

Enhancing Community Security through Smart Closed-Circuit Television Technology

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Abstract

This study aims to enhance community security in Kampung Lio RW 19, Depok, by implementing smart closed-circuit television (CCTV) technology. Kampung Lio RW 19 is a residential area facing increasing crime risks, such as theft and drug trafficking. To address these issues, a Smart CCTV system was installed at several strategic locations to monitor suspicious activities in real-time. This system has advanced features, including facial recognition, automatic zoom, alert notifications, and two-way communication, designed to improve surveillance effectiveness. In addition to installation, training was provided to the community to enhance their technical understanding of CCTV installation and maintenance. The methodology used in this community service is participatory action research (PAR). This aims to involve the community in every process of community service. In addition, the community can make repairs when there is damage to the CCTV or the inappropriate placement of the CCTV location. There are five stages, namely, to know, to understand, to plan, to act, and to change. The system's effectiveness was evaluated through questionnaires distributed to residents after implementation. The survey results indicated that residents felt safer and were satisfied with the system, with an average satisfaction score above 4.4. This demonstrates that the community directly benefited from the Smart CCTV system, leading to a safer and more secure environment. Furthermore, the program empowered residents by enhancing their technical capabilities, fostering collaboration within the community, and increasing awareness of technological solutions for neighborhood safety. However, some challenges were encountered during installation, such as difficult terrain and limited equipment, which were overcome through active community involvement. This study demonstrates that Smart CCTV effectively improves security in Kampung Lio and can be adopted in other high-crime areas.

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INTRODUCITON

Kampung Lio in RW 19, Pancoranmas District, Depok, is a residential area facing various security challenges. As an area with a continuously increasing population, security threats such as theft and other criminal activities have become a major concern. Recently, RW 19

Kampung Lio, Depok, has experienced a rise in criminal activities, causing residents to feel increasingly unsafe. On June 20, 2024, two motorcycle thieves in the area failed to carry out their crime and became the target of the residents' anger, who then handed them over to the authorities ([Ibnumasy, 2024](#)). Additionally, another major case in the same area involved the arrest of a drug dealer found with 20 kg of methamphetamine ([Lantara, 2019](#)).

These incidents indicate an increasing security risk in Kampung Lio, RW 19, Depok. In this digital era, CCTV technology has proven effective in monitoring and preventing criminal activities in various locations ([Sulistiyono et al., 2023](#)). This technology can be a suitable solution to enhance security in Kampung Lio, in line with the development of information technology and the community's need for a safe environment.

The main issue faced by the residents of Kampung Lio is the high level of crime threats, particularly theft ([Sulistiyono et al., 2023](#)). The lack of adequate monitoring systems increases the risk for residents, especially in areas not visible from the main road. Furthermore, the community's awareness of the importance of technology in maintaining security is still low, hindering the implementation of technological solutions like CCTV.

Various studies have demonstrated the effectiveness of CCTV in improving security in various communities ([Alkodri & Yanuarti, 2022](#); [Erico & Yasin, 2023](#); [Sihombing et al., 2023](#); [Hidayatullah & Putra, 2022](#); [Lidyawati et al., 2021](#); [Ma'arif et al., 2023](#); [Parenreng & Hamzidah, 2023](#); [Fakhruddin et al., 2022](#); [Parenreng et al., 2021](#); [Pindarwati et al., 2022](#); [Dilapanga et al., 2021](#); [Setiadi et al., 2019](#); [Sulistiyono et al., 2023](#)). For example, in Gondang Village, Mojokerto Regency, the use of CCTV successfully enhanced security and encouraged community participation in maintaining environmental safety ([Erico & Yasin, 2023](#)). In one study, CCTV was used in a laboratory to ensure the security of frequently lost or damaged computer and network equipment. The installation of CCTV enabled monitoring of activities in the laboratory, which significantly improved security and surveillance efficiency ([Alkodri & Yanuarti, 2022](#)).

