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RESEARCH ARTICLE **INFORMATION TECHNOLOGY**

"Tenang" Mobile Application for Student Self-Development and Emotion Monitoring

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ABSTRACT

University students are a group whose mental health deserves attention, as academic and social demands expose them to stress, anxiety and emotional pressure. Existing mental health applications often centre on a single function, while the evidence on chatbot-based support is mixed and raises privacy and safety concerns. The purpose of this study is to design and develop "Tenang", a mobile application for student self-development and emotion monitoring that brings together DASS-21 screening, daily mood tracking, an emotion journal, emotional history visualisation and a chatbot accompanying self-reflection. An online questionnaire filled in by 30 students chosen through purposive sampling provided the primary data, after which UML-based design was carried out and the application was implemented with Flutter, Supabase and PostgreSQL. A generative large language model accessed via the Gemini API drives the chatbot, whose system prompt restricts topics to emotional reflection and refers users showing crisis signs to professional help, while Row Level Security protects the conversations. According to the questionnaire, 83.3% of respondents had faced anxiety or stress caused by academic demands and 86.7% were prepared to use an emotion monitoring application regularly. All main functions specified in the requirements are performed by the application and its administrator website, and every Black Box Testing scenario returned the expected result. These findings demonstrate functional feasibility alone, without establishing effectiveness, usability or user satisfaction, and no systematic evaluation has yet been made of the quality and safety of chatbot responses. The application supports independent monitoring and self-development and is not intended for diagnosis or professional services.

تطبيق «تينانغ» للهاتف المحمول لتطوير الذات لدى الطلبة ومراقبة المشاعر

خيرونا أماليا[1,*]، إيريك إيمان هيري أوجيانتو[2]

الكلمات المفتاحية

تطوير الذات
مراقبة المشاعر
الصحة النفسية
روبوت الدردشة
Flutter
DASS-21
تتبّع المزاج

الملخص

تُعدّ الصحة النفسية من القضايا المهمة لدى طلبة الجامعات، إذ هم عرضة للتوتر والقلق والضغوط العاطفية الناتجة عن المتطلبات الأكاديمية وبيئتهم الاجتماعية. وتركّز كثير من تطبيقات الصحة النفسية الحالية على وظيفة واحدة، وأدلة دعم روبوتات الدردشة متباينة وتثير مخاوف الخصوصية والسلامة. تهدف هذه الدراسة إلى تصميم وبناء تطبيق «تينانغ» للهاتف المحمول بوصفه وسيلة لتطوير الذات ومراقبة المشاعر لدى الطلبة، يدمج الفحص العاطفي المستند إلى مقياس DASS-21 وتتبّع المزاج اليومي ودفتر المشاعر وعرض السجل العاطفي وروبوت دردشة يرافق التأمل الذاتي. جُمعت البيانات الأولية عبر استبيان إلكتروني أجابه 30 طالبًا اختيروا بالعينة الهادفة، ثم أُجري تحليل المتطلبات وتصميم النظام باستخدام لغة UML، ونُفّذ التطبيق باستخدام Flutter مع Supabase كخلفية وPostgreSQL كقاعدة بيانات. يعتمد روبوت الدردشة على نموذج لغوي توليدي كبير عبر واجهة Gemini البرمجية، مع موجّه نظام يقصر مواضيعه على التأمل العاطفي ويوجّه المستخدمين الذين تظهر عليهم علامات أزمة إلى المساعدة المتخصصة، بينما يُحمى سجل المحادثات بأمان مستوى الصف (RLS). أظهر الاستبيان أن 83.3% من المشاركين عانوا من القلق أو التوتر بسبب المتطلبات الأكاديمية، وأن 86.7% مستعدون لاستخدام تطبيق لمراقبة المشاعر بانتظام. ويؤدي التطبيق وموقع المشرف الوظائف الرئيسية المحددة في المتطلبات، وقد بيّن اختبار الصندوق الأسود أن جميع سيناريوهات الاختبار أعطت النتائج المتوقعة. وتُعدّ هذه النتائج دليلًا على الجدوى الوظيفية فقط، ولا تُثبت فعالية التدخل أو قابلية الاستخدام أو رضا المستخدمين، ولم تُقيَّم جودة ردود روبوت الدردشة وسلامتها بصورة منهجية بعد. ويُعدّ التطبيق وسيلة للمراقبة المستقلة وتطوير الذات، وليس بديلًا عن التشخيص أو الخدمات المتخصصة.

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Introduction

Emotional conditions such as stress, anxiety and emotional pressure can arise among university students as a consequence of the academic and social demands they encounter. Students do not always notice these conditions on their own, which creates a need for media that allow them to observe their emotional state independently. Earlier studies have demonstrated that mobile applications widen access to mental health services that used to be constrained by time and location [1]. Applications running on mobile devices also make it easier for users to log their emotional state and to find information on mental health [2].

Various approaches have been taken in applying digital applications to mental health monitoring. Features such as discussion, emotion logging and mental health education can be offered to users through mobile applications [3]. Android-based mental health applications have also been reported to assist individuals in understanding and regulating their emotional condition [4]. For students and adolescents, digital applications have likewise supported the monitoring of conditions linked to academic and social pressure [5]. Logging mood periodically allows users to follow shifts in their emotional condition and in the stress they are under [6].

Progress in conversational technology, beyond logging and screening, makes emotional companionship through chatbots possible. Through text-based dialogue, a chatbot or conversational agent offers users support that is easy to reach and accessible at all times [7]. According to a recent systematic review and meta-analysis, chatbot-based interventions hold particular promise for depressive symptoms, while their effects on anxiety and stress remain inconsistent, and further work is required on evidence quality, durability of effects and safety [8]. Chatbots have also been trialled among students and young adults as a support tool for anxiety, depression and stress symptoms [9].

