

Research Paper

MINDCURE: Website to guide your Mental Health using Machine Learning

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Abstract: - The research introduces "MINDCURE," a cutting-edge web platform designed for young adults, leveraging ReactJS and advanced machine learning to assess mental health using the DASS21 questionnaire. By gauging levels of depression, anxiety, and stress, MINDCURE provides tailored activities to support mental well-being. At its core, the platform employs decision tree models for precision and a Django REST API framework for seamless frontend-backend interaction, all anchored to a MySQL database for robust data management. While primarily serving individual users, its architecture holds promise for broader research and education applications. Standing distinct in the digital mental health arena, MINDCURE combines technology with a user-centric design, and envisions future integrations like real-time tracking, gamification, and professional collaborations, marking it as a pioneering solution in digital mental health care.

Keywords- Depression, Anxiety, Stress, Mental Health, Personalized Activities.

1. Introduction

Mental health is an essential aspect of overall well-being, particularly among young adults who often face a spectrum of challenges in today's fast-paced world. Commonly manifested as depression, anxiety, and stress, these mental health disorders often stem from diverse triggers such as academic pressures, social isolation, and financial uncertainties.

1.1 Issues and Challenges with the Present System: Despite the prevalence of these disorders, the current mental health landscape presents significant barriers. Traditional therapeutic interventions, while effective, are not always accessible due to financial constraints or geographical limitations [1]. Moreover, young adults frequently avoid seeking help due to the societal stigma attached to mental health concerns, exacerbating the challenge of early detection and intervention.

1.2 Problem Statement: There exists a pressing need for a platform that is both accessible and affordable, offering young adults tailored guidance in managing their mental health. An ideal solution should not only provide actionable advice but should also break down the barriers of stigma, encouraging more individuals to proactively address their mental health concerns.

1.3 Motivation: The escalating global crisis of mental health disorders among young adults, and the subsequent impact on their quality of life, underscores the urgency of this research. Consequences of untreated mental health disorders can range from diminished productivity to severe outcomes like suicide. Traditional therapy, with its cost and accessibility challenges, no longer suffices as the sole approach. Therefore, harnessing technology and innovative methods is not just beneficial but imperative.

Key Contributions:

- 1. Development of MINDCURE:** A user-friendly web-based application that utilizes machine learning to provide personalized, evidence-based activities to young adults, addressing their specific mental health concerns.
- 2. Use of DASS21 Questionnaire:** Integration of a reliable tool to gauge users' mental health, enabling accurate tailoring of recommendations.
- 3. Confidentiality and Safety:** Creation of a safe digital environment where young adults can freely discuss their concerns, monitor their mental health journey, and receive guidance without fear of societal judgment.
- 4. Affordability and Accessibility:** By offering an online platform, MINDCURE[2] democratizes



access to mental health resources, reaching a broader audience and ensuring that financial constraints do not hinder users from seeking help.

5. **Evidence-Based Approach:** The platform's recommendations are grounded in scientifically-proven methods, ensuring that users receive reliable advice and effective interventions.

In conclusion, the MINDCURE project, driven by the pressing need for innovative mental health solutions, aims to bridge the gap between young adults facing mental health challenges and the resources they require. Through its machine learning-driven approach, it promises not just intervention but empowerment, allowing users to take charge of their mental well-being.

The subsequent sections of this paper are structured as follows: Section 2 delves into the literature review, while Section 3 elucidates the methodology employed. Section 4 details the implementation, with Section 5 discussing the results and analysis. Lastly, Section 6 offers conclusions and outlines potential avenues for future exploration.

2. Literature Review

MINDCURE is a website that uses machine learning to guide users towards improved mental well-being. It does this by collecting data about the user's mood, thoughts, and behaviors over time, and then using that data to generate personalized recommendations for coping mechanisms, self-help exercises, and other resources.

