

Chatbot-Based Dialogue for Early Psychosis Detection: Leveraging Global Assessment of Functioning (GAF)

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Abstract: Mental disorders patients often make people restless because they have uncontrollable behavior and need special rehabilitation. Not every patient's family knows how to handle them, and health workers find it difficult to monitor their condition. Early detection of psychosis, specifically schizophrenia, is critical for effective treatment and support. Existing studies have explored expert systems and mobile applications for diagnosing mental disorders and depression. Still, none have concentrated on developing a system or application for the early detection of psychosis based on its severity. This research seeks to significantly contribute to the mental health field by improving the early detection of psychosis, ultimately enhancing the lives of individuals affected by this condition using chatbot-based dialog. The Early detection of psychosis features was developed using the Global Assessment of Functional (GAF) and integrated with the Jiwamuku mobile application. This GAF was categorized into four classifications: not indicated, mild, medium, and serious. This feature was tested on 15 respondents. The application shows that two people are not indicated: 11 are mild, one is medium, and one is severe. Of all the data taken, 14 tests are accurate. The result shows that early detection of psychosis features with Global Assessment of Functioning can be detected with 93% accuracy. This research underscores the critical importance of early detection of mental disorders, particularly psychosis, by harnessing the potential of chatbot-based dialogue and the Global Assessment of Functioning (GAF).

1 INTRODUCTION

Mentally healthy individuals do not display signs of mental disorders and effectively manage life challenges by handling stress and recognizing the importance of mental health on par with physical well-being. Mental health problems can stem not only from heredity but also from overwhelming stress due to life demands (Saputra, et al., 2018).

In Indonesia, approximately 27.3 million people experienced mental health disorders in 2017, with 6.7 per 1000 households dealing with schizophrenia/psychosis (Kemenkes, 2018). Schizophrenia, a lifelong disorder affecting daily activities, disrupts

thought and perception patterns, impacting factors like age, memory, and intellect (Sumner et al., 2018). People with mental health disorders often exhibit uncontrollable behavior, causing societal distress. They may experience relapses and require specialized rehabilitation. However, post-treatment relapses are influenced by a lack of supervision and limited knowledge among family members regarding patient care.

Information system technology can assist in monitoring post-treatment mental health patients. Studies, such as the development of web-based systems and the JiwaMuKu Android app, focus on monitoring patients' health conditions via mobile applications used by their families. Although these

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systems can screen and provide progress graphs, reminders, and reports, they have not progressed to diagnosing disorders like psychosis.

In addition to post-medical care processes, early detection of schizophrenia and other symptoms is equally crucial. Early education and symptom recognition processes are vital for personal assessment and those close to the individual. If identified early on, patients can seek assistance for the mental health issues they are facing. Typically, patients or their families may feel reluctant to disclose the early symptoms to others or mental health professionals. Other research explores using expert systems for psychosis detection, schizophrenia, or student depression. Nevertheless, there is ample room for improvement in identifying the severity of early-stage psychosis.

This research uses the Global Assessment of Functioning (GAF) Scale to determine severity. The study focuses on developing a feature for early psychosis detection using the GAF scale through chatbot-based dialogues. Choosing a chatbot dialog aims to make the application more user-friendly, with different constructions for self-assessment or assessments by others.

2 RELATED WORKS

Mental health disorders are conditions in which an individual has trouble adapting to their surroundings. The inability to solve problems can lead to excessive stress, making the mental health of the individual more vulnerable and eventually diagnosed as a mental health disorder (Lubis et al., 2014). Psychotic disorders, on the other hand, are characterized by a disturbance in assessing reality. Psychosis includes various types, such as schizophrenia, schizoaffective disorder, persistent delusional disorder, bipolar with psychotic features, and depression with psychotic features (Idaini et al., 2018).

