

A Mobile AI-Assisted Teletherapy Framework for Mental Health Support in Malaysia: Design, Evaluation, and Engineering Implications

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Abstract

The increasing prevalence of mental health challenges in Malaysia, compounded by urbanization, academic pressure, and limited access to mental healthcare services, necessitates scalable technological interventions. This study proposes a mobile-based artificial intelligence (AI)-assisted teletherapy framework, designed to enhance accessibility, cost-efficiency, and user engagement in mental health support systems. Unlike prior implementations, this research contextualizes teletherapy within Malaysia's socio-technical landscape, incorporating local usage patterns, infrastructure constraints, and behavioral insights from university populations. A mixed-method explanatory sequential design was employed, combining survey data from Malaysian private university students with qualitative interviews to evaluate system feasibility and acceptance. Results indicate moderate-to-high awareness of mental health issues, strong receptivity to digital therapy tools, and cost-driven preference for online consultation. However, limitations in perceived effectiveness compared to face-to-face therapy remain significant. This study contributes a localized engineering framework for AI-enabled teletherapy, emphasizing adaptive chatbot interaction, scalable mobile architecture, and integration with Malaysia's digital health ecosystem. The findings provide actionable insights for engineers, developers, and policymakers aiming to deploy digital mental health solutions in emerging economies.

Keywords: Teletherapy, Artificial intelligence, Mobile health (mHealth), Malaysia, Mental health engineering, Chatbot systems

1. Introduction

Mental health disorders, including depression, anxiety, and stress-related conditions, have emerged as a critical public health concern globally, with increasing prevalence observed across both developed and developing nations. In Malaysia, recent national and regional studies indicate a significant rise in mental health issues, particularly among adolescents and

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young adults, driven by rapid urbanization, socio-economic pressures, and post-pandemic effects [1][2]. Notably, the prevalence of mental disorders in Malaysia has increased substantially over the past two decades, with a growing proportion of the population experiencing psychological distress and limited access to professional care [3]. From an engineering standpoint, this trend underscores the urgent need for scalable, technology-driven solutions that address both accessibility and efficiency challenges in mental healthcare delivery.

Concurrently, Malaysia is undergoing a rapid digital transformation, particularly within its healthcare sector. The digital health and telemedicine market has experienced substantial growth, supported by widespread smartphone adoption, expanding mobile network infrastructure, and strong governmental initiatives promoting digital healthcare integration [4][5]. Recent reports estimate that smartphone penetration in Malaysia exceeds 90%, enabling mobile health (mHealth) applications to serve as viable platforms for healthcare delivery and monitoring [4]. Furthermore, telemedicine use has increased significantly following the COVID-19 pandemic, with both healthcare providers and patients preferring remote consultation services for convenience and safety. These developments present significant engineering opportunities for the design and deployment of intelligent, mobile-based healthcare systems.

Artificial Intelligence (AI) has further enhanced the capabilities of digital health platforms by enabling advanced functionalities such as personalized recommendations, real-time monitoring, and predictive analytics. In the context of mental healthcare, AI-driven chatbots and virtual therapy systems have demonstrated potential to improve accessibility, reduce costs, and support early intervention strategies [6][7]. In Malaysia, recent studies highlight increasing acceptance of AI-enabled mobile health applications, particularly among digitally literate populations, where factors such as performance expectancy and ease of use significantly influence adoption [8]. However, integrating AI into healthcare systems introduces several engineering challenges, including data privacy, system reliability, algorithmic bias, and the need for culturally adaptive models.

Despite these advancements, several structural and technical limitations persist in Malaysia's mental healthcare ecosystem. First, there is a notable disparity in access to mental health services between urban and rural areas, largely due to uneven digital infrastructure and limited availability of healthcare professionals [4]. Second, existing telehealth platforms face challenges in user experience, system usability, and trust, particularly regarding data security and confidentiality [9]. Third, current implementations of mobile mental health applications often lack robust engineering frameworks that integrate AI capabilities with scalable, secure, and user-centered system architectures. These limitations highlight a critical gap between technological potential and practical deployment within the Malaysian context.

From an engineering research perspective, there remains a lack of localized frameworks that systematically address the design, implementation, and evaluation of AI-assisted teletherapy systems tailored to Malaysia's socio-technical environment. While prior studies have explored mobile health adoption and telemedicine use, few have focused on integrating AI-driven conversational systems with mobile platforms while accounting for infrastructure constraints, user behavior, and healthcare delivery requirements [6][8]. Moreover, limited attention has been given to hybrid models that combine automated chatbot interaction with human therapist support, which are essential for ensuring both scalability and clinical relevance.

To address these gaps, this study aims to develop and evaluate a mobile AI-assisted teletherapy framework tailored to the Malaysian context. Specifically, the objectives of this research are to:

1. design a scalable mobile architecture integrating AI-based chatbot systems for mental health support;
2. assess user acceptance and behavioral responses toward teletherapy applications among Malaysian university students; and
3. Identify key engineering considerations for deploying secure, efficient, and accessible digital mental health solutions in Malaysia.

By addressing these objectives, this study advances engineering-driven digital healthcare systems by providing a localized, practical framework for enhancing mental health service delivery in emerging economies.

