

# Desimination of Technology for Increasing the Security of Community-Based Citizens of Gawan Village, Colomadu Using I-Siskamling

Umi Salamah<sup>a,1</sup>, Wiharto<sup>b,2,\*</sup>, Ristu Saptono<sup>b,3</sup>

<sup>a</sup> Informatics Study Program, Universitas Sebelas Maret, Surakarta

<sup>1</sup> [umisalamah@staff.uns.ac.id](mailto:umisalamah@staff.uns.ac.id); <sup>2</sup> [wiharto@staff.uns.ac.id](mailto:wiharto@staff.uns.ac.id); <sup>3</sup> [ristu.saptono@staff.uns.ac.id](mailto:ristu.saptono@staff.uns.ac.id)

\* Corresponding Author

## ABSTRACT

The residents of Gawan Village, RT 02 and 04 RW 12 Colomadu, Karanganyar have almost the same characteristics: most of the residents work during the day and they are migrants. It gives security problems during the day, especially in an empty house and a long holiday. The vast area and the number of access roads, as well as proximity to the center of the crowd such as malls, factories, and warehouses, cause very inefficient when using security services during the day. Therefore, i-Siskamling which IP Camera Outdoor using internet access can be one solution to overcome these security problems. IP cameras are installed in strategic places. As a result, nine CCTV cameras with two controls (NVR) were installed with monitors at the two Partner locations. The results are very encouraging as seen from the absence of reports of theft in the two regions and the monitoring of several disturbing events in the community. In addition, community support was very evident with providing the electricity for the camera and access points and two additional CCTV cameras and accessories for the system.

## KEYWORDS

i-Siskamling;  
CCTV;  
IP Camera



This is an open-access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license

## 1. Introduction

Gawan Village, Colomadu, Karanganyar is an area where there are many uninhabited spots such as gardens and vacant land. In addition, there are several housing estates with a cluster system that separates the walls from the surroundings. RT 04, RW 12 Gawan Village, Colomadu, Karanganyar which is a community service partner is the widest RT area in RW 12 which is between these spots and outside the cluster housing. This condition causes the partner area to be prone to crime, especially cases of theft because it is easy for thieves to move. Coupled with the condition that most of the residents work during the day and are immigrants, so that the owner's house is often left empty during the day or during long holidays. This is supported by the fact that almost most of the houses in RT 04 RW 12 Gawan have experienced theft. Meanwhile, RT 02 RW is a cluster housing which is directly adjacent to RT 04 RW 12. Even though it is a cluster housing area, theft has occurred in residents' houses, although not as often as in RT 04. The number of access roads and proximity to crowded centers such as malls, factories and warehouses makes it very inefficient to use security services during the day. Generally, theft during the day has a mode of repair, delivery or collection of goods, so that residents who live at home do not become suspicious of this. This is reinforced by the large number of residents who live as housemaids, who do not come from the housing or village, so they do not know their neighbors. In addition, the strategic location factor because it is close to the center of the crowd and access to more than one location makes a lot of vehicle traffic that may pass through the location. Security problems most often occur at quiet times such as during the day between 10-12 hours or when left homecoming. On average every year there are about 5-7 cases of theft. This security problem tends to be similar to the security cases that occurred in Karanganyar Regency in general, which occurred in empty houses left by their owners. The theft occurred during the day or early morning. Surveillance camera technology that has been studied by previous

researchers is used for this community service. Weapon detection in real-time CCTV video using deep learning researched by Bhatti [1]. Optimization of Wireless Video Surveillance System for Smart Campus Based on Internet of Things was researched by Zhou [2]. Multilevel object tracking in a wireless multimedia sensor network for surveillance applications using graph-based big data was researched by Kucukkececi [3]. Eye-to-face synthesis: a new approach to human-centered intelligent surveillance was researched by Chen [4]. Multi-modal anomaly detection using audio and visual cues was investigated by Rehman [5].

