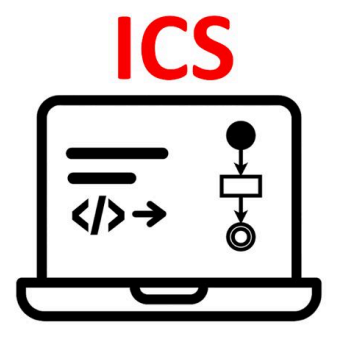


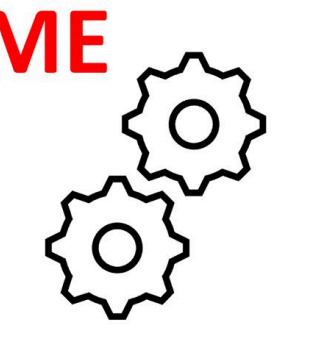
TEAM 083 Smart Locker: A Modular Intelligent Locker System

Team 083 | Term 252 | King Fahd University of Petroleum & Minerals (KFUPM)

Members: Abdulla Alahmadi, Mohammad Murtada, Omar Almubayyidh, Faisal Alanazi, Mohammad Alharbi, Nawaf Aldossary



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INTRODUCTION & BACKGROUND



BUILDING

- Growing demand for secure and convenient storage in residential and corporate spaces.
- Traditional lockers lack intelligence and integration with modern building systems.



ENERGY

- Increasing energy consumption from always-on cooling and poor utilization.
- Need for energy-efficient solutions that adapt to usage patterns.

OBJECTIVES

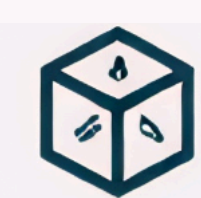


Traditional locker systems operate in isolation, lacking coordination, real-time monitoring, and energy awareness—resulting in:

- ✗ High energy waste
- ✗ Low utilization
- ✗ Limited security & accessibility
- ✗ Poor user experience

