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Strengthening Community-Based Environmental Security through Digital Technology in Ciganitri Village, Bandung Regency

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ABSTRACT

Background: Environmental security is essential for residential safety and quality of life. In RW 10, Kp. Ciganitri, Lengkong Village, Bojongsoang District, Bandung Regency, the existing conventional surveillance system has several blind spots, contributing to several theft incidents and estimated economic losses of approximately IDR 35,000,000. This community service program aims to strengthen community-based environmental security by integrating digital technology and citizen empowerment.

Contribution: This program contributes to the community by strengthening environmental security, enhancing residents' capacity to manage digital security technology, and fostering active community participation.

Method: A participatory and collaborative approach was adopted involving residents and RW administrators. The program included blind-spot mapping, CCTV installation at strategic locations, integration of a remote monitoring system, preparation of standard operating procedures (SOPs), resident training, the establishment of a community security monitoring group, followed by monitoring and evaluation.

Results: Four outdoor IP CCTV units were installed at strategic points (main gate, main road, and parking area) with standalone local storage, cloud backup, and real-time remote monitoring via a mobile application. A community security monitoring group was formed and residents were trained in system operation and incident reporting. A satisfaction survey of 20 residents showed that 100% agreed or strongly agreed that the program met community needs, was well implemented, and should be continued.

Conclusion: The integration of digitally-based CCTV with community empowerment effectively strengthened environmental security in RW 10, closing surveillance blind spots and increasing residents' sense of safety, while supporting SDG 9 and SDG 11 and providing a replicable model for other community-based digital security initiatives.

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INTRODUCTION

Environmental security is a fundamental aspect of community well-being, particularly in residential areas, where a safe environment contributes to residents' quality of life and social cohesion [1], [2]. As residential activities become increasingly dynamic, conventional security measures such as night patrols are no longer sufficient to provide comprehensive surveillance. Integrating digital technology with active community participation has become an effective approach to improving environmental security management [3], [4].

RW 10, Kp. Ciganitri, Lengkong Village, Bojongsoang District, Bandung Regency consists of approximately 300 households. The area still relies on a conventional surveillance system that has not been integrated with digital technology, resulting in several blind spots that reduce monitoring effectiveness [5]. Several theft incidents involving motor vehicles, livestock, and personal belongings have caused estimated economic losses of approximately IDR 35,000,000. Relying solely on security officers or manual night patrols is insufficient given their limited coverage and susceptibility to human error, and these conditions indicate the need for a more effective and sustainable environmental security system [6].

In response to these challenges, the Community Service Team of Telkom University implemented the program "Strengthening Community-Based Environmental Security through Digital Technology in RW 10, Kp. Ciganitri, Lengkong Village, Bojongsoang District, Bandung Regency." The program aims to strengthen environmental security through the implementation of a digitally integrated CCTV system [7] combined with community empowerment. Activities include blind-spot mapping, CCTV installation at strategic locations, remote monitoring integration, preparation of standard operating procedures (SOPs), resident training, and the establishment of a community security monitoring group to support long-term system sustainability and to strengthen the system's deterrence effect [8]–[10].

This initiative also supports Sustainable Development Goal (SDG) 11, which promotes safe, resilient, and sustainable communities, and SDG 9, which encourages innovation and reliable infrastructure for improving public services [20]. Through collaboration among residents, RW administrators, technology partners, and Telkom University, the program is expected to strengthen environmental security management, improve residents' capacity to manage digital security technology, and encourage sustainable community participation.

METHOD

As illustrated in Figure 1, the implementation followed three main stages: a collaborative approach involving needs assessment and blind-spot mapping, technology implementation combined with community capacity building, and monitoring and evaluation.

Figure 1. Stages of community service program implementation

The program employed a participatory and collaborative approach involving residents, RW administrators, and the community-service team. The implementation began with problem identification and situation analysis through field observations, discussions with RW administrators, and direct communication with residents. This stage aimed to identify surveillance blind spots, previous theft incidents, and the limitations of the existing conventional security system. The findings served as the basis for determining strategic CCTV installation points and designing appropriate interventions.

