



From Standards to Smart Solutions

Evidence-Based AI Integration for Predictive Fire Services

Bridging Research and Practice

Lt. Col. Dr. Humaid Al Ali, CFO

Deputy Director of Fire Affairs, UAE General Command of Civil Defence

Ministry of Interior, United Arab Emirates



Speaker Profile



**Lt. Col. Dr.
Humaid Al Ali**



Doctorate
DBA in AI (UK)



Certification
CFO (CPSE)



Recognition
3x Best Officer



RedCon Platform

Digital transformation of 100+ fire stations -
paperless operations & data analytics



Hassantuk

smart fire alarm monitoring system



Axes Excellence Program

KPI-driven operational excellence
with measurable outcomes



Author: UAE Civil Defense Gap Analysis 2016 & 2017-2021 Strategic Framework



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The Problem: Reactive Fire Service Model



Global Challenge

Every 24s

US fire dept responds

12%

Use predictive analytics



Traditional Model Issues

- ✗ Respond AFTER incidents occur
- ✗ Limited predictive capability
- ✗ Volume-based success metrics
- ✗ High cost in lives & property



Australian Context

Structure Fires (Annual)

2,500+

Economic Loss

\$1.5B

Avg Response Time (VIC)

11.2 min

Source: AFAC 2023, Fire Rescue Victoria



Key Insight

Prevention costs 7× less than response

We need evidence-based transformation



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The Problem



Fire and Losses



Trends



Fires

1,389,000

in 2023

↗ +9.1%

from 2014



Deaths

3,670

in 2023

↗ +15.9%

from 2014



Injuries

13,350

in 2023

↘ -12.3%

from 2014



\$ Loss*

\$23.2 billion

in 2023

↗ +16.3%

from 2014

Source: National Fire Protection Association



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What If We Could Predict Fires?



Reactive Model

- Wait for emergency calls
- Respond to active fires
- Damage already occurring
- Limited prevention focus



AI-Powered Transformation



Predictive Model

- Identify risks proactively
- Prevent fires before they start
- Optimize resource allocation
- Data-driven decisions

The global fire service is evolving from reactive to predictive



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The Research Gap



Technology Potential

AI can revolutionize fire safety and prevention

- Machine learning pattern recognition
- Predictive risk forecasting
- Automated compliance checking



THE GAP

- Limited empirical evidence on AI adoption factors
- No validated frameworks for fire service context
- Unclear which factors drive successful integration



Practical Reality

Implementation faces barriers and resistance

- Organizational resistance to change
- Concerns about AI reliability
- Budget constraints & skill gaps



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Bridging Research & Practice



Academic Quality



Validated UTAUT Framework

Widely accepted technology adoption model



Quantitative Methodology

411 participants across multiple organizations



Statistical Analysis (PLS-SEM)

Rigorous hypothesis testing with effect sizes



Peer-Reviewed Standards

Contribution to scientific knowledge base



Operational Reality



Real-World Implementation

UAE Civil Defence transformation case study



Measurable Performance Outcomes

34% fire reduction, 22% faster response



Practical Challenges & Solutions

Lessons learned from actual deployment



Scalable Approaches

Applicable to international fire services



Research INFORMED the practice, and practice VALIDATED the research



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Theoretical Framework: UTAUT

Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003)



Performance Expectancy

- Perceived operational benefits
- Job efficiency
- Effectiveness
- Productivity



Effort Expectancy

- Perceived ease of use
- Ease of learning
- User-friendly



Social Influence

- Organizational culture
- Peer adoption
- Culture
- Leadership support



Facilitating Conditions

- Infrastructure & support
- Technical support
- IT infrastructure
- Resources



Framework Validation

70%
Variance explained

30K+
Citations

Multi-industry
Validated



Research Question: Which factors most strongly predict AI adoption in fire services? How do demographics moderate these relationships?



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EMPIRICAL FINDINGS

Research Results from 411 Public Safety Professionals



8/10

8 of 10 hypotheses
supported



$p < 0.001$

Strong statistical
significance



Clear

Practical implications



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Performance Expectancy: Strongest Predictor



H1: PE → Behavioral Intention

STRONGLY SUPPORTED

Performance expectancy is the clearest signal for AI adoption intention.



WHAT THIS MEANS



Strongest driver
of AI adoption
intention



Believe it improves work
professionals adopt AI
when value is clear



Benefits beat ease of use
perceived impact
matters most



PRACTICAL APPLICATION

Turn evidence into adoption behavior by showing tangible value early.

