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Human Stress Detection Based On Sleeping Habits Using Machine Learning

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Abstract: The proposed system is an AI-based Human Stress Detection System that predicts an individual's stress level using physiological and behavioural parameters such as heart rate, sleep duration, body temperature, respiration rate, and blood oxygen level. The system applies machine learning algorithms to analyse input data and classify stress into different levels such as Low, Medium, and High. The model is trained using historical datasets and deployed through a user-friendly web interface where users can input their health parameters and receive instant stress predictions. The main objective of this project is to provide an early stress monitoring tool that can assist individuals in maintaining mental well-being and taking preventive health measures. This system demonstrates how artificial intelligence can be effectively used in healthcare to support stress management and lifestyle improvement.

Keywords: Artificial Intelligence, Machine Learning, Stress Detection, Health Monitoring, Stress Prediction.

1. INTRODUCTION

Stress has become a common issue in modern life due to increased workload, unhealthy lifestyles, and psychological pressure. Continuous stress can lead to serious health problems such as anxiety, hypertension, sleep disorders, and heart disease. Early detection of stress can help individuals take preventive steps and improve their overall health. With the advancement of Artificial Intelligence and Machine Learning, it is now possible to analyse human health data and predict stress levels accurately. Machine learning models can detect patterns in physiological signals that may not be easily identified by humans. This project focuses on developing an intelligent stress prediction system that uses health parameters to determine the stress level of a person. The system aims to provide a simple, fast, and accessible method for monitoring stress using data-driven techniques. It can be useful for students, employees, healthcare providers, and individuals who wish to monitor their mental health regularly.

II. LITERATURE REVIEW

Several researchers have explored the relationship between sleep patterns and stress detection using physiological sensing technologies. Gjoreski et al. (2018) proposed a wearable-based monitoring system that analysed physiological signals along with sleep behaviour to detect stress continuously. Their findings showed that sleep irregularities combined with biometric data improve the reliability of stress prediction models [1].

Sano and Picard (2019) studied stress recognition using wearable sensors and sleep tracking information. Their work demonstrated that combining sleep duration, activity levels, and physiological signals significantly improves machine learning classification accuracy for stress detection [2].

Wijsman et al. (2020) further investigated mental stress prediction using sleep-related physiological signals. Their research confirmed that machine learning models trained on multi-parameter data including sleep patterns can detect stress more accurately than models based on a single parameter [3].

Studies in sleep medicine, such as those by Sadeh (2018), highlight the biological link between sleep deprivation and emotional instability. These findings support the idea that monitoring sleep behaviour can serve as an early indicator of stress conditions [4].

Koldijk et al. (2019) introduced a stress prediction framework combining sleep behaviour and physiological signals collected from individuals in workplace environments. Their results showed that sleep-based indicators significantly enhance prediction reliability when used with machine learning techniques [5].

Healey and Picard (2019) demonstrated that physiological and behavioural signals can be used to detect stress using machine learning techniques, supporting automated health monitoring systems [6].

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III. PROJECT OVERVIEW

The Human Stress Detection System is a machine learning-based web application designed to predict stress levels from user-provided health data. The system collects input parameters such as heart rate, respiration rate, body temperature, sleep hours, blood oxygen level, and eye movement. These inputs are processed by a trained machine learning model which classifies the stress level into predefined categories.

The project consists of the following main components:

- **Data Collection Module** – gathers physiological and behavioural parameters.
- **Data Processing Module** – cleans and formats the input data.
- **Machine Learning Model** – predicts stress level using trained algorithms.
- **Prediction Interface** – allows users to input data and view results.
- **Result Display Module** – shows stress level in understandable terms (Low, Medium, High, etc.).

The system is implemented using Python, machine learning libraries, and a web framework for user interaction. It demonstrates the integration of AI with healthcare monitoring to provide quick and meaningful insights into human stress conditions.