Despite the range of mental health applications produced by earlier research, important limitations remain. Several of the applications reported concentrate on a single function, such as mental health education or [2]discussion forums [3]. Evidence for chatbot-based support is also mixed: its effects on anxiety and stress remain inconsistent, and the quality, durability and safety of the evidence need strengthening [8], while an AI-enhanced student wellbeing application showed no significant effect on wellbeing in two trials, with low recruitment and retention [9]. What is still needed, therefore, is not simply an application that offers more features, but one in which a companion chatbot is deliberately bounded in role, privacy and safety and sits alongside structured emotion monitoring designed for students. This situation calls for an application that assists students in monitoring their emotional condition and, at the same time, supports their independent self-development. The evidence behind this gap and the specific contribution of this study are set out in the Research Gap and Problem Statement section.

The focus of this study is the development of "Tenang", a mobile application intended as a medium for student self-development and emotion monitoring. Emotional screening, daily mood tracking, an emotion journal, visualisation of emotional history and a companion chatbot for self-reflection are provided in the application. It is developed so that students become more aware of their emotional condition and can reflect on themselves in a more structured manner. "Tenang" functions as a medium supporting monitoring and self-development and does not replace diagnosis or professional services. The study does not claim to demonstrate effectiveness; it documents the design, implementation and functional testing of the application.

Theoretical Framework

Self-Development and Mental Health

Self-development refers to an ongoing process by which individuals enhance their skills, knowledge and self-awareness. Among students, it is associated with the capacity to understand their own emotions, thoughts and behaviour so that academic pressure can be handled and productivity raised [10]. Mental health describes a state in which people can cope with stress, work productively and contribute to their surroundings; it includes emotional, psychological and social well-being rather than merely the absence of mental disorders [11]. Monitoring mental condition digitally can help people notice shifts in their psychological state and supports mental health management [12].

Emotion Monitoring and Mobile Applications

Emotion monitoring, also known as mood tracking, involves recording and observing emotional states at regular intervals in order to understand the emotional patterns a person goes through [13]. Logging emotions routinely enables users to identify mood changes and their influencing factors, and data shown in visual form help users grasp their emotional patterns [14]. Mobile applications are software built for mobile devices, for example smartphones and tablets, and they offer the benefit of flexible access [15]. In health care, mobile applications can facilitate independent monitoring of a user's condition and ease access to mental health services [16].

Chatbots as Emotional Companionship Media

A chatbot, or conversational agent, refers to a system that interacts with users by means of written or spoken language [8]. Within mental health, chatbots serve purposes such as screening, psychoeducation, symptom monitoring and interventions grounded in cognitive behavioural therapy (CBT) [17]. Depending on how they operate, chatbots fall into two groups: rule-based chatbots, which run along a programmed decision tree, and generative artificial intelligence chatbots built on large language models (LLMs), which generate more open and personalised dialogue [18]. A recent scoping review indicates rapid growth in mental health chatbot research with varied features and approaches, although intervention design and the reporting of safety aspects differ considerably [19].

Ethical concerns also accompany the application of chatbots in mental health, among them privacy, transparency, accuracy, safety and accountability, and these concerns may weigh more heavily for users living with mental health disorders [20]. Therapeutic misconception can occur as well, whereby users overestimate what a chatbot can do beyond its role as a therapeutic companion [21]. For this reason, the chatbot in this study is placed as a self-reflection companion that complements the monitoring features rather than replacing diagnosis or professional services.

Flutter and Supabase

Google developed Flutter as an open-source framework that builds cross-platform applications from one codebase written in the Dart programming language [22]. Flutter ships with numerous widgets that make it possible to craft interfaces that respond quickly and invite interaction, and the resulting applications perform nearly as well as native ones [23]. Running on PostgreSQL, Supabase is offered as an open-source Backend as a Service (BaaS) platform. Integrated

backend services, including a database, authentication, file storage, a RESTful API and realtime subscriptions, are supplied by Supabase to support data management in applications [24]. Its Row Level Security (RLS) feature also restricts data access according to user identity, which strengthens data security within the application [25].

Related Works

Mobile-Based Mental Health Applications

Progress in mobile technology has made it possible for digital tools to assist mental health care and the independent monitoring of emotional condition. Access to services formerly restricted by time and place can be improved by mobile-based mental health applications [1], which also let users log their emotions and find mental health information with less effort [2]. Supporting features such as discussion, emotion logging and mental health education can be offered by these applications [3], and they assist individuals in understanding and regulating their emotional condition [4].

Digital technology for mental health is becoming more relevant to students and adolescents, as both groups are susceptible to academic and social pressure. Mental health programmes delivered through digital applications can be implemented for groups facing pressure in everyday life [5]. Stress, anxiety and emotional changes can also be monitored by users through periodic mood logging in digital applications [6]. Monitoring in a structured way helps users identify their psychological condition and choose suitable steps for managing stress [26]. Positive effects on stress management and on the psychological well-being of users have also been reported from the use of mental health applications [27].

Digital Technology, Artificial Intelligence and Wearables

As digital devices are used more widely, emotional condition monitoring has also become linked to how technology is used every day. Emotion regulation among students is associated with the growing intensity of digital device use [28], and heavy use of digital technology by adolescents carries consequences for behavioural change and mental health [29]. Mental health can be monitored with smartphones by analysing the linguistic expressions users produce [30], while artificial intelligence embedded in mobile applications makes it possible to analyse mood changes from users' digital interactions [31].

