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SAFEBORDERS (DIGITAL CONVERSATIONAL AGENT): PREVENTION OF SMUGGLING OF CIGARETTES, DRUGS AND CONTROLLED GOODS AT MALAYSIAN BORDERS

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Abstract:

This study presents the design, development, and usability evaluation of SafeBorders, an AI-powered bilingual digital conversational agent developed to support public advocacy and community engagement in preventing the smuggling of cigarettes, drugs, and controlled goods at Malaysian borders. Grounded in Mayer's Cognitive Theory of Multimedia Learning, Social Agency Theory, and Conversational Design Principles, and guided by user-centered design, SafeBorders delivers general safety information, emergency guidance, and a structured incident reporting mechanism across web and mobile platforms in English and Bahasa Melayu. The system was developed in alignment with Malaysia's National Security Policy (2021-2025) and underwent expert review and client feedback prior to user evaluation. A mixed-method summative evaluation involving 32 participants was conducted using an instrument adapted from the USE Questionnaire (Lund, 2001), supplemented by a focus group discussion with 10 participants guided by 11 discussion questions. Descriptive and thematic analyses revealed high levels of perceived usefulness, ease of use, ease of learning, and user satisfaction. Participants reported that SafeBorders effectively improved their awareness of cross-border

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smuggling prevention, provided a smooth and accessible interaction experience, and offered a practical and trustworthy platform for incident reporting. The feedback further highlighted the value of the Report Incident function, report monitoring dashboard, and Emergency Instructions feature, while also suggesting enhancements such as voice input support, additional language options, and GPS-based location detection. The findings demonstrate that SafeBorders is an effective, user-friendly, and reliable digital advocacy tool with strong potential to support public participation in Malaysia's border security efforts.

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Keywords:

Border Security, Chatbot, Digital Conversational Agent, Incident Reporting, Public Advocacy, Safeborders, User Acceptance



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Introduction

Cross-border smuggling of cigarettes, drugs, and controlled goods keeps outpacing Malaysia's enforcement efforts. Seizure records show the problem is not shrinking despite repeated operations and awareness drives (Rahim et al., 2023; Global Initiative Against Transnational Organized Crime, 2023). Cigarette smuggling alone costs the country more than RM5 billion a year in unpaid tax, according to the Confederation of Malaysian Tobacco Manufacturers, while drug trafficking and controlled goods smuggling drain national revenue and threaten social security in their own right (Kang, 2025; National Anti-Drug Agency, 2024). Smuggling syndicates have adapted faster than enforcement can respond, and traditional strategies alone can no longer keep pace with how complex cross-border crime has become at Malaysia's land, sea, and air entry points.

One gap stands out in Malaysia's current border security strategy: border communities are rarely treated as active participants in prevention rather than passive bystanders. Community involvement in crime prevention stays weak largely because accessible, trusted reporting channels simply do not exist (Nik Mohd Shazlee, 2019; Khairuldin, 2019). Posters, community talks, and public campaigns have not managed to sustain long-term awareness, especially among younger residents who live on digital platforms rather than physical bulletin boards (Kee et al., 2024). Even when border residents notice something suspicious, many hesitate to report it, worried about their own safety, unsure how to reach a formal channel, or simply distrustful of how conventional reporting works (Business Times, 2026). Closing this gap calls for something more inclusive and more digitally native than what currently exists.

Chatbots have already proven their worth elsewhere, improving public communication and community engagement across health, education, and public services (Adamopoulou & Moussiades, 2020; Larsen & Følstad, 2024). When designed with attention to local language, cultural context, and user needs, they connect institutions to communities faster and more

directly than traditional channels can (Jais & Ngah, 2024). Malaysia's Ministry of Home Affairs has itself named artificial intelligence a strategic technology for strengthening border operations, pointing specifically to tools that distribute information quickly and engage communities in real time (Minoi et al., 2024). Yet for all this momentum in the Malaysian public sector, chatbots have barely touched border security advocacy or community-based crime prevention (Jais et al., 2024).

SafeBorders was built to close that gap: an AI-powered, bilingual digital conversational agent designed to strengthen public advocacy and community engagement against cross-border smuggling in Malaysia. Behind the scenes it runs on Natural Language Processing through the ChatGPT API, and on the surface it delivers general safety information, emergency guidance, and a structured incident reporting mechanism across both web-based and mobile platforms, in English and Bahasa Malaysia. Its design draws on Mayer's Cognitive Theory of Multimedia Learning (2001), Social Agency Theory (Mayer, 2014), and Conversational Design Principles (Clark et al., 2024), all pointing toward the same priorities: accessible communication, cultural relevance, and an interaction style that works for border residents regardless of their digital literacy.

This study looks at how SafeBorders was designed, built, and evaluated for usability, drawing on expert review, client feedback, and real users. Using the USE Questionnaire developed by Lund (2001), it measures perceived usefulness, ease of use, ease of learning, and satisfaction. In doing so, it adds to the conversation on conversational AI in public safety communication, showing what a chatbot-based advocacy tool can do for public awareness, community participation, and trusted incident reporting under Malaysia's National Security Policy (2021-2025) and the MADANI Economy agenda.

Background of Study

Malaysia shares land and maritime borders with several neighboring countries, and its smuggling networks, spanning cigarettes, drugs, controlled goods, and other prohibited items, have grown more complex rather than less (Rahim et al., 2023). Enforcement operations such as Ops Benteng and Ops Kontraban continue to produce significant arrests and seizures, but the fact that smuggling activity remains widespread suggests enforcement on its own cannot solve the problem (Shahrizal & Mohd Ikbal, 2023). Mohd Sidek et al. (2022) situate some of the resulting economic damage: lost government revenue and disrupted border towns, on top of the roughly RM5 billion a year in tax losses that cigarette smuggling alone is expected to cause (Kang, 2025).

