Artificial Intelligence-Based Network Monitoring System Training for Computer and Telecommunication Network Engineering Students at SMK Cipta Insani Mandiri Depok

Johan Bastari[1*] , Rino Subekti[2] , Astried Silvanie[3], Devi Puspita Sari[4] , Boy Firmansyah[5] , Dwi Sidik Permana[6], Rahmat Jaya[7]

[1,2,3,4]Department of Informatics Engineering, Faculty of Computer Science, Institute of Business and Informatics Kosgoro 1957, Jakarta, Indonesia
* Corresponding Author:
E-mail: johan.bastari@ibi-k57.ac.id

Abstract.
The increasing adoption of Artificial Intelligence (AI) in network management requires vocational students to possess competencies that align with current industry demands. However, students of the Computer and Telecommunications Network Engineering (TJKT) program at SMK Cipta Insan Mandiri Depok have limited experience in utilizing AI-based network monitoring systems.[1] *Therefore, a community service program was conducted to improve students' knowledge and practical skills in intelligent network monitoring. The program was implemented through three stages: preparation, training, and evaluation. Training activities included theoretical sessions, hands-on practice using network monitoring tools, and the application of AI for network traffic analysis and anomaly detection. Evaluation was carried out through pre-tests, post-tests, and participant feedback. The results showed an improvement in students' understanding of network monitoring concepts and their ability to utilize AI-assisted monitoring tools. Participants also demonstrated positive engagement and satisfaction throughout the training activities. This program successfully enhanced students' competencies in AI-based network monitoring and contributed to their readiness for the increasingly automated and technology-driven networking industry.*

Keywords: *Artificial Intelligence, Network Monitoring, Anomaly Detection, Vocational Education and Community Service.*

I. INTRODUCTION

Development technology rapid information has bring change significant in various aspect life, including in world education . In this digital era, networks computer become vital components that support communication and data exchange efficiently.[2] For vocational school students, especially in the field of information technology, a good understanding of network computer installation and configuration is a necessity. However, many students who only get theory without existence practice direct, which has the potential hinder ability they For compete in the job market

The rapid advancement of information and communication technology has brought significant changes to the management of computer network systems. The increasing demand for stable, secure, and reliable networks capable of supporting various digital activities requires monitoring systems that are not only conventional but also intelligent and adaptive. In this context, the application of Artificial Intelligence (AI) in network monitoring has emerged as a relevant approach to improving efficiency, accuracy, and speed in detecting network disruptions.

Vocational High Schools (SMKs), particularly those offering Computer and Telecommunications Network Engineering (TJKT) programs, play an important role in preparing graduates to meet the demands of the workforce. However, based on preliminary observations conducted at SMK Cipta Insan Mandiri Depok, network monitoring education is still limited to the use of basic monitoring tools and has not yet been integrated with Artificial Intelligence technologies. Furthermore, students have limited practical experience in developing intelligent and data-driven network monitoring systems.

As a result, students' competencies have not fully aligned with current industry requirements, which are increasingly oriented toward network automation and AI-driven technologies. In fact, AI-based network monitoring systems are capable of detecting anomalies, predicting potential network failures, and providing more accurate real-time network performance analysis.

Therefore, a Community Service Program in the form of training and mentoring on Artificial

Intelligence-based network monitoring systems is needed.[2] This activity is expected to enhance students' knowledge and practical skills in utilizing emerging technologies, thereby improving their readiness to enter the workforce in the field of computer networking.

II. RESULT AND DISCUSSION

2.1 Place and Time of Implementation

As part of the implementation of the Tri Dharma of Higher Education, a Community Service Program was carried out by lecturers and students from the Faculty of Computer Science, Institute of Business and Informatics Kosgoro 1957. The program took place on May 26, 2025, at the third-floor hall of SMK Cipta Insani Mandiri in Beji District, Depok City, West Java, Indonesia. This location was chosen to support the delivery of training activities designed to improve participants' knowledge and practical skills in computer networking technology.

Fig.1. Cipta Insani Vocational School Building Independent , Depok

Activity Devotion To this Community besides in progress offline . Participants who attended totaling 86 people including students class XII of Cipta Insani Vocational School Independent , Lecturers, Students and School Teachers .