2. Literature review

Malaysia's transition toward a digitally enabled and sustainable economy has accelerated engineering research across multiple domains, including renewable energy systems, smart manufacturing, sustainable construction, resilient infrastructure, and smart cities. These domains reflect national priorities aligned with Industry 4.0 and the Sustainable Development Goals, while simultaneously exposing critical engineering challenges in system integration, scalability, and socio-technical adaptation. Within this evolving landscape, the development of digital healthcare systems—particularly mobile-based teletherapy platforms—can benefit significantly from cross-domain engineering insights.

In the domain of renewable energy, recent studies emphasize integrating Internet of Things (IoT) technologies and Artificial Intelligence (AI) to enhance monitoring, optimization, and predictive maintenance of energy systems in Malaysia [13][14]. These systems rely on real-time data acquisition, distributed computing, and adaptive control mechanisms to maintain operational efficiency. Such engineering principles are highly relevant to mobile health (mHealth) applications, where continuous user monitoring and AI-driven processing must be achieved within constraints of energy efficiency and limited computational resources [15]. This highlights the need for energy-aware system design in teletherapy platforms, particularly in regions where network stability and device performance may vary.

Parallel advancements in smart manufacturing under Industry 4.0 further illustrate the role of AI and data-driven decision-making in complex system environments. In Malaysia, the adoption of cyber-physical systems, machine learning algorithms, and automation technologies has enabled significant improvements in manufacturing efficiency and system reliability [16][17]. These systems require robust data preprocessing, low-latency communication, and high model accuracy, all of which are directly applicable to AI-assisted healthcare platforms. Moreover, the increasing emphasis on Explainable AI (XAI) in industrial systems underscores the importance of transparency and user trust, which are critical considerations in teletherapy applications where users rely on AI-generated insights for mental health support [18].

In the context of sustainable construction, research in Malaysia has increasingly focused on integrating digital technologies such as Building Information Modeling (BIM), IoT, and data analytics to enhance lifecycle performance and environmental sustainability [19][20]. A notable shift in this domain is the adoption of human-centric design principles, which prioritize usability, accessibility, and user experience. These principles are particularly relevant to mobile teletherapy systems, where user engagement and interface design

significantly influence system adoption and effectiveness. Studies in human-computer interaction further highlight the necessity of culturally adaptive and intuitive interfaces, especially in Malaysia's diverse socio-cultural environment, where variations in language, digital literacy, and attitudes toward mental health must be carefully addressed [21].

Resilient infrastructure engineering offers additional insights into the design of robust, reliable systems capable of operating under uncertain, dynamic conditions. In Malaysia, infrastructure resilience has become increasingly important due to challenges associated with climate change, urbanization, and system complexity [22][23]. Engineering solutions in this domain emphasize fault tolerance, redundancy, and rapid recovery mechanisms. These principles are directly applicable to teletherapy platforms, which must ensure continuous availability, secure data transmission, and stable performance across varying network conditions. The adoption of cloud and edge computing technologies has been identified as a key enabler of resilience, enabling distributed processing and reducing latency in real-time applications [24].

Furthermore, Malaysia's smart city initiatives have created a conducive environment for integrating digital healthcare systems into broader urban ecosystems. Smart city frameworks emphasize interconnected services, data sharing, and citizen-centric design, enabling more efficient and responsive healthcare delivery models [25][26]. Within this context, mobile health applications can play a pivotal role in supporting continuous monitoring, early intervention, and personalized care. However, challenges related to interoperability, data governance, and regulatory compliance remains significant barriers to large-scale implementation [27]. Addressing these challenges requires advanced engineering solutions that integrate secure data architectures with scalable and interoperable system designs.

Despite substantial progress across these engineering domains, several critical gaps remain. First, there is limited integration of AI technologies with scalable mobile architectures in mental healthcare systems. Second, existing solutions often fail to account for the diverse socio-technical conditions present in Malaysia, including disparities in digital infrastructure and variations in user behavior. Third, concerns about data privacy, system reliability, and user trust continue to hinder the widespread adoption of telehealth platforms. Although prior studies have examined aspects such as telemedicine adoption and AI implementation, there is a lack of comprehensive engineering frameworks that address these challenges holistically [28][29].

In response to these gaps, the present study seeks to develop a mobile AI-assisted teletherapy framework tailored to Malaysia's unique engineering and socio-cultural context. By synthesizing principles from renewable energy systems, smart manufacturing, sustainable design, resilient infrastructure, and smart city development, this research aims to provide a scalable, secure, and user-centered solution for digital mental healthcare. The proposed framework not only addresses technical challenges, such as system architecture and AI integration, but also incorporates user behavior and cultural considerations, thereby advancing engineering-driven healthcare innovation in Malaysia.

3. Methodology

3.1. Research design and system architecture

This study adopts a system-oriented, mixed-method research design to develop and evaluate a mobile AI-assisted teletherapy framework tailored to Malaysia's socio-technical environment. The methodological approach integrates engineering system development with

empirical user analysis to ensure both technical robustness and practical applicability. An explanatory sequential mixed-method design is employed, consisting of an initial quantitative phase followed by a qualitative phase. This structure enables the identification of general trends in user awareness and acceptance of teletherapy systems, followed by an in-depth exploration of user perceptions and behavioral factors. Such an approach is particularly suitable in the Malaysian context, where diverse socio-cultural and infrastructural conditions influence technological adoption.

