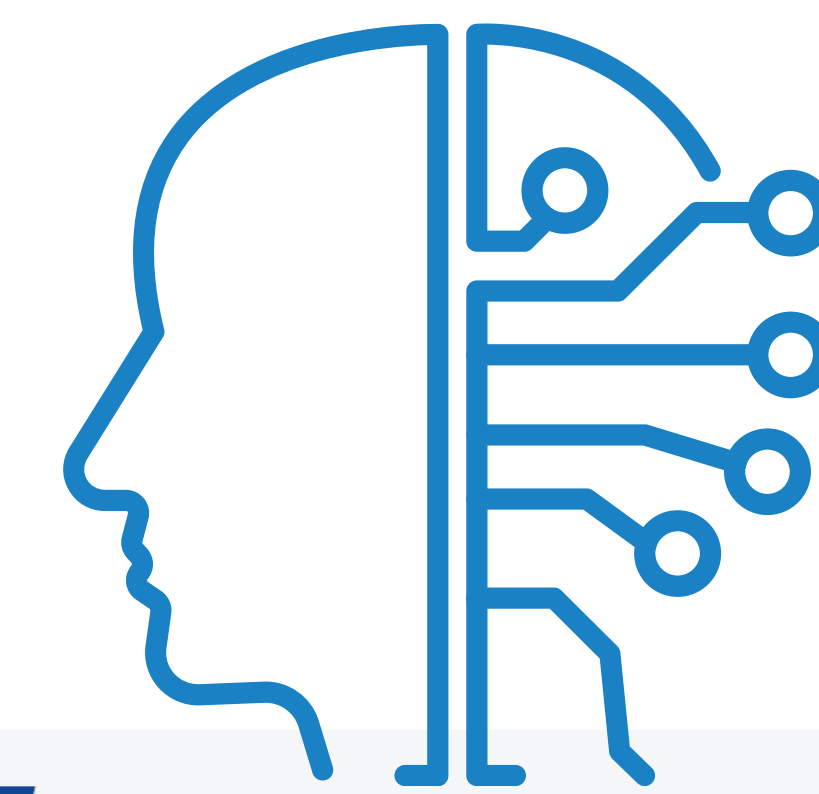




# NeuroGait AI



## CONTINUOUS BIOMETRIC VERIFICATION & THREAT RESOLUTION SYSTEM

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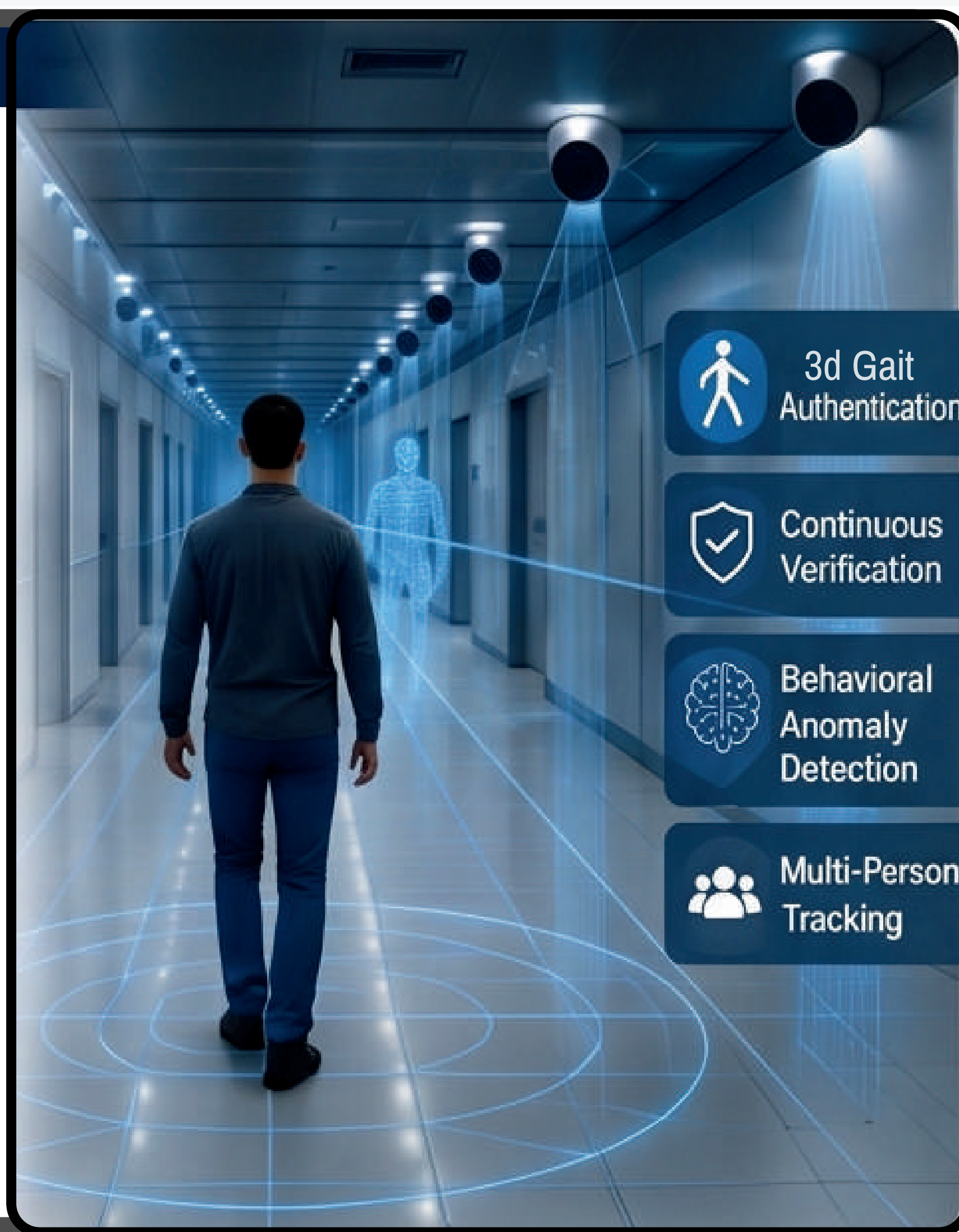


### 1. INTRODUCTION

Traditional biometric systems such as fingerprint and iris recognition, provide point-in-time authentication, creating a critical vulnerability once access is granted. These systems lack the ability to verify identity or detect abnormal behavioral states continuously.

This project introduces **NeuroGait AI**, a continuous, non-intrusive security framework based on 3D gait biometrics and multi-modal sensor fusion. By analyzing human locomotion patterns and spatiotemporal skeletal dynamics in real time, the system enables persistent identity verification across controlled environments.

Additionally, the framework explores behavioral anomaly detection using gait deviation and physiological signals, providing an added layer of security in high-risk environments.



### 2. PROBLEM STATEMENT & OBJECTIVES

#### THE PROBLEM

- Current Access controls suffer from a "Zero-Trust" blind spot once the perimeter is breached.
- Legitimate Credentials can be exploited through blackmail or kidnapping, which static biometrics cannot detect

#### OBJECTIVES

- Develop a theoretical framework for a 3D spatiotemporal tracking system that authenticates an individual via their unique biometric gait.
- Integrate Multi-Spectral Sensor Fusion (RGB, LiDAR, Thermal) to detect micro-tremors and physiological anomalies indicative of extreme stress or duress.
- Design a self-Supervised, Evolving AI architecture that continuously monitors and seamlessly hands off biometric tokens across a high-security facility.