2.2 Community Service Material To the Community

The training process of Artificial Intelligence-based network monitoring systems covers the following topics :

1. Definition and Concept of a Computer Network Monitoring System. The purpose of system monitoring is :

- Maintaining systems performance
- Detecting disruption more quickly
- Preventing system damage
- Optimizing resource usage

2. Artificial Intelligence

- Understanding Artificial Intelligence
- How Artificial Intelligence works
- Artificial Intelligence in monitoring
- The difference between regular monitoring and AI monitoring
- Tools for system monitoring
- AI monitoring system architecture
- Machine Learning

3. Programming Languages and Applications

- Python
  A versatile and highly popular high-level programming language. Known for its simple and easy-to-read syntax (similar to human language), Python is often used for web development, data analysis, artificial intelligence (AI), and even the automation of everyday tasks.
- Visual Studio Code (VSCode)
  Microsoft's very popular free and open-source code editor software. It's used to write, edit, and debug source code for various programming languages, including JavaScript, Python, PHP, and C++.
- Google Colaboratory
  Google Colaboratory is a free cloud computing service from Google that lets you write, run, and share Python code directly through a web browser. This platform is very popular for data analysis, artificial intelligence (machine learning), and programming learning.

4. Practical Learning

- Practice 1 - Basic monitoring with Python / Google Colab
- Practice 2 - Simple anomaly detection (AI Logic)
- Practice 3 - Monitoring with machine learning (AI)
- Practice 4 - Real-Time monitoring + AI (Simple)
- Practice 5 – AI-Based System Monitoring (Dashboard)

5. Implementation in the Network

- Monitoring can be implemented at the Server School, Router, PC Lab, and IoT Device

Implementation Method

The implementation method for this Community Service activity is designed systematically, in a participatory manner, and is applicable to address partners' concerns, namely the limited use of Artificial Intelligence in the monitoring system for students majoring in TJKT. This method emphasizes active partner involvement in every stage of the activity, from identifying needs, training, mentoring, to evaluating results. With this approach, the activity not only provides theoretical knowledge but also develops practical skills that can be directly applied to implementing the monitoring system in the school environment. The activity is implemented through several interrelated stages to ensure the solutions provided are effective, measurable, and sustainable.

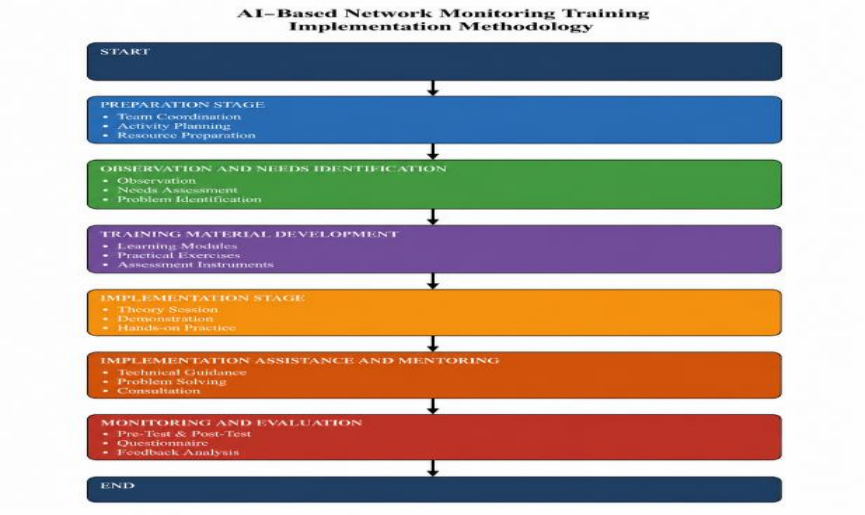

Fig. 2. Method of Community Service To the Community

The implementation stages include :

1. Preparation Stage

The preparation stage is carried out as an initial step to ensure that activities can proceed according to plan. At this stage, the implementation team conducts internal coordination regarding task allocation, activity schedules, training materials, and technical requirements during the community service implementation.

2. Observation and Identification Stage

This stage is carried out to obtain a realistic picture of the partner's condition, infrastructure capabilities, and technical constraints before training and mentoring activities are provided.

- The implementation team conducts a comprehensive assessment of the TJKT department's existing server room and computer laboratory architecture. This includes analyzing how instructors currently monitor server health, which reveals a heavily manual process prone to human error and a lack of real-time alerting systems for critical failures.
- The team evaluates the existing technical literacy of the TJKT instructors and laboratory technicians regarding Artificial Intelligence. The diagnostic assessment indicates that while the partners possess strong fundamental skills in traditional computer networking, server configuration, and basic scripting, they have limited to no theoretical knowledge or practical experience in deploying Machine Learning models—such as unsupervised learning algorithms—for daily network operations and infrastructure diagnostics.

3. Material Development Stage

At this stage, the implementation team designs and compiles the technical training modules required for the program. The content is explicitly tailored to the operational realities of the TJKT department, focusing on integrating Machine Learning (ML) into the daily workflows of a network engineer. Material development is structured into two main areas:

- Applied Unsupervised Learning for Networks: Developing modules that introduce unsupervised machine learning algorithms—specifically the Isolation Forest algorithm—to detect infrastructure anomalies without requiring pre-labeled training datasets. The material covers hyperparameter configuration (such as tuning n_estimators, contamination margins, and max_samples) to identify data outliers. Practical Scripting and System
- Automation: Creating step-by-step laboratory sheets and Python implementation guides utilizing core data engineering and system metrics libraries (pandas, numpy, scikit-learn, and psutil). These resources guide partners through extracting raw JSON performance metrics, handling features like CPU and RAM load percentages, and performing local model serialization via joblib for instant backend retrieval.