This study focuses on developing an IoT-based security monitoring system in residential areas. Using technologies such as PIR sensors and ESP32 cameras, this system can provide real-time notifications if suspicious activity is detected ([Lidyawati et al., 2021](#)). The study describes implementing an IoT-based security system using ESP32 cameras and PIR sensors. This system is designed to detect motion and send data to smartphones via the Telegram app, significantly enhancing security in Karyawangi Village ([Lidyawati et al., 2021](#)).

This study explores how CCTV can be used to monitor and improve environmental security, particularly in addressing issues such as theft. The system also facilitates law enforcement in handling criminal cases with recorded evidence ([Alkodri & Yanuarti, 2022](#); [Sulistiyono et al., 2023](#)). The study examines the effectiveness of using IP cameras in environmental security systems. These cameras can record activities in detail and provide valid evidence in case of incidents. Additionally, this study included training for the community on using security technology such as CCTV. The goal is to enhance the community's technical skills and awareness of the importance of digital security.

The study by [Lidyawati et al. \(2021\)](#) focuses on developing an IoT-based independent security system that can be monitored remotely. This system has proven effective in reducing crime risk and providing a sense of security for residents. The study shows that implementing smart CCTV integrated with IoT technology can significantly improve environmental protection, especially in areas prone to crime.

Based on the above background, the PKM (Community Service Program) team from the Department of Informatics and Computer Engineering, Politeknik Negeri Jakarta, has resumed community service activities. In previous years, the PKM team has regularly conducted community service ([Arnaldy et al., 2023](#); [Rasyiidin et al., 2022](#)).

Kampung Lio, RW 19, Pancoranmas District, Depok, was selected as the research location due to its notable rise in criminal activities, including theft and drug trafficking, which have caused significant concern among residents. The lack of a comprehensive "Siskamling" system and the absence of real-time environmental monitoring have further increased the area's vulnerability to crime. Recent incidents, such as the thwarting of motorcycle thefts and the seizure of 20 kg of methamphetamine, highlight the urgent need for enhanced security measures in this neighborhood. These conditions make Kampung Lio an ideal setting to implement and evaluate the effectiveness of Smart CCTV technology, providing a valuable opportunity to address pressing security issues while empowering the community through participatory involvement. The research questions addressed in this study are:

- How effective is the implementation of the Smart CCTV system in enhancing security in Kampung Lio, RW 19, Pancoranmas District, Depok?
- What challenges are faced in implementing this system?
- How can community participation in maintaining environmental security through the use of CCTV be increased?

The objectives of this study are to analyze the effectiveness of the Smart CCTV system in enhancing security in Kampung Lio, to identify challenges and obstacles in implementing this system, and to develop strategies to increase community participation in maintaining environmental security using CCTV technology. Based on these objectives, this study proposes implementing the Smart CCTV system at strategic locations in Kampung Lio and training residents to improve their technical skills in operating and maintaining the system. Additionally, a collaborative approach involving local government and residents is necessary to ensure the success of this project.

This study is expected to significantly improve security in Kampung Lio by applying Smart CCTV technology. As a result, a safer and more comfortable environment can be created for the local community, while also encouraging active participation from residents in maintaining their neighborhood's security ([Erico & Yasin, 2023](#)).

METHODS

The methodology used in this community service employs the participatory action research (PAR) approach. There are two main focuses of the PAR approach: community empowerment and knowledge within the community ([Afandi et al., 2022](#)). This positions the community as the primary actors of change rather than as the object of community service. Therefore, the presence of lecturers and students from higher education institutions should position the community as the main agents of change and development.

There are four primary cycles of community service using the PAR approach, as shown in Figure 1. These four stages include know, understand, plan, act, and change. In the "to know" stage, the community service practitioners from the higher education institution engage with the community to identify the issues in the environment where the service will occur. The outcome of this stage is a detailed, comprehensive, and in-depth description of the actual condition of the environment where the community service will be conducted. In the "to understand" stage, the practitioners grasp the key issues occurring within the community. At this stage, a focus group discussion (FGD) is conducted. The outcome is an analysis of the main problems and solutions. In the "to plan" stage, the community service practitioners design an action plan to solve the identified issues. The output of this activity is a series of steps for the community service. In the "to act" stage, the practitioners begin executing each process that was planned during the planning stage. The outcome of this stage includes products, activities, and documentation of the activities in the form of photos.

and videos. In the final stage, "to change," the practitioners reflect on the results of the implementation and empowerment processes.