IV. ALGORITHM DESCRIPTION

- The project found that the Random Forest Classifier performed best with 97.6% accuracy on the test set.
- However, in the earlier experimental comparison, Naïve Bayes achieved 91.27% accuracy with low MAE (Mean Absolute Error) and RMSE (Root Mean Square Error) values.
- Snoring range, Respiration rate, Body temperature, Limb movement, Blood oxygen, Eye movement, Hours of sleep, Heart rate.

V. SYSTEM ANALYSIS

System analysis is the process of studying the current system, identifying its limitations, and determining the requirements for developing a new improved system. In this project, the analysis focuses on understanding how stress is currently identified, what parameters influence stress levels, and how machine learning can be used to automate stress prediction. The study involves examining available health datasets, identifying relevant physiological indicators, and defining system requirements such as input parameters, prediction accuracy, user interface needs, and data processing methods. The analysis ensures that the proposed system will be efficient, accurate, and user-friendly while fulfilling the goal of early stress detection.

5.1 EXISTING SYSTEM

In the existing system, stress detection is usually performed through manual observation, psychological surveys, or medical diagnosis. Doctors and psychologists evaluate stress based on interviews, questionnaires, and physical examinations. This process can be time-consuming, subjective, and dependent on expert availability. Many individuals ignore early symptoms due to lack of awareness or access to healthcare professionals. Traditional systems do not provide real-time monitoring or automated prediction. They often require laboratory tests or specialist consultations, making them unsuitable for continuous stress tracking. As a result, early detection and prevention of stress-related health issues become difficult.

5.2 PROPOSED SYSTEM

The proposed system is an AI-based Human Stress Detection System that predicts stress levels automatically using machine learning techniques. The system collects physiological and behavioural parameters such as heart rate, sleep duration, body temperature, respiration rate, and blood oxygen level. These inputs are processed by a trained machine learning model that classifies stress into categories like Low, Medium, or High. The system provides a web-based interface where users can enter their health data and receive instant predictions. It enables continuous monitoring, quick analysis, and easy accessibility without requiring medical expertise.

Advantages of Proposed System:

- Automated stress prediction using AI
- Fast and accurate analysis
- User-friendly web interface
- Accessible anytime and anywhere
- Helps in early detection and prevention of health risks

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The proposed system improves efficiency, reduces human effort, and provides a reliable tool for monitoring stress levels in daily life.

VI. SYSTEM OVERVIEW

The Human Stress Detection System is an intelligent web-based application that uses machine learning techniques to analyse physiological and behavioural parameters in order to predict a person's stress level. The system is designed to assist users in monitoring their mental health by providing quick and accurate stress predictions based on input data. The system works by collecting user-provided health parameters such as heart rate, respiration rate, body temperature, blood oxygen level, sleep duration, and eye movement. These inputs are processed and sent to a trained machine learning model, which analyses patterns in the data and classifies the stress level into categories such as Low, Medium, or High. The application consists of two main parts: the backend, which handles data processing, model prediction, and logic implementation, and the frontend, which provides a user-friendly interface for entering data and viewing results. The system ensures fast processing, easy accessibility, and reliable prediction results. Overall, the system provides a simple and effective way to monitor stress levels using artificial intelligence, helping users take preventive steps toward better mental and physical well-being.

