PREDICTION OF DEPRESSION AND ANXIETY USING ML TECHNIQUES WITH PHQ AND GAD

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In partial fulfillment of the requirements for the award of the Degree of

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CERTIFICATE

Certified that the project work entitled

"Prediction of anxiety and depression using ML techniques using PHQ & GAD"

is a bonafide work carried out by

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in partial fulfilment of the requirements for the award of ***Bachelor of Engineering Degree in Computer Science and Engineering*** *prescribed by* ***Visvesvaraya Technological University, Belagavi*** *during the year* ***2022-2023.***

It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library.

The project report has been approved as it satisfies the academic requirements in respect of the project work prescribed for the Bachelor of Engineering Degree.

24/5/23

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Name of the Examiners **Signature with Date**

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ABSTRACT

One of the most crucial components of artificial intelligence is machine learning. Nearly every area of science and technology incorporates it.
One sector where the application of machine learning has produced excellent outcomes is the healthcare industry.

The health sector has shown remarkable success with machine learning. And yet, certain places remain devoid of advancing technologies.
One of the conditions for which there hasn't been a complete cure is mental illness. The biggest challenge is determining whether a person has a mental disorder in the first place. One-on-one physical encounters are used by psychologists to examine and treat their patients. Yet, there is some confusion over the course of action. Even while psychologists provide their patients a variety of medications, such as antidepressants, sleeping aids, etc., the drugs haven't been able to completely treat or eliminate the illness. A person may be going through a particular scenario for a number of reasons, including society, work pressure, family, etc., It can cause a loss of interest in general activities that can lead to suicidal thoughts.

Our study into this issue will be limited to forecasting such illness in human bodies and determining what the patient is experiencing using the previously collected dataset for the detection of depression and anxiety using questioner such as PHQ-9 and GAD-7 and model such as logistic regression.

Here, we will be building a website that will be used by the people/users to check their depression and anxiety levels.

CONTENTS

CHAPTER 1
INTRODUCTION

Depression is a state of low mood and detachment from activities, in accordance with the definition of the word. A person's thoughts, behavior, feelings, and sense of well-being can all be impacted by this illness. There are two types of depression: long-term and transient. A person suffering from depression may experience excruciating sadness, hopelessness, loss of interest in activities, and occasionally even suicidal thoughts.

A depressive episode may be classified as mild, moderate, or severe depending on the quantity and intensity of symptoms. Worldwide, more than 280 million people among all nationalities suffer from depression. Depression affects women's more than males according to the study conducted.

The illness of depression is quite complex. This disease is challenging because of its complexity. A person can become depressed for a variety of reasons. Biological, social, environmental, personal, and even lifestyle factors are among them. It is also claimed that certain cases of depression are inherited, while others may be brought on by the death of a loved one, the dread of failure brought on by a terrible event that causes them to lose hope, etc.

As per reports by WHO (World Health Organization) 1 in 4 people in the world will be affected by mental or neurological disorders at some point in their lives.
Depression is the leading cause of disability worldwide; Suicide is the second leading cause of death among 15-29-year-olds globally.
Low- and middle-income countries have fewer resources to address mental health issues, leading to a treatment gap for mental health disorders.
Discovering the results of being depressed may be extremely depressing. Humans frequently respond in extremely unusual ways. They may exhibit signs like losing their temper over seemingly insignificant things, overeating or undereating, overthinking, sleep deprivation, or even, in severe cases, attempting suicide.

Psychologists may recommend drugs like antidepressants and anxiolytics. Even patients can discuss their issues through one-on-one physical interactions with their psychiatrist. Machine learning algorithms can be divided into three major groups: reinforcement, unsupervised learning, and supervised learning. The supervised learning algorithms utilize standard data, analyze it, and then generate the required outputs. Unsupervised learning makes use of clusters of data rather than the 45complete set of data. We must operate it and assess the necessary results among these data clusters. Action, environment, status or reward, and the agent all interact in a cycle during reinforcement. People in low-income countries hardly have the money to pay for treatment for a psychiatrist. The primary objective of this paper is to combine the right algorithms to identify depression at an early stage.

A product called NLP is needed by a machine to comprehend human language. NLP allows people to communicate in their own language while also making machines understandable. A division of natural language processing called sentiment analysis uses machine learning techniques to discover precise information. The logistic regression algorithm will be utilized in the PHQ, GAD model for prediction, which is a machine learning method.

CHAPTER 2
LITERATURE SURVEY

1.Prediction of anxiety, depression and stress in modern life using machine learning algorithms
By :Anu Priya, Shruthi Garg, Neha Tigga
Abstract: In this paper they have considered 348 participants and have asked 7 different questions for anxiety, depression and stress based on how participants have answered 7 questions each of the individual scores are calculated and based on the scores severity levels are calculated according to level of severity classification is done using machine learning models after classification is done confusion matrix is plotted for all three cases using this matrix accuracy and other parameters are calculated.

2.Relationship between clinical, momentary and sensor-based assessment of depression
By:Sohrab Saeb, Mi Zhang
Abstract: In this paper the assessment of only depression is done using Ecological Momentary Assessment(EMA) and GPS sensor and PHQ scores are calculated the GPS sensor has features like location entropy and circadian movements these parameters are calculated using suitable formulas data is collected using EMA and GPS sensor from the user's smartphone over period of 2 weeks then severity levels are calculated based on PHQ scores.

3.Automatic prediction of depression and anxiety from behavior and personality attributes
By:Shashank Jaiswal, Siyang Song, Eighth
Abstract: This paper uses the technique in which the training of deep neural network is done for the prediction of anxiety and depression scores and for facial behavior attributes are considered and then these attributes are represented in form of graphs and are analyzed while the participants were asked questions these questions are nothing but PHQ-9, GAD-7 and Big Five Inventory(BFI) questions then scores are calculated based on how they answer these questions then the scores obtained from each of these questionnaires were compared and the best was PHQ-9.

4.Using AI chatbots to provide self-help depression interventions for university students: A Randomized trial of effectiveness
By: Hao Liu, Chenzi Xu
Abstract: The paper explains that they have developed a chatbot which is recommended to the patients after they have answered the pPHQ-9 and GAD questionnaire the name of chatbot is XiaoNan and is a therapy chatbot deployed through "WeChat Official Accounts Platform" which is a pipeline-based and powered by open-source conversational AI RASA. We can access this chatbot through the WeChat app on our smartphone.

5.Mental health tracker:
By:Vaishnavi N Jadhav, Manasi S Bhamare,Manasvi U Vengurleka and Vidya S Kubde
This is aimed at developing a mental health tracker that uses machine learning algorithms to predict depression in a chat bot and recommends activities. We will gather data from the user's chat history and use sentiment analysis to determine their emotional state. Based on this analysis, we will use ML algorithms to predict the likelihood of depression and recommend activities to help improve their mental health. Our goal is to provide an accessible and user-friendly platform for individuals to track their mental health and receive personalized support.

6.A Machine Learning Approach Detecting Digital Behavioral Patterns of Depression Using Non-intrusive Smartphone Data - A Complementary Path to PHQ-9 Assessment: A Prospective Observational Study
By: Soumya Choudhary, Nikita Thomas, Jaine Ellenberger, Girish Srinivasan and Roy Cohen
The report describes a prospective observational study that suggests using non-intrusive smartphone data and machine learning to identify digital behavioral patterns of sadness. According to the study, this method can aid in the PHQ-9 assessment's ability to identify depression.

With the aid of a smartphone app that tracked movement, location, and phone use, the researchers gathered information from the participants. They later used machine learning algorithms to discover digital behavioral patterns connected to depression using this data.
The study's findings demonstrated that utilizing data from smartphones, the machine learning approach could precisely identify depression. The PHQ-9 examination, which is presently the norm for detecting depression, might be supplemented by this strategy in clinical settings, according to the researchers. The paper's overall conclusion emphasizes the potential of employing machine learning to identify depression using unobtrusive smartphone data, which could result in more effective and precise diagnosis and treatment of depression.

7.Adaptation of IDPT system based on patient-authored text data using NLP
By: Suresh Kumar Mukhiya, Usman Ahmed, Fazle Rabbi, Ka I Pun and Yngve Lamo
The research suggests a natural language processing (NLP)-based adaptation of an existing IDPT (Integrative Dynamic Psychotherapy) system that is based on text data created by patients. The objective is to increase the IDPT system's precision and effectiveness in determining the psychological requirements and states of patients.

Using the use of a web-based platform, the researchers gathered text data from patients, which they then analyzed using NLP methods. Based on the data analysis, they created a model to identify psychological states and wants, which was subsequently incorporated into the IDPT system.

The outcomes demonstrated that the modified IDPT technique was more effective than conventional approaches in accurately identifying the psychological states and demands of patients. According to the researchers, utilizing NLP approaches can greatly increase the IDPT system's accuracy and effectiveness, resulting in better patient diagnosis and treatment.

Overall, the research emphasizes the possibility for modifying current psychotherapy systems based on text data created by patients using NLP techniques, resulting in more precise and effective diagnosis and treatment of psychiatric problems.

8.Depression Severity Estimation from Multiple Modalities
By: Evgeny Stepanov, Evgeny Stepanov, Sham Ur Absar Chowdhury, Arind am Ghosh, Radu L.Vieriu,Nicu Sebe and Giuseppe Riccardi
The strategy for evaluating the degree of depression is suggested in the paper by looking at a variety of modalities, such as speech content, vocal tonality, and facial expressions. The objective is to increase the reliability of the diagnosis of depression and offer a more thorough picture of the patient's psychological condition.

The researchers used a variety of sensors, including video and audio recordings, to gather data from the individuals. In order to examine the data and determine the severity of depression, they next utilized machine learning techniques.

The findings demonstrated that using many modalities rather than a single modality increased the accuracy of estimating the degree of depression. The researchers propose that this method might be applied in clinical settings to enhance depression diagnosis and care.

Overall, the study emphasizes the possibility for more precise diagnosis and therapy by utilizing a variety of methods to gauge depression severity.

9.Predicting Depressive Symptoms Using Smartphone Data
By: Shweta Ware,Chaoqun Yuea, Reynaldo Morilloa, Jīn Lua, Chao Shanga, Jinbō Bia, Jayesh Kamath, Alexander Russella, Athanasios Bamisc and Bing wanga

The report presents a meta-analysis study that makes use of machine learning techniques to identify depression using data from the Patient Health Questionnaire-9 (PHQ-9) that was gathered through mobile devices. The objective is to apply machine learning to increase the precision of depression diagnosis and screening.

Using a smartphone app, the researchers gathered PHQ-9 data from participants and then used machine learning algorithms to assess the data. They then evaluated the accuracy of the machine learning models in diagnosing depression.
The study's findings demonstrated that using PHQ-9 data gathered from mobile devices, machine learning models could accurately diagnose depression. According to the researchers, this method might be applied in clinical settings to increase the precision of depression screening and diagnosis.

The paper's main conclusion emphasizes the potential of applying machine learning techniques to identify depression using PHQ-9 data gathered from mobile devices, resulting in more precise and effective depression screening and diagnosis.

10.Mental health tracker
By: Vaishnavi N Jadhav, Manasi S Bhamare,Manasvi U Vengurleka and Vidya S Kubde

The strategy for early depression identification proposed in the research makes use of social media data and machine learning algorithms. By analyzing social media data, the researchers want to increase the effectiveness and accuracy of depression identification.

To find linguistic and emotional patterns related to depression, the researchers gathered information from social media platforms and used machine learning algorithms. Based on the data they had already evaluated, they created a model to identify depression. The outcomes demonstrated that the model was highly accurate and efficient in spotting early-stage depression. The researchers propose that this method might be applied in clinical settings to enhance depression diagnosis and care.

Overall, the paper emphasizes the promise of employing machine learning algorithms to identify depression from social media data, resulting in more effective and precise diagnosis and treatment of depression.

11.Automatic depression score estimation with word embedding models
By: Anxo Pérez,Javier Parapar and Álvaro Barreiro

The approach for automatic depression score estimation using word embedding models is suggested in the paper. Enhancing the effectiveness and precision of depression diagnosis and therapy is the aim.