As introduced above, weak community engagement remains one of the central obstacles to prevention, and conventional advocacy, posters, talks, campaigns, has not kept pace with how younger, digitally engaged residents actually get their information (Nik Mohd Shazlee, 2019; Khairuldin, 2019; Kee et al., 2024).

AI-powered chatbots have already shown they can improve communication and engagement in Malaysia's healthcare, education, and public administration sectors when tailored to local language and digital literacy needs (Adamopoulou & Moussiades, 2020; Larsen & Følstad, 2024; Jais & Ngah, 2024), yet border security advocacy remains an open frontier for that technology (Jais et al., 2024).

SafeBorders grew directly out of this enforcement gap, conceived as a community-centred tool that complements rather than replaces existing operations. It was built in alignment with Malaysia's National Security Policy (2021-2025) and the MADANI Economy agenda, both of which name digital innovation and community empowerment as pillars of national security and public governance (Prime Minister's Office, 2023).

What follows examines how SafeBorders was designed, built, and evaluated in partnership with the Malaysian Border Control and Protection Agency (AKPS), focusing on what its usability, ease of use, ease of learning, and satisfaction scores, gathered through Lund's (2001) USE Questionnaire, reveal about its potential as a public safety tool for Malaysia's border regions.

Problem Statement

Enforcement alone has not been enough. Cross-border smuggling of cigarettes, drugs, and controlled goods keeps threatening Malaysia's national security, economy, and border communities, and smuggling syndicates have gotten better at exploiting porous routes and the weak communication links between residents and enforcement authorities (Rahim et al., 2023; Shahrizal & Mohd Ikbal, 2023). Operations such as Ops Benteng and Ops Kontraban post real seizure numbers, but their long-term impact hinges on community involvement that stays critically low in border areas (Shahrizal & Mohd Ikbal, 2023; BERNAMA, 2023).

Existing advocacy and reporting mechanisms simply are not built for these communities. Posters, talks, and media campaigns keep missing the younger, digitally active residents who are often best placed to notice something wrong (Kee et al., 2024), and without a trusted, user-friendly channel to report through, the gap between what residents notice and what actually reaches enforcement stays wide (Nik Mohd Shazlee, 2019; Khairuldin, 2019). Enforcement agencies end up carrying the burden of prevention largely on their own, which limits how effective national border security strategies can be.

This was borne out directly in a consultation session with representatives from the Malaysian Border Control and Protection Agency (AKPS) and the Royal Malaysian Police, who confirmed both the severity of ongoing smuggling activity and how little the current communication channels support meaningful public participation. No interactive, accessible, trusted digital platform existed to bridge national policy and what actually happens at the grassroots level.

Chatbots could plausibly fill that gap, given their track record elsewhere (Jais & Ngah, 2024; Jais et al., 2024), but Malaysian public-sector chatbots so far stop at customer service. None have been built for public safety communication or incident reporting, leaving conversational AI an untapped strategic tool for community engagement in national security.

SafeBorders responds to that need directly: a bilingual, accessible, user-centered conversational agent that folds public safety information, emergency guidance, and incident reporting into one interface. Whether it actually works, how usable, effective, and trustworthy real users find it, determines whether border communities will adopt it. That question is what this study sets out to answer, evaluating SafeBorders' perceived usefulness, ease of use, ease of learning, and satisfaction among real users, with the aim of demonstrating how

conversational AI can support public advocacy and community participation in cross-border smuggling prevention in Malaysia.

SafeBorders: An AI-Powered Digital Conversational Agent for Border Security Advocacy

SafeBorders was developed as an AI-powered digital conversational agent designed to support public advocacy and community engagement in preventing the smuggling of cigarettes, drugs, and controlled goods at Malaysian borders. The development of SafeBorders was motivated by the need to strengthen communication between enforcement agencies and border communities by providing an accessible, interactive, and trusted digital platform for delivering safety information, emergency guidance, and incident-reporting support. Previous studies have highlighted the limitations of conventional advocacy methods in sustaining community participation in crime prevention, particularly in border areas where residents face significant barriers to reporting suspicious activities (Nik Mohd Shazlee, 2019; Khairuldin, 2019; Kee et al., 2024). By combining conversational artificial intelligence with structured public safety content, SafeBorders aims to provide users with convenient access to verified border security information and a secure, accessible channel to submit incident reports to the Malaysian Border Control and Protection Agency (AKPS).

Unlike traditional advocacy approaches that rely on one-way information delivery, SafeBorders adopts a conversational interaction approach that enables users to engage with the system through natural language queries in either English or Bahasa Melayu. The chatbot allows users to seek information related to cross-border smuggling prevention, obtain emergency guidance during dangerous situations, and submit incident reports directly through the conversational interface. The bilingual conversational design is supported by research highlighting the effectiveness of chatbots in providing accessible, real-time, and personalized communication that improves public engagement and information accessibility across diverse user groups (Adamopoulou & Moussiades, 2020; Larsen & Følstad, 2024).

SafeBorders is structured around three core functional modules. The General Information module serves as the primary informational component of the system, allowing users to inquire about cross-border smuggling prevention, border safety awareness, prohibited items, penalties, and other relevant public advocacy content through conversational interaction. The Emergency Instructions module provides immediate guidance for users who encounter dangerous or suspicious situations near border areas, delivering important emergency contact numbers for the Royal Malaysian Police (PDRM) and the Malaysian Maritime Enforcement Agency (APMM), as well as information on available reporting channels. The Report Incident module allows users to submit structured incident reports related to cross-border smuggling activities directly through the chatbot interface, with support for image uploads. Predefined incident categories include Human Trafficking, Drugs Smuggling, Controlled Goods Smuggling, and Others, along with structured checkpoint location selection covering land, sea, and air entry points.

