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Implementation of CCTV Network Performance Monitoring Optimization for Level Crossing Safety at JPL 154 and JPL 164

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A B S T R A K

This community service activity aims to implement and socialize CCTV network performance monitoring to partner staff in order to improve safety at the level crossings of JPL 154 and JPL 164 within the working area of the Surabaya Class I Railway Technical Hall (BTP). The activity methods include preparation and coordination, preparing materials and socialization media, carrying out socialization through presentations and prototype dashboard demonstrations, evaluating participants' understanding through pre-tests and post-tests, and reporting along with follow-up recommendations. The materials use prototypes and Quality of Service (QoS) data from related research at the same location. The results show network availability of 98.97% (JPL 164) and 98.81% (JPL 154), as well as video availability of 99.77-100%. Participants' understanding increased from an average of 46 to 84, and all respondents (100%) expressed interest in following up on the system implementation. This activity has proven effective in raising partner awareness as an initial step in implementing a sustainable CCTV network performance monitoring system

INTRODUCTION

Level Crossings (JPL) are accident-prone spots between motor vehicles and trains. Data shows that as much as 87 percent of traffic accidents happen at unguarded crossings, or a total of 1,543 incidents with 450 deaths (PT KAI, 2023). The increased traffic capacity in the work area of the Surabaya Class I Railway Technical Office (BTP), for example on the Wonokromo-Mojokerto corridor which can reach 272 trains per day (Permadi & Supriyatno, 2025), puts level crossings under growing risk pressure, as reflected in 105 accident cases in Daop 8 Surabaya over 2017-2020 (Leliana et al., 2023).

Video surveillance through CCTV plays an important role in monitoring road users' compliance and the condition of railway crossing gates in real-time, while also providing visual evidence for incident investigations, as mandated by Article 110 paragraph (2) of Government Regulation No. 56 of 2009 (Republic of Indonesia, 2009) and expanded by Ministry of Transportation Regulation No. 45 of 2018 (Ministry of Transportation of the Republic of Indonesia, 2018a) and No. 94 of 2018 (Ministry of Transportation of the Republic of Indonesia, 2018b). However, the performance of CCTV heavily depends on the quality of the telecommunications network that continuously delivers video to the monitoring center. Service Unit data from Jember in 2025 recorded 448 crossings, with 188 of them unmanned, making the need for real-time CCTV network monitoring urgent (Wibowo & Feryando, 2024).

Based on initial interviews with the BTP Class I Surabaya technical team, partner officers don't really have much technical understanding of Quality of Service (QoS) parameters and the importance of regularly monitoring network performance. Without proper understanding, even the best prototype monitoring system risks not being used optimally by field officers (Defani & Wijayanto, 2023). That's why this community service activity was designed as a socialization program on implementing CCTV network performance monitoring, using dashboard prototypes and QoS data from related research at JPL 154 and JPL 164 as empirical evidence (Wibowo et al., 2026). This article aims to report on the implementation and results of the outreach activities, including improvements in participants' understanding, their satisfaction and interest in applying it, as well as follow-up recommendations for partners.

IMPLEMENTATION AND METHODS

The activities were carried out through participatory communication in five stages: preparation and coordination with partners, preparation of materials and outreach media, implementation of equipment installation and socialization activities, evaluation of participants' understanding and satisfaction, and reporting and follow-up. The targets were five BTP Class I Surabaya partner officers and the Track Guard (PJL) officers responsible for JPL 154 and JPL 164. The outreach materials were prepared in the form of presentations, printed and digital leaflets/modules, as well as a prototype monitoring dashboard demonstration adapting the display and research-related data at the same locations, including maps of JPL locations, device statuses, network and video QoS indicators, and sample disturbance notifications.

The socialization activities carried out consisted of an opening session and pre-test, material presentation, prototype demonstration, discussion and Q&A, as well as post-test and questionnaire filling. The understanding evaluation instrument used ten multiple-choice questions that were identical in both the pre-test and post-test. The satisfaction and application interest evaluation instrument used a dichotomous questionnaire (Agree = 1, Disagree = 0) with five questions (X1-X5) and one question (Y) indicating interest/readiness to follow up on the system implementation, filled out by six field supervisors. Pre-test/post-test data were analyzed by comparing average scores, while the questionnaire data were analyzed descriptively in the form of the percentage of agree responses per question

RESULTS AND DISCUSSION

Implementation of System Installation and Socialization

The installation of the surveillance system started in April 2026 at the guard post locations of the JPL 154 and JPL 164 railway crossings.



