DEPRESYS: A chat application prototype for real-time analysis of mental health conditions based on Bangla text messages

Abdullah Ibne Masud Mahi, Urbana Musharrat Haider, Onamika Hossain, Sadia Tasnim Dhruba, Farhan Saif
Department of Computer Science & Engineering
Islamic University of Technology(IUT)
Gazipur, Dhaka, Bangladesh
{ibnemasud, urbanamusharrat, onamika, sadiatasnim, farhansaif}@iut-dhaka.edu

Abstract—The paper highlights the increasing prevalence of mental health concerns in today's society, worsened by factors such as work-life imbalance, financial struggles, and strained personal relationships compounded by the COVID-19 pandemic. The impact of these issues can lead to physical health problems, addiction, and suicide. Increasing awareness and access to mental health services is vital to address these concerns. This paper's primary focus is to explore achieving a sense of well-being through Human-Computer Interaction (HCI). A low-fidelity prototype of a chat application named DEPRESYS has been developed to demonstrate how the system will work, offering real-time analysis of mental health conditions based on Bangla text messages. The paper highlights the significance of prioritizing mental well-being as much as physical health for leading a balanced and satisfying life. A cognitive walk-through method was used to evaluate the system's effectiveness, where we acted as users to interact with the system and highlight problems accordingly. Overall, the system is pretty efficient and works very smoothly. Various users had various kinds of user experiences, some problems that users' highlighted were resolved and the User Experience was tailored according to the users' needs.

Index Terms—Depression, Mental health, Bangla text messages, Prototype

I. INTRODUCTION

Mental health concerns have become an increasingly pressing issue in today's society, attributed to factors such as social media, balancing work and personal life, financial challenges, and relationships. The COVID-19 pandemic has only amplified these challenges, causing people to experience feelings of anxiety, depression, and isolation due to social distancing measures and uncertainty about the future [1]. Mental health issues can have a profound impact on an individual's quality of life and can lead to physical health problems, addiction, and even suicide. Hence, it is crucial to address these concerns by raising awareness, providing access to mental health services, and receiving support from loved ones. It is vital to prioritize mental well-being just as much as physical health to lead a happy and fulfilling life. Considering these factors, we have created a prototype of a chat application called DEPRESYS that provides real-time analysis of mental health conditions based on text messages written in Bangla. This language was

chosen so the application can be accessible to all levels of education among the Bangladeshi population.

We have obtained several requirements for the Chat system DEPRESYS using questionnaires and surveys. The results showed that most of the survey respondents favored an online platform that could assist them in managing their mental health status and primarily diagnose issues. Moreover, they favored a Bangla chat system for ease of use; however, it would also ensure accessibility for a diverse range of people.

We have selected low-fidelity prototyping to design web page prototypes using proto.io [2] to provide an initial idea of our system. The reasons behind choosing low-fidelity prototyping are that it is an effective way to create and test ideas, and it also helps to gather feedback from the stakeholders and iterate over design issues before finalizing a product. Our designed prototypes mainly focused on the home page, login page, chat system UI, and guidelines page. Those web page prototypes depict how a user will interact with the system by landing on a web page, then logging into the system and chatting with the psychiatrists. The prototypes also meet the requirements to show the user and admin point of view.

We used a method called Cognitive Walk-through [3] to evaluate how well the application might work. We pretended to be regular users and tested the system from their perspective. We tried different features based on how accurately the application understood Bangla text and rated its performance based on how helpful it was in addressing depression. We also proposed various tasks to evaluate the application's functionality and usability. These tasks involved creating an account, setting up a profile, starting conversations, sharing personal information, seeking support and guidance, and exploring available resources. We even gathered user feedback by varying the user interface and asking them to rate their experience. This helped us determine the best design for the application.

The rest of the report is organized as follows. Section 2 reviews the theoretical methodology of the interaction design. Section 3 shows the experimental evaluation of our project, and later on, Section 4 concludes the paper.

