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Assistive Mobile Application for Software Engineers in Sri Lanka to Support Depression '*Emoods*'

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Abstract:- This paper presents an Assistive mobile application in Sri Lanka to support depression. The framework uses face recognition technologies and algorithms to identify depressionprediction via machine learning for the users. The most effective means of improving the quality of Depression and mental illnesses at work is becoming increasingly widespread in the tech industry. Software developers, according to the International Journal of Social Sciences, have a far higher risk of depression, burnout, anxiety, and stress than their colleagueswho execute mechanical activities. Employees' mental health, as well as the company's total productivity, is threatened by declining mental health. Researchers from Stuttgart's Institute of Software Technologies discovered that developers who are emotionally exhausted or depressed generate lower-quality code and are more concerned about missing deadlines. The objective of this research is to determine the prevalence of depression among Sri Lankan software engineers. It is critical not to deal with depression on one's own. They require a system of loving individuals, such as family members, friends, coworkers, and neighbors, who enable them to be themselves. Building and maintaining a strong support system of people who can provide encouragement, help to keep moving and involved in meaningful activity, and help them challenge their negative thinking is a critical part of an assistive mobile app. This app provides features such as patient attention, patient awareness, treatment for patient depression levels, monitoring patient progress through time series analysis, collecting patientinformation via chatbot, and monitoring the improvement of doctor-patient relationships.

Keyword:- *Machine Learning, Depression, Facial Expression Analysis, Treatment, Chatbot*

I. INTRODUCTION

Depression is a mood disorder that affects millions of people around the world. Lately, most with the Covid-19 crisis arising around the globe, people being stuck to one place, persons have become so much exposed to severe depression conditions, withnegative repercussions. Thus, it is vital to have a good supporting system around such people to help them get over thecondition. Other than a close circle of friends and family, a professional mental health doctor or a therapist could get you on the right path by providing an accurate diagnosis and the besttreatment options. There are certain phases of life that an individual has to get through and most commonly, this chronicillness does contain different types of depression, listed as bipolar disorder, major depressive disorder, postpartum depression, and post-traumatic stress disorder. An estimated 3.8 percent of the world's population suffers fromdepression, with 5.0 percent of adults and 5.7 percent of persons over 60 years old being affected. In 2020, there will be 280 million depressed persons around the globe. In Sri Lanka, thereare an estimated 802,321 cases overall, or 4.1 percent of the population. By age, prevalence rates change, reaching a peak inlater adulthood (above 7.5 percent among females aged 55-74 years, and above 5.5 percent among males) [1].

Although depression is curable, fewer than a quarter of people obtain proper treatment of mental conditions because of treatment access challenges such as time and transportation restrictions, lengthy waiting lists, and a shortage of qualified specialists to provide high-quality care. The use of technology might significantly reduce access issues; several studies have already shown that Internet-based methods are as possible and efficacious as in-person therapy. Due to the effectiveness of these remote methods, there is a lot of interest in using mobile applications as a substitute foundation for the delivery of healthcare.

Even though there are IT solutions for depression across the world, Sri Lanka does not have any. Because of the pressure todeliver rapidly and the assumption that difficult issues will haveimmediate answers, the majority of software engineers are at greater risk and are frequently pushed to lower their typical standards. It may be detrimental to certain creators' sense of purpose. In order to help Sri Lankan software engineers overcome this, we decided to create an aiding application. In a nutshell, these Mental health applications provide users with the freedom to use these resources whenever they need to and as frequently as they like, not having to wait for a mental health expert to be present.

Finding out how often depression is among Sri Lankan software developers is the purpose of this research. A crucial component of an assistive mobile app is creating and maintaining a solid network of support that may offer motivation, aid in keeping users active and engaged in worthwhile activities, and support in challenging their maladaptive cognitions. Our major goal is to create a mobile application that includes all of these and that genuinely supports individuals in their struggle with depression. The Chatbot element in this assistive mobile app acts as a sentient touch point and offers a special opportunity to improve accessibility and user-friendliness. A chatbot is a type of virtual assistant that can communicate and engage in graphical, textual, and spoken dialogue with human users. Theuser-friendly chatbot is automated and put into place for their comfort. Additionally, it strives to improve user experience byaccelerating user responses and responding to all queries.