4. Implementation and Training Stage.

This stage serves as the core execution phase where the developed Machine Learning architecture is deployed, and knowledge is systematically transferred to the TJKT partners through two parallel tracks:

Backend & Pipeline Deployment: The implementation team works alongside TJKT instructors to establish the model's production environment within a web framework. This involves constructing asynchronous data views in Django to handle real-time inference via loaded_model.predict(), and setting up an automated notification mechanism using the Telegram Bot API to instantly report detected performance anomalies. Interactive Capacity Building Workshops: Hands-on training sessions are conducted for TJKT faculty and laboratory staff. Participants learn how to spin up Jupyter Notebook or Google Colab environments for initial model training, interact with the Django administration dashboard, and write asynchronous front-end logic using jQuery and AJAX polling (setInterval) to dynamically update network status indicators without full-page reloads.

5. Mentoring and Troubleshooting Stage

To bridge the gap between initial training and completely independent network operations, a structured mentoring phase is executed. The implementation team provides technical assistance as the TJKT department integrates the model into live school server operations. Key efforts during this period focus on: Model Optimization and Scaling: Assisting partners in gathering live local network logs and adjusting the model's contamination baseline to minimize false positives in a live production environment. Stress Testing and Edge Case Resolution: Guiding teachers through executing deliberate server stress tests (e.g., using stress-ng-cpu utilities) to artificially force a ~100% processing load. This empowers partners to safely verify

that the model correctly flags anomalous data (returning a -1 prediction value), alters the UI indicator cards from green to red, and successfully broadcasts automated alerts via Telegram pipelines.

6. Evaluation and Reflection Stage

The final stage measures the technical proficiency gains of the partners, the practical performance of the system, and the overall sustainability of the community service program. Evaluation is executed across two criteria:Quantitative Assessment: Evaluating the technical capability of the TJKT staff using diagnostic pre-tests and post-tests regarding machine learning pipelines. Simultaneously, system reliability is verified by auditing model inference speeds, AJAX polling accuracy intervals, and Telegram notification delivery rates during high-traffic anomalies. Qualitative Assessment: Conducting evaluation interviews and feedback surveys with the TJKT departmental heads to measure usability, document administrative challenges, and establish a long-term maintenance roadmap. This ensures the school can independently sustain, retrain, and expand the AI-powered infrastructure monitoring system to accommodate additional hardware assets in the future.

2.5 Documentation Activity

This section explains the results of the societal activity titled "Training for the Installation and Configuration of Simple Computer Networks" aimed at students of Cipta Insani Vocational School. It will be reviewed based on the achievement of goals, benefits, and targets. The discussion includes various aspects of the project.

1. Results are reviewed in terms of achieving goals

The results obtained were that students gained a better understanding of artificial intelligence-based network monitoring. Students were able to use AI hardware and tools to support network monitoring systems and detect and prevent anomalies within computer networks, as shown in Figure 3.

Fig.3. Presentation of Material for Activity I Devotion To the Community

2. Results reviewed from the benefits

This training contributes to improving the quality of education at SMK Cipta Insani Mandiri by increasing students' competencies in the field of computer networks. After completing the training, students feel more confident in their ability to work with computer networks, which can increase learning motivation, as shown in Figure 4.

Fig. 4. Presentation of Material Activity II Devotion To the Community

1. Results reviewed against targets

In the implementation of this PKM, the targets achieved by SMK Cipta Insani Mandiri students get direct benefits from the training. Through this training, teachers can gain new insights into teaching computer networks and how to apply practical methods in learning. With more skilled students, the industry will get a more prepared and competent workforce. shown in Figure 5.