To ensure accountability and traceability in the reporting process, SafeBorders incorporates a user registration and login system that allows registered users to submit and monitor their reports through a dedicated user dashboard. Upon successful report submission, users receive a unique reference number to track their report's processing status. The administrative dashboard, accessible exclusively through the web-based version of the system, provides AKPS administrators with a comprehensive report management interface that supports viewing

and updating report statuses, downloading reports in PDF format, and sharing reports with relevant parties when necessary.

The SafeBorders interface was designed using user-centered design principles to ensure clarity, consistency, and accessibility across diverse user groups with varying levels of digital literacy. The system incorporates an introductory onboarding message, descriptive function buttons, and contextually appropriate upload options to guide first-time users effectively. Prior to the summative evaluation, formative reviews involving two domain experts and client representatives from AKPS were conducted to assess usability, interface clarity, reporting functionality, and operational suitability. Feedback from these reviews resulted in several refinements, including the addition of a Back to Website button, renaming of feature labels, contextual display of the upload icon, image relevance validation, structured location input, and PDF export capability. Figures 1(a) to 1(k) illustrate the user interface of the SafeBorders web application, and Figures 2(a) to 2(h) illustrate the user interface of the SafeBorders mobile application.

Technically, SafeBorders was developed as both a web-based (Figure 1) and mobile-based application (Figure 2). The conversational component is powered by the ChatGPT API, which serves as the core Natural Language Processing (NLP) engine, generating contextually relevant and coherent responses to user queries. The system operates on a cloud-based server infrastructure to support real-time processing, scalability, and reliable performance. Educational and advocacy content was developed based on verified information aligned with Malaysia's national border security awareness objectives and validated through consultation with AKPS representatives to ensure accuracy and operational relevance.

