TECHNOLOGICAL ADVANCES TO DROWNING PREVENTION IN AN ERA OF LIFEGUARD SHORTAGES

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Affiliations

- Ellis companies:
  - Ellis & Associates
  - Jeff Ellis Management
  - Ellis Aquatic Innovations

Conflict Declaration

- No financial interest in any of the organizations associated with the conference, and have not received compensation in any manner for this presentation.

- Ellis Aquatic Innovations has a proprietary AI system, and its product and research are included as part of the presentation.

Learning Outcomes

- Describe the state of artificial intelligence (AI) as it pertains to drowning recognition.
- Discuss the strengths and limitations of AI drowning prevention surveillance systems.

Learning Outcomes

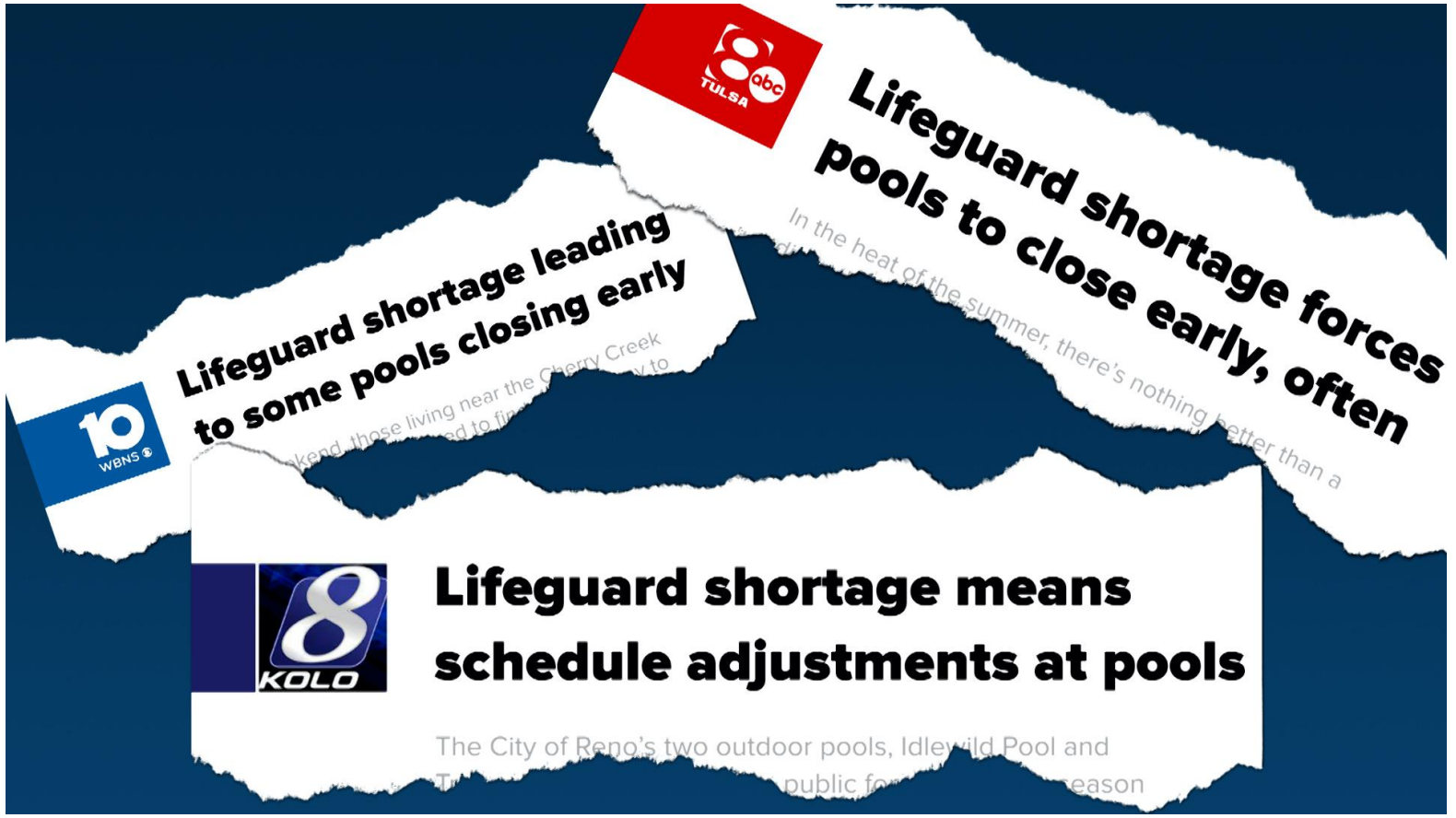
- Discuss aquatic research related to drowning prevention technology.
- Become an educated consumer of AI surveillance systems.
- Discuss regulatory statutes affecting the use of drowning prevention technology.

Introduction

Is There a Lifeguard Shortage?

About That Lifeguard Shortage …..

- Up to 50% of public pools affected in 2023
- COVID closed facilities and young people found other more lucrative /easy jobs
- Reduction of J1 employees
- Current salaries, lack of qualified applicants, and training and work both deemed to demanding



Can Technology Help Create a Safer Aquatic Experience?

“Technology has made large populations possible.
Large populations now make technology indispensable.”

Joseph Krutch

What Do We Call These Drowning Prevention Systems?

- Assisted Lifeguard Technology
- Augmented Lifeguarding
- Blended Lifeguarding

How Knowledgeable Are You Regarding AI Drowning Prevention Technology?

- New to AI - just getting started
- Already implemented a system
- System manufacturer

What would you like an AI system to do at your facility?