1

Prove value early

Run pilot projects with measurable improvements



2

Focus on operational benefits

Frame AI around job-performance gains



3

Quick wins matter

Start with applications that show immediate benefit



4

Communicate specifically

"AI reduced plan review from 5 days to 2 days"



Mistake to Avoid

Don't lead with "AI is the future" or "everyone is adopting AI"

Instead: Lead with "Here's how AI improved these specific tasks"



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Effort Expectancy: Ease of Use Matters

UTAUT • Hypothesis 2

When systems feel easy to use, people are more willing to adopt them.



H2: EE → Behavioral Intention

SUPPORTED

Ease of use is a direct adoption lever.



Key Insights

- ✓ **User experience** significantly impacts adoption
- ✓ **Complex interfaces** create barriers
- ✓ **Training** reduces perceived difficulty
- ✓ **Intuitive design** accelerates adoption



Practical Application

A simple adoption roadmap: reduce friction, build confidence, and fit existing workflows.

1

Invest in UX/UI Design

Test with actual users; iterate based on feedback

2

Provide Adequate Training

Hands-on practice builds confidence

3

Start with Simple Applications

Begin with straightforward use cases

4

Minimize Workflow Disruption

Integrate AI into existing processes



Design takeaway:

Make the first interaction feel easy — confidence and behavioral intention follow.



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Social Influence: Organizational Culture Impact



H3: SI → Behavioral Intention

STRONGLY SUPPORTED



Key Insights

- ✓ **Leadership support** crucial for adoption
- ✓ **Peer adoption** creates social pressure
- ✓ **Organizational culture** enables or blocks AI
- ✓ **Change champions** accelerate diffusion



Three Sources of Social Influence



Leadership/Supervisors

Do chiefs support AI? Is it a stated priority?



Peers/Colleagues

Are respected colleagues using AI successfully?



Professional Community

Are NFPA, IAFC, FPA promoting AI adoption?



Practical Application

- 1 Secure Leadership Buy-In FIRST
- 2 Identify and Empower Champions
- 3 Build Organizational Culture
- 4 Leverage Professional Networks



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Facilitating Conditions: Infrastructure is Critical

H4: FC → Actual Use

VERY STRONGLY SUPPORTED



Four Components of FC



Technical Infrastructure

Network, hardware, software compatibility



Organizational Support

IT support, help desk, troubleshooting



Resources

Budget, time allocation, dedicated personnel



Policies & Procedures

Clear guidelines, SOPs, accountability



Critical Distinction

PE, EE, SI predict **INTENTION** to use

FC predicts **ACTUAL** use



Intention-Behavior Gap: Many people **INTEND** to use AI but can't because infrastructure isn't in place



Practical Application

- 1 Infrastructure **BEFORE** AI - Don't buy before IT is ready
- 2 Allocate Resources Adequately - Budget for ongoing support
- 3 Ensure System Integration - AI must work with existing platforms
- 4 Provide Ongoing Support - Help desk, maintenance, updates



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Moderating Effects: Experience Strengthens Adoption



H5: Experience Moderates PE → BI

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What Moderation Means

As **work experience increases**, the effect of Performance Expectancy on Behavioral Intention becomes **STRONGER**

Low Experience

Moderate Effect

High Experience

STRONG Effect

Surprising Finding

We tested TWO types of experience:

- ❌ **AI-specific experience** - less important than expected
- ✅ **General fire service experience** - mattered MORE!

Why? Experienced professionals have:

- Better understanding of operational challenges
- Clearer sense of what "good performance" means
- More accurate assessment of AI value
- Confidence to distinguish hype from reality



Practical Application

- 1 Target Experienced Personnel as Champions
- 2 Don't Require AI Experience - Fire service expertise > AI expertise
- 3 Listen to Veterans - Their judgment is calibrated by years of operations
- 4 Start Pilots with Experienced Stations



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Moderating Effects: Training Enables Usage



Training Moderates FC → Use

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Key Insight

Training enhances **USAGE**, not initial buy-in

Critical Timing Discovery



Common Mistake

Train staff **BEFORE** systems are deployed
Skills decay if not immediately practiced



Our Finding

Train **DURING** implementation, not BEFORE
Users practice immediately on real tools

Optimal Training Sequence

1

Build Infrastructure (FC)



2

Deploy Systems



3

Provide Training **WITH** Live Systems



4

Users Practice Immediately



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Key Research Insights: What We Learned

