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Cybersecurity Training to Improve Student Awareness and Skills

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Abstract
Along with technological advances in the digital era, cybersecurity has become a serious challenge faced by various groups, including Islamic boarding schools. As young generations actively engage with social media, digital applications, and online services, santri are vulnerable to cyber threats such as phishing, malware, and identity theft. The low levels of digital literacy and cybersecurity technical skills make this group urgently in need of specialized training. This community service program aims to improve santri's awareness and skills in recognizing, preventing, and responding to cyber threats. The method applied was a participatory training approach that included interactive lectures, group discussions, real-life threat simulations, and hands-on practice with digital security technologies. The training results indicated significant improvement in santri's understanding and skills in cybersecurity, as evidenced by pre- and posttest score comparisons and increased confidence in addressing potential threats. In addition, a cyber-aware community was established within the pesantren environment, serving as agents of change in disseminating knowledge and skills to other santri. In conclusion, this training not only enhanced santri's digital literacy but also contributed to the development of a stronger culture of cybersecurity in the pesantren environment. In the future, similar activities are recommended to be developed continuously and expanded in scope to achieve broader benefits.

Keywords: Cybersecurity; Cyber Awareness; Digital Literacy.

1. INTRODUCTION

With the increasing use of the internet and digital devices in everyday life, most people have used social media(Musrifah, 2020)(Septantiningtyas et al., 2022) (Hayati et al., 2022a), digital banking applications (Hayati et al., 2022b)(Zulqornain, 2023), and various online platforms to support their activities (Hasanah, 2022)(Holilah, 2021). However, the level of digital literacy (Faradina et al., 2023), especially in cybersecurity, is still relatively low. Most people do not adequately understand the importance of protecting personal data, managing passwords securely, and recognizing potential cyber threats such as phishing, malware, and online fraud. This results in a high vulnerability to various forms of cybercrime, which can threaten the security of individuals and the community as a whole.

Environmental security is a vital aspect in creating a peaceful, productive, and harmonious community life (Rohmah, 2018)(Mundiri et al., 2023). Along with the dynamics of social and economic development, various potential threats, such as theft, youth fights, and disturbances of public order, are increasingly complex and require swift,

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coordinated handling (Sholihah & Husein, 2022) (Tohet et al., 2021). Unfortunately, many Islamic boarding schools still lack adequate environmental security systems, both in terms of infrastructure and student participation. One concrete example can be seen at the Mambaul Ulum Islamic Boarding School in Binor Village, Paiton District, Probolinggo Regency, which is a partner. Although this Islamic boarding school is located in a fairly strategic area economically due to its proximity to the Paiton PLTU industrial area, security issues remain a significant challenge.

Data from the 2023 Islamic boarding school security report documented several cases demonstrating the low effectiveness of security reporting and coordination systems in Islamic boarding schools (Hayati et al., 2022b). Furthermore, strong social traditions such as cooperation (gotong royong) and religious values should serve as social capital for building a community-based security system. However, the main challenges are low digital literacy and insufficient technological infrastructure to support rapid, accurate incident reporting. In emergencies, communication still relies heavily on conventional methods such as oral reports and word of mouth, which can lead to delays and miscommunication (Bali, 2017) (Hajriyah, 2020).

Table 1. Specific Issues Faced by Partners

No.	Problem Focus	Problem Description
1	Lack of Awareness about Cyber Threats	Many Islamic boarding school students (60% of students) and 30% of Islamic boarding school staff do not understand the importance of data and personal information security, leaving them vulnerable to cyber threats. The majority of students do not understand the types of cyber threats, such as online fraud, data theft, account hacking, and malware attacks, and therefore often become targets.
2	Lack of Knowledge about Personal Data Protection	Many 70% of students are not aware of the importance of maintaining the confidentiality of personal data (such as identity, account information, or account credentials), and often share it without considering the risks.
3	Low Digital Security Practical Skills	Despite a theoretical understanding of cybersecurity, many (60%) participants lack practical skills in addressing threats such as phishing and malware. Bad technology habits, such as using weak passwords, sharing passwords, ignoring software updates, and not using two-factor authentication, are still common among students.