Benefits of AI Systems

- Enhance Guest Safety
- Increase Liability Protection
- Reduce Insurance Claims
- Improve Facility Security
- Improve Operations
- Aid Lifeguarding Challenges

Select the Right System for the Right Attractions

Determine Your Needs Beyond Drowning Prevention

- Understand exactly what you are getting & costs
  - System capability
  - Network needs
  - Initial costs
  - Maintenance costs
  - Warranties
  - Support services
  - Training

Regulatory & Legal Concerns

- OSHA & Health Department
  - Modifying existing structures
  - Modifying existing lifeguard locations / staffing level

- Legal
  - Recorded footage
  - Reliance on AI

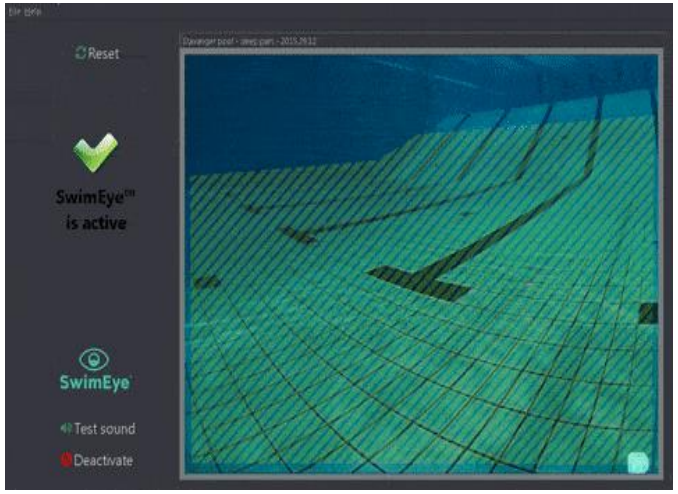
AI, Analytics, Alerts, Monitoring

3 General Systems

- Submersion detection
- Wearable detection devices
- Cameras above and below water

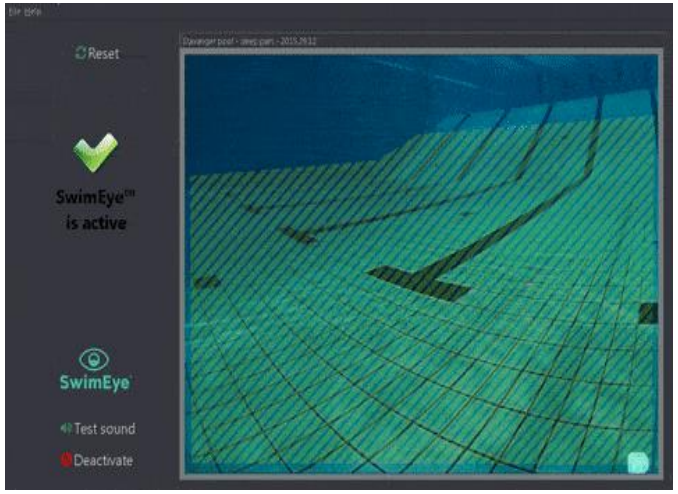
- Proactive Monitoring
  - Live CCTV views
  - Relies on humans watching monitors & analytic support

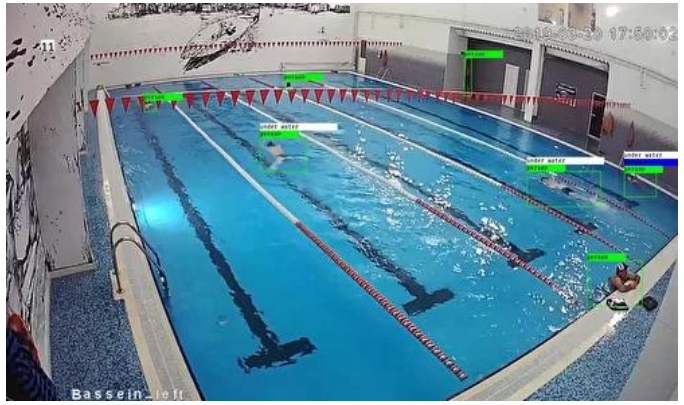
- Reactive Monitoring
  - With or without worn devices
  - Relies on AI alerts



AI Drowning Systems

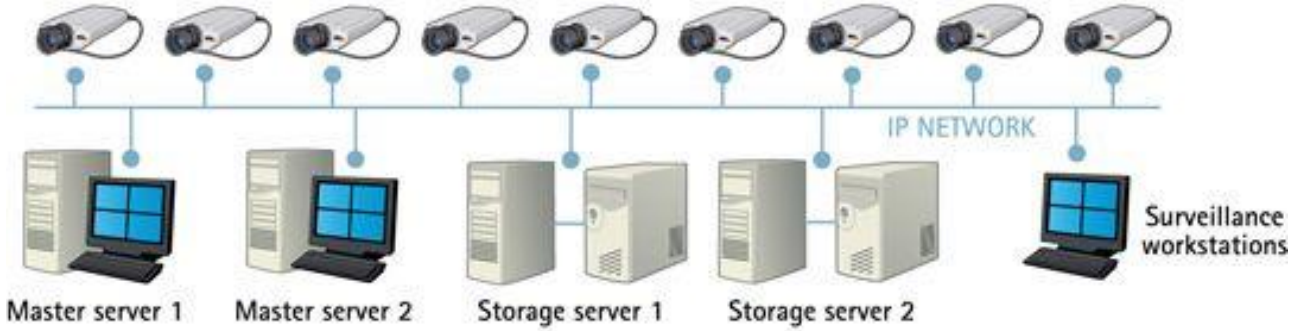
- Angel Eye
- Ellis Aquatic Innovations (EAVS)
- Lifeguard Eye
- Lynxight
- Poolview
- Poseidon
- Sentag
- Swim Eye





AI Integrated System

- Cameras
  - Attractions
  - Deck
  - Control room
- Conduit, Cable, Fiber
- Switches
- Network Video Recorder (NVR)
- Workstation(s)
- TV Monitor(s)
- Communication Devices



Can Artificial Intelligence (AI) Successfully Recognize a Drowning Person?

Depends on how you define it and the accuracy you expect

- A static person below the surface
- A person passive or struggling on the surface

