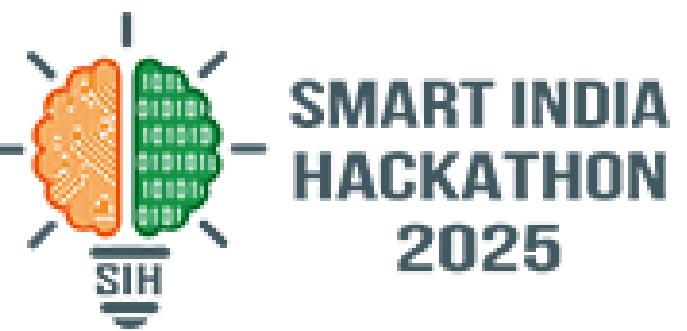
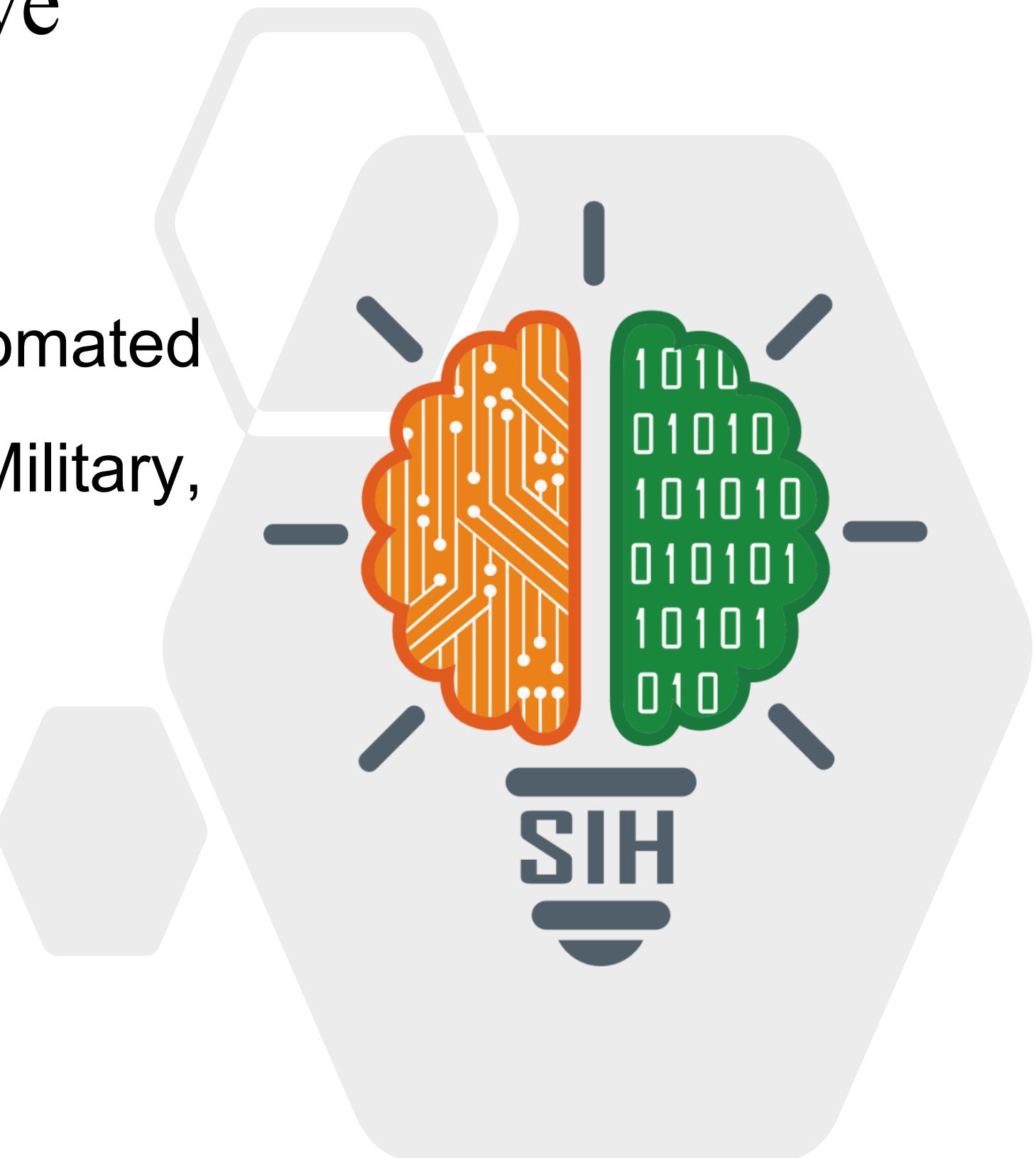