1



Evidence-Based Approach

Reduces implementation risk and increases success rates through validated frameworks

2



Demonstrate Value

Performance expectancy must be demonstrated, not just promised - show tangible outcomes

3



Infrastructure First

Investment prerequisite for AI success - build facilitating conditions first

4



Experience + Training

General experience + targeted training = effective adoption strategy

5



Long-Term Commitment

Transformation takes years, not months - sustainable change requires patience

6



Measure What Matters

Prevention value over response volume - shift metrics from reactive to proactive



8 Hypotheses

Supported



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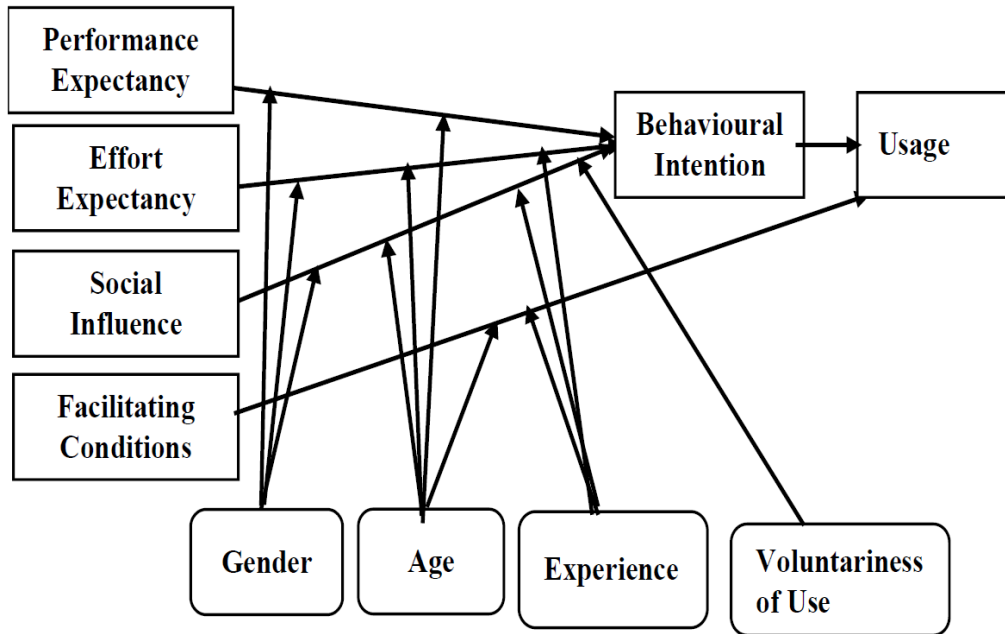


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Theoretical Framework: From UTAUT to Extended Research Model

Original UTAUT Model

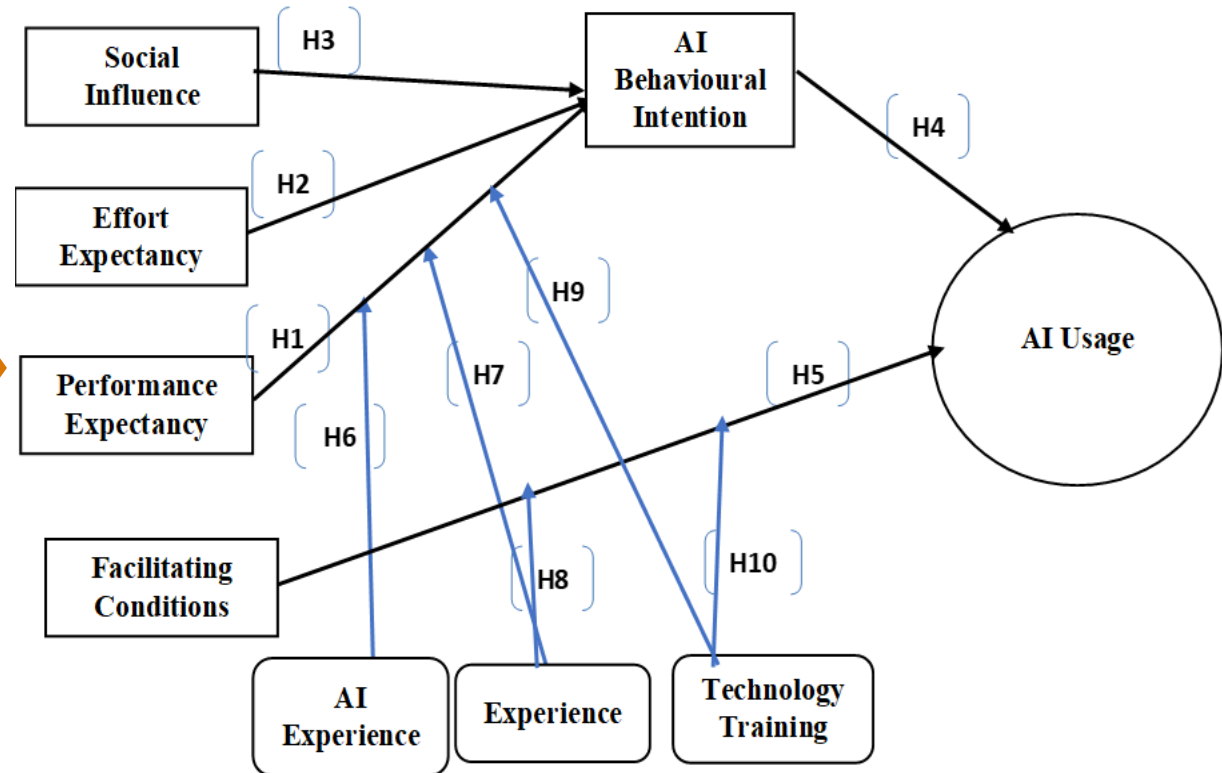
Venkatesh et al. (2003) — 4 predictors, 4 moderators



