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Mental Health Assistant using Sentiment Analysis through NLP

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Abstract - Given the increasing prevalence of mental health problems and social disruption, quality mental health services are an important issue in today's society. This paper provides a comprehensive understanding of the mental health assistant application proposed. By combining insights from psychology, healthcare, and technology, we identify problems arising from existing systems, including barriers to access, limited affordability, and disparities in supply. The system is an Android platform that allows people seeking mental health care to record and use features such as self-diagnosis, taking mental health tests for various conditions such as Depression, Bipolar Disorder, OCD and Anxiety, analyzing their daily mood , and sharing one-on-one conversations with mental health professionals. This research contributes by providing opportunities for improving mental health services in the future.

***Key Words*:** Mental Health, Android, Personality Tests, One-on-one Conversation

1.INTRODUCTION

Our emotional, psychological, and social well-being are all parts of our mental health. It influences our thoughts, emotions, and behavior's. Additionally, it influences how we respond to stress, interact with others, and make good decisions. Every period of life, from childhood and adolescence to maturity, is vital for mental health. Poor mental health and mental illness are not the same things, despite the fact that the phrases are sometimes used synonymously. Even if they may not have a mental disorder, a person can have poor mental health. Poor mental health can serve as a breeding ground for conditions like depression, OCD, anxiety, and bipolar disorder, where unresolved stressors, genetic predispositions, and neurochemical imbalances converge to manifest debilitating symptoms. Mental health disorders such as depression, obsessive-compulsive disorder (OCD), anxiety, and bipolar disorder significantly impact daily life, affecting individuals' cognitive, emotional, and behavioral functioning. Depression manifests as persistent feelings of sadness, hopelessness, and lethargy, hindering motivation and engagement in activities of daily living. OCD entails intrusive thoughts and compulsive behaviors, disrupting routine tasks and causing distressing preoccupation with rituals. Anxiety disorders provoke excessive worry and fear, impairing concentration, sleep, and decision-making abilities. Bipolar disorder involves unpredictable mood swings, alternating between manic episodes of elevated mood and energy and depressive episodes characterized by profound sadness and fatigue. These conditions not only undermine productivity and interpersonal relationships but also pose substantial challenges in maintaining overall well-being and quality of life. Effective intervention strategies, including psychotherapy, medication, and lifestyle adjustments, are essential in mitigating symptoms and facilitating functional recovery for individuals grappling with these mental health challenges.

2. LITERATURE SURVEY

Paper Name: Mental Health Mobile Application with Diagnosis, Sentiment Analysis and Chatbot [1]

Tanvi Gadgil et al,in,2022, [1] This study looks at a variety of mental health-related app-related issues that appeared between 2016 and 2020 in the Google Play Store. The data was scraped using a variety of programs and programming languages. It provides a variety of strategies for enhancing mental health. One of the methods is to relax, manage stress, track symptoms, listen to calming music, journal, connect with mental health resources, get support from others, practice meditation, and so on.

Paper Name: Awareness of Mental Health Applications among Smartphone Users in India: A Population-Based Survey [2]

Sneha Chakraverty et al,in, 2020, [2] To find out how often people use smartphones and health apps, a population- based online survey was conducted and 303 responses were recorded nationwide. The subjects were required to complete a Google form survey online. The use of health apps and smartphones was evaluated via a cross-sectional survey. 46.2% of respondents indicated they are only familiar with a

small number of the applications on their phones, compared to 50.8% who said they are familiar with the bulk of them. Only 30.2% of individuals are aware of mental health apps, despite the fact that most people are familiar with all of the apps on their smartphones. This implies that it is necessary to inform Indian smartphone users about the availability of mental health apps before releasing various mental health applications.

Paper Name: Mobile Mental Health: A Review of Applications for Depression Assistance [3]

Wellington S. Silva et al,in, 2019,[3] The purpose of this study is to define, examine, and classify the condition of mobile applications for depression as it stands right now. To do this, we thoroughly examined depression treatment applications. The findings of this study demonstrated that apps are being used for an increasing number of purposes, including chatbots, online therapy, mood monitoring, self-help, educational tools, and testing.

3. PROPOSED SYSTEM

The mental health app is built on Android studio framework where Java is used for backend development and XML (Extensible Markup Language) is used for frontend development. The app also includes an NLP emotional analysis model trained using a machine learning SVM (Support Vector Machine) algorithm. The following sections describe all the methods and functions of the application. The flow chart of the application is shown in Figure 2.3.1.