II. LITERATURE REVIEW

According to “Development of a Mobile Phone App to SupportSelf-Monitoring of Emotional Well-Being: A Mental Health Digital Innovation” [2], The state of one's emotional health is critical to both one's mental health and overall well-being. Using conventional methods, however, it is challenging to keeptrack of the day-to-day changes in an individual's emotional state over a long period of time[3].It is difficult to provide support for mental health when only around one in two personswho have mental health problems seek professional assistance.The technology that is included in mobile phones provides a way that may be maintained to improve one's ability to self- manage their emotional well-being. The purpose of this study is to discuss the creation of a tool for use on mobile phones thatis intended to monitor changes in an emotional state in arealistic daily setting and in real-time. This evidence-based mobile phone application monitors the user's emotional and mental health and well-being, and it gives connections to the websites of organizations that focus on mental health as well as other resources. Self-report psychological questionnaires, experience sampling methodology (ESM),[4], and automated behavioral data collection are the three methods that are used togather information using this app. The results of a survey and focus group discussions with 11 persons (ages ranging from 16to 52 years old; 4 males and 7 females) who used the app for a period of thirty days revealed that it was both functional and useful[5].

According to another research, Smartphones and other pervasive and personal sensing technologies have made it possible to continuously gather data in an inconspicuous way, allowing for this to be done in real-time. To anticipate user contextual information such as location, mood, physical activity, and so on using machine learning techniques, continuous sensor data have been used in machine learning methods. Recently, there has been an increasing interest in utilizing pervasive sensing technology for applications in mental health care. This would allow for the automated and continuous monitoring of various mental illnesses, such as anxiety, stress, depression, and so on. The purpose of this studyis to provide an overview of current research efforts in the field of mental health monitoring systems (MHMS), which use sensor data and machine learning. Our primary concentration was on research works pertaining to mental diseases and conditions such as stress, anxiety, depression, and bipolar disorder, among others. We offer the main stages of MHMS as well as a categorization taxonomy that we suggest using as a reference for reviewing related publications. In addition, the difficulties encountered by researchers working in the sector aswell as the potential for the future are highlighted[6].

Students who are in need of mental health care confront a number of obstacles, including the expense of treatment, its location, its availability, and the stigma associated with seekingtreatment. Studies have shown that computer-assisted therapy and one conversational chatbot that gives cognitive behavioral therapy (CBT) offer an alternative treatment that is less time- consuming and more cost-effective for the treatment of anxietyand depression. Applying an integrated approach has been associated with similarly effective posttreatment improvement as cognitive behavioral therapy (CBT), which is widely considered to be one of the most successful treatment modalities. Integrative psychological artificial intelligence (AI)provides a solution that is scalable in response to the growing need for help that is not only economical but also convenient, long-lasting, and safe [7].

The most recent developments in mobile communications and technology have the door to brand new opportunities for mobilehealth (mHealth)[8]. These gadgets, of which there are more than 1 billion cellphones and 100 million tablets throughout theglobe, have the potential to be useful tools in the administrationof health care. Because of the more than 50 million fatalities that were predicted to be caused by diseases or health issues in2008, any assistance that can be provided for medical treatmentis not only appreciated but also required. Depending on how common some of these illnesses are certain ones take on a greater level of significance.