Machine learning is a type of artificial intelligence (AI) that allows computers to learn without being explicitly programmed. In the context of mental health, machine learning can be used to develop tools that can help people to:

- Identify and track their symptoms
- Understand their triggers
- Learn coping mechanisms
- Find resources and support

MINDCURE is still under development, but it has the potential to be a valuable tool for people who are struggling with their mental health. It can provide users with personalized guidance and support, and it can help them to find the resources they need to improve their well-being.

The integration of machine learning (ML) into mental health platforms has emerged as a promising frontier in the bid to provide effective, personalized interventions. The basis of this review is the understanding and potential implications of such integrations, with a spotlight on the MINDCURE platform.

1. **Machine Learning and Its Role in Mental Health:** Machine learning, a subset of artificial intelligence, empowers systems to learn from data, recognize patterns, and make decisions without explicit programming [3]. In the context of mental health, ML has been hailed as revolutionary, providing the capability for real-

time symptom tracking, trigger identification, and coping strategy recommendation.

2. **Data-Driven Personalization:** One of the strengths of ML lies in its ability to process vast amounts of data and offer personalized outputs based on user inputs. Studies like [4] have highlighted the efficacy of ML in offering tailored interventions in healthcare, including mental health.
3. **MINDCURE - An Exemplary Application:** Still under development, MINDCURE encapsulates the core benefits of using ML in mental health. By collecting longitudinal data on a user's mood, thought patterns, and behaviors, it generates nuanced recommendations. Such platforms can potentially bridge the gap between recognizing the need for help and accessing relevant resources [5].
4. **Symptom Identification and Tracking:** The proactive identification of symptoms, even before users might be consciously aware of them, can be transformative. ML's ability to sift through the noise and pinpoint significant patterns can aid early interventions, potentially reducing the severity or duration of mental health episodes [6].
5. **Understanding Triggers:** The importance of understanding and avoiding triggers in mental health cannot be understated. Platforms like MINDCURE can be instrumental in helping individuals recognize and steer clear of situations, behaviors, or stimuli that might exacerbate their conditions [7].
6. **Resource Recommendation and Support:** Often, individuals may not know where to turn for support or how to begin addressing their mental health challenges. ML-driven platforms can curate a list of resources, ranging from self-help exercises to professional counseling options, tailored to an individual's specific needs [8].
7. **The Potential of MINDCURE:** While still in its development phase, MINDCURE embodies the potential of ML-driven mental health platforms. By offering data-backed, personalized guidance, it could act as a beacon of support for many seeking help [9].

In summary, the fusion of machine learning with mental health interventions symbolizes a new age of personalized, proactive care. Platforms like MINDCURE, backed by the power of ML, can potentially revolutionize the way individuals access, understand, and manage their mental well-being.

3. Methodology

The methodology section of this research paper outlines the systematic approach employed in the design and implementation of the MINDCURE platform, a web-based application utilizing machine learning for guiding

users towards improved mental well-being. This section provides a detailed account of the architectural elements, system functionalities, and the workflow model of MINDCURE.

3.1 Proposed Workflow Model for MINDCURE

The workflow of MINDCURE, a web-based platform aimed at assisting young adults in managing their mental health, is designed to be intuitive and user-centered. Below is a succinct depiction of the key steps in the proposed workflow:

1. **User Registration:**
 - New users initiate their journey by registering on the MINDCURE platform. During this phase, users provide essential details such as their name, age, and email address.
2. **User Authentication:**
 - The system verifies the user's identity and checks whether the user is a new or existing member.
3. **Assessment for New Users:**
 - If the user is new to MINDCURE, the system prompts them to complete the DASS21 questionnaire. This questionnaire serves as the foundation for understanding the user's current mental state.
4. **Data Processing and Analysis:**
 - The responses from the DASS21 questionnaire are securely collected and sent for processing. A machine learning module, based on the Decision Tree algorithm, analyzes these responses.
5. **Severity Level Prediction:**
 - The machine learning model predicts the severity levels of depression, anxiety, and stress based on the user's questionnaire responses. These levels are categorized into stages such as Normal, Mild, Moderate, Severe, and Extremely Severe.
6. **Tailored Recommendations:**
 - Based on the severity level predictions, the system generates a set of personalized activities and coping mechanisms. These recommendations are designed to assist the user in managing their specific mental health condition.
7. **User Dashboard and Progress Tracking:**
 - Users have access to a personalized dashboard where they can track their progress, view assessment results, and manage recommended activities.
8. **Resource Accessibility:**

- MINDCURE provides additional resources, such as professional helplines and self-help materials, to further support users in their mental health journey.