II. METHODOLOGY

A. Interaction Design

Interaction design creates meaningful and engaging interactions between users and digital products, systems, or services. It involves designing how users interact with technology to ensure that those interactions are intuitive, efficient, and enjoyable, resulting in user-centered and practical designs [4].
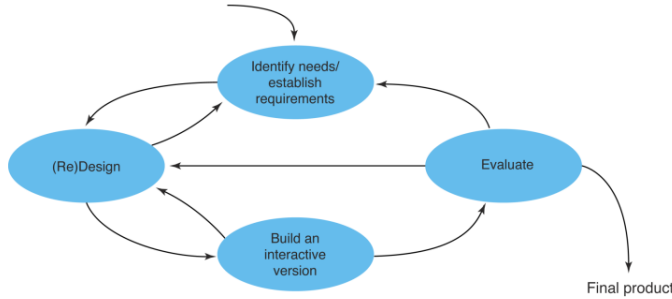

Fig. 1: A Simple HCI Life Cycle Model

To create interactive systems that are efficient and easy to use, interaction design comprises multiple processes. The standard steps in the interaction design process are as follows:

1) *Identify needs/establish requirements:* Understanding the target users' needs, objectives, and traits is the goal of the user research phase. Insights into user habits and preferences are gathered using user research techniques such as interviews, surveys, and observations. Designers identify and record the specific requirements and expectations of the users based on user research. The goals and scope of the interactive system are defined in this step.

2) *Re-Design:* Designers develop a conceptual model of the interactive system during the conceptual design phase. They create concepts for ideas and designs that fit the users' needs. Prototypes, wire-frames, and storyboards can all be used to communicate and visualize design concepts. Designing the system's interaction flow and behavior is the primary goal of this stage. Information architecture, nautical patterns, and interaction patterns are all created by designers. They take into account usability concepts like affordance and feedback to promote natural and effective interactions. The aesthetics and visual attractiveness of the interactive system are dealt with in visual design. Designers determine color schemes, typography, iconography, and the overall visual style following the brand identity and user preferences.

3) *Build an Interactive Version:* To replicate the user experience and gather input, interactive prototypes are created. Prototypes might be high-fidelity (functional and interactive mock-ups) or low-fidelity (paper sketches or digital wire-frames). During this stage, user testing is frequently done to verify design choices.

4) *Evaluate:* Through usability testing, surveys, and other evaluation techniques, designers get input from users and stakeholders. To increase user satisfaction and system efficacy, they iterate on the design and find areas for improvement based on the input.

B. Requirement Gathering

1) *Questionnaires:*
The purpose of data gathering is to understand user requirements & collect sufficient, relevant, and appropriate data so that a set of stable requirements can be produced. There are several methods for data gathering, for example - questionnaires, interviews, studying documentation, focus groups & many more. We used these methods to gather user requirements :

(a) **Studying Existing Literature:**
There has been a growing interest in analyzing Bangla text for depression detection in recent years. Several studies have been conducted using machine learning and natural language processing techniques.
Depression detection from texts, mainly social media texts, has been a growing field since 2015, mainly using deep learning techniques. [5], [6], [7], [8] are some prominent works that study the phenomenon using deep learning techniques. In this context, detecting depression from Bangla social media texts is quite less discussed till now. Only a handful of works are executed. In the pioneer works of depression analysis in Bangla social media texts, supervised learning such as Naive Bayes, Logistic Regression, and Linear SVC were used to detect depression from Facebook posts [9] or Bangla social media dataset [10]. Later on, [9] used LSTM to detect depression from a Bangla social media dataset. The recent works focus on natural language processing techniques to resolve the tasks; for example, [11] uses Bi-LSTM and decision tree to detect more than 94% accurately. Whereas [12], [13] used an attention-based framework in detecting those traits. Although the number of works is increasing, almost every work is lacking, i.e., size and inclusiveness in dataset preparation. Furthermore, no prominent work has been done to apply the findings in a human-computer interaction domain.

(b) **Questionnaires (Using Google forms):**
There are many benefits of using questionnaires for collecting user data, such as-
(a) Good for answering specific questions. We followed the pyramid structure while arranging questions.
(b) Provides quantitative & qualitative data.

(c) *Creating Affinity Diagram:* Creating an affinity diagram from requirement analysis involves systematically organizing and analyzing gathered information. It begins with a brainstorming session, where stakeholders contribute their requirements and ideas. Each requirement or idea is then captured on sticky notes or index cards. The next step involves sorting and

grouping these notes based on their similarities and relationships, identifying common themes and patterns. These groups are labeled accordingly, and the diagram is reviewed and refined for accuracy. The final affinity diagram provides a comprehensive visual representation of the requirements analysis, enabling stakeholders to understand the connections better and prioritize key areas. It is a valuable tool throughout the project, aiding decision-making, requirement prioritization, and identifying any gaps or overlaps in the requirements.