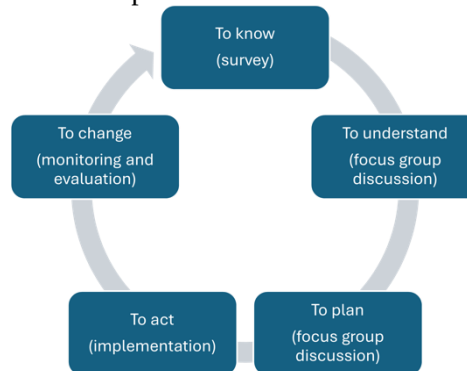


Figure 1 Community service cycle based on PAR approach ([Ahmad & Sulistyowati, 2021](#))

The activities at this stage involve monitoring and evaluation. Monitoring was conducted through direct visits to the community service location, where the functionality and effectiveness of the Smart CCTV system were observed in real-time. The practitioners collaborated with the head of RW 19 and community representatives to ensure the system operated as intended. Evaluation activities included distributing questionnaires to the residents in the area where the CCTV system was installed. The questionnaires contained 20 questions designed to assess various aspects of the system, such as its ability to enhance security, detect suspicious activities, and provide safety. Data from the questionnaires were analyzed to calculate satisfaction levels and identify areas for improvement. The results indicated a high level of satisfaction, with an average score above 4.4, demonstrating the community's positive reception of the system and its effectiveness in improving security.

RESULT AND DISCUSSION

It has been explained in the previous sub-chapter that the approach used in this community service is the Participatory Action Research (PAR) approach. The PAR approach was chosen because it emphasizes active collaboration with the community, empowering them to become agents of change rather than mere recipients of external intervention. This approach is particularly effective in addressing complex community issues, as it integrates local knowledge, fosters ownership, and ensures sustainability of the implemented solutions ([Afandi et al., 2022](#); [Ahmad & Sulistyowati, 2021](#)). In this PAR approach, there are five stages: to know, to understand, to plan, to act, and to change. Next, each stage will be explained in detail.

To know the stage

This study was conducted through several stages, including an audience with the head of RW 19, a survey, training, and the installation of CCTV. The audience aimed to identify the needs in the RW 19 area. A survey was conducted to directly observe the location and conditions in Kampung Lio RW 19. Based on the results of the audience and survey, it was found that the residents of Kampung Lio RW 19 require the installation of CCTV to monitor their environment. Additionally, the community needs to be trained on CCTV introduction, installation, and maintenance. Figure 2 shows the documentation of the PNJ PKM team's survey in Kampung Lio RW 19.



Figure 2 Field survey

The survey also revealed that Kampung Lio RW 19 is just 2.17 km from the PNJ campus. This distance was measured using Google Maps, as shown in Figure 3.

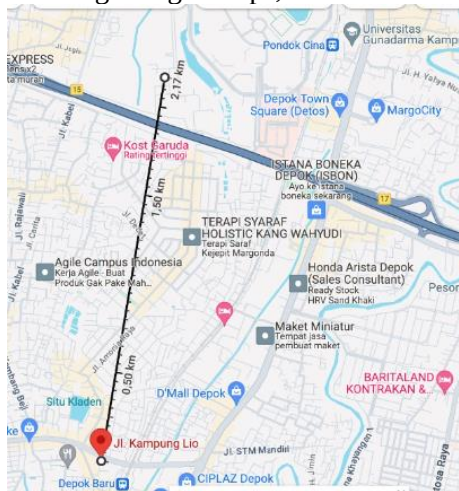


Figure 3 The distance between kampung lio and politeknik negeri jakarta

To Understand Stage

At this stage, FGD was conducted to discuss the main problems that should be solved. Based on the discussion's results, the main issue was security. This problem was selected because there had been a theft in a short period ([Ibnumasy, 2024](#)) and drug crimes in RW 19, Lio village ([Lantara, 2019](#)). This is very disturbing for residents. Figure 4 shows the documentation of FGD activities.



