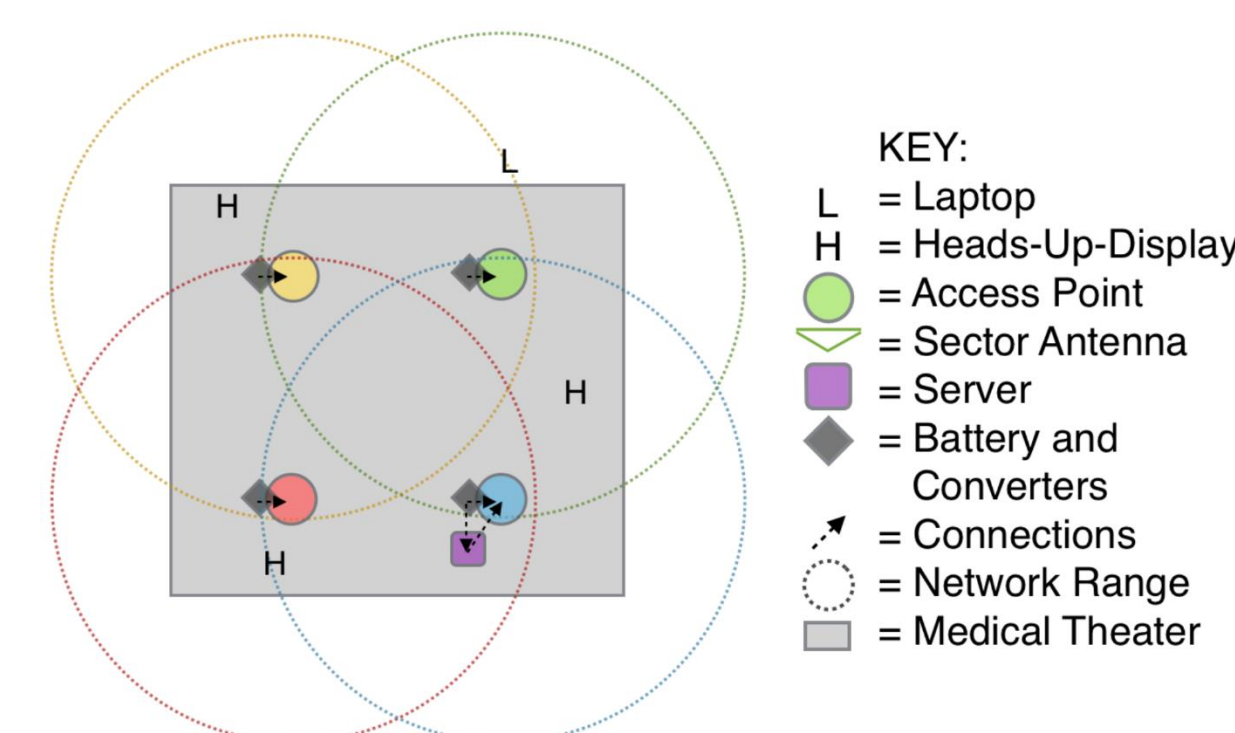


Figure 5: WebRTC based live video communication

- Virtual Beacons/QR Codes: By accessing the QR code scanner on the glass, staff can quickly change the status of a patient in the database and enable other micro-location based services



Triage Color	Acuity	Need for Treatment	Comments
RED	Emergent	Immediate	Threat to life, limb, or organ
YELLOW	Urgent	Delayed	Significant injury or illness but can tolerate a delay in care
GREEN	Non-Urgent	Minimal / Non-urgent	Can safely wait for treatment
BLACK	Expired or Expected to Expire	No treatment; Expectant; Treat if resources are available, comfort care	Consider transport and care for expectant patients after initial "Reds" are cleared; if resources exist and it does not delay care for Yellows.

Figure 6: Virtual Beacons with QR Codes replace cumbersome paper tags for triage

## Experimental Evaluation

Panacea's Glass Platform Evaluation:

Heat Study:

- Measured temperatures on Google Glass and Recon Jet during video and audio stream processing
- Concluded that Recon Jet had a lower temperature and would be more advantageous to use

Wearable Technology	0 Sec.	1 Min.	5 Mins.	10 Mins.
Google Glass	105° F	115° F	130° F	133° F
Recon Jet	90° F	97° F	117° F	124° F

Connection Study:

- Tested length of stream connection with Google Glass and Recon Jet in static and dynamic environments
- Recon Jet did not disconnect for both static and dynamic situations, but Google Glass disconnected

Wearable Technology	Static (minutes)	Dynamic (minutes)
Google Glass	7:59	2:20
Recon Jet	Did Not Disconnect	Did Not Disconnect

Usability Evaluation of Intelligent Dashboard:

Simulation Study:

- Incident Scenario: Conducted a two-incident simulation (car crash and building fire) to test co-ordination effectiveness for commander response

Section of Panacea's Glass Intelligent Dashboard	Ease of Use (Score 1-5)
Setup and Customization	5
Staff Pages	5
Incident Page	5
Facilities Page	5
Video Feeds	3

Figure 7: HUD and Dashboard Usability Results

Expert Opinion:

- Discussed improvements with actual ICS user to provide better communication and co-ordination
- Test subject concluded that Panacea's Glass Intelligent Dashboard was 'Very Effective' for the claimed purpose!!

*Our results illustrate Incident Commander can efficiently deploy staff and resources to ultimately reduce triage time and potentially save many lives during disasters!*

## Acknowledgements



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