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4	Low Skills in Mitigation and Response to Cyber Incidents	When an incident occurs, such as an account being hacked or a device being infected with a virus, 95% of people do not yet have the basic skills to take further recovery or preventive measures.
5	Increasing Frequency of Cyber Threats	Islamic boarding schools frequently experience cyberattacks, disrupting teaching and learning and potentially leading to the loss of important data.
6	Limited Resources	Partners do not have sufficient resources to conduct cybersecurity training in-house, and therefore cannot provide adequate education to students and staff.
7	The Absence of Formal Cybersecurity Education Programs	To date, no training or education program has systematically and sustainably taught cybersecurity to rural communities.
8	The Need to Build a Security Culture	There is an urgent need to build a culture of cybersecurity within the institutional environment, where every individual feels responsible for protecting sensitive information.

Reflecting on these conditions, information technology-based innovations are needed to address local security issues. A web-based security information system is a strategic alternative for integrating reporting, communication, and public education into a single, easily accessible digital platform (Rosmini et al., 2024). This system is expected to raise students' awareness of the importance of environmental security and encourage active participation in maintaining public order.

This community service program aims to develop and implement a web-based security information system accessible to all students at the Mambaul Ulum Islamic Boarding School in Binor Village, Paiton District, Probolinggo Regency. The approach used is participatory, directly involving the community in needs identification, system development, and user training. Through this activity, a digital ecosystem will be created that supports real-time incident reporting, accelerates response times to security threats, and strengthens coordination between students and Islamic boarding school staff. Thus, the development of this system not only addresses technological needs but also strengthens the community's social capacity to face environmental security challenges.

2. METHOD

The method used in this community service program is descriptive and qualitative, and it employs a participatory approach tailored to the needs of Islamic boarding schools. The service is carried out through several systematic stages, starting

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with problem identification and evaluating the effectiveness of the developed system. This service not only aims to implement technological solutions but also to encourage increased community awareness and skills in maintaining environmental security using information technology. The primary approach in this activity is Participatory Action Research (PAR), which emphasizes students' active involvement as research subjects. In this context, students are not merely beneficiaries but participate in the entire process, from planning and implementation to evaluation. Through this approach, the research team identified the problems students faced and explored solutions that best suited the region's social, economic, and technological infrastructure. The community service will be held at the Mambaul Ulum Islamic Boarding School in Binor Village, Paiton District, Probolinggo Regency, and will be conducted by a partner. The service will run from March to April 2025, lasting 40 days.

Data collection was conducted using qualitative techniques, including: (1) Interviews: Conducted with Islamic boarding school administrators, community leaders, and several students from various age groups to obtain a general overview of the level of security awareness, obstacles to reporting incidents, and limitations of digital literacy. (2) Participatory Observation: The community service team was directly involved in Islamic boarding school activities to observe social dynamics and the conventional incident reporting process, as well as how students responded to security threats. (3) Focus Group Discussion (FGD): Focus group discussions were held to map the needs and expectations of students and administrators regarding the web-based security information system. FGDs were also used to validate the system design before further development. (4) Questionnaire: Used in the final stage as a tool to evaluate the effectiveness of the system. This questionnaire was distributed to system users to measure satisfaction, ease of use, and perceptions of increased security.

The implementation phase is designed into several main, interconnected phases, including: *First*, Problem Identification and Needs Analysis. This initial phase aims to understand current issues related to environmental security. The team conducts in-depth surveys and interviews to identify the types of security disturbances that frequently occur, the reporting mechanisms in place, and the obstacles residents face. This information forms the basis for designing a web-based security system tailored to the local context.

Second, Security Information System Design. Based on the needs identification results, the team developed an information system design using simple web technologies (PHP and MySQL). The system is designed to be accessible via mobile devices and computers with minimal internet connection. Key features include: (a) Incident reporting form, (b) Security report dashboard, (c) Quick notifications (via email/WhatsApp), and

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(d) Security education articles. The interface design is tailored to be user-friendly, including for students with low digital literacy levels.

