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## Component 5: Data Security & Privacy Layer

This is the ethical and technical shield of the N.E.X.U.S. system. It ensures that health data, nanobot behavior, and AI decisions are private, secure, and always under user control.

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### Primary Objectives

#### 1. Data Encryption

End-to-end encryption for all data in motion (commands, feedback) and at rest (stored health history)

AES-256 or post-quantum cryptography (e.g., Kyber) for future-proofing

#### 2. Biometric Authentication

All user access and overrides require fingerprint, iris, or DNA token validation

Emergency commands require multi-factor + biometric confirmation

#### 3. Consent Management

AI cannot operate without explicit user consent

Users can enable/disable nanobot actions per body region or task

Log of all permissions granted, revoked, and changed

#### 4. Anonymization & Federated Learning

User data is anonymized before being used to train models

No raw health data ever leaves the device unless explicitly authorized

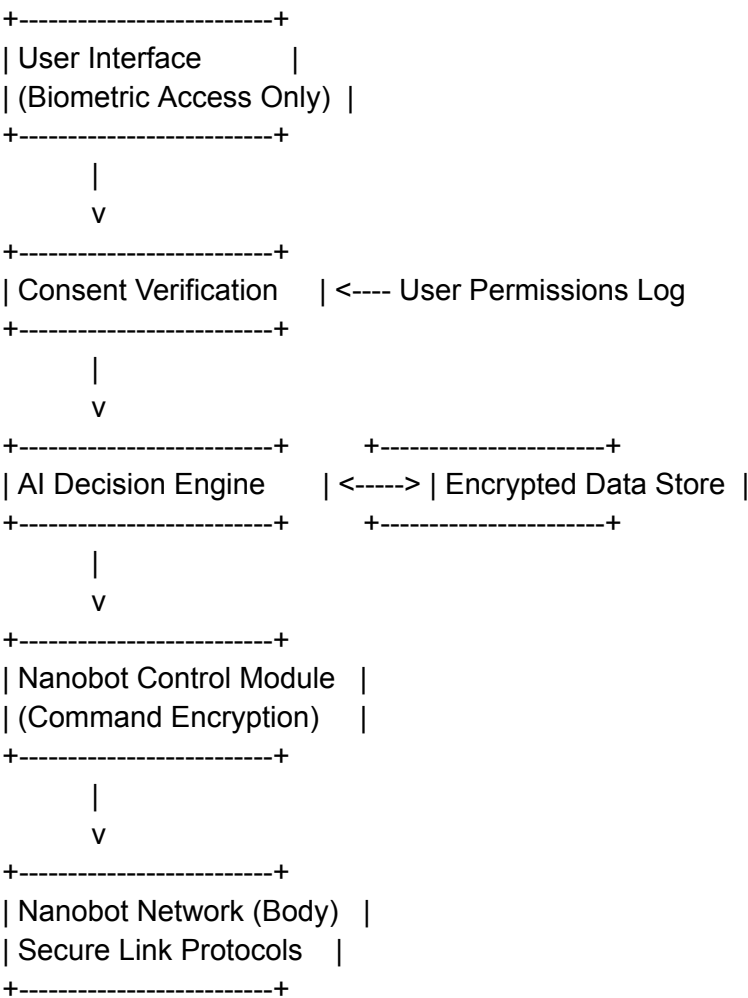
5. Audit Logs & Transparency

Every AI decision, nanobot action, and data transmission is recorded

Logs can be reviewed, exported, and inspected by third parties (e.g., physicians)

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🔒 Data Flow Security Diagram (Text Description)



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## Pseudocode Example: Encrypted Command Dispatch

```
from cryptography.fernet import Fernet

class SecureChannel:
    def __init__(self, key):
        self.cipher = Fernet(key)

    def encrypt_command(self, command):
        command_str = json.dumps(command).encode()
        return self.cipher.encrypt(command_str)

    def decrypt_command(self, encrypted_command):
        return json.loads(self.cipher.decrypt(encrypted_command).decode())

# Usage
secure = SecureChannel(load_encryption_key())
safe_command = secure.encrypt_command({"action": "repair", "target": "heart"})
```

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## Privacy Compliance Goals

Standard	How N.E.X.U.S. Complies
HIPAA (US Health Law)	Full encryption, user access controls
GDPR (EU Privacy Law)	Data portability, right to erasure
IEEE AI Ethics Guidelines	Transparent AI, user control, fairness
Future Tech-Ethical Review	Encouraged for all human-machine integration

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