Based on the initial assessment, the program continued with planning and system design. This stage included mapping CCTV locations to maximize natural surveillance at strategic points [14], designing a remote monitoring system, and preparing standard operating procedures (SOPs) to support system operation and sustainability.

Community empowerment was carried out through training and socialization activities involving residents and RW administrators. The training covered CCTV operation, remote monitoring, basic system maintenance, and security incident reporting. A community security monitoring group was also established to encourage active community participation in maintaining neighborhood security.

The implementation stage included CCTV installation at strategic locations, monitoring-system configuration, and functional testing to ensure proper system operation. Finally, monitoring and evaluation were conducted to assess system implementation.

RESULTS AND DISCUSSION

The community service program was implemented on 9 June 2026 in RW 10, Kp. Ciganitri, Lengkong Village, Bojongsoang District, Bandung Regency, in collaboration with RW administrators and residents. This section presents the results of the CCTV system installation, the community training and empowerment activities, and the evaluation of community feedback following the program.

1. CCTV System Installation and Configuration

A needs assessment confirmed that residents were concerned about recurring theft incidents and the absence of surveillance at several blind spots, which had previously caused estimated losses of approximately IDR 35,000,000. Together with RW administrators and residents, the community service team mapped strategic installation points, prioritizing locations with high pedestrian and vehicle traffic such as the main gate, main road, and parking area. This placement strategy is consistent with Crime Prevention Through Environmental Design (CPTED) principles, which emphasize natural surveillance of high-traffic access points to maximize deterrence [14], and with evidence that the crime-reduction effect of CCTV is strongly associated with the spatial distribution of camera coverage [11]. Figure 2 shows the location of RW 10 and the surrounding access routes considered during the mapping process.

Figure 2. Location of RW 10, Kp. Ciganitri, Lengkong Village, Bojongsoang District, Bandung Regency

Four outdoor IP CCTV units (EZVIZ) were installed as the primary monitoring devices. Each camera supports real-time viewing and automatic recording through a mobile application, and the system was configured as a stand-alone setup rather than relying on a centralized recorder such as an XVR or NVR. Video is stored locally on a 64 GB SD card per unit and backed up through the manufacturer's cloud service, an approach consistent with recent low-cost IoT-based surveillance designs that favor local storage and cloud synchronization over centralized recording infrastructure to reduce cost and simplify community-level maintenance [17]–[19]. Technically, each EZVIZ camera records at Full HD 1080p (2 MP) resolution with a wide field of view of approximately 110°, ensuring clear image capture across the monitored areas. The 64 GB SD card in each unit provides roughly 7–10 days of continuous recording at standard resolution before older footage is overwritten, while remote monitoring and cloud backup require an internet connection of at least 2 Mbps upload speed. Recordings are automatically synchronized to the EZVIZ cloud service, providing an additional backup layer in case the local SD card is damaged or removed. Figure 3 documents the installation process carried out jointly by the community service team and local residents.

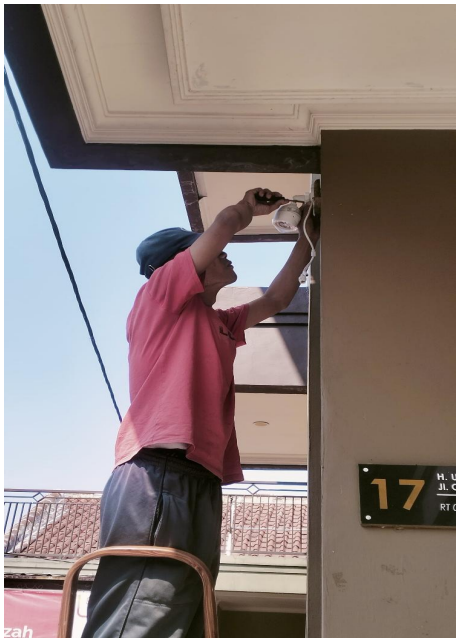

Figure 3. CCTV installation process carried out with local residents

After installation, each camera was tested for image clarity, field of view, and network connectivity, and the team provided a short walkthrough on accessing and reviewing recordings through the mobile application (Figure 4). Configuring the system for remote access allows RW administrators to monitor the neighborhood from any location with an internet connection, addressing one of the main limitations of the previous conventional, patrol-based surveillance arrangement.