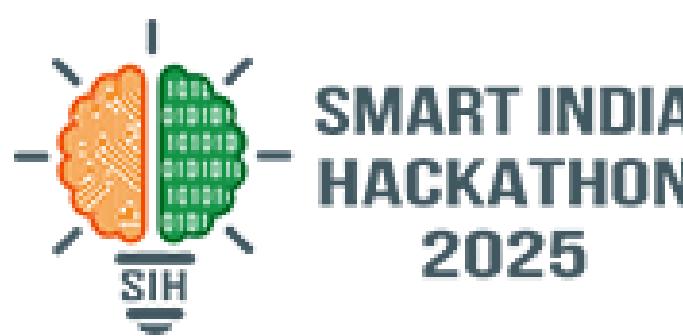
# SMART INDIA HACKATHON 2025



## SecureWave

- **Problem Statement ID** - SIH25118
- **Problem Statement Title** - Real-Time, Automated Multi-Layer Surveillance System for Military, Prisons and Industrial Sectors.
- **Theme** - Student Innovation
- **PS Category** - Hardware
- **Team ID** - 71869
- **Team Name** - BlackICE Dynamics





## Proposed Solution:

### Proposed Solution:

- A Low Cost Centralized Surveillance System which Includes **SMART Sensors** which to Detect **Human Presence** capable of working under **Extreme Weather Conditions** and **Survive Power Failures** with internal Battery Backup.
- **Ai-Powered Human and Weapon Detection** with Integrated Cameras provides extra layer of Security and **Redundancy** to the system.
- **Fail-Proof, Easy to Use, Energy Efficient** System Designed for Prisons, Military and Industrial Sectors such as High Security Datacenters, Highway Fencing.