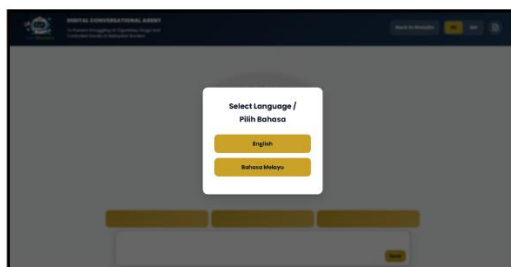


Figure 1(a):
Language Selection Page

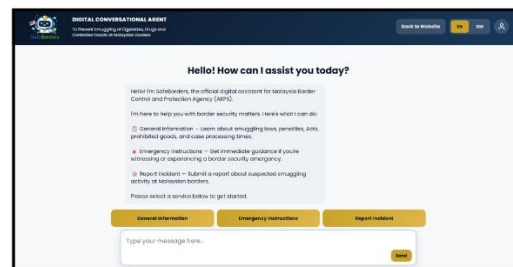


Figure 1(b):
Chatbot Main Page

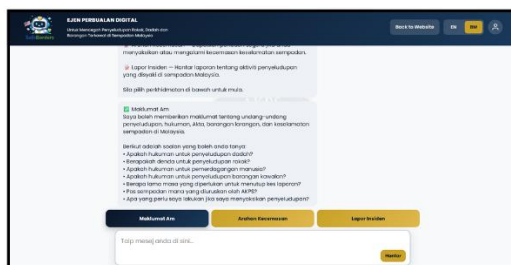


Figure 1(c):
General Information Feature

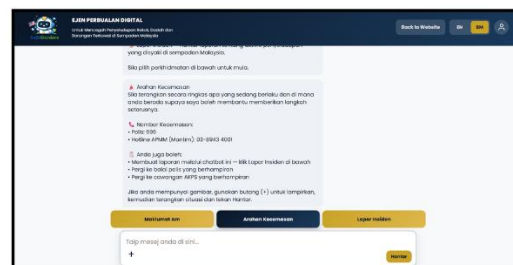


Figure 1(d):
Emergency Instructions Feature

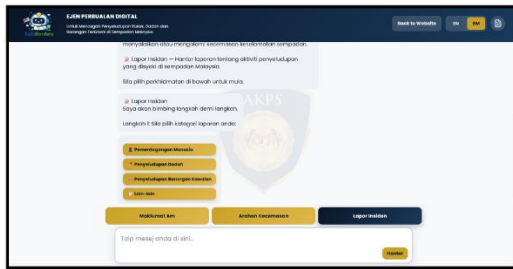


Figure 1(e):
Report Incident Feature

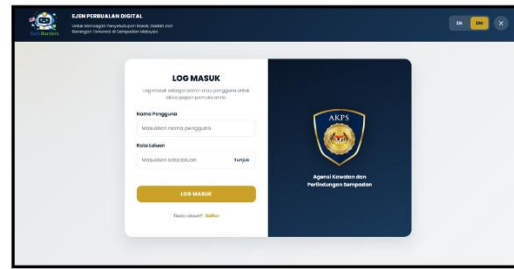


Figure 1(f):
Login Page

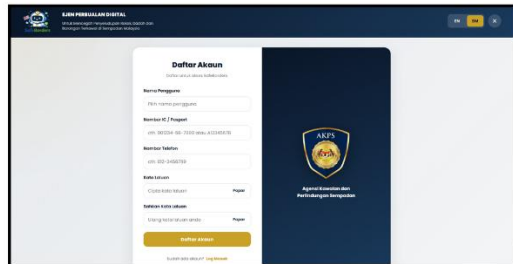


Figure 1(g):
Sign Up Page

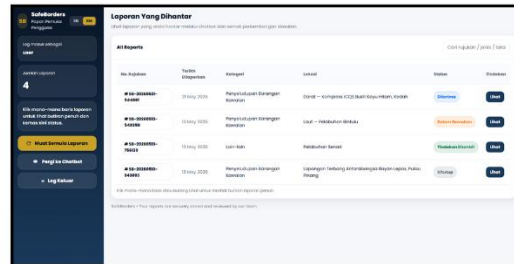


Figure 1(h):
User Dashboard Page

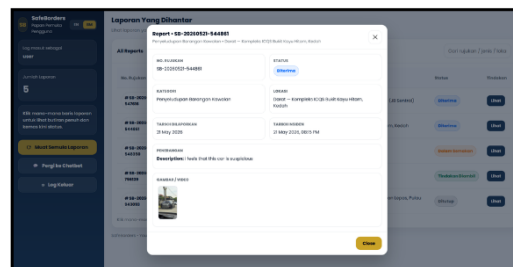


Figure 1(i):
User Dashboard Feature

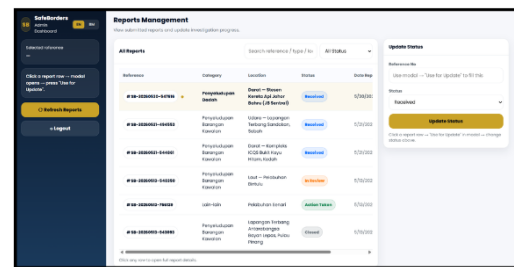


Figure 1(j):
Admin Dashboard Page

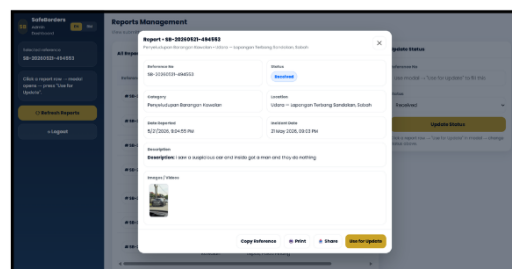


Figure 1(k):
Admin Dashboard Feature

Figure 1: User Interface Of The SafeBorders Web Application



Figure 2(a):
Language Selection Page

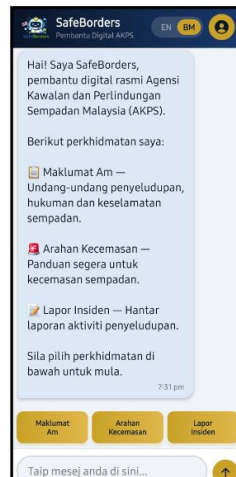


Figure 2(b):
Chatbot Main Page

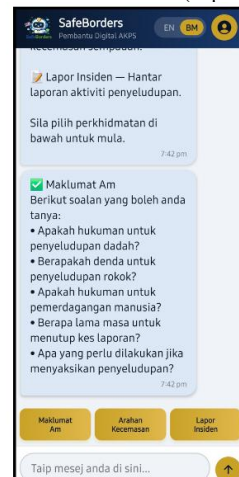


Figure 2(c):
General Information Feature

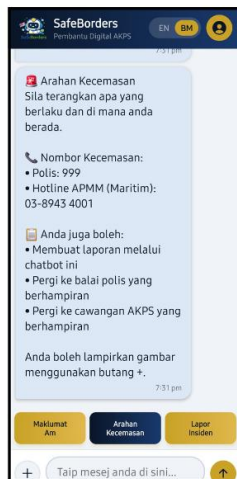


Figure 2(d):
Emergency Instructions Feature

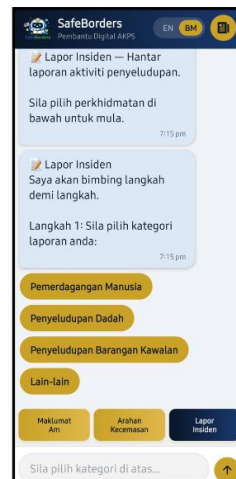


Figure 2(e):
Report Incident Feature

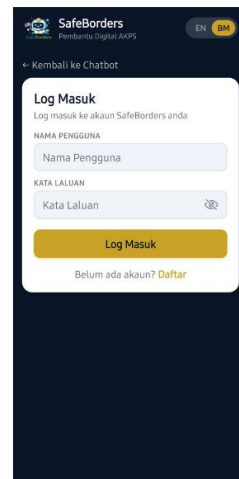


Figure 2(f):
Login Page



Figure 2(g):
Sign Up Page

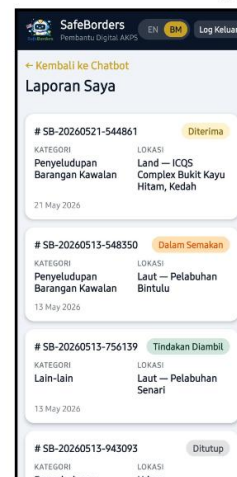


Figure 2(h):
User Dashboard Page

Figure 2: User Interface Of The SafeBorders Mobile Application

Methodology

The usability and effectiveness of the SafeBorders system were examined through a summative evaluation conducted with real users after the prototype refinement process. The primary objective of this evaluation was to assess users' perceptions of the system's usefulness, ease of use, ease of learning, and overall satisfaction after interacting with the SafeBorders chatbot. By focusing on these constructs, the methodology aimed to provide empirical insights into the extent to which SafeBorders meets the communication and reporting needs of its intended users and whether its core features, namely the General Information functions, Emergency Instructions functions, and Report Incident functions, contribute to an accessible, functional, and satisfying user experience.

A mixed-method research design was adopted, combining quantitative data collection through a structured questionnaire and qualitative data collection through a focus group discussion. The quantitative component was guided by the USE Questionnaire framework developed by Lund (2001), which was selected for its established relevance in evaluating digital systems and its ability to provide valid indicators of perceived usability across four key dimensions: Usefulness, Ease of Use, Ease of Learning, and Satisfaction. The qualitative component was guided by focus group discussion principles as outlined by Krueger and Casey (2014), which enabled the collection of in-depth user perspectives, experiences, and suggestions that complemented and enriched the quantitative findings. Together, both methods provided a comprehensive and balanced assessment of the SafeBorders system's usability and overall user experience (Creswell & Creswell, 2017).