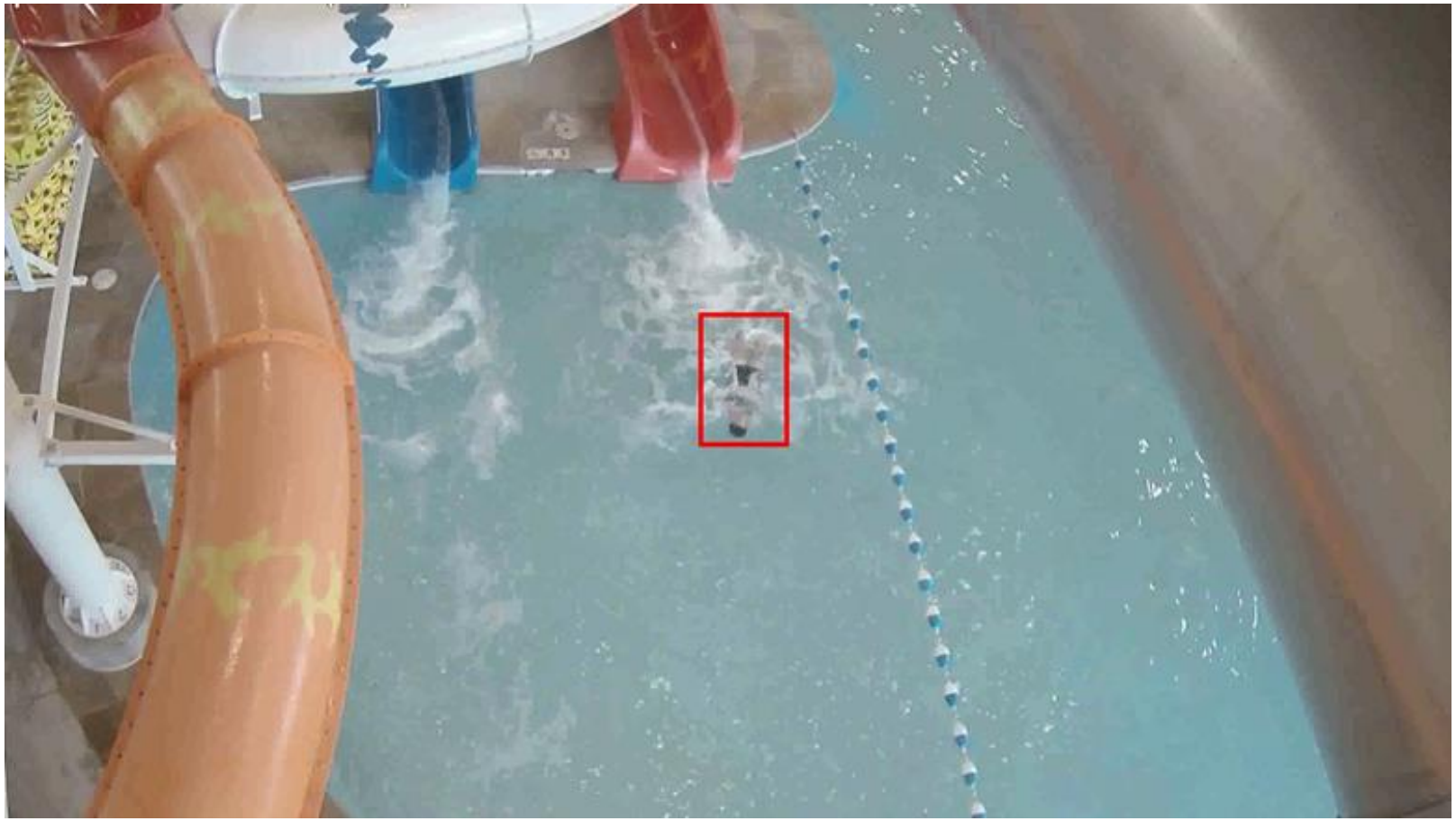
False Positives

- Reduction is key to improved performance

Video of Near Drowning in Activity Pool Cannot be Accessed
(Proprietary Property)

Analytics, Alerts, and Monitoring

- Identify someone potentially in trouble in the water or on land

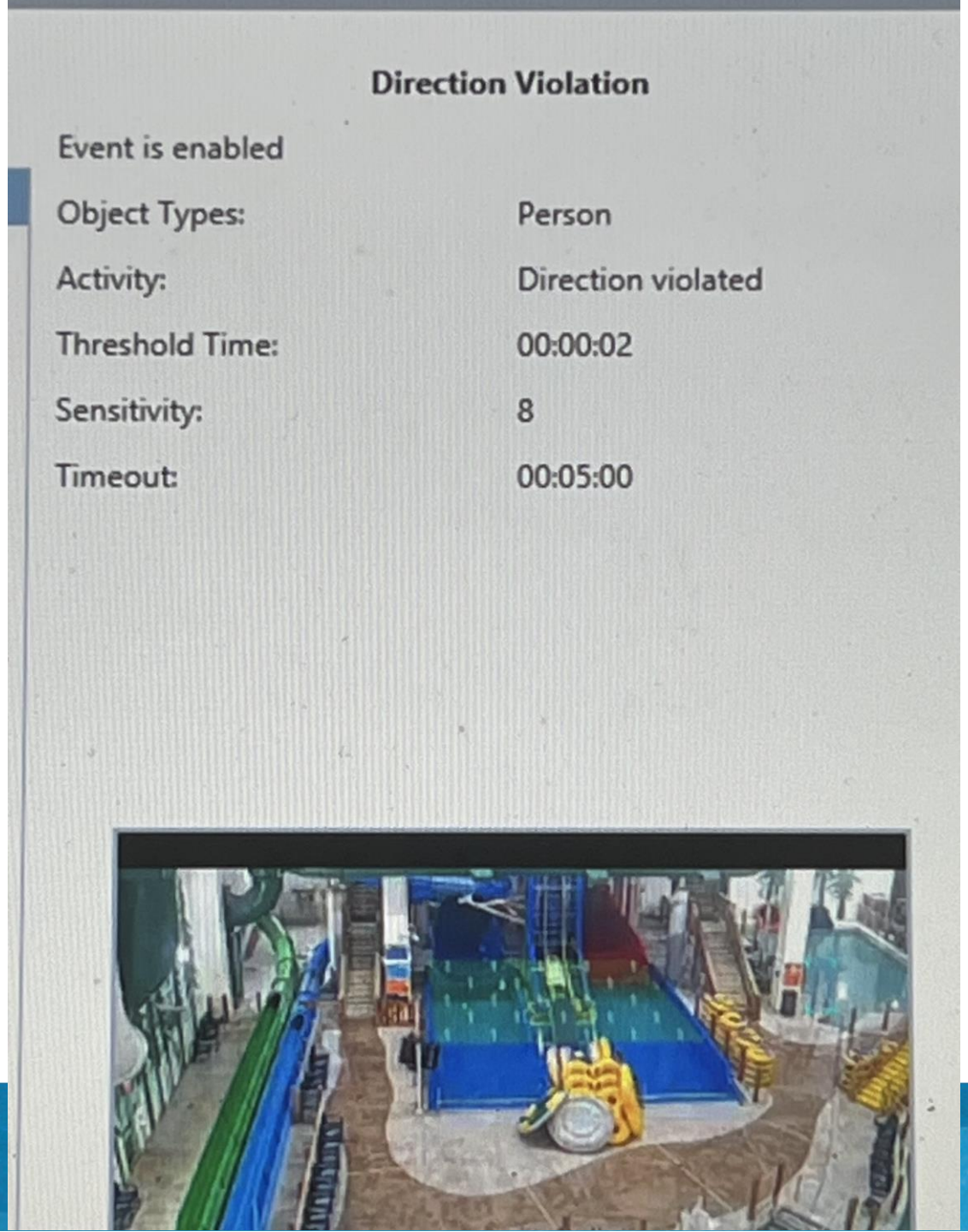


Analytics, Alerts, and Monitoring (cont)