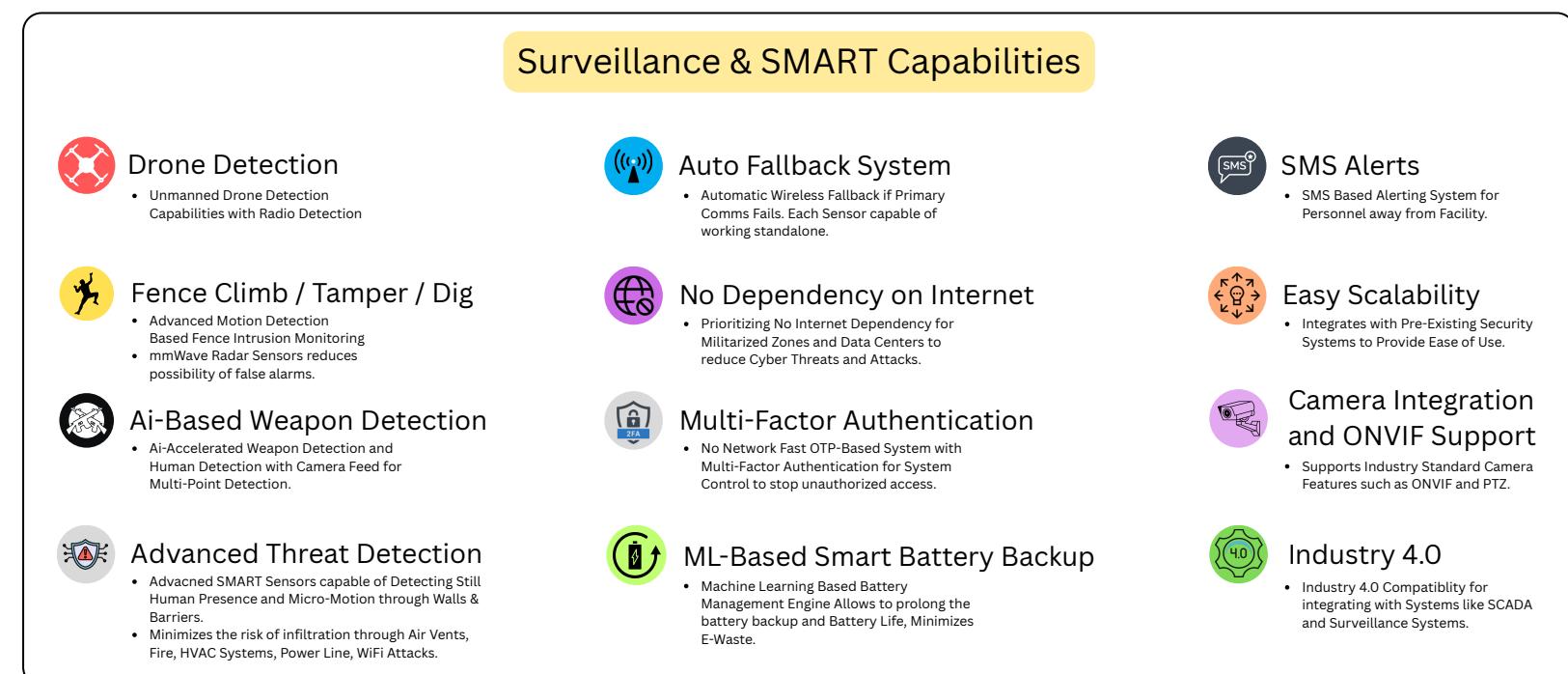
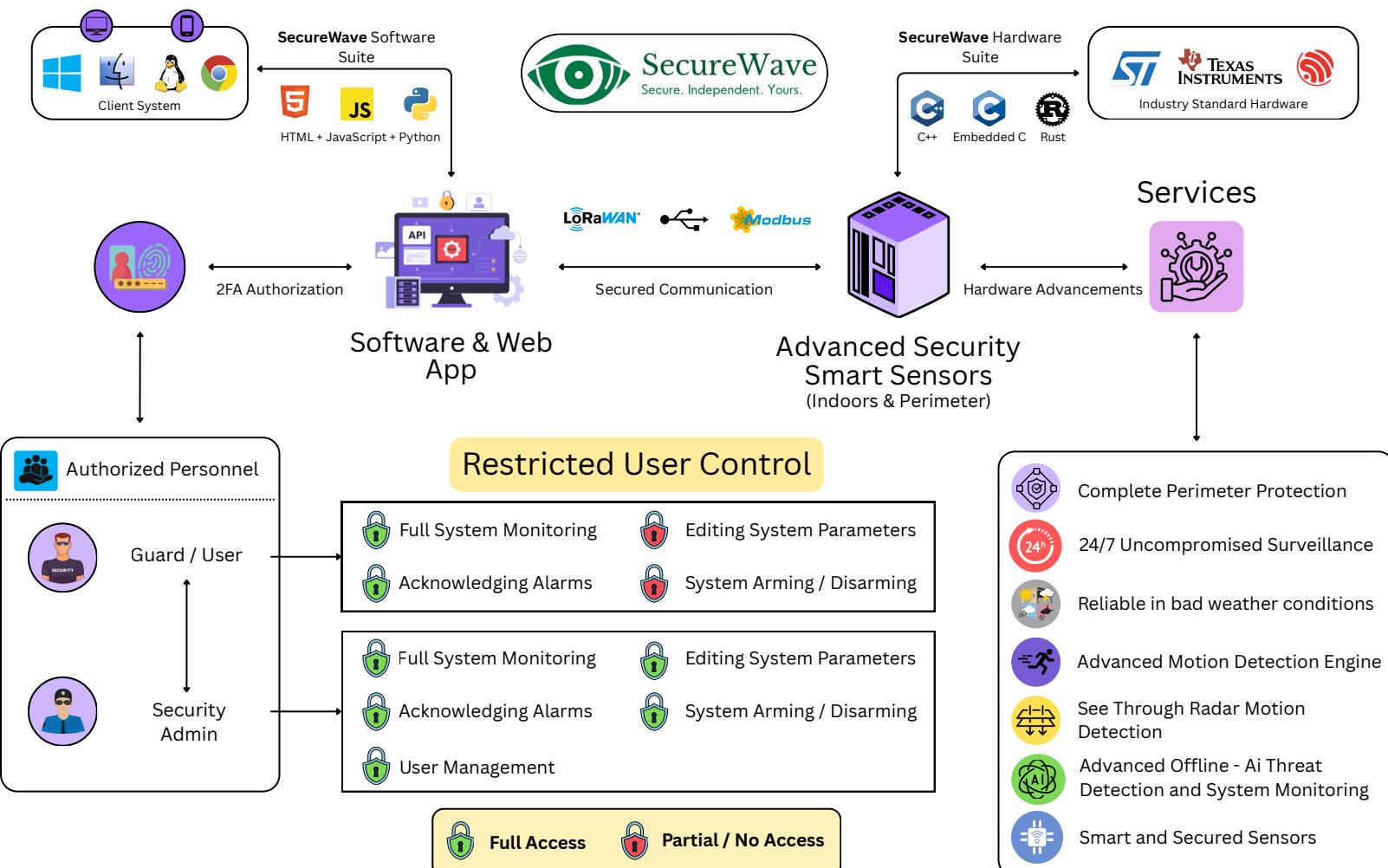
### Address Problems:

- Reduces Dependency on **Physical Guards & Imported CCTV** Systems currently used in **Prisons** and **Military Zones** and even Industrial Sectors such as **Datacenters** etc.
- **Low Cost** ensures **Large Scalability** and Deployment even in **Rural Areas**.
- Doesn't Rely on **Visual Threat Analysis** unlike pre-existing Systems.
- Custom **Encrypted** Communication Protocol ensures no Tapping and Tampering of Signals.
- **24x7** Security and Surveillance without manual inputs.
- Complete Security for **Perimeter (Outdoors)** as well as **Indoors**.

### Unique Value Proposition (UVP):

- **"Beyond-the-Wall" Perception:** Unmatched detection capability that sees **through physical obstacles**, leaving zero blind spots, minimizing the dependency of Camera based security Systems.
- **Zero-Trust Offline Architecture:** Guarantees absolute immunity to external **cyber threats**, ensuring total operational integrity.
- **Offline Intelligence Suite:** Local software visualizes threats on **interactive** floor plans and **Google Map** Integration eliminating all internet risks.

## System Architecture

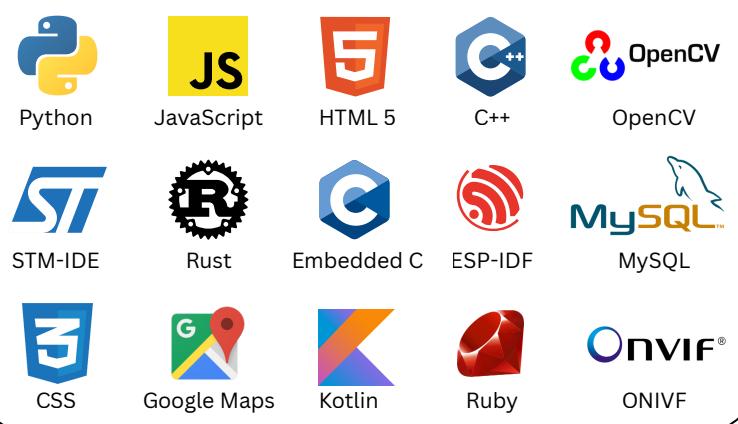


# TECHNICAL APPROACH

## System Working:

1. **mmWave Radar and AMDU:** Fence Sensor & Indoor Sensor Consisting of Advanced Motion Detection Unit (**AMDU**) and **mmWave** sensor for See-Through Capability.
2. **2FA and Custom QR - SMS Service:** Base Unit Consists of which only gives system access to authorized personals via scanning the **QR** with SecureWave **Phone App**.
3. **Redundancy:** Each Sensor consists of **2 Comms.** and internal **Batteries** and are Capable of Working Individually.
4. **User Access Control:** **Webpage** for (*un-privileged*) user only displays alerts and alarm messages while **Software App** gives complete System Control (*Admin*).