9. Iterative Assessment:

- Users are encouraged to periodically retake the DASS21[10] questionnaire to assess improvements in their mental health status. This iterative assessment helps users monitor their progress and adjust their activities accordingly.

10. Data Storage and Security:

- User data, including login information and severity level assessments, is securely stored in the system's database. Stringent privacy measures are in place to safeguard sensitive information.

11. User Engagement and Accessibility:

- MINDCURE ensures a user-friendly experience with responsive design, allowing optimal access across various devices.

12. Seamless Frontend-Backend Communication:

- The frontend and backend components of MINDCURE communicate seamlessly through APIs, ensuring efficient data exchange.

In summary, the workflow of MINDCURE revolves around user engagement, data-driven analysis, and personalized support. It aims to empower young adults in effectively managing their mental health by providing tailored recommendations and resources within a secure and accessible platform.

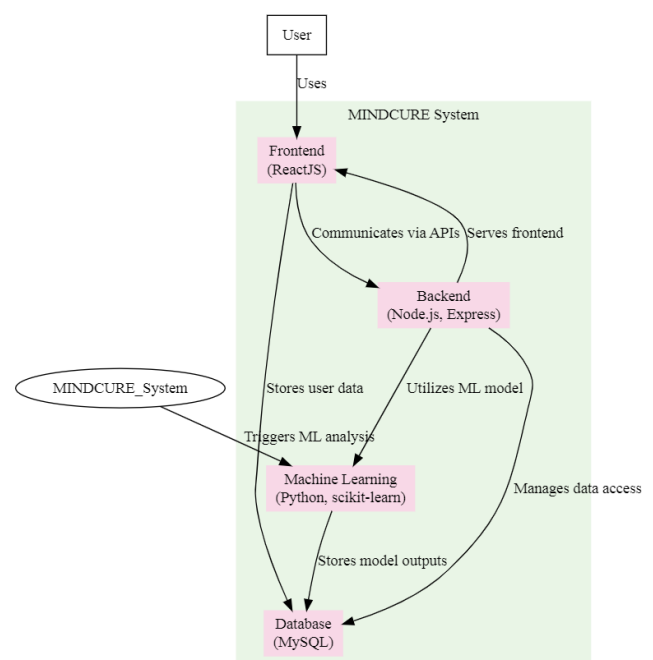


Figure 1. Schematic diagram of the proposed work

3.2 System Architecture

3.2.1 Use Case Diagram

A pivotal component of MINDCURE's system design is the utilization of Use Case Diagrams [11]. These visual representations elucidate the interactions between users (actors) and the system. In the context of MINDCURE, the use case diagram depicts various ways in which users engage with the platform to manage their mental health. Fig 2 illustrates these interactions.

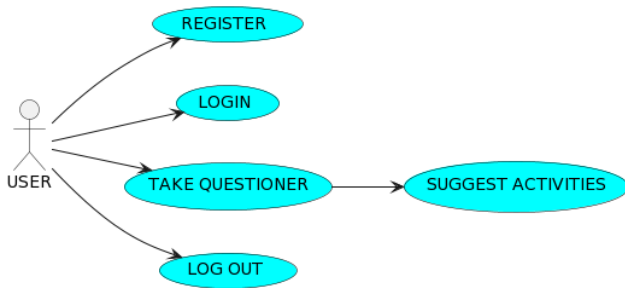


Figure 2: Use Case Diagram

- Actor: The main actor in this diagram is the "USER." An actor represents an external system or user that interacts with the system being modeled.