IBaggedFCNet: Ensemble Framework for Anomaly Detection in Surveillance Videos researched by Zahid [6]. Re-identification of people between visible and thermal camera images based on residual CNN using a single input was investigated by Kang [7]. Regional Traffic Congestion Detection Using a Large-Scale Monitoring System through Deep Residual TrafficNet was researched by Wang [8]. Hawk-Eye: An AI-Powered Threat Detector for Intelligent Surveillance Cameras researched by Ahmed [9]. The Literature Survey on Multi-Camera Systems and Its Applications was investigated by Olagoke [10]. Target field of view prediction using artificial pheromones for re-identification of people was studied by Santiago-Ramirez [11]. Re-identification of People by Multi-Camera Networks for Internet of Things in Smart Cities was researched by Zhang [12]. A non-participatory surveillance system for preserving privacy for pandemics such as COVID-19 was investigated by Nabil [13]. Intelligent Video Surveillance of Tourist Attractions Based on Virtual Reality Technology was researched by Huang [14]. A survey on a deep learning-based person re-identification system was investigated by Almasawa [15]. Re-identification of People Using Hybrid Representation Reinforced by Learning Metrics was investigated by Perwaiz [16]. Anchor-based vehicle detection for traffic control using boundary ellipse was investigated by Yu [17]. Detection of Thermal Objects in Difficult Weather Conditions Using YOLO was studied by Kristo [18]. Rapid pedestrian detection in video surveillance based on shallow random forest soft target training was investigated by Kim [19]. The Light Encryption Method for Privacy Protection in Video Surveillance was researched by Zhang [20].

Smart Campus Care and Guiding with Special Video Foot printing Through Internet of Things Technology researched by L.-W. Chen [21]. Distilled Camera Conscious Self Training for Re-identification of Semi-Supervised Persons was investigated by Wu [22]. A robust extrinsic calibration method for non-contact gaze tracking in 3-d space was investigated by Kang [23]. Data-Based Logical Topology Inference for Managing Safety and Re-identification of Patients Through Multi-Camera IoT was investigated by [24]. Forensic Video Analysis: Passive Tracking System for Automated Person of Interest (POI) Localization researched by Khan [25]. The Design of Monitoring Transceiver Module for Improving Irradiation Coverage and Grayscale Image Quality was investigated by Lee [26]. Detection of Smoky Vehicles Based on Range Filtering in Three Orthogonal Planes and a Histogram of Motion Orientation studied by Tao [27]. ESTHER: Joint Camera Self-Calibration and Automatic Radial Distortion Correction of Human Walking Tracking was investigated by Tang [28]. Using Roads for Autonomous Air Vehicle Development was investigated by Hartley [29]. Choice of Application Layer Protocol for Next Generation Video Surveillance Using Internet of Video Things researched by Sultana [30].

Initial identification obtained that the root of the problem is the lack of self-help security guarding and the security system has not been implemented during the day. This is proven to have resulted in increased cases of theft or house burglary during the day or during long holidays. The contribution of this community service, namely the installation of shared security cameras at strategic locations and main access locations, is seen as a reasonable solution. This is reinforced by the development of IP Camera technology. Based on these problems, a security system i-Siskamling (internet - Environmental Security System) is proposed that uses IP Camera security camera technology and cloud storage.

## 2. Method

The stages of implementing this service adopt a prototyping approach, namely an iterative approach with each iteration using the following steps.

### 2.1. Requirements Gathering

Requirements related to i-Siskamling including installation location, technical storage and management were collected through interviews and observations.

### 2.2. Requirements Analysis

This stage is needed to analyze the needs that have been successfully defined. The resulting artifact is a specification document.

### 2.3. Design (Design)

The design stage is carried out to determine the architecture, communication method and i-Siskamling security system. Based on the specification document that has been made in the previous stage, at the design stage a system design document is produced.

### 2.4. Installation (Installation) and Evaluation (Evaluation)

Installation in the actual environment/location is carried out at this stage. Evaluation of the installation results is carried out in stages and becomes input for the next iteration.

## 3. Results and Discussion

The preparation of requirements related to i-Siskamling includes the installation location and the type of CCTV that must be used, which are determined through interviews and observations. Observations with the aim of the two partners were carried out on April 29, 2019. Based on the survey results in partner areas, several CCTV camera installation points and types of cameras were installed. The type of camera installed is IP Camera Wifi which is strengthened using an access point. This is because in partner areas it is not possible to apply CCTV cameras using cables even though the results are more stable. In partner areas, most of the roads and sidewalks are covered with concrete or asphalt and rarely have gutters. So the cable planting process will require a great effort. For this reason, the Wifi system is used as a solution. The electricity used comes from houses adjacent to the installation of the equipment. The initial installation topology is shown in Fig. 1.