- Identify dangerous situations

Analytics, Alerts, and Monitoring (cont)

- Setting Events
  - Directional
  - Loitering
  - Restricted area
  - Objects
  - Slip & Fall



Analytics, Alerts, and Monitoring (cont)

- Capture rough housing and injuries
- Capture theft, drug use, and sexual assault

Analytics, Alerts, and Monitoring (cont)

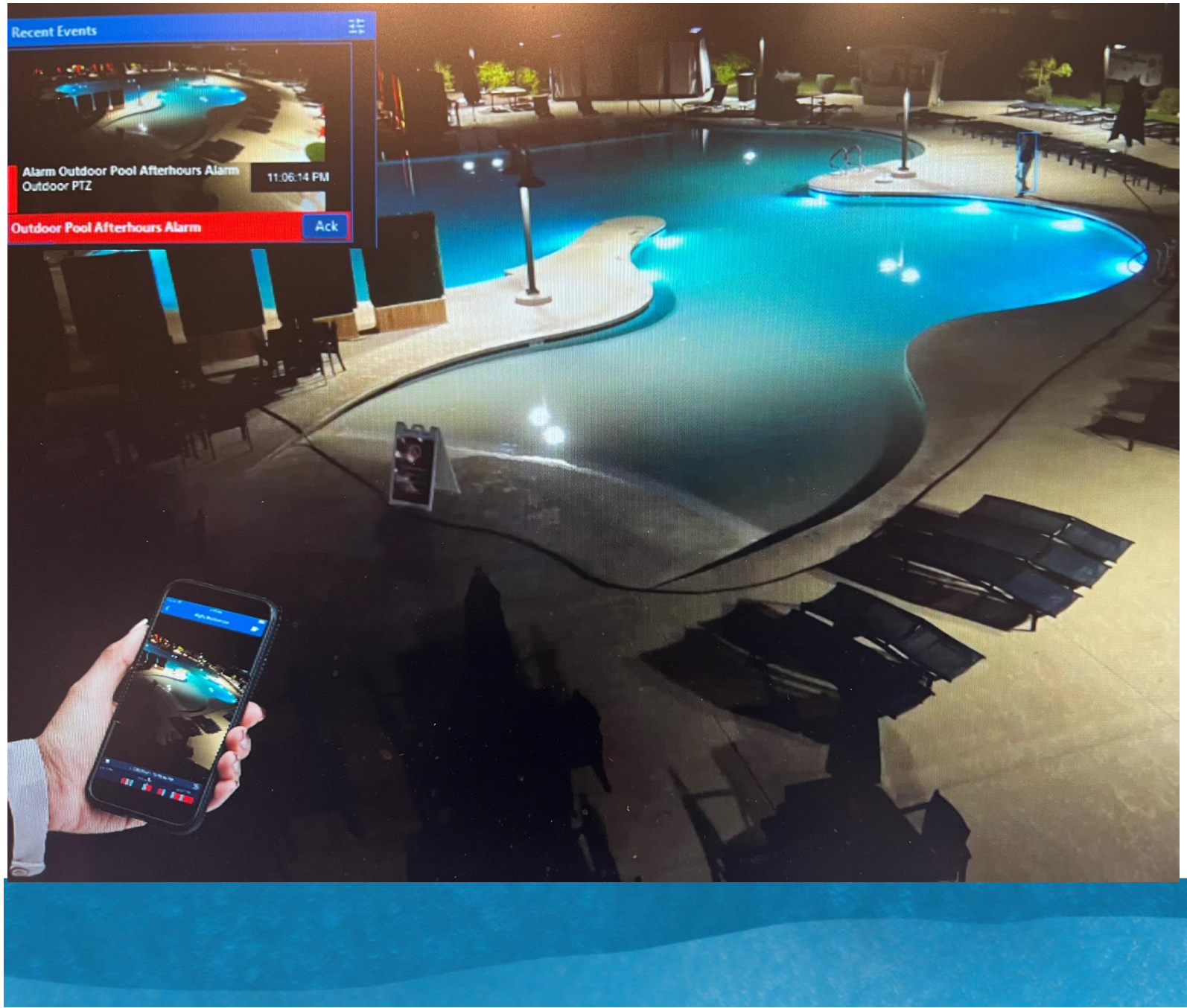
- Rapidly search for a missing person

What More Can AI Systems Do to Improve Facility Operations?

- Health Analytics protection
- Occupancy counts
- Facial recognition
- Chemical Maintenance Integration
- Thermal vision / Security

Analytics, Alerts, and Monitoring (cont.)

- Immediately identify an intruder in a restricted area
- Alerts appear on the monitor and are sent instantly to email and SMS