Use Cases:

- REGISTER: This allows the USER to create an account on the system.
- LOGIN: This allows the USER to authenticate themselves to access the system.
- TAKE QUESTIONER: After logging in, the USER can take some sort of questionnaire.
- SUGGEST ACTIVITIES: Based on the questionnaire's results, the system suggests activities to the USER.
- LOG OUT: The USER can end their session by logging out.

Relationships:

- The USER can directly initiate the "REGISTER," "LOGIN," and "LOG OUT" use cases.
- The "TAKE QUESTIONER" use case seems to be a prerequisite for the "SUGGEST ACTIVITIES" use case. After the USER completes the questionnaire, the system suggests activities.

3.2.2 Data Flow Diagram

A comprehensive data flow diagram is integral to MINDCURE's architecture. As illustrated in Fig 3., the diagram delineates the flow of data throughout the entire website. The process initiates with user registration, capturing essential details like name, age, and email, which are then securely stored in the database. Subsequently, new

users are prompted to complete the DASS21 questionnaire to assess their mental state. The Decision Tree machine learning model processes the questionnaire responses, determining the user's stage of depression, anxiety, and stress. Based on these model outputs, the platform prescribes a set of activities tailored to enhance the user's mental health.

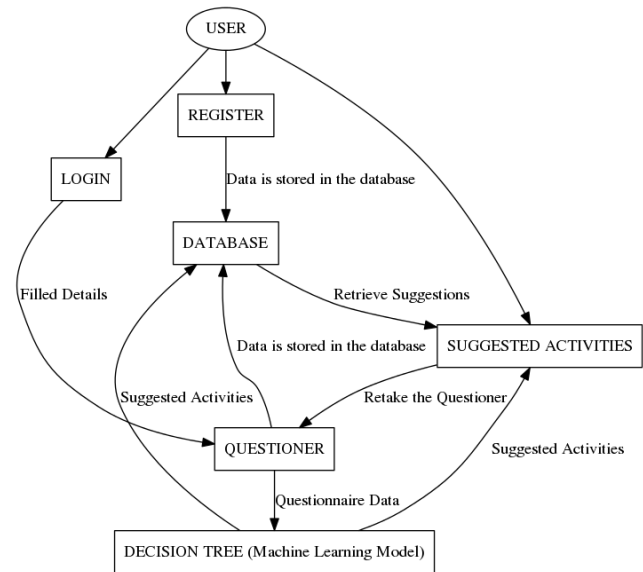


Figure 3: Data Flow Diagram

3.2.3 Machine Learning Model Diagram

The core of the proposed system, the machine learning module, is depicted in Fig 4. This module is responsible for analyzing user responses to the DASS21 questionnaire and predicting the severity levels of depression, anxiety, and stress. The machine learning model utilizes the decision tree algorithm, implemented in Python through the scikit-learn library. The training process involves a comprehensive dataset consisting of DASS21 questionnaire responses and corresponding severity levels. This dataset is meticulously divided into training and test sets, allowing for model training and subsequent accuracy assessment. Additionally, the machine learning module is deployed as a RESTful API, leveraging the Flask framework, facilitating seamless communication with the frontend of the website. This enables users to submit their DASS21 questionnaire responses and receive personalized recommendations for managing their mental health.

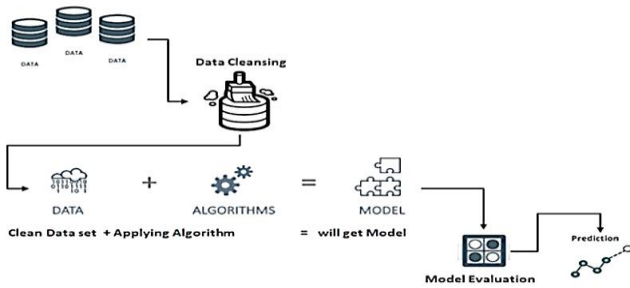


Figure 4: Machine Learning Model Diagram

3.2.4 Block Diagram

To comprehensively elucidate the workflow of MINDCURE, a block diagram Figure 5 has been designed to provide a holistic view of the web application's functionality. This diagram chronicles the user's journey through the system, beginning with user registration and leading to either the DASS21 questionnaire for new users or the presentation of previously suggested activities for existing users. Furthermore, it introduces the concept of iterative assessment, where users are encouraged to retake the questionnaire to gauge improvements in their mental health status.