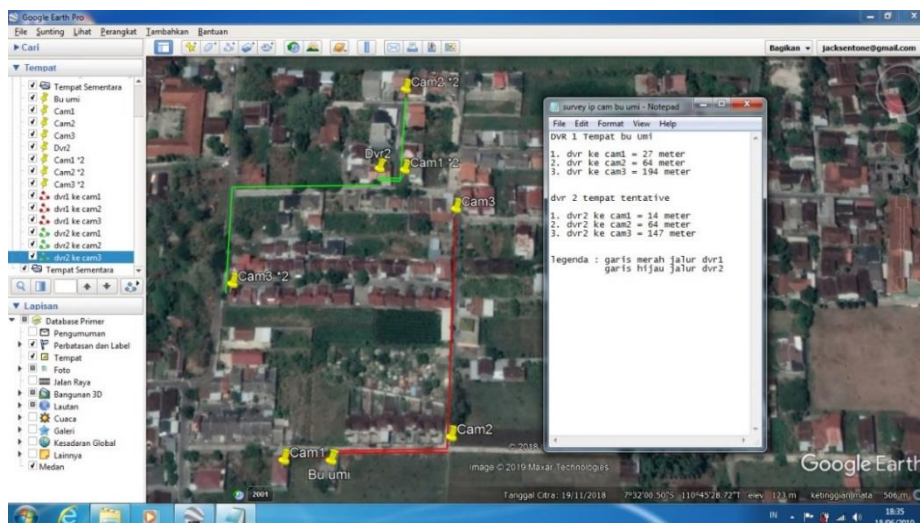


Fig. 1. Initial topology of CCTV installation

The CCTV installation stage is carried out for 4 days. Several changes in the determination of camera installation points were made to accommodate the residents' suggestions. This is due to the addition of 2 cameras and their equipment using non-governmental funds to expand the monitoring area of the i-Siskamling system that was created. As a result, a total of 8 points were installed with 9 CCTV cameras in RT 02 and RT 04.

The installation of the i-Siskamling equipment is carried out with the help of four workers who help install the equipment, in the form of cameras, access points, and wiring. The following Fig. 2 is documentation of the installation of i-Siskamling equipment at Partner locations.



**Fig. 2.** The CCTV Installation Stage

After the installation of all CCTV cameras has been completed, and has been connected to each component, then the visual adjustment of the image on the CCTV monitor is carried out, as shown in Fig. 3.



**Fig. 3.** Monitor Settings for Image and Time Visualization

The completion of the CCTV installation process was marked by the handover of goods/equipment supporting i-Siskamling, which was handed over by the 2019 UNS PNBPKM service team to the two partners on August 13, 2019. The handover ceremony was carried out after the CCTV installation process had been completed. The tools handed over to Partners can be shown in Table 1.

**Table 1. Equipment needed for i-Siskamling for Partners**

Name of goods	Specification	Volume
NVR hik 8 port	DS-7608NI-Q1	2
CCTV cameras	IP CAM 2,0 mp hikvision outdoor	9
Access Point	Ubiquiti Nanostation M2 2.4GHz	6
UTP cable and RJ connector 45	Kabel UTP Belden Cat 5e	9
Hard disk	HDD SATA 1 TB WD PURPLE	2

Matters relating to the use and benefits of i-Siskamling and also the location where the tools will be placed are socialized with the residents of the two partners. Socialization is carried out using the village WA group or through RT meetings. The following is documentation of socialization regarding matters related to i-Siskamling, both the equipment and the location where the i-Siskamling equipment is installed, shown in Fig. 4.



**Fig. 4. i-Siskamling Socialization to Residents**

Thus, the implementation of P2M PKM 2019 has reached the stage of implementing CCTV installations and socialization for both partners. The next stage is usage training. Training is carried out for personnel who are directly related to CCTV monitoring.

