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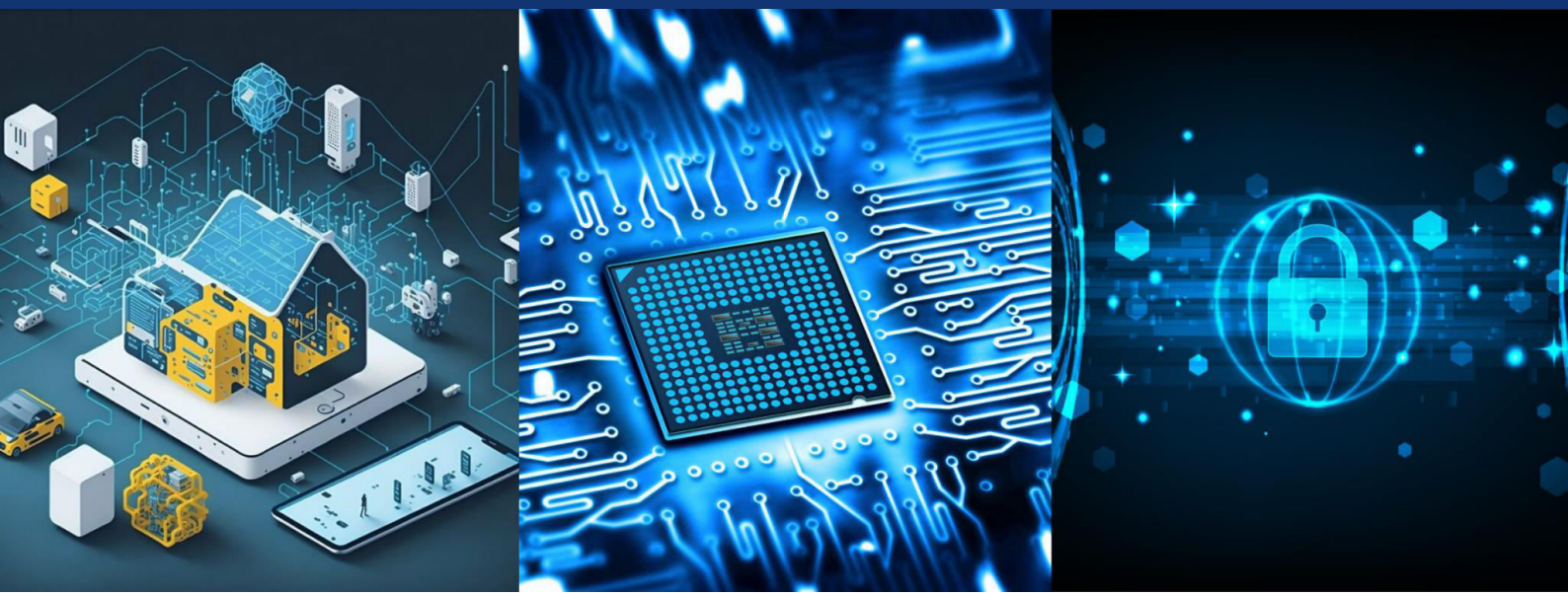