Psychological condition can be monitored continuously by AI-based systems that analyse behavioural data collected from digital devices [32]. Students' stress levels can be tracked in real time by combining wearable technology with machine learning [33], and stress levels can also be assessed automatically from physiological data captured by wearable sensors [34]. Periodic logging in mood monitoring applications helps users understand their emotional patterns [35]. A trend towards more automated monitoring is reflected in AI-based mobile assistants that detect users' emotional condition [36], pupil change analysis for identifying depressive symptoms [37], real-time emotion recognition based on smartwatch sensors [38], and AI-driven mood tracking systems [39].

Chatbots for Student Mental Health

Evidence from several studies suggests that chatbots can act as a psychological support tool for students and young adults, even though the findings are mixed. When 81 young adults with subclinical depressive or anxiety symptoms were randomly assigned to a therapy chatbot grounded in CBT, both symptom types declined after two weeks of use and stayed stable at one-month follow-up, yet the control group showed a comparable decline [7]. Ehrlich et al. [9] reported less favourable outcomes when evaluating Mind Tutor, an AI-based wellbeing application whose chatbot feature points students to relevant wellbeing content. Across two randomised controlled trials with 177 and 240 first-year students at two universities in the United Kingdom, no significant effect on student wellbeing was observed, and recruitment and retention rates were low.

Among reviews, Li et al. [8] synthesised 35 studies, including 15 randomised controlled trials pooled in a meta-analysis, and showed that AI-based conversational agents reduced depression and distress symptoms significantly without improving overall psychological well-being. Pooling randomised controlled trials, He et al. [17] showed that people with mental health problems benefit from and accept interventions delivered by conversational agents, and that longer interaction durations are linked to larger effect sizes. The scoping review by Casu et al. [19] found that AI-based chatbots offer potential benefits for mental and emotional well-being, although their broad adoption relies on better usability, user engagement and integration with healthcare systems. More recently, a randomised trial of Therabot, a generative chatbot, among 210 participants with depression, anxiety or a high risk of eating disorders reported promising clinical outcomes while noting that the best role for the chatbot as a psychotherapy companion requires further study [18]. Ethical studies, for their part, stress caution concerning privacy, transparency, accuracy and safety [20], together with the risk of therapeutic misconception among users [21].

Cross-Platform Frameworks

From the standpoint of development technology, cross-platform frameworks offer one route to building mobile applications more efficiently. Applications can be produced from one codebase with Flutter, which also helps keep interfaces consistent across operating systems [22]. Cross-platform frameworks can likewise make the mobile application development process more efficient [23].

Research Gap and Problem Statement

The studies reviewed above reveal four limitations that motivate this work. First, several of the applications described are built around one type of function, for example mental health education [2] or a discussion forum [3]. Second, approaches that automate emotion monitoring depend on additional sensing data, such as wearable sensors [33,34], smartwatch signals [38] or pupillary response [37], to detect or recognise stress and emotional states; this differs from the self-reported, self-reflective monitoring pursued here. Third, the evidence for chatbot-based support is inconsistent: the control group in one trial declined comparably to the chatbot group [7], no significant effect on wellbeing was found for an AI-enhanced student application [9], and the effects on anxiety and stress remain inconsistent across reviewed trials [8], while a generative chatbot with promising results still requires study of its role as a psychotherapy companion [18]. Fourth, ethical issues of privacy, transparency, accuracy, safety and therapeutic misconception [20,21], together with considerable variation in the reporting of safety aspects [19], mean that a chatbot cannot simply be added to an application without an explicit design for its role, data handling and safety.

Against this background, the scholarly contribution of this study does not lie in placing several features within a single application, since integration alone does not establish a scientific contribution. It lies in three elements that are

examined in this article. (i) A student-oriented design in which requirements were derived from a questionnaire answered by student respondents and carried through UML-based design, implementation and functional testing. (ii) An explicit, literature-informed design of the companion chatbot that confines it to self-reflection without diagnosis, restricts its topics and refers crisis signs to professional help through a system prompt, ties stored conversations to the owner's account through Row Level Security, and keeps mood records and screening results out of the model's context. (iii) A transparent statement of what has and has not been evaluated, so that the work is not mistaken for evidence of effectiveness. Compared with the single-function applications [2,3], "Tenang" combines self-reported monitoring and reflection in one account-based system; compared with sensor-based approaches [33,34,37,38], it does not rely on wearable sensors; and compared with chatbot studies in which the chatbot is the intervention under evaluation [7,9,18] the chatbot here is one bounded component of a monitoring application whose outcomes have not yet been tested. These comparisons rest on the studies reviewed in this article and not on a systematic review of existing applications.

Digital tools for university students have also been evaluated empirically with student participants. For example, a study published in this journal examined a gamified quiz platform in a university course over two phases of an academic year, looking at student engagement, motivation and learning outcomes [40] . Evaluation of this kind has not yet been carried out for "Tenang" and is discussed as a limitation below.

The problem addressed here is how a mobile application can be designed and built to help students monitor their emotional condition and support their independent self-development, with a companion chatbot whose role, privacy and safety are explicitly bounded. This study aims to deliver the "Tenang" application along with an administrator website, with their functions tested against the system requirements. It does not aim to evaluate effectiveness, usability or user satisfaction.

Research Methodology

Research Framework

Figure 1 presents the research framework, which outlines the stages of designing and building a self-development application that supports students in monitoring their emotional condition independently. The framework consists of three consecutive stages, namely problem identification, system design and outputs, and the result of each stage is the input of the next: the problem and the student needs identified in Stage 1 become the requirements for Stage 2, and the design models and architecture produced in Stage 2 become the specification for the outputs of Stage 3.