A total of 32 participants took part in the questionnaire evaluation session, providing quantitative feedback on their experience with the SafeBorders system. The participants consisted of users from diverse educational backgrounds and age groups with prior experience using mobile applications and conversational AI platforms. In addition, 10 participants took part in the focus group discussion session to provide qualitative feedback, opinions, and suggestions regarding the conversational interaction, reporting experience, bilingual usability, and overall user experience of the SafeBorders chatbot. The focus group discussion was guided by 11 structured discussion questions adapted from the USE Questionnaire developed by Lund (2001) and the Questionnaire for User Interaction Satisfaction (QUIS) developed by Wallace et al. (1988) and were modified and contextualized to evaluate users' experiences specifically in relation to the SafeBorders system.

Data were collected using a structured questionnaire adapted from Lund's (2001) USE Questionnaire. The instrument assessed users' perceptions across four key dimensions. The Usefulness dimension assessed the extent to which the SafeBorders chatbot was perceived as practically beneficial, including its ability to provide useful assistance and to improve users' awareness of smuggling prevention. The Ease-of-Use dimension assessed users' impressions of the chatbot's simplicity, conversation flow clarity, interface user-friendliness, and the speed and clarity of chatbot responses. The Ease of Learning dimension assessed how quickly users learned and became familiar with the chatbot's functions after the initial interaction. The Satisfaction dimension assessed users' overall satisfaction with the system, including the pleasantness of the interaction experience and their willingness to recommend it to others. All items used a five-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree", supplemented by demographic questions to identify participants' background information and prior experience with chatbot-based systems.

The summative evaluation was conducted after the complete development and formative refinement of the SafeBorders prototype. Prior to the evaluation session, participants were briefed on the purpose of the study and the functions of the SafeBorders system. They were then invited to independently explore and interact with the system using both a web browser and a mobile device, testing the bilingual conversational chatbot, navigation structure, General Information function, Emergency Instructions function, and Report Incident function. Upon completion, participants completed the questionnaire to provide quantitative feedback on their interaction experience. Following the questionnaire session, 10 participants took part in a focus group discussion to provide additional qualitative insights into their overall impressions, interaction experiences, the trustworthiness of chatbot responses, and suggestions for future improvements. Prior to this summative evaluation, a formative evaluation involving two domain experts through semi-structured interviews and client representatives from AKPS through a focus group discussion was conducted to refine the interface design, improve functional completeness, and ensure operational suitability. Their feedback led to several prototype enhancements, ensuring that the version evaluated in the summative phase was both functionally complete and operationally relevant.

Data were analysed using descriptive statistics to determine users' perceptions of each usability construct. Frequency distributions provided insight into the levels of perceived usefulness, ease of use, ease of learning, and satisfaction across all questionnaire items. Additionally, thematic analysis was applied to the qualitative responses gathered from the focus group discussion. This analysis identified recurring themes related to users' overall impressions, interaction experiences, helpful features, usability concerns, and suggestions for improvement. Together, the quantitative and qualitative findings provided a comprehensive understanding of users' perceptions of the SafeBorders system and offered valuable directions for the platform's future development and enhancement.

Findings

The summative evaluation of SafeBorders yielded highly positive results across all constructs measured: Usefulness, Ease of Use, Ease of Learning, and Satisfaction. A total of 32 participants completed the questionnaire, while 10 participated in the focus group discussion. The findings indicate a high level of user acceptance towards the SafeBorders chatbot as an effective platform for cross-border smuggling awareness, emergency guidance, and incident reporting. The evaluation was adapted from Lund's (2001) USE Questionnaire to enable systematic assessment of users' perceptions of the chatbot's practical value, usability, learnability, and overall satisfaction.

Table 1: Item-Level Descriptive Statistics For User Acceptance Of SafeBorders

Construct	Item	Mean (M)	SD	% Agree	% Strongly Agree	% Agree / Strongly Agree
Usefulness	The SafeBorders chatbot provides useful assistance and information.	4.53	0.51	46.9%	53.1%	100.0%
	The chatbot helps me understand smuggling	4.59	0.50	40.6%	59.4%	100.0%

	prevention more effectively.					
	The chatbot makes it convenient to seek information or report smuggling activities.	4.50	0.51	50.0%	50.0%	100.0%
	The chatbot responds according to my needs.	4.44	0.50	56.2%	43.8%	100.0%
Ease of Use	The chatbot is easy to use.	4.59	0.50	40.6%	59.4%	100.0%
	The conversation flow with the chatbot is clear and understandable.	4.62	0.49	37.5%	62.5%	100.0%
	The chatbot interface is user-friendly.	4.47	0.51	53.1%	46.9%	100.0%
	I can interact with the chatbot without confusion.	4.66	0.48	34.4%	65.6%	100.0%
	The chatbot gives responses quickly and clearly.	4.59	0.50	40.6%	59.4%	100.0%
Ease of Learning	I learned to use the chatbot quickly.	4.56	0.56	37.5%	59.4%	96.9%
	It is easy to remember how to interact with the chatbot.	4.50	0.51	50.0%	50.0%	100.0%
	I quickly became familiar with the chatbot functions.	4.53	0.51	46.9%	53.1%	100.0%
Satisfaction	I am satisfied with the SafeBorders chatbot.	4.56	0.50	43.8%	56.2%	100.0%
	The chatbot provides a pleasant interaction experience.	4.50	0.51	50.0%	50.0%	100.0%
	I would recommend the SafeBorders chatbot to others.	4.38	0.71	37.5%	50.0%	87.5%
	Overall, the chatbot works the way I expect it to.	4.44	0.50	56.2%	43.8%	100.0%

Note: Items were rated using a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) (N = 32).