## Technology Stack



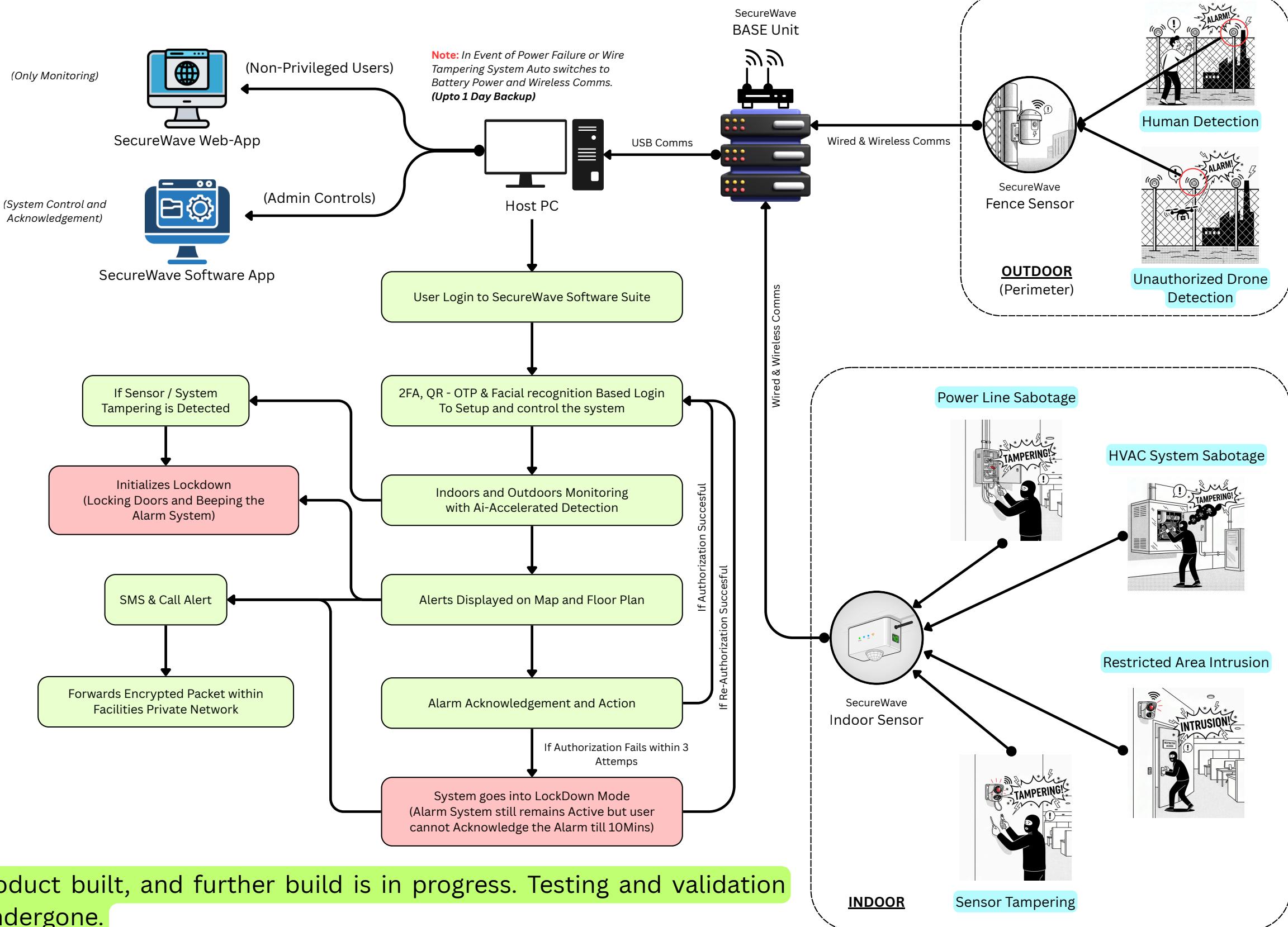
### Front End:

Python, HTML5, JavaScript, CSS, Ruby, Kotlin

### Back End:

C++, Embedded C, SQL

- Product Status: 60% product built, and further build is in progress. Testing and validation process are next to be undergone.