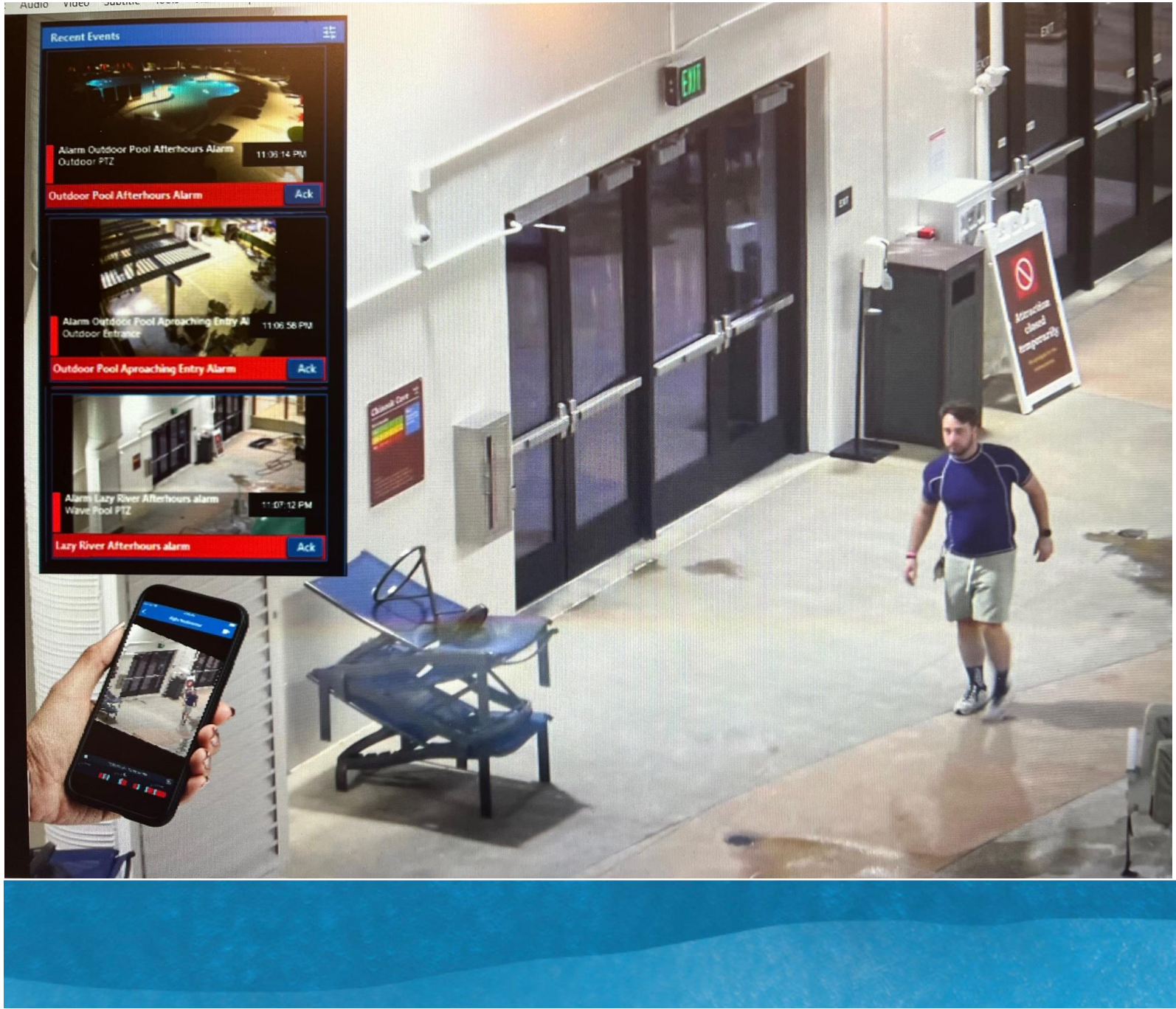


Analytics, Alerts, and Monitoring (cont)

- Cameras track person; providing “handoff” and re-alert

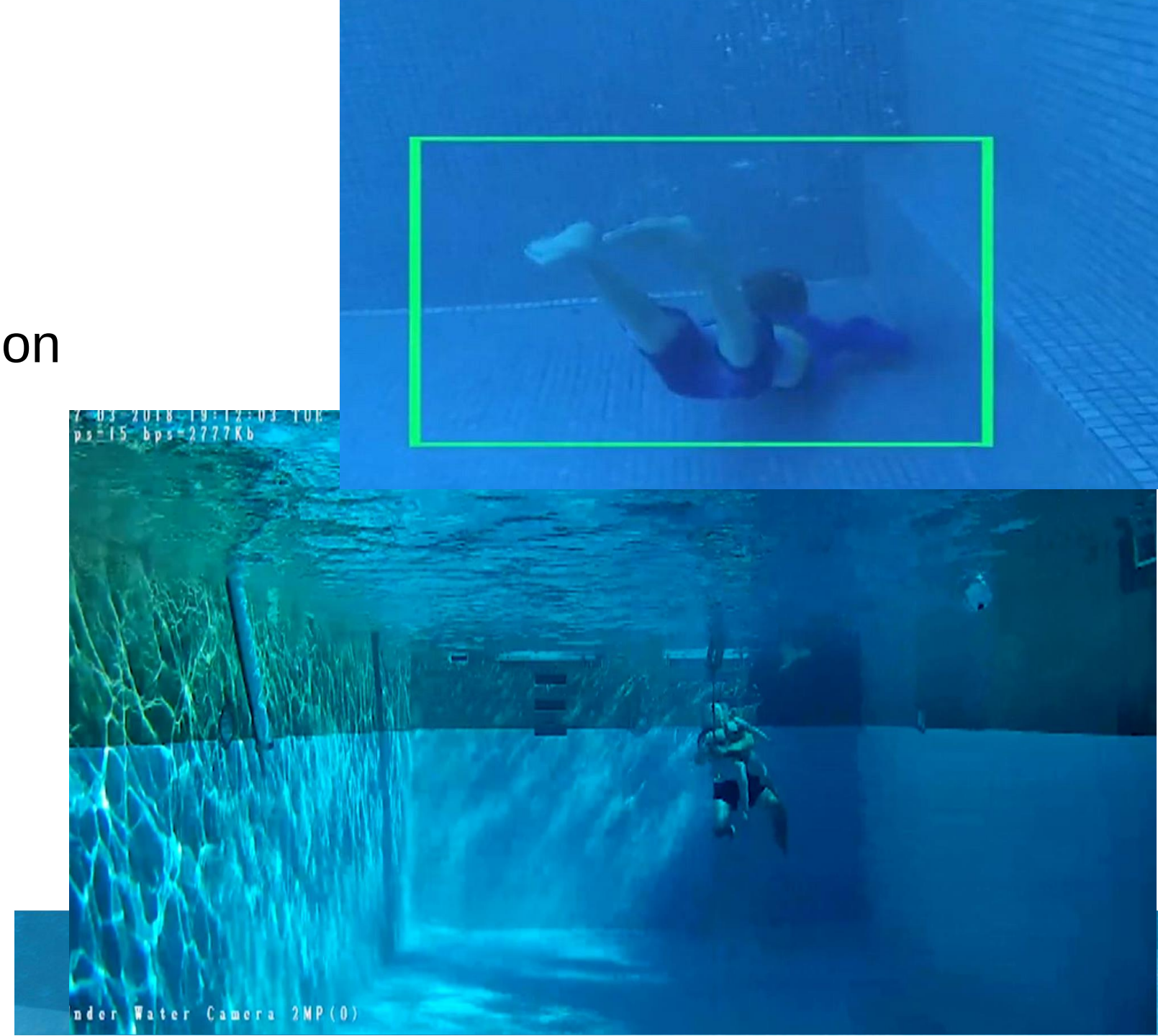
Analytics, Alerts and Monitoring (cont)