In Stage 1 (Problem Identification), the current condition was identified, namely that students have no structured tool for monitoring their emotional condition and that academic pressure and stress therefore go unaddressed. The activities in this stage were a literature review and an online questionnaire answered by 30 students, described in the next subsection. In Stage 2 (System Design), the questionnaire findings were analysed as requirements, and the design was carried out with UML-based models, namely the application flowchart (Figure 3) and the use case diagram (Figure 4), together with the system architecture (Figure 2). The tools used for the design and development were Flutter and Dart for the mobile application, Supabase (authentication, REST API, Row Level Security and realtime services) with a PostgreSQL database as the backend, and Google's Gemini API for the companion chatbot. In Stage 3 (Outputs), the "Tenang" mobile application and its administrator website were implemented, offering DASS-21 screening, mood tracking, an emotion journal, monitoring history, visualisation of emotional condition data and a companion chatbot, and Black Box Testing was carried out on the user side to confirm that every developed function works in accordance with the system requirements.

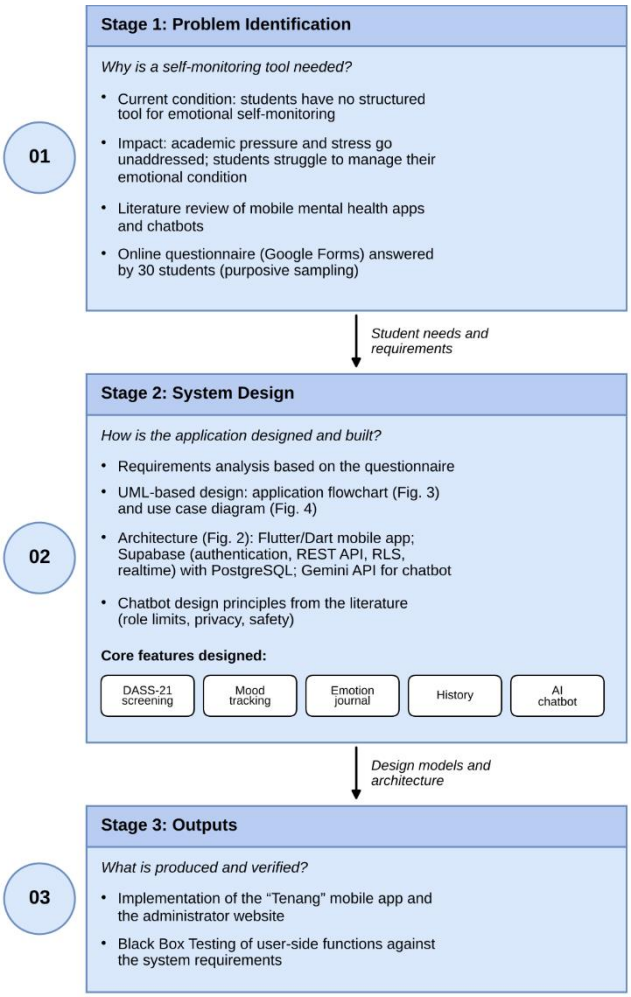


Figure 1: Research framework of the student emotion monitoring and self-development application

Population, Sample and Research Data

Primary data were gathered directly from students using an online questionnaire created with Google Forms. Between 18 and 30 May 2026, the questionnaire circulated through WhatsApp, Instagram and other social media or messaging channels, and 30 active students from various study programmes chosen through purposive sampling filled it in. Of the respondents, 26 were female (86.7%) and 4 were male (13.3%), and most were in their sixth semester. According to the questionnaire, 90% of respondents viewed mental health as equally important as physical health, 83.3% had felt anxiety or stress because of academic demands, and 86.7% were ready to use an emotion monitoring application on a regular basis. Support was highest for the emotional history feature (90%) and daily mood tracking (86.7%). These findings served as the foundation for analysing requirements

and developing the student emotion monitoring self-development application.

Target population and purposive sampling. The intended users of "Tenang" are university students, who face the academic and social demands described in the Introduction. Participants were therefore limited to active students, drawn from various study programmes so that the views of more than one programme were captured. Purposive sampling, a non-probability technique in which participants are chosen deliberately because they have characteristics relevant to the purpose of a study [41], was used because the questionnaire aimed to collect the needs and expectations of the intended user group and not to estimate characteristics of the whole student population. Dissemination through social media and messaging channels allowed this group to be reached quickly, but it also means that participation depended on who saw and chose to answer the questionnaire (self-selection).

Sample size. The questionnaire was a preliminary survey for requirements analysis. It was not used to test hypotheses or to generalise to all students; it served to identify the need for an emotion monitoring application and the features that respondents would support. The sample size reflects the number of students who completed the questionnaire during the collection period, and all completed responses were used. For this descriptive purpose, the 30 responses were treated as a sufficient basis for design decisions, but not for statistical inference. With 30 respondents, each respondent corresponds to 3.3 percentage points, so the percentages reported here should be read as approximate indications of the respondents' views and not as population estimates.

Gender distribution. Female students formed 86.7% of the respondents (26 of 30) and male students 13.3% (4 of 30). This imbalance means that the needs, attitudes and willingness to use the application reported here mainly reflect the perspectives of female students and may not represent male students, and the male subgroup is too small for separate analysis. The sample is therefore not claimed to be statistically representative of the target student population, and a larger, more gender-balanced sample is recommended for future work.

System Architecture

As shown in Figure 2, the system architecture comprises a mobile application operated by users. Built with Flutter and Dart, the mobile application offers mood tracking, DASS-21 screening, an emotion journal, a history of emotional condition monitoring and a companion chatbot. Supabase handles the application data by providing authentication, a REST API, Row Level Security (RLS) and realtime services, and PostgreSQL acts as the database holding user profile information, screening results, and mood and journal data. Within the Flutter application, the chatbot module communicates directly with Google's Gemini API, and conversation history is kept in a dedicated RLS-protected table of the Supabase PostgreSQL database.