From an engineering perspective, the proposed teletherapy system is conceptualized as a multi-layered architecture integrating mobile computing, artificial intelligence, and cloud-based services. The system comprises three functional layers. The user interface layer consists of a mobile application designed with human-centered principles to ensure accessibility, usability, and inclusivity. Key features include secure authentication with anonymization, chat-based interaction, daily mental health notifications, and emergency support mechanisms. The AI processing layer forms the core intelligence of the system, incorporating natural language processing for conversational interaction, machine learning algorithms for emotion detection, and adaptive response generation. This layer is optimized for real-time performance, requiring low latency and high reliability, and is designed to support multilingual capabilities relevant to Malaysia's diverse population. The service and data layer manages backend operations, including cloud-based storage, secure communication protocols, and integration with professional therapists. A hybrid cloud-edge architecture is considered to enhance system scalability, reduce latency, and improve resilience under varying network conditions.

3.2. Data collection and sampling strategy

The empirical component of this study involves data collection conducted in two sequential phases. In the quantitative phase, a structured survey was administered to students from selected Malaysian private universities, including UCSI University, Universiti Tunku Abdul Rahman (UTAR), Tunku Abdul Rahman University College (TARUC), and Multimedia University (MMU). These institutions were selected for their diverse student populations and high levels of digital engagement, making them suitable representatives of technology-savvy users. The survey instrument was designed to measure key variables such as awareness of mental health issues, perceived usefulness and ease of use of teletherapy systems, attitudes toward AI-based interaction, and behavioral intention to adopt such technologies. Responses were collected using a Likert scale format to facilitate quantitative analysis.

Following the survey, the qualitative phase involved semi-structured interviews with a subset of respondents. The interviews aimed to provide deeper insights into user experiences, expectations, and concerns regarding teletherapy systems. Key themes explored include perceived effectiveness of online consultation, trust in AI-based interaction, data privacy concerns, and preferences for hybrid AI-human support models. A purposive sampling strategy was employed to ensure that participants were active smartphone users, familiar with mobile applications, and within the 18 to 30-year age group, which is most relevant to digital mental health trends. While this sampling approach ensures alignment with the study objectives, it also introduces limitations in terms of generalizability to broader population groups in Malaysia.

3.3. Data analysis and ethical considerations

Quantitative data collected from the survey were analyzed using descriptive statistical methods, including frequency distributions, percentage analyses, and mean score calculations. These methods provide an overview of user awareness, acceptance levels, and behavioral patterns related to teletherapy adoption. Qualitative data obtained from interviews were analyzed using thematic analysis, involving systematic coding, identification of recurring themes, and interpretation of findings in relation to system design requirements. The integration of quantitative and qualitative findings enables a comprehensive evaluation of both technical feasibility and user-centered considerations.

Based on the research objectives, three hypotheses were formulated to guide the analysis. First, online communication between therapists and patients is hypothesized to reduce overall consultation costs for both parties. Second, reliable internet access is expected to influence the effectiveness of teletherapy systems significantly. Third, user recommendations are expected to contribute positively to the adoption and awareness of teletherapy applications. These hypotheses are evaluated through quantitative data and supported by qualitative insights.

Ethical considerations were strictly observed throughout the study. Informed consent was obtained from all participants before data collection, and all personal information was anonymized to ensure confidentiality. Data were securely stored, and participation was entirely voluntary, with participants able to withdraw at any time. Given the sensitive nature of mental health data, particular attention was paid to data protection, privacy, and ethical handling of participant information.

4. Results

4.1. Overview of findings

This section presents the quantitative and qualitative findings for the proposed mobile AI-assisted teletherapy framework, with additional inferential analysis to strengthen the empirical rigor of the study. The results indicate three central patterns. First, the respondents exhibited a generally adequate level of mental health awareness, suggesting a user base receptive to digitally mediated interventions. Second, teletherapy was viewed positively as a mechanism for improving awareness and widening access to support, particularly in a Malaysian setting where mobility, cost, and service availability remain practical constraints. Third, respondents were more cautious when evaluating whether online consultation is more effective than conventional face-to-face therapy, indicating that adoption of teletherapy is likely to depend on system design quality, trust, and the extent to which digital platforms can approximate human interaction.

To elevate the analysis beyond descriptive reporting, the response distributions were examined using weighted mean scores, standard deviations, confidence intervals for key proportions, and chi-square goodness-of-fit tests. These tests were selected because the available dataset is aggregated by response category. As a result, they allow statistically valid assessment of response concentration and directional tendencies. However, correlation and regression analyses require respondent-level raw data and, therefore, cannot be performed reliably from aggregated counts alone. This limitation is stated explicitly to preserve methodological transparency.

4.2. Mental health awareness and user readiness

The first analysis examined respondent awareness of mental health issues. As shown in Table 1, 16 of 31 respondents (51.6%) reported being either "Aware" or "Very Aware," whereas only 9.7% fell into the two lowest awareness categories. The weighted mean score for awareness was 3.68 on a five-point scale, with a standard deviation of 1.17, indicating a moderately high overall awareness level with some variability across respondents.