Table 2: Summary of Descriptive Statistics For User Acceptance Of SafeBorders

Construct	Measure	Mean (M)	SD	% Agree / Strongly Agree	Description of Findings
Usefulness	Information assistance, awareness enhancement, reporting convenience, response relevance	4.52	0.50	100.0%	Participants strongly perceived SafeBorders as a useful platform for obtaining information, increasing awareness, and facilitating incident reporting.
Ease of Use	Ease of interaction, conversational flow, interface clarity, navigation, response clarity	4.59	0.49	100.0%	Users reported that the chatbot was simple to use, easy to navigate, and provided clear conversational guidance throughout the interaction.
Ease of Learning	Learnability, memorability, and familiarity with functions	4.53	0.52	99.0%	Participants quickly learned how to use the chatbot and became familiar with its functions after minimal interaction.
Satisfaction	Overall satisfaction, interaction experience, recommendation intention, expectation fulfilment	4.47	0.56	96.9%	Most participants expressed high satisfaction with the chatbot and indicated their willingness to recommend it to others.

Note: Items were rated using a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) (N = 32).

The Usefulness dimension drew the strongest response of the four constructs (Lund, 2001). Every one of the 32 respondents agreed or strongly agreed that the chatbot provides useful assistance and information on preventing cross-border smuggling, and all of them likewise agreed the platform makes it convenient to seek information or report smuggling activities; 59.4% went further and strongly agreed it helped them understand smuggling prevention more effectively. Responses were also judged relevant and appropriate by every single respondent, since 100% agreed on that item too. Taken together, these numbers suggest SafeBorders is doing what it set out to do: disseminating information and drawing communities into border security initiatives as a digital advocacy platform.

Ease of Use held up just as well (Lund, 2001). All 32 participants called the chatbot easy to use and its interface user-friendly, and every respondent agreed the conversation flow was clear and understandable. The item on interacting without confusion pulled the strongest agreement in this construct, 65.6% strongly agreed, and most participants also found the chatbot's

responses quick and clear. Read together, these results point to a conversational design, navigation structure, and bilingual interface that worked across different digital literacy levels, letting users complete tasks without much friction.

Ease of Learning came out favourably too (Lund, 2001), though not quite unanimously: 59.4% strongly agreed they learned to use the chatbot quickly, while one respondent (3.1%) chose Neutral on that item, the only neutral response in the entire questionnaire. Everyone else agreed or strongly agreed that the system was easy to remember and that its functions became familiar quickly. That near-unanimous pattern points to an interaction experience intuitive enough that first-time users need little guidance or training to get started.

Satisfaction followed the same pattern (Lund, 2001), with 56.2% strongly agreeing they were satisfied overall and half strongly agreeing the interaction itself was pleasant. The one item to draw any real hesitation was recommending SafeBorders to others: four respondents (12.5%) sat on Neutral, though the remaining 87.5% still agreed or strongly agreed. Every respondent, without exception, agreed the chatbot worked as expected, meeting the functional and interactional bar users had set for it.

These numbers held up in the focus group too. Participants described the chatbot as easy to use, informative, and well-organized, with several singling out the General Information feature for helping them understand smuggling activities, prohibited goods, and reporting procedures. The bilingual functionality also came up unprompted, users liked being able to switch comfortably between English and Bahasa Melayu, and the Report Incident feature was named repeatedly as one of the system's most valuable parts, letting users submit reports and supporting evidence through a process that felt structured rather than bureaucratic.

Awareness of border security issues improved for participants, they said, and the chatbot gave them a more convenient alternative to the information channels they had used before. The Emergency Instructions feature drew particular praise for delivering immediate guidance and emergency contacts in what could be a genuinely dangerous situation near a border. Not everything was flawless, though: participants wanted GPS-based location detection to make incident reporting simpler and more accurate, voice input so reporting does not require typing, more languages (Chinese came up specifically, for foreign users in border areas), and clearer onboarding for first-time users. These suggestions indicate valuable opportunities for future development while reflecting users' strong interest in the continued use and improvement of the SafeBorders platform.

Put simply, SafeBorders met what users expected of it: a digital conversational agent for public advocacy and community engagement against cross-border smuggling. High agreement across all four usability dimensions, backed up by the focus group, points toward real potential here, not just for raising public awareness, but for giving communities a working channel to report through and strengthening the relationship between citizens and the agencies meant to protect Malaysia's borders.

Discussion

Taken as a whole, these results show strong user acceptance of the SafeBorders digital conversational agent: pairing conversational AI with bilingual support, public safety information, and structured incident reporting produced something border community users

found genuinely accessible, functional, and useful. That pattern squares with existing theoretical claims about conversational AI's effectiveness in public communication, community engagement, and information accessibility. Across all four USE Questionnaire constructs, Usefulness, Ease of Use, Ease of Learning, and Satisfaction, the responses point the same direction: SafeBorders achieved what it was built to do as a digital advocacy and reporting tool (Lund, 2001).

Usefulness drew the most emphatic response of the four constructs. Every one of the 32 respondents agreed or strongly agreed on every usefulness item, and the single strongest agreement of the whole set came on whether the chatbot helped them understand smuggling prevention more effectively, 59.4% strongly agreed. That lines up with prior work showing conversational AI can genuinely deliver public safety information and raise community awareness, provided the language is accessible, the content relevant, and the interaction responsive (Adamopoulou & Moussiades, 2020; Larsen & Følstad, 2024). Focus group participants echoed the same point in their own words, describing the chatbot's information on border security, emergency guidance, and the reporting process as clear, relevant, and credible. Ease of Use tells a similar story from the interface side. Respondents agreed the chatbot was easy to use, its conversation flow clear, its interface user-friendly, and interaction largely confusion-free, with the strongest agreement (65.6%) on being able to interact without confusion at all. Lund (2001) treats clarity, simplicity, and consistency as the core determinants of usability, and that is essentially what participants described: guided response buttons, a structured conversational flow, and clear navigation that kept the cognitive burden low enough for users to focus on the task, not the interface (Mayer, 2001).

Ease of Learning followed the same broadly positive trend, with most respondents saying they picked up the chatbot quickly, remembered how to use it, and grew familiar with its functions after one session. The single neutral response in the entire questionnaire landed here, one respondent (3.1%) on the item about learning quickly, a small but real signal that onboarding could still be tightened for users who need more guidance the first time around. Given that SafeBorders is meant for border residents with uneven digital literacy, that onboarding gap matters more than the number alone suggests (Kee et al., 2024).

