

## AIQ-ADNOC Onshore – HSE Humanoid Office PoC

### Use Case Catalogue – PoC & Scale-Up Phases

Category 1 – PPE, Permit & Signage Compliance	
Use Case	Description
1. PPE Compliance Detection	Detects missing or non-compliant PPE (helmet, vest, gloves, coverall, earmuffs, H2S detector) on workers during patrol. Each PPE item is detected independently on every visible worker, with a separate alert and timestamped video evidence for each missing item.
2. PTW Verification via Barcode / QR Scan	Robot approaches active work areas and scans the Permit to Work barcode or QR code. SMARTi checks the approval to work against the live PTW system and flags non-compliance.
3. Signage Verification	Verifies that safety signage are in place and legible along the patrol route. Missing signage triggers an alert for maintenance follow-up.
Category 2 – Near-Miss Detection	
Use Case	Description
4. Fall Detection	Monitors the camera feed for sudden changes in body posture and position indicating a fall event. Triggers an immediate priority alert to the HSE dashboard with a video clip of the event.
5. Fire & Smoke Detection	Analyses the camera feed for visual fire and smoke signatures — colour patterns, texture, and movement characteristics — during patrol. Upon detection, an alert is triggered.
6. Housekeeping – Slip Hazards (Spills & Wet Surfaces)	Analyses the floor surface visible in the robot's camera feed to identify abnormal conditions such as fluid pooling, wet patches, or spill marks. Triggers an alert with location and video clip for maintenance follow-up.
7. Housekeeping – Unattended Objects	Detects tools, equipment, or objects left unattended in walkways or designated clear areas. Items are flagged as unattended, generating an alert with a video evidence.

8. Pipe & Infrastructure Leakage Detection	Analyses the camera feed for visual indicators of leakage along pipes, joints, and valves. Triggers alerts with a video clip, and maintenance notification.
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### Category 3 – Platform, LLM & Robot Enablement (foundational — runs in parallel)

Use Case	Description
A. LLM Integration & Tuning	Integration of the LLM backbone into SMARTi for downstream voice and reasoning use cases. Includes model selection, prompt engineering for ADNOC HSE context and latency optimisation for on-robot interaction.
B. Robot Training, SDK & Configuration	Core enablement work on the humanoid platform: SDK integration, autonomous routing and waypoint mapping, movement tuning for workshop environments, SMARTi ↔ robot control-plane integration, network connectivity, and ongoing configuration of patrol behaviours.
C. Camera Configuration, Stabilisation & Movement Control	Configuration and tuning of the robot's onboard camera system for reliable AI analysis during patrol. Includes camera parameter setup (resolution, frame rate, exposure, white balance), vibration and motion stabilisation to compensate for humanoid gait movement, and programmatic control of camera pan/tilt/zoom and head movement to track subjects of

### Category 4 – Reporting & Analytics

Use Case	Description
I. Automated HSE Patrol & Effectiveness Reporting	Consolidated reporting output delivered after each patrol session and as aggregated effectiveness rounds. Compiles all detections, alerts, and observations — areas visited, PPE compliance rate, permit adherence, housekeeping score, and open follow-up items — into a structured report delivered to the HSE officer dashboard with optional email/notification
II. Trend Analytics – Repeat Violations & Shift Comparison	Longitudinal analytics across patrol sessions. Maintains a persistent violation log to flag repeat offenses and aggregates patrol data by shift to highlight compliance patterns, violation counts, and alert frequency across shift periods — surfacing the highest-risk periods for targeted intervention.

Development Time	Exclusions
1 week (H2S detection) + 2–4 days (refinement)	Does not verify PPE certification, expiry, or fit. No biometric worker identification (pairs with face recognition only if separately configured). Detection limited to camera field of view during patrol.
3 weeks	Requires API access to the ADNOC PTW/SAP system. Does not validate the physical work itself against permit scope — only the permit approval.
1 week	Requires pre-configured expected-signage map per patrol route. Does not verify signage content accuracy against regulations — only presence and legibility versus configured baseline.

Development Time	Exclusions
2–4 days (refinement)	Detection limited to events within camera field of view. Does not detect medical collapse versus trip cause. No worker identification without separate face recognition.
Fire ready, smoke 1 week	Visual detection only — not a substitute for certified fire/gas detection systems. No thermal/IR detection in PoC. Early-stage smoldering fires without visible smoke will not be detected.
2 weeks	Does not identify spilled substance type or hazard classification. Transparent liquids are not included. Does not measure spill volume.
2 weeks	Requires pre-configured walkway/clear-zone map. Does not identify object owner.

3 weeks	Visual detection only — no gas leak detection (requires dedicated gas sensors, out of PoC scope). Slow weeps and pinhole leaks may not be detectable. No quantification of leak rate. Transparent liquids are not included.
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Development Time	Exclusions
3 weeks	Not a standalone deliverable for the PoC phase. Production-grade fine-tuning on ADNOC proprietary data requires a separate data-sharing agreement. No multilingual support, only English.
6 weeks	Not a standalone use case — foundational enablement. Outdoor and hazardous-zone (ATEX) operation out of scope. Stair climbing and dynamic obstacle avoidance limited to platform native capability.
3 weeks	Not a standalone use case — foundational enablement for all vision-based detections. Hardware-level gimbal upgrades out of scope. Stabilisation limited to software/algorithmic compensation within the platform's native camera capability. Low-light and high-glare conditions

Development Time	Exclusions
1.5 weeks	Report templates limited to those agreed during PoC kickoff. Benchmarks PoC be supplied by ADNOC HSE. No automated regulatory filing or submission to external authorities.
1.5 weeks	Requires minimum dataset window ( $\geq 2$ weeks of patrol data) before trends become meaningful. No predictive/forecasting models in PoC.