Using a web-based platform, the researchers gathered data from the users and then used word embedding models to analyze the data. On the basis of the data analysis, they then created a model to estimate depression scores.

The findings demonstrated that the word embedding model was highly accurate at estimating depression scores. The researchers propose that this method might be applied in clinical settings to enhance depression diagnosis and care.

Overall, the paper emphasizes the possibility for automatic depression score estimate using word embedding models, which could result in more effective and precise depression diagnosis and therapy.

12.Screening for Depression in Mobile Devices Using Patient Health Questionnaire-9 (PHQ-9) Data: A Diagnostic Meta-Analysis via Machine Learning Methods
By: Sunhae Kim and Kounseok Lee
The approach for automatic depression score estimation using word embedding models is suggested in the paper. Enhancing the effectiveness and precision of depression diagnosis and therapy is the aim.

Using a web-based platform, the researchers gathered data from the users and then used word embedding models to analyze the data. On the basis of the data analysis, they then created a model to estimate depression scores.

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Overall, the paper emphasizes the possibility for automatic depression score estimate using word embedding models, which could result in more effective and precise depression diagnosis and therapy.

13.Predicting the course of mood and anxiety disorders with automated machine learning: A comparison between auto-sklearn, naïve Bayes classifier, and traditional logistic regression
By: Wessel A. van Eeden a, Chuan Luo b, Albert M. van Hemert a, Ingrid V.E. Carlier, Brenda W. Pennix c, Klaas J. Weidenaar d, Holger Hoos b, Erik J. Giltay a

The strategy for evaluating anxiety, sadness, and stress using machine learning models is suggested in the study. The objective is to increase the precision and effectiveness of assessments of mental health.

A questionnaire was used by the researchers to collect data from the participants, and machine learning techniques were used to analyze the data. Based on the data analysis, they then created models to forecast levels of stress, sadness, and anxiety.

The outcomes demonstrated that the machine learning models were highly accurate at predicting levels of stress, despair, and anxiety. According to the researchers, this method might be applied in clinical settings to increase the effectiveness and precision of mental health assessments.
Overall, the study shows how applying machine learning models to the evaluation of stress, anxiety, and depression could result in more effective and precise mental health assessments.

14.Machine Learning Algorithms for Depression: Diagnosis, Insights, and Research Directions
By: Shumaila Aleem, Noor Ul Huda,Rashid Amin, Samina Khalid, Sultan S.Alshamrani and Abdullah Alshehri

The study offers an overview, perspectives, and future research goals regarding the application of machine learning algorithms for diagnosing depression. The authors want to draw attention to how machine learning could increase the precision and effectiveness of diagnosing and treating depression.

Decision trees, random forests, support vector machines, and deep learning models are just a few of the machine learning techniques covered in this study that are employed in depression research. Additionally, it covers the significance of feature selection and data preprocessing in the study and diagnosis of depression.
The authors also discuss the possible advantages and disadvantages of applying machine learning to the detection and treatment of depression. They make the case that machine learning can increase the precision, effectiveness, and accessibility of diagnosing and treating depression, but they also draw attention to potential ethical and privacy issues.

In its whole, the report demonstrates the promise of machine learning algorithms in the study, diagnosis, and treatment of depression and offers future research options.

15.Machine Learning-based Approach for Depression Detection in Twitter Using Content and Activity Features
By: Hatton AlSagri, Mourad Ykhlef

Using content and activity data, the article suggests a machine learning-based method for identifying sadness on Twitter. The objective is to increase the precision and effectiveness of depression identification using data from social media.

The researchers gathered participant Twitter data and extracted depressive-related content and activity parameters. After analyzing the data using machine learning algorithms, they created a model for identifying depression.
The findings demonstrated that the model, which combined content and activity variables, was highly accurate in identifying depression. According to the researchers, this method could be applied in clinical settings for the early identification and treatment of depression.

The paper's main point is that machine learning algorithms have the ability to identify depression in Twitter data, allowing for more effective and precise diagnosis and treatment of the condition.

16.Psychologically Inspired Music Recommendation System
By: Danila Rozewski, Jie Zhu, Boyuan Zhao

The study suggests a system for recommending music that draws inspiration from psychology. By including psychological variables into the suggestion process, it is hoped to increase the efficiency and user satisfaction of music recommendation systems.

A model was created by the researchers based on psychological traits like personality, musical taste, and mood. The model analyzes user data and produces individualized music recommendations using machine learning methods.
The outcomes demonstrated that in terms of user pleasure and efficiency, the psychologically inspired music recommendation system outperformed conventional music recommendation systems. To increase user involvement and pleasure, the researchers propose implementing this strategy in commercial music recommendation systems.

The research emphasizes the potential for enhancing the efficiency and user experience of music recommendation systems by adding psychological elements.

17.Assessment of Anxiety,Depression and Stress using Machine Learning Models
By: Prince Kumara, Shruti Garga*, Ashwani Gargb
The paper proposes the use of machine learning models for assessing anxiety, depression, and stress. The researchers collected data from participants using a questionnaire and analyzed the data using machine learning algorithms. The study evaluated the performance of various machine learning algorithms, including decision trees, support vector machines, and artificial neural networks, for predicting anxiety, depression, and stress. The results showed that the models achieved high accuracy

in predicting anxiety, depression, and stress. The researchers suggest that machine learning models can be used as an effective tool for assessing mental health conditions and developing personalized treatment plans. They also highlight the potential of machine learning for improving the efficiency and accuracy of mental health assessments. Overall, the paper highlights the potential of machine learning models in the assessment of anxiety, depression, and stress, leading to more accurate and personalized treatment plans for individuals with mental health conditions.

18.Depression detection using emotional artificial intelligence and machine learning: A closer review
By: Manju Lata Joshi, Nehal Kanoongo
The paper reviews the use of emotional artificial intelligence and machine learning for depression detection. The researchers provide a comprehensive overview of the current state of research in this area and discuss the potential of these technologies in improving depression detection. The paper highlights the importance of early detection of depression and the limitations of current methods. The researchers discuss the potential of emotional artificial intelligence and machine learning in addressing these limitations and improving the accuracy and efficiency of depression detection. The researchers also provide a detailed review of the different approaches and techniques used in emotional artificial intelligence and machine learning for depression detection, including facial expression analysis, speech analysis, and text analysis.
Overall, the paper provides a valuable review of the potential of emotional artificial intelligence and machine learning for depression detection, highlighting the need for further research in this area to develop more accurate and effective methods for detecting depression.

19.Classification of Anxiety Disorders using Machine Learning Methods: A Literature Review
By: Muhammad Arif, Ashjan Basri, Ghufran Melibari, Taghreed Sindi, Nada Alghamdi,Nada Altalhi and Maryam Arif

The paper provides a literature review of the use of machine learning methods for classifying anxiety disorders. The researchers discuss the prevalence and impact of anxiety disorders and the limitations of current diagnostic methods. The paper reviews different machine learning methods used in the classification of anxiety disorders, including support vector machines, decision trees, and artificial neural networks. The researchers provide an overview of the different data sources used in these studies, such as clinical interviews, self-report measures, and physiological data. The paper highlights the potential of machine learning in improving the accuracy and efficiency of anxiety disorder diagnosis and treatment. The researchers also identify some of the challenges and limitations of current research, including small sample sizes, lack of standardized diagnostic criteria, and potential biases in data collection. Overall, the paper provides a comprehensive review of the current state of research on the use of machine learning methods for classifying anxiety disorders, highlighting the potential of these methods in improving diagnosis and treatment.

20.Machine Learning-Based Behavioral Diagnostic Tools for Depression: Advances, Challenges, and Future Directions
By: Thalia Richter, Barak Fishbain,Gal Richter-Levin and Hadas Okon-Singer

The paper provides a literature review of the use of machine learning methods for classifying anxiety disorders. The researchers discuss the prevalence and impact of anxiety disorders and the limitations of current diagnostic methods. The paper reviews different machine learning methods used in the classification of anxiety disorders, including support vector machines, decision trees, and artificial neural networks. The researchers provide an overview of the different data sources used in these studies, such as clinical interviews, self-report measures, and physiological data. The paper highlights the potential of machine learning in improving the accuracy and efficiency of anxiety disorder diagnosis and treatment. The researchers also identify some of the challenges and limitations of current research, including small sample sizes, lack of standardized diagnostic criteria, and potential biases in data collection.
Overall, the paper provides a comprehensive review of the current state of research on the use of machine learning methods for classifying anxiety disorders, highlighting the potential of these methods in improving diagnosis and treatment.

21.Using machine learning-based analysis for behavioral differentiation between anxiety and depression
By: Thalia Richter, Barak Fishbain, Andrey Markus, Gal Richter-Levin & Hadas Okon-Singe
The study, which employs machine learning-based analysis to distinguish between anxiety and depression based on behavioral patterns, is described in the report. The researchers stress the need of correctly distinguishing between these two illnesses because they have different underlying processes and call for various therapeutic modalities.
Using a smartphone app, the study involves gathering behavioral data from people who had anxiety or depression. Machine learning techniques were used to examine the data in order to find trends and characteristics that could distinguish between the two illnesses.
The study's findings demonstrated that using behavioral patterns, machine learning-based analysis could distinguish between anxiety and depression with accuracy. The researchers observed distinct characteristics that were more pronounced in one illness than the other, such as social activity and mobility.The study shows that machine learning-based analysis has the potential to increase the precision of separating anxiety from depression. According to the researchers, this method might be applied in clinical settings to help with diagnosis and treatment decision-making.

22.Level of Depression of College Students with Binary Logistic Regression Model Approximation in Covid-19 times
By: Yersi-Luis Huamán-Romani, Edwin Roque-Tito, Luis Bautista-Lopezm arco-Dennis Gutiérrez-Aguilar

The study, which uses a binary logistic regression model to estimate depression levels among college students during the COVID-19 epidemic, is discussed in the paper. The researchers stress the necessity for appropriate assessment and support as well as the detrimental effects of the epidemic on mental health.

A self-administered questionnaire used in the study to measure depression levels was used to gather information from college students in Peru. To find factors that were significantly linked with depression, the data was evaluated using a binary logistic regression model.

According to the study's findings, a number of variables, including gender, living circumstances, and academic standing, were strong indicators of depression among college students during the COVID-19 epidemic. The amount of depression might be approximated with high accuracy using the logistic regression model.
Overall, the study suggests that a binary logistic regression model can be an effective tool for approximating the level of depression among college students during the COVID-19 pandemic. The researchers suggest that this approach could be used in other settings to improve the accuracy of depression assessment and support.

23.MonDep App: Monitoring patients with depression using sentiment analysis of therapeutic diary entries
By: Andrés Cárcamo,Franco Kemper, David Mauricio

The MonDep app is a mobile application designed to monitor patients with depression using sentiment analysis of therapeutic diary entries. The app allows patients to record their thoughts and feelings in a digital diary, which is then analyzed using sentiment analysis algorithms to identify patterns and trends in the patient's mental state. The paper describes the development and implementation of the MonDep app, including the use of natural language processing techniques and machine learning algorithms to analyze the diary entries. The app was evaluated in a pilot study involving patients with depression, and the results showed that the app was effective in identifying changes in the patient's mental state over time. The paper also discusses the potential benefits of using the MonDep app for monitoring patients with depression, including the ability to provide timely interventions and support. The app could also be used to improve the accuracy of depression diagnosis and to personalize treatment plans based on the patient's individual needs and preferences. Overall, the MonDep app represents a promising approach to using mobile technology and machine learning algorithms for depression monitoring and support. The app has the potential to improve the quality of care for patients with depression and to reduce the burden on healthcare providers by providing more personalized and efficient monitoring and support.

24.Depression Diagnosis and Forecast based on Mobile Phone Sensor Data
By: Xingheng HendreesTriantafyllopoulos, Alexander Kathan, Manuel Milling,Tianhao Yang, Srividya Tirunellai Rajamani, Ludwig Küster

The study describes a machine learning-based method for identifying and predicting depression using sensor data from mobile phones. The authors classified depression severity levels and predicted upcoming depressive episodes using sensor data from participants' mobile phones and a variety of machine learning techniques. The study provided encouraging evidence that mobile phone sensor data might be used to identify and predict depression.