Conceptual Design

Figure 3 models the application flow as a flowchart that traces the sequence of user steps from opening the application to exiting it. In the flowchart, rectangles denote processes, diamonds denote decision points, and rounded shapes denote the start and end of the flow. Once the user opens the application, the system starts by verifying whether an account already exists. Users who have no account are sent to the registration page before proceeding to login, while users who already own an account move straight to login. Registration requires a full name, an email address and a password, which

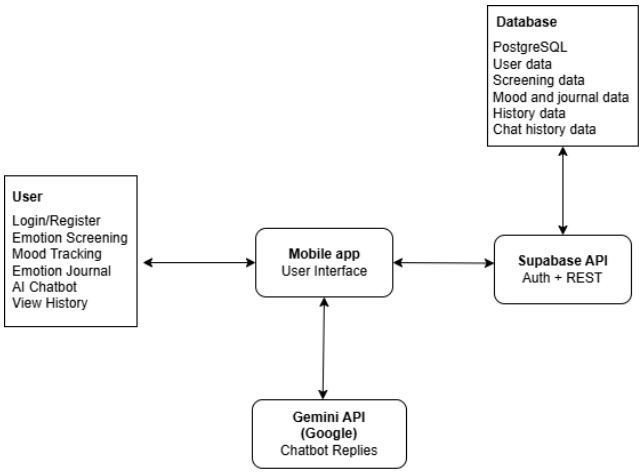


Figure 2: System architecture of the student emotion monitoring and self-development application

are handled by Supabase Authentication. If the email address is already registered, the message "user already registered" is displayed and no new account is created; when registration succeeds, a notification that registration was successful is displayed and the user proceeds to the login step. A failed login, for example one caused by an incorrect email or password, displays the message "Invalid login credentials" and brings the user back to the login step, and a successful one takes the user directly to the dashboard, the point from which features are selected.

At the dashboard, the user selects one of five features, and only the selected feature is executed; once it finishes, the flow returns to the dashboard. Data entered in each feature are validated and saved in the system. In the screening feature, the user responds to the DASS-21 items while the system checks data completeness; incomplete data send the user back to the items, whereas complete data prompt the system to compute the score and present the result. In the mood tracking feature, a mood is chosen, entered and saved, and in the emotion journal feature, a journal entry is written and likewise saved. In the chatbot feature, a message is sent by the user, Gemini composes a reply, and the reply is displayed as the chat history is saved. In the history feature, a chart showing the progress of the user's emotional condition is displayed. On finishing a selected feature, the user goes back to the dashboard (the return path in Figure 3) to select another feature or to log out, which concludes the flow.

Figure 4 shows the use case diagram, which depicts how the user interacts with the main features of the application. After registering and logging in, users can open DASS-21 screening, mood tracking, the emotion journal, history and the companion chatbot, and they can also log out. The screening feature processes user answers into a score and feedback, while mood tracking and the journal keep records of emotional condition that can be revisited via the history feature.

Companion Chatbot Design

As a text-based conversational companion, the chatbot feature is intended to help users voice their feelings, reflect on themselves and receive initial support concerning the emotional condition logged in the application. Three principles drawn from the literature review guide the design. The first principle confines the chatbot to the role of a self-reflection companion: it offers no diagnoses and underlines that professional services remain necessary, thereby lowering the risk of therapeutic misconception. The second principle

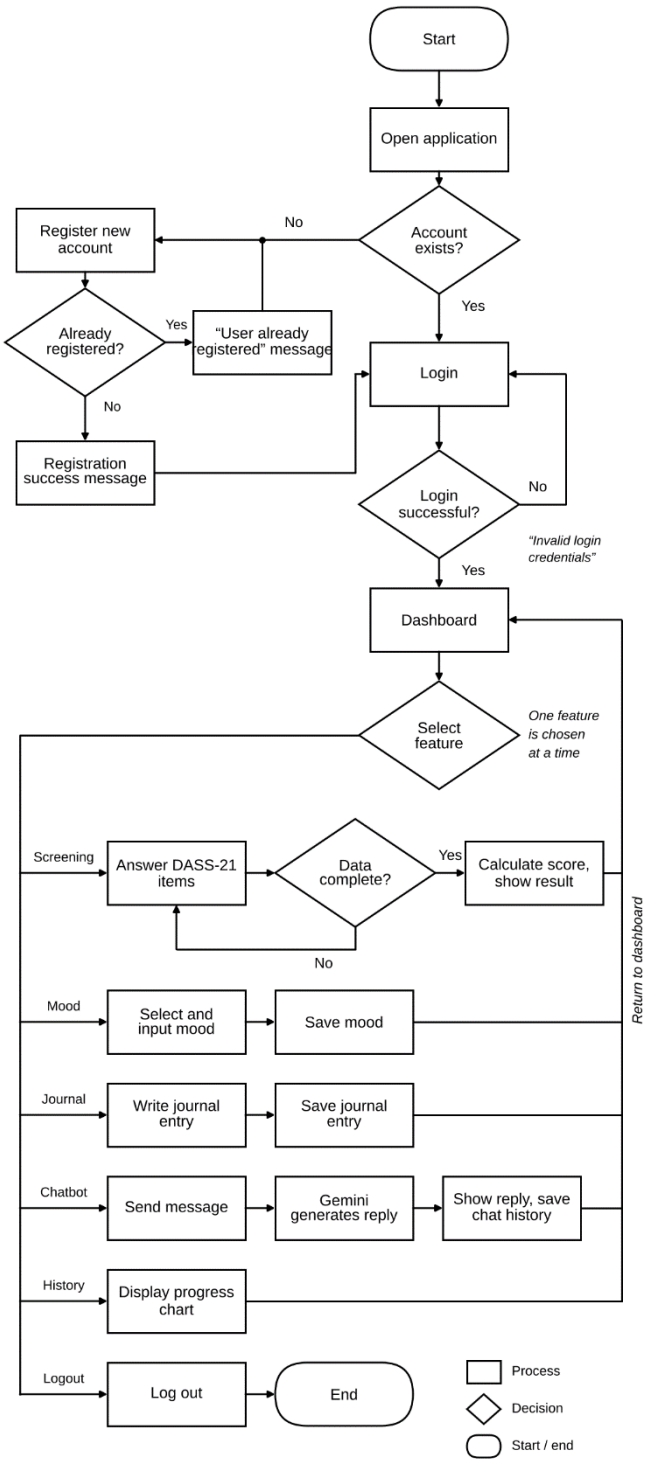


Figure 3: Flowchart of the student emotion monitoring and self-development application