### 3. METHODOLOGY

#### 1 SENSOR FUSION

Deploy an array of 8-30 cameras in a corridor

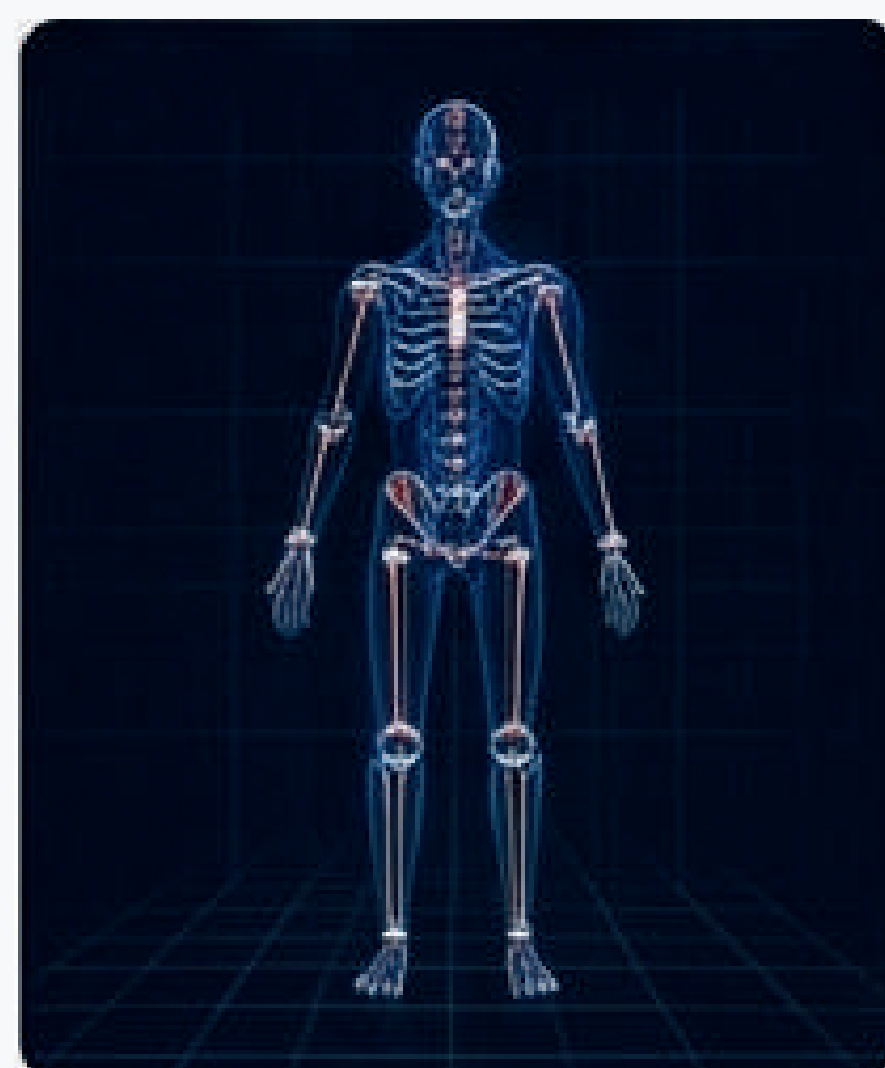
- RGB Cameras
- T3F Septh Sensors
- LIDAR Senses
- Thermal Cameras