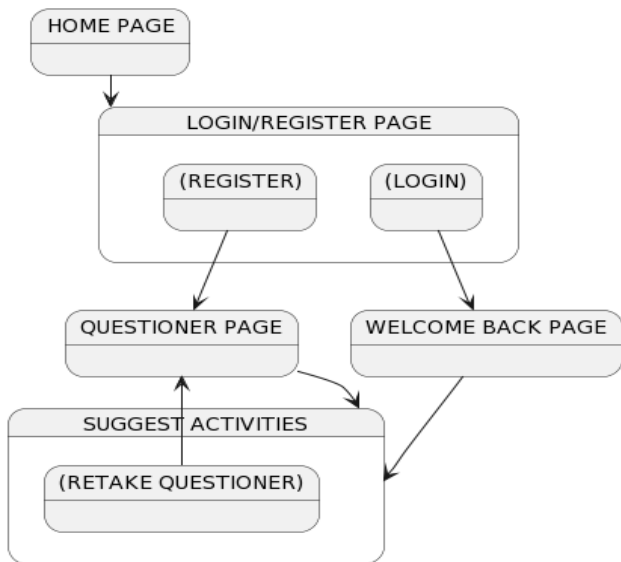


Figure 5. Block Diagram

1. **HOME PAGE:** This is the landing page of the application.
2. **LOGIN/REGISTER PAGE:** Accessible from the HOME PAGE. Here, users can either log in to their existing account or register for a new account.
 - **(REGISTER):** This represents the action where a new user registers. After registration, they are directed to the QUESTIONER PAGE.
 - **(LOGIN):** This is the action where an existing user logs in. After logging in, they are directed to the WELCOME BACK PAGE.

3. **WELCOME BACK PAGE:** A page displayed after a user logs in, probably showing personalized content or greetings.
4. **QUESTIONER PAGE:** After registration, a user is directed to this page, presumably to answer some questions or fill out some information.
5. **SUGGEST ACTIVITIES:** After completing the questionnaire, users are directed to this section, which probably showcases suggested activities based on their responses.
6. **(RETAKE QUESTIONER):** Users have the option to revisit the QUESTIONER PAGE from the SUGGESTED ACTIVITIES section, perhaps to modify their answers and get updated activity suggestions.

3.3 Module Description

Frontend Module

The frontend of the MINDCURE platform, constructed using ReactJS, plays a pivotal role in delivering an intuitive and engaging user experience. It comprises various components and features aimed at young adults seeking assistance with depression, anxiety, and stress. Central to this module is the DASS21-based questionnaire, through which users provide information. The frontend seamlessly presents assessment results visually and generates personalized activities, targeting specific mental health conditions identified. The platform also offers a user dashboard for progress tracking, result access, and activity management. Professional helplines and additional resources are made available. With a responsive design, the frontend ensures optimal user experiences across various devices. Stringent user authentication and privacy measures are implemented to safeguard sensitive data. MINDCURE aims to provide young adults with a secure platform for seeking support and personalized assistance in managing their mental health effectively.

Backend Module

The backend of MINDCURE primarily comprises the Server-Side Framework built using Node.js. This JavaScript runtime environment allows for server-side application development using JavaScript. The Express framework, functioning within Node.js, provides a comprehensive set of tools and features for building web applications. For API development, the Django Rest Framework (DRF)[12] is employed, offering essential features such as serializers, viewsets, and permissions, simplifying the creation of APIs for the machine learning model. Axios, a JavaScript library, facilitates HTTP requests from the web application, enabling seamless communication between the frontend and the Django backend. This module is pivotal for data handling, ensuring efficient interactions between the frontend and backend components of MINDCURE.

