

Original Research Paper

Anxiety Assistance Mobile Apps Chatbot Using Cognitive Behavioural Therapy

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Article History

Received:
15.04.2022

Revised:
13.05.2022

Accepted:
21.05.2022

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Abstract: The current pandemic COVID-19 and lockdown have worsened patients' health, especially those who suffer from an anxiety disorder. However, anxiety disorders are treatable by undergoing different therapies treatment. This paper aims to develop an Anxiety Assistant Mobile Apps Chatbot (ANUVA) for university students using Cognitive Behavioural Therapy (CBT). Structured activities are used to motivate the user to question their thought distortions and change them back. The ANUVA chatbot is developed using Evolutionary Prototyping Model. The effectiveness of the ANUVA chatbot was tested using Confusion Matrix. The result indicates that the accuracy of the ANUVA chatbot is 75%, precision 85% and recall 88%. The System Usability Scale (SUS) test was used to measure the usability, and the score shows 86.75 for the result. For future work, all the chat records will link with the counselling unit system to enhance the efficiency of the therapies.

Keywords: Anxiety Disorder, Chatbot, Cognitive Behavioural Therapy, Mobile Apps.



1. Introduction

The global market for chatbot services has widely benefited from the outbreak of the COVID-19 pandemic. Most banking markets use chatbots to handle their customer. The market is expected to grow rapidly, leading to various organizations and businesses' increasing acceptance of remote work. Aside from that, chatbots can also be used in multiple industries, including healthcare, human resources, banking, and finance.

In the healthcare industry, AI-powered chatbots can be used in helping patients assess their symptoms and recommend therapies or doctors for further treatment. Anxiety disorder cases among students are rising during the COVID-19 pandemic. Due to this, appropriate service is required to support their need and provide adequate treatment. However, students with anxiety disorder require consistent support and help due to the lack of awareness among society.

Most students who suffer from anxiety disorder do not get proper support from society because of a lack of awareness. The research found that a lack of support from a partner, family, and community was a major contribution to anxiety disorder [1]. According to the survey conducted by Young [2], the current pandemic and lockdown have worsened patients' conditions. Around 26 per cent of them were unable to receive treatment for mental health since support groups and 'face to face services' have been prevented [3]. They also worry about the public perception of anxiety disorder. People may give a negative response when someone asks about their mental health. The mental health problem is still taboo in our society, and it could lead to significant issues such as suicide. Therefore, this paper aims to develop an Anxiety Assistant Mobile Apps Chatbot (ANUVA) for university students using Cognitive Behavioural Therapy (CBT) to help them overcome their anxiety issues.

2. Literature Review

Anxiety disorder causes severe anxiety and is associated with behavioural disorders. From the report of anxiety among the world population, the number keeps increasing to 3.76%. Each anxiety illness is only diagnosed if the symptoms are not from medication's physiological impact or other medical issues [4]. People with a Generalized Anxiety Disorder (GAD) express excessive emotion about a feeling, such as physical well-being, work, social interactions, and everyday life circumstances, at least for six months. This anxiety and feeling could cause significant problems in their social interactions, academics, and business. People with social anxiety disorder tend to fear and resist other people's attention. In such situations, the person will act weird [5]. According to Stein [6], social anxiety disorder has been ignored in the psychiatric field. Now, it has become more generally understood, disabled, yet curative [7].

This gap can be minimized using smartphones via self-management approaches to expand the availability and quality of mental health self-care [8]. One of the approaches is using a chatbot. According to a review of 15,000 applications conducted by the World Health Organization, 29% focus on mental health diagnosis or support [9]. Chatbots are expected to make a beneficial contribution to addressing the mental health care shortage [10]. An initial study of a chatbot has been done to measure a chatbot's effectiveness in supporting mental health issues [11]. Chatbots can be used to boost the ability of psychology students to detect GAD [12]. Some of the studies used a webcam and a series of questions to assess users' self-esteem and anxiety to help the patient manage their stress and anger [13].

A study conducted in Brazil using a chatbot to improve mental health within one month shows a promising result [14]. The sample was collected from adult females under 24 years and have a different demographic background. The study shows that the chatbot (Vitalk) can reach its target audience and is useful for users with elevated stress and mental health symptoms [14]. Chatbots also can help those hesitant to seek help for mental health because of the stigma attached to it [15]. Across all research, the potential for conversational agents in psychiatric use was reported to be high. The review was to explore the current evidence for chatbots in the field of psychiatry. The satisfaction rating of chatbots was high across all studies, suggesting that they would be an effective and enjoyable tool in psychiatric treatment [15].

Cognitive behavioural therapy (CBT) is a form of psychological treatment that teaches people how to recognize and change negative thinking processes that negatively affect behaviour and emotions [16]. The previous study has reported that CBT can reduce patients' anxiety levels and patients manage to conquer their fear in particular situations [17]. There best mobile apps that support chatbot has been downloaded from Google Playstore and studied. The findings are described in Figure 1.