Captures real-time 3D points of multiple subjects

#### 2 3D RECONSTRUCTION

Multi-view geometry reconstructs a 3D Character Model



#### 3 KINEMATIC EXTRACTION

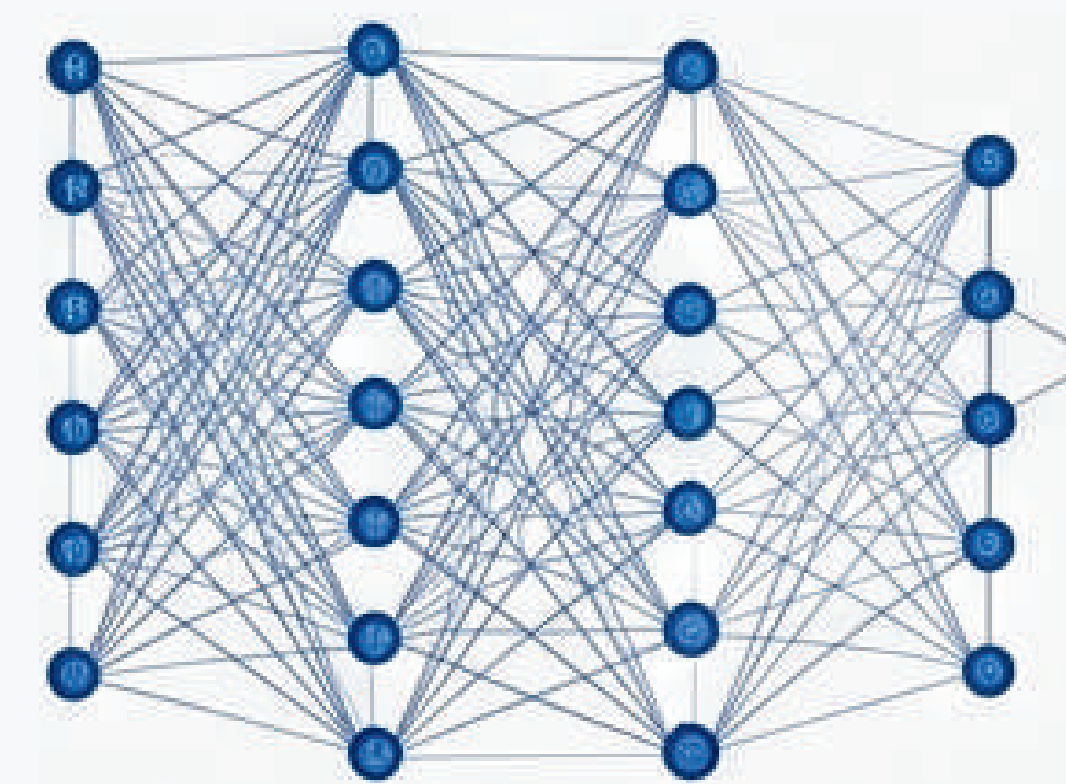
CNNs extract biomechanical features from the distogram

- Joint Angles
- Stride Length
- Gait Cycle Timing
- Posture Symmatry
- Weight Distribution

Generates a unique skeletal signature (Gait IR)

#### 4 AI ANALYTIC ENGINE

Deep Learning models authenticates identity & monitors behavior



Models: CNN + LSTM + Transformer (Self-Supervised & Adaptive Learning)