25.Automatic prediction of Depression and Anxiety from behavior and personality attributes

By: Michel Valstar,Siyang Song, Shashank Jaiswal
The study proposes a machine learning-based method for automatically predicting levels of anxiety and depression based on traits of behavior. Together with self-reported personality qualities, the authors also gathered information on participant actions, including facial expressions, body language, and vocalizations. They successfully predicted sadness and anxiety levels using a variety of machine learning methods. The study provided encouraging evidence that behavior and personality traits might be used to predict sadness and anxiety automatically.

26.Psychologically Inspired Music Recommendation System
By: Danila Rozhevskii, Jie Zhu, Boyuan Zhao

This study suggests a psychologically based music recommendation system that considers user preferences and emotional states. In order to train a machine learning model that can predict a user's emotional response to a specific piece of music, the authors first define a set of emotion-related music features. Then, based on the user's emotional state and musical preferences, the system makes music recommendations. According to the study, the suggested approach performs better in terms of accuracy and user satisfaction than alternative recommendation systems.

27.Three-year prediction of depression and anxiety with a single self-rated health item
By: David Ostberg, Steven Nordin
The paper offers a study that looks at the association between three-year development of anxiety and depression and self-rated health. The scientists discovered that a single self-rated health item may be used to forecast the emergence of depression and anxiety in the future using information from a sizable population-based study in Sweden. They also determined that the self-rated health item's prediction accuracy was equivalent to that of other widely used screening methods. According to the authors, their findings may help in the creation of new, more effective depression and anxiety screening instruments.

28.Anxious Depression prediction in real-time social data
By: Akshi Kumar, Aditi Sharma, Anshika Arora
The study offers a framework for anticipating anxious depression using Twitter's real-time social data. The study uses feature engineering approaches and a variety of machine learning algorithms to extract pertinent characteristics from Twitter data and build predictive models. The suggested paradigm predicts anxious depression with encouraging findings, demonstrating the potential of social media as a tool for monitoring and treating mental illness.

29.Predicting anxiety depression and stress levels from videos using facial action coding system
By: Mihai gavrilescu, Nicolae vizireanu

The Facial Action Coding System (FACS) and machine learning algorithms are used in this work to offer a method for predicting anxiety, sadness, and stress levels based on facial expressions retrieved from films. The study's high accuracy rate for predicting the three mental health problems was based on a dataset of 160 movies. The suggested approach may be used for early identification and treatment of certain mental health issues.

CHAPTER 3

PROBLEM DEFINITION

Mental health is a growing concern worldwide as more and more people are experiencing mental health challenges that negatively impact their daily lives. Despite significant advances in understanding and treating mental health conditions, a significant number of individuals do not receive adequate support or treatment due to lack of resources, stigma, and limited access to mental health care services. This results in a negative impact on individuals' quality of life, productivity, and well-being, as well as significant social and economic costs. Thus, there is an urgent need to address mental health challenges and improve access to mental health care services to ensure better mental health outcomes for all individuals.

Motivation:

The growing mental health challenges faced by individuals worldwide and the significant negative impact they have on their daily lives, productivity, and well-being motivate the need for urgent action to address this issue. Despite significant advances in mental health understanding and treatment, limited access to mental health care services, stigma, and lack of resources continue to prevent individuals from receiving adequate support and treatment. By improving access to mental health care services, we can promote better mental health outcomes for individuals and society as a whole, leading to improved quality of life and reduced social and economic costs.

CHAPTER 4

SYSTEM REQUIREMENTS SPECIFICATION

Hardware Requirements: -

Strongly recommend a computer less than 5 years old.
• Processor: Minimum 1 GHz, Recommended 2GHz or more.
• Ethernet connection (LAN): LAN cable or a wireless adapter (Wi-Fi).
• Hard Drive: Minimum 16 GB, Recommended 32 GB or more.
• Memory (RAM): Minimum 1 GB, Recommended 4 GB or above.
Mobile Phones and other digital viewable devices are also compatible.

Software Requirements: -

People often ask what browser they should use. There is no single answer for this. Use whichever browser works best on your computer. However, we recommend downloading Brave and/or Chrome in addition to having Firefox, Internet Explorer or Safari.

- Browser
- Visual studio code or any other IDE
- Xampp
- PHP
- MySQL
- HTML, CSS, JAVASCRIPT

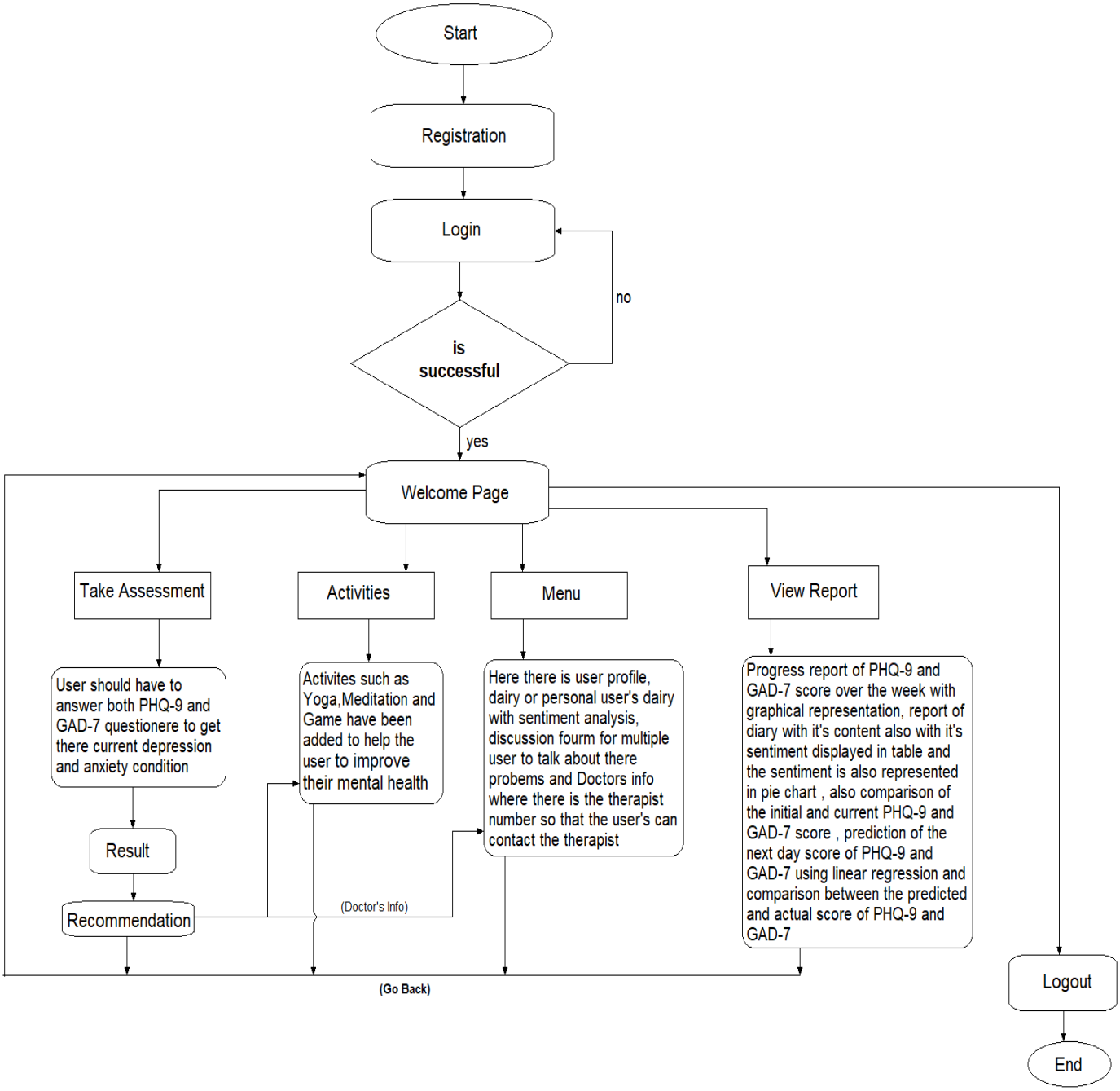
CHAPTER 5

SYSTEM DESIGN

The website offers a step-by-step guide on how to use the platform, starting with a login page for registered users and a sign-up option for new users. The website then proceeds to ask the user a series of questions to identify their current mental state and mood, which is then used to generate a report for the user. The website also provides a graph to help the user track their progress over time. Based on the report, the website suggests various activities to improve the user's mental health. In addition, the website also provides contact details for psychologists if the user requires professional help. The user interface of the website is designed to be user-friendly and easy to understand, making it easy for users to navigate the platform. By using questionnaires to predict the user's mental health, the website provides a comprehensive view of the user's emotional state and assigns tasks to help improve their mental health.

HTML, CSS, and JavaScript:
This website was created with HTML, CSS, and JavaScript to offer a responsive and user-friendly experience. Interactive surveys, custom dashboards, and other elements that improve user experience .

Login feature:
Users can create an account on the website and save their questionnaire responses and severity scores by using the login option. On the basis of their prior survey findings, this function can also offer users a future prediction of their level of anxiety and depression.



PHP-based backend:
The server-side code that runs the website is written in PHP. The PHQ and GAD questionnaire responses can be processed to provide severity scores using this backend, which can also manage user authentication, store user data, and generate tailored suggestions based on the user's results.

PHQ and GAD questionnaires:
Standardized screening instruments for determining the severity of mental health problems including depression and anxiety include the PHQ and GAD questionnaires.

These surveys can be found on the website as a series of questions that visitors can respond to.

Severity score generation:
The PHP backend can process the results and produce severity scores for each condition once the user has finished the PHQ and GAD questionnaires. The user's mental health disorders can be categorized as mild, moderate, or severe using the severity scores.

Recommendation:
The website has the option to provide the user with tailored recommendations based on the severity scores obtained from the PHQ and GAD questionnaires. Depending on the severity of the user, these recommendations may include coping mechanisms, relaxation exercises, meditation, and other self-help practices like small mind games and yoga.

Contact doctor feature:
Users of the website also have access to a contact doctor function that enables them to get in touch with a mental health expert for further help and direction. A listing of local mental health specialists with their contact details and availability is a part of this service.

CHAPTER 6

METHODOLOGY

PHQ(Patient Health Questionnaire)

It is referred to as a Patient Health Questionnaire(PHQ) and it is a series of questions that the user needs to answer to determine the mental health of the user. It has 9 questions, which are used to gauge the severity of depression and for other purposes.

Depression treatment Patients are given the opportunity to respond to these questions, based on the previous two weeks on a range of 0 to 3, and scores ranging from 0 to 27 are calculated based on the scale. If the score is high, the severity level is severe, and the patients are treated in accordance with the severity level. In this way, we can monitor the user's mental health and treat it over time. This is primarily used to evaluate depression.

GAD(Generalized Anxiety Disorder)

Generalized Anxiety Disorder(GAD) has a set of seven questions that the patient must respond to. It has seven questions, and these are intended to evaluate the patient's level of anxiousness severity. This concentrates on symptoms like excessive worry, excessive worry, restlessness, etc. These symptoms have been scored on a scale of 0 to 3 over the past two weeks, with scores ranging from 0 to 27. If a score is high, the severity level is likely to be high. This is primarily employed in anxiety assessment.

SENTIMENT ANALYSIS OF TEXT

Another strategy we employ is analyzing the patient's text diaries in order to determine how the patient feels about themselves. Here, we are performing sentiment analysis and computing the sentiment score, which is then used to determine the patient's severity level and the appropriate course of treatment.

