

# Design of NLP-based chatbot media as a mental health consultation media with Depression Anxiety Stress approach

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**Abstract:** The development of technology has increased rapidly, this is in line with the increasing consumption of data and information. Getting information for all users has become easier with the development of artificial intelligence, Chatbot is partly an example of artificial intelligence technology that allows machines to think and make decisions independently, Depression Anxiety Stress Scales (DASS) is a commonly used tool for measuring mental health conditions, consisting of a series of questions used to measure a person's level of depression, anxiety, and stress. DASS helps provide a better picture of a person's psychological condition, which can help further diagnosis and intervention. In this study, we conducted a chatbot design using the NLP approach using DASS data as many as 3 categories of anxiety, stress, and depression. From the test results obtained by the chatbot from 41 questions, there were 85% percent accurate answers.

**Keywords:** Chatbot, DASS, Natural Language Processing, Mental health, Media

## 1. Introduction

The development of technology has increased rapidly, this is in line with the increasing consumption of data and information. The fact is that in getting information all users have become easier. One type of technology that has experienced rapid development in the contemporary era is artificial intelligence. Chatbots are some examples of artificial intelligence technology that allows machines to think and make decisions independently [7,8,9]. A chatbot, also known as a "conversation with a robot", is an artificial intelligence application that can mimic the way people speak well through text messages [19,20].

User activities in general at any time are required to always be focused and consistent in carrying out tasks and responsibilities in supporting their activities, therefore not a few workers experience problems, for example having mental health complaints, mild depression, and mild anxiety. Mental health is an important part of a person's well-being that is often overlooked because health measures will affect productivity in doing or completing work. Depression Anxiety Stress Scales (DASS), is a commonly used tool for measuring mental health conditions, consisting of a series of questions used to measure a person's level of depression, anxiety, and stress. The DASS helps to provide a better picture of a person's psychological state, which can aid further diagnosis and intervention.

DASS is usually implemented manually, so it can require a long process, one of the DASS assessment processes is through questionnaires usually written or through direct interviews. These methods not only consume a lot of time and resources, but they may also be uninteresting and non-interactive. Therefore, users do not want to do a good assessment. In addition, social stigma about mental health often prevents people from seeing a doctor in person. With a chatbot can make it easier for users to consult.

Consulting with chatbot media is part of the data processing procedure with an approach in using natural language modeling (NLP) so that it can allow computers to analyze, understand, and derive meaning from user questions related to mental health, NLP-based chatbots have many weaknesses so that they can make it easier for users to interact so that they can solve the problems experienced. The chatbot that is built is full-



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based so that it can carry out the search process, translation, spam filter, and spell check the results of DASS data.

NLP-related research conducts a validation process of the system with two methods, namely cross-validation and user validation. So the results of cross-validation get an accuracy of 83.33%. User validation is done by asking 10 users to test the system and get an accuracy of 76% [2]. The application of an NLP-based chatbot as a means of facilitating tuition payments for parents of students using the WhatsApp API and Node.js this research resulted in an accuracy value of 90, 91% of functional testing on 6 features [3]. Benedictus et al. [5] created a chatbot that functions as a helpdesk for Sam Ratulangi University in the Integrated Information System. This is different from previous research. The chatbot developed by the study uses the big ram algorithm to adapt the user's question sentence. A sentence will be divided into pairs with this algorithm. In this research, forward chaining is also used to reason about certain conditions in a question so that the system can find the right answer.

This study uses a chatbot design approach built with a Natural Language Processing (NLP) approach [10,11,12] because it can replace the role of humans to provide answers from DASS data quickly to users without having to read or scan data. Because it uses natural language so that it can be represented in text or voice [4].

## 2. Theory

### 2.1 DASS

The DASS is a psychological assessment that measures three main emotional states: stress, depression, and anxiety. 42 items are included in this scale, which consists of three subscales and each has fourteen items. Each item is rated with points ranging from zero (not applicable at all) to three (very applicable). A higher number of scores indicates that the condition is more serious. [7]

### 2.2 NLP-based Chatbot

A chatbot is an application that allows machines to talk to humans using human natural language [13,14,15]. They use human natural language processing (NLP) approaches to understand human natural language and process each human spoken word into a text message [6]. Here is an example of the components of NLP.