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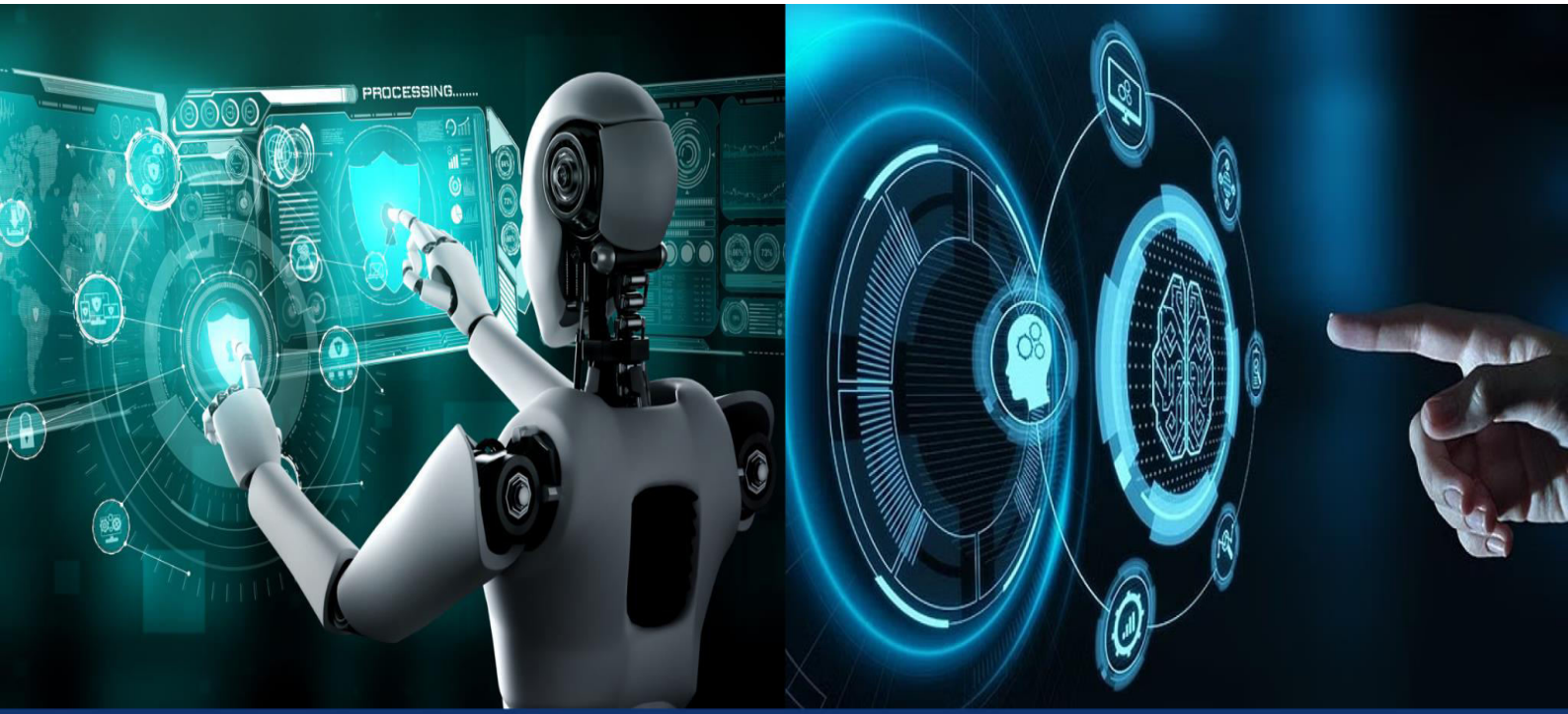

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Personal Mental Wellbeing Assistant Empowering Self-Care through AI-Driven Emotional Insights

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ABSTRACT: The rising emphasis on mental health in our fast-paced society calls for innovative tools that empower individuals to monitor and improve their emotional well-being. The Personal Mental Wellbeing Assistant is an AI-powered platform designed to support self-care by tracking mood, analyzing journal entries, monitoring daily habits, and providing personalized mental health recommendations. By leveraging advanced machine learning (ML) and natural language processing (NLP) techniques—such as sentiment analysis using VADER, mood forecasting with Random Forest regression, and personalized recommendations through a Mistral LLM-powered chatbot—the system delivers actionable insights in real time. With a user-friendly web interface built using Flask, this project aims to enhance self-awareness, foster proactive mental health management, and ultimately contribute to improved quality of life.

KEYWORDS: Mental Health, Emotional Well-being, AI-Powered Assistant, Mood Prediction, Sentiment Analysis, VADER, Random Forest Regressor, Habit Tracking, Personalised Recommendations, Chatbot Integration, Mistral LLM, Flask Web Application, Data Analytics, Self-Care Tools, Mental Health Technology, Predictive Analytics, User Engagement, Data Visualisation, Machine Learning, NLP (Natural Language Processing).

