SMART INDIA HACKATHON 2024

Problem Statemet ID: SIH1529

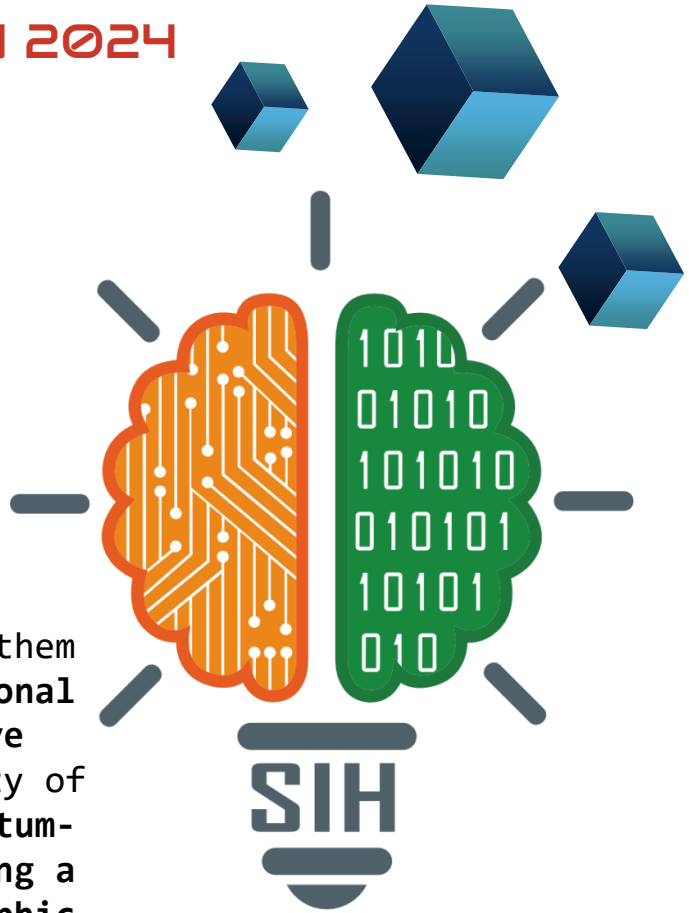
Problem Statement Title: Student Innovation

Theme: Blockchain & Cybersecurity

PS Category: Hardware

Team ID: SVCESIH24HW053

Team Name: IoTEnigma



Problem Statement/Idea

The **increasing adoption of IoT devices** has made them **vulnerable to quantum computing threats. Traditional cryptographic algorithms** may become **ineffective against quantum attacks,** compromising the security of sensitive data and critical infrastructure. **Quantum-Shield** aims to address this challenge by **providing a robust and efficient quantum-resistant cryptographic solution for IoT devices.**

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Solution Approach

Hybrid Approach:

- Combines Lattice-Based Encryption (LBE) and Code-Based Error Correction (CBEC).

Quantum Resistance:

- Offers enhanced protection against quantum attacks.

Lightweight Design:

- Suitable for resource-constrained IoT devices.

Improved Security:

- Provides stronger cryptographic guarantees compared to traditional methods.

Efficiency:

- Balances security with performance requirements.

Real-World Applicability:

- Can be integrated into existing IoT systems with minimal modifications.

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Technical Approach

Hybrid Cryptographic Framework

Lattice-Based Encryption (LBE): Quantum-resistant encryption using complex lattice problems for secure key generation and encryption.

Code-Based Error Correction (CBEC): Enhances data integrity with error-correcting codes, ensuring reliable communication.

Evaluation Metrics

Performance: Measures encryption/decryption time, memory, and power usage
Security: Assesses quantum resistance and error correction effectiveness

IoT Device Implementation

Public/Private Key Management: Each IoT device (NodeMCU) uses public/private keys for secure communication; encryption by NodeMCU-1 and decryption by NodeMCU-2.

Resource Optimization: Lightweight algorithms designed to fit IoT device constraints.