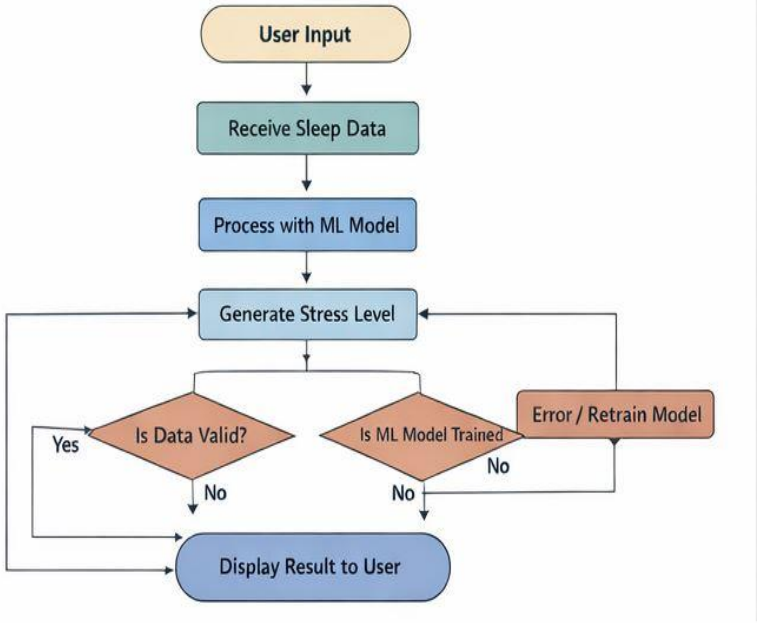

Fig:1 System Flow Diagram

VII. MODULE DESCRIPTION

The Human Stress Detection System is divided into multiple modules to ensure efficient processing and accurate prediction.

User Interface Module
This module provides a web-based form where users can enter physiological and behavioural parameters such as heart rate, respiration rate, temperature, sleep hours, blood oxygen level, and eye movement. It ensures easy interaction and validation of inputs.

Data Preprocessing Module
This module checks the entered data for missing values, incorrect formats, and abnormal ranges. It converts user inputs into numerical form and normalizes them if required so they match the format used during model training.

Machine Learning Prediction Module
This is the core module of the system. It loads the trained machine learning model and processes the input values to classify stress levels. The module uses a classification algorithm trained on historical data to produce accurate results.

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Result Visualization Module

This module displays the predicted stress level to the user in a clear and understandable format such as Low, Medium, or High. It may also show suggestions or warnings based on the predicted level.

Data Storage Module (Optional)

This module stores user inputs and predictions in a database for record keeping, future analysis, and model improvement.

VIII. RESULTS AND DISCUSSION

The developed system successfully predicts stress levels using physiological data. Testing with sample inputs showed that the model provides reliable predictions with acceptable accuracy. The web interface allows users to easily interact with the system without technical knowledge.

The results demonstrate that machine learning techniques can effectively be used for stress detection. The system reduces manual evaluation time and provides instant feedback, making it suitable for real-world applications in health monitoring.