#### 5 AFFECTIVE COMPUTING (DURESS DETECTION)

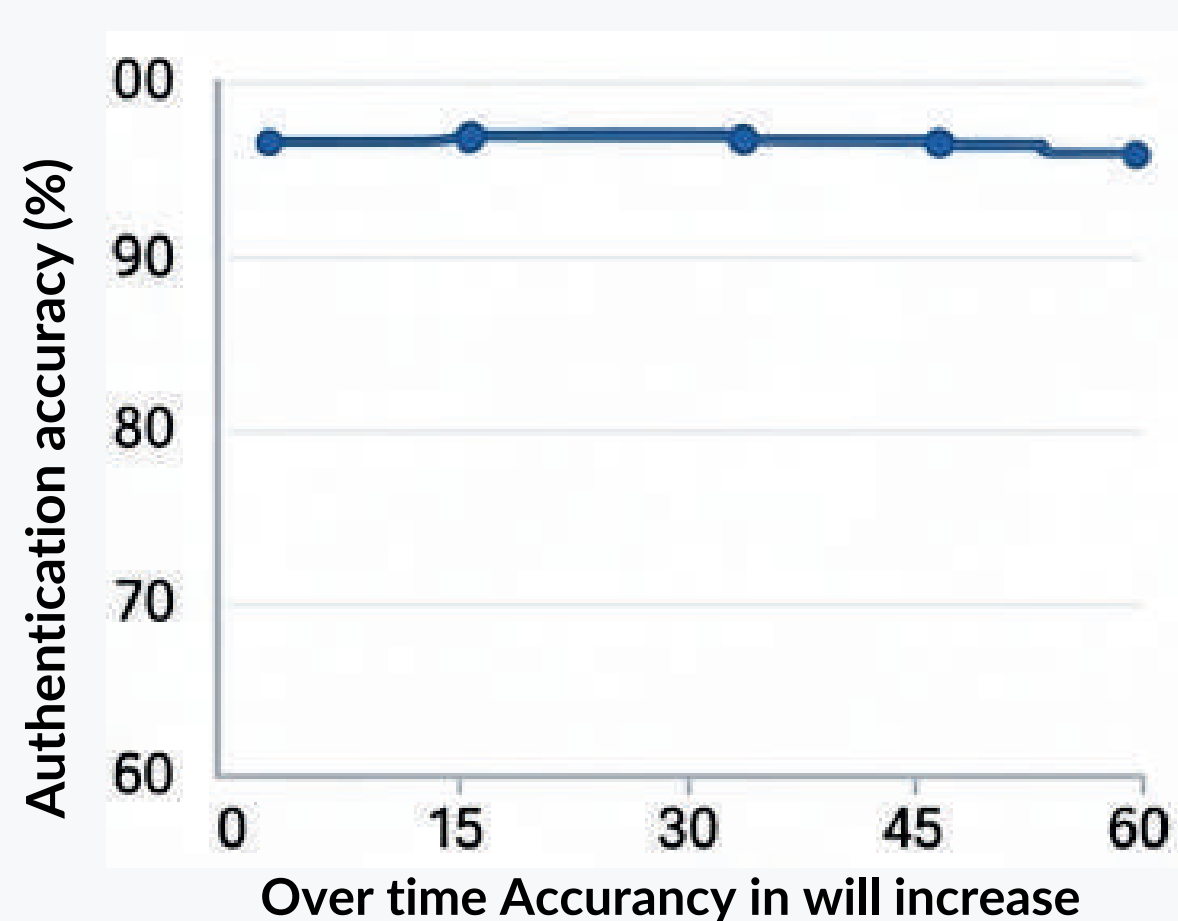
- Thermal Anomalies (Face/Body)
- Heart Data via PPG (Photoplethysmography)
- Gait Stiffness & micro tremors

OUTPUT: Continous Authentication | Behaviour Anomoly Detection | Real-time Alerts & Escalation