# FEASIBILITY AND VIABILITY



## Feasibility:

1. **Technical:** Make System Compatible with **pre-existing** Systems.
2. **Modularization:** Modular Design allows **phased implementation**.
3. **Market:** Requirement of Such system to reduce the dependency on **Chinese Based CCTV Cameras**.
4. **Economical:** Low Cost Allows **Large Scale Deployment** and reach of **rural Areas**.



## Viability:

1. **Wide User Base:** Facilities and Militaries World Wide can Implement such system, **High Security Prisions** etc.
2. **Scalability:** Can Expand from **Militarized Zones to Country Borders**.
3. **Long Term Value:** Provides **Uncompromized Security** for Militaries and Industry Sectors which will not **Phase Out**.



## Challenges:

1. **Privacy:** Data Privacy and Cyber-Security Concerns
2. **Scalability:** Ease of Use for user adoption, Alerts when user / personnel is afar.
3. **Evolution:** Constant Upgrades for technologically advancing systems and sensors.



## Solution:

1. Implement **Robust** and **Encrypted** Custom Communication Framework.
2. Creating a Ease to Use **User Interface** and WebApp.
3. Establishing Dedicated team for **Constant Technical Advancement** Research and **R&D**.



## Business Potential:

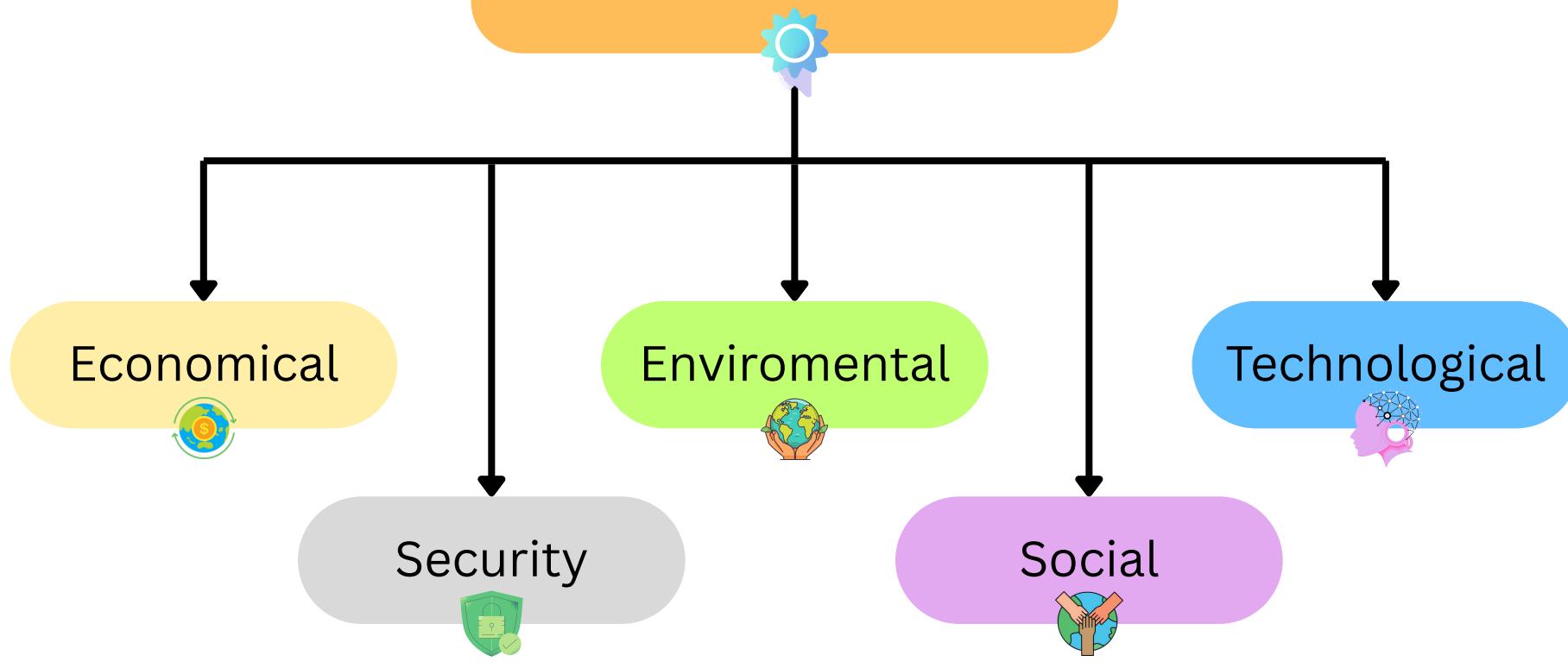
1. Hardware Products and **SaaS** Based Model.
2. Charging a small amount for every Advanced Alerting Systems (**AAS**) via SMS and MAIL
3. Providing **Privatized - Local Data Analytics** to the Company itself for improving its own Security.
4. **Patnership** with Goversments for Implementing this system for Highways, Militaries, Railways, etc.
5. Creating a Version for Home Use to form a **B2C** Model.