Extended Model (AI Ali, 2023)

UAE public safety context — 10 hypotheses, 3 new moderators (H6–H10)

Extended
➔



Key extension: replaced original UTAUT moderators (Gender, Age, Voluntariness of Use) with operationally relevant moderators for public safety AI —

AI Experience (H6), Work Experience (H7, H8), Technology Training (H9, H10)



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UAE PRACTICAL IMPLEMENTATION

From Research to Reality: Transforming Fire Services

1969
IN UAE



1976: Shaikh Zayed with the Apollo 17 crew (Eugene Cernan, Ronald Evans, Harrison Schmitt) and NASA scientist Dr Farouk Al Baz in February 1976.

45 years



2019: the first Arab and Emirati astronaut to travel to the ISS on an eight-day space mission on 25 September 2019.



2021: The Emirates Mars Mission is a United Arab Emirates Space Agency uncrewed space exploration mission to Mars. The Hope orbiter was launched on 19 July 2020, and went into orbit around **Mars on 9 February 2021.**



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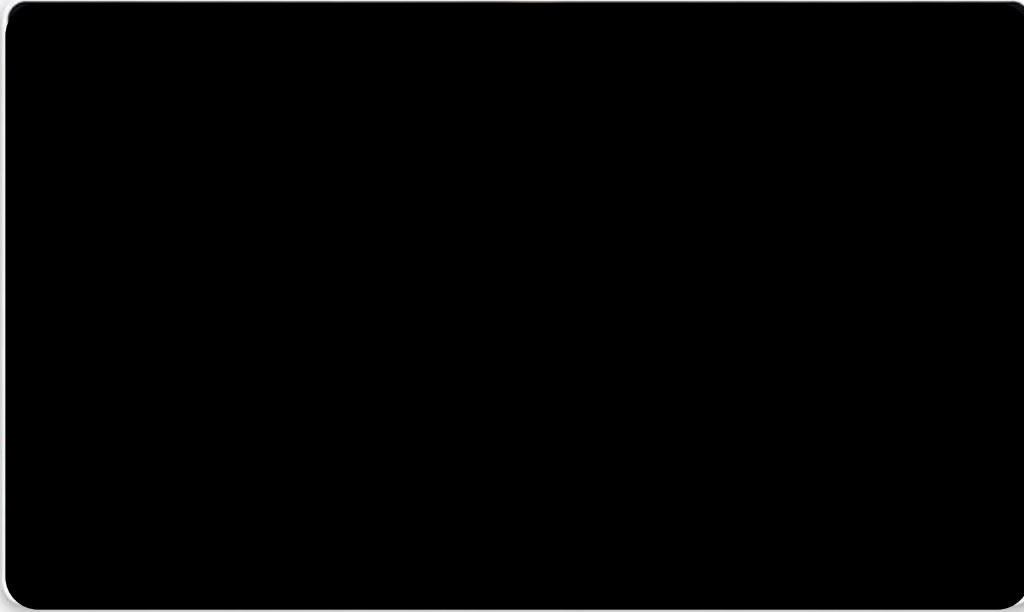
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“The UAE has worked for years to ensure maximum preparedness to face challenges and crises. The response process does not come during firefighting, but years before it, in which roles and duties are defined.”