addresses privacy, transparency, accuracy and safety, since emotional conversations are sensitive; conversation data are tied to the user's account and are accessible only to the owner through RLS in Supabase. The third principle concerns construction, in which the chatbot relies on a generative large language model (LLM) approach via Google's Gemini API, using Gemini 3.5 Flash-Lite as the main model and Gemini 3.8 Flash as the fallback model, together with a system prompt that restricts topics to emotional reflection and instructs users to reach professionals or emergency services when signs of crisis appear.

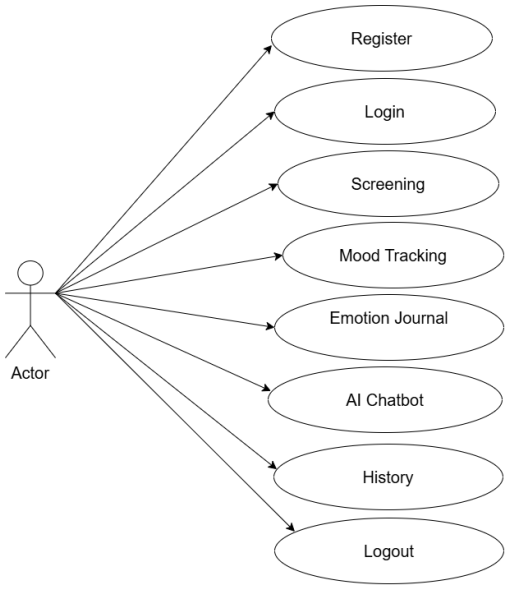


Figure 4: Use case diagram of the student emotion monitoring and self-development application

Privacy Protection of Chatbot Conversations

Because conversations with the chatbot may contain sensitive emotional disclosures, the privacy measures documented in the system design are summarised here. (1) Access control: the conversation history is stored in a dedicated table of the Supabase PostgreSQL database that is protected by Row Level Security, so that records are tied to the user's account and are accessible only to their owner [25]; access to the application requires authentication through Supabase Authentication. (2) Data minimisation towards the language model: only the conversation content, limited to the last 20 messages, is used by the chatbot as context, and the user's mood records and screening results are never passed to the model. (3) User control: the conversation history (up to the 100 most recent messages) can be reopened by the user, and the whole history can be removed through a delete icon followed by a confirmation dialogue. (4) Content safeguards: a system prompt restricts the chatbot to emotional reflection, and the chatbot gives no diagnoses and directs users who show signs of crisis to professionals or emergency services.

(5) Administrator access: the administrator website does not display the content of chatbot conversations. Several privacy-related aspects are nevertheless limitations of this study. First, the chatbot module sends message content to Google's Gemini API, and the free (unpaid) tier of that API was used. Under Google's published terms, content submitted to unpaid services and the generated responses may be used to improve Google products and may be read by human reviewers, and users are advised not to submit sensitive or personal information, whereas for paid services prompts and responses are not used to improve Google products [42]. Conversations in this study were therefore not private from the model provider. Second, no privacy notice or consent step is shown to users before they use the chatbot. Third, encryption of stored and transmitted data beyond the default features of the platforms used was not examined. No security or privacy audit is reported in this study, so the chatbot should not be regarded as a confidential or clinical channel, and users should avoid entering identifying information. These points are included in the future development described in the Conclusions.

Results

Application Implementation Results

This research produced a self-development application for monitoring student emotions, whose mobile side was written in Dart on top of Flutter, and with Supabase serving as the backend and cloud-based data storage. Its purpose is to help students record and monitor their emotional condition on their own through screening, mood tracking, an emotion journal, visualisation of emotional history and a companion chatbot. Alongside the mobile application for users, an administrator website was built for managing and monitoring user data.

A splash screen opens the implementation by showing the application identity, after which authentication status decides whether the user lands on the login screen or on the home screen. Authentication on the login page is handled by Supabase Authentication, and users without an account can sign up by supplying a full name, an email address and a password. Once login succeeds, the user arrives at the dashboard, which acts as the navigation hub for the screening, mood tracking, emotion journal, emotional history and chatbot features (Figure 5).

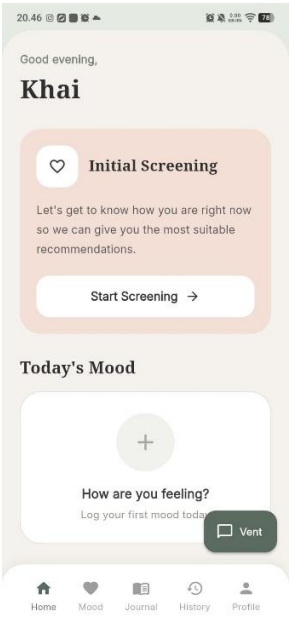


Figure 5: Dashboard page of the student emotion monitoring and self-development application

Through the DASS-21 screening feature, users can monitor their emotional condition by filling in a questionnaire (Figure 6). The answers are validated by the system, after which the score is calculated and the screening result is shown along with feedback matching the user's emotional condition category. The results are then saved so that they contribute to the ongoing monitoring of the user's emotional condition.