Table 1. Distribution of Mental Health Awareness Among Respondents (n = 31)

Awareness Level	Frequency	Percentage (%)
Very Not Aware	2	6.5
Not Aware	1	3.2
Neutral	12	38.7
Aware	6	19.4
Very Aware	10	32.3
Total	31	100.0

A chi-square goodness-of-fit test was conducted to determine whether the observed distribution of awareness differed significantly from a uniform distribution across the five response categories. The result was statistically significant, $\chi^2(4) = 14.97$, $p = 0.0048$, indicating that responses were not evenly distributed and were concentrated toward the middle-to-upper end of the scale. The estimated proportion of respondents in the positive awareness group ("Aware" + "Very Aware") was 51.6%, with an approximate 95% confidence interval of 34.8% to 68.0%.

These findings are illustrated in Figure 1, which shows the concentration of responses in the "Neutral" and "Very Aware" categories.

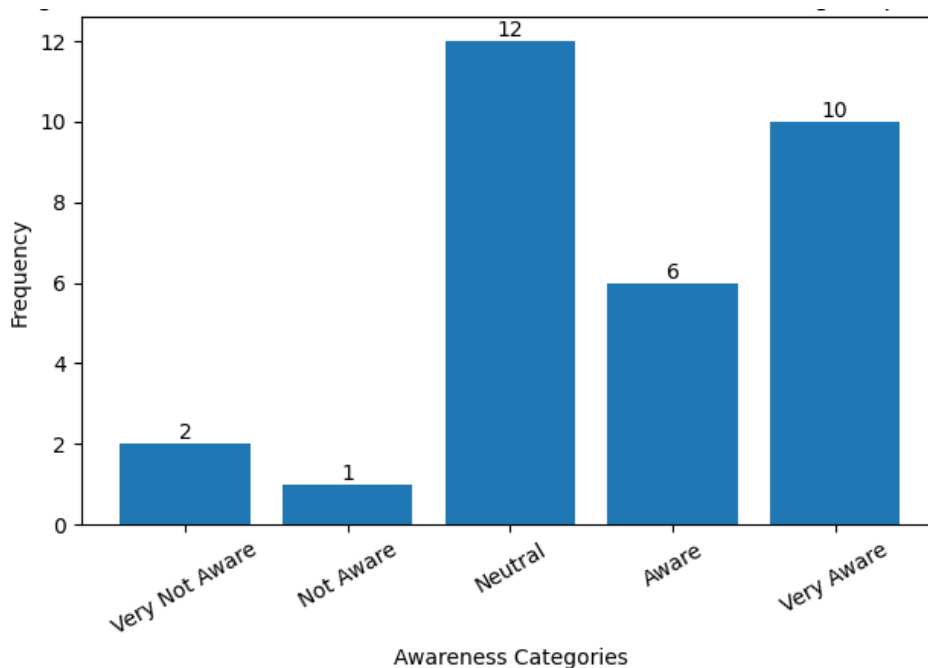


Figure 1. Distribution of mental health awareness levels among respondents

Figure 1 illustrates the frequency distribution of respondents across five awareness categories. The results show a concentration in the “Neutral” and “Very Aware” groups, indicating a moderately informed population with varying levels of engagement. This distribution suggests that while baseline awareness exists, targeted system features such as onboarding guidance and adaptive educational modules are necessary to enhance user readiness for teletherapy adoption.

From an engineering standpoint, this result is important because baseline awareness affects onboarding burden, feature discoverability, and digital engagement. In practical terms, the data suggest that a Malaysian teletherapy platform should not assume a uniform level of mental health literacy. Instead, the system should include embedded educational support, guided navigation, and context-sensitive prompts to move neutral users toward active utilization.

4.3. Perceived role of teletherapy in increasing mental health awareness

The second analysis evaluated whether respondents believed that online therapy can increase awareness of mental health issues. As presented in Table 2, 26 of 60 respondents, or 43.3%, selected either “Agree” or “Strongly Agree,” while 30.0% selected disagreement categories. The weighted mean score was 2.80 with a standard deviation of 1.05. Because this item was coded from 1 = Strongly Agree to 5 = Strongly Disagree in the original response pattern, a lower mean reflects more favorable attitudes toward teletherapy’s awareness-building role.

Table 2. Perception of teletherapy as a tool for increasing mental health awareness (n = 60)

Response Category	Frequency	Percentage (%)
Strongly Agree	6	10.0
Agree	20	33.3
Neutral	16	26.7
Disagree	16	26.7
Strongly Disagree	2	3.3
Total	60	100.0

The chi-square goodness-of-fit test again indicated a statistically significant departure from a uniform distribution, $\chi^2(4) = 19.33, p < 0.001$. This suggests that respondents did not answer randomly across categories; rather, the responses were systematically tilted toward agreement and neutrality. The positive-response proportion (“Agree” + “Strongly Agree”) was 43.3%, with a 95% confidence interval of approximately 31.6% to 55.9%.

Figure 2 illustrates the frequency distribution of respondents across five awareness categories. The results show a concentration in the “Neutral” and “Very Aware” groups, indicating a moderately informed population with varying levels of engagement. This distribution suggests that while baseline awareness exists, targeted system features such as onboarding guidance and adaptive educational modules are necessary to enhance user readiness for teletherapy adoption.