#### 1. Text Input

The user provides text input, for example: "I have a pain in the stomach."

#### 2. Text Preprocessing

The user provides text input, for example: "I have a pain in the stomach."

Tokenization breaks the text into tokens. Example: ["I", "have", "pain", "in", "stomach"]

Normalization converts the text into a standard form. Example: ["me", "have", "sick", "at", "stomach"]

#### 3. Feature Extraction

Stemming/Lemmatization converts words into their base form. Example: ["me", "have", "sick", "at", "stomach"]

Named Entity Recognition (NER) identifies important entities in the text. Example: ["sick" (condition), "stomach" (body part)]

#### 4. Text Classification

Uses trained machine learning models to classify text into predefined categories. Example: "Health. stomach pain"

#### 5. Intent Recognition

The system recognizes the user's intention based on the given text. Example: "Health. stomach pain"

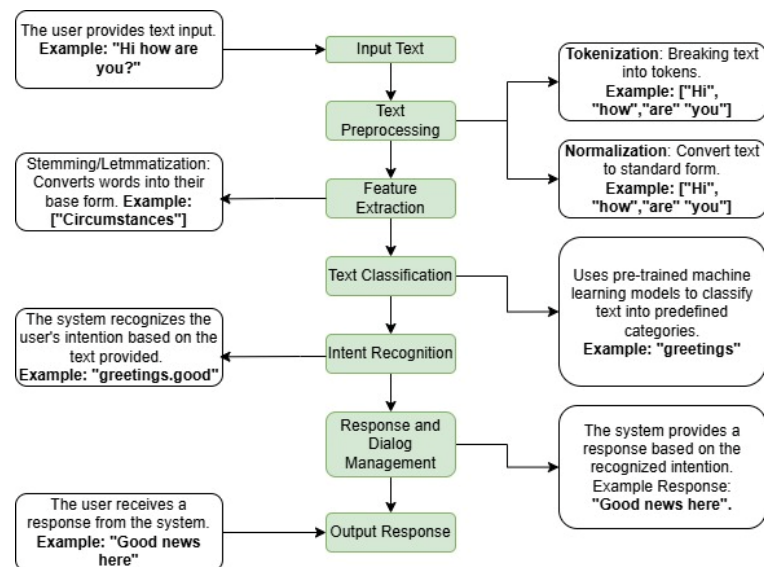
#### 6. Response and Dialog Management

The system provides responses based on the recognized intent. Example Response: "Try lying down and drinking warm water. If the pain persists, consult a doctor."

#### 7. Output Response

The user receives a response from the system. Example: "Try lying down and drinking warm water. If the pain persists, consult a doctor."

NLP.js eases the development of applications that require natural language processing by providing comprehensive tools and features for various NLP needs [8]. Figure 1 is a diagram of an NLP-based Chatbot [16,17,18].



**Figure 1.** NLP-based Chatbot Diagram

### 2.3 FireBase

Cloud-based application development platform developed by Google, and firebase based on realtime database through API (application programming interface), firebase is a platform developed by Google that has a complete library for cross-platform and hybrid application development, to create web and mobile applications that include hosting, user authentication, analytics, and data storage [9].

## 3. Method

### 3.1 Data Analysis

This process starts with building a chatbot system that can automatically identify and understand user responses. The chatbot must be able to process natural language to identify anxiety, depression, and stress based on the user's responses. This algorithm was used to evaluate user responses to the chatbot's DASS questions. Taking into account that cultural and regional variables might affect the way symptoms are reported, each answer was evaluated to measure the intensity of the user's symptoms. The chatbot calculates the DASS score based on the user's answers after the text analysis is completed. Moreover, Table 1, Table 2, and Table 3 show the Depression Anxiety Stress Scales (DASS) which is used to measure the scale on Stress, Anxiety, and Depression specifically.

