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Training for the Randu Alas Batik Group in Processing Batik Waste by Internet of Things

Liya Yusrina Sabila[1*], Shinta Amelia[2], Arsyad Cahya Subrata[3] , Sandhy Auliya Ma'arief [4], Irvanda Cheza Noor Fadhilla[5] , Fakhra Kurnia Yasa[6]

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ABSTRACT

The Industrial Revolution 4.0 era has encouraged the integration of Internet of Things (IoT) technology in various sectors, including industrial waste management. This article discusses the implementation of IoT technology for processing batik liquid waste in the Randu Alas Batik Community Group, Mrisi, Tirtonirmolo, Bantul Regency, Yogyakarta. Batik liquid waste, which comes from the processing and dyeing process, contains dangerous chemicals that can increase chemical oxygen demand (COD) values and cause water pollution. This community service activity is carried out through outreach, training, and practice in using IoT-based waste processing equipment, which aims to increase community knowledge and skills in managing waste effectively and sustainably. The evaluation results show a significant increase in understanding and application of IoT, reflected in the pretest and post-test results. The conclusion of this activity shows that IoT technology effectively improves the quality of batik waste management and has great potential to be widely applied to maintain environmental sustainability.

Keywords: Batik Group; Community Service; Internet of Things; Batik Waste; Waste treatment

PENDAHULUAN

The current Industrial Revolution 4.0 era has brought major changes in various sectors, including the increasing need for information and communication technology competencies in the world of work, which has encouraged the integration of the Internet of Things (IoT) in various aspects (Adha, 2020; Arisanti et al., 2024; Pratama & Iryanti, 2020). Batik liquid waste originates from the batik industry's processing, dyeing, and polishing activities. Processing cloth and dyeing batik produces liquid waste containing chemicals that can potentially increase the value of chemical oxygen demand (COD) and the color of wastewater (Anugrah et al., 2022; Nurhidayah et al., 2022). The batik waste processing process is still not being manually processed at all, which causes losses to the aquatic environment.

Using Internet of Things technology, an innovative step was taken to increase efficiency and quality in processing batik waste in the Randu Alas Padukuhan Mrisi batik community group, Tirtonirmolo. As time passes, IoT technology becomes increasingly important in maintaining environmental sustainability and optimizing waste management. The method used goes through several stages, namely, socialization/introduction, to explain quality water standards and IoT technology comprehensively. Training and introduction regarding the tools and technology needed in IoT-based batik waste processing.

These stages are carried out to transfer science and technology to service partners so they can be independent in utilizing the technology introduced. This activity aims to increase the ability of community groups to manage batik waste

[1-6] Universitas Ahmad Dahlan

*) *corresponding author*

Liya Yusrina Sabila
Universitas Ahmad Dahlan, Kampus 4, Jl. Ring Road Selatan, Tamanan, Banguntapan Yogyakarta 55191, Indonesia

Email: liya.sabila@te.uad.ac.id

effectively and modernly. It also encourages using IoT technology in the waste processing process to maintain environmental sustainability. The expected benefits are being able to improve the quality of batik products produced, strengthening the independence of community groups in managing waste and marketing batik products efficiently, reducing the negative impact of batik waste on the environment and public health, providing motivation and inspiration for community groups to continue working and innovating in local batik industry. Through this collaborative effort, the local batik industry can continue developing and benefit the surrounding community and the environment significantly.

MATERIALS AND METHODS

This community service activity will take place for two days on Saturday, July 13, 2024, and Saturday, July 27, 2024, starting at 08.00 – 12.00 WIB at Pendopo Buya, Mrisi RT.06, Tirtonirmolo, Kasihan, Bantul. The targets of community service are batik artisans from the Nurul Ummah Mrisi Batik Association, Bantul Regency. The method used in this community service activity is

1. Pretest. The pretest was conducted to determine how much the public understood before the material was presented.
2. Discuss. The first discuss invited speakers from Batik Nitik Yogyakarta, delivering material about the canting method.
3. Discuss. The second discuss was to deliver material regarding the definition of Internet of Things (IoT) Technology, current IoT applications, tool forms, and tool working principles.
4. Practice. Practicing batik waste processing equipment with IoT technology.
5. The questions and answers will discuss the material that has been presented again so that there is a reciprocal interaction between the participants and between the participants and the presenters.
6. Posttest. The posttest was conducted to assess the increase in public understanding after the material was delivered and as an instrument for measuring the success of delivering the material posttest. The posttest was carried out to assess the increase in public understanding after the material was delivered and as an instrument for measuring the success of delivering the material.

RESULTS AND DISCUSSIONS

First Day

On Saturday, July 13, 2024, the first day of service activities was held at Pendopo Buya, Mrisi RT.06, Tirtonirmolo, Kasihan, Bantul, with partners from batik artisans from the Mrisi Batik Association, Bantul Regency, Yogyakarta. This activity takes place from 08.00 – 12.00 WIB. Participants who attend are asked to fill in the attendance list, pretest, and posttest as proof of activity data. Mandatory information that participants must fill in includes their full name, address, and signature in the column provided. After registering, participants are allowed to sit down before the training event begins. This service activity also involved lecturers and students from Electrical Engineering.

The activity began with remarks from the chief executive and representatives of batik artisans. The chief executive introduced the PkM team and explained the aims and objectives of the activity. The method used in this service activity is the lecture method and question and answer discussion. Material delivery begins with filling out a questionnaire instrument before the activity (pretest) to measure participants' understanding before counseling is carried out. The pretest results show that all artisans are proficient in using the Internet but do not yet understand the definition and application of the Internet of Things (IoT). Therefore, this service activity also aims to increase public knowledge about IoT.

