JARDIRA
(Jurnal Pengabdian Digital dan Rekayasa Informatika)
ISSN 3110-018X (online)
https://journals.cognispectra.com/index.php/jardira/index
Vol 1, No. 1, pp. 1-8

Digital Transformation in Environmental Security Management in Calosa Cluster, Bandung Regency

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DOI : 10.65917/jardira.v1i1.20

Article history:

Received : June 23, 2025

Revised : July 14, 2025

Accepted : July 16, 2025

Keywords : Digital Transformation, Environmental Security Management, Bandung Regency

ABSTRACT

Background: This community service activity aims to enhance environmental security in residential areas through digital transformation by integrating technology and community empowerment. Conducted at the Calosa Cluster, Bandung Regency, this program was initiated due to frequent losses and the limited effectiveness of existing surveillance systems, especially in blind spots. The objective is to develop a sustainable and community-managed security system using modern surveillance technology.
Contribution: This program contributes to the community by increasing residents' sense of security, enhancing technological literacy, and fostering collective responsibility in managing neighborhood safety.
Method: A participatory and collaborative approach was applied, involving residents, housing managers, and a university implementation team. The method included needs analysis, planning, training, and system installation. Surveys and interviews were conducted to identify security gaps, followed by the installation of devices and training on CCTV operation and data management.
Results: The implementation successfully improved surveillance coverage and reliability. Residents gained practical skills to operate and manage the system independently. The positive response indicated a strengthened sense of security and community involvement.
Conclusion: The program successfully addressed the security challenges in the Calosa Cluster through a digitally based, community-oriented solution. It demonstrates that integrating technology and community participation can create an effective, sustainable environmental security model applicable to similar residential areas.

INTRODUCTION

With the synergy between community elements, universities, and technology partners, the results of this activity are expected to form a sustainable digital-based security ecosystem, improve the community's quality of life, and become a model for implementing digital transformation in managing environmental security in other residential areas [1], [2], [3], [4]. Environmental security is fundamental in creating community peace and welfare, especially in residential areas [5]. In the current digital era, security challenges can no longer be optimally addressed solely with conventional approaches; they require the integration of adaptive technology and active community participation [6]. Cluster Calosa, located in Bandung Regency, West Java Province, is a relatively small-scale residential area comprising 90 households with 263 residents and 113 housing units. The low residential density provides a strategic opportunity to implement a more effective and efficient technology-based security system [4], [6].

Responding to these problems, the Community Service Team at Telkom University implemented a program titled "Digital Transformation in Environmental Security Management" in the Calosa Cluster, Bandung Regency. This program is designed to enhance the security system's effectiveness by utilizing the latest digital technology and fostering community participation in environmental monitoring activities. The empowerment approach is the primary foundation of the activity, where residents are given education and training on the use of CCTV-based surveillance technology, and environmental monitoring groups are formed collectively [7].

In response to these problems, the Community Service Team at Telkom University implemented a program titled "Digital Transformation in Environmental Security Management" in the Calosa Cluster, Bandung Regency. This program is designed to enhance the security system's effectiveness by utilizing the latest digital technology and fostering community participation in environmental monitoring activities. The empowerment approach is the primary foundation of the activity, where residents are given education and training on the use of CCTV-based surveillance technology, and environmental monitoring groups are formed collectively [8].

This activity is expected to produce a sustainable digital-based environmental security ecosystem through synergy between the community, higher education institutions, and technology partners. In addition to improving residents' quality of life, its results are also expected to be a model for replicating the application of digital transformation in environmental security management in other settlements with similar challenges.

METHOD

The method of implementing this community service activity employs a participatory and collaborative approach, prioritizing the active involvement of various stakeholders, including residents of Calosa Cluster Housing, neighborhood managers, local security forces, and the implementation team from the universities. The activity began with a problem identification and situation analysis stage through surveys, observations, and in-depth interviews with residents and managers. The aim was to gather data on the blind spots of existing CCTV cameras, the frequency of loss incidents, and residents' perceptions of the effectiveness of the current security system. This data became the basis for formulating a contextual and participatory intervention strategy [9].

Furthermore, the program planning and design of a new security system were carried out, including the relocation and addition of Pan-Tilt-Zoom (PTZ) type CCTV cameras to cover blind

spot areas dynamically. The system was designed to be integrated with a cloud-based monitoring application that residents and security personnel can access in real time [10]. Training modules and socialization materials were also developed to support the implementation of the technology and improve residents' understanding of the system's use [11]. The next stage is training provided to residents and neighborhood managers, which includes introducing artificial intelligence-based CCTV technology, remote monitoring applications, and rapid response procedures to security threats. As part of the empowerment process, a neighborhood monitoring group was formed, comprising residents who were responsible for rotating surveillance and routine reporting.