### 3. RESULTS / FINDINGS (SIMULATED & PROPOSED IMPLICATIONS)

#### A. CONTINUOUS AUTHENTICATION

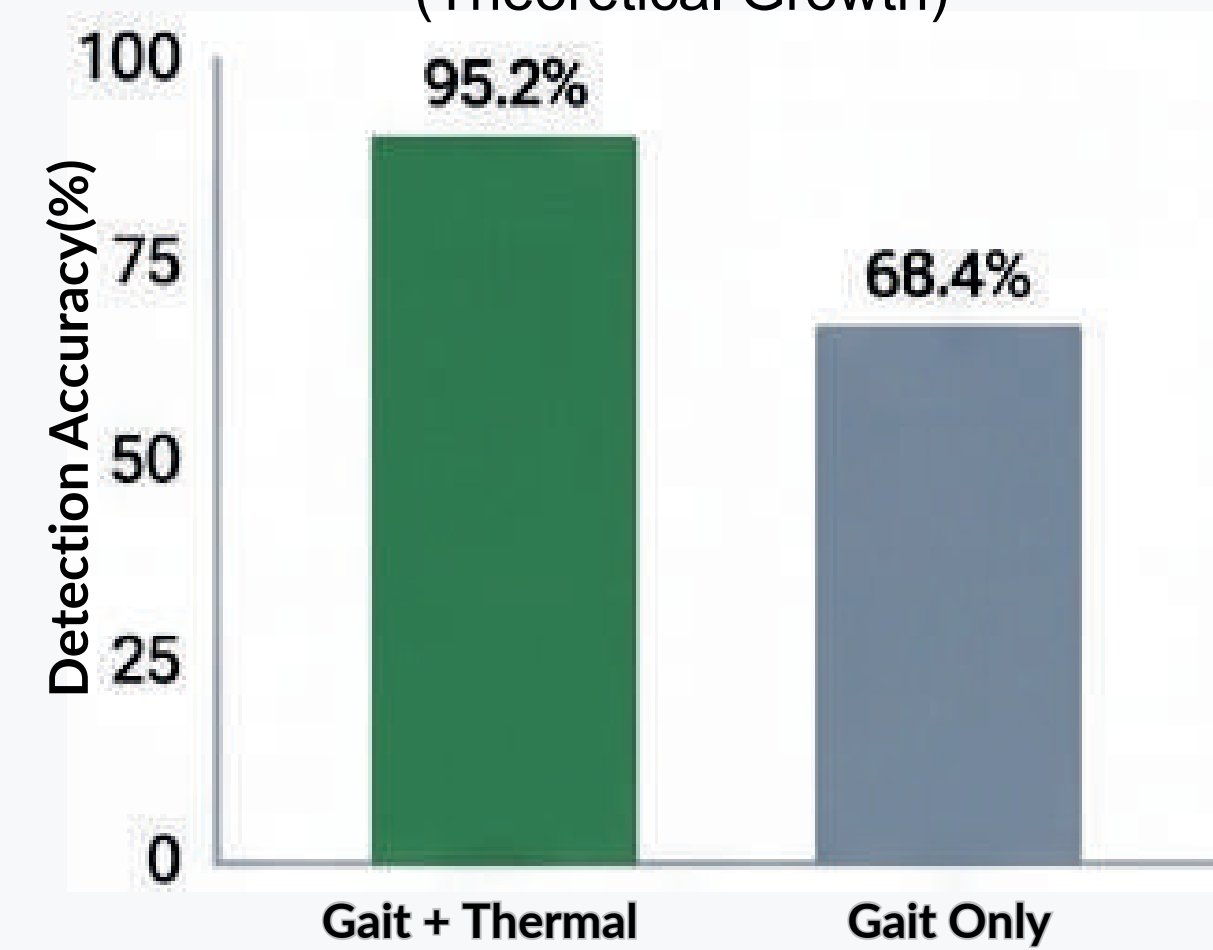
(Accuracy vs Time)



The system transitions from single-point verification to continuous identity tracking, significantly reducing the risk of unauthorized access after entry.