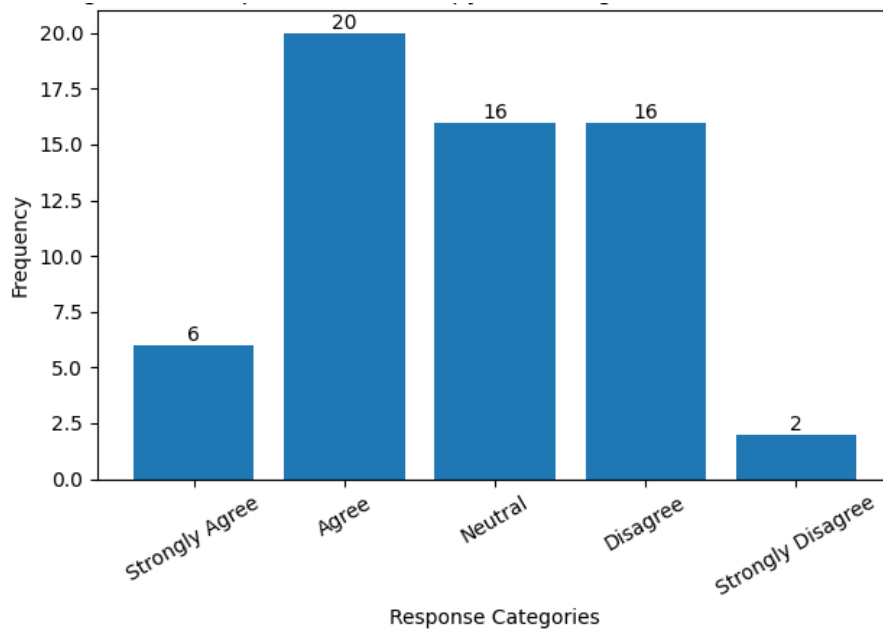


Figure 2. Perception of teletherapy's contribution to mental health awareness

This result supports the engineering rationale for integrating awareness-oriented functions into the system architecture. In the Malaysian context, where stigma and delayed help-seeking still affect mental healthcare utilization, teletherapy platforms can serve not only as service-delivery systems but also as digital awareness infrastructures. Features such as educational nudges, progress dashboards, and AI-personalized psychoeducational content may therefore have functional value beyond mere user retention.

4.4. Perceived effectiveness of online consultation relative to face-to-face therapy

The third analysis focused on perceived effectiveness. Respondents were asked whether online consultation is more effective than traditional face-to-face consultation. As shown in Table 3, only 25.0% agreed or strongly agreed, whereas 48.3% disagreed or strongly disagreed. The weighted mean score was 3.35 with a standard deviation of 1.04, indicating a central tendency toward skepticism.

Table 3. Perceived effectiveness of online consultation compared with face-to-face therapy (n = 60)

Response Category	Frequency	Percentage (%)
Strongly Agree	1	1.7
Agree	14	23.3
Neutral	16	26.7
Disagree	21	35.0
Strongly Disagree	8	13.3
Total	60	100.0

The distribution was statistically significant under the chi-square goodness-of-fit test, $\chi^2(4) = 19.83$, $p < 0.001$, confirming that the responses were meaningfully concentrated rather than evenly dispersed. The proportion of positive responses was only 25.0% (95% CI: 15.8% to 37.2%), while the proportion of negative responses reached 48.3% (95% CI: 36.2% to 60.4%).

60.7%). This asymmetry indicates that respondents distinguished clearly between teletherapy’s practical advantages and its perceived clinical or interpersonal effectiveness.

These results are visualized in Figure 3, which shows a distribution concentrated in the “Neutral” and “Disagree” categories.

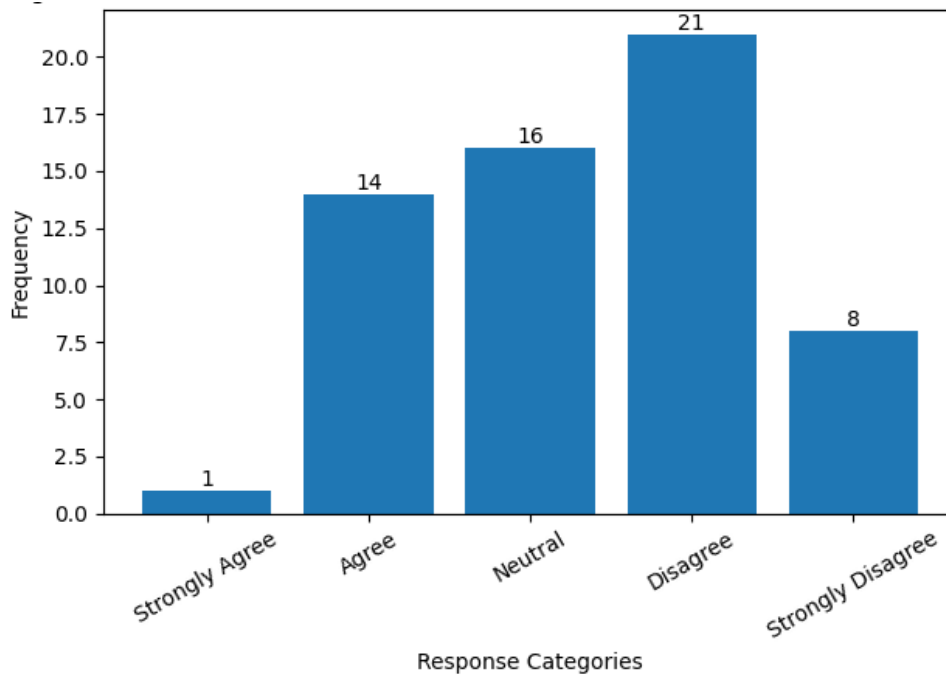


Figure 3. Perceived effectiveness of online consultation relative to face-to-face therapy