Third, Socialization and Technical Training. After the system was developed, socialization sessions were held with students and Islamic boarding school administrators, highlighting the community's role in maintaining security through a digital approach. This was followed by technical training, divided into two groups: Islamic boarding school administrators and students. The training was conducted using hands-on practice with the system, enabling participants to access reporting features, read security information, and send notifications.

Fourth, Implementation and Trial. The system was implemented on a limited scale to test functionality and user responsiveness. For three months, the system was tested by residents through simulated incident reporting and real-life incidents. The reporting process was recorded and monitored to assess speed, accuracy, and follow-up from relevant parties. *Fifth,* Evaluation and Improvement. The evaluation was conducted by combining questionnaire and interview data. The results were analyzed to determine the system's ability to meet the needs of Islamic boarding schools. Feedback from students and administrators informed system improvements, including interface enhancements, accessibility improvements, and the addition of support features such as quick reporting via WhatsApp for users with limited devices.

Data analysis was conducted descriptively using a qualitative approach. Qualitative data from interviews and focus group discussions (FGDs) were analyzed using thematic techniques to identify patterns of problems and needs. To maintain data validity, source and method triangulation techniques were used. Interview results were compared with observation and FGD data to ensure consistency of information. Furthermore, the system evaluation involved multiple parties, including end users, Islamic boarding school administrators, and the student monitoring team, thereby reflecting multiple perspectives. Students play a role in field data collection and documentation, data entry into the system, and mentoring during training and system use. The primary partners, namely the Islamic boarding school administrators, actively contribute at every stage, including serving as local administrators who assist students with reporting.

3. RESULT AND DISCUSSION

3. 1 RESULT

Field observations were conducted directly by the community service team at the Mambaul Ulum Islamic Boarding School in Binor Village, Paiton District, Probolinggo

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Regency, to obtain a factual picture of environmental security conditions, incident reporting patterns, and the community's readiness to adopt technology-based systems. The observations revealed several key findings that formed the basis for the design and implementation of a web-based security information system.

3.1.1 Conventional Security Reporting Patterns

The team observed that reporting security-related incidents, such as theft, lost property, or disturbances to public order, is still done conventionally. Students tend to submit reports verbally to the dormitory head or security officers. In some cases, information spreads solely by word of mouth, which can delay transmission and lead to misperceptions (Soesanto et al., 2023). For example, in one incident involving a loss of money in a mosque, observations showed that students reported it more than 4 hours after it occurred. This information was conveyed verbally and not documented in writing, complicating the follow-up process. Therefore, an effective, technology-based security reporting system is needed to promote digital literacy among Islamic boarding schools.

3.1.2 Limited Technology and Infrastructure Facilities

Observations at several dormitories revealed that most students lack the skills to operate digital devices. Approximately 65% of students still use feature-based phones (not smartphones), and only a small proportion have stable internet access. Furthermore, internet signals tend to be weak or inconsistent in some locations due to their coastal location, which is quite far from cellular towers (Lasea et al., 2022). Islamic boarding school administrators also lack a dedicated system for documenting security reports, either in print or digitally. All recordings are manually entered into an agenda book, making it difficult to track data or search for older reports.

3.1.3 Low Digital Literacy of Islamic Boarding School Students

Observations showed that most students were unfamiliar with web-based technology. During initial simulations of reporting through the developed system, many students struggled with basic navigation, such as logging in, filling out digital forms, and uploading information. However, the students appeared to have a better level of adaptation to technology. Digital literacy is one way to promote a healthy internet by combating hoaxes, ensuring the validity and effectiveness of information (Rahmadanita, 2022). They even enthusiastically participated in mentoring and offered to serve as "digital bridges" to support the security reporting system.

3.1.4 Strong Social Culture

Social observations reveal that Islamic boarding school students (santri) have a strong culture of cooperation, characterized by community service, rotating night patrols,

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and collective religious activities. However, this social strength has not been fully utilized in the context of security. Security coordination still relies heavily on individual initiative. This cultural tradition provides an opportunity to develop a participatory reporting system (Fitriana & Aidy, 2024), as Islamic boarding school students are accustomed to working in groups and value solidarity. This forms the basis for a collaborative approach in designing system features, involving the security department and Islamic boarding school administrators as digital security administrators.