Figure 4 Documentation of forum group discussion

To Plan Stage

At this stage, a discussion was held to determine the type of activity and the time of implementation. Some points from the discussion are as follows:

- CCTV installation will be carried out at 8 points according to Figure 6. These points were obtained based on the level of danger and high community activity.
- Training activities for Karang Taruna youth which will be held on June 29, 2024.
- Installation of smart CCTV in the RW 19 environment will be carried out on July 11, 2024.
- Monitoring and evaluation on August 6, 2024.

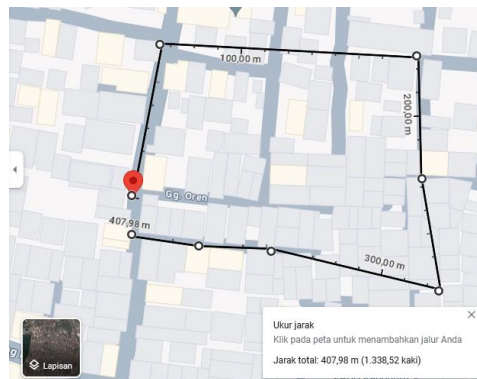


Figure 5 Layout of cctv installation points in kampung Lio rw 19

To Act Stage

The next stage of this community service activity is the training. The training focuses on enhancing the security of Kampung Lio RW 19 by using a Smart CCTV system. Security is defined as being free from dangers related to crime and accidents, and is essential for individual and environmental safety. Traditional community security systems, such as night patrols (*ronda*), remain relevant but are enhanced with modern technology like CCTV and environmental sensors. Smart CCTV includes advanced features like real-time monitoring, automatic zoom, facial recognition, alert notifications, two-way communication, and light adjustment for clearer images. Although effective, the installation and configuration of Smart CCTV require technical knowledge and are more costly than conventional CCTV systems.

The training agenda began with an opening speech from the head of the PKM (Community Service Program) and a speech from the head of RW 19 Kampung Lio, Depok. The event started with preparation by the MC from 07:00 to 08:00, followed by participant registration conducted by the registration team from 07:30 to 08:00. After that, participants took a pretest guided by the MC for 15 minutes until 08:15. The next session was the presentation of the first material on CCTV introduction by Iim Imamudin, which took place from 08:15 to 09:00. This was followed by the second material on CCTV installation practice by Fachroni Abi Murad from 09:00 to 09:50. Then, the entire team carried out the practical installation of CCTV until 11:30.

The participants were very enthusiastic about attending the training and workshop on the introduction and installation of CCTV. Figure 6 shows the documentation of the excitement during the training and workshop.



Figure 6 (a) Introduction to CCTV by the first presenter, (b) UTP cable introduction workshop by the second presenter, and (c) CCTV installation workshop by the second presenter

The training concluded with a group photo of all participants, organizers, and presenters. Figure 7 shows the group photo taken at the end of the training.



Figure 7 Group photo with participants, organizers, and presenters

After conducting training and workshops on the introduction and installation of CCTV, the next step is to install the CCTV system. The main devices used in this study include IP Cameras/PTZ CCTV Cameras, Monitors (TV/Smartphone), and internet network devices (such as Access points, switches, and LAN cables). Figure 8 shows the IP CCTV installation topology.

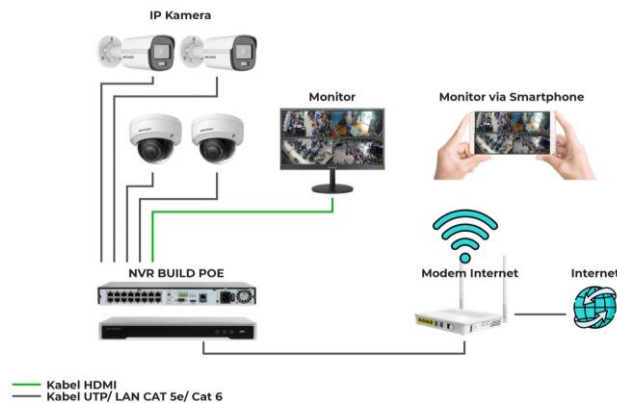


Figure 8 Ip CCTV installation topology ([Techpoint, 2022](#))

Based on the IP CCTV installation topology, the NVR BUILD POE device and monitor were installed in the home of the RW 19 leader in Kampung Lio. This setup facilitates the monitoring of the surrounding area. Then, cables were extended from the RW 19 leader's house to the locations of the CCTV installation points. Figure 9 shows the monitor installation and CCTV cable extension.