Detecting depression in its earliest stages is critical and may possibly save a patient's life. Nonlinear analysis of EEG signals is examined in this work to distinguish between depressed patients and healthy controls. This research included 45 depressive individuals who were unmedicated and 45 healthy volunteers. From the EEG data, we were able

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to extract the power of four EEG bands and four nonlinear characteristics, such as detrended fluctuation analysis (DFA), Higuchi fractal, correlation dimension, and Lyapunov exponent. k-nearest neighbor, linear discriminant analysis, and logistic regression are employed as classifiers to distinguish between the two groups. In addition to the correlation dimension and LR classifier, the highest classification accuracy of 83.3% may be achieved using nonlinear features. Classifiers use a combination of all nonlinear characteristics to boost their performance even more. The LR classifier and all nonlinear characteristics work together to obtain a classification accuracyof 90%.[9] The genetic algorithm is used in every test toidentify the most significant characteristics. Comparing and contrasting the suggested strategy with existing techniques, it isshown that incorporating nonlinear characteristics improves performance. An EEG nonlinear analysis may be used to tell apart depressed individuals from healthy ones, as shown in thisresearch. Psychiatrists might use this data in addition to their current methods of identifying depression in their patients.

Both anxiety and depression are different mental health conditions that are presently diagnosed based on the patient's self-reporting of their symptoms. Subclinical anxious and depressed persons may now be diagnosed using a novel diagnostic approach that systematically examines for cognitivebias abnormalities. A total of 125 individuals were categorizedinto four groups depending on the severity of their anxiety anddepression symptoms. A wide range of cognitive and emotionalbiases was discovered and measured using a complete battery of behavioral tests. In this work, advanced machine-learning technologies were used to examine the data. In order to predictgroup membership, these techniques use specific characteristics that distinguish anxiety and depression. When comparing people with high symptoms of depression, anxiety, or both to those without, the prediction model showed a sensitivity of 71.44% and a specificity of 70.78%, respectively, for the two groups (specificity). Two-group models with highdepression/anxiety had a prediction accuracy of 68.07 percent and 74.18 percent, respectively. The analysis also revealed which particular behavioral measures contributed to the prediction and pointed to critical cognitive pathways in anxiety vs depression. The study findings In light of these findings, newdiagnostic devices, and personalized treatment plans may be developed.

III. RESEARCH OBJECTIVES

The main objective of this research is to provide a unique solution for the current depression among software engineers inSri Lanka and to develop a mobile application to really supportthem in depression.

A. *A method for identifying the depression of the patient:* Python, PyCharm, and a variety of databases are used to determine the degree of a person's depression. Face recognition technology can be used to identify and monitor patients. While patients are participating in the specified activity, a face recognition tool will be used to ascertain their emotional state using conventional neural networks and deep learning techniques. The results of the test, including whether or not the individual is depressed and, ifso, the level of depression, would be revealed next, followed by the indicators gained from the machine learning algorithms derived via those activities, such as the duration of a patient would take to complete the activity, his/her facial expressions, and the scored amount of the given activity. In order to construct a questionnaire to measure an individual's stress levels, it is necessary to use a mobile application development tool.

B. *Create a system for analyzing and curing:* An automated therapy suggestion system is being trained using user input data gleaned from surveys and interviews with patients about their demographics and mental health. To teach machine learning models to make sequential judgments, one might use a technique called reinforcement learning. The agent learns to function in a harsh and unpredictable environment. The topic of reinforcement learning uses a gaming environment to teach computers new skills. The algorithm uses trial and error to determine the best course of action. Artificial intelligence may be rewarded or penalized for specific actions to encourage it to perform the intended actions.

C. *Creating a system to avoid aloneness:* Using chatbots, which are powered by AI, is a scalable option that provides an engaging way to engage customers in behavioral health therapy. Natural language processing (NLP) is used to recognize text while users converse with the chatbot, and NLP is also used to comprehend user conversations as the mobile app is being developed. Then, you may anticipate a language analysis and user language identification. It is also expected that you would employ a number of strategies to achieve this goal. A chatbot is an AI-powered conversational virtual assistant designed to take over mundane, repetitive tasks such as answering common questions or resolving common problems. In order to forecast the user's response, artificial intelligence (AI) use machine learning algorithms to decipher the user's natural language input. Machine learning algorithms to decipher the user's naturallanguage input.