LINEAR REGRESSION

The relationship between a dependent variable and one or more independent variables can be modeled statistically using linear regression. It employs a line to illustrate the relationship between the variables, presuming that it is linear. By reducing the difference between the dependent variable's actual values and its anticipated values, the line is fitted to the data. To find patterns in data, create predictions, and test theories about the relationships between variables, utilize linear regression. It is a widely used technique to comprehend and forecast the behavior of complex systems in a variety of disciplines, including economics, psychology, and medicine.

CHAPTER 7

IMPLEMENTATION

Collection of Data

Standardized questionnaires for screening for depression and anxiety are the PHQ-9 (Patient Health Questionnaire) and GAD-7 (Generalized Anxiety Disorder-7) are shown in the images 1(a) and 1(b) below which our user is recommended to take on a regular basis.

fig 7.1

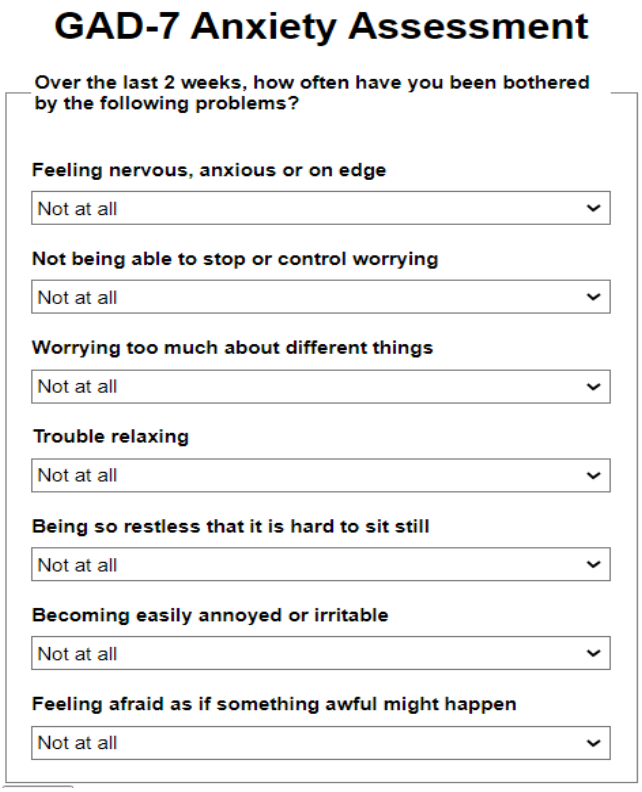


fig 7.2

The figure 7.1 and 7.2 show the questionnaire the user has to take so that his/her depression and anxiety level can be calculated and displayed in the result page as shown in image 7.3.

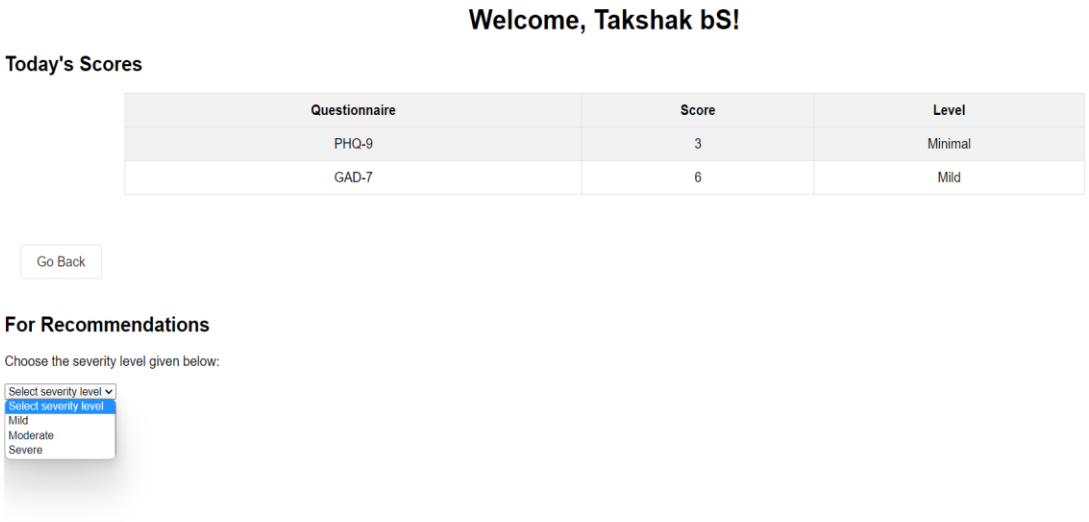


fig 7.3

In the above figure 7.3 it shows the result page of the assessment taken by the user where the PHQ-9 and GAD-7 scores are displayed along with their severity level and below we have the Recommendations section on the result page that provides users with helpful suggestions based on their severity level. These recommendations may include self-care strategies, lifestyle changes, or suggestions to seek professional help. It is important to note that these recommendations are general in nature and may not be appropriate for everyone. Users should always consult with a healthcare

professional before making any significant changes to their lifestyle or seeking treatment.

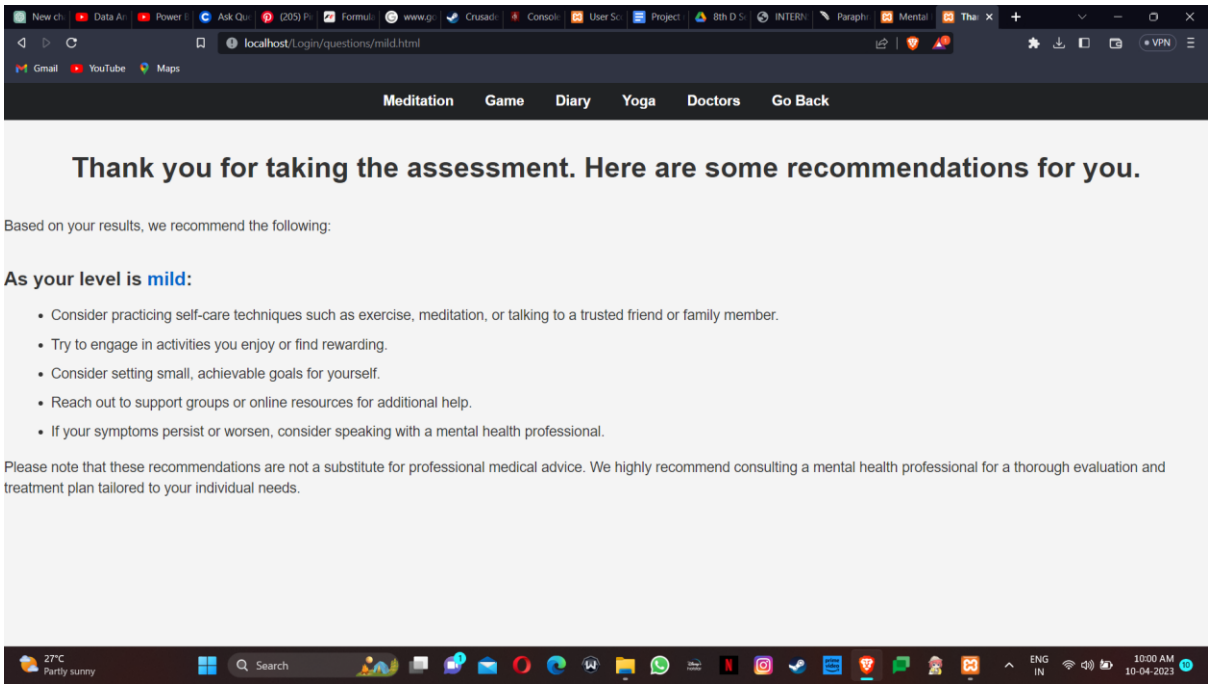


fig 7.4

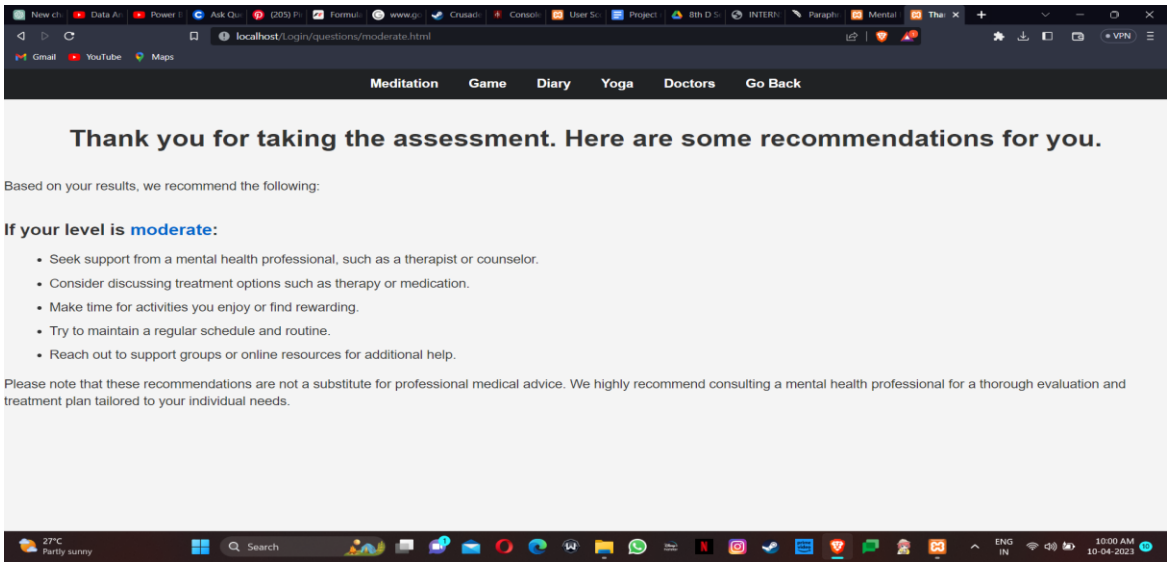


fig 7.5

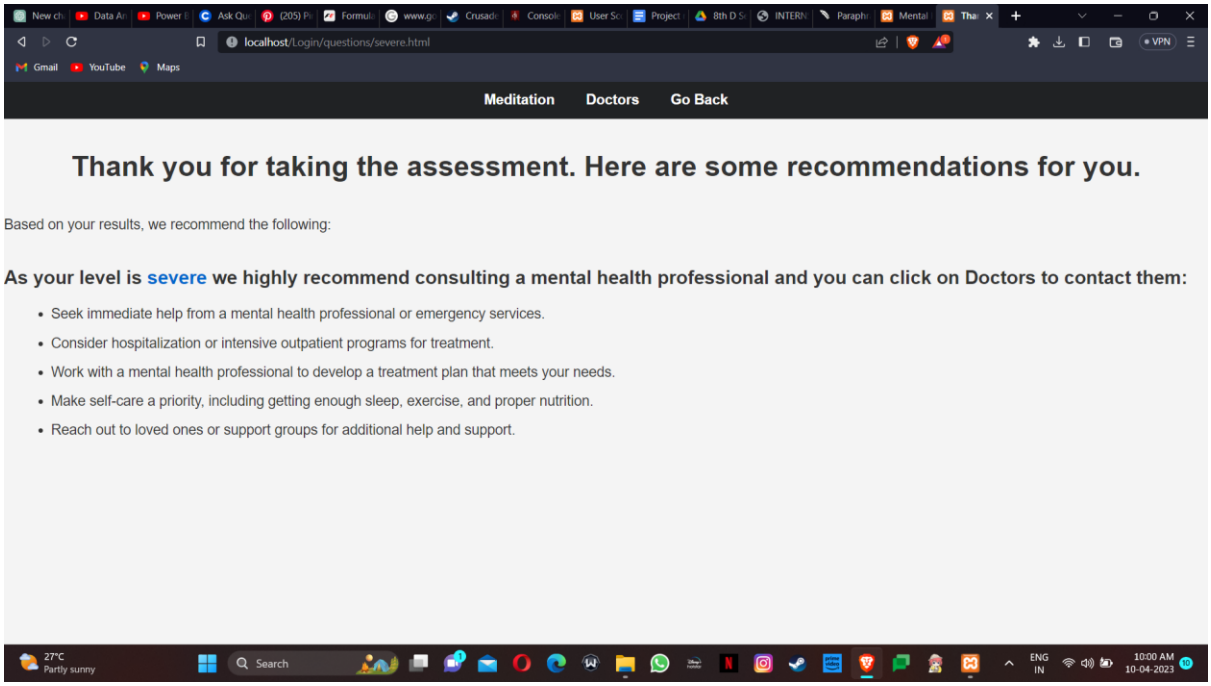


fig 7.6

The figures 7.4, 7.5 and 7.6 show our recommendation pages for the following severity levels mild , moderate and severe. For the three severity levels we have given some recommendations which vary according to severity level. Also we have specified to contact the doctors for more proper care and have given doctors contact as we can see in the figure 7.13 given below.