2.1. Replika: Your AI Friend

Replika is a mobile app with a chatbot. Users can freely talk about their feelings to calm their anxiety. In this application, users can create a friend by choosing a 3D avatar and customizing the way it looks. The Replika grows together and develops its personality and memories alongside the user. Replika helps users understand their feelings, track their moods, calm anxiety, and stress management, improving their mental well-being. Users may have a conversation with Replika about various topics provided in the application. They also can make a voice call if they want to have physical communication.



Figure 1. Interface of Replika Mobile Apps

2.2. Wysa: Mental Health Support

Wysa is full of daily spiritual meditation that enhances mental health. It lets users keep track of their emotions and helps combat depression and anxiety with its validated strategies and relaxing audio therapy content. Regularly checking in with Wysa will enhance users' mental health and fulfil their satisfaction and mood. This application has a mental health assessment and tests for depression and anxiety. By empathetic conversation and a free CBT therapy-based approach, user can conquer their mental health barriers.

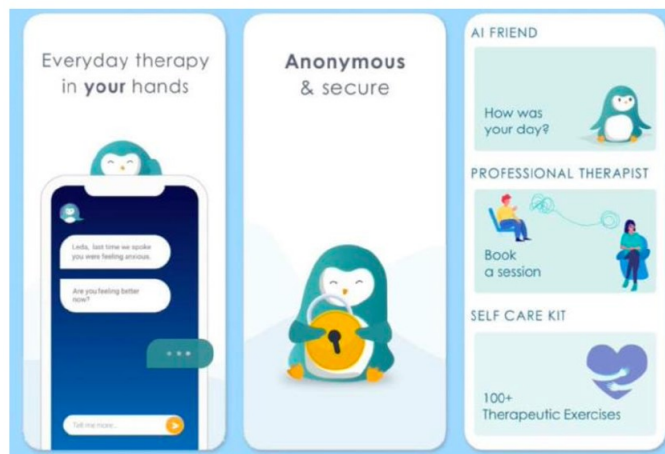


Figure 2. Interface of Wysa Mobile Apps

2.3. Sayana: Daily Self-Care

Sayana is a daily self-care mobile application with features such as a moods tracker, tips and practices, personal insights and community support. By using this application, user can track their mood and every day. It will suggest the best option for the user situation and how to boost the user's mood. In addition, Sayana will provide insight so that the user will learn about themselves. Users also may chat anonymously with other people who are going through the same situations in their life, get advice and support.

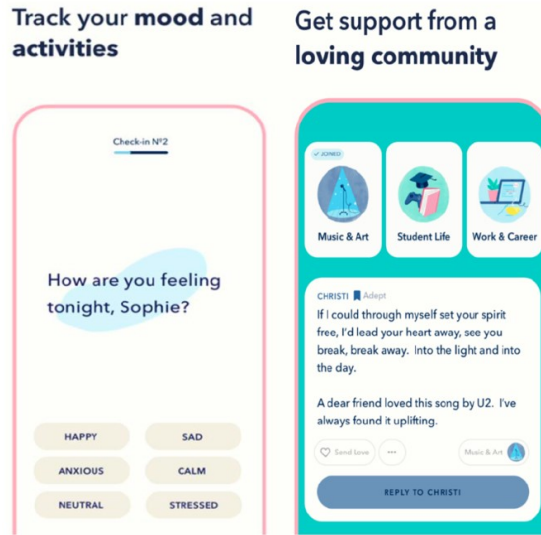


Figure 3. Interface of Sayana Mobile Apps

3. Methodology

The ANUVA application was developed using evolutionary prototyping, and the architecture is described in Figure 4. First, the user will start to communicate with the chatbot by typing using the keyboard. The input will integrate with the Dialogflow knowledge base. Then, the request is sent to fulfilment and response with the possible output. The intent which has been set earlier will map with the input and entities. Finally, Natural Language Processing (NLP) will respond to the JSON database and display the output. In this project, we embed the CBT technique to reduce the anxiety level.

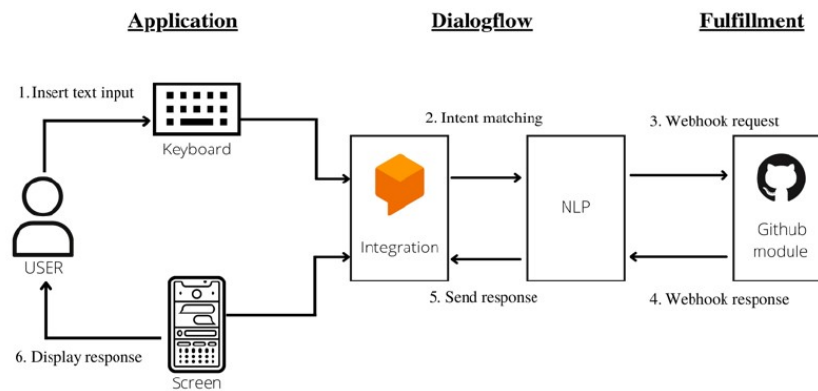


Figure 4. ANUVA Architecture

The prototype was presented to the expert, and all feedback was documented and refined in the next prototype. Furthermore, the information from treatment used in counselling and suggestion from the expert was collected as input. Finally, all the transcript was evaluated by the expert before being tested on the chatbot. Figure 5 shows the whole process involved to develop ANUVA apps.