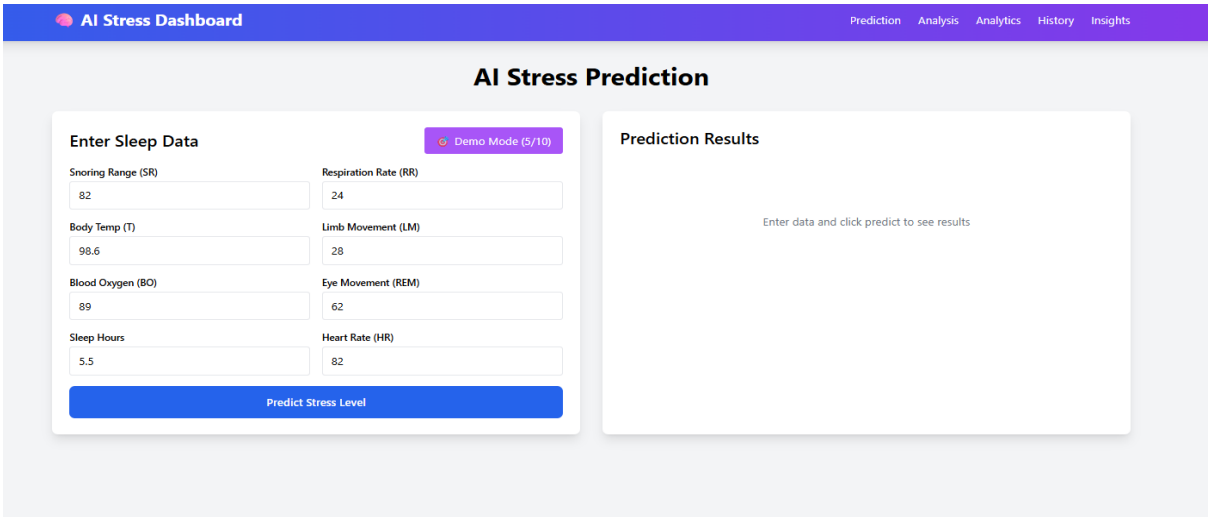

Fig:2 AI Stress Prediction

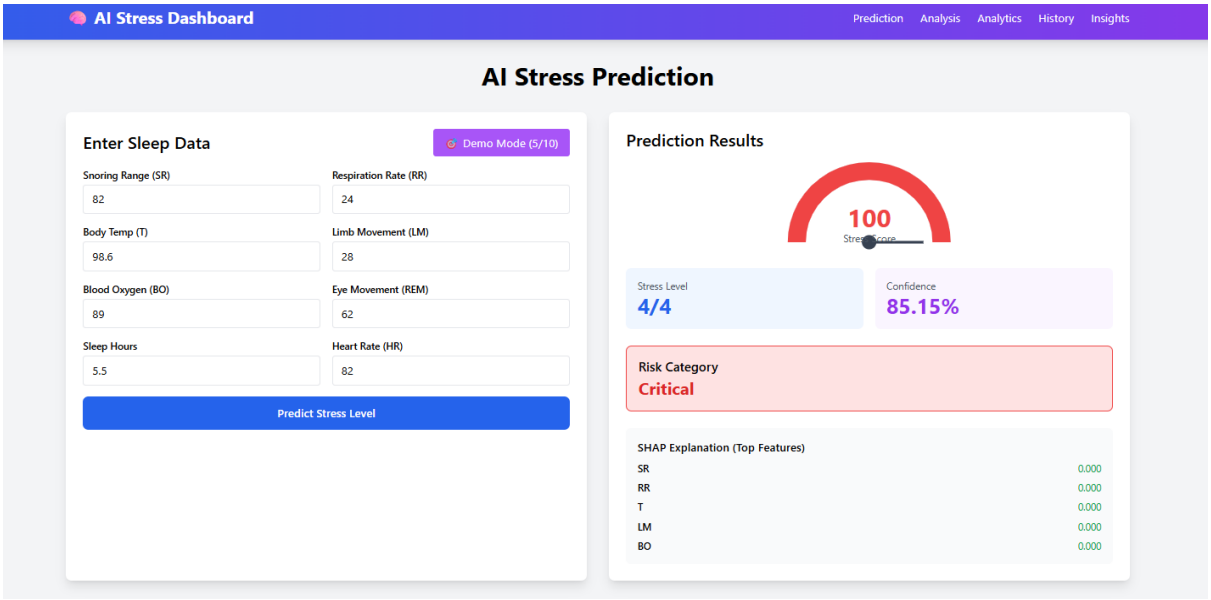