This finding is especially important for engineering design. It indicates that system acceptance is not determined solely by convenience or accessibility. Users appear to perceive a gap between digital efficiency and therapeutic depth. For a Malaysian teletherapy platform, this suggests that a fully automated chatbot-only architecture would be unlikely to achieve optimal trust or sustained adoption. Instead, the results support a hybrid architecture, in which AI handles triage, routine interaction, reminders, and low-intensity engagement. At the same time, human therapists remain available for escalation, interpretation, and emotionally complex cases.

4.5. Behavioral intention and recommendation potential

The fourth analysis examined whether respondents would recommend online therapy or online consultation to a friend or relative. As presented in Table 4, 23 of 60 respondents, or 38.3%, selected either “Agree” or “Strongly Agree,” while 28.3% selected disagreement categories. A substantial neutral group of 33.3% remained undecided. The weighted mean score was 2.95 with a standard deviation of 1.11, indicating a moderately favorable but not strongly committed stance.

Table 4. Willingness to recommend teletherapy to friends or relatives (n = 60)

Response Category	Frequency	Percentage (%)
Strongly Agree	4	6.7
Agree	19	31.6
Neutral	20	33.3
Disagree	10	16.7
Strongly Disagree	7	11.7
Total	60	100.0

The chi-square goodness-of-fit test confirmed that the pattern was statistically non-random, $\chi^2(4) = 17.17$, $p = 0.0018$. The estimated positive recommendation proportion was 38.3%, with a 95% confidence interval of 27.1% to 51.0%. Although this does not indicate overwhelming advocacy, it does suggest moderate viral or peer-to-peer diffusion potential, especially if system credibility can be strengthened.

This pattern is illustrated in Figure 4, which shows that positive recommendation responses outnumber negative ones, yet neutrality remains a significant component.

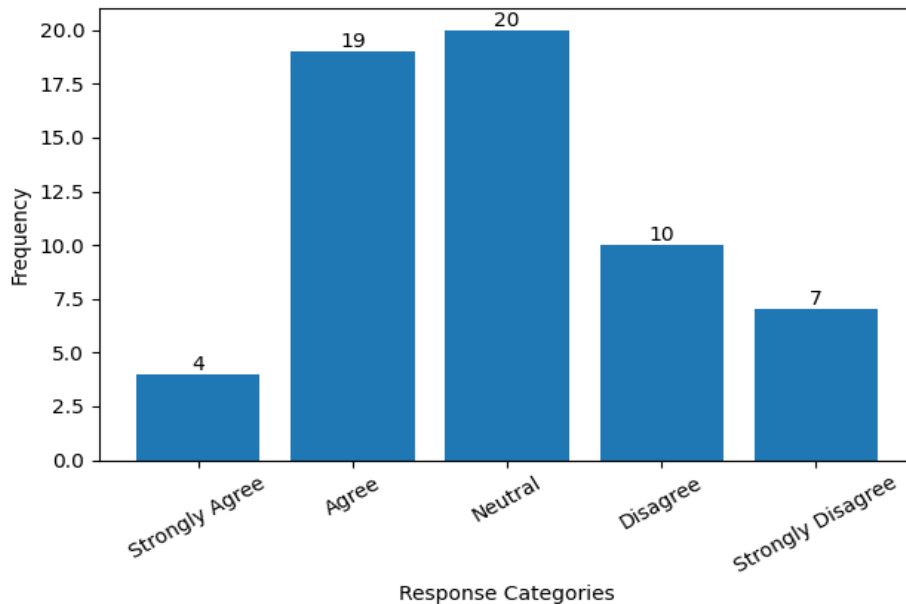


Figure 4. Willingness to recommend teletherapy applications

From an engineering perspective, this result is actionable. Recommendation intention is often a downstream effect of interface quality, response speed, trustworthiness, and emotional fit. The large neutral segment implies that performance optimization and user experience refinement could produce measurable gains in diffusion. In practical Malaysian deployment, recommendation behavior may also be amplified through socially embedded trust networks, particularly among students and young adults.

4.6. Statistical validation of the study hypotheses

The inferential results permit cautious hypothesis validation, although the strength of inference is constrained by the absence of respondent-level raw data.

Hypothesis 1 (H1): Online communication between therapists and patients reduces overall consultation costs for both parties.

This hypothesis is qualitatively supported and, to a lesser extent, quantitatively supported. Interview responses consistently identified reduced transport costs, lower opportunity cost of travel time, and improved scheduling flexibility as major benefits of teletherapy. While no direct cost regression could be estimated from the available data, the positive orientation toward teletherapy’s accessibility and awareness role provides convergent evidence that users perceive tangible utility in the online model.

Hypothesis 2 (H2): Reliable internet access significantly influences the effectiveness of teletherapy systems.