- PTZ cameras zoom in to better identify and track person
- Providing additional “handoffs” and re-alerts



Underwater Camera Considerations

- Camera installation
- Submersion time activation
- Viewing considerations
  - Distance and angles
  - Water clarity
  - Glare & shadows
  - Turbidity
  - Blocked views



Research

UK Research

- Questioned the effectiveness of the “10/20 protection standard”.
- Video w/ eye tracking
- Considered anxiety level
- Decided on a “more natural 20 second scan”

Research informs critical changes to the UK and Ireland's most popular pool lifeguard qualification

05/09/2023

RLSS UK is committed to working with research experts and academics to ensure their pool lifeguard qualification – the National Pool Lifeguard Qualification (NPLQ) remains fit for purpose for the leisure industry, and lifeguards are trained with the right skills and knowledge to carry out their role and keep swimming pool users safe.

RLSS UK has a strong working relationship with the University of Chichester and has carried out various projects since 2015. Over the past five years, research has focused on the effectiveness of methods for scanning and supervision and the impact of training and intervention.

Research has prompted two changes to the way in which RLSS UK recommends lifeguards scan a zone and the period in which they do this. Swimming pool operators should consider adopting two critical changes:

- A new system for supervising pools (Natural Scan: 20)
- Lifeguard rotation and duration on poolside

A new system for supervising pools (Natural Scan: 20)

The 10:20 system of bather supervision (or 10:20 protection standard, as known by its creator - Ellis & Associates), has been within the NPLQ for over 30 years. RLSS UK wanted to examine its effectiveness and commissioned a research project to learn more.

Research process

To examine the effectiveness of 10:20, RLSS UK and the University of Chichester compared lifeguards in two conditions. Condition one was the 10 second scanning strategy, and condition two was a natural scan strategy.

Australia Research

- VR Study
- As the number of pool patrons increased, scanning effectiveness decreased.
- When patrons in a zone exceeded 75, lifeguards failed to identify a drowning victim 50% of the time.

What is the optimal pool lifeguard to patron ratio to prevent drowning? A virtual reality eye-tracking study

Author links open overlay panelPaola Araiza-Alba [a], Bernadette Matthews [b c], Victoria Foster [a], Jordy Kaufman [a]
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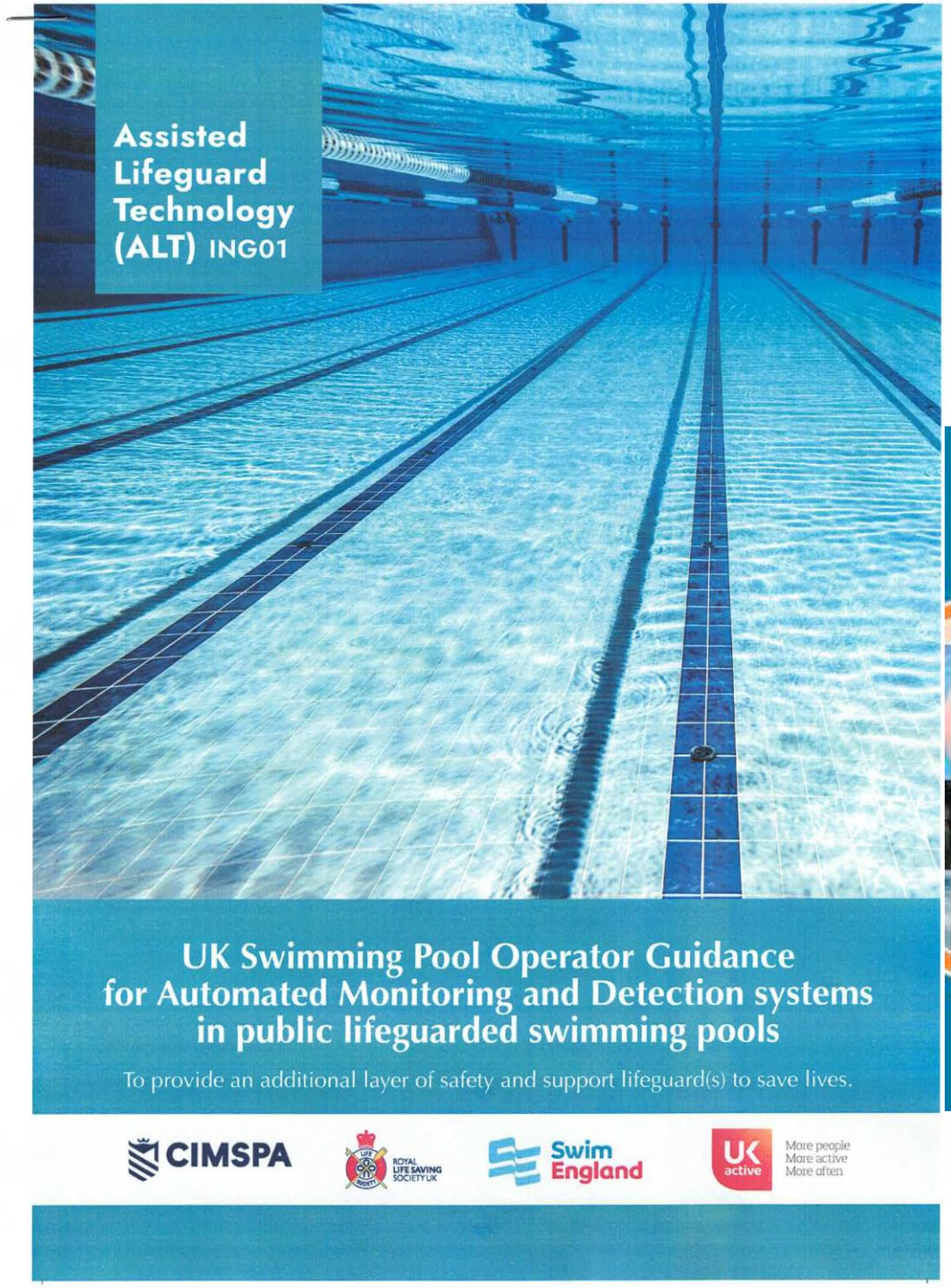
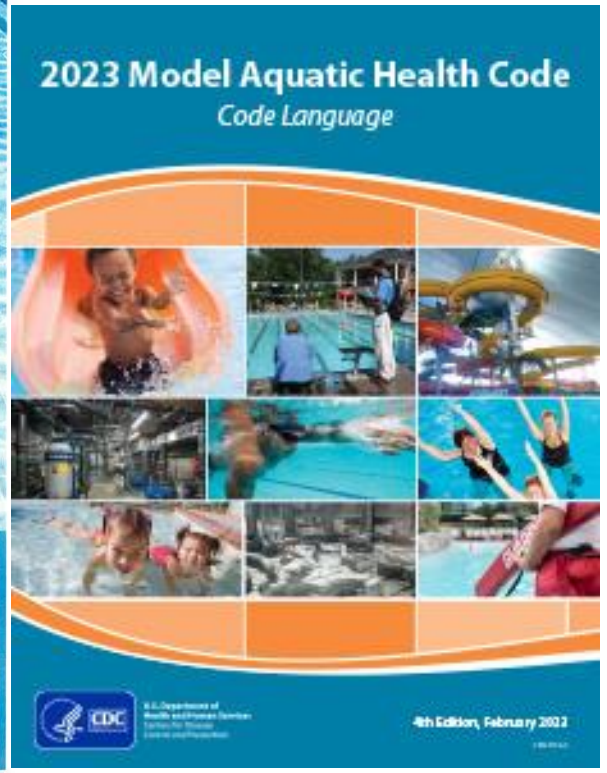
Abstract