Meditation

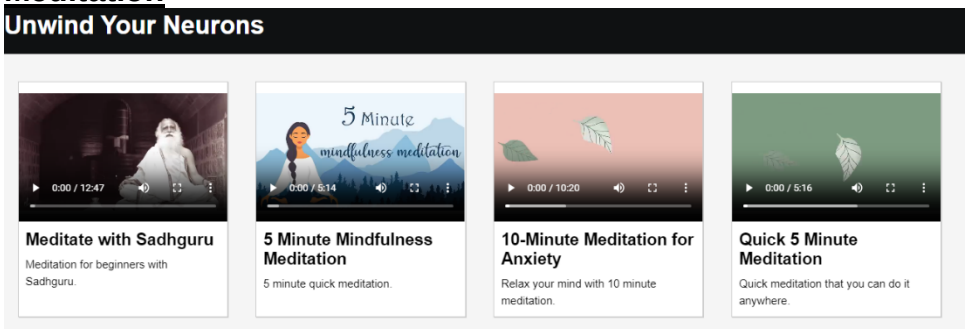


fig 7.7

Yoga

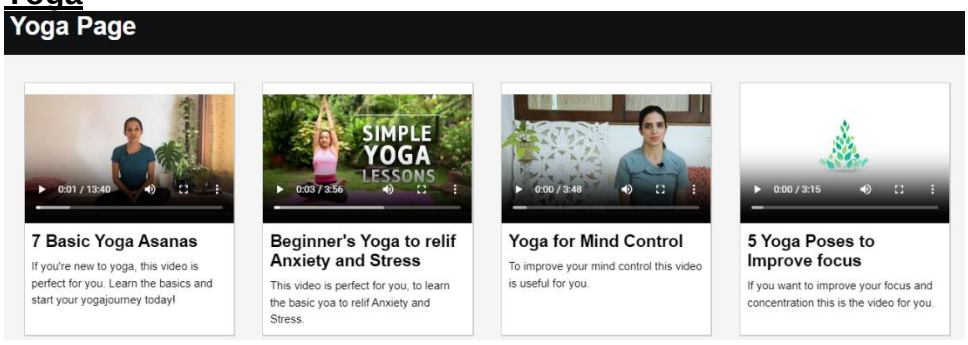


fig 7.8

The figures 7.7 and 7.8 show the Yoga and Meditation page where four videos have been added for the user to see and start his journey in yoga and meditation and try to increase his mental strength.

Games:

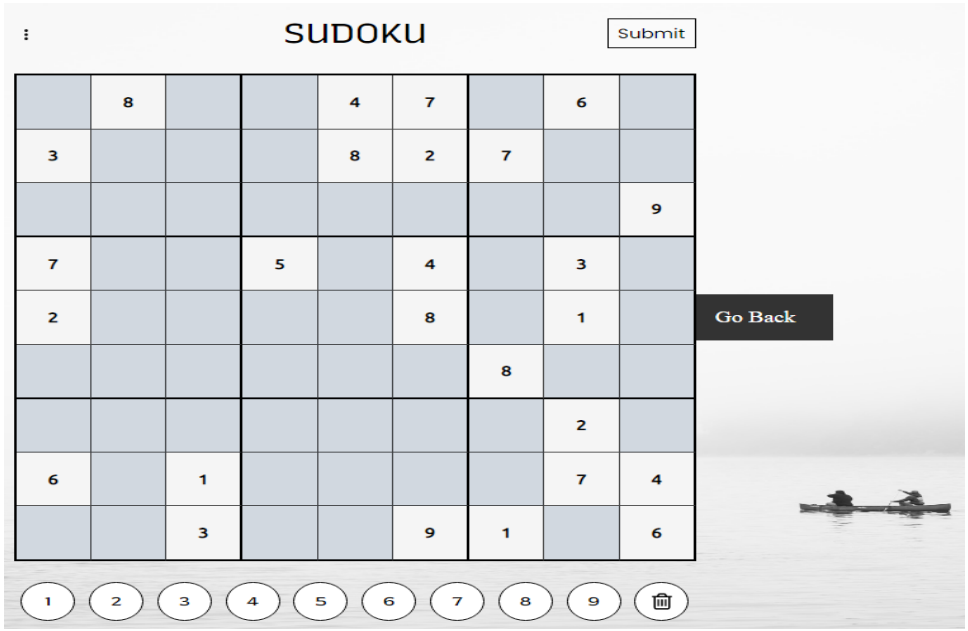


fig 7.9

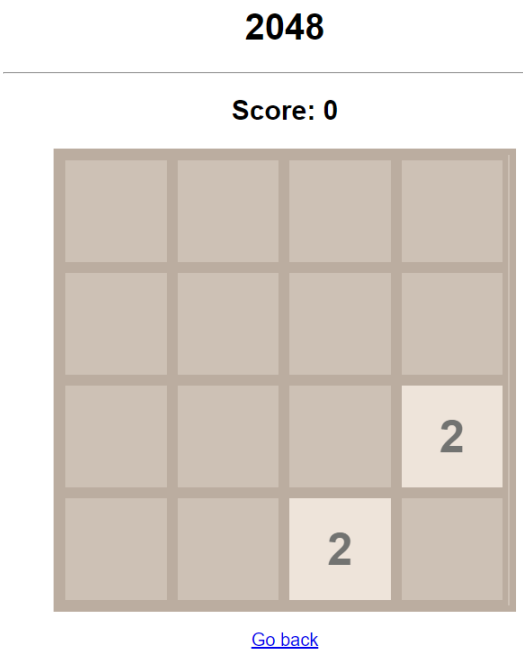


fig 7.10

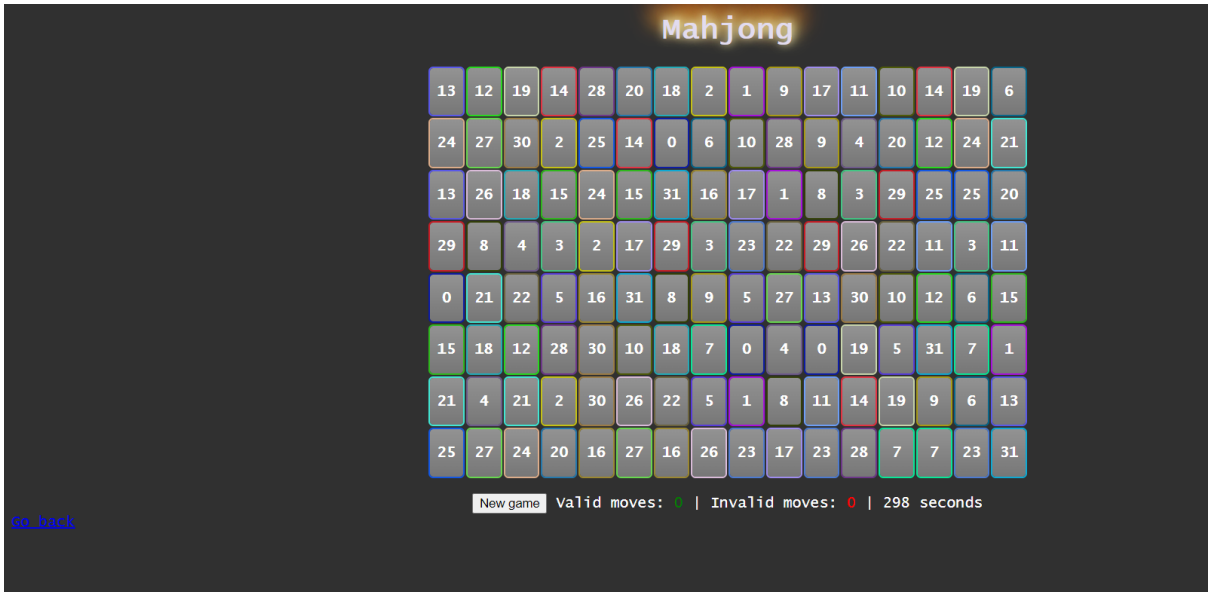


fig 7.11

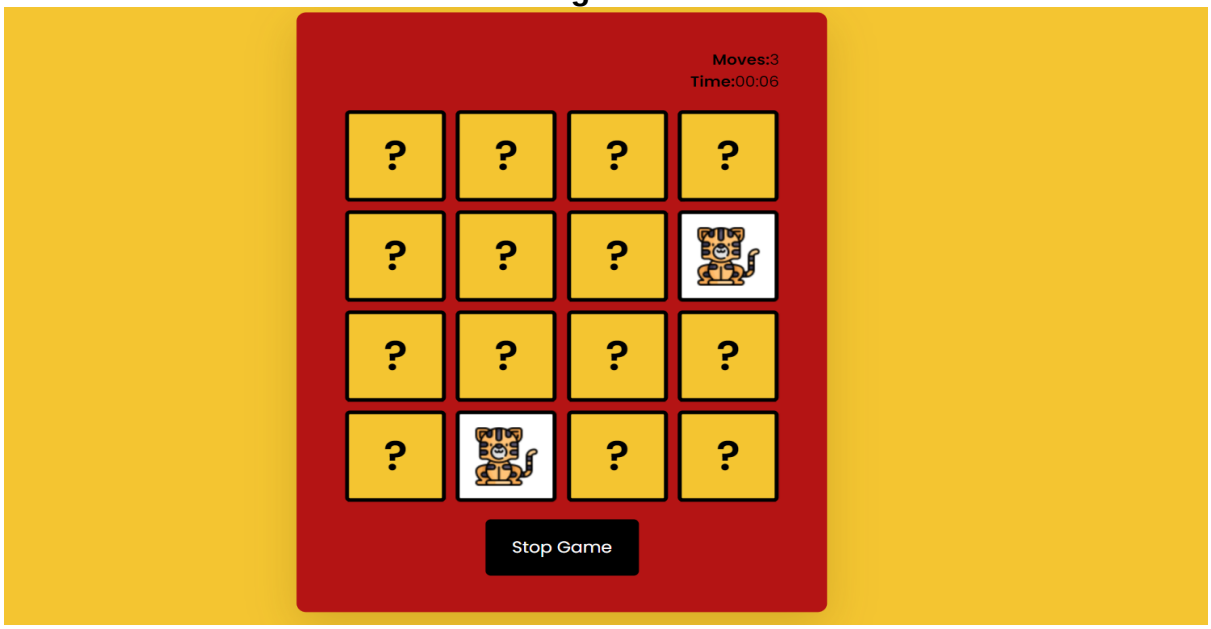


fig 7.12

The figures 7.9, 7.10, 7.11 and 7.12 are the games that have been added to make the user feel relaxed and to help them to improve their mental health.