This hypothesis is strongly supported by qualitative evidence and conceptually reinforced by the effectiveness results. Respondents repeatedly associated online effectiveness with connection quality, interaction continuity, and communication smoothness. The relatively weak endorsement of online consultation as more effective than face-to-face therapy suggests that technical reliability remains a decisive factor. In engineering terms, the system must be designed for variable bandwidth, connection recovery, and low-latency interaction.

Hypothesis 3 (H3): User recommendations contribute positively to the adoption and awareness of teletherapy applications.

This hypothesis is partially supported. Recommendation intention was moderately positive, with more positive than negative responses. However, the large neutral group indicates that recommendation-based diffusion is not yet robust enough to be assumed as a primary adoption engine. The result implies that peer-driven expansion is possible, but contingent on improved system quality, trust, and perceived therapeutic value.

To summarize the inferential findings more systematically, Table 5 presents the statistical indicators for the four main measured constructs.

Table 5. Summary of inferential statistics for main survey constructs

Construct	n	Mean	SD	Positive response (%)	95% CI for Positive Response	χ^2 (df = 4)	p-value
Mental health awareness	31	3.68	1.17	51.6	34.8–68.0	14.97	0.0048
Teletherapy increases awareness	60	2.80	1.05	43.3	31.6–55.9	19.33	<0.001
Online consultation is more effective than face-to-face	60	3.35	1.04	25.0	15.8–37.2	19.83	<0.001
Willingness to recommend teletherapy	60	2.95	1.11	38.3	27.1–51.0	17.17	0.0018

As shown in Table 5, all four distributions are statistically significant, confirming that the response patterns are structured and interpretable rather than random. Importantly, the mean values also clearly differentiate the constructs: teletherapy is viewed more favorably as an awareness and access mechanism than as a full substitute for in-person therapy.

4.7. Engineering interpretation of the statistical results

The statistical results provide several implications for engineering design and deployment in Malaysia. First, awareness levels are sufficiently high to justify a mobile-first deployment strategy, but the wide confidence intervals indicate heterogeneity in user readiness. This means that the system should include layered user journeys rather than assuming a uniform starting point. Second, teletherapy’s positive awareness function suggests that AI-assisted

systems can add value even before they are fully trusted as clinical substitutes. In engineering terms, this supports incremental adoption models in which chatbot modules are initially deployed for screening, psychoeducation, and routine support, rather than for full therapeutic replacement.

Third, the relatively low confidence in the effectiveness of online consultation underscores the need for multimodal, human-in-the-loop design. For high-impact engineering implementation, the platform should incorporate escalation protocols, therapist handoff features, and mechanisms for richer interaction, such as voice or video integration. Fourth, the moderate recommendation potential indicates that technical performance and trust are likely leverage points for adoption. Improvements in privacy assurance, response latency, reliability under unstable connectivity, and personalization may have measurable downstream effects on peer recommendation behavior.

4.8. Link to research objectives

The results directly address the study objectives. With respect to the first objective, the findings confirm the feasibility of a scalable mobile architecture because respondents demonstrated adequate awareness and moderate readiness for digital engagement. Regarding the second objective, the survey and interview results identify user acceptance patterns highly relevant to design, especially the preference for convenience alongside caution about therapeutic equivalence. Regarding the third objective, the inferential analysis clarifies the engineering conditions under which teletherapy is most likely to succeed in Malaysia: hybrid AI-human interaction, bandwidth-aware operation, secure data handling, and user-centered interface design.

Overall, the results indicate that the proposed teletherapy framework is not merely socially relevant but technically actionable. Its strongest immediate value lies in improving awareness, accessibility, and low-barrier support. At the same time, its long-term effectiveness will depend on architectural refinement, human integration, and performance optimization under Malaysian deployment conditions.

5. Discussion

5.1. Interpretation of findings and engineering implications

The findings of this study provide a comprehensive understanding of the feasibility and engineering implications of deploying a mobile AI-assisted teletherapy framework within the Malaysian context. Overall, the results indicate that respondents demonstrate a moderate-to-high level of awareness regarding mental health issues, suggesting a user base that is generally receptive to digital health interventions. However, the presence of a substantial proportion of neutral responses highlights a critical gap between awareness and active engagement. This suggests that teletherapy systems cannot rely solely on users' familiarity with mental health concepts; they must incorporate features that actively guide, educate, and engage users. From an engineering perspective, this requires integrating adaptive onboarding processes, personalized content delivery, and intelligent user interaction mechanisms that dynamically respond to varying levels of user awareness and digital literacy.

The results further reveal that teletherapy is widely perceived as a valuable tool for increasing mental health awareness and improving accessibility to care. In Malaysia, where geographical, financial, and social barriers often limit access to traditional mental health services, mobile-based solutions offer a scalable and cost-effective alternative. This reinforces

the role of teletherapy platforms as not only service delivery systems but also awareness-enhancing infrastructures. Engineering-wise, this supports the development of systems with proactive engagement features, such as AI-driven recommendations, push notifications, and continuous monitoring functionalities. These capabilities enable the system to function as an active participant in the user's mental health journey rather than a passive tool.