I. INTRODUCTION

Mental well-being is an essential component of overall health, yet many traditional approaches to self-care lack the sophistication to offer timely, personalized insights. The Personal Mental Wellbeing Assistant addresses this challenge by integrating cutting-edge AI technologies into an intuitive platform. This system enables users to record their daily thoughts and emotions via journal entries, which are then analyzed for sentiment. By combining historical mood data with machine learning predictions, the platform forecasts future emotional trends and identifies potential triggers.
Key features include:

- **Mood Prediction:** Using a Random Forest Regressor trained on past mood scores and contextual features such as the day of the week.
- **Sentiment Analysis:** Utilizing VADER to convert journal text into quantifiable mood scores.
- **Habit Tracking:** Enabling users to log daily habits and correlate them with emotional trends.
- **Personalized Recommendations:** A chatbot powered by the Mistral 2B LLM (via Ollama) delivers context-aware mental health suggestions.
- **Interactive Dashboard:** A responsive web application provides real-time visualizations, detailed reports, and CSV export/import capabilities for data backup.

By combining these functionalities, the system empowers users to adopt a data-driven approach to mental health and self-improvement.

II. METHODOLOGY

2.1 Data Collection

The system gathers comprehensive data from multiple sources:

- **Journal Entries:** Daily inputs by users capturing thoughts, emotions, and reflections.
- **Mood Scores:** Derived from sentiment analysis on the journal entries, representing emotional states.

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- **Habit Tracking Data:** Binary data indicating whether daily habits were completed.
- **Historical Trends:** Accumulated data from past entries and habits, used for predictive modeling and trend analysis.

2.2 Data Preprocessing

Accurate analysis hinges on thorough data preprocessing:

- **Text Cleaning:** Journal entries are cleansed by removing special characters, numbers, and extra spaces, and converting text to lowercase.
- **Sentiment Analysis:** The VADER tool is employed to analyze the text, producing sentiment scores (positive, neutral, negative) along with a compound score to represent overall mood.
- **Feature Engineering:** Additional features are created, including:
  - Day of the week (numerical encoding)
  - Rolling averages of past mood scores to detect trends
  - Word and character count for journal entries
- **Handling Missing Data:** Missing mood scores are interpolated based on previous trends, and habit data is standardized.

2.3 Model Training & Evaluation

The system uses a combination of ML techniques to forecast future mood trends:

- **Random Forest Regressor:** Captures non-linear relationships and complex interactions among features.
- **Model Evaluation:** Performance is measured using metrics like Mean Squared Error (MSE), R^2 score, and prediction accuracy. Hyperparameter tuning (via techniques like GridSearchCV) is applied to optimize model performance.

2.4 Personalized Chatbot Recommendations

A key innovation of the system is its AI-powered chatbot:

- **Mistral 2B LLM Integration:** Through the Ollama API, the chatbot leverages the Mistral 2B language model to analyze journal content in real time.
- **Context-Aware Insights:** Based on the sentiment analysis and mood predictions, the chatbot provides personalized mental health recommendations—ranging from mindfulness exercises to stress management techniques.
- **User Interaction:** The chatbot offers an interactive conversational interface where users can ask for advice, track progress, and receive motivational support.

2.5 User Interface and Deployment

The Personal Mental Wellbeing Assistant is deployed as a Flask-based web application:

- **Journal Management:** Users can add, edit, and delete entries, with automated sentiment scoring.
- **Mood & Habit Tracking:** Interactive dashboards display real-time mood trends, habit completion, and predictive insights.
- **Visualizations & Reports:** Graphical representations (line charts, bar graphs, heatmaps) are provided, and users can export data in CSV or PDF formats.
- **Seamless Integration:** The system supports CSV import/export for data backup and restoration, ensuring continuity and ease of use.