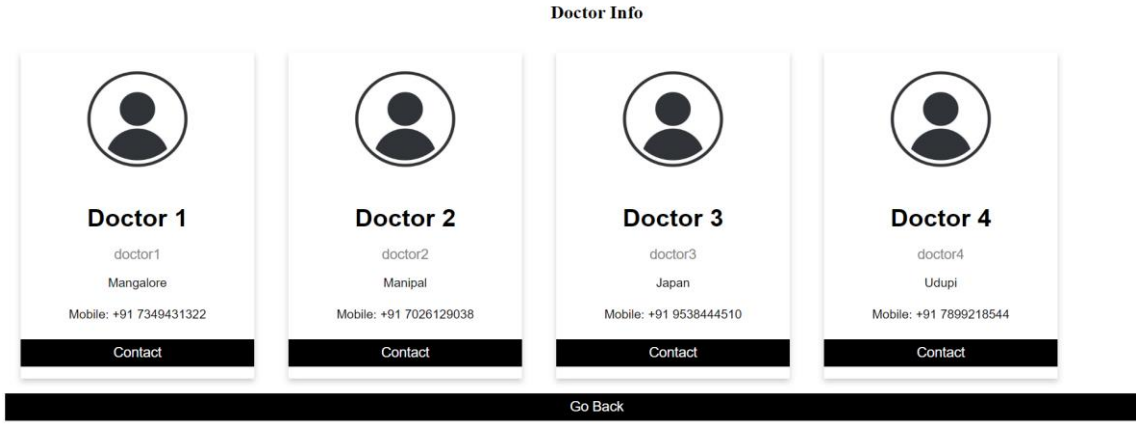


fig 7.12

Prediction of PHQ, GAD score of future using Linear Regression:

```
import mysql.connector
import csv
import warnings
from mysql.connector import Error
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error

# Suppress warning messages
warnings.filterwarnings("ignore")

# PHQ-9 Severity Level Mapping
def get_phq_severity(score):
    if score < 5:
        return "Minimal severity level"
    elif score < 10:
        return "Mild severity level"
    elif score < 15:
        return "Moderate severity level"
    else:
        return "Severe level"

# establish a database connection
try:
    conn = mysql.connector.connect(
        host='localhost',
        database='project',
        user='root',
        password=''
    )
    if conn.is_connected():
        user_id = 1  # define the user_id here

        # retrieve the name from the user_form table based on the user_id
        stmt = conn.cursor()
        stmt.execute("SELECT name FROM user_form WHERE id = %s", (user_id,))
        username = stmt.fetchone()[0]
        stmt.close()
        # Load the dataset from the CSV file
        dataset = pd.read_csv('scores.csv')

        # Filter the dataset based on the username
        user_dataset = dataset[dataset['Name'] == username]
        # Retrieve the last 7 entries from the dataset
        user_dataset_last_7 = user_dataset.tail(7)
        # Extract the relevant features and target variable
        features = user_dataset_last_7[['Score', 'Gender', 'Age', 'Employment Status', 'Relation Status']]
        target = user_dataset_last_7['Score']

        # Convert categorical features into numerical using one-hot encoding
        features_encoded = pd.get_dummies(features)

        # Retrieve the feature names after one-hot encoding
        feature_names = features_encoded.columns.tolist()

        # Split the data into train and test sets
        X_train, X_test, y_train, y_test = train_test_split(features_encoded, target, test_size=0.2, random_state=42)

        # Initialize the Linear Regression model
        model = LinearRegression()

        # Fit the model on the training data
        model.fit(X_train, y_train)

        # Predict the next PHQ-9 score using the test set
        next_score = model.predict(X_test.iloc[-1:].values)

        # Convert the predicted score to an integer value
        next_score = int(np.round(next_score[0]))

        # Get the actual next score from the dataset
        actual_score = y_test.iloc[-1]
        # Map the predicted score to severity level
        predicted_severity = get_phq_severity(next_score)

        print(f"Predicted next PHQ score for {username} is:", next_score,predicted_severity)
```

```
        print("Actual Next PHQ-9 Score:", actual_score)

        # Calculate the prediction accuracy (RMSE)
        rmse = np.sqrt(mean_squared_error([actual_score], [next_score]))
        print("Prediction Accuracy (RMSE):", rmse)

        # Store the predicted score, username, and severity level in a CSV file
        predicted_data = pd.DataFrame({'Username': [username], 'Predicted_PHQ_Score': [next_score], 'Severity_Level': [predicted_severity]})
        predicted_data.to_csv('predicted_phq_score.csv', index=False)



        dataset = pd.read_csv('gad_scores.csv')
        # Filter the dataset based on the username
        user_dataset = dataset[dataset['Name'] == username]
        # Retrieve the last 7 entries from the dataset
        user_dataset_last_7 = user_dataset.tail(7)
        # Extract the relevant features and target variable
        features = user_dataset_last_7[['Score', 'Gender', 'Age', 'Employment Status', 'Relation Status']]
        target = user_dataset_last_7['Score']

        # Convert categorical features into numerical using one-hot encoding
        features_encoded = pd.get_dummies(features)

        # Retrieve the feature names after one-hot encoding
        feature_names = features_encoded.columns.tolist()

        # Split the data into train and test sets
        X_train, X_test, y_train, y_test = train_test_split(features_encoded, target, test_size=0.2, random_state=42)

        # Initialize the Linear Regression model
        model = LinearRegression()

        # Fit the model on the training data
        model.fit(X_train, y_train)

        # Predict the next PHQ-9 score using the test set
        next_score = model.predict(X_test.iloc[-1:].values)
```

```
        # Convert the predicted score to an integer value
        next_score = int(np.round(next_score[0]))

        # Get the actual next score from the dataset
        actual_score = y_test.iloc[-1]

        # Map the predicted score to severity level
        predicted_severity = get_phq_severity(next_score)

        print(f"Predicted next GAD score for {username} is:", next_score,predicted_severity)
        print("Actual Next GAD-7 Score:", actual_score)

        # Calculate the prediction accuracy (RMSE)
        rmse = np.sqrt(mean_squared_error([actual_score], [next_score]))
        print("Prediction Accuracy of GAD(RMSE):", rmse)

        # Store the predicted score, username, and severity level in a CSV file
        predicted_data = pd.DataFrame({'Username': [username], 'Predicted_GAD_Score': [next_score], 'Severity_Level': [predicted_severity]})
        predicted_data.to_csv('predicted_gad_score.csv', index=False)

except Error as e:
    print("Error connecting to the database:", str(e))
```

The PHQ-9 (Patient Health Questionnaire-9) and GAD-7 (Generalized Anxiety Disorder-7) scores for a particular user are predicted using linear regression analysis in this code. Based on the supplied user ID, it creates a connection to a MySQL database and retrieves the user's name from the database. The algorithm then loads two datasets including PHQ-9 and GAD-7 historical assessment results. These datasets are filtered to exclude the user's scores and pertinent information from the previous seven evaluations, such as gender, age, employment position, and marital status. One-hot encoding is used to translate the category information into numerical values. Training and test sets have been created from the dataset.

The training data are used to initialize and train a linear regression model. Based on the test set and the trained model, the code forecasts the user's upcoming PHQ-9 and GAD-7 scores. The function 'get_phq_severity' maps the projected scores to various severity levels. The Root Mean Squared Error is used by the code to determine the forecast accuracy. The projected scores are then saved in separate CSV files along with the user's name and severity levels.
Overall, this code makes use of historical assessment information to create a regression model that forecasts a user's future PHQ-9 and GAD-7 scores. It assesses the prediction accuracy and offers insights into the projected scores' severity levels.

Diary sentiment analysis

```
import pandas as pd
from textblob import TextBlob

# Load the CSV file into a Pandas DataFrame
diary = pd.read_csv('diary.csv')

# Use the TextBlob library to perform sentiment analysis on each row in the DataFrame
diary['Sentiment'] = diary['Content'].apply(lambda text: TextBlob(text).sentiment.polarity)

# Classify the sentiment as positive, negative, or neutral based on the polarity score
diary['Sentiment'] = diary['Sentiment'].apply(lambda score: 'positive' if score > 0 else 'negative' if score < 0 else 'neutral')

# Save the updated DataFrame to a CSV file
diary.to_csv('diary.csv', index=False)
```

The code reads in a CSV file called 'diary.csv' using Pandas and performs sentiment analysis on each row of text in the DataFrame using TextBlob. It then classifies the sentiment as positive, negative, or neutral based on the polarity score, and saves the updated DataFrame back to the same 'diary.csv' file.

PHQ and GAD score comparison

```
<!DOCTYPE html>
<html>
<head>
    <title>User Scores</title>
    <style>
        /* Style for the body */
        body {
            background-color: #f2f2f2;
            font-family: Arial, sans-serif;
            font-size: 16px;
            line-height: 1.5;
            margin: 0;
        }

        /* Style for the container */
        .container {
            max-width: 800px;
            margin: 0 auto;
            padding: 20px;
            background-color: #fff;
            border: 1px solid #ccc;
            box-shadow: 0 0 10px rgba(0, 0, 0, 0.2);
        }

        /* Style for the table */
        table {
            border-collapse: collapse;
            width: 100%;
            margin-top: 20px;
            margin-bottom: 40px;
        }

        /* Style for the table header */
        th {
            background-color: #4CAF50;
            color: #fff;
            font-weight: bold;
            text-align: left;
            padding: 12px;
            border: 1px solid #ccc;
```

```
        }

        /* Style for the table rows */
        tr:nth-child(even) {
            background-color: #f2f2f2;
        }

        /* Style for the table data */
        td {
            padding: 12px;
            border: 1px solid #ccc;
        }

        /* Style for the table data links */
        td a {
            color: #0070c0;
            text-decoration: none;
        }

        /* Style for the table data links on hover */
        td a:hover {
            text-decoration: underline;
        }

        /* Style for the table data score cells */
        .score {
            font-weight: bold;
            color: #008000;
        }

        /* Style for the table data username cells */
        .username {
            font-weight: bold;
        }

        /* Style for the table data rank cells */
        .rank {
            font-weight: bold;
            color: #a9a9a9;
        }
```

```
        /* Style for the table data date cells */
        .date {
            font-style: italic;
            color: #a9a9a9;
        }
    </style>
</head>
<body>
    <div class="container">
        <h1>User Scores</h1>
        <?php
error_reporting(0);
// include the config file
include_once(__DIR__ . '/../config.php');
// start the session
session_start();

// check if the user is logged in
if(!isset($_SESSION['user_id'])){
   // if not logged in, redirect to the login page
   header('location:login.php');
   exit(); // terminate script execution
}

// get the user ID and name from the session
$user_id = $_SESSION['user_id'];

// fetch the user's name from the database
$stmt = mysqli_prepare($conn, "SELECT name FROM `user_form` WHERE id = ?");
mysqli_stmt_bind_param($stmt, "i", $user_id);
mysqli_stmt_execute($stmt);
mysqli_stmt_bind_result($stmt, $name_from_db);
mysqli_stmt_fetch($stmt);
mysqli_stmt_close($stmt);

// read the scores from the scores.csv file
$scores = [];
if (($handle = fopen("scores.csv", "r")) !== false) {
    while (($data = fgetcsv($handle, 1000, ",")) !== false) {
        if ($data[1] == $name_from_db) {
            $scores[] = $data[2];
```

```
        }
    }
    fclose($handle);
}

if ($scores) {
    $actual_score = end($scores);
    // read the predicted score from the predicted_phq_score.csv file
    $predicted_score_file = file("predicted_phq_score.csv");
    $predicted_score = end($predicted_score_file);
    // check if the name in the predicted_phq_score.csv file matches the name in the scores.csv file
    $predicted_score_arr = str_getcsv($predicted_score);
    if ($predicted_score_arr[0] == $name_from_db) {
        $predicted_score_value = $predicted_score_arr[1];
        // display the actual score and predicted score
        echo "PHQ Scores Comaprision for $name_from_db:<br>";
        echo "Actual PHQ Score : $actual_score<br>";
        echo "Predicted PHQ Score : $predicted_score_value<br><br>";
    } else {
        echo "Error: Name in predicted_phq_score.csv does not match name in scores.csv";
    }
} else {
    echo "No scores found for $name_from_db";
}

$scores = [];
if (($handle = fopen("gad_scores.csv", "r")) !== false) {
    while (($data = fgetcsv($handle, 1000, ",")) !== false) {
        if ($data[1] == $name_from_db) {
            $scores[] = $data[2];
        }
    }
    fclose($handle);
}

if ($scores) {
    $actual_score = end($scores);
    // read the predicted score from the predicted_phq_score.csv file
    $predicted_score_file = file("predicted_gad_score.csv");
    $predicted_score = end($predicted_score_file);
    // check if the name in the predicted_phq_score.csv file matches the name in the scores.csv file
    $predicted_score_arr = str_getcsv($predicted_score);
    if ($predicted_score_arr[0] == $name_from_db) {
        $predicted_score_value = $predicted_score_arr[1];
        // display the actual score and predicted score
        echo "GAD Scores Comaprision for $name_from_db:<br>";
        echo "Actual GAD Score : $actual_score<br>";
        echo "Predicted GAD Score : $predicted_score_value<br><br>";
    } else {
        echo "Error: Name in predicted_phq_score.csv does not match name in scores.csv";
    }
} else {
    echo "No scores found for $name_from_db";
}

?>
    </div>
</body>
</html>
```

The above code is a PHP script that retrieves scores from two separate CSV files and displays them in a table. The script starts by checking if the user is logged in and then proceeds to read the user's name from the session and fetches it from the database. It then reads scores from two CSV files named scores.csv and gad_scores.csv. The scores are matched to the user's name, and the last score value is extracted. The script then reads the predicted scores from two separate CSV files named predicted_phq_score.csv and predicted_gad_score.csv respectively, and checks if the predicted scores match the user's name. If they do match, the actual and predicted scores are displayed in a formatted table. The table has several CSS styles applied to it, such as font size, font weight, background color, border, and text alignment.

