

# OMS CS6440: Introduction to Health Informatics

## Sleep Pattern Analysis App

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***Abstract***—The Sleep Pattern Analysis App (SPAA) is a single-page web analytics application designed for the end user. The application aims to provide users with valuable insights into their sleep patterns and quality, helping them make informed decisions to improve their sleep habits. It processes sleep-related data from the imported file and provides deep insights into sleep patterns, efficiency, and quality, visualizes it, and exports it in a FHIR compatible format.

### 1 BACKGROUND

Sleep is one of the fundamental needs of the human body. It directly affects our physical and mental health. It's not only important to have the required amount of hours of sleep but it's also important to have quality sleep. While some people thrive on having a long 8-hour sleep session, others function better when taking naps during the day and a shorter 6-hour sleep session at night. The sleep needs of each individual differ according to their body. It is only by tracking and analyzing the sleep data, we can come to know if these needs are fulfilled properly. The main aim of the Sleep Pattern Analysis App (SPAA) is to make the user aware of which sleeping pattern works best for them.

While there are a lot of tools on the market that track and report sleep data (Android Apps, Smartwatches, Fitness Trackers, etc), very few of them provide some analysis of the sleep data. They inform the user on how long they have slept and in which stage (REM, deep, etc), but they don't provide information regarding the quality of the sleep, recovery, sleep debt, etc. A lot of the apps also gatekeep information behind paywalls.

## 2 PROBLEM STATEMENT

The main challenge addressed by the SPAA is the need to efficiently process and analyze sleep-related data to extract meaningful insights. This includes calculating sleep metrics, such as sleep duration, efficiency, and sleep stages, and visualizing these metrics in an intuitive and informative manner. Additionally, the app must handle and process the data format and provide options for data import and export.

## 3 SOLUTION

The Sleep Pattern Analysis App (SPAA) empowers users by providing them with a detailed analysis of their sleeping patterns to help them make informed decisions. It allows users to import their weekly/monthly data in JSON format, clean and visualize the data, and provide the user with a calculated sleep score along with some recommendations (continue sleep pattern, recovery hours, etc.)

The core functionality is divided into several modules, including:

- Data Import - Includes functions to import sleep data from JSON files or sample data
- Data Processing - Includes functions to calculate sleep metrics, including duration, efficiency, sleep stages, and sleep scores, based on input sleep data
- Summary Calculations - Aggregates processed data to calculate overall sleep metrics, such as average sleep score, efficiency, and sleep debt, for the entire dataset.
- Visualization and Analysis - components to visualize sleep metrics using line charts, bar charts, and pie charts, providing users with a clear understanding of their sleep patterns.
- Export - Includes compatibility functions to export processed data in the FHIR format for integration with healthcare systems

Overall in the project the only major challenge I faced is the sleep score engine code. It required spending time researching sleep science - understanding the sleep stages, average benchmarks, requirements unique for each person, etc. It

also required a few iterative sessions (based on how it behaved) to get it to be as accurate as possible. Some other minor challenges I faced included - exploring and understanding the data visualization/plotting libraries and parsing the analyzed data in the form of FHIR resources for export.

#### **4 OUTCOME AND FURTHER WORK**

I believe I was able to achieve the goals I had set for this project i.e. provide users with valuable insights into their sleep patterns and quality, helping them make informed decisions to improve their sleep habits. I was able to cover all tasks planned out in sprint #2 in time as well as include some extra features like reactive graphs, sample data button, and show/hide processed JSON button. Further enhancements to the app could include:

- Enhanced Exports - More customizations (FHIR compatible) for the export feature.
- Enhanced Visualization - Adding more interactive and customizable visualization options.
- Google SSO Login - for quick and easy access to import the data.
- Enhanced compatibility - Add support to directly import data from the Fitbit APIs, as well as integration and support with Apple Health and Garmin.
- Integration with Wearable Devices - Integrating with wearable devices to directly import sleep data, providing real-time insights and personalized recommendations.

#### **5 REFERENCES**

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