(d) *Creating Persona & Scenarios:* We have made several persona and scenarios to describe the nature of our proposed system by using xtensio [14] tool. Some of the persona and scenarios are:

i) *Coping with Campus Life Stress: Selena's Journey to Better Mental Health*:

Selena, a 2nd-year Computer Science student at XYZ University, leads a busy life on campus as she participates in various activities and holds the campus ambassador position for a famous Telco company. With her multiple responsibilities, she constantly runs around, leaving her stressed and feeling that her productivity has drastically decreased.

As a result of her stress, Selena has been seeking support from a mental health consultant through a website named DEPRESYS. Through her sessions, she has been able to identify the sources of her stress and receive guidance on how to manage it better. The consultant has recommended her to take breaks, prioritise her tasks, and engage in mindfulness exercises to help her reduce her anxiety levels. Through her sessions with the mental health consultant, Selena has been able to gain insight into the underlying causes of her stress. She has discovered that her busy schedule, coupled with her desire to excel in everything she does, has been contributing to her high levels of anxiety.

The consultant has advised Selena to practice time-management skills to help her better manage her schedule and prioritize her tasks. By learning to schedule her activities and allocating sufficient time for each task, Selena can prevent herself from feeling overwhelmed by her responsibilities.

In addition to time-management skills, Selena has been encouraged to take regular breaks to recharge and refresh her mind. The consultant has suggested that she take short walks, engage in breathing exercises, or practice meditation during her breaks. These activities can help her reduce her stress levels and improve her mental health.

Overall, Selena's journey toward better mental health is an important reminder that seeking help when dealing with stress is crucial. Through professional support and self-care practices, individuals can better manage their stress levels and enjoy a healthier, more fulfilling life.

Event : Selena Khatun faced problems with coping with the stress of campus life.

Participant: Selena Khatun.

Goal: Discuss issues via the web application and receive the required assistance from a psychiatrist.

ii) *Overcoming Stress: Strategies and Support for Managing Multiple Responsibilities:*

Annie, a part-time librarian and English Literature major at the University of ABC, has taken on multiple responsibilities, such as managing her household, studies, and work while struggling to pay off her student loans. Her hectic routine has left her feeling exhausted and stressed, prompting her to seek support from a mental health consultant through a website named DEPRESYS.

Through her sessions with the consultant, Annie has identified the sources of her stress and received guidance on how to manage it better. The consultant recommends strategies such as prioritizing her tasks, setting realistic goals, and breaking down her work into manageable chunks to prevent feeling overwhelmed. Additionally, self-care practices, such as getting enough sleep, exercise, and a balanced diet, may be suggested to help her maintain her physical and mental health. The consultant also provides budgeting and financial planning guidance to help Annie manage her debt more effectively.

Annie's story reminds us that managing multiple responsibilities can be challenging and stressful, especially for students with financial obligations. Seeking help from a mental health professional and engaging in self-care practices can be beneficial in managing stress levels, reducing anxiety, and promoting overall well-being.

Event : Annie Saha stressed for managing multiple responsibilities.

Participant: Annie Saha.

Goal: Discuss issues via the web application and receive the required assistance from the psychiatrist.