Satisfactory results were obtained after the installation of i-Siskamling at partner locations. During the period of completion of the installation, until now there has been no record of theft which was previously rampant at partner locations. Even the existence of environmental CCTV is able to provide other advantages. i-Siskamling is a reference for information if there is an incident in the community. For example, the sugarcane plantation fire which was close to a residential area caused several houses to become victims. The cause can be monitored through CCTV as shown in Fig. 5.



Fig. 5. Documentation of the Sugarcane Plantation Fire Case

#### 4. Conclusion

The implementation of i-Siskamling in the form of installing CCTV integrated in one panel in Gawan Village RT 02 and 04 RW 12 Colomadu, Karanganyar, has been successfully implemented. There are eight CCTV cameras placed at the two partners, two of which are non-governmental organizations. Cameras are placed in strategic locations, namely vulnerable points that are often used for thieves to pass and access villages. The implementation of the system can significantly reduce theft crimes in both partner locations. And now, this system becomes the main information reference if something happens in the environment.

#### Suggestion

It is necessary to increase the awareness of citizens so that security will increase. Currently, it is the residents whose houses are located with the NVR.

#### Acknowledgment

Thank you to Eleven Maret University for supporting this activity through the PKM (Community Service) grant scheme, so that it can increase security in partner areas.

#### Author Contribution

All authors contributed equally to the main contributor to this paper. All authors have read and agreed to the published version of the manuscript.

#### Funding

Thank you to Eleven Maret University for supporting this activity through the PKM (Community Service) grant scheme, so that it can increase security in partner areas.

#### Conflict of Interest

The authors declare no conflict of interest.

