**Smart Security System Optimization Log**

During the development of the smart security system, we considered these factors and utilized them to optimize the application.

1. **Logging**

* Ensured that the logging configuration is appropriate for production use.
* PIN input and MQTT connection attempts with output (Success/Failure) was logged.

1. **Code Structure and Comments**

* Provided clear and concise comments for each function and section of the code.
* Broke down the code into smaller functions to improve readability and maintainability in the future.

1. **MQTT Configuration**

* Reviewed MQTT configuration parameters for optimal performance.
* Utilized a secure connection (TLS) instead of the provided default configuration.
* Used MQTT QoS level 0 since a copy of this is stored locally on a log file delivery of these messages was not a concern. However, since it utilizes TLS, some level of reliability was expected.

1. **Keypad Input:**

* Delay in the detect\_key function was fine-tuned to debounce buttons effectively.
* To add in the future: Adding a timeout mechanism to prevent waiting indefinitely for button release.

1. **Network Resilience:**

* Implemented reconnection mechanisms for MQTT in case of network interruptions.

1. **Local Storage:**

* Ensured real-time update of the access log stored on the local storage where changes are appended instead of writing the file a fresh (only the differential data is appended any time there is user interaction)

1. **Resource Cleanup:**

* Ensured proper cleanup of resources: GPIO pins and the OLED display, in all scenarios, including unexpected exits.

1. **Error Handling:**

* Implemented proper error handling mechanisms, especially in MQTT connection and message reception. Any output would be logged in the text file to enable ease of troubleshooting and debugging.
* Log error messages with appropriate log levels for debugging.

**Conclusion.**

By addressing these areas, these aspects of the IoT application were ensured:

1. performance,
2. reliability, and
3. maintainability