Figure 9 Configuration on the monitor screen and CCTV cable extension

After all the CCTV cameras were installed at the designated points, the next step was configuring the system to display the captured images from each CCTV. Figure 10 (a) shows the configuration results. All the CCTV cameras were successfully connected and displayed images on the monitor screen (Figure 10 (b)).

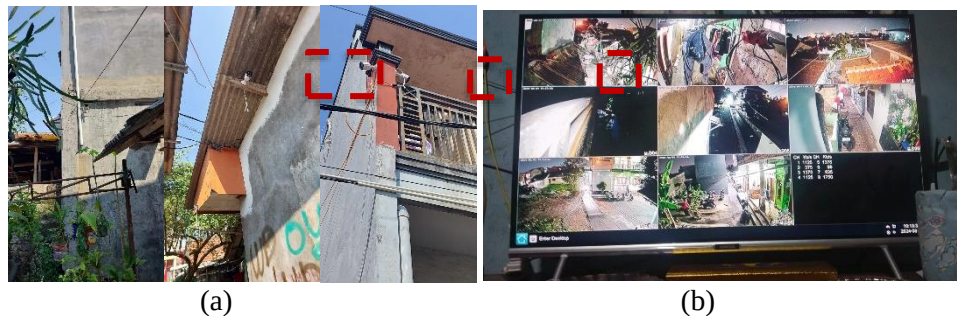


Figure 10 (a) Cctv instalation and (b) Screenshot displaying all images from each cctv

To Change Stage

At this stage, monitoring and evaluation of the implementation of smart CCTV in the RW 19 Kampung Lio area are carried out. Monitoring is conducted through direct visits to the community service location, which are carried out jointly by the lecturer and the head of RW 19, Kampung Lio. Figure 11 shows the documentation of the monitoring process.



Figure 11 Documentation of the smart cctv system monitoring in rw 19, kampung Lio, Depok

In addition to monitoring, evaluation is also conducted at this stage. An evaluation is necessary to determine the effectiveness of the Smart CCTV implementation. One method to achieve this is through the distribution of questionnaires ([Sihombing et al., 2023](#)). This method was chosen for its ease of distribution, collection, and analysis. The questionnaires were distributed using Google Forms. A series of questions were posed to the community

around the CCTV installation site. A total of 20 questions were included. Table 1 shows the questions presented to the community.

Table 1 List of questions

No	Question
1	CCTV is very effective in monitoring critical areas in my neighborhood.
2	CCTV can record incidents clearly, especially at night.
3	The use of CCTV as an initial security measure can prevent vandalism.
4	CCTV's motion detection capability is excellent.
5	I am satisfied with the surveillance coverage provided by CCTV.
6	I find CCTV highly beneficial in enhancing security in my neighborhood.
7	I feel safer after the installation of CCTV.
8	CCTV helps in monitoring activities in the surrounding area in real-time.
9	CCTV is effective in preventing crimes in the monitored areas.
10	The presence of CCTV helps me monitor daily activities.
11	The impact of CCTV on the comfort of residents or area users is very positive.
12	CCTV is very effective as an initial security measure in preventing crimes.
13	The presence of CCTV can reduce anxiety related to neighborhood security.
14	CCTV helps monitor and oversee suspicious activities in the surrounding area.
15	CCTV can provide strong evidence in criminal cases.
16	The implementation of CCTV as an initial security measure is crucial for neighborhood safety.
17	The presence of CCTV can enhance security responses to emerging threats.
18	CCTV can be used as a learning tool to improve security procedures.
19	CCTV can help verify incident reports provided by eyewitnesses.
20	CCTV can increase discipline and awareness among residents or area users.