Users' daily moods are captured by the mood tracking feature, in which the user picks the type of emotion being felt (Figure 7). Entered data undergo validation before storage and are stamped with the recording time, allowing changes in emotional condition to be followed over time. The emotion journal feature, in turn, lets users write down their experiences or feelings in greater depth as a means of self-reflection. All stored data can later be reopened via the history feature.



Figure 6: Screening page of the student emotion monitoring and self-development application

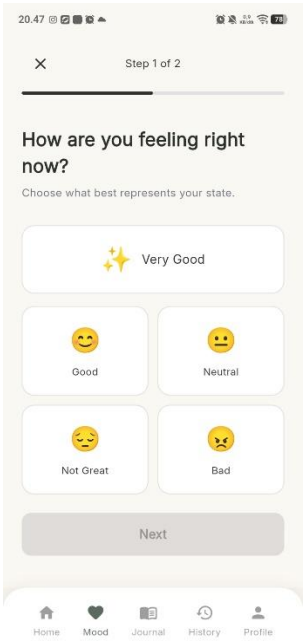


Figure 7: Mood tracking page of the student emotion monitoring and self-development application

Based on the data saved in the system, the history feature shows how the user's emotional condition has developed (Figure 8). Displaying the data visually allows users to trace shifts in their emotional state in a more orderly way across time. Account details and an overview of personal emotional progress are also shown on the profile page using the available graphs and interpretations.

Named "Tenang AI" within the application, the companion chatbot feature gives users a space to share what they feel and to look inward through typed conversation (Figure 9). A button on the dashboard opens the chatbot, where users either type into the input field or pick one of the quick replies at the beginning of the conversation ("Lagi sedih" [feeling sad], "Stres kuliah" [university stress] or "Mau curhat aja" [just want to vent]), and they receive replies in Indonesian written

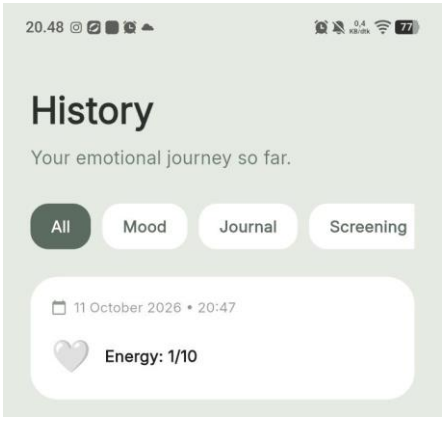


Figure 8: History page of the student emotion monitoring and self-development application

in a casual, warm tone and kept brief by instruction (2–4 sentences). Every user message and chatbot reply is saved in the database, so the conversation history (up to the 100 most recent messages) can be opened again, and the whole history can be removed via a delete icon followed by a confirmation dialogue. Only the conversation content, limited to the last 20 messages, is used by the chatbot as context, and the user's mood records and screening results are never passed to the model. Consistent with the design principles set out in the Companion Chatbot Design subsection, the chatbot gives no diagnoses and acts as a companion that complements professionals instead of replacing them.

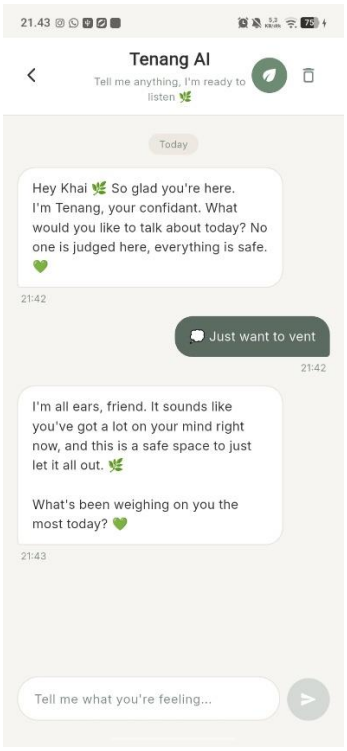


Figure 9: Companion chatbot page of the student emotion monitoring and self-development application

Black Box Testing Results

Black Box Testing was applied to the user side of the application to verify that each main feature operates in line with the defined functional requirements. Registration, login, DASS-21 screening, mood tracking, the emotion journal, history, profile, chatbot and logout were all included in the tests (Table 1). Each of these nine scenarios (rows 1–9) produced the expected result, and the corresponding features were therefore declared Valid. Two further scenarios requested during peer review were added to Table 1: login with an incorrect email or password (row 10), which displays the message "Invalid login credentials", and registration with an email address that has already been registered (row 11), which displays the message "user already registered". Both produced the expected result and were declared Valid.

Table 1: Black Box Testing results of the student emotion monitoring and self-development application

No	Feature	Test scenario	Expected result	Status
1	Registration	Registration data are entered by the user	A new account is created	Valid
2	Login	A valid email and password are entered	The dashboard is opened for the user	Valid
3	Screening	Every screening question is answered	The score is calculated, and the result and feedback are shown	Valid
4	Mood tracking	A mood is chosen and saved	Mood data are stored	Valid
5	Emotion journal	A journal entry is written and saved	Journal data are stored	Valid
6	History	The history page is opened	Emotional development data appear	Valid
7	Profile	The profile page is opened	Profile data and development information appear	Valid
8	Chatbot	A message is sent to the chatbot	A reply appears and the conversation is stored	Valid
9	Logout	The logout button is pressed	The account is signed out and the login page reappears	Valid
10	Login	An incorrect email or password is entered	The message "Invalid login credentials" is displayed, the dashboard is not opened and the user returns to the login step	Valid
11	Registration	Registration data with an email address that is already registered are entered	The message "user already registered" is displayed and no duplicate account is created	Valid

Note: Rows 10 and 11 were added in response to peer review.