D. *Creating a database and analyzing the patient feedback:* User input, both good and negative, as well as suggestions for improvement, is essential for reaching this goal. We can categorize their comments as good, negative, or constructive depending on how they choose to respond to us. All users have the option of responding to comments or receiving star ratings for their responses. All comments are being recorded in a database for future analysis. The purpose of this survey is to help the segment's creators learn how to better serve those experiencing depression and use that knowledge in the future. The feedback analysis feature will make use of sentiment analysis to decipher the text of a Google form, Natural Language Processing (NLP), and the flutter framework.

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IV. METHODOLOGY

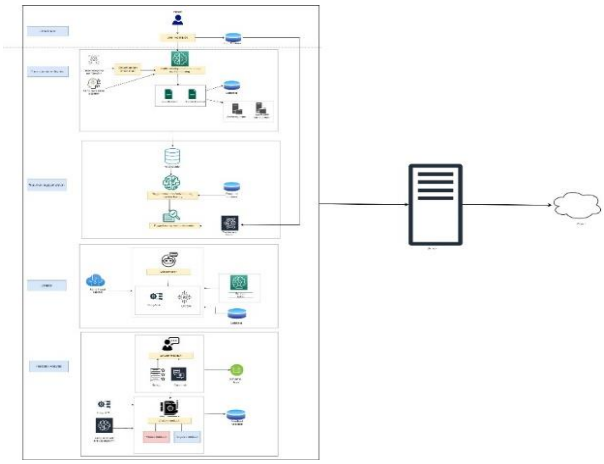

Fig 1: Overall System Diagram

High-level architecture

This section provides an overview of the solution's overall design as well as its evolution. An investigation is conducted into the conceptual foundation of the system, including its capabilities. After that, the visual specification, technical creation, and overall system design of the suggested solution are presented to the audience.

The "Assistant mobile application for software engineers in SriLanka to assist depression" system research focuses on how theframework makes use of facial recognition technologies and algorithms for identifying depression prediction for the users using machine learning. There are primarily four different partsthat make up the solution.

A. Identification of depression level.
B. Treatment Suggest system.
C. Developing chatbot.
D. Analyzing user feedback component.

System Design: This Assistive mobile application for software engineers in Sri Lanka to support depression has developed for4 components as follows;

The primary use of this is to serve as a depression-level systemfor software developers in Sri Lanka. Regarding this particularscenario, we are delivering a mobile application that has several different functions. The system's ability to recognize the **level of deterioration** is the very first feature of the system.In light of this, the following depression-level-related questions have been provided for your consideration. During that period of time, the technology that recognizes facial expressions will be operational. The image processing algorithm is used to determine the amount of depression a person is experiencing. By utilizing these two different approaches, the system is able to provide some treatments thatthe user may carry out on herself or herself. A **therapy suggestions system** is what you are looking at right now. Not only will the treatment suggestion system continue to functionfor that, but it will also determine the location of the treatmentfacility that is geographically closest to the patient. That is going to serve as a proposal.

After that, this system will begin providing **chatbot functionality**. Using that chatbot feature, the patient may talk with the system in order to gain an understanding of the mobile application, and the functional working details. The greatest part of this chatbot is that it offers live chat about his or her depression, and it will recognize the patient's depression. In theend, the system will give a **feedback mechanism**, which will be utilized in the upcoming innovations that we want to accomplish. It analyzes both the good and the negative feedback that has been given. Overall, this mobile application uses image processing, natural language, developing languages, and many other tools are used for the development of the mobile application.

A. Identification of depression level.

To identify the depression level system will generate basic questionnaires. Face recognition finds and tracks patients. During the procedure of patients partaking in the specified activity, anticipate employing a face recognition tool to determine their facial expressions. Indicators gained from machine learning algorithms derived from those activities, such as the duration a patient would take to complete the activity, his/her facial expressions, and the scored amount of the given activity, would give the results of the test; whether the individual is suffering from depression and, if so, the level of depression. A mobile app development tool is needed to createa stress questionnaire. Here is the survey.

Over the last two weeks, how often have you been bothered byany of the following problems?