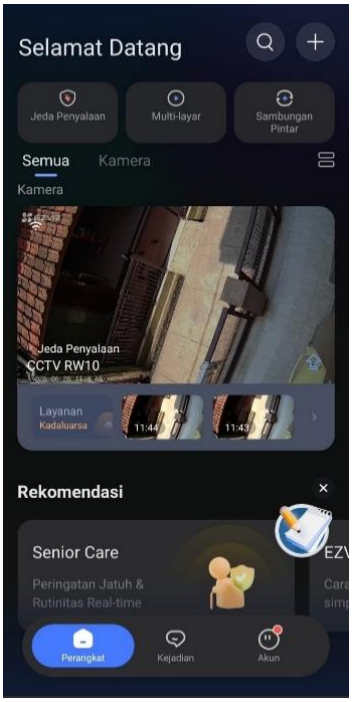

Figure 4. Remote monitoring interface accessed via the mobile application

2. Community Training, Empowerment, and Monitoring Group Formation

Beyond the technical installation, the program placed equal emphasis on community empowerment, since the long-term sustainability of a community-based security system

depends on residents' active participation [1], [2]. Training sessions covered CCTV operation, use of the remote monitoring application, basic troubleshooting, and the procedure for reporting suspicious activity.

A community security monitoring group was established at the RW level, consisting of resident volunteers and RW officials responsible for periodic monitoring, verifying that the cameras remain functional, and escalating technical issues or security incidents to RW administrators. A standard operating procedure (SOP) was jointly developed to guide incident response and routine system checks, supporting the transition from an ad hoc, individually managed system toward a structured community-based security system.

3. Community Feedback and System Evaluation

Following implementation, a satisfaction survey was distributed to 20 residents of RW 10 using a five-point Likert scale (STS = strongly disagree, TS = disagree, N = neutral, S = agree, SS = strongly agree). As summarized in Table 1, all 20 respondents (100%) selected “strongly agree” for every statement, indicating unanimous satisfaction with the relevance of the program's content, the adequacy of the implementation schedule, the clarity of the training materials, the quality of service provided by the organizing team, and residents' hope that similar programs will continue in the future.

The 20 respondents were selected purposively from residents who actively participated in the training and socialization sessions, comprising RW administrators, heads of households, and members of the newly formed community security monitoring group. The questionnaire was administered immediately after the training session concluded on 9 June 2026, allowing respondents to evaluate the program based on their direct experience.

It should be noted, however, that these survey results represent residents’ initial perceptions shortly after the program was implemented and are therefore subject to certain limitations. The unanimous 100% “strongly agree” responses likely reflect the enthusiasm associated with a newly introduced program (a novelty effect) rather than a fully settled, long-term assessment. Consequently, the findings should be interpreted as an early indication of acceptance, and continued longitudinal evaluation is needed to confirm the program’s sustained impact over time.

Table 1. Community satisfaction survey results (n = 20)

No	Statement	STS	TS	N	S	SS
1	Program content aligns with community needs	0	0	0	0	20
2	Implementation schedule was appropriate and sufficient	0	0	0	0	20
3	Training materials were clear and easy to understand	0	0	0	0	20
4	The organizing team provided good service during the program	0	0	0	0	20
5	Residents welcomed the program and hope for its continuation	0	0	0	0	20

Note: STS = strongly disagree, TS = disagree, N = neutral, S = agree, SS = strongly agree. Overall agreement (S + SS) = 100%. Source: Field survey, 2026.