Satisfaction held up too, though with a bit more hesitation than the other three constructs. Most respondents were satisfied overall, found the interaction pleasant, and said the system worked as they expected, but the item on recommending SafeBorders to others pulled the most neutral responses of the whole questionnaire, four respondents (12.5%), even as the remaining 87.5% still agreed or strongly agreed. That gap between being satisfied and being willing to actively recommend something is consistent with research tying satisfaction with digital public service tools to perceived reliability and how complete the feature set feels (Larsen & Følstad, 2024; Jais & Ngah, 2024), suggesting room to deepen the system before user confidence fully converts into advocacy.

What the numbers alone do not fully capture, the focus group filled in. Participants kept returning to three features specifically, the Report Incident function, the report monitoring dashboard, and Emergency Instructions, as what set SafeBorders apart from a conventional reporting channel: submitting through conversation, tracking a report by reference number, getting emergency guidance immediately, and walking away with a chat summary. Trust came up unprompted too. The AKPS logo, several participants said, was itself part of why they trusted the chatbot's responses, which tracks with research linking user trust in public safety

tools to visible institutional backing as much as to the accuracy of the information itself (Jais et al., 2024).

None of this means the system is finished. Participants asked for voice input, more languages (Chinese specifically), GPS-based location detection, a better-tuned session timeout, and clearer onboarding labels for newcomers. These are refinements rather than red flags, but they map closely onto what the broader conversational AI literature already recommends: multimodal input, multilingual accessibility, and onboarding built around the user rather than the system (Adamopoulou & Moussiades, 2020).

Put together, the picture that emerges is of an effective, accessible, user-friendly advocacy tool, one that helps the public understand cross-border smuggling prevention and gives them a practical, trusted way to report what they see. That outcome backs up existing theory on conversational AI, usability evaluation, and public engagement, while adding something more concrete: evidence that a chatbot-based advocacy system can actually move the needle on community participation and on the working relationship between border residents and enforcement agencies in Malaysia.

Implications

Several implications follow for public safety communication, digital system design, and future research on community-based crime prevention. First, and most directly, users' acceptance of SafeBorders makes the case for building conversational AI into public advocacy rather than treating it as a side experiment. People responded well to the chatbot's information delivery, emergency guidance, and reporting capability, and that response supports conversational AI as a real bridge between enforcement agencies and the communities they serve (Adamopoulou & Moussiades, 2020; Larsen & Følstad, 2024). For policymakers, the implication is fairly direct: posters and community talks are a one-way channel, and it may be time to invest instead in something interactive and digital-first that communities actually trust. SafeBorders shows what that looks like when the design is intentional, user-centered, bilingual, and culturally grounded. Second, how positively users responded to the Report Incident function and its monitoring dashboard says something about reporting-system design more broadly. A conversational format made reporting feel less intimidating than the conventional channels, matching research on why user-friendly, trusted channels matter for getting community members to actually come forward (Nik Mohd Shazlee, 2019; Khairuldin, 2019). Agencies designing public reporting platforms, particularly for populations with limited digital literacy or low trust in formal systems, would do well to consider a conversational interface for that reason. Reference number tracking, structured location input, and image validation show that this format does not have to trade rigour for accessibility.

Third, the strong ease-of-use and ease-of-learning scores make a case for interface design as a genuine adoption factor, not a cosmetic afterthought. Minimalist layouts, clear labelling, and structured onboarding did real work here, echoing research on how user-centered interface design reduces friction and widens adoption across different user populations (Lund, 2001; Jais & Ngah, 2024). Users who are not fighting the navigation are simply more likely to engage with what the system actually offers.

Institutional trust turns out to matter more than the questionnaire alone would suggest. Participants kept mentioning the AKPS logo unprompted as a reason they trusted the chatbot,

pointing to perceived institutional backing as a real determinant of trust in government-affiliated digital tools. Public safety chatbots, on this evidence, need visible and consistent institutional branding, clear data-handling policies, and transparent sourcing if they want that same level of user confidence, a pattern that holds across research on digital public service adoption more generally (Jais et al., 2024; Larsen & Følstad, 2024).

Zooming out, the results speak to Malaysia's broader border security and digital transformation agenda. Users' acceptance of SafeBorders, paired with their interest in features like voice input, GPS-based location detection, and more languages, suggests real community appetite for more advanced digital engagement tools in this space. That SafeBorders works at all is evidence that digital advocacy grounded in solid theory, user-centered design, and institutional collaboration can meaningfully complement enforcement rather than compete with it, in line with the goals the National Security Policy (2021-2025) and the MADANI Economy agenda already set out (Prime Minister's Office, 2023).

The overall takeaway for enforcement agencies and government institutions is straightforward: conversational AI tools are worth developing and adopting to strengthen public advocacy, improve community reporting, and build closer collaboration with citizens. SafeBorders, by folding bilingual interaction, structured reporting, and trusted institutional branding into one platform, offers a working, scalable template for that kind of community-centred digital advocacy against cross-border crime in Malaysia.

Limitations and Future Work

Although the findings demonstrate strong user acceptance of SafeBorders, several limitations should be acknowledged. First, the summative evaluation involved a relatively small sample consisting primarily of community residents and young working adults. While the participants were able to provide valuable insights into the system's usability and acceptance, the findings may not fully represent the broader target population, particularly border community residents from diverse age groups, educational backgrounds, and socioeconomic backgrounds in high-risk border areas such as Bukit Kayu Hitam and Padang Besar. Future studies involving larger, more geographically representative groups of participants would provide a more comprehensive understanding of user acceptance across different segments of the target audience.