PROBLEM STATEMENT

1 Modular design for flexible deployment



2 Intelligent monitoring and real-time analytics



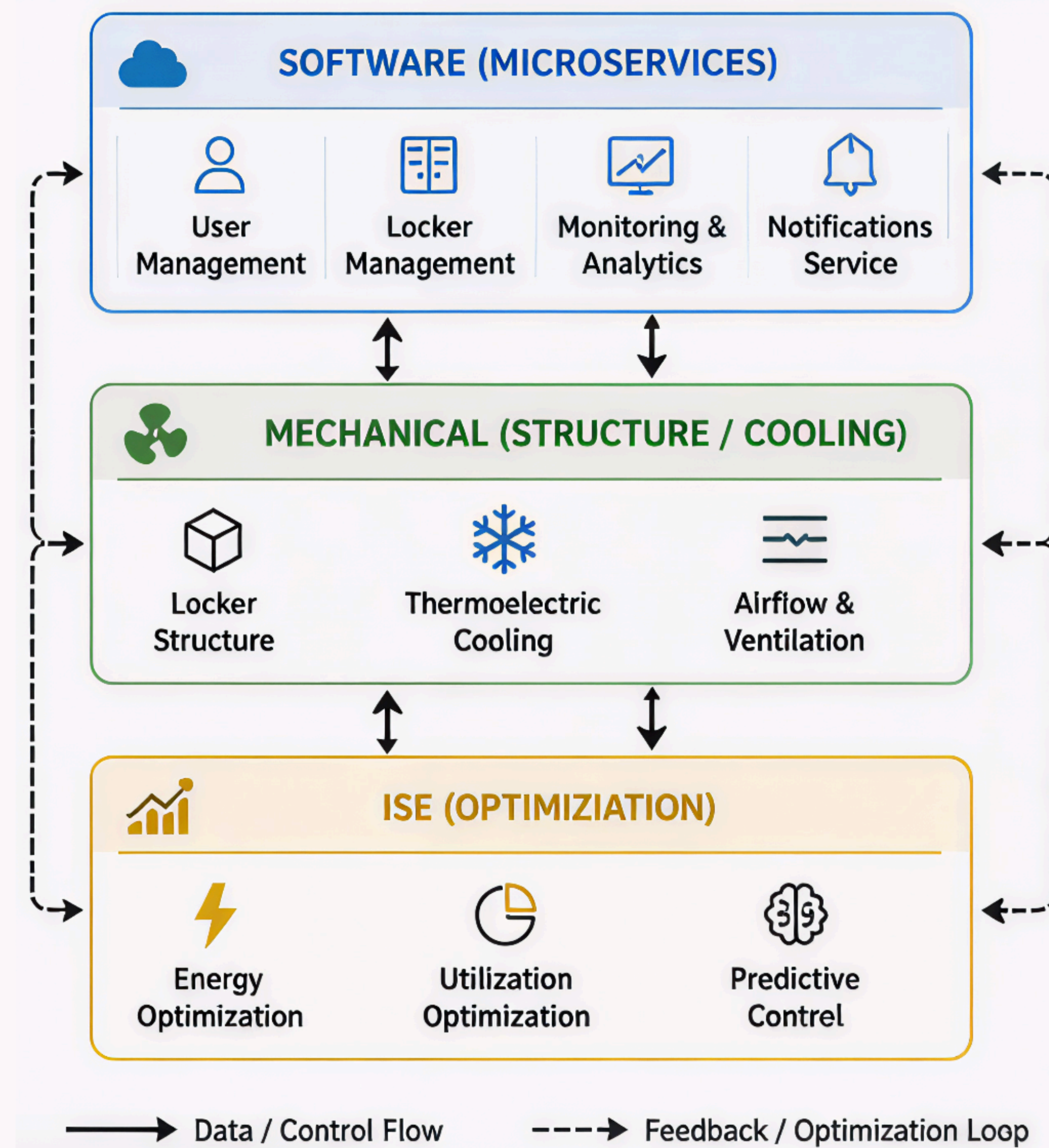
3 Energy-aware cooling for efficiency



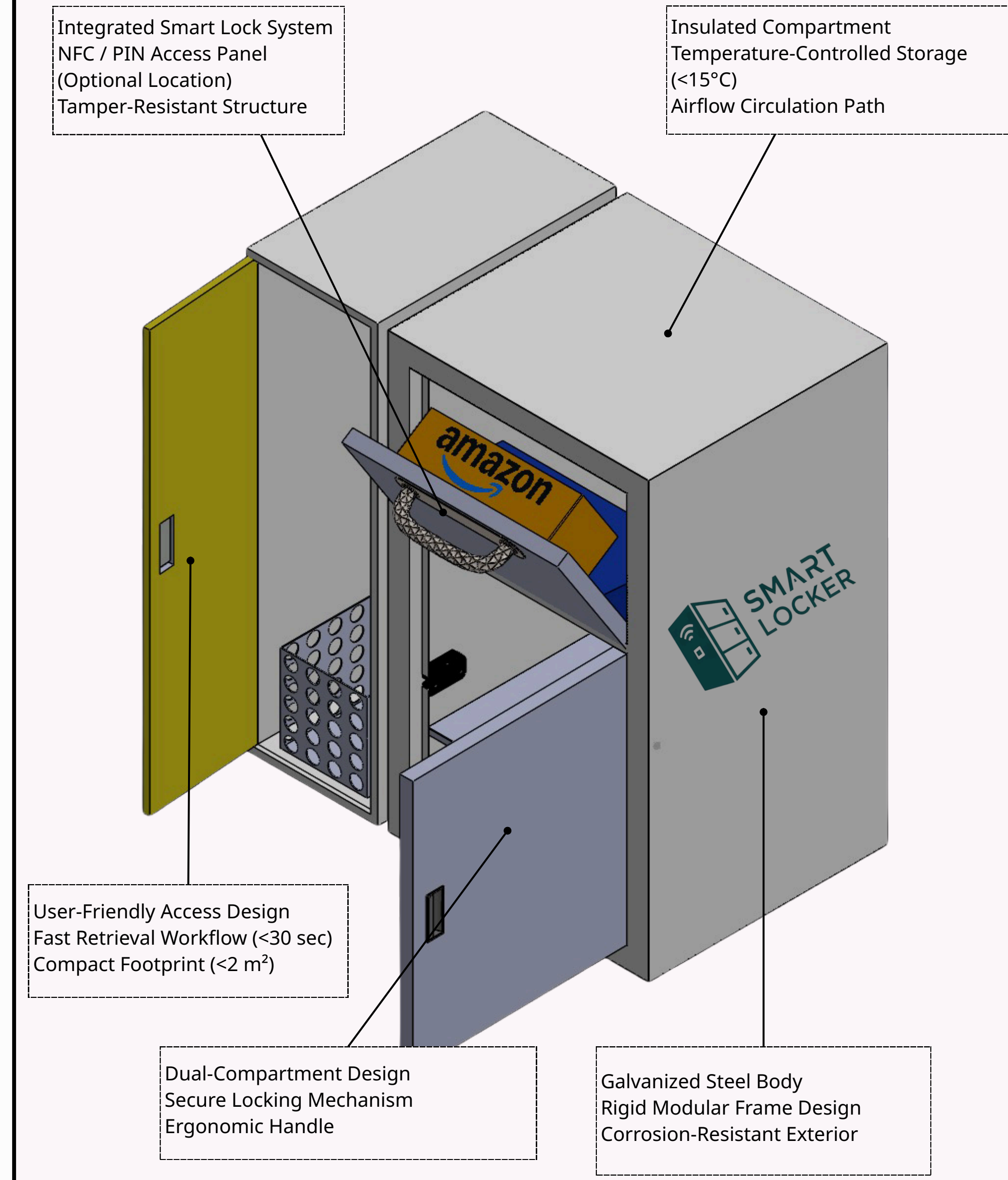
4 Secure dual access with NFC and Mobile App