**Table 1.** Depression Anxiety Stress Scales (DASS): Stress

Assessment Aspect	Scale
Getting angry over small/trivial things	Stress scale
Difficulty relaxing	Stress scale
Easily irritated	Stress scale
Feeling like you're wasting a lot of energy because of anxiety	Stress scale

**Table 2.** Depression Anxiety Stress Scales (DASS): Anxiety

Assessment Aspect	Scale
Mouth feels dry	Anxiety Scale
Feeling interruptions in breathing (rapid breathing, difficulty breathing)	Anxiety Scale
Weakness in limbs	Anxiety Scale

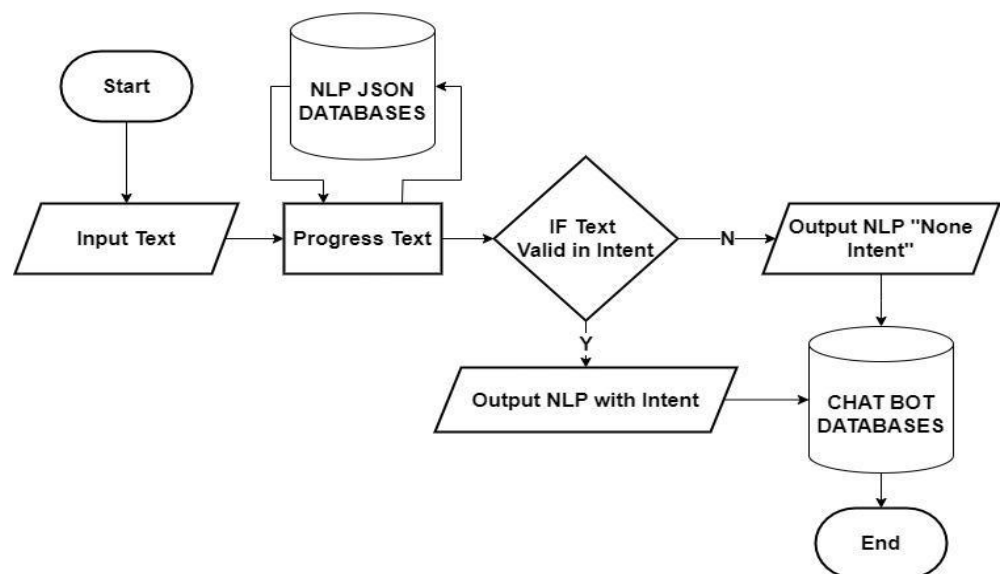
**Table 3.** Depression Anxiety Stress Scales (DASS): Depression

Assessment Aspect	Scale
Unable to see the positive in events	Depression Scale
Feeling like you can't do something anymore	Depression Scale
Pessimist	Depression Scale

### 3.2 Chatbot Flow

NLP-based chatbot design with stages that mark the beginning of the process. Next, the system receives Input data provided by the user and is processed by the system which also retrieves and sends data in databases, in several stages, involving Decision points, where the system will determine the next path based on certain conditions.

The processed data will continue to respond to the user according to the Decision that has been processed by the system. After going through the processing and decision-making stages. Figure 2 is a diagram of the Chatbot Flow.

**Figure 2.** Chatbot Flow Diagram

### 3.3 Architectural framework of chatbot design

Architectural framework to support chatbot responses that can be used by clients on their website. The focus of the system is to provide health-related information. This chapter includes details of the architecture, user interface, and workflow of the system. The system architecture diagram can be described as following Figure 3.

The health chatbot content management system consists of several main components, namely:

1. Client Website

The user interface where the end user interacts with the chatbot.

2. Backend API

Service that connects the website admin with Firebase.

3. Firebase

A repository for all intent data, utterances, and answers.

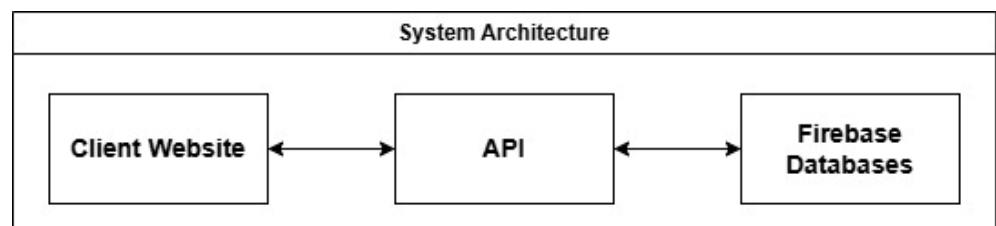


Figure 3. System Architecture Diagram

## 4. Result and Discussion

### 4.1 Wireframe

This wireframe shows the basic layout for the login, registration, and forgot password pages designed specifically for mobile device use. A detailed wireframe is shown in Figure 4.