Table 2. Comparison of security before and after the program

Aspect	Before	After
Surveillance coverage	Several blind spots at main gate, main road, and parking area	Four IP CCTV cameras installed at strategic points with overlapping coverage
Monitoring method	Manual patrol by security officer	Real-time remote monitoring via mobile application
Incident reporting	Informal, ad hoc reporting	Structured SOP for incident reporting and system checks
Data storage	No digital recording	Local SD card (64 GB per unit) with cloud backup

Community involvement	Limited to night patrol volunteers	Dedicated community security monitoring group established

These results align with the broader literature on CCTV-based crime prevention. Meta-analytic evidence indicates that CCTV is associated with a modest but consistent reduction in crime, particularly for property offenses such as theft, when cameras are actively monitored and properly targeted [12]. Quasi-experimental evaluations of publicly monitored CCTV networks similarly report significant reductions in targeted offenses within the surrounding coverage area [13], and studies in comparable community settings report improved suspect identification and a perceived deterrent effect once cameras are visibly installed [15]. The overlapping coverage created by the four cameras installed at RW 10's main access points is also consistent with findings that jointly covering high-traffic entry and exit routes strengthens the overall deterrence effect compared with isolated, non-overlapping camera placement [16].

At the same time, the literature cautions that deterrent effects can attenuate over time if a system is not actively maintained and monitored [21], underscoring the importance of the community monitoring group and SOP established in this program. The stand-alone, cloud-backed configuration was deliberately chosen for its lower operating cost and ease of community-led maintenance, in line with evidence that cost-effective CCTV designs are more sustainable for community adoption than complex, centrally managed systems [6]. Taken together, the implementation results and community feedback indicate that the program achieved its objective of closing surveillance blind spots and strengthening residents' sense of safety, while also contributing to SDG 11 (Sustainable Cities and Communities) and SDG 9 (Industry, Innovation and Infrastructure) by demonstrating a low-cost, community-managed model for digital security infrastructure at the neighborhood level [20].

4. Privacy and Data Governance

To ensure responsible use of the surveillance system, the program established clear privacy and data governance arrangements agreed upon together with residents. Access to the monitoring application and recorded footage is restricted to registered RW administrators and members of the community security monitoring group; no other parties are permitted to view or download the recordings. The footage is used strictly for neighborhood security purposes and may not be used for commercial or personal interests.

Incident reporting and any use of recorded data follow the standard operating procedure (SOP) collectively agreed upon by residents, which specifies how footage may be accessed, reviewed, and reported. In addition, CCTV notification signs and stickers are installed at each camera location to inform residents and visitors that the area is under surveillance, thereby maintaining transparency and ensuring that the use of data consistently follows the SOP agreed upon by the community.

5. Dissemination and Publication of Outputs

As a final step, the results of the program were disseminated to a wider audience through several output channels. Documentation of the CCTV installation and training activities was compiled into a video published on the team's YouTube channel, while a summary of the program was published through Telkom University's official media channel. These outputs are intended to serve as a reference for other RW-level communities considering similar digital

security initiatives, and to support the outreach and reporting requirements of the community service program.

CONCLUSION

This community service program successfully strengthened environmental security in RW 10, Kp. Ciganitri, Lengkong Village, Bojongsoang District, Bandung Regency by integrating a digitally-based CCTV system with participatory community empowerment. Four outdoor IP cameras were installed at strategic, high-traffic points identified jointly with residents, equipped with local and cloud-based storage and real-time remote monitoring, closing surveillance blind spots that had previously contributed to theft losses of approximately IDR 35,000,000. Beyond the technical intervention, the program trained residents, established a community security monitoring group, and produced a standard operating procedure to support long-term, community-led maintenance. All 20 surveyed residents (100%) reported satisfaction with the program and expressed hope for its continuation, indicating strong community acceptance and a meaningful contribution to residents' sense of safety.

The novelty of this program lies in combining low-cost, stand-alone IoT-based CCTV technology with a structured community empowerment process in a semi-urban Indonesian neighborhood, offering a replicable model for other residential areas facing similar blind-spot security challenges. The program directly supports SDG 11 (Sustainable Cities and Communities) and SDG 9 (Industry, Innovation and Infrastructure), and is aligned with Telkom University's SPICE research roadmap in Computer Engineering and Information Security. Future development is recommended toward IoT-based integration, AI-assisted surveillance analytics, and expanded camera coverage to further strengthen the sustainability and scalability of the community-based security system.

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