1. Little interest or pleasure in doing things
- Not at all
- Several days
- More than half of the days
- Nearly every day
2. Feeling down, depressed, or hopeless
- Not at all
- Several days
- More than half the days
- Nearly every day
3. Trouble falling or staying asleep, or sleeping too much
- Not at all
- Several days
- More than half the days
- Nearly every day
4. Feeling tired or having little energy
- Not at all
- Several days
- More than half the days
- Nearly every day
5. Poor appetite or overeating
- Not at all
- Several days
- More than half the days
- Nearly every day
6. Feeling bad about yourself - or that you are a failure or havelet yourself or your family down
- Not at all
- Several days

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- More than half the days
- Nearly every day

7. Trouble concentrating on things, such as reading the newspaper or watching television

- Not at all
- Several days
- More than half the days
- Nearly every day

8. Moving or speaking so slowly that other people could havenoticed

- Not at all
- Several days
- More than half the days
- Nearly every day

9. Thoughts that you would be better off dead, or of hurting yourself

- Not at all
- Several days
- More than half the days
- Nearly every day

10. If you've had any days with issues above, how difficult have these problems made it for you at work, home, school, orwith other people?

- Not difficult at all (0)
- Somewhat difficult (1)
- Very difficult. (2)
- Extremely difficult. (3)Total - /30

Depression Severity: 0-4 none, 5-9 mild, 10-14 Moderate, 15-19 moderately severe, 20-27 severe.Not at all – 0
Several days -1
More than half the days -2Nearly every day -3

For that purpose, we obtain the inputs such as facial recognition, questionnaire duration time, and the score of the questionnaire, from the user to our system. we anticipate recognizing whether the user is suffering from depression or not and if yes, which level of depression he or she is at. Moreover, the facial recognition system of the application is also connected to the back end of the diagram, which is further connected to the database that has all the gathered details of thepatients.

The Details that the user enters into the system go to the Backend part and are saved in the database.

B. Treatment Suggest system.

First, patients will be provided questionnaires to gather user input data to assess their depression level depending on age andgender. Then, the reinforcement learning model will evaluate the data to train to auto-recommend a therapy. Reinforcement learning teaches machine learning models to make judgments. The agent learns to attain a goal in an uncertain environment. Reinforcement learning puts AI in a game-like setting. The computer tries things till it works. AI is rewarded or punished for activities to encourage the machine to do what the programmer wants. It aims to maximize return. The designer sets the reward policy (game rules) but gives the model no guidance on how to win. The model must learn how to fulfill the task to maximize the reward, starting with random trials andrising to complicated tactics and superhuman abilities. Reinforcement learning uses search and trials to indicate computer inventiveness. Artificial intelligence can learn from thousands of simultaneous gameplays provided a strong enough computer infrastructure is used.

In the proposed system, the model will be trained with the sample data to analyze the questionnaire and from the analysis,the model will suggest treatment for the patients.

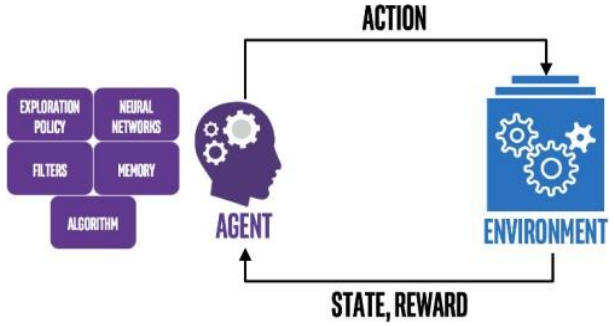

Fig 2: Methods for treatment suggest the system

C. Developing chatbot.

A scalable option that offers an interactive way to engage consumers in behavioral health therapies powered by artificial intelligence is chatbots. Developing the mobile application is using natural language processing (NLP) to identify text when users chat with the chatbot and Natural Language Processing tounderstand the dialogues of users. Then, expect to identify language and analysis the language that language using users. And also expected to do that by using several methods. Chatbots are conversational virtual assistants that employ artificial intelligence to automate interactions with humans. Artificial intelligence (AI) is used to predict replies to the users,which uses machine learning techniques to interpret natural language.