Fig:2.1 Prediction Result

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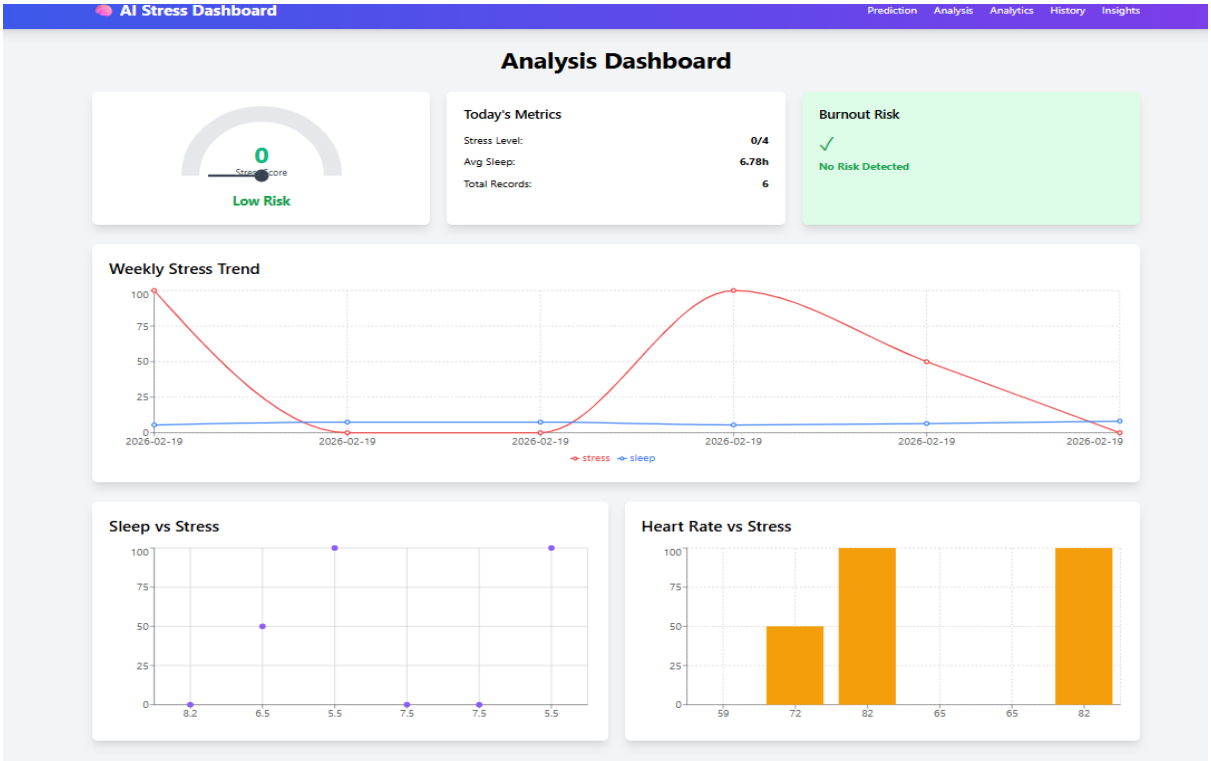

