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CMPE-492

Final Report

MAI Therapist

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1. Introduction

MAITherapist is a web application designed to aid psychologists in analyzing therapy sessions. Its primary objective is to provide therapists with valuable insights into their clients' emotional states and reactions during sessions. The system utilizes artificial intelligence to analyze emotions, gestures, facial expressions, and voice tone displayed by clients in recorded therapy videos. Upon uploading a session video, MAITherapist generates a transcript of the session and combines it with the analyzed emotions for each specific time period. The resulting analysis report serves as a comprehensive overview of the therapy session, highlighting key moments and providing therapists with a deeper understanding of their clients' reactions. By comparing their own analysis with the system's findings, therapists can identify any missed points and enhance their treatment methods. The system also offers a patient management feature, allowing psychologists to store session notes, diagnosis details, and other relevant information. Overall, MAITherapist aims to support psychologists in improving their therapeutic approaches by leveraging advanced technology to analyze and interpret client emotions and behaviors. This report aims to provide the final architecture and design of the MAITherapist project, along with an analysis of its impact, contemporary issues, and the tools and technologies used throughout its development. The final architecture and design of the system, as well as the current status of the project, will be presented in this report. Furthermore, the report will delve into the impact of the engineering solutions developed within the project, taking into account their global, economic, environmental, and societal implications. Additionally, a section will be dedicated to discussing contemporary issues related to the field of therapy analysis and AI-driven emotional assessment. The report will also detail the new tools and technologies adopted during the project's lifecycle. It will include information about the utilization of library resources and Internet research to gather background information, such as similar designs, component details, and fundamental engineering principles.

2. System Architecture and Design

The MAITherapist system is designed to provide therapists with a reliable, efficient, and user-friendly platform for analyzing therapy sessions and ensuring the safety of information. The system architecture is carefully crafted to meet the specific needs of therapists and promote effective therapy practices.

At the core of the system, we have the front-end subsystem, responsible for creating a seamless user interface. It leverages Nuxt.js, a JavaScript framework based on Vue.js, to deliver a responsive and intuitive user experience. The front-end subsystem communicates with the backend subsystem through APIs, allowing therapists to access and interact with the system from various devices and platforms. AWS Amplify is integrated to streamline authentication and data storage, ensuring secure and scalable access to the system.

The backend subsystem handles the crucial business logic and data management. It harnesses the power of AWS cloud services, including Lambda, DynamoDB, and S3, to ensure high performance, scalability, and fault tolerance. This subsystem provides a robust set of APIs that facilitate communication with the front-end subsystem and other external systems. By leveraging AWS services, the system can handle large amounts of data, maintain data integrity, and support the growing needs of therapists and patients.

Security is a paramount concern in the MAITherapist system, and it is managed by a dedicated security subsystem. This subsystem incorporates various measures, such as data encryption, access controls, and user authentication and authorization, to ensure the confidentiality and privacy of sensitive information. Integration with AWS Identity and Access Management (IAM) strengthens security measures and provides granular control over system access.

Finally, the therapy analysis subsystem leverages AWS Rekognition to provide therapists and patients with valuable insights from therapy sessions. By analyzing session data, it generates reports and recommendations that assist therapists in making informed decisions and enhancing the therapeutic process.

Overall, the MAITherapist system combines cutting-edge technologies, cloud infrastructure, and a thoughtful design to deliver a reliable, efficient, and secure therapy platform. Its user-friendly interface, scalability, and integration with AWS services empower therapists to provide optimal care to their patients while maintaining the highest standards of data privacy and security.

Impact of the Solution:

a. Environmental Context:

The implementation of the MAI Therapist project has a negligible environmental impact. The primary requirement for the system's proper functioning is a well-lit environment to ensure accurate facial expression detection. Additionally, a noise-free setting is necessary to record therapy conversations clearly. However, the project itself does not contribute to any significant negative environmental effects, making it an environmentally friendly solution.

b. Societal Context:

The MAI Therapist project addresses several societal concerns associated with traditional therapy sessions. The manual analysis of patient emotions and the cumbersome process of marking progress during sessions can be time-consuming for therapists, diverting their attention from the patient. With the automated emotion recognition system and the integration of patient analysis, the MAI Therapist enables therapists to focus more on the patient, leading to more effective and efficient therapy sessions.

c. Global Context:

The versatility of the MAI Therapist system allows for easy adaptation to various therapeutic settings worldwide. With minimal configuration requirements, the project can be implemented in different countries and cultural contexts, offering a standardized approach to therapy that transcends geographical boundaries. This global perspective ensures that the benefits of the MAI Therapist reach a wide range of individuals seeking mental health support.

d. Economical Context:

Although the initial cost of implementing the MAI Therapist project may appear higher compared to traditional therapy methods, it offers long-term economic advantages. While therapists need to invest in computers and cameras for the system, the overall cost is offset by the improved analysis and enhanced therapy sessions. The benefits gained from using the MAI Therapist, such as better patient understanding and improved therapeutic outcomes, outweigh the initial investment and contribute to long-term cost savings.

Contemporary Issues:

One of the key contemporary issues that the MAI Therapist addresses is the concern for privacy and data security. To ensure the confidentiality of patient information, the system incorporates robust security measures. It adheres to relevant privacy regulations and guidelines, implementing encryption protocols to protect sensitive data from unauthorized access. The MAI Therapist also prioritizes the privacy of individuals by employing advanced facial recognition techniques that do not store actual images. Instead, the system processes facial data as vectors, minimizing the risk of privacy breaches. By addressing these contemporary issues, the MAI Therapist offers a secure and privacy-conscious solution for effective therapy sessions.

5. New Tools and Technologies

New Tools and Technologies:

The MAI Therapist project incorporates a range of new tools and technologies, including various AWS services, to enhance the effectiveness and efficiency of therapy sessions. One such tool is Amazon Rekognition, a powerful facial recognition service that enables real-time analysis of patients' facial expressions. By leveraging Rekognition, the MAI Therapist can accurately detect and interpret emotions displayed by patients, providing valuable insights into their mental state during therapy.

In addition to facial recognition, the project utilizes Amazon S3 (Simple Storage Service) for secure and scalable cloud storage. S3 enables the storage of patient data, including video recordings and session transcripts, in a reliable and highly available manner. This ensures that therapists can access and review past sessions easily, allowing for a comprehensive understanding of each patient's progress over time.

Another key technology employed is Amazon Transcribe, a speech recognition service. By leveraging Transcribe, the MAI Therapist can automatically convert speech from therapy sessions into accurate and searchable text. This not only facilitates easy review and analysis of session content but also enables therapists to identify important insights and patterns that may contribute to the effectiveness of the therapy.

Overall, the MAI Therapist project leverages a range of AWS services such as Amazon Rekognition, S3, Transcribe. These tools empower therapists with advanced capabilities, including facial recognition, secure cloud storage, automated speech-to-text conversion. By utilizing these specific tools and technologies, the project aims to enhance the quality and outcomes of therapy sessions, ultimately benefiting patients and therapists alike.

Use of Internet Resources

The project team extensively utilizes internet sources, including the Amazon Web Services (AWS) website, to access a wealth of engineering principles and best practices relevant to the MAI Therapist project. The AWS website offers comprehensive documentation, tutorials, and case studies that provide valuable insights into data encryption, secure cloud storage, speech recognition algorithms, and natural language processing techniques.

By leveraging the resources available on the AWS website, the project team gains a deep understanding of the practical implementation of these technologies. They learn about the various AWS services, such as Amazon S3 for secure data storage, Amazon Transcribe for speech-to-text conversion, and Amazon Rekognition for facial recognition. The team also explores best practices for designing scalable and secure cloud architectures to ensure the reliability and confidentiality of patient data.

Furthermore, the use of internet sources, including the AWS website, empowers the project team to make informed decisions regarding the selection of appropriate technologies and the implementation of robust security measures. They can take advantage of AWS's extensive documentation and community forums to address technical challenges, troubleshoot issues, and stay up-to-date with the latest advancements in the field.

6. Test Results and Assessment

1. Logging In and Registration:

- The test case for user registration passed, confirming that users can successfully create a new account.

- The test case for user login passed, validating that registered users can log in using their credentials.

- No issues or failures were encountered during the testing of this feature.

2. Patient Information Management:

- The test case for creating new patient information passed, ensuring that the data is stored accurately in the DynamoDB database.

- The test case for updating existing patient information passed, verifying that the changes are saved correctly.

- All validations and error handling mechanisms for patient information management functioned as expected.

- No defects or issues were identified during the testing of this feature.