PHQ progress report code:

```
<?php
error_reporting(0);

// include the config file
include_once(__DIR__ . '/../config.php');
// start the session
session_start();

// check if the user is logged in
if(!isset($_SESSION['user_id'])){
   // if not logged in, redirect to the login page
   header('location:login.php');
   exit(); // terminate script execution
}

// get the user ID and name from the session
$user_id = $_SESSION['user_id'];

// fetch the user's name from the database
$stmt = mysqli_prepare($conn, "SELECT name FROM `user_form` WHERE id = ?");
mysqli_stmt_bind_param($stmt, "i", $user_id);
mysqli_stmt_execute($stmt);
mysqli_stmt_bind_result($stmt, $name_from_db);
mysqli_stmt_fetch($stmt);
mysqli_stmt_close($stmt);

?>
<!DOCTYPE html>
<html>
  <head>
    <title>PHQ Progress Report</title>
    <style>
      table {
        border-collapse: collapse;
        width: 100%;
      }
      th, td {
        text-align: left;
        padding: 8px;
        border-bottom: 1px solid #ddd;
      }
      th {
        background-color: #f2f2f2;
      }
      tr:hover {
        background-color: #f5f5f5;
      }
      canvas {
        max-width: 800px;
        margin: 0 auto;
      }
    </style>
    <script src="https://cdn.jsdelivr.net/npm/chart.js"></script>
  </head>
  <body>
    <h1>PHQ Progress Report</h1>
    <?php
      // Open the CSV file for reading
      $file = fopen('scores.csv', 'r');
      // Create an array to store the score data
  $scores = array();

  // Loop through the CSV data and add the score data to the array
  while (($data = fgetcsv($file)) !== FALSE) {
    // check if the fetched name matches the name in the second column
    if ($data[1] === $name_from_db) {
      // Get the date and score
      $date = $data[0];
      $score = intval($data[2]);

      // Add the score to the array
      $scores[$date] = $score;
    }
  }

  // Close the CSV file
  fclose($file);
```

```
// Create an array to store the chart data
$chart_data = array(
  'labels' => array(),
  'data' => array()
);

// Loop through the score data and add it to the chart data array
foreach ($scores as $date => $score) {
  $chart_data['labels'][] = $date;
  $chart_data['data'][] = $score;
}

// Create a new Chart.js line chart
echo '<canvas id="chart"></canvas>';
echo '<script>';
echo 'var ctx = document.getElementById("chart").getContext("2d");';
echo 'var chart = new Chart(ctx, {';
echo 'type: "line",';
echo 'data: {';
echo 'labels: '.json_encode($chart_data['labels']).',';
echo 'datasets: [{';
echo 'label: "PHQ Score",';
echo 'data: '.json_encode($chart_data['data']).',';
echo 'borderColor: "rgba(255, 99, 132, 1)",';
echo 'backgroundColor: "rgba(255, 99, 132, 0.2)"';
echo '}]';
echo '},';
echo 'options: {';
echo 'scales: {';
echo 'yAxes: [{';
echo 'ticks: {';
echo 'beginAtZero: true';
echo '}';
echo '}]';
echo '}';
echo '}';
echo '});';
echo '</script>';
?>
```

```
?>
<h2>Welcome,</h2>
<p>Below is your PHQ-9 score progress over time:</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<?php
        // Loop through the score data and display it in the table
        foreach ($scores as $date => $score) {
          echo '<tr>';
          echo '<td>' . $date . '</td>';
          echo '<td>' . $score . '</td>';
          echo '</tr>';
        }
      ?>
</tbody>
</table>
  </body>
</html>
```

This PHP code displays a PHQ (Patient Health Questionnaire) progress report for a logged-in user. It fetches the user's name from a MySQL database and reads score data from a CSV file. The score data is filtered based on the user's name and then displayed in a table along with a line chart showing the PHQ score progress over time. The chart is created using Chart.js library. The code uses prepared statements to

prevent SQL injection attacks and also checks if the user is logged in before allowing access to the report. The code also hides error messages using error_reporting(0).

GAD progress report code:

```
// Create an array to store the chart data
$chart_data = array(
  'labels' => array(),
  'data' => array()
);

// Loop through the score data and add it to the chart data array
foreach ($scores as $date => $score) {
  $chart_data['labels'][] = $date;
  $chart_data['data'][] = $score;
}

// Create a new Chart.js line chart
echo '<canvas id="chart"></canvas>';
echo '<script>';
echo 'var ctx = document.getElementById("chart").getContext("2d");';
echo 'var chart = new Chart(ctx, {';
echo 'type: "line",';
echo 'data: {';
echo 'labels: '.json_encode($chart_data['labels']).',';
echo 'datasets: [{';
echo 'label: "PHQ Score",';
echo 'data: '.json_encode($chart_data['data']).',';
echo 'borderColor: "rgba(255, 99, 132, 1)",';
echo 'backgroundColor: "rgba(255, 99, 132, 0.2)"';
echo '}]';
echo '},';
echo 'options: {';
echo 'scales: {';
echo 'yAxes: [{';
echo 'ticks: {';
echo 'beginAtZero: true';
echo '}';
echo '}]';
echo '}';
echo '}';
echo '});';
echo '</script>';
?>
```

```
?>
<h2>Welcome,</h2>
<p>Below is your GAD-7 score progress over time:</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<?php
       // Loop through the score data and display it in the table
       foreach ($scores as $date => $score) {
         echo '<tr>';
         echo '<td>' . $date . '</td>';
         echo '<td>' . $score . '</td>';
         echo '</tr>';
       }
     ?>
</tbody>
</table>

  </body>
</html>
```

This PHP code is a web application that displays a user's GAD-7 score progress over time in a table and a line chart. The application uses a CSV file named 'gad_scores.csv' to store the score data, which is read and filtered based on the currently logged-in user's ID. The user's name is fetched from a MySQL database using the user ID stored in the session. The score data is then looped through and added to an array, which is used to generate the chart using Chart.js library. Finally, the score data is displayed in a table below the chart. If a user is not logged in, they will be redirected to the login page. The error reporting is turned off in the beginning of the code, which is not a good practice for debugging purposes.

CHAPTER 8

RESULTS

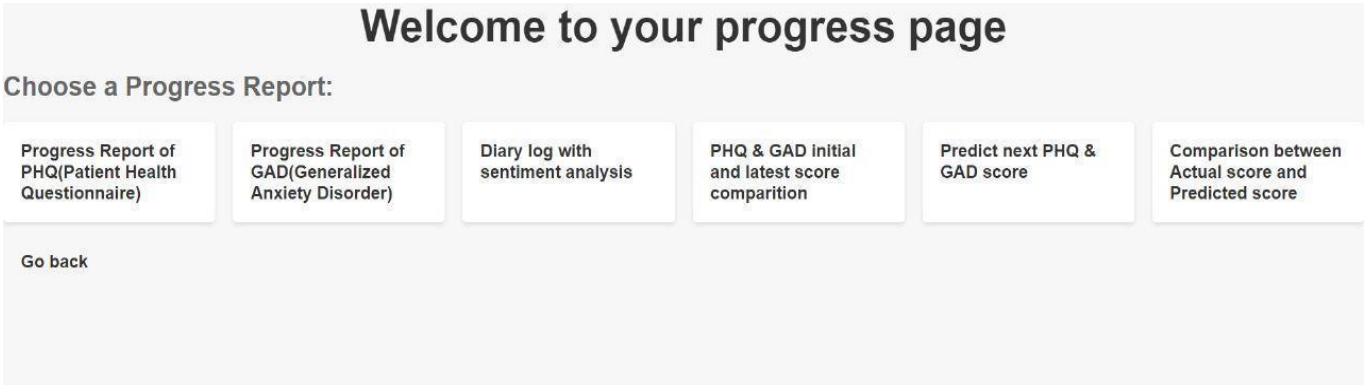


fig (8.1)

The figure (8.1) shows the result/progress page of the user that consists of progress report of PHQ and GAD and the user's diary with sentiment and the comparison of PHQ and GAD score.

It also consists of a predict option and compare option for predicted and actual score

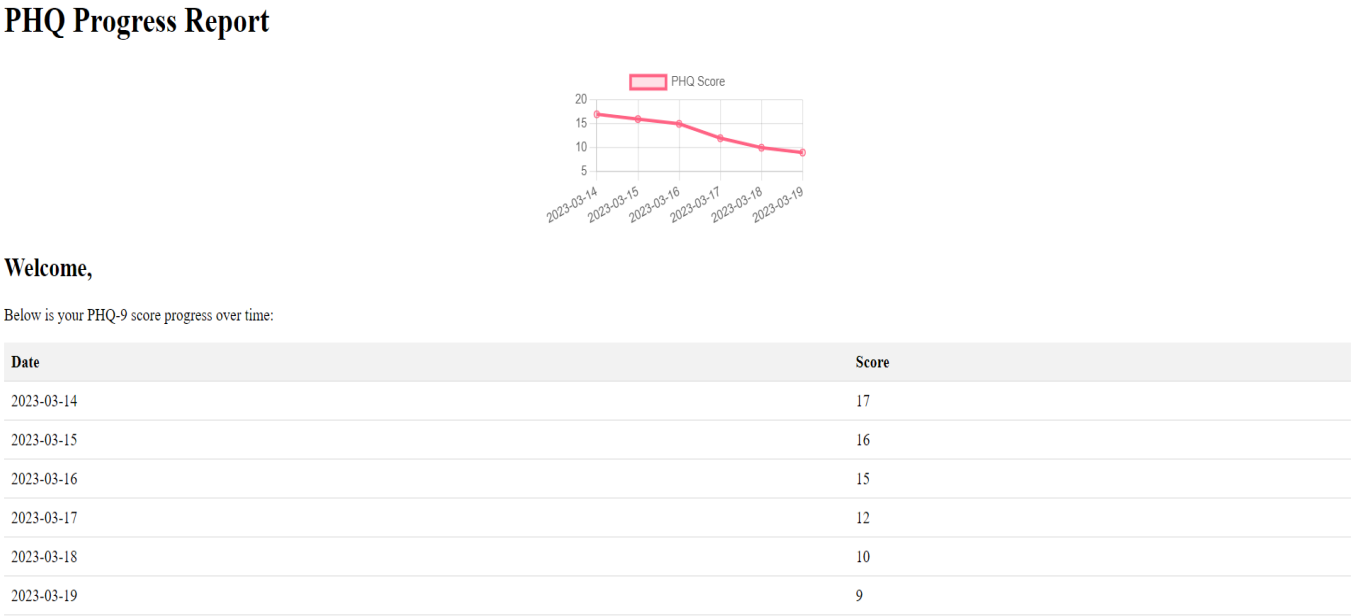
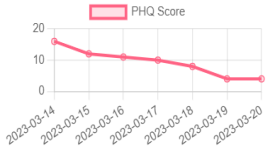


fig (8.2)

The figure (8.2) shows the progress report of the PHQ-9 scores over the week. The scores are displayed in the graphical form by using chart.js and the users PHQ-9 score and the date on which the user took the assessment is displayed in the tabular form. And the displayed data is for a specific user.