Lt. General H.H. Sheikh Saif bin Zayed Al Nahyan

Deputy Prime Minister and Minister of Interior

World Government Summit - 2016



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Why the UAE Model Matters?

A forward-looking benchmark driving resilience, innovation and global impact.



الإمارات
THE EMIRATES



Urbanization and
development



Smart city
initiatives



Climate factors



Economic Assets



Wellbeing



Global leadership
innovation



Compliance with
international
standards



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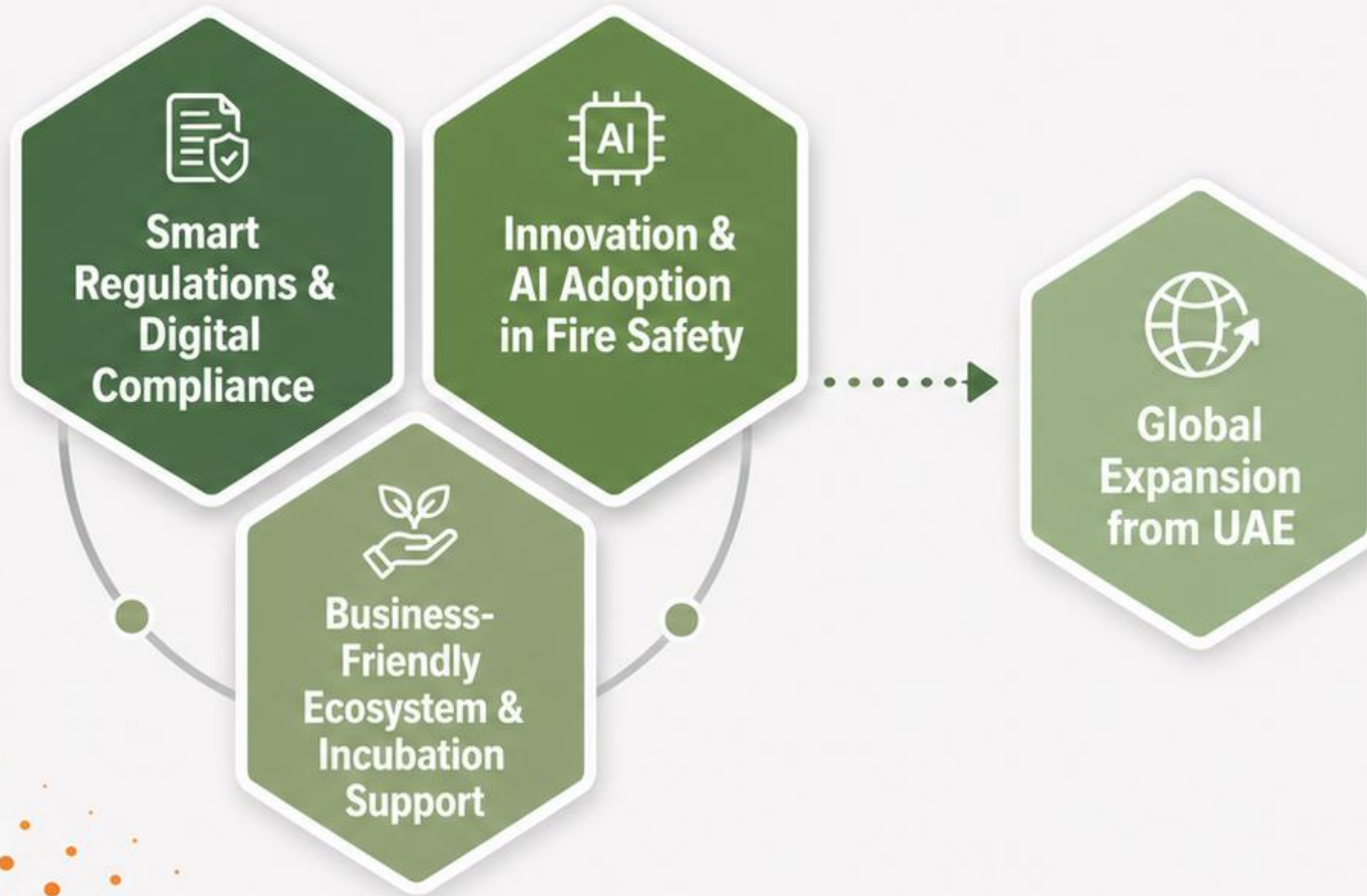


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Innovation Ecosystem in UAE Fire Safety



Companies benefit from UAE's **world-class infrastructure** to scale globally.