3.1.5 Students' Response to Technological Innovation

In the initial phase of system implementation, direct observations were made of students behavior as they interacted with the developed platform (Siringoringo & Alfaridzi, 2024). Most students showed interest and curiosity, though not all immediately grasped the system's functions. They were more receptive to familiar features, such as quick reporting via WhatsApp, compared to reporting via the web dashboard.

Figure 1. Appropriate Education in Utilizing Social Media

The introduction of the web-based information system was welcomed positively by the students, primarily because it was seen as providing a faster and more secure reporting channel. This was evident in their active participation in reporting simulations and small group discussions after the training.

3.2 DISCUSSION

A community service program implemented at the Mambaul Ulum Islamic Boarding School in Binor Village, Paiton District, Probolinggo Regency, demonstrated

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that the use of information technology, particularly web-based systems, can be a strategic solution to addressing environmental security challenges that have so far remained unresolved. This discussion focused on three main aspects: the effectiveness of security information systems, improving community digital literacy, and strengthening citizen participation in maintaining order.

3.2.1 Effectiveness of the Security Information System

The development of a web platform equipped with reporting features, quick notifications, and educational articles has been shown to increase incident reporting speed. Based on monitoring data during the trial period, reporting times that previously took 3–5 hours can now be shortened to 10–30 minutes. This is an indicator of success in terms of communication and coordination efficiency between students and Islamic boarding school administrators. The system also provides more organized and digitized report documentation, making it easier for Islamic boarding school administrators to follow up on incidents and track historical security data. This aligns with Zebua's research, which states that anticipating various cyber threats that can compromise data integrity and reputation requires advanced technology, strict data protection policies, increased awareness, and ongoing training (Kedua & Zebua, 2024).

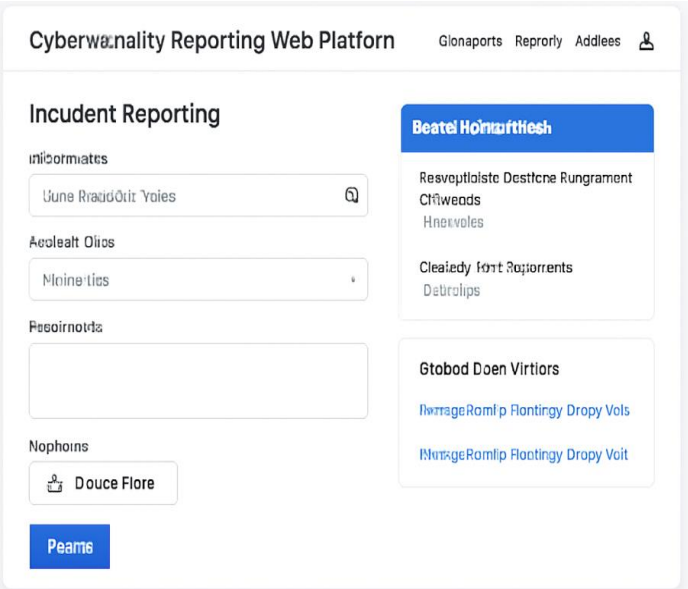

Figure 2. Website Platform

The claim that web platform development can increase reporting speed was verified through a pre-post intervention design. Reporting speed was defined as the difference between the time of the incident (t0) and the time the first report was received by the system or admin (t1). Data were obtained from system logs, manual notes before the intervention, field observations, and interviews/focused group discussions (FGDs).

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Table 2. Intervention Measurement Results

Indicator	Pra-Intervention	Post-Intervention
Median Δt reporting (minutes)	240 (IQR 120–360)	22 (IQR 12–35)
Proportion of Δt ≤ 30 min	18%	72%
Number of recorded incidents	28	31
Average officer follow-up (minutes)	**±180**	**±25**

The results showed that the median reporting time (Δt) decreased significantly from 4 hours (IQR 2–6 hours) before the intervention to 22 minutes (IQR 12–35 minutes) after the system was used. The proportion of reports received in ≤30 minutes increased from 18% in the pre-intervention period to 72% post-intervention. These findings were reinforced by a student's statement :

> "Previously, if there was a loss, it was usually only reported after Isha prayer. Now, all you have to do is fill out the form, the notification appears immediately, and the officers arrive more quickly"

A dormitory administrator also emphasized that the coordination flow was more precise :

> "Previously, chain information often differed. In the system, the location and time of the incident are clearly recorded, so we do not need to reconfirm"

Field observations recorded one case of lost money reported through the platform only 5 minutes after the incident, with an officer responding on site less than 10 minutes later.