Collaboration between implementers, batik artisans, lecturers, and students is expected to benefit the development of skills and understanding of IoT in managing batik waste. The first core activity begins by providing education about the canting method delivered by Batik Nitik, as in Figure 1.

Figure 1. Delivery topic from Batik Nitik

The canting method is a typical batik-making technique batik craftsmen use to produce fine and detailed patterns. Canting is a tool to manually apply wax (wax) to batik cloth (Ilham Sayekti, Ulfa Hidayati, 2020; Masfufah & Fardhani, 2022; Sembiring et al., 2023). With canting, artisans can create the desired pattern or motif with high precision and detail (Syukur Alfauzi et al., 2024; Wicaksana et al., 2021). The wax painting process with canting requires skill and precision to make the resulting batik pattern beautiful and high-quality. Apart from that, the resource person is also motivated to batik artisans. Motivation is an important factor influencing the quality and creativity of batik-making (Anita, 2023). atik artisans need to be highly motivated to continue developing their abilities and create new designs. Motivation also encourages artisans to maintain the continuity of batik traditions and improve the quality of the products produced. With strong motivation, batik artisans will be more enthusiastic about their profession and producing high-quality batik.

The second activity is socialization or counseling about technological developments, especially the definition of IoT and its application in the world today, as in Figure 2.

Figure 2. Delivery of material about IoT

The Internet of Things is a concept in which an object or object is embedded with sensors and software (Gunoto et al., 2022; Nanda Putri Milania, Muhamad Ghalih Pratama, 2024). Processing batik waste, the objectives of using IoT technology are:

1. Real-Time Monitoring (Dewi, 2024): IoT allows real-time monitoring of batik waste conditions, such as water quality, temperature, and pollution levels. With installed sensors, managers can immediately learn about changes in batik waste processing.
2. Waste Reduction: By implementing IoT, the batik production process can be optimized to reduce waste, thereby increasing environmental sustainability.
3. Resource Management: IoT can help in managing resources like water. The treated water will become clear again and can be used to wash batik.
4. Time efficiency (Fendriani et al., 2020; Fitria et al., 2024): This can increase time efficiency so that craftsmen do not have to wait while batik waste processing takes place.

Second Day

Activities continued with batik waste processing equipment training on Saturday, July 27, 2024. The first day of service activities was carried out at Pendopo Buya, Mrisi RT.06, Tirtonirmolo, Kasihan, Bantul, with batik artisans partners from the Mrisi Batik Association, Bantul Regency, Yogyakarta. This activity takes place from 08.00 – 12.00 WIB. The batik waste processing tool is designed to use an intelligent system for processing batik waste, where the tool automatically processes it. Figure 3 shows the activities during the training.

Figure 3. Training on the use of batik waste processing equipment

At the end of the activity, participants fill out a questionnaire instrument (posttest) to determine the level of understanding of the participants after participating in the training to determine the impact the community has from implementing this service activity. Evaluation of the assessment is carried out by comparing the results of the pretest and post-test with the theme of the questionnaire questions indicated in Table 1. The results of the pretest and post-test assessments are shown in Figure 4.

Table 1. Themes of pretest and posttest questionnaire questions

Question to	Question Theme
1	Experience in processing batik waste
2	Understanding the dangers of batik waste
3	Substances contained in batik waste
4	Internet Users
5	The term IoT stands for
6	Application of the Internet of Things
7	Purpose of using the Internet of Things
8	Understanding of using batik waste processing equipment
9	Participants' interest in gaining knowledge about IoT
10	Desire for continuous learning

Based on the evaluation results, this service activity effectively increases participants' understanding of the Internet of Things (IoT) and batik waste processing tools. The following is a summary of the increase in participants' understanding based on the questions asked:

Question 1	:	All participants had no experience in processing batik waste
Questions 2 and 3	:	Only around 65% of partners understand the dangers of batik waste and the substances contained in batik waste
Question 4	:	All participants are internet users, showing the relevance of the themes raised.
Questions 5 and 6	:	Knowledge of what the terms IoT stand for and the application of the Internet of Things each increased by 40%.
Question 7	:	Understanding the purpose of using IoT increases by 30%.
Question 8	:	The level of public understanding after counseling increased by 40%.
Questions 9 and 10	:	Participants' interest and desire to find out about IoT technology increased significantly by 40%.

Figure 4. Evaluation based on pretest and posttest

These results show the positive impact of the service activities carried out and also show that participants are interested in applying IoT technology in everyday life. This success can become the basis for further service activities to deepen knowledge and application of IoT in society.

CONCLUSIONS AND RECOMMENDATIONS

Based on service activities that have been carried out, including socialization or counseling and training on batik waste processing equipment technology at the Batik Randu Alas Padukuhan Mrisi Community Group, Tirtonirmolo, at Pendopo Buya, Mrisi RT.06, Tirtonirmolo, Kasihan, Bantul, Yogyakarta, it is known that the level of community understanding has increased. 90% or an increase of 40%. These results indicate that the community service activities that have been carried out have been successful and have positively impacted the community who participated in this activity. The suggestion that can be given is that this service activity can be carried out continuously or sustainably.

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Conflict of Interests

The authors declared that there is no potential conflict of interest with respect to the authorship and publication of this article.

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