Figure 1. Installation of Monitoring System Equipment at The JPL Post

The installation of monitoring equipment was carried out together by cadets, lecturers, and Level Crossing Guard officers.A socialization attended by five partner officers with high levels of participation, especially in the demonstration and discussion sessions.



Figure 2. Demonstration of the CCTV Network Performance

Table 1. Schedule of Socialization Activity Sessions

Sessions	Activities
Opening	Welcome and pre-test
Exposure	QoS concepts and JPL case studies
Demonstration	Purwarupa dashboard monitoring
Discussion	Application FAQs
Evaluation	Post-test and questionnaire

Many participants asked questions about the ease of installation, costs, and how to handle issues shown on the dashboard, indicating a high interest in the possibility of real-world implementation at their workplaces. CCTV Network Performance Case Study The main content of the socialization explains a case study on the QoS data of the CCTV networks JPL 154 and JPL 164 from related research as empirical evidence of the benefits of network performance monitoring, as presented in Table 2.

Table 2. Network QoS and CCTV Video Data JPL 154/164

Location	RTT/Loss	Avail. Jrg	Avail. Vid
JPL 164	67,4ms/1,03%	98,97%	99,77-100%
JPL 154	85,7ms/1,19%	98,81%	99,93%

Both locations are in the very good category according to TIPHON standards (Nisa et al., 2024), with delays under 150 ms and packet loss under 3%, and network and video availability above 95%. Showing real data from participants' own work locations proved to be more convincing than just explaining concepts, in line with the idea that disseminating appropriate technology needs to be backed by empirical evidence to be accepted by end users (Ardiansyah et al., 2022).

Improving Participant Understanding

The pre-test and post-test evaluation of five participants showed a significant increase in understanding, as summarized in Table 3.

Table 3. Summary of Pre-Test and Post-Test Scores

Aspects	Pre-Test	Post-Test
Average comprehension score (scale 0-100)	46	84

The average score went up by 38 points, from 46 to 84, showing that the socialization method combining concept exposure with a dashboard prototype demo effectively boosted non-IT staff's understanding in just one day of activities. This finding aligns with the view that visualization and hands-on demos speed up

users' understanding of dashboard-based monitoring systems (Defani & Wijayanto, 2023).

Satisfaction and Interest in Application

The questionnaire evaluation of six field supervisor respondents showed a high level of satisfaction and interest in applying all the questions, as summarized in Table 4.

Table 4. Summary of Satisfaction and Implementation Interest Questionnaire

Question Item	Agree
X1 - Understanding concepts and benefits	100%
X2 - Ease of understanding the demonstration	100%
X3 - Relevance of JPL case studies	83%
X4 - Usefulness of the material/leaflet	100%
X5 - Understanding notification response	100%
Y - Interest in follow-up implementation	100%

All respondents (100%) said they are interested and ready to support the follow-up implementation of the system at their workplaces. The lowest score was on item X3 (83%), related to participants requesting more case study examples from other JPLs in the BTP Class I Surabaya work area. Overall, these results confirm that the outreach activities effectively raised awareness and commitment among partners, which is a prerequisite before fully implementing the CCTV network performance monitoring system, in line with the principle that the sustainability of appropriate technology is largely determined by user acceptance from the early stages of dissemination (Pramono & Widiasari, 2023).

CONCLUSION AND RECOMENDATION

The implementation of network performance monitoring activities for CCTV on JPL 154 and JPL 164 was successfully carried out. QoS data case studies showed a network availability rate of 98.97% (JPL 164) and 98.81% (JPL 154), as well as video availability of 99.77-100%, all categorized as very good according to TIPHON standards. Participants' understanding increased from an average of 46 to 84 (pre-test to post-test), and all respondents (100%) expressed interest in following up on the system implementation, with satisfaction scores across all aspects ranging from 83-100%. This activity proved effective as a first step in disseminating appropriate technology before full implementation. It is recommended to provide technical assistance for system installation, expand socialization to other JPLs, and establish SOPs for regular CCTV network monitoring. Further research and community service are suggested to evaluate the sustainability of implementation after socialization.

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