Discussion

Findings Supported by This Study

The implementation and Black Box Testing show that the eleven scenarios defined for the main user-side functions of "Tenang" behaved as specified, and the administrator website supports structured data monitoring. The questionnaire indicates that most of the 30 respondents reported academic stress or anxiety (83.3%) and were ready to use an emotion monitoring application (86.7%), with the highest support for emotional history (90%) and daily mood tracking (86.7%). These figures describe the respondents only and were used to define requirements; they are not evidence that the application meets those needs.

Interpretation in Light of Previous Studies

The respondents' readiness to use a monitoring application is consistent with earlier reports that mobile applications can ease self-monitoring and access to mental health support [1,2,16], and the share of respondents reporting academic

stress or anxiety is in line with the premise of earlier work on student and adolescent stress [5], [6], [26]. No direct comparison of figures was made, because the populations and instruments differ, and stated readiness is not the same as actual use or benefit: a trial of an AI-enhanced student wellbeing application reported low recruitment and retention [9], and broad adoption of chatbots is said to depend on usability, engagement and integration with healthcare systems [19]. The readiness reported here should therefore be treated as a preliminary indicator only.

Regarding the chatbot, the decision to position it as a self-reflection companion agrees with the cautious conclusions of earlier studies: the effects of chatbot interventions on anxiety and stress are inconsistent and the evidence on safety needs strengthening [8]; a therapy chatbot trial found a comparable decline in symptoms in its control group [7]; a generative chatbot with promising clinical outcomes was still recommended as a companion to psychotherapy rather than a substitute [18]; and ethical studies warn of risks to privacy, accuracy and safety and of therapeutic misconception [20,21]. The present study differs from these in kind: they measured symptom or wellbeing outcomes in trials, whereas this study measured no outcome and can therefore neither confirm nor contradict their results. It applies their design implications, namely a bounded role, topic restriction, crisis referral and limited data exposure, and how successfully these have been applied requires further evaluation.

Contribution Relative to Existing Applications

Placing screening, mood tracking, a journal, history and a chatbot in one application is not claimed here as a scholarly contribution in itself. In comparison with single-function applications [2], [3], sensor-based monitoring approaches [33], [34], [37], [38] and chatbot studies [7], [9], [18], the distinguishing elements are the documented, literature-informed bounding of the chatbot's role, safety and data exposure; the traceable path from student questionnaire to requirements, UML-based design, implementation and testing; and the explicit reporting of what remains unevaluated. The privacy-oriented choice not to pass mood records and screening results to the model also has a cost, because chatbot replies cannot be personalised from those records. The contribution is therefore a design and implementation contribution. Whether it yields better usability or outcomes than existing applications was not tested, and no comparison with other applications was carried out.

Limitations

First, no empirical evaluation with users was conducted. Black Box Testing confirms that functions match the requirements, but it does not measure usability, ease of use, user satisfaction or acceptance, nor whether the application changes what students know about or feel in their emotional life. The questionnaire was administered before the application was built and did not evaluate it, so the utility and ease of use of "Tenang" remain undemonstrated. By contrast, a study published in this journal evaluated an interactive digital tool with students over a semester, examining engagement, motivation and learning outcomes [40]. Second, no systematic evaluation has yet been made of the quality, accuracy and safety of chatbot responses, and the privacy and security mechanisms have not been audited; in particular, message content was processed by the free tier of the Gemini API under terms that allow Google to use and review it [42] (see Privacy Protection of Chatbot Conversations). Third, the questionnaire sample was small (30 students), predominantly female (86.7%) and recruited through purposive sampling on social media, so the findings cannot be generalised to all students or to male students. The findings should therefore be read as evidence that the application is functionally feasible, not as proof that it is usable, accepted or effective.

Recommendations for Future Research

Future studies should (1) evaluate usability, user satisfaction and acceptance with student users, using task-based testing and structured questionnaires after actual use; (2) assess the quality, accuracy and safety of chatbot responses, including the handling of crisis messages; (3) use larger, more gender-balanced and multi-institution samples; (4) examine effectiveness through controlled and longitudinal designs comparable to those used for chatbots [7,9,18]; (5) assess the privacy and security of stored conversations and of the data sent to the language model provider; and (6) analyse real-world usage data, with appropriate privacy safeguards, in the way that data-driven studies have analysed real clinical records, such as more than 500,000 records from a clinic in Tripoli [43], to understand patterns of use and emotional change.

Conclusions

The outcome of this study is "Tenang", a mobile application built with Flutter and Supabase that supports students in monitoring their emotional condition independently. DASS-21 screening, mood tracking, an emotion journal, a history of emotional development and a companion chatbot form its main features, enabling users to record, monitor and reflect on their emotions over time. The implemented system shows that user data and monitoring results are managed via Supabase and presented again in the application as designed. Black Box Testing on the user side demonstrated that every main function covered by the eleven test scenarios delivered the expected results.

Future development may include daily reminder notifications so that users record their mood and journal entries more consistently. The chatbot could be extended through an assessment of response quality and safety, a privacy notice and consent step for the chatbot, a review of the provider's data terms including the paid tier (under which prompts are not used to improve Google products [42]), a privacy and security assessment of stored conversations, a fuller mechanism for crisis handling, and the incorporation of mood and journal records so that recommendations become more personalised for managing emotions, provided that privacy safeguards are maintained. Subsequent studies may also involve a larger and more gender-balanced group of respondents for more representative results, evaluate usability, user satisfaction, user acceptance and effectiveness with student users, and introduce an online consultation feature linking users with professionals such as psychologists or campus counsellors.

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