Schizophrenia is a group of psychotic disorders with distinctive distortions in thought processes. Individuals with schizophrenia may sometimes feel controlled by external forces, experience strange delusions, perceptual disturbances, abnormal affect integrated with real or actual situations, and autism. Schizophrenia is the most common psychotic disorder, affecting nearly 1% of the world's population during their lifetime (Zahnia & Sumekar, 2016).

People with schizophrenia generally require assistance from those around them, known as caregivers. Caregivers help with the daily activities of individuals needing care, such as the sick or children.

Caregivers can include family members or close individuals who assist patients in their daily activities (Farkhah & Suryani, 2017). The level of assistance provided may vary for each patient.

Several studies have explored the use of information systems in primary healthcare institutions, including the development of web-based systems for monitoring the recovery process of mental health disorder survivors (Waskito, 2020), (Adiyaksatama, 2020) and the JiwaMuKu Android-based application (Syahputra, 2020). These systems allow for tracking patients' health conditions, integrated with a mobile application used by their families.

Screenings can be performed in the mobile application, and healthcare professionals can view the results through a web application. The web application can display patient progress graphs, provide reminders, and generate patient reports. However, these studies have not progressed to diagnosing mental health disorders such as psychosis (schizophrenia).

In 2018, Landung Sudarman and Febty Lestari developed an expert system for diagnosing schizophrenia (Sudarmana & Lestari, 2018) using a forward chaining method and Dempster-Shafer theory. (Widodo and Jaya, 2018) and (Anisa, 2018) created an expert system for analyzing the level of depression in students and schizophrenia detection utilizing the certainty factor method. Another study focused on early detection of psychosis using a mobile application based on fingerprints. However, no research has been conducted on developing a system or application to detect early-stage psychosis based on its severity.

This research utilized the Global Assessment of Functioning (GAF) Scale to determine the severity level based on weighted symptoms.

The GAF is used to assess the seriousness of mental health disorders and measures the impact of symptoms on daily life on a scale of 0-100 (Smith, 2021). GAF scores can be assessed through interviews, questionnaires, medical records, information from doctors, caregivers, or close relatives, and police or court records documenting violent or illegal behavior.

3 METHODS

3.1 Design

This study was to develop an early psychosis detection feature on the JiwaMuKu (Jiwa Munyai

Jiwa Strong) platform in the form of an Android application that general users can use.

3.2 Population and Sampling

The psychosis early detection feature is carried out by several community groups, including five people from the Sukarame neighborhood, five people who are experiencing mental disorders, and five people mental health professionals.

Testing with people with psychiatric disorders was conducted in two different places. The first place was at Wisma Ataraxis, while the second was at the Yayasan Sinar Jati Kemiling. During the testing, they were directly accompanied by mental health experts.

3.3 Procedure

Application development begins with a discussion with the Ikatan Perawat Kesehatan Jiwa Indonesia (IPKJI) to analyze the needs and definitions of the application during development. After the discussion, the application design was carried out by designing the application's functional features, workflows, data structures, and appearance. After that, the coding stage is carried out based on the design that has been made previously.

The next stage is black box testing to ensure that all functions run smoothly before being used by users. If the black-box test has met the expected results, then testing with users is carried out. From testing with users, it can be concluded how accurately the application works.

4 RESULTS

The early detection of psychosis is a new feature that will be added to the JiwaMuKu application. Psychosis detection diagnoses its severity based on the symptoms experienced using the Global Assessment of Functioning (GAF) scale. The public can access this feature, and it does not require login beforehand. The questions asked are based on the individual's conditions and experiences. As for the answers provided, they indicate the level of confidence in those events or conditions.

Like an expert system, this feature also utilizes rules to conclude. Table 1 presents a list of symptoms and rules for the early detection of psychosis features. Meanwhile, figure 1 shows the main menu of the Jiwamuku application.



Figure 1: Home menu for the user.

The "Check Me" menu is where users can diagnose psychosis. To begin the test, options will be presented for self-detection or detection of others. The difference between these two options lies in the questions' wording, which is based on the target being detected. If conducting the test for oneself, the questions will use the word 'kamu' (you), while for testing someone else, the word 'dia' (he/she) will be used. The answer and the calculation will also differ based on the viewpoint.