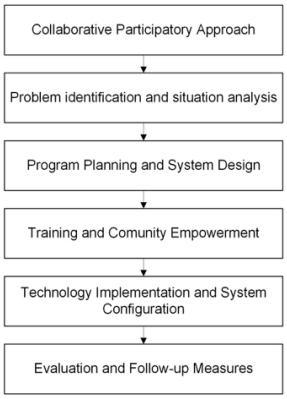

Figure 1. Methodology

The implementation of the system involved installing additional devices and configuring the monitoring system by a joint technical team from the university and the environmental manager. Following installation, two weeks of functional testing and periodic monitoring were conducted to ensure system reliability. A comprehensive program evaluation was conducted through the collection of quantitative and qualitative data, including citizen satisfaction levels, changes in loss incidence, and the identification of barriers to implementation. The evaluation results served as the basis for an action plan to develop the security system, which included the possibility of adding motion sensor features and automatic notifications. Housing managers play a key role as partners throughout the process, providing procurement funds, technical teams, and implementation support. This approach is expected to result in a community-based digital security model that can be replicated in other residential neighborhoods.

RESULTS AND DISCUSSION

1. System Needs

The Calosa Cluster neighborhood in Bandung Regency demonstrates a significant need for a reliable digital security system in response to residents' concerns about potential crime and suspicious activity in the area. As a rapidly developing area, the ever-increasing number of residents demands a neighborhood surveillance solution that can be accessed collectively and run sustainably [12]. Residents require a system that is not only capable of real-time monitoring but also records events for documentation and follow-up in the event of security breaches. These needs include devices with high weather resistance, sufficient storage capacity, and ease of daily operation [13].

2. System Implementation

Responding to these needs, the service team designed and implemented a technology-based surveillance system by providing several key devices, including a Bardi Smart IP Camera Static Outdoor, Dahua POE CS4010-8GT-60 (Gigabit), Dahua IPC-HFW1430, Dahua NVR4116HS-4KS3, Dahua Cat PFM9221-6UN-C-B/Roll, and a WD 2TB Hard Disk. These devices were selected based on technical considerations, including durability in outdoor environments, compatibility with both analog and digital CCTV systems, and the ability to store long-term records. Figure 2 illustrates the implementation of the system using a citizen needs-based approach, where each device is designed to integrate with others and support a security system that can be expanded in the future, including potential integration with IoT systems or cloud-based monitoring if the infrastructure supports it [14].

(a) (b)

Figure 2. (a) and (b) Provide system requirement tools for implementation

3. Installation of the system

Figure 3 illustrates the technical implementation design of the surveillance system within the Calosa Cluster. The map highlights the strategic placement of cameras across critical points in the residential area to maximize coverage and reduce blind spots. The locations were selected based on a comprehensive site survey and community input, ensuring that intersections, entry points, and vulnerable areas are adequately monitored. The design integrates multiple camera nodes connected to a central network system, which includes a Network Video Recorder (NVR) for data storage and future scalability towards IoT integration. This configuration not only enhances real-time monitoring but also supports potential upgrades such as cloud-based surveillance and mobile access. The systematic placement ensures overlapping fields of view to provide continuous coverage and minimize potential security gaps.

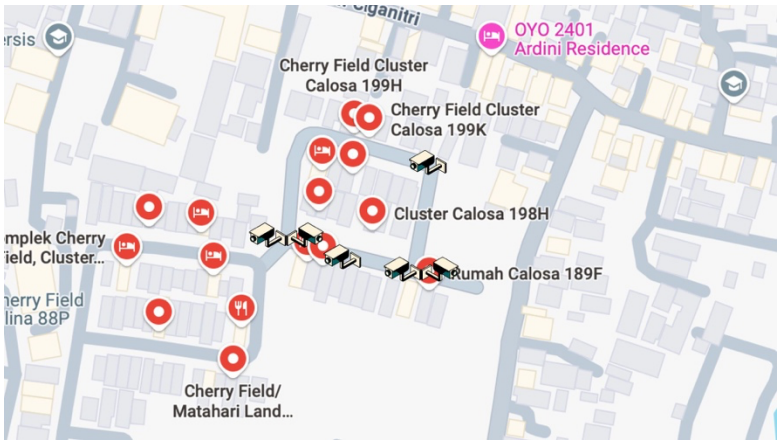

Figure 3. Design of technical implementation

The installation of the device was carried out by involving residents and neighborhood administrators in the process of identifying strategic points for camera placement, such as cluster entrances, parking areas, and main roads, as shown in Figure 4. In addition to ensuring the effectiveness of camera coverage, this approach also builds a sense of ownership of the system. After installation, XVR configuration and CAT6 cable connection to all devices were carried out to ensure optimal connectivity and recording functions. The team also provided hands-on training to community representatives on how to operate the system, monitor recordings, and perform data backup procedures, enabling the system to be managed independently without dependence on third parties [15].