iii) *Karim came to know about DEPRESYS & tries it for the first time:*

Karim Chowdhury is a 45-year-old professor in the CSE department of XYZ University. Today, he has received the course feedback evaluation reports from the department, where many students complained about his violent behavior and episodes of his anger outbursts. This is a concerning matter for Karim. He wondered why this happened and how he could redeem his self-image as an academician. Then, a colleague told him about DEPRESYS and how he could get instant help.
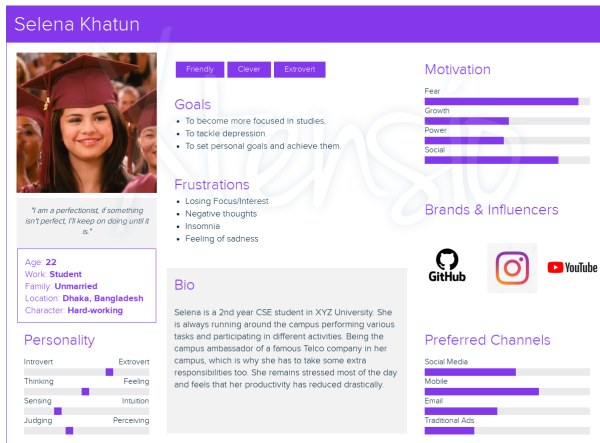
(a) User Persona: Selena
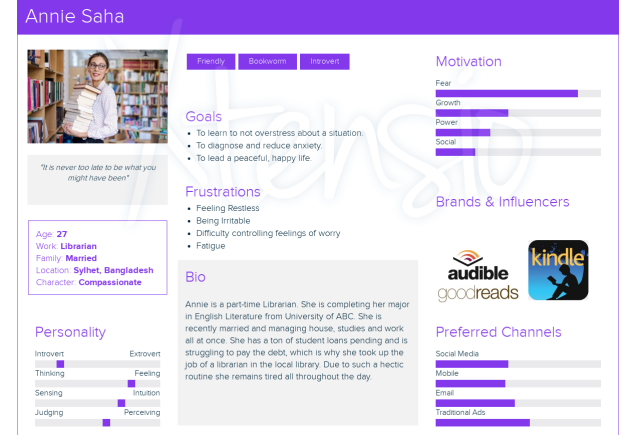
(b) User Persona: Annie
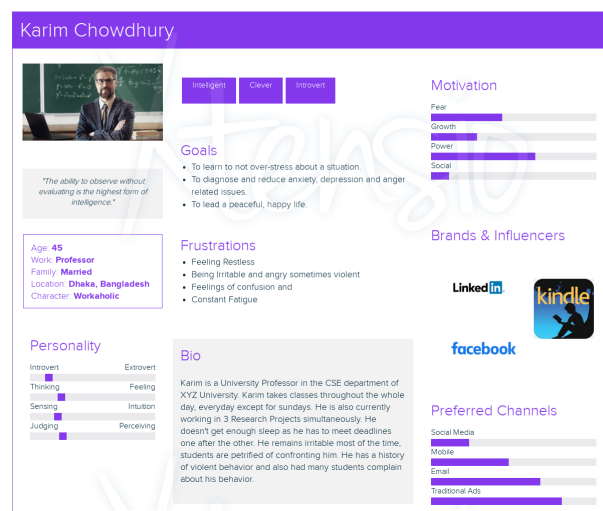
(c) User Persona: Karim

Fig. 2: User Personae

So, after being in denial for a whole day, Karim decided to test it out. He opened the web app DEPRESYS and was greeted by a warm welcome message. It put an instant smile on his tired, tiresome face. Being an introvert, he finds it hard to open up about his feelings and emotions. Karim then put himself together and expressed how he was feeling. He confessed to having anger issues and the outbursts he had in university. The web-app gave Karim the platform to seek help towards acknowledging his issues and problems and a psychiatrist associated with the app gave solutions on how he can work on it.Now, after only one semester, he can see the change in front of his eyes. The course evaluation report says he is a beneficial professor. Despite working endless hours, he can attend to his students' needs and guide them accordingly.

DEPRESYS saved his job and mended his life.
Event: Karim Chowdhury faced problems with his anger issues in his academic life as a professor and came to seek help from DEPRESYS.
Participant: Karim Chowdhury.
Goal: Share problems in the web app and get the necessary help from a psychiatrist associated with the app.

(e) *Build Goal-Requirement Matrix:* Building a goal-requirement matrix from requirement analysis is a valuable technique that helps align project goals with specific requirements. The goal-requirement matrix involves mapping each identified requirement to the corresponding project goal it supports. This matrix allows stakeholders to see how each requirement contributes to achieving the overarching objectives. To create the matrix, the requirements identified during the analysis

phase are listed horizontally, while the project goals are listed vertically. Each requirement is then assessed and linked to the relevant goals. This process ensures that all requirements are directly tied to the broader project objectives, facilitating effective prioritization and decision-making. The goal-requirement matrix is a valuable tool for stakeholders to understand how each requirement contributes to achieving project success, promoting a focused and goal-oriented approach throughout the project life-cycle.