Workflow And Technical Stack

Workflow Diagram

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Sample Message

<Web Request From Server>

NodeMCU With Quantum Resistive Algo Trained

Response

Server

Raises Requests

Web Page GUI

Gets insights & Performs Tasks

End Users

Encrypted ⟷ Decrypted Msg Transfer

Encryption

Algorithm

Decryption

Decrypted Message

Output Display

Tech Stacks

ESP NOW

POSTMAN

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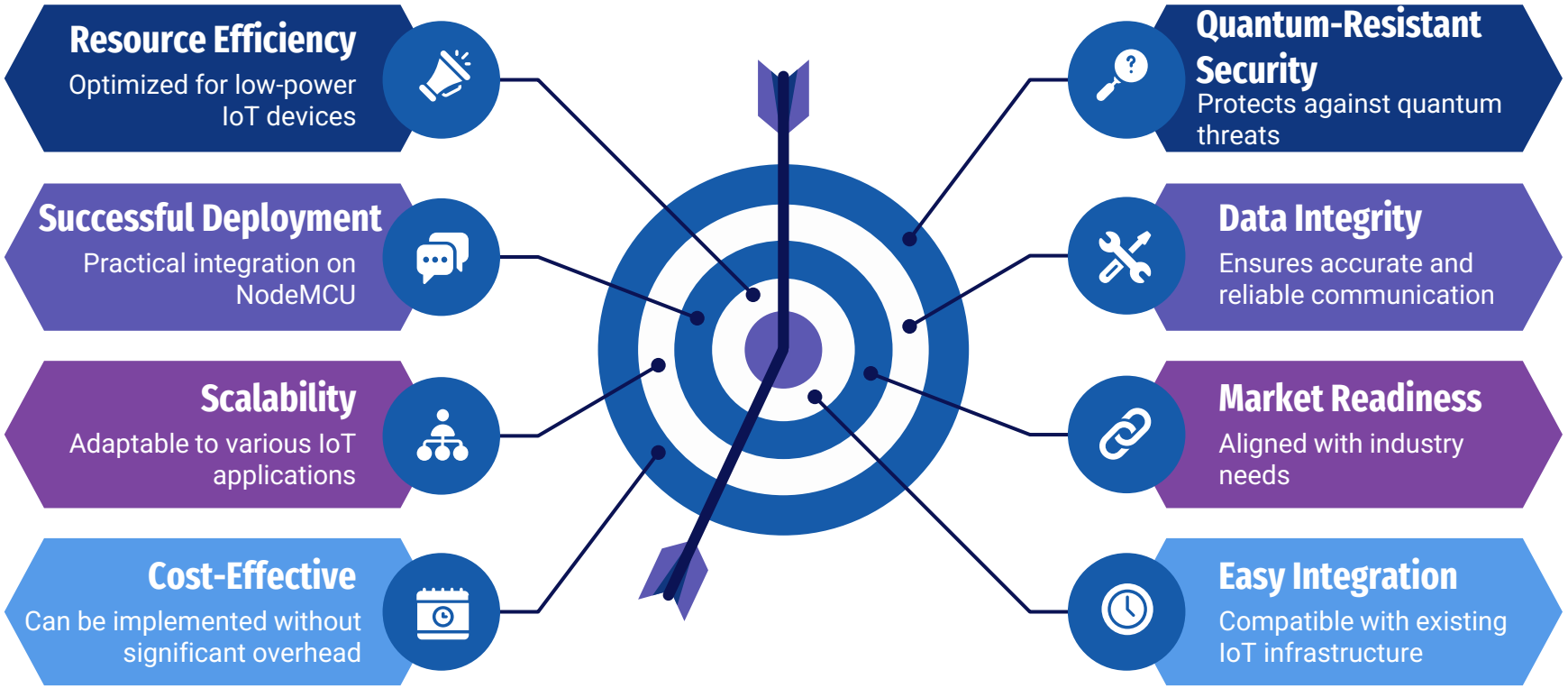
Feasibility and Viability



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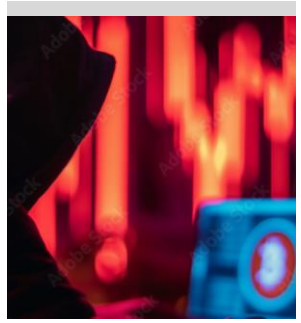
IMPACT AND BENEFITS

Enhanced Cybersecurity: Protects critical infrastructure and personal data from quantum-based attacks

Improved Privacy: Safeguards sensitive information, ensuring individuals' privacy rights.

Economic Benefits: Reduces costs associated with data breaches and disruptions, benefiting businesses and consumers.



Technological Advancement: Drives innovation in quantum-resistant cryptography and related fields.

Global Security: Contributes to overall global security by mitigating potential threats from quantum computing.

Trust and Confidence: Builds trust in digital technologies and promotes confidence in online interactions.

Enhanced Security: Protects against quantum threats and improves data privacy.

Efficient Resource Use: Balances security with performance.

Reduced Risk: Minimizes financial losses and reputational damage.

Regulatory Compliance: Reduces legal risks.

Scalability: Easily adaptable to various IoT applications

Quantum-Resistant Encryption: Protects against future quantum attacks.