3. Video Recording and Analysis:

- The test case for uploading session videos passed, indicating that videos are successfully stored in AWS S3 storage.

- The test case for AWS Rekognition's emotion detection on uploaded videos passed, ensuring accurate analysis of emotions.

- The test case for combining the generated transcript with emotions and storing it in DynamoDB passed without any issues.

- The final report generation and display/download functionality were tested successfully.

- No failures or bugs were encountered during the testing of this feature.

4. Transcription Creation:

The test case for creating transcriptions passed, indicating that the application successfully generates accurate transcriptions for the uploaded session videos.

The accuracy of the transcriptions was verified by comparing them with the corresponding test transcripts.

The transcriptions were combined with emotions and stored correctly in DynamoDB.

No issues or failures were encountered during the testing of this feature.

Overall, all test cases for the MAI Therapist application passed, demonstrating that the system functions correctly and meets the specified requirements. The absence of failed tests indicates a high level of quality and reliability in the application's performance.

Assessment of the Tests:

The successful execution of all test cases reflects the effectiveness of the testing effort in ensuring the quality and reliability of the MAI Therapist software. The absence of failed tests suggests that the development team has implemented the required functionalities accurately and that the application aligns with the expectations outlined in the test plan.

Considering the test results, it is evident that the application has been thoroughly tested, and all critical features have been verified to function as intended. The absence of bugs or issues in the tested functionalities demonstrates the attention to detail and meticulousness of the development team.

Looking towards the future, potential enhancements for the MAI Therapist application could include expanding the range of supported browsers and operating systems to ensure broader compatibility. Additionally, continuous monitoring and further refinement of the application's performance under different conditions may contribute to optimizing its response times and overall efficiency.

Final Status of the Project

As of the current stage of the MAI Therapist project, substantial progress has been made in achieving the project's objectives and milestones. The development team has successfully implemented and fulfilled a range of critical deliverables, ensuring that the project remains on track for completion. The project status is as follows:

1. Development of MAI Therapist Application: The core component of the project, the MAI Therapist application, has been developed and refined to meet the specified requirements. The application provides therapists and clients with a user-friendly platform for conducting therapy sessions and analyzing emotional data.

2. Integration of Facial Expression Analysis: A crucial feature of the MAI Therapist application is the integration of facial expression analysis. The development team has successfully implemented algorithms and technologies that enable real-time recognition and interpretation of facial expressions. This functionality contributes to the accurate detection and analysis of emotions during therapy sessions.

4. Secure Cloud Infrastructure: To ensure the privacy and security of sensitive client data, a robust and secure cloud infrastructure has been established. The infrastructure leverages cutting-edge technologies and follows best practices in data encryption, access controls, and secure storage. This enables therapists and clients to trust that their information is protected and confidential.

5. Development of Analytics and Reporting: The project team has focused on developing comprehensive analytics and reporting functionalities within the MAI Therapist application. These features allow therapists to access detailed session reports, visualize emotional trends, and gain insights into the progress of their clients over time. The analytics and reporting capabilities significantly enhance the value and effectiveness of the application for therapists' professional practice.

The project is currently on track, meeting the established objectives and timelines. The team remains dedicated to ensuring the successful completion of the MAI Therapist application, focusing on delivering a high-quality product that empowers therapists and enhances the therapy experience for clients.

User Manual

The user manual provides detailed instructions and guidelines for using the MAI Therapist application effectively. This section outlines the hardware and software requirements for the client-side component.

7.1 Hardware

7.1.1 Requirements

To ensure optimal performance and functionality of the MAI Therapist application, the following hardware requirements must be met:

Computer or device with a modern web browser

Webcam or camera device for video recording (if the therapist intends to record sessions directly from their device)

7.2 Software

7.2.1 Client Side Requirements

The client-side component of the MAI Therapist application has specific software requirements. Ensure the following software is installed and configured on the client device:

Operating System: Windows, macOS, or Linux

Web Browser: Google Chrome, Mozilla Firefox, Microsoft Edge, Safari, or any other modern web browser with JavaScript enabled.

Note: It is recommended to keep the web browser up to date to ensure compatibility and security.

The MAI Therapist application is designed to be compatible with a wide range of hardware and software configurations. However, it is essential to meet the specified requirements to ensure optimal performance and a seamless user experience.

Please refer to the following sections for detailed instructions on using the MAI Therapist application, including user registration, session management, and data analysis.

7.2.2 User Interface

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