Lifeguards play a crucial role in ensuring patron safety at public swimming pools to detect victims in distress to prevent drowning. Whilst there are guidelines as to the ratio of lifeguards to patrons to ensure adequate supervision, there has been no empirical evidence to support these ratios. This research aims to ascertain the ideal ratio of lifeguards to persons in the water to detect a drowning victim within an appropriate timeframe to prevent death or neurological damage, using immersive virtual reality eye-tracking technology. Fifty qualified lifeguards in Victoria, Australia, viewed nine 120 s video clips filmed at a public pool, using a 360-degree GoPro camera to create a 360 view of one or two pools. Six videos contained simulated drownings, and three had no drowning. Videos were randomized with different scenes and patron numbers (25–115). Lifeguards noted if they identified a potential drowning and the time of identification. Results demonstrate that when the number of patrons exceeded 75, the lifeguards did not identify a drowning victim 50% of the time. A higher number of patrons in the pool also influenced the time taken by lifeguards to identify a potential drowning victim (>10 s). This study shows that with higher numbers of patrons in a pool, the ability of lifeguards to detect a drowning victim within the recommended time to prevent long-term effects

Research Leads to Guidelines

- UK has comprehensive guidance on detection systems covering all forms of devices





Ellis Aquatic Vigilance System Research Project

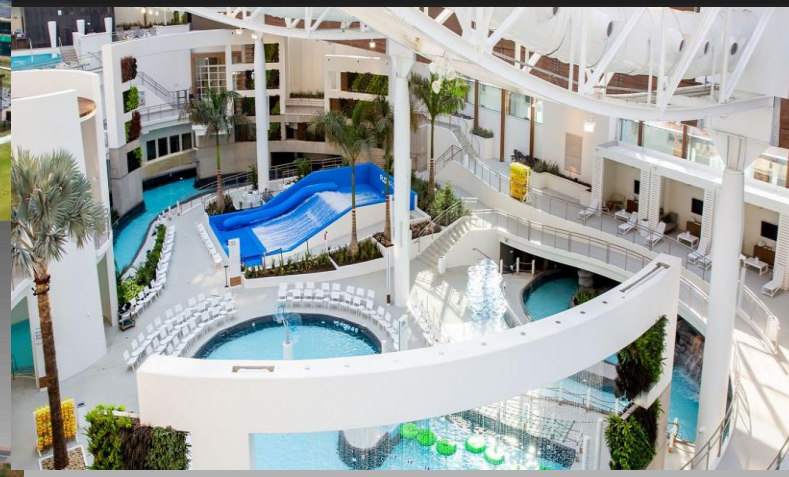
EAVS™

- Augments lifeguard scanning with certified control room operators
- CCTV with AI technology
- Proactive system
- Does not rely only on analytics to detect drowning

Development

- 6.5 years / >200,000 operational hours

- Locations:
  - Large Waterparks
  - Community pools



Research

- Physical Environment
- Vigilance
- Cognitive Load
- Communications
- Operator Selection, Training, Assessment

Human Factors Considerations for Ellis Aquatic Vigilance System (EAVS) Operations

Cathleen M. Moore, Michael A. Oostman, Larry Newell

October 16, 2023

1. Executive Summary

Ellis Aquatics Innovations is engaged in a multi-year study of human factors considerations regarding its Ellis Aquatic Vigilance System (EAVS). EAVS is a control-room based video monitoring system designed to supplement on-deck lifeguard surveillance at large aquatic facilities. The initial phase of the study is a review of relevant research literature that can provide guidance for best practices for EAVS operation. The human factors literature on Closed-Circuit Television (CCTV) operations and the basic-research literature on human cognition were the focus of the review. Five domains were considered: (1) the physical environment, (2) vigilance, (3) cognitive load (4) communications, and (5) Operator selection, training, and assessment. This report provides a summary of the most relevant findings in each of those domains, including identifying questions for which no specific information is available to date, and summaries of recommendations for EAVS operations based on what was found in the literature.

2. Overview and Methodology

2.1 Introduction

The Ellis Aquatic Vigilance System (EAVS) is a video-based monitoring system that utilizes multiple-camera feeds and human operators to aid in preventing drowning incidents and provide facility safety and security. EAVS uses a hybrid lifeguarding model that is a combination of on-deck lifeguards and control-room personnel to monitor and respond to emergency events throughout the facility.

High-resolution cameras are positioned throughout the facility to maximize visual coverage of the entire swimming and recreational area. The placement of the EAVS cameras and the positions of the on-deck lifeguards are determined through a systematic process of zone validation that is outlined in the Ellis Aquatic Innovations (EAI) materials that include the Vigilance Awareness Training (VAT) program. The purpose is to facilitate achievement of the recognition-and-response metric that derives from the original Jeff Ellis & Associates 10/20 protection model by supplementing surveillance. According to the original model, lifeguards are expected to recognize a guest in distress within approximately 10 seconds of its onset and reach the guest within a defined zone in approximately 20 seconds. The model has been supported by years of rescue data reflecting that if a lifeguard could reach a guest in distress within 30 seconds the guest did not need further care.