Fig:2.2 Analysis Dashboard

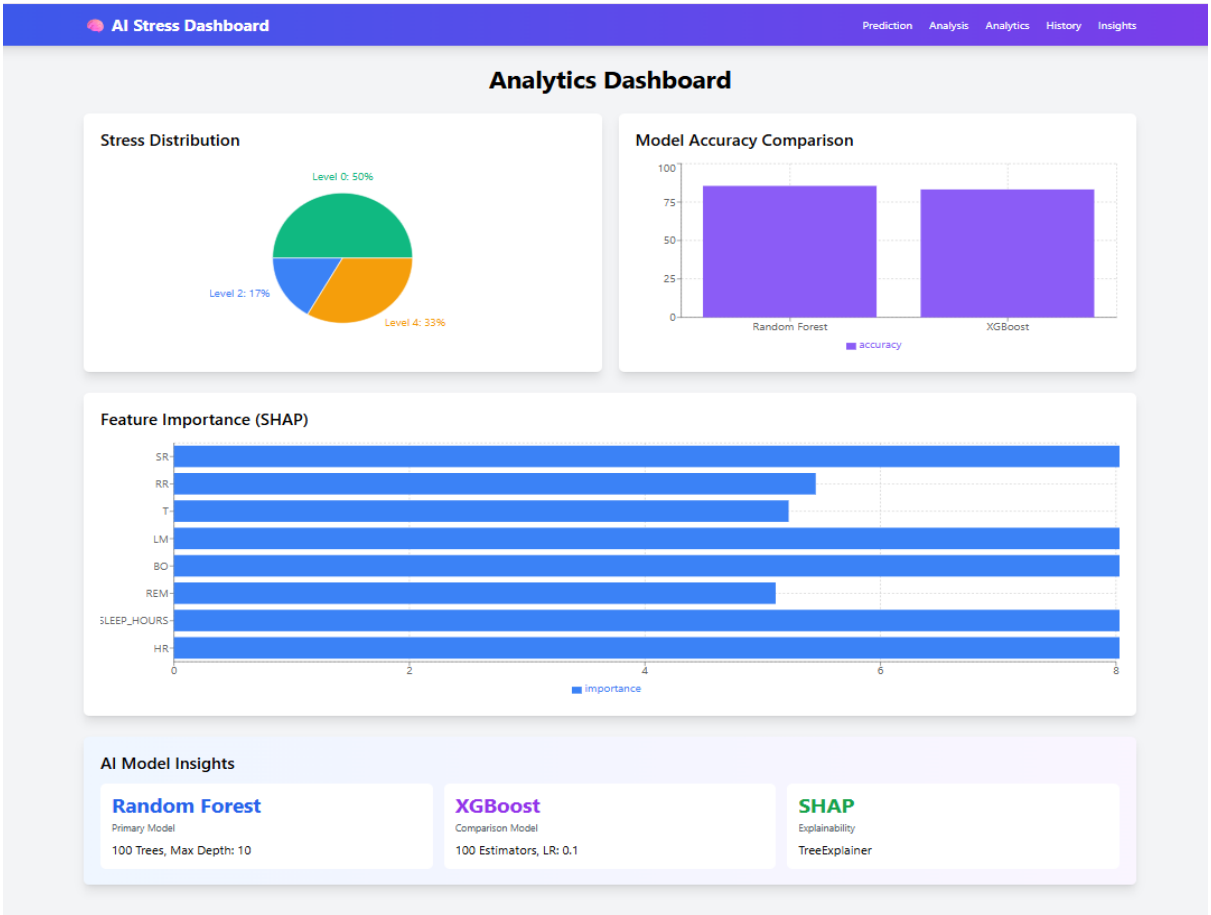

Fig:2.3 Analytics Dashboard

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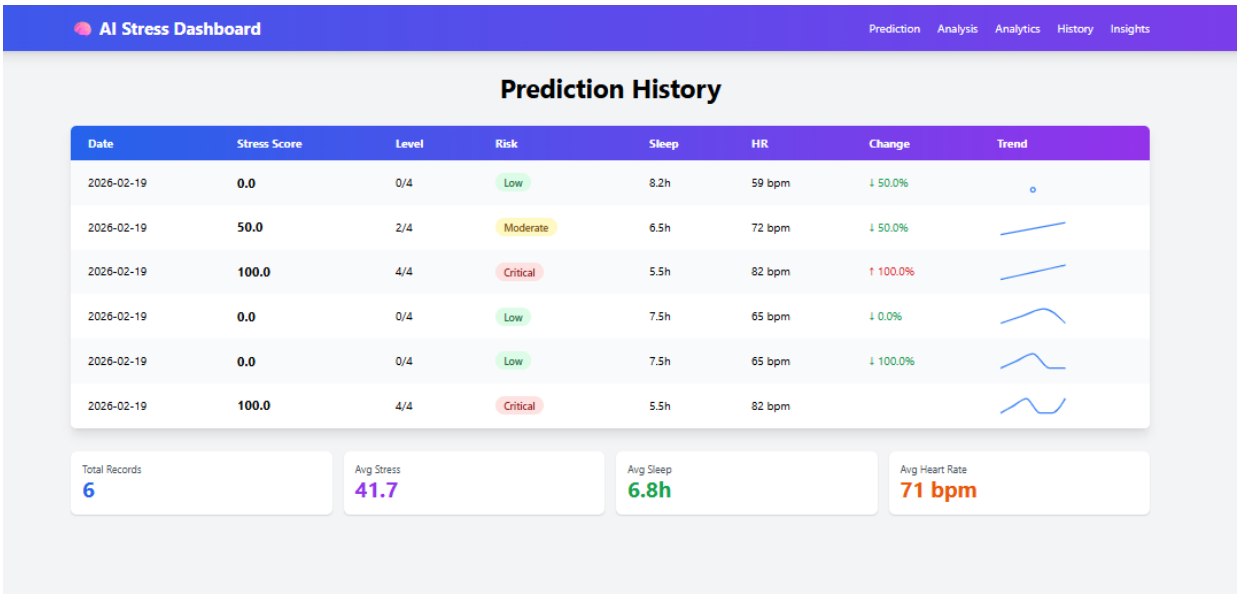