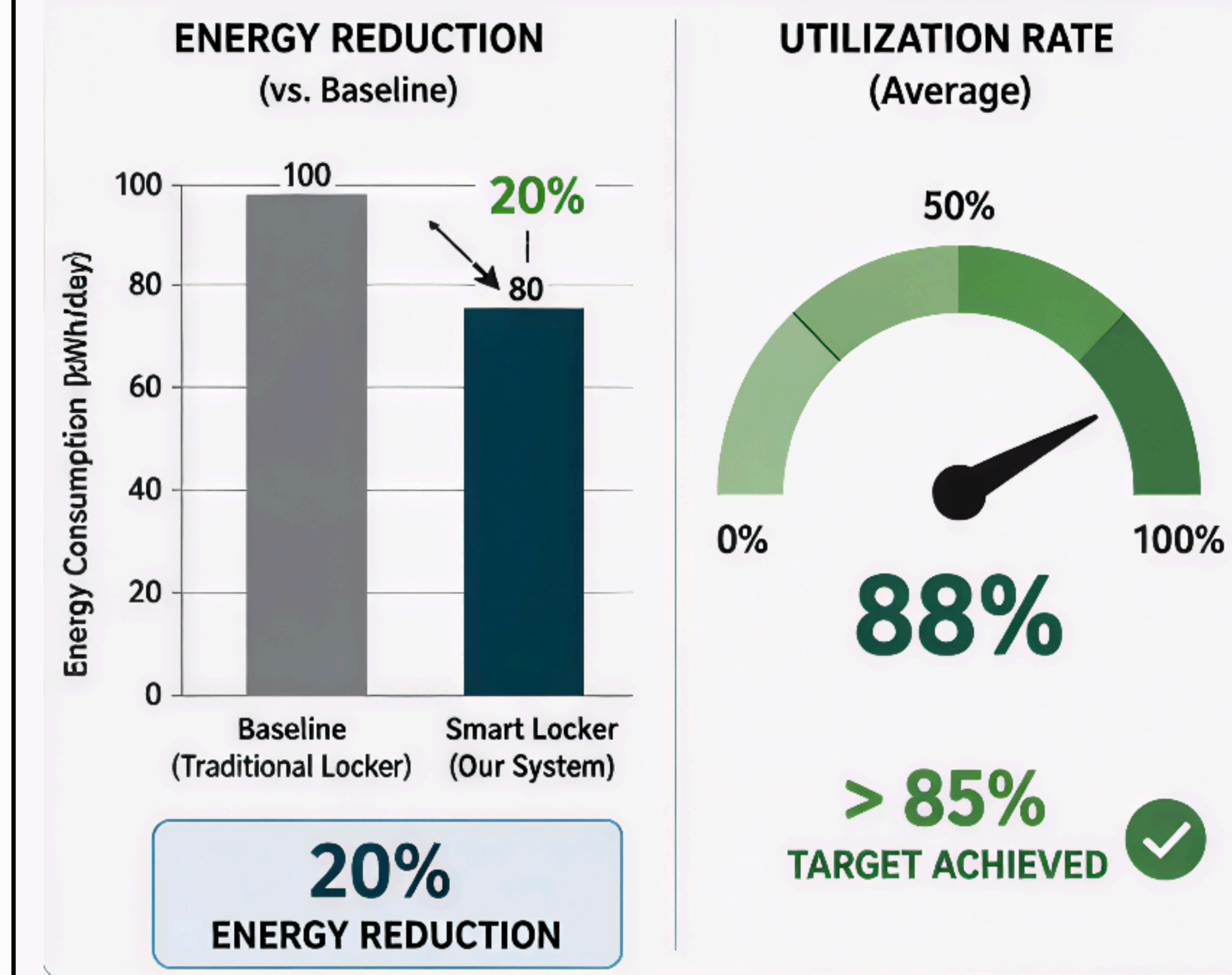
METHODOLOGY & SYSTEM DESIGN



PROTOTYPE DESIGN



TESTING & RESULT

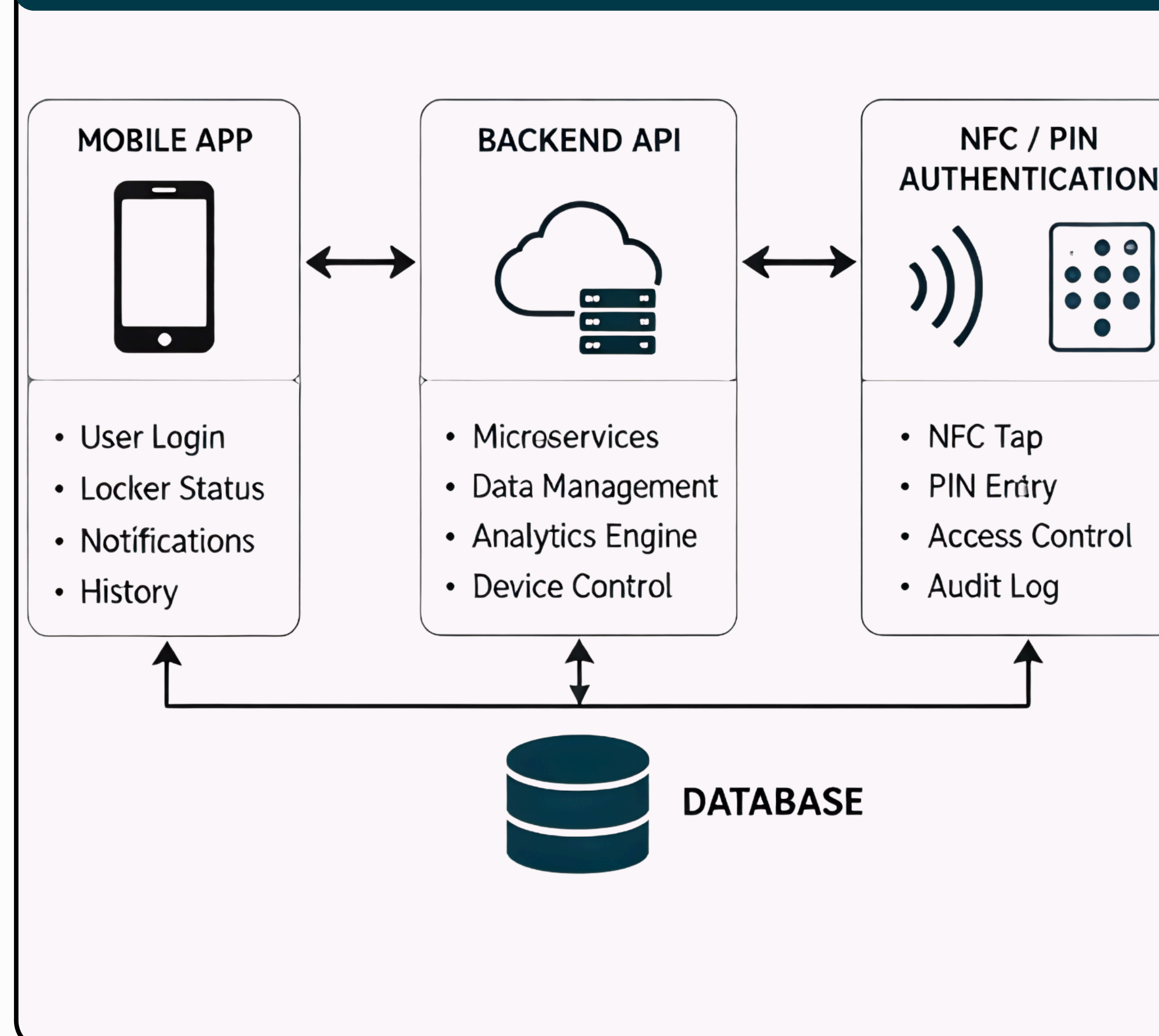


CONSTRAINTS & REQUIREMENTS

Constraints	
AES-256 secure tokens, fast revocation	Microservices architecture for scalability
System footprint under 2 m²	≥85% utilization without queues
Cooling below 15°C	Supports 25 ±2 kg load

Specifications	
AI assignment < 200 ms	Data sent to cloud every 24 h
API handles >150 requests/min	Galvanized steel, FOS < 1.5
Covers >80% user needs	Cycle time ≤ 30 seconds
Locker size: 1 m × 0.55 m × 0.9 m	App response ≤ 2 seconds
Handles 10+ location options	User notified on access.

SYSTEM ARCHITECTURE



KEY INSIGHTS & CONCLUSIONS

- Achieved 20% energy reduction while maintaining optimal cooling performance.
- High utilization rate (>85%) demonstrates strong user adoption and system reliability.
- Modular architecture enables easy scalability and integration with smart building systems.
- Smart Locker delivers a secure, efficient, and user-centric storage solution for modern environments.

FUTURE WORK

- AI optimization for smarter assignment & energy efficiency
- Enhanced mobile app experience
- Scalable deployment for smart buildings
- Additional sensors & system integrations
- Cost optimization for manufacturing