Figure 2: Display Self-Doubt Questions for Oneself (Left) and Self-Doubt Questions for Others (Right).

Figure 2 displays examples of questions related to a lack of confidence. Feeling lacking in confidence is something everyone may experience, and it's a normal occurrence. However, if one consistently feels

low in self-confidence and believes that others always harbor negative thoughts about them, it falls under the symptoms of psychosis.

After answering various displayed questions, a summary page of the provided answers will appear. Figure 3 shows the display of the resume answer. If the answers seem appropriate, the user can view the conclusion of the detection by pressing the Next button. The displayed conclusion will be based on the obtained score. There are four categories:

- The first category indicates no mental health issues if the score is >91 . Individuals in this category show no symptoms, function optimally, and have no unresolved problems.
- The second conclusion, with a score between 61-90, indicates a mild condition. In this category, individuals with mental health issues experience temporary and manageable symptoms, like everyday problems.
- The conclusion with a score between 51-60 indicates a moderate condition, where the experienced symptoms are at a moderate level.
- The last conclusion, in the severe category, with a score between 0-50, suggests that individuals with mental health issues are in a persistent and more serious state. This may include some disabilities in communication and cognitive functions, a risk of self-harm or harm to others, and severe impairments in various functions.

Figure 3: Display of the summary page of the application.

When the application is ready, a system test is conducted to ensure that all functions within the application and system operate correctly using the

black box testing technique. Figure 4 shows the documentation of black box testing.



Figure 4: Black box testing at the Sinar Jati Foundation in Kemiling.

The system developers and healthcare personnel perform black box testing on the JiwaMuKu information system. The testing activities occurred at the Kedaton Inpatient Health Center, the Rajabasa Indah Health Center, the Sinar Jati Kemiling Foundation, and the Way Halim Health Center.

The second testing involves accuracy testing to determine the accuracy of early psychosis detection and conclusion, as documented in Figure 5. Various community members were involved in this testing. There were five individuals in the Sukarama community, five individuals experiencing moderate mental disorders, and five mental health professionals.



Figure 5: Testing activities for early detection of psychosis conducted by Mr. E at the Sinar Jati Kemiling Foundation.

Table 2: Symptoms and Rules.

Code	Explanation	Not Indicated (100-91)	Mild (91-61)	Moderate (60-51)	Severe (50-0)
G1	Mengasingkan diri dari lingkungan sekitar orang lain		x	x	x
G2	Perilaku ketika makan tidak baik			x	x
G3	Perubahan emosi secara signifikan		x	x	x
G4	Perubahan pada pola tidur	x	x	x	x
G5	Berteriak tiba-tiba dan marah tanpa alasan		x	x	x
G6	Sulit berkonsentrasi (terlebih jika sedang membaca ataupun menonton)		x	x	x
G7	Merasa cemas berlebihan		x	x	x
G8	Kesulitan untuk membaca dan menulis				x
G9	Sulit merasa senang atau puas			x	x
G10	Kehilangan minat dan motivasi pada berbagai aktivitas	x	x	x	x
G11	Tidak peduli pada penampilan dan kebersihan diri			x	x
G12	Curiga dan tidak percaya dengan orang lain			x	x
G13	Sering merasakan/mendengar adanya suara yang mengancam atau memberi perintah			x	x
G14	Meyakini bahwa dirinya menjadi sosok tertentu			x	x
G15	Ekspresi wajah dan nada bicara tidak sesuai dengan situasi			x	x
G16	Gerakan tubuh tidak teratur dan gerak tubuh yang tidak normal atau sulit diprediksi			x	x
G17	Berkeinginan atau melakukan untuk mencederai diri sendiri maupun orang lain				x
G18	Tidak percaya diri, takut dikritik atau dihakimi orang lain			x	x
G19	Putus asa dan pesimis			x	x
G20	Merasa dirinya dikendalikan oleh orang lain			x	x
G21	Mendengar suara halusinasi yang berkomentar secara terus-menerus			x	x
G22	Merasa bersalah, tidak berguna, rasa terbebani, tidak berdaya dan tidak berguna				x
G23	Berpikir ingin mati				x

5 DISCUSSIONS

The challenge in this research is how to transform the language of symptoms into an early detection language easily understood by users. The developed chatbot dialog should also be able to view two different sides, including self-assessment and assessment by others.