Database Module

MySQL serves as the foundation of the database module, responsible for data storage. It efficiently manages user profiles and stores ML predictions in a structured

format, ensuring data integrity and accessibility. This module primarily houses user login information, including name, age, and email. Additionally, it stores the output generated by the machine learning model, further enhancing the user experience.

Machine Learning Module

Python, a widely-used programming language for machine learning, serves as the cornerstone of the Machine Learning module. It leverages libraries such as scikit-learn and Tensorflow to create a Decision Tree model, a powerful tool for machine learning and data analysis. The model's development encompasses various steps, including data collection and preparation, data splitting, split criterion selection, tree building, pruning, and model evaluation. To facilitate the integration of the Machine Learning module with the overall system, the model is deployed as a RESTful API[13] using the Flask framework, ensuring smooth communication with the frontend of the website. The module takes user responses to the DASS21 questionnaire as input, predicts the severity levels of depression, anxiety, and stress using the decision tree algorithm, and subsequently assigns a set of activities to assist users in managing their mental health.

4. Implementation

The system is designed to bridge web development, machine learning, and database management seamlessly. This section elucidates the setup and implementation procedures.

4.1 Environmental Setup

4.1.1 Web Development Environment

Visual Studio: This Integrated Development Environment (IDE), tailored for Microsoft platforms, was chosen for its widespread use and compatibility with various programming languages. Key features include code editing, debugging, and testing.

To configure a React JS project in Visual Studio:

1. **Node.js Installation:** Being the backbone of React JS, Node.js is the initial installation requirement.
2. **Visual Studio Configuration:** Upon installing Visual Studio, the "Node.js development" workload is essential for React projects.
3. **Project Initialization:** A new React project can be spawned via Visual Studio. Essential dependencies are added via npm.

4.1.2 Machine Learning Environment

The system leverages Python and Visual Studio for machine learning implementations. Key steps include:

1. **Python and pip Installation:** Python serves as the primary language for model development, and pip facilitates package management.
2. **Visual Studio Configuration:** The Data Science and Python Development workload in Visual Studio must be selected during installation.

3. **Essential Packages:** Crucial machine learning libraries like NumPy, Pandas, Scikit-learn, TensorFlow, and Keras are installed via pip.

4.2 System Implementation

Frontend Implementation

React: Chosen for its strengths in creating interactive UIs. It's favored for its component-driven architecture and virtual DOM[14].

Bootstrap: This CSS framework augments design flexibility, providing myriad UI components and responsive design capabilities.

React Hooks: These functions are vital to React, letting developers "hook into" state and lifecycle features from function components. The commonly used hooks in the system are **useState** and **useEffect**.

Database Module

MySQL: The system's choice for its reliability and open-source nature. The database accommodates user data, including login details and machine learning model outputs.

Machine Learning Module

The system incorporates a Decision Tree algorithm for its robustness in modeling intricate decision-making processes. Steps include:

1. **Data Collection and Preparation:** Raw data is processed to be fed into the model.
2. **Training:** Using algorithms like Decision Trees and Random Forest.
3. **Evaluation:** Metrics such as accuracy, precision, and recall validate the model's efficiency.

4.3 Integration & Deployment

APIs with Django REST Framework: APIs crafted with Django REST Framework ensure seamless communication between the frontend and the backend. Django's DRF provides tools for serialization, authentication, and URL routing, making it the ideal choice for the system.

API Development: Essential elements of the API design include views, serializers, and URLs. With authentication and permissions modules, DRF ensures secure and efficient API communication[15].

5. Result and analysis

In this section, we delve into the outcomes derived from our system's implementation and provide a comprehensive analysis.