(a) (b) (c)

Figure 4. (a), (b), and (c) Installation of the system

4. Feedback on the results of community service

The results of this activity show a very positive response from Calosa Cluster residents. They feel helped by the existence of a surveillance system that can provide a sense of security and comfort in their neighborhood, as shown in Figure 5. This system can reduce the potential for crime and serve as a documentation tool in the event of an incident [16], [18]. The training provided also enhances residents' technological literacy, particularly in managing digital security devices [19], [20]. This service activity is considered not only to meet technical needs but also to strengthen the community's capacity to maintain security independently and sustainably [16]. This success opens up opportunities for replication of similar programs in other areas with similar challenges and needs [17].

(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure 4. (a) surveillance of intersection 1, (b) surveillance of intersection 2, (c) surveillance of intersection 3, (d) location of surveillance cameras for intersections 1 and 2, (e) location of surveillance cameras for intersection 3, (f) location of surveillance cameras for rear and corner intersections, (g) rear guard, (h) corner surveillance, and (i) surveillance of intersections results of community service blindspot reduction

The implementation of surveillance cameras in various strategic locations within the Calosa Cluster addresses blind spots and enhances neighborhood security. Images (a), (b), and (c) display live monitoring of three critical intersections that previously lacked adequate visibility. Images (d), (e), and (f) show the exact placement of cameras at intersections and other key areas, ensuring comprehensive coverage of entry and exit points. Furthermore, images (g), (h), and (i) highlight surveillance at rear and corner areas, which are often vulnerable to unauthorized access or unnoticed activity. This arrangement demonstrates a systematic approach to minimizing security gaps and supporting real-time monitoring across the residential area.

Table 1 shows that participants provided highly positive feedback on the community service activities. All respondents agreed that the materials were relevant to the needs of the partners or participants, with 71.4% strongly agreeing and 28.6% agreeing. The implementation time was also considered appropriate, as reflected by 57.1% who agreed and 42.9% who strongly agreed. The clarity and comprehensibility of the materials and activities received similar positive responses, with no participants expressing disagreement [17]. Regarding the service provided by the committee, although the majority gave positive feedback (42.9% agreed and 42.9% strongly agreed), 14.3% of respondents were neutral, suggesting a potential area for improvement in participant support and engagement. Finally, all respondents expressed optimism about future initiatives, with 57.1% strongly agreeing and 42.9% agreeing that similar activities should be continued. Overall, these results indicate a high level of satisfaction with the content, timing, and delivery of the program, with only minor opportunities identified for enhancement in service quality.

Table 1. Results of Responses from Calosa Cluster Residents on the Evaluation Metrics of This Community Service

No	Question	SD (%)	D (%)	N (%)	A (%)	SA (%)
1	The activity materials were in accordance with the needs of the partners/participants	0	0	0	28,6	71,4
2	The implementation time of this activity was relatively appropriate and sufficient	0	0	0	57,1	42,9
3	The materials/activities presented were clear and easy to understand	0	0	0	57,1	42,9
4	The committee provided good service during the activity	0	0	14,3	42,9	42,9
5	The community accepted and hoped that similar activities would continue in the future	0	0	0	42,9	57,1

SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree

CONCLUSION

This community service activity successfully implemented a technology-based surveillance system in the Calosa Cluster, Bandung Regency, thereby achieving digital transformation in environmental security management. The delivery of devices such as Bardi Smart IP Camera Static Outdoor, Dahua POE CS4010-8GT-60 (Gigabit), Dahua IPC-HFW1430, Dahua NVR4116HS-4KS3, Dahua Cat PFM9221-6UN-C-B/Roll, and a WD 2TB Hard Disk has addressed residents' needs for a modern, reliable, and easy-to-operate security system. The implementation process, which involved the active participation of residents and technical training, has also increased the community's capacity to manage the system independently. Positive feedback from residents further reinforces the success of this initiative. All participants provided highly positive responses regarding the relevance of the materials, clarity of the activities, and the appropriateness of the implementation timeline. In particular, 71.4% of respondents strongly agreed and 28.6% agreed that the materials met their needs. Similarly, the implementation time and delivery of activities were well received, with no disagreement expressed. Although 14.3% of participants were neutral about the committee's service, the overall satisfaction level remains very high, indicating only minor areas for improvement. This feedback highlights that the system not only enhances residents' sense of security but also fosters collective awareness in maintaining neighborhood safety. The success of this program demonstrates that community-based security digitization can be implemented effectively and sustainably, making it a worthwhile model for replication in other residential areas facing similar challenges.

Acknowledgement

The author would like to thank Telkom University for the support and facilitation provided in the implementation of this community service activity. Great appreciation is also extended to the residents and managers of Cluster Calosa, Bandung Regency, for their active participation and good cooperation during the program. The results of this activity will provide tangible benefits to the community and can be an inspiration for the development of similar programs in the future. This activity is supported through the Community Service scheme with contract number 0014/ABD07/PPM-JPM/2025.

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