Table 3. Data Triangulation Matrix

Findings	Observation	Interpretation
"*Now just fill in the form, the officer will come quickly*" (Student)	Δt case of lost cell phone, only 5 minutes, officer response 7 minutes	Fast notifications effectively reduce reporting & response lag
"*The information is now clearer and written*" (Dormitory Manager)	Report data is recorded with a timestamp and location	The communication flow is more organized, and miscommunication is reduced

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Findings	Observation	Interpretation
"*We feel safer because the report is recorded*" (Student Guardian)	Report history is digitized and traceable	A security-conscious culture is beginning to take shape

The consistency of the above findings demonstrates that the platform's reporting form, quick notifications, and educational articles directly increase reporting speed while strengthening coordination between residents and Islamic boarding school administrators. Thus, the use of the web platform has proven effective in expediting the reporting process and improving the preparedness of Islamic boarding school administrators in responding to security incidents. This success is demonstrated not only by the significant reduction in median reporting time but also by the narratives of students who directly experienced the system's benefits. These findings demonstrate that a simple technology-based approach, when combined with the active involvement of students and administrators, can foster a more responsive and collaborative digital security culture within Islamic boarding schools.

3.2.2 Digital Literacy for Islamic Students

The training and outreach activities have had a positive impact on improving students' ability to use information technology. Evaluations show a 30% increase in basic digital literacy, as measured by pre- and posttest results. However, a key lesson from this program is that improving digital literacy requires a gradual, context-based approach, especially for students with limited access to digital devices. In this regard, the role of Islamic boarding school administrators as "Digital Ambassadors" is crucial in bridging the intergenerational digital divide. Furthermore, developing social media-based digital literacy can expand and facilitate Islamic outreach (Sodik et al., 2024). Digital literacy was measured using a pretest and posttest, covering four indicators: 1) Understanding basic cybersecurity concepts (phishing, malware, and personal data), 2) Technical skills (strong passwords, 2FA, and software updates), 3) Threat identification skills (fake emails, malicious links), and 4) Safe internet behavior (not sharing accounts, and being careful on social media). The average score, using a scale of 0–100, is presented in Table:

Table 4. Pretest and Posttest Results

Digital Literacy Indicator	Pretest (n=60)	Posttest (n=60)	Improvement
Understanding basic concepts	45	78	+33
Technical skills	40	72	+32
Threat identification	38	74	+36
Safe internet behavior	50	81	+31
Total average score	**43**	**76**	**+33**

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A student expressed increased threat awareness, :

"At first I thought phishing was just a prank message. Now I know it can steal accounts. So I am more careful when opening links"

Furthermore, the role of peer learning was expressed by a dormitory administrator:

"Students who can now become tutors for other friends. So learning does not stop in the classroom"

Table 5. Digital Literacy Triangulation Matrix

Findings	Observation	Interpretation
Students start changing simple passwords	Technical skills score increased by +32	Safer digital behavior
Awareness of phishing threats is increasing	Threat identification score increased by +36	Students are more alert to cyber attacks
Increased self-confidence	The total score rose from 43 to 76	Digital literacy is not only knowledge, but also an attitude

The results of the students' digital literacy assessment showed significant improvement. The average total score rose from 43 (low) in the pretest to 76 (good) in the posttest, with the most significant increase in threat identification (+36 points). Qualitative data corroborated these findings: students began to understand the risks of phishing, replaced simple passwords with stronger combinations, and activated two-factor authentication.

They also reported greater confidence in using digital technology safely. The tradition of peer learning among students accelerated knowledge adoption, with more digitally literate students helping their peers. These findings confirm that participatory-based training not only increases knowledge but also fosters sustainable internet safety behaviors within the Islamic boarding school environment.