GAD Progress Report



Welcome,

Below is your GAD-7 score progress over time:

Date	Score
2023-03-14	16
2023-03-15	12
2023-03-16	11
2023-03-17	10
2023-03-18	8
2023-03-19	4
2023-03-20	4

fig (8.3)

The figure (8.3) shows the progress report of the GAD-7 scores over the week. The scores are displayed in the graphical form by using chart.js and the users GAD-7 score and the date on which the user took the assessment is displayed in the tabular form. And the displayed data is for a specific user.

Diary Sentiment Analysis

Name	Date	Content	Sentiment
Takshak bS	2023-03-15	I am feeling good	positive
Takshak bS	2023-03-16	I am feeling sad today	negative
Takshak bS	2023-03-24	I am feeling down today	negative
Takshak bS	2023-03-24	I am feeling depressed	neutral
Takshak bS	2023-03-24	I am Feeling bad	negative
Takshak bS	2023-03-14	Happy	positive

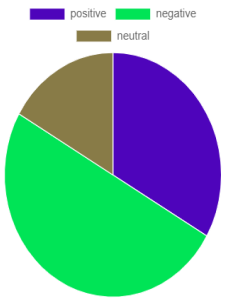


fig (8.4)

The figure(8.4) shows the diary sentiment analysis over the period. The sentiments are displayed in the pie form by using pie.js and the user's name,the date on which the user wrote this diary and the content of the diary is displayed in the tabular form. And the displayed data is for a specific user.

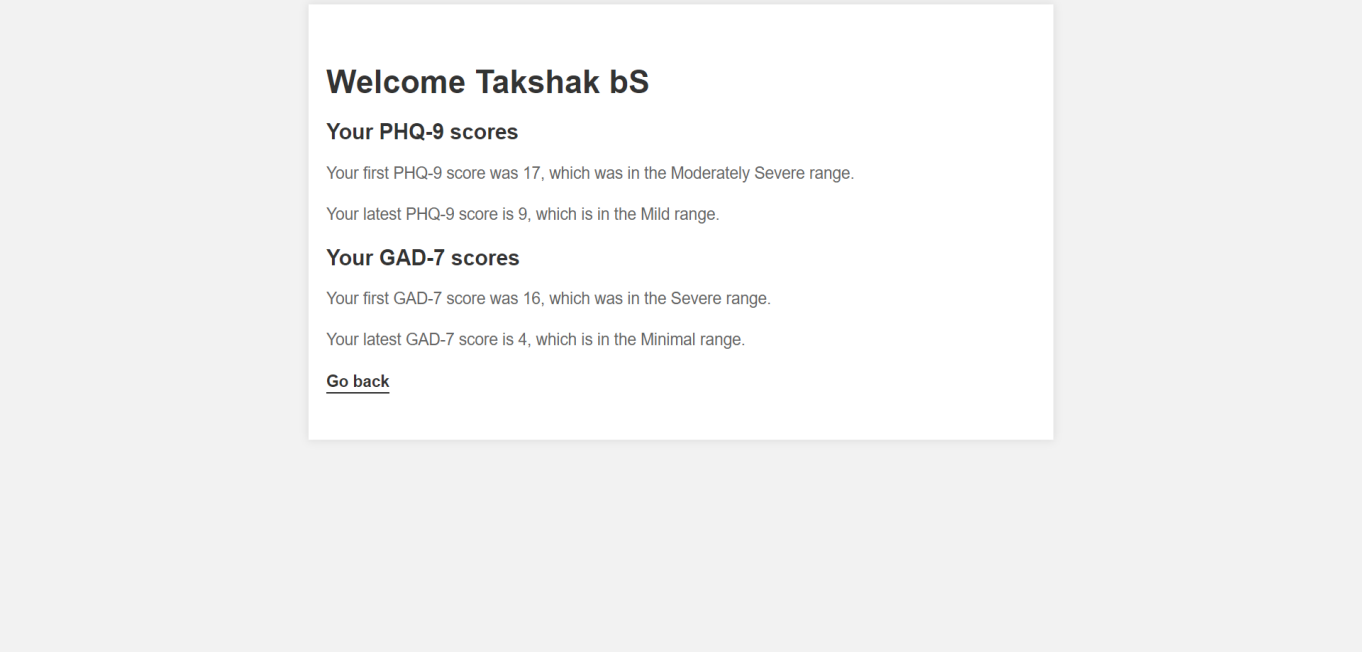


fig (8.5)

The figure (8.5) shows the comparison of the user's initial/first score with the latest/current score of PHQ-9 and GAD-7. To do the comparison mainly php code is used and php code was used to connect to phpmyadmin to derive the user's name from the database.

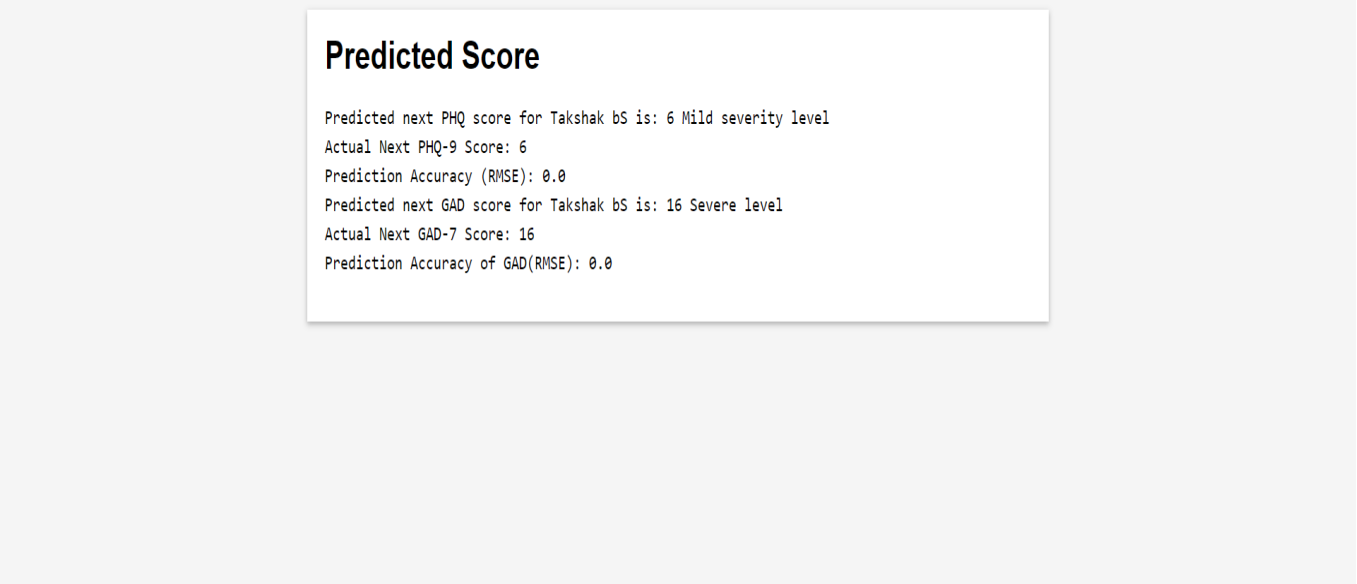


fig (8.6)

The figure (8.6) shows the predicted score of the user. Here the predicted score for the next day along with the user's name is displayed. The score is displayed with its severity level.
In the above image linear regression is used for prediction using python and the python code is connected to php code to display the result of the python code. Once we click predict when this page opens the predicted scores are saved in csv file.

Limitation: Here in the python code 'user_id = 1' is used to specific which user's predicted score must be displayed and to get the predicted score for other users user_id must be changed manually. And you can refer to the code in the implementation chapter.

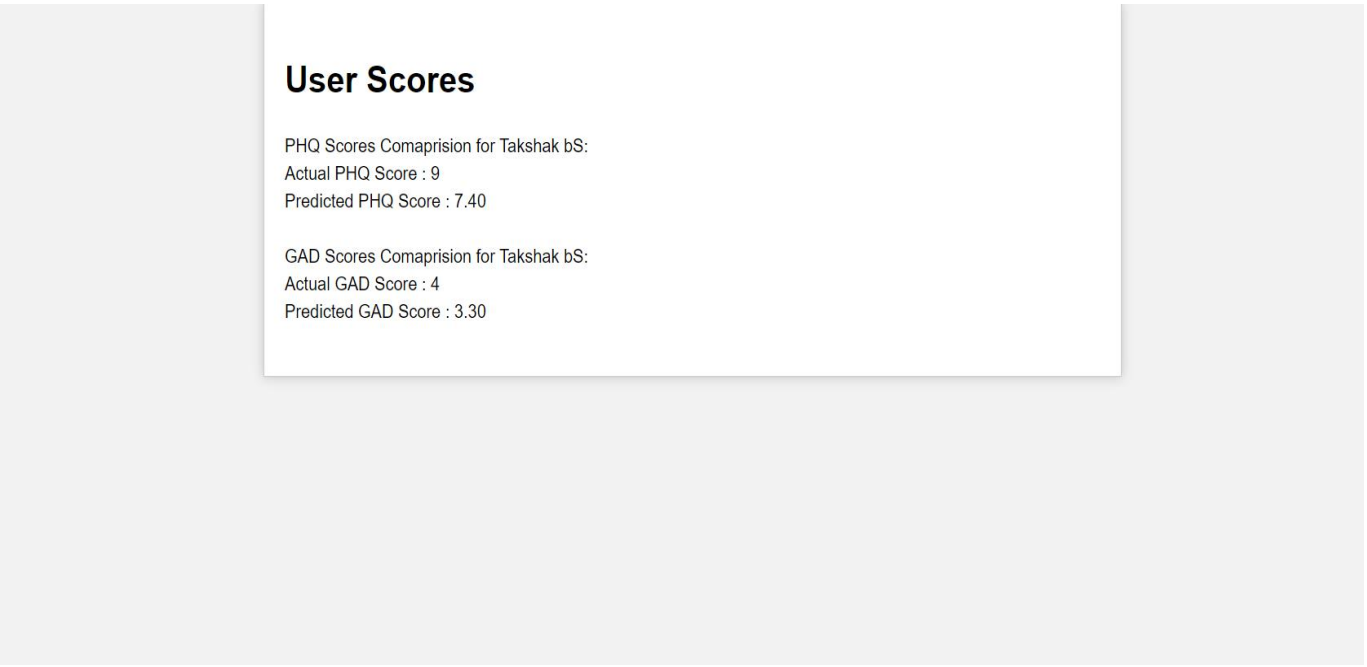


fig (8.7)

The figure (8.7) shows the comparison or the difference or the accuracy of the predicted score with the actual score. Here mainly the php code is being used to do the comparison of the scores where the scores are being taken from the csv file where they were stored.

CHAPTER 9

CONCLUSION & FUTURE WORK

Those living in developing nations and under-developed nations will undoubtedly benefit from the ability to detect depression using smartphones. It is also beneficial for those who need therapy but are unable to pay for it because of their high costs.

The ability to interact with patients who are far away and conduct therapy and sessions in-depth while continuously observing their patient's actions is beneficial to both the therapist and the medical team.

The disparity between the number of patients seeking therapy and the number of available therapists will minimize as these technologies progress.
Despite the fact that there is still more research to be done in this area, this paper encourages researchers to work on it. It is essential to identify depression early on so that undesirable actions can be avoided. With the aid of technology, we can minimize these situations and prevent people from acting in extreme ways, further securing their future.

The potential for future work in technology-enabled mental health interventions is vast. Incorporating additional screening tools, personalizing recommendations, integrating wearable technology, implementing chatbots or virtual assistants, and conducting user research can improve accuracy, engagement, availability, and effectiveness of mental health interventions. Expanding the user base to employers and healthcare providers could improve employee well-being and enable more efficient mental health care delivery. By continuing to innovate and improve these technologies, we can promote well-being for individuals and society.

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