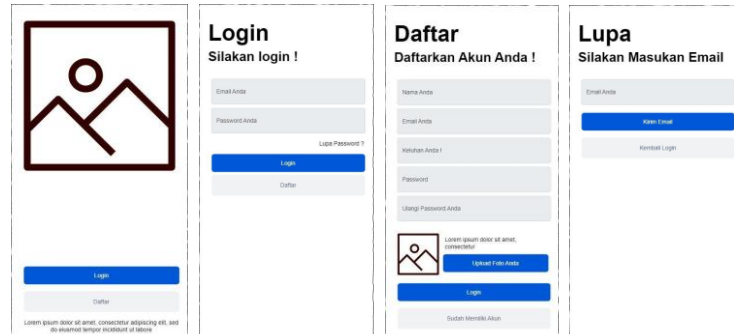


Figure 4. Wireframe

### 4.2 Firebase

Once the configuration of the Firebase project is complete, the next step is to integrate Firebase with the React project and create a new file with the name `firebase.js` in the `src` directory. Copy the Firebase SDK configuration obtained from the Firebase console into the `firebase.js` file:

```

firebase.js

// src/firebase.js
import firebase from 'firebase/app';
import 'firebase/auth';
import 'firebase/firestore';
  
```

```
const firebaseConfig = {
  apiKey: "API_KEY_ANDA",
  authDomain: "PROYEK_ID.firebaseio.com",
  projectId: "PROYEK_ID",
  storageBucket: "PROYEK_ID.appspot.com",
  messagingSenderId: "SENDER_ID",
  appId: "APP_ID",
  measurementId: "MEASUREMENT_ID"
};

firebase.initializeApp(firebaseConfig);

export const auth = firebase.auth();
export const firestore = firebase.firestore();
export default firebase;
```

Firebase is correct and has been imported into the React project. Firebase provides several services such as authentication (auth) and Firestore that can be used according to the needs of the project. Then iterate to ensure that the Firebase integration has gone well and is ready to be used in the React application.

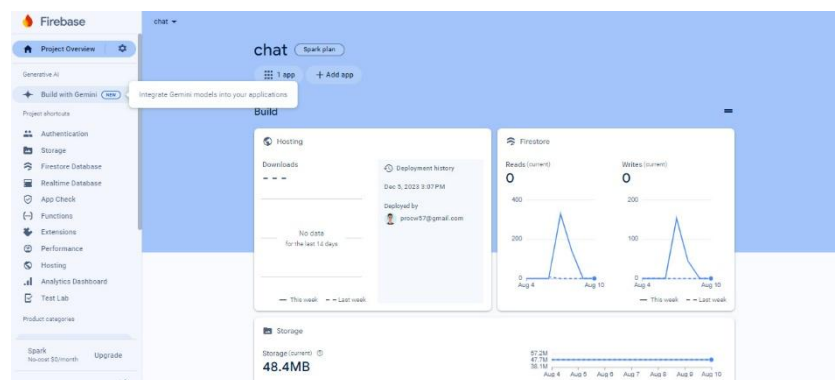
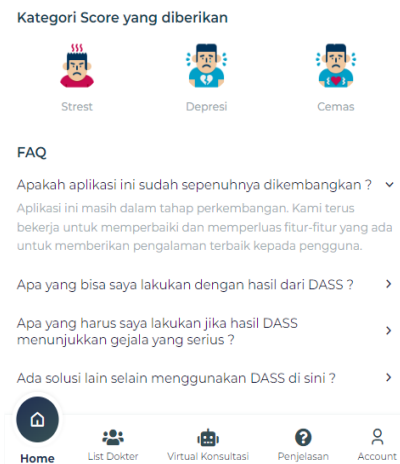


Figure 5. Firebase

The main page of the mobile application displays the interface, shown in Figure 5. The top of the screen contains the app logo and a navigation bar with menu icons that allow easy access to the different sections of the app. Below that, there is a main banner with an attractive image and a welcome text inviting users to explore the app further.