## Supporting Facts for Feasibility and Viability

1. **NIJ / Academic Study (2020):** A U.S. National Institute of Justice study showed that facilities upgrading CCTV saw measurable drops in infractions, proving poor or absent cameras worsen misconduct.
2. **U.S. Dept. of Justice OIG (2021):** The DOJ audit found dozens of federal prisons with inoperable or blind-spot cameras, directly linked to escapes, assaults, and failed investigations.
3. **HM Inspectorate of Prisons, UK (HMP Channings Wood, 2022):** Inspectors reported large areas without functioning CCTV, leaving inmates unmonitored and raising risk of escapes and violence.
4. **Financial Times (2024):** Prison governors in England and Wales warned that broken cameras and alarms at dozens of sites have already enabled perimeter breaches and high-profile escapes.

# IMPACT AND BENEFITS

## Benefits of SecureWave



## Benefits of the Solution:

### Economical:

- Cuts recurring expenses by **reducing manual monitoring** needs.
- Prevents costly damage and losses through **proactive threat detection**.
- Offers scalable deployment, lowering long-term upgrade and maintenance costs.
- Taking **Make in India (Swadeshi Bharat)** to a new level by cutting down imports of **international surveillance systems** and **Chinese CCTV camera**.

### Environmental:

- Reduces unnecessary power consumption with **intelligent hardware optimization**.
- ML-Based Battery Management Engine **minimizes e-waste** and help maximizing lifespan.
- Prolongs Battery Life and hence overall life of the product, lowering **carbon footprint** in sensitive areas.

### Technological:

- Uses advanced, **tamper-resistant** hardware for reliable protection.
- Integrates seamlessly with **existing infrastructure** and **future technologies**.
- Enables **automation** and **real-time alerts**, reducing human error.

### Security:

- Provides multi-layered defense against **intrusions** and **sabotage**.
- Ensures constant monitoring with **minimal downtime** and **blind spots**.
- Strengthens compliance with **national** and **international** security standards.
- **Made In India Product** **minimizes** risk of potential data and privacy loss to other countries.

### Social:

- Enhances public safety by protecting **critical assets** and communities.
- Builds trust through **non-visual surveillance**, **reliable** security infrastructure.
- Supports societal resilience against **disruptions** or **attacks**.