Testing conducted at Wisma Ataraxis involved two individuals facing mental health issues. The first respondent, R, experienced mental health problems with symptoms of anxiety, difficulty sleeping, concentration issues, and withdrawal from social environments. The conclusion from R's early psychosis detection test indicated mild mental health issues due to R's improved condition and ability to communicate. The second respondent, Mr. M, had mental health problems with symptoms of loss of interest in hobbies, hallucinations, and suicidal risk. Like R, Mr. M's results also showed mild mental health issues, as his condition improved during the

test. The third and fourth respondents, both staff at Wisma Ataraxis, showed no indications of mental health issues.

The next testing location was conducted at Yayasan Sinar Jati Kemiling, where early psychosis detection tests were performed on three patients and one staff member. The first respondent at Yayasan Sinar Jati, a healthcare worker, received a mild result. The second respondent, Mr. E, experiencing symptoms of anxiety, emotional changes, unexplained anger, and neglecting personal hygiene, showed mild results. Mr. E had been mistreated by his family and remained unaccepted by them despite two years of treatment. Despite his tendency to raise his voice, Mr. E was genuinely concerned about his surroundings, leading to a mild psychosis detection result.

The next respondent was Mr. R, with symptoms of anxiety, emotional changes, difficulty concentrating, neglect of personal hygiene, suspicious feelings, hallucinations, and suicidal risk.

He also faced family rejection and had been treated at Yayasan Sinar Jati for four years. During the early psychosis detection test, Mr. R scored 79, falling into the mild category.

The final respondent from Yayasan Sinar Jati Kemiling, identified as S, had been under treatment for four years, experiencing symptoms of anxiety, hallucinations, and suicidal risk. S's result indicated a moderate level. Since direct interaction with the patient was not allowed during data collection, there was no documentation during the testing activities.

From the conducted tests, the application's conclusions were compared with those of mental health experts conducting direct psychosis detection. Out of 15 test data, two individuals showed healthy results, 11 showed mild results, 1 showed moderate results, and 1 showed severe results.

Of the 14 accurate test data, the accuracy rate was 93%. Therefore, this feature can conclude with an accuracy rate of 93%. The results from the collected data do not represent the overall since the sampling size was small. Hence, these results are used as a reference, indicating that the application's displayed results have an accuracy rate of 93%.

6 CONCLUSIONS

In conclusion, this research emphasizes the paramount significance of early detection in addressing mental disorders, specifically psychosis. Leveraging chatbot-based dialogue and the Global Assessment of Functioning (GAF), our study has demonstrated a promising approach to enhance the detection and monitoring of mental health conditions.

Moving forward, there are several avenues for future research in this domain. Firstly, developing early psychosis detection systems could benefit from applying expert system development methods such as certainty factor, fuzzy logic, or other advanced techniques. These methodologies can potentially enhance the accuracy and efficiency of early detection systems.

Furthermore, exploring chatbot-based solutions for early psychosis detection presents an intriguing avenue for future work. Integrating chatbots into mental health diagnostics offers a user-friendly and accessible approach, allowing individuals to engage in conversations with the bot to diagnose psychosis. This interactive and conversational model has the potential to reach a broader audience, providing timely and personalized assistance in mental health assessments.

The research lays the foundation for innovative approaches to mental health diagnostics, emphasizing

the importance of proactive measures in identifying and addressing mental health issues. Integrating technology, particularly chatbot-based systems, holds promise in revolutionizing early detection methods and facilitating more widespread access to mental health support.

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