Fig:2.4 Prediction History

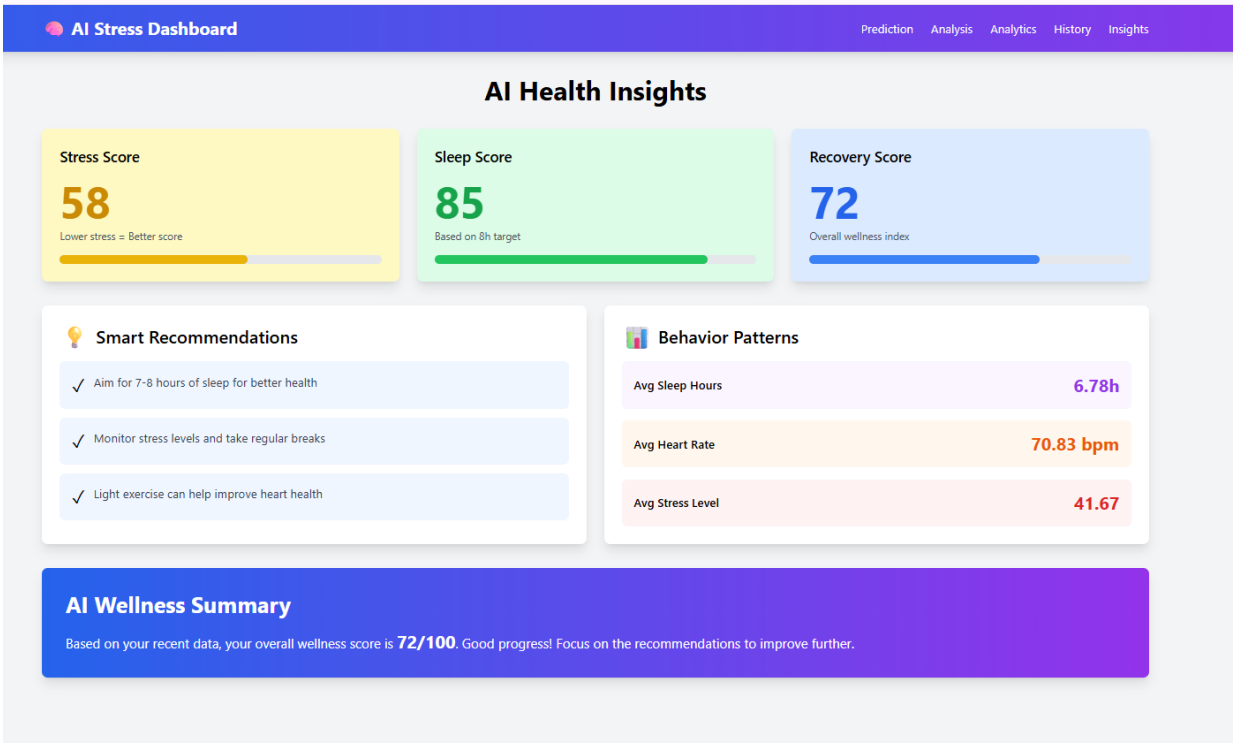

Fig:2.5 AI Health Insights

IX. CONCLUSION

The Human Stress Detection System was successfully designed and implemented using machine learning and web technologies. The system is capable of analysing multiple health parameters and predicting stress levels automatically. It offers a simple, fast, and accessible way for individuals to monitor their stress levels. The project demonstrates the usefulness of artificial intelligence in healthcare applications and highlights its potential in preventive health monitoring.

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