UAE fosters **partnerships between startups & international fire safety organizations.**



UAE-based company, started locally and expanded to **over 100 countries**, becoming a **global leader in fire safety solutions.**



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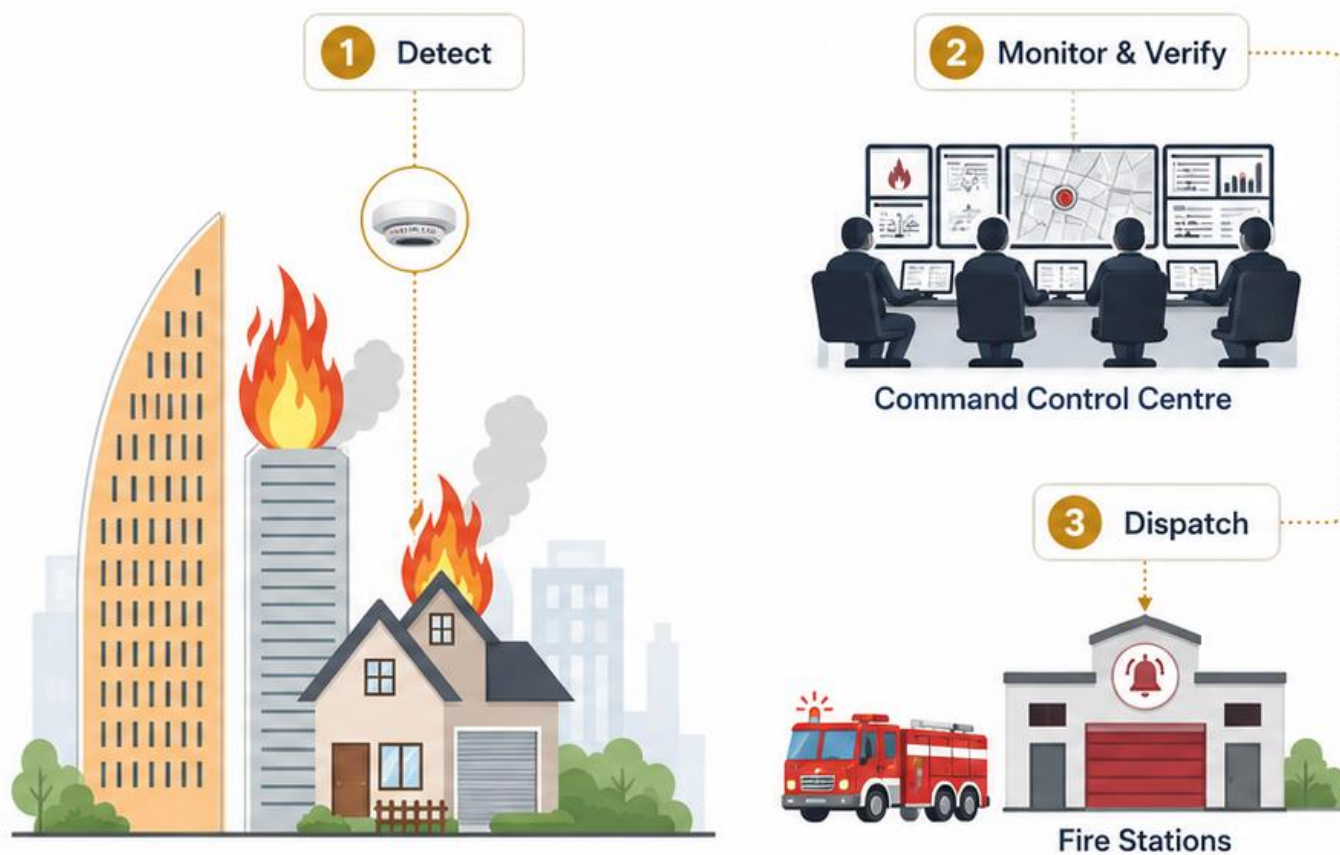


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Protect the ones you love

Hassantuk connects protected buildings to the Command Control Centre and Fire Stations for fast, coordinated response.