The questionnaire was distributed after the installation of CCTV, from August 6, 2024, to August 20, 2024. A total of 14 households participated in filling out the form. Table 3 summarizes the questionnaire results.

The average scores calculated for each question are above 4.4. This indicates that the community perceives the implementation of Smart CCTV as effective in enhancing monitoring and security in Kampung Lio, RW 19. Figure 12 presents a graph of the average scores for each question.

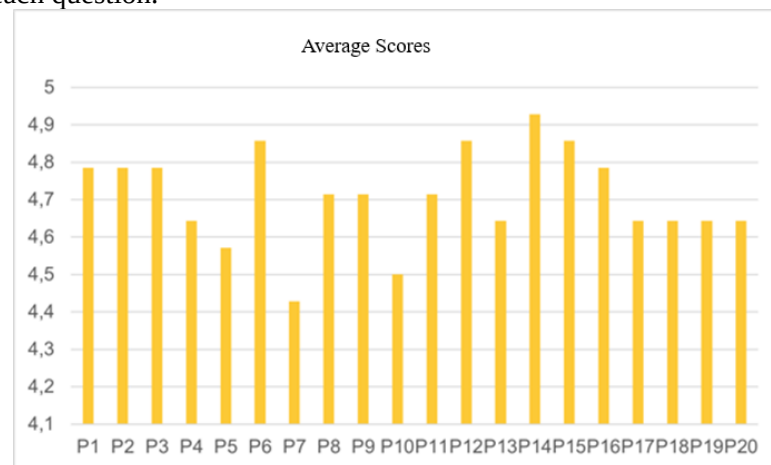


Figure 12 Graph of average community satisfaction scores

First, the mean score for each parameter (P1 to P20) was calculated by averaging the ratings provided by all 14 respondents (R1 to R14). Each parameter's average represents the respondents' overall perception of that aspect. Once the mean for each parameter was

determined, these averages were combined to calculate the overall satisfaction score as shown in (1). The average scores for each parameter were: P1: 5.00, P2: 4.21, P3: 5.00, P4: 4.00, P5: 3.43, P6: 4.79, P7: 4.79, P8: 4.21, P9: 5.00, P10: 4.21, P11: 5.00, P12: 4.79, P13: 4.00, P14: 5.00, P15: 4.79, P16: 4.79, P17: 4.21, P18: 5.00, P19: 4.00, and P20: 5.00, with a total sum of 91.21 across all parameters. The overall satisfaction score is 4.56, which falls under the "Very satisfied" category based on the threshold. This suggests that most respondents feel very satisfied with the evaluated parameters.

CONCLUSION

The study focuses on improving community security in Kampung Lio RW 19, Depok, by implementing Smart Closed-Circuit Television (CCTV) technology. The area faces rising crime, such as theft and drug trafficking, which has led to growing concerns among residents. To address these issues, a Smart CCTV system was installed strategically to monitor suspicious activities in real-time. The system, equipped with advanced features such as facial recognition, automatic zoom, alert notifications, and two-way communication, aims to enhance surveillance and improve the community's safety.

In addition to the installation, residents were trained on operating and maintaining the CCTV system, thereby promoting technical self-sufficiency. The study evaluated the system's effectiveness through surveys, which showed that residents felt safer and more satisfied with the Smart CCTV, reflected by an overall satisfaction score of over 4.56.

Active community participation mitigated challenges faced during the project, such as difficult terrain and limited equipment. The study concludes that Smart CCTV technology can significantly enhance security in high-crime areas and recommends its adoption in similar communities to foster a safer environment.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS STATEMENT

MA is responsible for preparing the progress report (Monitoring and Evaluation – Monev Phase 1) and creating a comprehensive PowerPoint presentation that outlines the project's development in a structured and informative manner. FAM serves as the training facilitator, delivering instructional materials and actively assisting in the implementation of the Community Service Program to ensure participants fully understand the content. IH takes the lead in coordinating the overall execution of the program and is also in charge of documenting all activities, including the collection of visual and written evidence. Meanwhile, SMPAT, HW, and RP play vital roles in providing hands-on assistance during training sessions, offering technical guidance and practical mentoring to ensure effective knowledge transfer to participants.

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