**Smart Safe - Dependencies**

**1. Hardware Dependencies**

| **Component** | **Dependency** | **Description** |
| --- | --- | --- |
| **Microcontroller (Arduino)** | Power Supply | Requires stable power for operation. |
| **Keypad (4x4 Matrix)** | Microcontroller | Needs GPIO pins for input detection. |
| **Fingerprint Sensor (R307, GT-511C3)** | Microcontroller, Storage | Requires UART/SPI/I2C communication and memory for storing fingerprints. |
| **Lock Mechanism (Solenoid/Servo Motor)** | Microcontroller, Power | Needs control signals and sufficient power to operate. |
| **LCD Display** | Microcontroller | Requires I2C/SPI communication for visual feedback. |
| **Buzzer/LED Indicator** | Microcontroller | Needs GPIO pins to provide user feedback. |
| **Power Supply (Adapter/Battery)** | All Components | Supplies energy for the entire system. |
| **Battery Backup (Optional)** | Power Supply | Provides power in case of failure. |

**2. Software Dependencies**

| **Feature** | **Dependency** | **Description** |
| --- | --- | --- |
| **Keypad Input Handling** | Microcontroller Firmware | Requires a code library to read and process inputs. |
| **Fingerprint Authentication** | Microcontroller, Sensor Driver | Needs a driver for the fingerprint module and storage for enrolled prints. |
| **Lock Control** | Microcontroller, Motor Driver | Requires control logic to activate/deactivate the lock. |
| **User Interface (Display & Buzzer)** | Microcontroller Code | Needs code to display messages and provide feedback. |
| **Power Management** | Microcontroller, Power Circuit | Requires logic for handling low power mode and switching to backup. |
| **Data Storage (Passcodes & Fingerprints)** | EEPROM/Flash Memory | Needs memory allocation and secure storage handling. |

**3. Functional Dependencies**

| **Feature** | **Depends On** | **Description** |
| --- | --- | --- |
| **Unlocking the Safe** | Keypad/Fingerprint, Microcontroller, Lock Mechanism | Needs user input and control logic to operate the lock. |
| **Security Alerts (Buzzer, Logs)** | Microcontroller, Sensors | Requires a trigger system for failed attempts or tamper detection. |
| **Power Backup Activation** | Battery, Power Circuit | Needs a switching mechanism when the main power fails. |