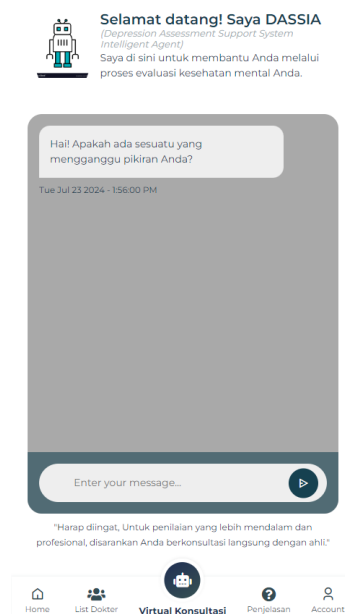
The center of the page contains some of the main features presented in the form of categories with icons and short descriptions. At the bottom of the screen, there is a set of quick navigation icons for direct access to important features such as Home, Todo, Chatbot, Chat, and Profile. These icons are always visible and accessible from every page in the app. For a description of the Category Score given and FAQ can be seen in Figure 6.



**Figure 6.** FAQ

### 4.3 Chatbot

The chat page is designed to provide a seamless and interactive communication experience for users. The top of the screen displays a header with the contact or group name, profile photo, and a back icon for navigation to the previous page. Alongside, there are menu icons to access additional options such as Contact Details or Chat Settings. Figure 7 is the welcome view of the Chatbot system.



**Figure 7.** Chatbot Welcome Screen

The main part of the page displays a conversation area containing the user's messages, sorted by time. Each message is displayed in a conversation bubble, with user messages on the right side and contact messages on the left side. Different colors are used to distinguish between sent and received messages, giving a clear and uncluttered look. There is also a time indicator below each message to show when it was sent or received.

At the bottom of the screen, there is an intuitive message input area. The text input field has a "Type a message..." placeholder. To the right of the input field, there is an attachment icon for sending images, or other files, as well as a send button that changes color when text is typed, making it easy for users to send messages quickly.

#### 4.4 Explanation Menu

This menu explains what the DASS scale is, which is used to provide a comprehensive overview of the level and intensity of symptoms experienced by individuals. This Explanation Menu is shown in Figure 8.



Figure 8. Explanation Menu

#### 4.5 Testing

In this section, we describe the process of user interaction with the chatbot for emotional support. The user is asked to start the interaction by pressing the "Please start chat!" button provided. This process is designed to facilitate the initial dialog between the user and the chatbot, to provide appropriate responses based on the user's emotional state.

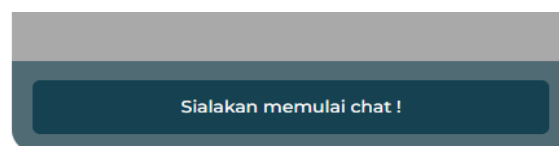


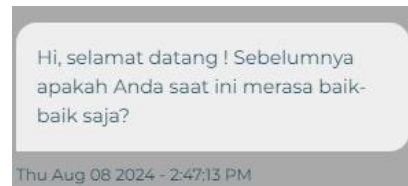
Figure 9. Start a Chat

##### Step 1: Greetings from the Chatbot

Once the "Please start chat!" button is pressed, the chatbot will initiate the interaction with the following message: Greetings from Chatbot can be seen in Figure 10.

1. "Hello Is there anything that makes you feel uncomfortable?"
2. Welcome! Are you feeling stressed or depressed today?
3. Hi, welcome! Previously did you currently feel okay?
4. Hi! Is there something bothering you?
5. Hi! Are you feeling heavy, depressed, down, sad, stressed or anxious today?
6. Hello Is there anything that makes you feel uncomfortable?