III. SYSTEM DESIGN & IMPLEMENTATION

3.1 Architecture Overview

The system adopts a client-server model that integrates several functional modules:

- **Frontend (User Interface):** Built using HTML, CSS, JavaScript, and Bootstrap for a responsive design.
- **Backend (Processing Unit):** A Flask server handles user requests, processes journal entries, executes ML models, and manages the chatbot interface.
- **AI Model Execution:** Machine learning models (Random Forest, VADER sentiment analysis) and the Mistral 2B LLM are orchestrated to analyze and predict mood trends.
- **Data Storage:** A SQLite database is used to store user data, including journal entries, mood scores, and habit logs, while CSV files support data export/import.

3.2 Workflow Design

The overall workflow of the system is as follows:

1. **User Journal Entry Submission:** The user logs thoughts and emotions via the web interface.

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2. **Data Preprocessing & Sentiment Analysis:** The input text is cleaned and processed, with VADER generating sentiment scores.
3. **Mood Prediction:** Historical mood scores and engineered features feed into the Random Forest model, predicting future mood trends.
4. **Personalized Chatbot Interaction:** The chatbot analyzes the journal content with Mistral 2B and provides tailored recommendations.
5. **Visualization & Reporting:** Users view interactive charts and graphs displaying mood trends, habit correlations, and prediction insights.
6. **Data Export/Import:** The system supports CSV file operations for data management.

IV. RESULTS

The Personal Mental Wellbeing Assistant has been tested using real-world user data, with the following outcomes:

- **High Predictive Accuracy:** The Random Forest model achieved a high R^2 score and low error rates, ensuring reliable mood predictions.
- **User Engagement:** The interactive dashboard and chatbot integration have enhanced user experience, enabling smooth navigation and timely insights.
- **Actionable Insights:** Personalized recommendations provided by the Mistral LLM-powered chatbot have helped users identify emotional patterns and adopt proactive self-care strategies.
- **Performance Efficiency:** The web application processes user data and generates visualizations within seconds, making it suitable for real-time mental health tracking.

Visual reports generated by the system clearly illustrate mood trends over time, correlations between daily habits and emotional states, and forecasted mood trajectories, providing users with a comprehensive view of their mental well-being.

V. DISCUSSION

The integration of AI-driven analytics with traditional self-care practices demonstrates significant potential in transforming personal mental health management. By leveraging both statistical and deep learning approaches, the system effectively captures non-linear patterns in mood data and provides highly personalized recommendations through the chatbot.

Key discussion points include:

- **Enhanced Self-Awareness:** Users are empowered to recognize recurring emotional patterns, triggering self-reflection and behavioral adjustments.
- **Proactive Mental Health Management:** Real-time insights and predictive analytics enable users to take preventive measures before negative emotional states escalate.
- **Scalability and Flexibility:** The modular design allows for the seamless addition of new features, such as integrating wearable data or incorporating external factors like weather or social trends.
- **Challenges and Limitations:** The accuracy of the system depends on the quality and consistency of input data. Future work should focus on improving data collection methods and expanding feature engineering to capture a broader range of emotional influences.

VI. CONCLUSION

The Personal Mental Wellbeing Assistant project presents an innovative, AI-powered approach to mental health management. By combining sentiment analysis, mood prediction, habit tracking, and a personalized recommendation chatbot powered by Mistral LLM, the system offers a comprehensive solution for monitoring and improving emotional well-being. The platform's user-friendly interface and robust analytics empower individuals to make informed decisions about their self-care routines, ultimately fostering improved mental health outcomes.

Future enhancements will focus on:

- Incorporating deep learning models such as LSTM for improved sequential analysis.
- Expanding data collection to include real-time inputs from wearable devices.
- Refining feature engineering to better capture the nuances of emotional states.
- Integrating external data sources (e.g., economic or social factors) to further contextualize mood predictions.

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