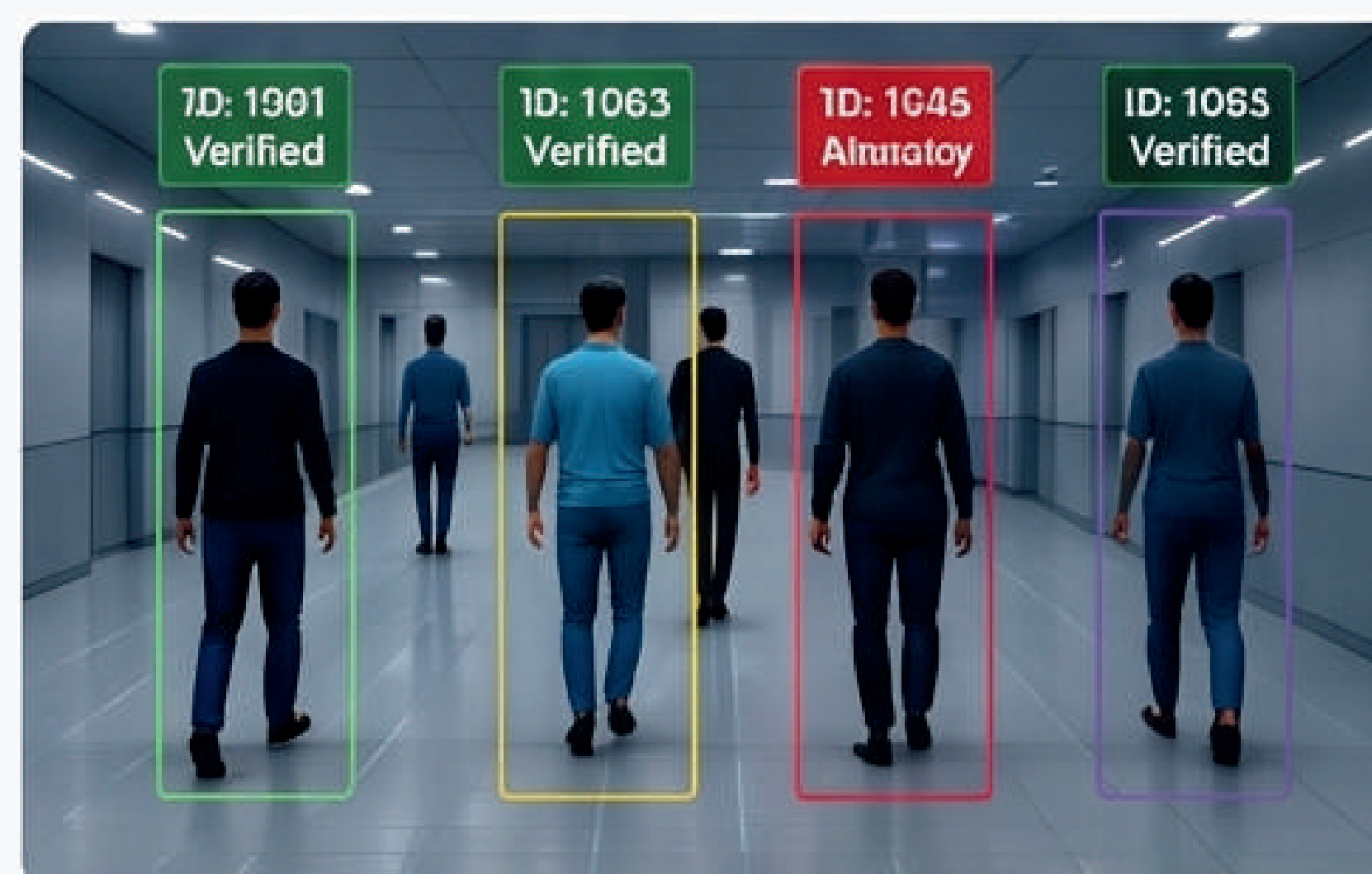
#### B. 'HOSTAGE' / DURESS DETECTION

(Theoretical Growth)



Simulation models suggest that combining gait-based features with physiological indicators can improve detection of abnormal or high-risk behavior patterns, enabling early warning and silent alert mechanisms.

#### C. MULTI-PERSON TRACKING



The system supports simultaneous identification and monitoring of multiple individuals, maintaining unique identity tracking in real time.

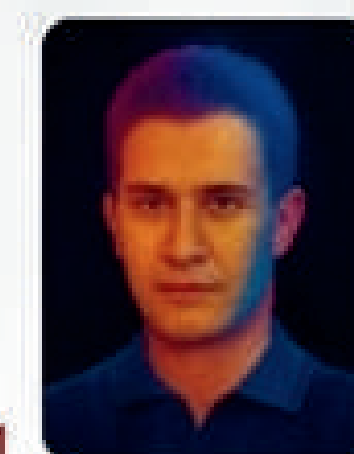
#### ALERT EXAMPLE

ID: 1003

STATUS: **ANDMALY**

REASON:

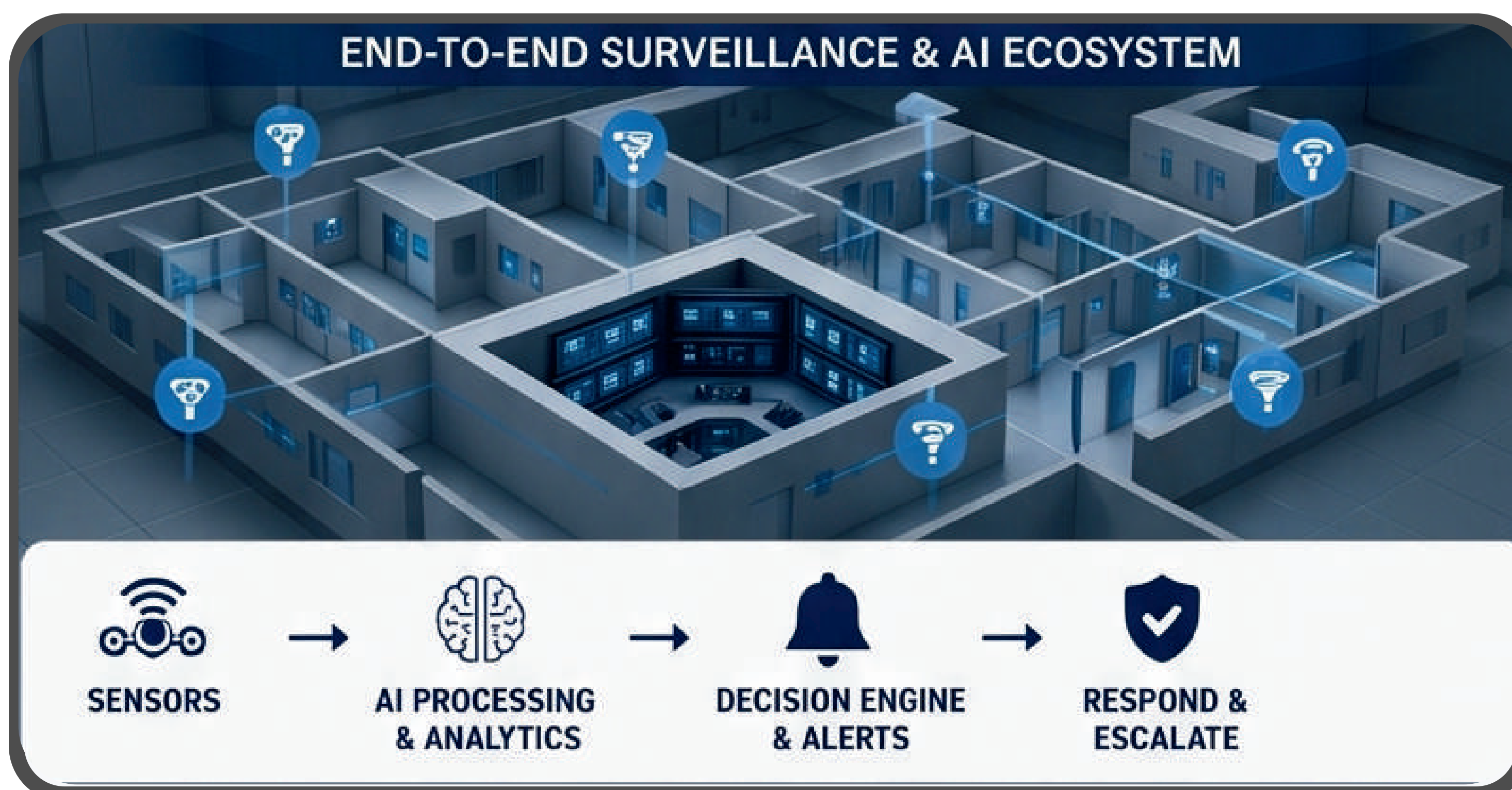
- Gait Stiffnese 1
- Heart Rate 1
- Fcalal Temperature 1



**ACTION: ESCALATE**

### 5. PRACTICAL APPLICATIONS

- Military Intelligence Bases**  
Secure internal areas & sensitive operations.
- BSL-4 Bio-Weapons Labs**  
Monitor personnel & detect inmate disorders.
- Critical Government Infrastructure**  
Continuous protection for high-value locations.
- Airports / Transportation Hubs**  
Enhance security with non-intrusive continuous verification.



### 6. REFERENCES

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- Wang, L., Tan, T., Ning, H., Hu, W. (2003). Silhouette-Based Gait Recognition. IEEE TPAMI.
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"FROM IDENTITY TO INTENT - SECURING PEOPLE, NOT JUST PERIMETERS"