- References:

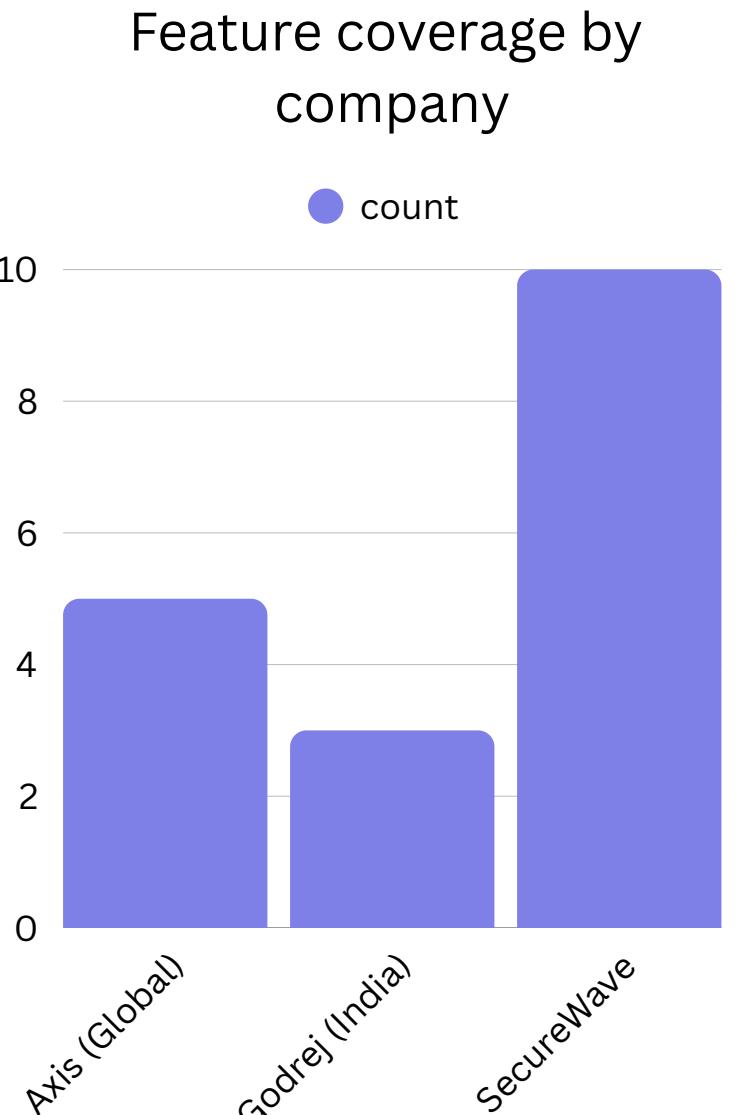
### Feasibility Facts:

1. U.S. Department of Justice – OIG: "[Notification of Needed Upgrades to the BOP's Security Camera System](#)" (Oct 27, 2021)
2. NIJ / Academic study: "[The Impact of Correctional CCTV Cameras on Infractions and Investigations](#)"
3. Her Majesty's Inspectorate of Prisons: ([HMP Channings Wood inspection report, 2022](#))
4. Financial Times / investigative reporting – "[Perimeter security broken at dozens of prisons in England and Wales, warn governors](#)"

### Research & Best Practices:

- "[UAV Detection Multi-sensor Data Fusion](#)" (Chiranjeevi Amit Kumar & Ozkan Giridhar, JRSE 2024)
- "[Secured Perimeter with Electromagnetic Detection and Tracking with Drone-Embedded and Static Cameras](#)" (Sensors, 2021).
- "[Environmental Monitoring with Wireless Sensor Network for Energy Aware Routing and Localization](#)" (Sreedhar Bhukya et al., 2023).
- "[Trustworthy Environmental Monitoring Using Hardware-Assisted Security Mechanisms](#)" (Sensors 2024)

- SYSTEM EXPLANATION VIDEO LINK



- PRODUCT WEBPAGE

Feature	SecureWave	Godrej (India)	Axis (Global)
Tamper-resistant hardware	✓	✓	✓
Environmental sensing	✓	○	✗
Anti-drone / C-UAS	✓	✗	○
Multi-sensor fusion	✓	✗	○
Blind-spot coverage	✓	○	✓
Low-power / energy optimized	✓	○	✗
Ruggedized outdoor deployment	✓	✓	✓
Automated local response	✓	○	○
Integration with legacy infra	✓	✓	✓
Modular / scalable expansion	✓	○	✓