Figure 5. Presentation of Material III-IV on Activity Devotion To the Community

2.6 Evaluation Questionnaire

At the end of the activity training, participants get a questionnaire evaluation. This covers ten questions completed by 17 participants in accordance with the following table

Table 1. Evaluation PKM Questionnaire

No	Question	SS	S	N	TS	STS	Total
1	Organized material with good and easily understood	41.2 %	52.9%	5.9%	0%	0%	100%
2	The material is very relevant and appropriate to what I expect	52.9 %	47.1%	0.0%	0%	0%	100%
3	The material is already sufficient for I For capable know network computer	35.3 %	58.8%	5.9%	0%	0%	100%
4	This material makes it easier I For to practice installation computer network and its configuration	41.2 %	47.1%	11.8%	0%	0%	100%
5	The speaker is very understanding of the material presented	70.6 %	29.4%	0%	0%	0%	100%
6	Allocation of time for delivery material sufficient	23.5 %	52.9%	17.6%	5.9%	0%	100%
7	Speaker presenting content material with good, easy-to-understand, and implemented	35.3 %	64.7%	0%	0%	0%	100%
8	Allocation time for discussion is sufficient to add knowledge I	29.4 %	64.7%	5.9%	0%	0%	100%

9	Speaker answer question participant with Good	41.2 %	58.8%	0%	0%	0%	100%
10	In general, overall discussion or ask answer has helped increase understanding I	41.2 %	58.8%	0.0%	0%	0%	100%
	Average	41.2 %	53.5%	4.7%	0.6%	0%	100%

Based on the questionnaire results, the Artificial Intelligence-Based Network Monitoring System training program was highly effective and well received by the participants. The evaluation showed that **94.7% of responses were positive**, consisting of **41.2% Strongly Agree** and **53.5% Agree**, while only **4.7%** of responses were Neutral and **0.6%** were Disagree. No participants selected the Strongly Disagree option.

The findings indicate that the training materials were well organized, relevant to participants' expectations, and effective in improving their understanding of computer networks and AI-based network monitoring systems. Participants also expressed high satisfaction with the instructors' competence, clarity of presentation, and ability to answer questions. Furthermore, the training successfully enhanced participants' practical skills and confidence in applying network monitoring techniques in real-world scenarios.

Overall, the program achieved its objectives by strengthening students' knowledge, technical competencies, and readiness to utilize emerging technologies in the field of computer networking. The positive feedback suggests that similar training activities should be continued and further developed to support vocational students in meeting current industry demands and technological advancements.

III. CONCLUSION

The AI-based network monitoring training program successfully improved the knowledge, practical skills, and confidence of TJKT students at SMK Cipta Insani Mandiri Depok in utilizing intelligent network monitoring systems. The combination of theoretical learning, hands-on practice, and mentoring activities enabled participants to understand the application of AI for network performance monitoring and anomaly detection. Evaluation results showed positive participant responses and a high level of satisfaction with the training. Overall, the program contributed to enhancing students' competencies and readiness to meet the demands of the modern networking industry, which increasingly relies on automation and Artificial Intelligence technologies.

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REFERENCES

[1] N. Purwandari, R. Sefina Samosir, and A. Kusumawati, "Presentation Material Making Training as Preparation for Entering the World of Work for Students of SMK Abdi Negara 2 Cibarusah," ***ABDIMAS J. Pengabdi.*** Kpd. Masy. , vol. 1, no. 1, pp. 16–22, 2020, doi: 10.53008/abdimas.v1i1.23.

[2] N. Purwandari, RA Kristantini, H. Hernalia, and M. Djulfikri, "Program to Improve the Capacity and Ability of Elementary School Teachers in Utilizing Internet Technology," ***J. Pengabdi. Teratai*** , vol. 1, no. 2, pp. 185–192, 2020.

[3] DM Machdum and E. Ardhianto, "Analysis of Online Learning During the Covid-19 Pandemic in the Information Systems Department of the Kosgoro 1957 Institute of Business and Informatics***," J. Sist. Inf. Bisnis*** , vol. 1, no. 2, pp. 96–103, 2020, doi: 10.55122/junsibi.v1i2.177.

[4] S. Hidayat, A. Silvanie, H. Rifiyanti, S. Syah, and A. Kurniawan, "Technical Guidance on Network Design and Internet Security for Vocational High School Students," Surya Abdimas , vol. 7, no. 3, pp. 442–449, 2023, doi: 10.37729/abdimas.v7i3.3179.

[5] AN Hasibuan, R. Laksono, R. Ardiyanty, and H. Aprilia, “E-Commerce Training as an Effort to Provide Entrepreneurial Skills and Strengthen MSMEs for the Jagakarsa Community, Jakarta***,” J. Pengabdi. Teratai*** , vol. 3, no. 1, pp. 61–69, 2022, doi: 10.55122/teratai.v3i1.382.

[6] SMA Madinatul and Q. Depok, “ISSN: 2746-6507,” vol. 2, no. 1, pp. 26–33, 2021.

[7] S. Hidayat, W. Cahya, and Y. Prasetya, "ISSN : 2746-6507," vol. 4, no. 2, pp. 189–194, 2023.

[8] B. Firmansyah, DS Permana, N. Evianti, AM Wihandar, and A. Kurniawan, “Clashing Teaching Schedules in the Informatics Study Program Ibi Kosgoro 1957 Jakarta Indonesia,” ***J. Sist. Inf. Business*** , 2021.