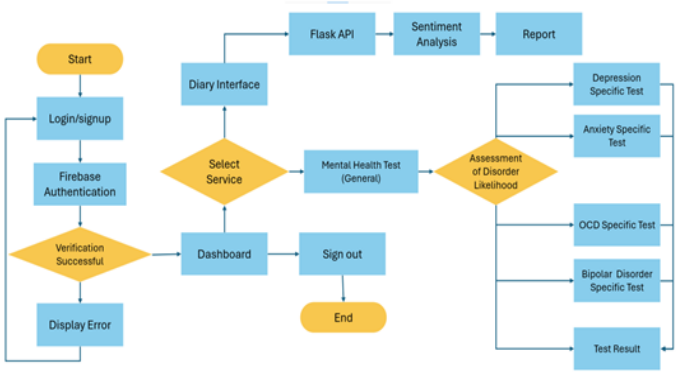

Figure 1. Proposed Algorithm

The application process is an Android application developed in JAVA and has a control panel that helps the user navigate the application and access all the features of the application. The application includes features such as psychological diagnosis, communication with a psychologist, and a Daily Diary that can record the user's thoughts and feelings. Psychological tests provide users with detailed information about their mental state based on their performance on the test. Another feature is daily thought journal where users can write down their thoughts for the day. Machine learning and NLP sentiment analysis will be used on logged emotions to analyse the user's mood. This will help the user keep track of their thoughts and improve accordingly. Chat allows users to communicate with psychologists. A pedometer is also provided to the users as it has been proven that walking can help one's mental health. Apart from these features, the application also provides authentication, profile, settings and all other necessary features. Firebase Cloud Services is used for authentication, instant databases, and Firebase Storage.

3.1 Evaluation:

The general health questionnaire (GHQ-12), comprising 12 questions, serves as the initial round of assessment, and this is the method employed to calculate the results of this round:

For depression, higher scores on questions 1, 2, 6, 8, and 11 may indicate a greater likelihood of depressive symptoms, with an adjusted cutoff of 8 or higher suggesting such symptoms. Anxiety symptoms may be suggested by higher scores on questions 3, 4, 7, and 9, with a cutoff of 7 or higher indicating a higher likelihood. For OCD, a higher score on question 10, addressing persistent unwanted thoughts or repetitive behaviors, may suggest symptoms, with a cutoff of 2 or higher. Bipolar disorder symptoms may be indicated by higher scores on questions 5, 8, and 12, addressing changes in energy levels, avoidance due to anxiety or fear, and heightened irritability or impulsivity, with a cutoff of 6 or higher. Methods for coping include staying in touch, being active, eating healthily, and establishing routines for depression; employing strategies like the 333 rule, breathing exercises, stepping back from stressful situations, and journaling for anxiety; establishing routines, prioritizing sleep, and mood tracking for bipolar disorder; and using distraction, engaging in physical activity, and practicing acceptance for OCD.

Based on the results of the preceding initial round, a subsequent round is conducted to categorize whether the individual exhibits symptoms indicative of depression, anxiety, OCD, or bipolar disorder, determined by the evaluation process:

1) Becks Depression Inventory:

The evaluation of scores on the Beck Depression Inventory (BDI) can provide valuable insights into the severity of depressive symptoms experienced by individuals. Scores ranging from 1 to 10 are typically considered indicative of normal fluctuations in mood,

while scores between 11 and 16 suggest mild mood disturbance. Those scoring between 17 and 20 may be experiencing borderline clinical depression, while scores falling within the range of 21 to 30 indicate moderate depression. Scores between 31 and 40 signify severe depression, and scores surpassing 40 suggest extreme depression.

2) Hamilton Anxiety Scale:

In assessing responses to the Hamilton Anxiety Scale (HAM-A), each item's score, ranging from 0 (not present) to 4 (severe), contributes to a comprehensive evaluation of anxiety symptom severity. The total score spans from 0 to 56, with varying ranges indicating different levels of severity: scores less than 17 suggest mild severity, scores between 18 and 24 suggest mild to moderate severity, and scores between 25 and 30 suggest moderate to severe anxiety symptoms. Notably, this scoring system allows for nuanced interpretation, capturing the spectrum of anxiety symptomatology and guiding clinicians in determining the appropriate level of intervention and support for individuals experiencing anxiety.