D. Analyzing user feedback component.

In order to do this, it is needed to collect positive, negative, andconstructive feedback from users and analyze the userfeedback. Based on their responses we can segment thosefeedbacks as positive, negative, and constructive. All the usersscan be given feedback by posting a comment or rating their feedback as stars. Feedback is stored in the database and we are looking to analyze each and every feedback. The Objectiveof collecting feedback is to apply for future improvements in the depression level and identify the segment. It is going to be used sentimental analysis to read the words in the google form,Natural Language Processing (NLP), and flutter framework to develop the feedback analysis component.

IV. RESULT AND DISCUSSION

This section provides the details of the results of the system. Basically, this system is depending on the creativeness of the mobile application and also on the back-end development of themobile application. If we discuss the UI of the system the first page provides the details of the name with other details ‘that have headings called “How is my

depression right now?”,” Chat with Ms.Deppresia”, and also the “Sign Up” icon.

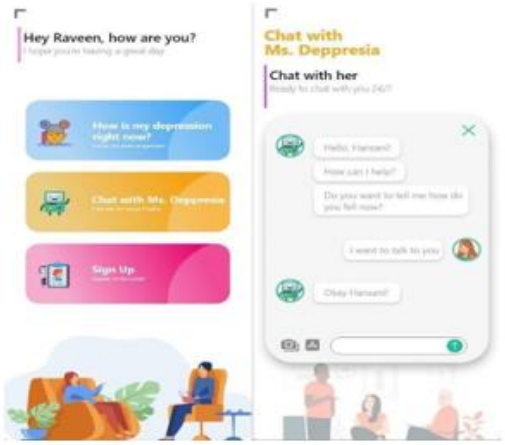

Fig 3: Logging page and Chatbo

The Chatbot is provided as “Chat with Ms. Deppresia” the patient can chat with the system, and they can ask about their system and about their level of depression and many other things about their depreciation. This is basically like “WhatsApp chat” but advanced with a face recognition system.

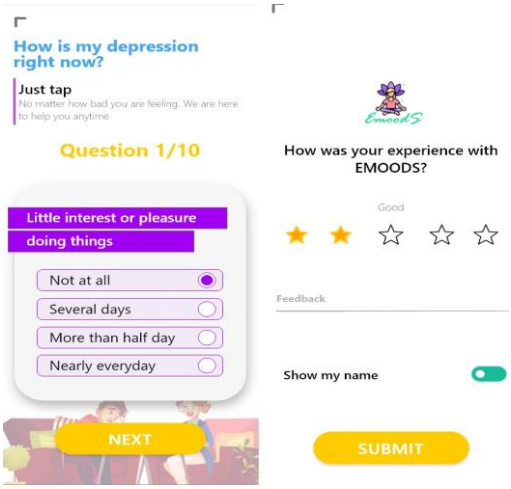

Fig 4: Depression level and feedback system

These UIs are providing the feedback and depression level measuring system in the mobile application. As I said this mobile application is created as user-friendly and with user- friendly colors. Everyone can understand the word that we usedfor mobile applications. After all, we tried to make a unique system for this problem. The solution came with this mobile application. Using this we are trying to avoid depression amongSri Lankan software engineers.

V. CONCLUSION

Depression-enabler Most applications focus on treating depression, anxiety, general mental health, stress, PTSD, bipolar disorder, panic disorder, sleep disturbance, schizophrenia, OCD, and addiction (non-drug and alcohol-related addiction). Apps provide ways to boost mental health. Relaxation, stress management, symptom monitoring, calming music, journaling, connecting with mental health resources, seeking assistance, meditation, and mood tracking are employed. It would be helpful to analyze the functionality of mobile apps for treating depression and any ethical issues they may raise given their rapid rise. We propose that marketplace developers regulate depression applications to eliminate ethical concerns including missing, weak, or inconsistent privacy regulations, such as sharing data with third parties, safeguarding kid data, and protecting vulnerable user groups. The app analysis offered new knowledge on how to prevent theharm caused by hazardous material, unrestricted access (with accompanying privacy problems), and less accurate screening procedures.

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