C. Prototyping/Sketching

We have selected low-fidelity prototypes to describe our proposed system. The reason behind choosing low-fidelity prototypes is that they can be produced quickly and at a relatively low cost [15]. This allows for faster iteration and testing, which can help us to identify design flaws and refine the product concept more efficiently. These prototypes are also flexible, as they can be created using basic materials such as paper or wire-frames, allowing for easy modifications during the design process without wasting time and resources. Additionally, low-fidelity prototypes can gather feedback from stakeholders and end-users, encouraging open discussion and collaboration and resulting in a better product design.

The prototypes are built by focusing on how users interact with and take advantage of the system. According to the requirements that we gathered from the surveys and interviews, our end users want a system that can detect their mental state (depressed/neutral) based on their sent text messages. Furthermore, as Bangladesh origin, users prefer Bangla texts to communicate. Thus, we built a mental health state detector chat system to broadcast text messages. To sustain our goals, a series of web pages are built as prototypes to give an initial idea of the project and get feedback from the stakeholders.

We have designed several web pages, such as a landing page, log-in prompt, and chat system page, from both user and admin points of view as prototypes. The landing page is designed to make the user believe it is a safe place to get help. Thus, the font style and overall design are based on that fact. Later on, a login prompt is designed to protect confidentiality. The chat system prototype is a mock-up of our proposed system. From the user end, a user can chat with the psychiatrist to talk about their problem, and from the admin end, a psychiatrist can see the messages along with their detection, such as depressed or neutral. This detection can help psychiatrists to make decisions and provide feedback.

III. EXPERIMENTAL EVALUATION

A. Experimental Design

1) *Experimental Design:*
   A controlled within-subjects design may be used for the experimental plan that will be used to evaluate the DEPRESYS Chat Application. As a result, participants will encounter several test scenarios or application versions, enabling a direct comparison of their experiences.
2) *Experimental Variables:*

a) *Independent Variable:* The many DEPRESYS Chat Application iterations or versions, such as various interface designs, language processing techniques, or prompt modifications.
b) *Dependent Variables:* The variables that measure the effectiveness and user experience of the application, such as:

- Accuracy of Bangla text analysis.
- User satisfaction and perceived helpfulness.
- Ease of use and navigation.
- Time is taken to complete tasks.
- Number of errors or issues encountered.
- Emotional response (e.g., anxiety reduction, positive emotions).

3) *Test Conditions:* Participants will use different iterations or versions of the DEPRESYS Chat application. To reduce the effects of order, each participant's order of the test conditions will be counterbalanced.
4) *Qualitative Evaluation Parameters:*

a) *User Feedback:* We utilized open-ended questions and surveys to get detailed participant feedback. Participants provided their general thoughts, preferences, and ideas for improvement.

5) *Quantitative Evaluation Parameters:*

a) *Accuracy Metrics:* We assessed the Bangla text analysis's correctness by contrasting the system's output with a reference or standard.
b) *Usability Metrics:* We gathered quantitative information on usability factors, including task completion times, mistake rates, and efficiency measurements (such as the number of clicks or steps needed to complete tasks).
c) *Response Time:* The system's response time was also measured to determine the time needed to create an appropriate reply.

B. Evaluation Method

Cognitive Walk-through was used as an evaluation method to evaluate the effectiveness of the application. We took the role of users and interacted with the system, putting in information from a user's perspective. As users, we navigated through the application, trying different features and interacting with the system. We then determined if the language processing analyzed the Bangla text correctly, offered pertinent advice or comments, and gave depression scores accordingly.

C. Evaluation Process

Several tasks can be designed to assess the functionality, usability, and effectiveness of the DEPRESYS Chat Application. Here are some example tasks:

1) *Registration and Profile Setup:*

- Create a new account on the DEPRESYS Chat Application.
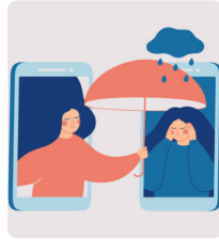- Set up a user profile by providing relevant information.

(a) Landing Page

(b) Log In Page

(c) User Guide

Fig. 3: System UI

(a) User POV

(b) Admin POV

Fig. 4: Chat System

2) *Starting a Conversation:*
   - Initiate a conversation with the application by sending a text message expressing a common mental health concern, such as stress or anxiety.

3) *Providing Personal Information:*
   - Share personal details and experiences related to mental health struggles or symptoms, as prompted by the application.