Despite these advantages, the study identifies a significant limitation: the perceived effectiveness of online consultation is lower than that of face-to-face therapy. A considerable portion of respondents expressed skepticism regarding the ability of digital platforms to replicate the depth, emotional nuance, and interpersonal connection of traditional therapeutic interactions. This finding has important implications for system design. It indicates that fully automated or purely chatbot-based systems may not meet user expectations for effective mental health support. Instead, the results strongly advocate for a hybrid system architecture that combines AI-based interaction with human therapist involvement. Such a design allows for efficient handling of routine interactions while preserving the human element necessary for complex emotional engagement. Additionally, incorporating multimodal communication features, such as voice and video integration, can enhance interaction quality and improve user trust.

Another critical engineering consideration highlighted by the findings is system reliability, particularly regarding internet connectivity. Respondents emphasized that stable network access is essential for effective teletherapy, especially in Malaysia, where infrastructure quality varies across regions. This underscores the need for network-aware system design, including adaptive bandwidth management, offline capabilities for non-critical functions, and efficient data synchronization. The adoption of hybrid cloud-edge architectures can further enhance system resilience by enabling localized processing and reducing latency in real-time interactions. Collectively, these findings emphasize that the success of teletherapy systems depends not only on functional capabilities but also on their ability to operate reliably under diverse real-world conditions.

User trust and data privacy also emerged as central factors influencing system acceptance. While respondents showed openness toward AI-assisted interaction, concerns regarding data security, confidentiality, and the reliability of AI-generated responses were evident. These concerns highlight the importance of incorporating secure data architectures, including encryption and anonymization, as well as explainable AI mechanisms that enhance transparency and user confidence. In the Malaysian regulatory context, adherence to data protection standards is essential to build trust and ensure compliance. From an engineering standpoint, designing systems that are both secure and transparent is critical for achieving long-term adoption and user retention.

5.2. Synthesis, adoption dynamics, and future directions

The behavioral findings of this study indicate that, while users are generally willing to adopt teletherapy systems, their readiness to actively recommend them remains moderate. The presence of a large neutral group suggests that many users are still evaluating the reliability, effectiveness, and trustworthiness of teletherapy solutions before fully committing to their use. This highlights the importance of refining system performance, user experience, and personalization features to enhance overall satisfaction. From an engineering perspective, improvements in response latency, interface design, and adaptive AI behavior can significantly influence user perception and increase the likelihood of recommendation and sustained engagement.

The results also provide empirical support for the study's hypotheses, albeit with varying degrees of strength. The hypothesis that online communication reduces consultation costs is strongly supported by qualitative findings, as respondents consistently identified cost savings and convenience as major advantages. The hypothesis regarding the importance of internet access is also supported, with respondents emphasizing the role of connectivity in determining system effectiveness. The hypothesis regarding user recommendations is partially supported, indicating that while social influence can contribute to adoption, it is contingent on system quality and user trust. These findings collectively reinforce the need for a holistic approach to system design that addresses both technical performance and user perception.

In relation to the research objectives, the study successfully demonstrates the feasibility of developing a scalable mobile teletherapy framework tailored to the Malaysian context. The integration of user-centered insights with engineering design considerations provides a strong foundation for system development and deployment. The findings highlight the importance of combining technical innovation with socio-cultural awareness to ensure the system is both functionally effective and contextually relevant. This is particularly important in Malaysia, where diversity in language, culture, and infrastructure necessitates flexible and adaptive system design.

Looking forward, several directions for future research and system enhancement can be identified. First, expanding the study to include a more diverse population, including rural communities and older age groups, would improve the generalizability of the findings. Second, incorporating longitudinal analysis would provide insights into long-term user engagement and system effectiveness. Third, integrating advanced AI techniques, such as multimodal emotion recognition and personalized intervention models, could enhance system performance and user experience. Finally, applying more advanced statistical methods, such as regression analysis and structural equation modeling, to respondent-level data would enable deeper exploration of the relationships among system features, user perceptions, and adoption behavior.

In conclusion, the discussion highlights that while mobile AI-assisted teletherapy systems offer significant potential for improving mental healthcare accessibility in Malaysia, their success depends on addressing key engineering and user-centered challenges. By adopting hybrid system architectures, ensuring robust, reliable performance, and prioritizing user trust and engagement, the proposed framework can help develop scalable, effective digital mental health solutions in emerging economies.

6. Conclusion

This study developed and evaluated a mobile AI-assisted teletherapy framework tailored to the Malaysian context, with emphasis on engineering feasibility, user acceptance, and system-level deployment considerations. The findings indicate that teletherapy has strong potential as an accessible, cost-efficient digital mental health solution, particularly among technologically engaged users, such as university students. Respondents generally recognized the value of teletherapy in increasing mental health awareness and improving access to support. However, they remained cautious about its ability to replace conventional face-to-face consultation fully.

From an engineering perspective, the results demonstrate that successful implementation depends on more than basic mobile functionality. Effective teletherapy systems must incorporate user-centered interface design, a reliable network-aware architecture, secure data

management, and hybrid AI-human interaction models to address limitations in trust, depth of communication, and service continuity. These requirements are especially important in Malaysia, where digital infrastructure, cultural attitudes, and healthcare accessibility vary across user groups and locations.

Overall, this study provides a localized framework for designing scalable digital mental health systems and shows that AI-assisted teletherapy can serve as a practical complement to existing healthcare services rather than a complete substitute. Future work should expand the system evaluation to broader demographic groups, include longitudinal and clinical outcome measures, and validate the framework using respondent-level data and real-world implementation testing.

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