## References

- [1] M. T. Bhatti, M. G. Khan, M. Aslam, and M. J. Fiaz, "Weapon Detection in Real-Time CCTV Videos Using Deep Learning," *IEEE Access*, vol. 9, pp. 34366–34382, 2021, doi: [10.1109/ACCESS.2021.3059170](https://doi.org/10.1109/ACCESS.2021.3059170).
- [2] Z. Zhou, H. Yu, and H. Shi, "Optimization of Wireless Video Surveillance System for Smart Campus Based on Internet of Things," *IEEE Access*, vol. 8, pp. 136434–136448, 2020, doi: [10.1109/ACCESS.2020.3011951](https://doi.org/10.1109/ACCESS.2020.3011951).
- [3] C. Kucukkececi and A. Yazici, "Multilevel Object Tracking in Wireless Multimedia Sensor Networks for Surveillance Applications Using Graph-Based Big Data," *IEEE Access*, vol. 7, pp. 67818–67832, 2019, doi: [10.1109/ACCESS.2019.2918765](https://doi.org/10.1109/ACCESS.2019.2918765).
- [4] X. Chen, L. Qing, X. He, J. Su, and Y. Peng, "From Eyes to Face Synthesis: a New Approach for Human-Centered Smart Surveillance," *IEEE Access*, vol. 6, pp. 14567–14575, 2018, doi: [10.1109/ACCESS.2018.2803787](https://doi.org/10.1109/ACCESS.2018.2803787).
- [5] A.-U. Rehman, H. S. Ullah, H. Farooq, M. S. Khan, T. Mahmood, and H. O. A. Khan, "Multi-Modal Anomaly Detection by Using Audio and Visual Cues," *IEEE Access*, vol. 9, pp. 30587–30603, 2021, doi: [10.1109/ACCESS.2021.3059519](https://doi.org/10.1109/ACCESS.2021.3059519).
- [6] Y. Zahid, M. A. Tahir, N. M. Durrani, and A. Bouridane, "IBaggedFCNet: An Ensemble Framework for Anomaly Detection in Surveillance Videos," *IEEE Access*, vol. 8, pp. 220620–220630, 2020, doi: [10.1109/ACCESS.2020.3042222](https://doi.org/10.1109/ACCESS.2020.3042222).
- [7] J. K. Kang, T. M. Hoang, and K. R. Park, "Person Re-Identification Between Visible and Thermal Camera Images Based on Deep Residual CNN Using Single Input," *IEEE Access*, vol. 7, pp. 57972–57984, 2019, doi: [10.1109/ACCESS.2019.2914670](https://doi.org/10.1109/ACCESS.2019.2914670).
- [8] P. Wang et al., "Regional Detection of Traffic Congestion Using in a Large-Scale Surveillance System via Deep Residual TrafficNet," *IEEE Access*, vol. 6, pp. 68910–68919, 2018, doi: [10.1109/ACCESS.2018.2879809](https://doi.org/10.1109/ACCESS.2018.2879809).
- [9] A. A. Ahmed and M. Echi, "Hawk-Eye: An AI-Powered Threat Detector for Intelligent Surveillance Cameras," *IEEE Access*, vol. 9, pp. 63283–63293, 2021, doi: [10.1109/ACCESS.2021.3074319](https://doi.org/10.1109/ACCESS.2021.3074319).
- [10] A. S. Olagoke, H. Ibrahim, and S. S. Teoh, "Literature Survey on Multi-Camera System and Its Application," *IEEE Access*, vol. 8, pp. 172892–172922, 2020, doi: [10.1109/ACCESS.2020.3024568](https://doi.org/10.1109/ACCESS.2020.3024568).
- [11] E. Santiago-Ramirez, J. A. Gonzalez-Fraga, E. Gutierrez Lopez, O. Alvarez-Xochihua, and J. Acosta-Guadarrama, "Target Field of View Prediction Using Artificial Pheromones for People Reidentification," *IEEE Access*, vol. 7, pp. 179010–179026, 2019, doi: [10.1109/ACCESS.2019.2958911](https://doi.org/10.1109/ACCESS.2019.2958911).
- [12] S. Zhang and H. Yu, "Person Re-Identification by Multi-Camera Networks for Internet of Things in Smart Cities," *IEEE Access*, vol. 6, pp. 76111–76117, 2018, doi: [10.1109/ACCESS.2018.2883560](https://doi.org/10.1109/ACCESS.2018.2883560).
- [13] M. Nabil, A. Sherif, M. Mahmoud, W. Alsmay, and M. Alsabaan, "Privacy-Preserving Non-Participatory Surveillance System for COVID-19-Like Pandemics," *IEEE Access*, vol. 9, pp. 79911–79926, 2021, doi: [10.1109/ACCESS.2021.3082910](https://doi.org/10.1109/ACCESS.2021.3082910).
- [14] J. Huang, A. Huang, and L. Wang, "Intelligent Video Surveillance of Tourist Attractions Based on Virtual Reality Technology," *IEEE Access*, vol. 8, pp. 159220–159233, 2020, doi: [10.1109/ACCESS.2020.3020637](https://doi.org/10.1109/ACCESS.2020.3020637).
- [15] M. O. Almasawa, L. A. Elrefaei, and K. Moria, "A Survey on Deep Learning-Based Person Re-Identification Systems," *IEEE Access*, vol. 7, pp. 175228–175247, 2019, doi: [10.1109/ACCESS.2019.2957336](https://doi.org/10.1109/ACCESS.2019.2957336).
- [16] N. Perwaiz, M. Moazam Fraz, and M. Shahzad, "Person Re-Identification Using Hybrid Representation Reinforced by Metric Learning," *IEEE Access*, vol. 6, pp. 77334–77349, 2018, doi: [10.1109/ACCESS.2018.2882254](https://doi.org/10.1109/ACCESS.2018.2882254).
- [17] B. Yu, J. Shin, G. Kim, S. Roh, and K. Sohn, "Non-Anchor-Based Vehicle Detection for Traffic Surveillance Using Bounding Ellipses," *IEEE Access*, vol. 9, pp. 123061–123074, 2021, doi: [10.1109/ACCESS.2021.3109258](https://doi.org/10.1109/ACCESS.2021.3109258).
- [18] M. Kristo, M. Ivasic-Kos, and M. Pobar, "Thermal Object Detection in Difficult Weather Conditions Using YOLO," *IEEE Access*, vol. 8, pp. 125459–125476, 2020, doi: [10.1109/ACCESS.2020.3007481](https://doi.org/10.1109/ACCESS.2020.3007481).
- [19] S. Kim, S. Kwak, and B. C. Ko, "Fast Pedestrian Detection in Surveillance Video Based on Soft Target Training of Shallow Random Forest," *IEEE Access*, vol. 7, pp. 12415–12426, 2019, doi: [10.1109/ACCESS.2019.2892425](https://doi.org/10.1109/ACCESS.2019.2892425).
- [20] X. Zhang, S.-H. Seo, and C. Wang, "A Lightweight Encryption Method for Privacy Protection in Surveillance Videos," *IEEE Access*, vol. 6, pp. 18074–18087, 2018, doi: [10.1109/ACCESS.2018.2820724](https://doi.org/10.1109/ACCESS.2018.2820724).