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Hassantuk: UAE National Smart Fire Alarm Monitoring System

How Hassantuk Works

1



Smart Sensor Detection

Smoke, heat and fire sensors in registered premises transmit signals

2



AI-Powered Alarm Verification

System verifies alarm authenticity, eliminating false alerts and prioritising genuine emergencies

3



Intelligent Command & Control Centre

Alarm routed to centralised command centre monitored 24/7, linked to all 7 emirates

4



Instant Dispatch — 999 & 997

Civil Defence units dispatched simultaneously via MDT; Police operations rooms notified



National Coverage: All 7 Emirates • 24/7 Monitoring •
Reduces false alarms response • Links fire count & fatality indices



Impact & Research Validation



Proactive Fire Prevention

Identifies building risk before incidents occur.
Predicted fires via AI-monitored sensors



UTAUT Performance Expectancy

Officers can see how AI clears incidents faster, reduces false alarms, and improves pre-incident planning



Facilitating Conditions

Hassantuk's national infrastructure — seamless APIs, cloud connectivity, MDT integration — is the highest-impact UTAUT factor in practice



Research Validation: Hassantuk embodies all four UTAUT factors

High PE: Clear operational benefits • Strong SI: Leadership & cross-agency support • Adequate FC: National infrastructure •
Moderate EE: Training addressed



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Smart Community Risk Assessment



Smart Services



- Easy Access
Anytime, Anywhere
- Secure
& Trusted
- 24/7
Availability
- Services for
Everyone

SERVICES... AT YOUR FINGERTIPS

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RedCon

DIGITAL READINESS & PREPAREDNESS

A smart platform for paperless fire station operations and decision-ready data



Paperless Fire Station

Replace manual paperwork with digital workflows



Electronic Station Operations

Run daily station processes through integrated digital systems



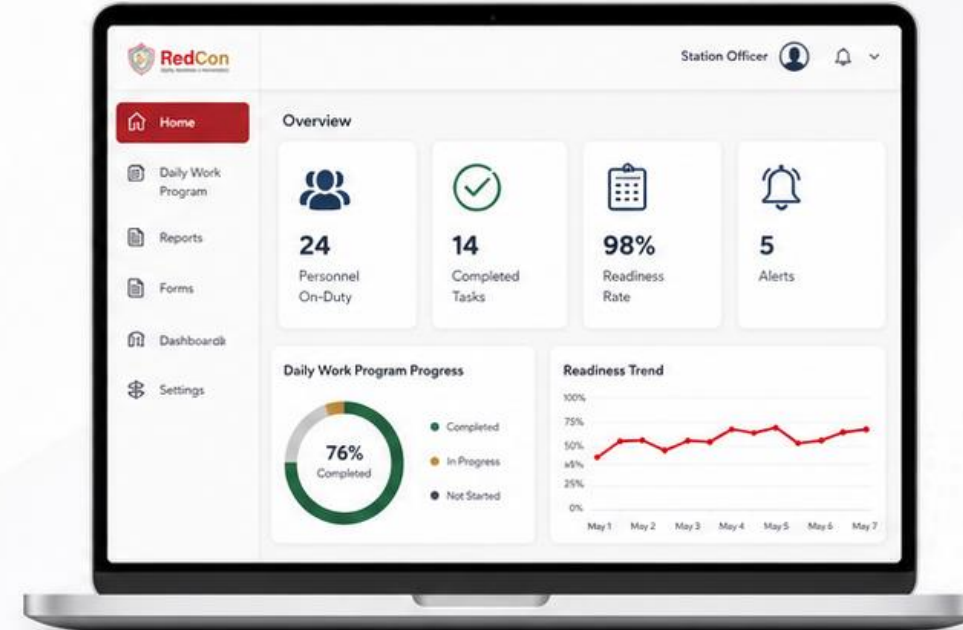
Daily Status Assessment

Track operational readiness and daily work status in real time



Decision Support Data

Provide accurate dashboards and insights for leaders and decision-makers



CORE CAPABILITIES



Smart KPI Dashboard

Real-time visibility of station performance and readiness



Digital Forms & Records

Standardized digital forms for accurate record-keeping



Daily Work Program Monitoring

Plan, track, and complete daily tasks with full visibility



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RedCon Digital Platform: The Foundation

? What is RedCon?

Comprehensive digital platform for fire station operations



Digital stations reporting



Shift management



Automated Community risk reduction



Fire Fitness



Why RedCon Was Essential

- Digital data infrastructure (AI needs data)
- Standardized processes (AI needs consistency)
- User familiarity with technology
- IT support capacity

Implementation & Results

Deployment

100+

Stations nationwide

3,000+

Users trained

6 mo

Rollout period

Results



Paperless operations

100%



Admin time reduction

85%



Daily active users

98%



Lessons Learned



Infrastructure first



User involvement critical



Phased rollout reduces risk



Ongoing support essential



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AL Barwa: AI-Powered Building Plan Review

The Process



How it works: AI analyzes architectural drawings using computer vision, checks against fire safety requirements, generates detailed compliance report in hours.