3) Mood Disorder Questionnaire:

In evaluating responses to the Mood Disorder Questionnaire (MDQ), specific criteria suggest a higher likelihood of bipolar disorder symptoms. If the patient answers "Yes" to seven or more of the 13 items in question number 1, indicating a prevalence of mood-related symptoms, and also responds affirmatively to question number 2, which addresses the presence of episodic mood changes, along with endorsing "Moderate" or "Serious" to question number 3, which assesses the impact of these symptoms on daily functioning, it may indicate a significant likelihood of bipolar disorder symptoms. This combination of responses suggests a pattern of mood instability and impairment that aligns with the diagnostic criteria for bipolar disorder.

4) Obsessive Compulsive Inventory:

In evaluating responses to the Obsessive-Compulsive Inventory (OCI), particularly considering a total score of 21 or above, there's a potential indication of the presence of obsessive-compulsive disorder (OCD). A higher overall score, especially surpassing this threshold, suggests a more pronounced severity of OCD symptoms across the various dimensions assessed by the inventory. These dimensions encompass a range of obsessive thoughts and compulsive behaviors, including washing, checking, obsessing, hoarding, ordering, and neutralizing. A total score meeting or exceeding 21 underscores the likelihood of significant impairment due to OCD-related symptoms and warrants further clinical assessment and intervention.

3.2 Sentiment Analysis:

The NLP Sentiment Analysis used in the application in the Daily Diary section for predicting user's sentient is trained using Support Vector Classifier (SVC). The model uses a Reviews Dataset which is first cleaned and then converted into vectorized format. Converting the unstructured reviews into a high dimension vector format is essential step and is carried out using TF-IDF vectorizer. Later this vectorized dataset is trained using Support Vector Classifier (SVC). The accuracy, confusion matrix and performance matrix of the sentiment analysis model is shown in the figures below.

```
predictions = text_clf_lsvc2.predict(X_test)
print(metrics.confusion_matrix(y_test,predictions))
[23]
... [[256  52]
     [ 48 284]]
```

Figure 2. Confusion Matrix

Fig. 2 shows the Confusion Matrix of the model trained using Support Vector Classifier. True negative, true positive, false negative and false positive values of the confusion matrix are shown accordingly in the figure. The Performance Matrix of the model is shown in Fig. 3. This performance matrix gives performance measures such as precision, recall, f1-score, and support for the trained model. And finally, the accuracy of the model with respect to Support Vector Classifier is shown is Fig.4. The model is 84.375 percentage accurate which works fine for the application. The model is converted into a pickle file and used in the flask API which is then called whenever the user clicks on the "SAVE" button on the Daily Diary Section of the android application.

```
print(metrics.classification_report(y_test,predictions))
[24]
...              precision    recall  f1-score   support

         neg       0.84      0.83      0.84       308
         pos       0.85      0.86      0.85       332

   micro avg       0.84      0.84      0.84       640
   macro avg       0.84      0.84      0.84       640
weighted avg       0.84      0.84      0.84       640
```

Figure 3. Performance Matrix

```
print(metrics.accuracy_score(y_test,predictions))
[25]
... 0.84375
```

Figure 4. Accuracy

4. FUTURE SCOPE

A mental health android app's future potential is huge, with the possibility to extend and improve on current capabilities to better serve the needs of users. Wearable devices: such as smartwatches or fitness trackers, might be coupled with the app to provide additional data points on users' mental and physical health. Data on sleep patterns, exercise routines, and stress levels, for example, could assist users and mental health practitioners in better understanding and managing mental health symptoms. Personalized recommendations using machine learning: Machine learning algorithms could be used to analyze user data and deliver personalized suggestions for self-help resources, therapies, or mental health experts. This could assist users in locating the most effective and acceptable.

5. CONCLUSIONS

Users can get professional advice from this mental health support android app, which also offers a variety of mental health support services. The user doesn't have to physically visit the psychiatrist or stand in long patient queues because everything is available on a single platform. Users can simply communicate their needs and difficulties with Psychiatrists by sending them The application offers a simple interface, allowing any user to utilize it with ease. Users of the application can take mental health tests and receive test results and analysis for improvement. This test results can be very helpful for the user as the user can know the current state of its mind. Based upon the test results the user can attempt to further tests if required. Therefore users can enhance their performance by applying for Mental Health examinations and reviewing the results. The daily diary feature allows the user to write down his or her thoughts and keep track of them. The use of this program will result in an overall improvement of the user's mental health without requiring the user to go through many obstacles. This ease of access to treatments will encourage individuals to take better care of their mental health rather than neglecting it.

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