Second, the evaluation focused primarily on users' perceptions and acceptance of the system rather than measuring actual improvements in public awareness of cross-border smuggling prevention or changes in reporting behavior. Although participants reported that the system helped them better understand smuggling prevention and reporting procedures, the study did not include pre-test and post-test assessments to objectively measure awareness outcomes. Future research could therefore investigate the effectiveness of conversational AI applications in improving public safety awareness and community reporting participation through longitudinal or experimental studies that track behavioral outcomes over time.

Several opportunities for system enhancement were identified during the focus group discussion. Participants suggested integrating voice input and voice interaction features to enable users to report incidents and seek information more quickly without typing, which is particularly important in urgent or emergency situations near the border. They also recommended foreign language support to include additional languages such as Chinese to

accommodate foreign nationals and diverse ethnic communities in border regions. Additional suggestions include implementing GPS-based automatic location detection to simplify incident location reporting, refining the session timeout duration to prevent users from losing their progress, and providing clearer onboarding guidance and labels to help first-time users navigate the system more effectively. These suggestions provide valuable guidance for future refinements to improve the usability, accessibility, and overall effectiveness of SafeBorders.

Future development of SafeBorders may also incorporate more advanced artificial intelligence capabilities. Potential enhancements include more context-aware conversational responses, adaptive interaction flows based on user behavior, predictive content recommendations, and real-time integration with enforcement agency databases for faster report verification and response. Such features could further improve user engagement and system effectiveness while providing a more personalized and responsive experience tailored to the diverse needs of users in border communities. Recent developments in artificial intelligence also highlight opportunities for conversational systems to support intelligent public service delivery and adaptive community engagement within mobile and web-based platforms (Adamopoulou & Moussiades, 2020).

Building on the existing collaboration with the Malaysian Border Control and Protection Agency (AKPS), future development efforts may focus on expanding SafeBorders' functional scope beyond smuggling prevention to include broader security awareness topics. Additional content modules covering areas such as human trafficking prevention, wildlife smuggling awareness, immigration regulations, and border community safety preparedness could further enhance the system's educational and advocacy value. Continuous updates to safety information and operational content would also ensure that the system remains accurate, relevant, and aligned with current enforcement priorities and national border security developments. Such enhancements have the potential to strengthen SafeBorders' role as a sustainable and comprehensive digital platform for promoting public awareness and community engagement in support of Malaysia's national border security objectives under the National Security Policy (2021-2025) and the MADANI Economy agenda (Prime Minister's Office, 2023).

Conclusion

This study set out to design, build, and evaluate SafeBorders, an AI-powered bilingual conversational agent meant to support public advocacy and community engagement against the smuggling of cigarettes, drugs, and controlled goods at Malaysian borders, and by most measures it succeeded. Participants reported high perceived usefulness, ease of use, ease of learning, and satisfaction, together indicating a system that delivered accessible safety information, emergency guidance, and structured incident reporting through an interface people found intuitive. These outcomes track with established research on conversational AI design, usability evaluation, and public engagement, all pointing to the same ingredients: accessible communication, bilingual support, and institutional trust as what makes public safety participation actually work.

The strength of these acceptance ratings says something about SafeBorders' practical value beyond the numbers themselves. Turning a one-way awareness campaign into a two-way conversational experience addresses a limitation that has dogged traditional advocacy for years, its inability to sustain real community involvement. The bilingual interface, structured

reporting workflow, image validation, and accessible onboarding all pull in the same direction: making the system usable by people with very different levels of digital literacy. That the response was this positive suggests digital tools built on evidence-based design and developed alongside institutional stakeholders can genuinely shift public awareness, reporting behaviour, and trust between residents and enforcement.

The study also surfaced a fairly clear roadmap for what comes next: voice input, wider multilingual support, GPS-based location detection, and better onboarding for first-time users. These are not afterthoughts so much as a direct list from the people who used the system, and they point toward longer-term questions worth investigating too, how SafeBorders shapes community awareness, reporting behaviour, and public trust in enforcement agencies over time rather than in a single evaluation session.

In the end, SafeBorders is a demonstration that conversational AI, user-centered design, bilingual accessibility, and institutional collaboration can actually come together into something people trust and use. The positive user feedback affirms the value of such tools in contemporary public safety communication and points toward expanding conversational AI applications across broader community engagement and crime prevention contexts in Malaysia. Whether that potential extends beyond border security is a fair question the results here start to answer, and one worth pursuing further, in support of the National Security Policy (2021-2025) and the MADANI Economy agenda (Prime Minister's Office, 2023).

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Ethics Statement:

This study was conducted in accordance with ethical research standards. All procedures involving human participants followed accepted ethical research guidelines. Informed consent was obtained from all participants prior to data collection. Participation was voluntary, and respondents were assured of confidentiality and anonymity. The data collected were used solely for academic purposes.

Author Contribution Statement:

All authors contributed significantly to the development of this manuscript. Subashini Annamalai was responsible for the conceptualization, methodology, supervision, and critical revision of the manuscript. Tan Ghong Tzi was responsible for the design and development of the SafeBorders conversational agent, data collection, analysis, and drafting of the manuscript. Then Lip Yang was responsible for the design and development of the AKPS website on which the SafeBorders chatbot is deployed, and contributed to the interface integration and revision of the manuscript. Sobihatun Nur Abdul Salam and Ruziana Rusli were responsible for client liaison and coordination with the Malaysian Border Control and Protection Agency (AKPS), including requirements gathering, validation of border security content, and stakeholder engagement throughout the development and evaluation of the system. All authors read and approved the final version of the manuscript prior to submission.

Declaration of AI-Generated Content

During the preparation of this manuscript, the authors used AI-assisted tool (Gemini) solely to improve the language, grammar, and readability of the written text. All research design, data collection, data analysis, and interpretation of findings were conducted independently by the authors. The authors reviewed and edited all AI-assisted content, take full responsibility for the accuracy and integrity of the final manuscript, and confirm that no AI or AI-assisted technology was used in the collection or analysis of data, or in generating the study's findings or conclusions.

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