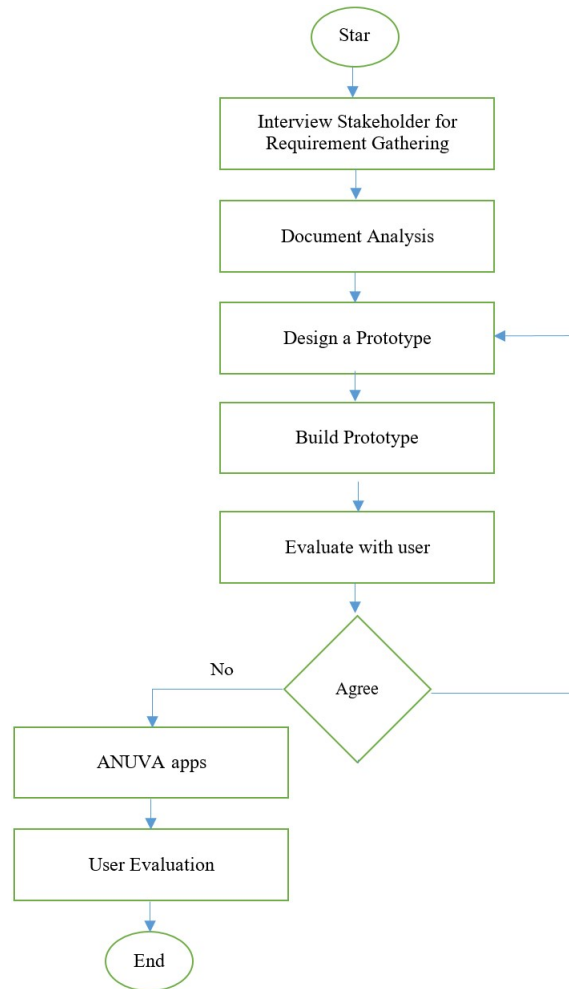


Figure 5. ANUVA apps Process

4. Result and Discussion

ANUVA app has been tested using 37 sentences and verified by the expert. In addition, a confusion matrix was used to calculate the precision, recall and accuracy of the apps. Table 1 shows the complete results of the ANUVA apps, while Table 2 shows the example of the ANUVA training dataset.

Table 2: ANUVA Apps Precision, Recall and Accuracy

Item	Percentage (%)
Precision	85
Recall	88
Accuracy	75

Table 2. Example of ANUVA Training dataset

SENTENCE	TRUE	PREDICT
Hi , Hello	option_select	option_select
Panic	panic	panic
I feel panic	panic	panic
I'm shacking	panic	fallback-custom
I'm afraid	panic	anxious
I'm afraid something bad might happen.	panic	random_phases
There is some specific thought that bothering me.	Panic-mind	panic-mind
It's my thought that always bothering me.	Panic-mind	panic-mind
It is mostly my thought	Panic-mind	panic-mind
I need to talk.	Panic-mind-talk	panic-mind-talk

ANUVA apps manage to produce 85% of precision, 88% of recall and 75% of accuracy. The precision measurement is performed based on the correctness of the intent map with the sentence. The accuracy level can be increased by adding more information about the intent.

The System Usability Scale (SUS) is used to measure ANUVA perceived-of-use by the student. 30 respondent was selected to perform this test. First, each user needs to install ANUVA apps on their phone and test the functionalities. Then, they need to answer the SUS questionnaire after they use the ANUVA apps. Overall, the apps tend to produce 86.75 for the SUS test. Figure 2 shows the result of the SUS test.

Table 3. SUS Test Result for 30 respondents

No.	System Usability Scale	Total respondent: 30				
		1	2	3	4	5
1.	I think that I would like to use this application.	0	0	2	11	16
2.	I found the system unnecessarily complex.	8	10	9	2	1
3.	I think the application is easy to use.	0	0	0	11	19
4.	I think I would need the support of technical person to be able to use this application	20	8	2	0	0
5.	The interface of this application is pleasant.	0	1	0	10	19
6.	I thought there was too much inconsistency in this system	7	15	7	1	0
7.	I would imagine that most people would like to use this application.	0	0	2	10	18
8.	I found the application very cumbersome to use	12	9	8	1	0
9.	I feel comfortable using this application.	0	0	1	14	15
10.	Overall, I am satisfied with this application.	0	0	0	10	20

5. Conclusion

In this paper, the Anxiety Assistant Mobile Apps Chatbot (ANUVA) is proposed to help students overcome their anxiety disorder during pandemic COVID-19 using CBT. Mental health is still taboo in Asia. Discriminating towards mental health patients made them refuse to seek treatment. However, there are many initiatives performed by the government, such as developing mobile apps to ease their problem. From this study, the use of chatbots and CBT has shown positive results to manage student anxiety disorder and at the same time create awareness in society.

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