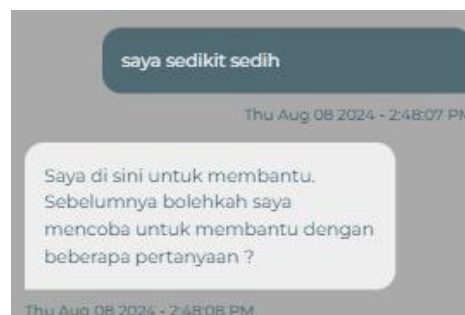




**Figure 10.** Greetings from Chatbot

### Step 2: User Response

1. If the user answers "yes": The chatbot will respond by providing further support or additional information according to the user's needs. An example answer from the chatbot can be seen in Figure 11.



**Figure 11.** User response, answered by chatbot

If the user answers "no": The chatbot will offer another option or continue by providing additional relevant information.

This process aims to ensure that every interaction with the chatbot can provide appropriate attention and support to the user's emotional state.

Once the questionnaire session begins, the chatbot will ask the user a total of 42 questions. These questions are designed to evaluate the user's emotional state in depth, focusing on the symptoms of Depression, Anxiety, and Stress.

Each answer will have a corresponding score. The scores of each answer will be summed up for each category (Depression, Anxiety, and Stress) to give a clearer picture of the severity of the symptoms felt by the user. The result of this summed score will be used to determine the severity category in the next session, which includes Normal, Mild, Moderate, Severe, or Very Severe. The question from the Chatbot is shown in Figure 12.



**Figure 12.** Questions from Chatbot

For each question, users will select one of the following four answer options:

1. No: Indicates that the symptom is not felt at all.
2. Infrequently: Indicates that the symptom is rarely felt.
3. Yes: Indicates that the symptom is felt quite often.
4. Every Day: Indicates that the symptom is felt every day.

#### 4.6 Score Result

After the user has answered all the questions posed by the chatbot, each answer will be scored and calculated to determine the score result. This score provides an overview of the severity of Depression, Anxiety, and Stress symptoms experienced by the user.

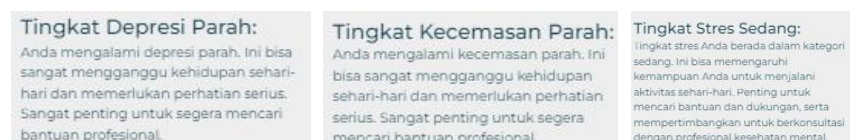
Score Calculation Process:

1. *Answer Scoring*: Each answer provided by the user will be converted into a numerical score. This score is assigned based on the answer options selected:  
No: Score 0, Rarely: Score 1  
Yes: Score 2, Every Day: Score 3
2. *Total Score Calculation*: The scores for each question will be summed for each category (Depression, Anxiety, and Stress). This total score reflects the intensity of symptoms experienced by the user in each category.  
Depression: Measures the severity of Depression symptoms  
Anxiety: Measures the severity of Anxiety Symptoms  
Stress: Measures the severity of Stress symptoms
3. *Score Result Display*: The score results will be displayed prominently on the user's screen, providing information on the severity of the symptoms experienced. The Score Display is shown in Figure 13.



**Figure 13.** Score result display

**Total Score for Each Category:** Shows the overall score for Depression, Anxiety, and Stress. **Category Severity:** Presents results in Normal, Mild, Moderate, Severe, or Very Severe categories. The category result display can be seen in Figure 14.



**Figure 14.** Category Result Display

## 5. Conclusions

Workers' activities require them to remain focused and consistent in completing their assigned tasks and responsibilities. As a result, many workers experience physical problems such as indications of anxiety and an unstable mental state. Mental health is an important component of a person's well-being that is often overlooked because it affects how productive they are in doing or completing their work. The Depression Anxiety Stress Scales (DASS), a commonly used tool to measure mental health conditions, consists of a series of questions used to measure a person's level of depression, anxiety, and stress. Providing a better picture of one's psychological state can help in further diagnosis and intervention. Chatbot is a medium that can easily classify multiple questions and quickly get an answer response, this chatbot approach uses NLP modeling.

The drawbacks of the manual DASS assessment process, which is usually done through written questionnaires or in-person interviews, exist. Not only does this approach take a lot of time and resources, but it also tends to be uninteresting and non-interactive. As a result, people may not want to complete the assessment well. In addition, social stigma about mental health often prevents people from consulting a clinician directly.

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