With EAVS, the 10/20 approach is more aptly addressed as a 30-second guideline where a guest in distress can be recognized by an on-deck guard, the control-room Operator, or both, and the total recognition/response time is approximately 30 seconds.

3 Year Research Project

- Phase 1 – 2022
- Phase 2 – 2023
- Phase 3 – 2024

Phase 1 Research Purpose

- Examine the total event time from the guest becoming distressed, recognition of the event, and response.
- Determine if lifeguards actually do see drowning victims in 10 seconds.
- Determine if lifeguard or operator recognized the event first..

Phase 1 Hypotheses

- Drowning victims will be recognized within 10 seconds of the event onset.
- Operators would recognize events faster or at the same time as lifeguards

Phase 1 Results & Limitations

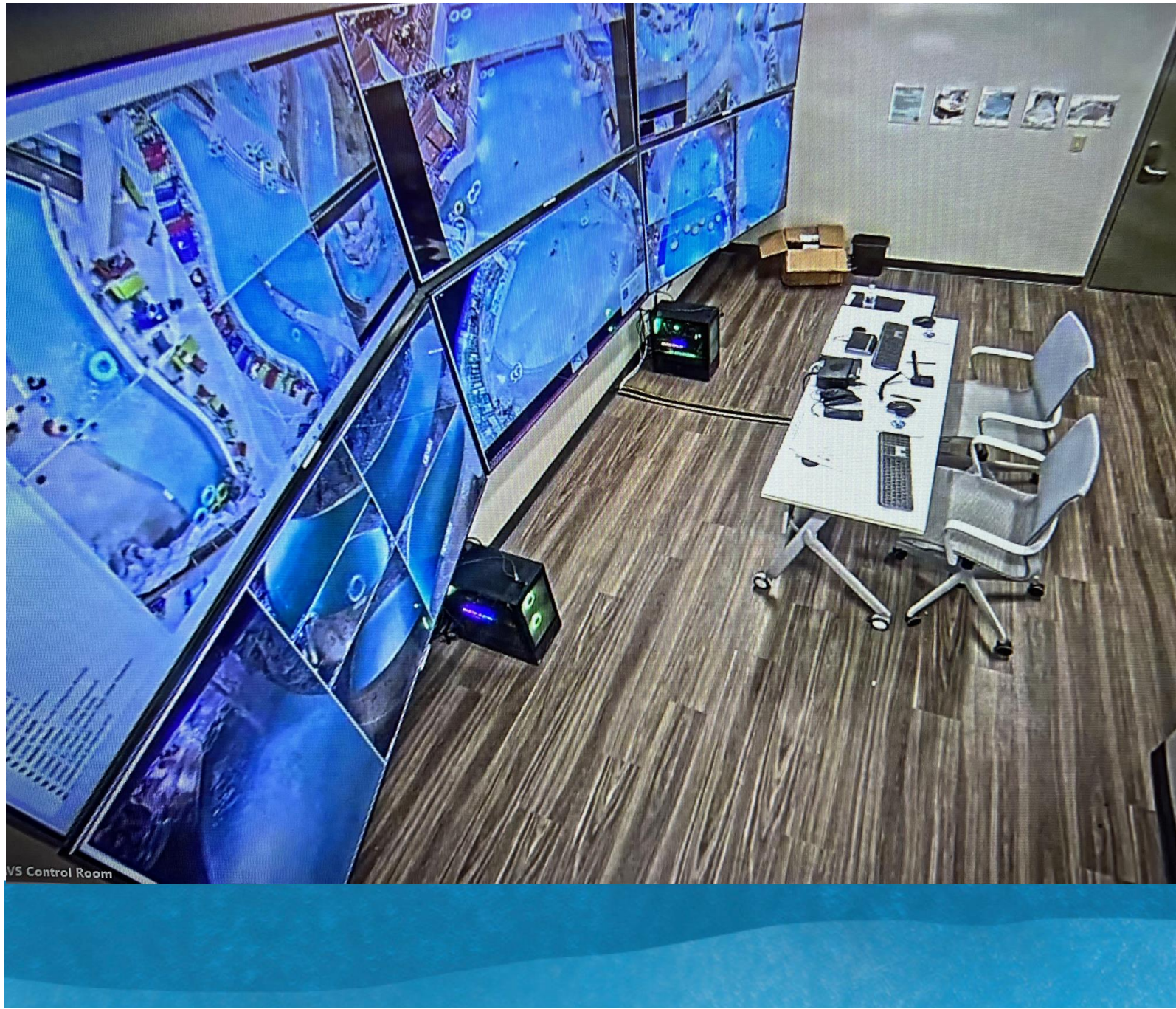
- Data from 2022.
- 6 large waterpark client facilities.
- Recorded footage from primary camera and control room camera w/ audio.
- 395 water rescues.
- 195 files met the criteria.

Phase 1 Results (Cont)

- 100% of the distressed guests were active on the surface.
- Average time from event onset to recognition was 9 seconds.
- Lifeguards recognized the event first 91% of the time.
- Average time between the recognition by the lifeguard and operator was <3 seconds

Phase 1 Results (Cont)

- 90% of the time the event was recognized and the rescue made within 30 seconds.
- 9% were within 36 seconds
- 1% included 2 incidents
  -45 and 60 sec
- Rescues occurred in –
  - Wave pool (37%)
  - Activity Pool (32%)
  - River (23%)
  - Slides (6%)
  - Kidzone (2%)



Phase 1 Takeaways

- All guests in distress were recognized before submersion or loss of consciousness
- Though the LG saw the event first in most cases, the Operator was only an average of < 3 seconds behind.
- In all instances if the LG had not witnessed the event, the Operator would have.

Phase 2 Research

- Larger N in 2023
  - 21 facilities
  - > 600 usable rescues
  - >300 VATs expected

- Comprehensive analysis of Human Factors Considerations

Human Factors Considerations

- Items impacting performance
  - Eye strain
  - Time on task
  - Mitigating vigilance decrements
  - Number of views
  - Time needed to see all views
  - Operator selection

Phase 3 Research

- Implement modifications made as a result of Phase 1 and 2 research
- Study the differences in performance and outcomes following implementation

Additional Questions or Discussion ?

Access the presentation: www.jellis.com/downloads