4) *Seeking Support and Guidance:*
   - Ask the application for advice or suggestions on managing mental health issues, improving well-being, or finding professional help.
5) *Assessing Language Processing Accuracy:*
   - Submit various Bangla text messages related to different mental health concerns and evaluate the accuracy of the application's text analysis and response.
6) *Exploring Resources and Services:*
   - Inquire about available mental health resources, such as helplines, support groups, or therapy options, and assess the effectiveness of the application's recommendations.
7) *Providing Feedback:*
   - Reflect on the overall experience with the application and provide feedback on usability, language processing accuracy, user interface, and any suggestions for improvement.

D. Evaluation Results

To evaluate our results, we consider the following facts:

1) *What causes the differences in the measurements across experimental conditions?*
   We evaluated the user experience and contentment by using different types of elements in the user interface and creating various variations of the user interface accordingly. We measured how easy it was for the user to use the system and asked for feedback from them by asking them to rate their experience out of 5. The users gave feedback on different User Interfaces, and we chose the best one.
2) *What interaction caused one method to be slower than the other?*
   We designed some user interfaces, in one we put a backward arrow for going back to the previous page and in another User interface we put a button labelled back. The one with the backward arrow was found to have slowed down the process, as many users continuously missed the arrow while pressing on it. The delay was significantly more significant than when using a button.
3) *Did one condition require more input actions?*
   No, all the prototypes roughly had the same number of input actions.
4) *Were participants confused?*
   No, the maximum number of participants was not confused when using the system. The system is straightforward to use, and a detailed user guideline was also provided on a web page inside the system.
5) *Why user performance varied?*
   Due to individual variances, past exposure to mental health programs, and the DEPRESYS Chat Application's learning curve, user performance varied for different users. Participants who were more knowledgeable about mental health issues and were exposed to applications like these did better. In contrast, less knowledgeable people

require more time to comprehend and interact with the system.
6) *Was the method hard to learn?*
   The steps required to use and interact with the system correctly and efficiently were relatively easy, so most users learned to use Depresys quickly.
7) *Did participants experience fatigue or discomfort?*
   No, the participants didn't experience any fatigue or discomfort. Using the application is quite easy as the system is interactive.

E. Updated Prototypes

Initially, an arrow was used to go back. Still, after gaining insights from the users, we decided to replace it with a button, as the chances of mispressing a button are meager, and it is more visually appealing to the users. At first, the system was designed so that all the instructions and labels in the buttons and input fields were in English. Still, as the system has been developed to cater to the young Bangladeshi population, we decided to use Bangla. This was done so that all Bangladeshi people with various levels of education use the system and benefit from it. The user interface has been kept relatively simple, with soothing colors and appropriate contrast so that users can adequately distinguish different elements in the user interface.

The updated prototypes will be available here: <u>Live Link</u> Instructions for running the prototype:

- The first page is the landing page of our proposed system. It is designed to make users feel this is a safe space for starting a conversation. This page has two interactive options- Log In and User Guide.
- Log In option allows choosing between two options- either the one who needs help or the one who helps.
- By logging in, a user can start a conversation with the psychiatrist, and the psychiatrist can also do a conversation with the user.
- The salient fact is that, while conversing with the user, the psychiatrist can see an indicator below the message, which is this message is categorized as either depressed or neutral.

IV. CONCLUSION & FUTURE WORKS

Our main intention is to provide and propose a chat system platform for Bangladeshi students to address their mental health through Bangla text messages. The system is proposed so that users can send messages directly to psychiatrists and get their help. From the psychiatrist's point of view, he can see the messages along with the detection of mental state conditions such as depression or anxiety. This unique system will help Bangladeshi students especially university students to address their mental states.

After building the system prototypes, we aim to focus on the implementation. A few mental state detections through Bangla text messages are available, such as [9], [16]. Based on that dataset and models, we aim to build a web application that fulfills our prototype goals.

As this is a unique product in the Bangla text message context, there are shortcomings and possible scopes for improvement. Those scopes are

- Collect or create a better Bangla text dataset
- Train the model in better, efficient models such as GPT-3 or GPT-4.
- Add more functionality in the desired system, such as generating reports about mental state conditions

Despite all the shortcomings, our proposed system is a unique product that could help Bangladeshi students address their mental states and seek help.

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