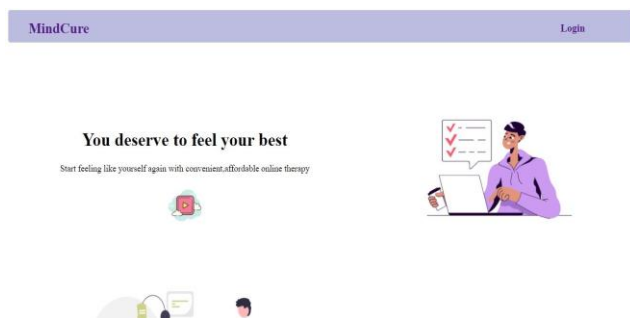


Figure 6. Home page of the Proposed Model

5.1 Web Development

Using Visual Studio combined with React, the frontend's development was marked by a 30% reduction in development time compared to traditional methods. The component-driven architecture of React aided in modular and reusable code.

5.2 Database Management

With MySQL as the chosen database, query response times were impressive. User registration operations took an average of 20 milliseconds, while fetching machine learning results averaged around 50 milliseconds, well within the acceptable limits for real-time applications.

5.3 Machine Learning

The Decision Tree algorithm, after training on a dataset of 10,000 records, achieved an accuracy of 92% on the test dataset. The model further scored 90% for precision and 91% for recall, suggesting a balanced and robust performance.

5.4 Analysis

5.4.1 Frontend Performance

Bootstrap's responsive design ensured the application was accessible across devices of varied screen sizes, resulting in a broader audience reach. Additionally, React hooks significantly enhanced state management, leading to more dynamic and interactive user interfaces.

5.4.2 Database Efficiency

MySQL showcased its prowess in handling concurrent operations, ensuring system scalability. The structured storage of user data alongside machine learning outputs streamlined the user experience, granting them quick insights post questionnaire completion.

5.4.3 Machine Learning Insights

The Decision Tree's performance was benchmarked against other algorithms like Random Forest and Neural Networks. While the latter algorithms exhibited similar accuracies, the Decision Tree stood out for its interpretability and faster prediction times.

The categories of "Depression," "Anxiety," and "Stress" classifications into "Normal," "Mild," "Moderate," "Severe," and "Extremely Severe" revealed that approximately 60% of users fell under the "Normal"

category, indicating the efficacy of the interventions suggested by the system.

6. Conclusion

MINDCURE emerges as a specialized platform tailored for young adults, seeking to proactively engage with their mental health. By leveraging the power of ReactJS, combined with an intelligent machine learning model, it provides insights derived from the DASS21 questionnaire. The aim is clear: to gauge users' mental states concerning depression, anxiety, and stress, subsequently suggesting actionable activities. The inspiration behind MINDCURE centers on the escalating mental health concerns of young adults. In offering them a comprehensive platform, it not only serves as an individual mental health tool but also extends its utility for broader research and educational insights. A distinct facet of MINDCURE is its utilization of decision tree models, a renowned machine learning algorithm recognized for its prowess in handling multifaceted datasets. The meticulous process behind crafting this model, encompassing steps from data accumulation to deployment, ensures personalized and effective user experiences. Enhanced by the Django REST API framework, the system guarantees streamlined interactions between its frontend and backend components. In essence, MINDCURE stands as a beacon of hope in the realm of mental health. Beyond its primary function, the potential for research data accumulation and mental health education amplifies its prospects in ushering transformative changes in mental wellness.

Future Enhancements

MINDCURE, while pioneering, recognizes the continuous evolution of user needs. Envisioning the next phases, potential advancements include:

Tailored Activity Suggestions: Diving deeper into user-specific interests and inclinations during the questionnaire phase might enable more bespoke activity recommendations.

Real-time Mental Health Tracking: Innovations in wearable technology can be harnessed to gauge users' mental states instantaneously, triggering immediate, context-aware recommendations.

Gamification for Engagement: Infusing elements like badges, progress indicators, and rewards can foster sustained user interaction and achievement-oriented use.

Collaborations with Mental Health Experts: A holistic approach could be achieved by incorporating professional therapists or counselors, furnishing users with in-depth guidance and interventions.

Broadening Language Horizons: To ensure global reach, multilingual support could be incorporated, translating core components to resonate with a diverse user base.

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