- 
- [21] L.-W. Chen, T.-P. Chen, D.-E. Chen, J.-X. Liu, and M.-F. Tsai, "Smart Campus Care and Guiding With Dedicated Video Footprinting Through Internet of Things Technologies," *IEEE Access*, vol. 6, pp. 43956–43966, 2018, doi: [10.1109/ACCESS.2018.2856251](https://doi.org/10.1109/ACCESS.2018.2856251).
- [22] A. Wu, W.-S. Zheng, and J.-H. Lai, "Distilled Camera-Aware Self Training for Semi-Supervised Person Re-Identification," *IEEE Access*, vol. 7, pp. 156752–156763, 2019, doi: [10.1109/ACCESS.2019.2950122](https://doi.org/10.1109/ACCESS.2019.2950122).
- [23] M.-C. Kang, C.-H. Yoo, K.-H. Uhm, D.-H. Lee, and S.-J. Ko, "A Robust Extrinsic Calibration Method for Non-Contact Gaze Tracking in the 3-D Space," *IEEE Access*, vol. 6, pp. 48840–48849, 2018, doi: [10.1109/ACCESS.2018.2867235](https://doi.org/10.1109/ACCESS.2018.2867235).
- [24] K. Cheng, M. S. Khokhar, Q. Liu, R. Tahir, and M. Li, "Data-Driven Logical Topology Inference for Managing Safety and Re-Identification of Patients Through Multi-Cameras IoT," *IEEE Access*, vol. 7, pp. 159466–159478, 2019, doi: [10.1109/ACCESS.2019.2951164](https://doi.org/10.1109/ACCESS.2019.2951164).
- [25] A. Khan et al., "Forensic Video Analysis: Passive Tracking System for Automated Person of Interest (POI) Localization," *IEEE Access*, vol. 6, pp. 43392–43403, 2018, doi: [10.1109/ACCESS.2018.2856936](https://doi.org/10.1109/ACCESS.2018.2856936).
- [26] H. Lee and B. Lin, "The Surveillance Transceiver Module Design for Improvement of Irradiance Coverage and Image Grayscale Quality," *IEEE Photonics J.*, vol. 11, no. 1, pp. 1–11, Feb. 2019, doi: [10.1109/JPHOT.2019.2893263](https://doi.org/10.1109/JPHOT.2019.2893263).
- [27] H. Tao and X. Lu, "Smoky Vehicle Detection Based on Range Filtering on Three Orthogonal Planes and Motion Orientation Histogram," *IEEE Access*, vol. 6, pp. 57180–57190, 2018, doi: [10.1109/ACCESS.2018.2873757](https://doi.org/10.1109/ACCESS.2018.2873757).
- [28] Z. Tang, Y.-S. Lin, K.-H. Lee, J.-N. Hwang, and J.-H. Chuang, "ESTHER: Joint Camera Self-Calibration and Automatic Radial Distortion Correction From Tracking of Walking Humans," *IEEE Access*, vol. 7, pp. 10754–10766, 2019, doi: [10.1109/ACCESS.2019.2891224](https://doi.org/10.1109/ACCESS.2019.2891224).
- [29] R. Hartley, B. Kamgar-Parsi, and C. Narber, "Using Roads for Autonomous Air Vehicle Guidance," *IEEE Trans. Intell. Transp. Syst.*, vol. 19, no. 12, pp. 3840–3849, Dec. 2018, doi: [10.1109/TITS.2018.2799485](https://doi.org/10.1109/TITS.2018.2799485).
- [30] T. Sultana and K. A. Wahid, "Choice of Application Layer Protocols for Next Generation Video Surveillance Using Internet of Video Things," *IEEE Access*, vol. 7, pp. 41607–41624, 2019, doi: [10.1109/ACCESS.2019.2907525](https://doi.org/10.1109/ACCESS.2019.2907525).