Key Benefits



Faster review



Accuracy



Availability



Plans/year

Addressing All Four UTAUT Factors



Performance Expectancy

Delivers faster, more accurate compliance reviews and reports.



Effort Expectancy

Intuitive workflow that simplifies complex plan review.



Social Influence

Builds trust and adoption through transparent, reliable outcomes.



Facilitating Conditions

Integrated tools, data, and support to enable seamless adoption.



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UAE Implementation Results: Measurable Impact



Fire Incidents

↓ 34%

Reduction over 3 years

Proves prevention works



Response Times

↓ 22%

Faster arrival on scene

Efficiency gains from optimization



Inspection Efficiency

↑ 156%

More done with same staff

Technology delivers performance benefits



↑ 87%

Prevention value vs.
response volume



91%

Public satisfaction rating



#2

Global security
competitiveness ranking



All metrics measured rigorously over 3-year period (2019-2024)



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Lessons Learned: What Worked and What Didn't



What Worked



Data Quality is Foundation

Clean, standardized data before AI - no shortcuts



Change Management Critical

Technology success depends on people acceptance



Start Small, Scale Smart

Pilots validate approach before major investment



Infrastructure Before AI

Build FC first, then deploy advanced capabilities



What Didn't



Don't Rush Implementation

Premature deployment creates resistance and failure



Don't Ignore User Feedback

Users know what works - listen and adapt



Technology Alone Doesn't Solve

Assuming tech alone solves problems without people



Don't Underfund Support

Ongoing maintenance and training need resources



Key Lesson

Evidence-Based Approach



Success Rate

Measurable Outcomes



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Research → Practice: Evidence-Based Framework



Performance Expectancy

➔ **Action:** Demonstrate tangible benefits through pilots and metrics



Effort Expectancy

➔ **Action:** Invest in UX/UI design and user-friendly interfaces



Social Influence

➔ **Action:** Secure leadership support and build change champions



Facilitating Conditions

➔ **Action:** Build robust infrastructure BEFORE deploying AI

The Integration

These factors work together in sequence:

1

Build Infrastructure (FC)



2

Show Performance Value (PE)



3

Make it Easy to Use (EE)



4

Build Cultural Support (SI)



Result

High Intention + High Usage = Successful AI Adoption



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Implementation Roadmap: Four Phases



Key Takeaways for Fire Protection Professionals

1



Evidence-Based Approach

2



Infrastructure First, Then AI

3



Design for Compound Threats from Day One

4



**Demonstrate Value —
Don't Just Promise It**

5



Buy-In Before Training

6



**Measure Prevention,
Not Just Response**

“Successful AI isn't about flashy pilots. It demands structured rollouts aligned with team culture.”

— Fire Middle East, Issue 69, p.95 | Al Ali (2024)

”



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50% of UAE Government Services on Agentic AI — in 2 Years



50%

of UAE government services
on Agentic AI



2 yrs

clear timeline
with performance measurement



AT A GLANCE



A new government model



50% adoption within two years



AI as an executive partner



People come first

“ AI is no longer a tool. It analyses, decides, executes, and improves in real time. It will become our **executive partner to enhance services, accelerate decisions, and raise efficiency**. The world is changing. Our principle remains constant. **People come first.** ”

— H.H. Sheikh Mohammed bin Rashid Al Maktoum,
Vice President and Prime Minister of the UAE | 23 April 2026



Civil Defence is inside this mandate

A government service. Not optional.
The work you have seen today is the
foundation for what must be delivered
in 24 months.



UTAUT framework is the delivery mechanism

The mandate sets the target. Our
validated research framework —
PE, EE, SI, FC — shows how
government organisations achieve it.



first government globally

to operate at this scale
through autonomous
systems



A model for the international fire and public safety industries

Government-mandated AI adoption with people-first principles.
Build now — not when the mandate arrives in your jurisdiction.





Thank You



 LinkedIn: Dr. Humaid AlAli

“The best fire we prevent is the one that never happens”



Lt. Col. Dr. Humaid Al Ali, CFO

Deputy Director of Fire Affairs

UAE General Command of Civil Defence



halali@moi.gov.ae



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