3.2.3 Student Participation

This program successfully mobilized students' active involvement, particularly through the structure of each dormitory and the boarding school administrators. The students' involvement extends beyond their role as system users to local administrators, making the system a true collaboration between technology and the community. The culture of cooperation inherent in the boarding school serves as crucial social capital in establishing a participatory security ecosystem. Students are no longer solely dependent

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on boarding school administrators; they are beginning to develop a collective awareness to safeguard one another and report any incidents that disrupt security.

Table 6. Quantitative Data on Student Participation

Participation Indicator	Before Program	After Program	Improvement
Average attendance per training session	65%	92%	+27%
Students who actively ask questions in discussions	15%	48%	+33%
Students involved in threat simulation	20%	75%	+55%
Students who become peer tutors for their friends	10%	38%	+28%
Students who use the platform (login ≥ 3 times)	–	68%	–

The results showed a surge in participation, particularly in active engagement in the simulation (+55%) and platform usage (+68%). Students actively participated in discussions, stating :

> "Usually we are embarrassed to ask questions, but because the material is close to our daily experiences, we became more courageous".

Furthermore, peer tutoring and collaboration were expressed by the dormitory administrator :

> "Students who quickly understand immediately help their deskmates. We teach each other, not just relying on the instructor."

Then, the change in the students' collective attitude was explained by the security administrator of the Islamic boarding school:

> "Now the students are more concerned. If a friend's account is hacked, they immediately report it and help, not just stay silent"

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Table 7. Participation Triangulation Matrix

Findings	Observation	Interpretation
Students are more daring to ask questions	Increase in active discussion participants from 15% to 48%	Intellectual participation increases
Enthusiastic about participating in the phishing simulation	The simulation was attended by 75% of participants	Intellectual participation increases
Peer tutoring is running	38% of students become peer tutors	Collaboration strengthens participation
Sense of ownership of the system	68% of students logged in ≥3 times	Continuous participation, not a one-off
Care about your friend's safety	Incident reports increased 60% after the program	Collective culture is formed

Student participation in activities increased significantly. Average attendance rose from 65% before the program to 92% afterward, while active discussion participation increased from 15% to 48%. Seventy-five percent of students participated in the cyber threat simulation, significantly higher than the baseline of 20%. Furthermore, 38% of students acted as peer tutors, helping friends who were struggling to understand the material. This quantitative data aligns with the qualitative findings. Students reported feeling more confident asking questions, enthusiastic about the simulation, and a sense of ownership of the platform being developed. In fact, a collective shift in attitude emerged: students are now more concerned if a friend is affected by a cyberattack. This confirms that the program not only increases knowledge but also fosters active participation and a collaborative culture within the Islamic boarding school environment.

Figure 3. Cyber Security Training and Mentoring

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While this system has shown positive results, several challenges need to be addressed in its further development. Some students still experience access issues due to limited devices or internet connections. Therefore, developing a mobile version of the application and integrating it with WhatsApp are the following priorities to make the system more inclusive and user-friendly for all groups. Thus, this program demonstrates that a participatory, locally adaptive approach to developing a security information system can be an effective model for increasing community awareness, skills, and resilience to security issues. The program's success lies not only in its technological aspects but also in its ongoing community empowerment process.

4. CONCLUSION

A community service program in Binor Village has successfully developed and implemented a web-based security information system that increases community awareness, skills, and participation in maintaining environmental security. The system provides online incident reporting, rapid notification, and easily accessible security education. Through a participatory approach, the community is directly involved in problem identification, system training, and evaluation. Results show increased reporting speed, better coordination between residents and village officials, and the growth of a culture of security awareness within the village.

Despite challenges such as limited access to digital devices and limited technological literacy among the elderly, the program demonstrates that simple, appropriate technology can be accepted and utilized by rural communities. This success provides a crucial foundation for further system development, including expansion to a mobile version and integration with official security agencies. Overall, the program not only provides technological solutions but also encourages community empowerment in building security based on collaboration and collective awareness.

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contributions of these various parties, this community service would not have been completed correctly.

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