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Socialization of Arduino-Based Organic Waste Destruction Tool for Kitchen Waste Utilization in Karang Besuki

[1]Justita Dura*, [1]Mufidatul Islamiyah, [1]Tri Wahyuni, [1]Fadilla Cahyaningtyas
[1]Institut Teknologi dan Bisnis Asia Malang, Indonesia

*Corresponding author
Email: justitadura@asia.ac.id

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Abstract

Purpose: The community service aims to socialize the early process of organic waste into organic fertilizer for local plants in Karang Besuki residents, Malang city, Indonesia. This addresses the community's lack of knowledge about kitchen waste utilization, limited access to waste management technology, and the need to understand the environmental benefits of proper waste management.

Method: The team conducted socialization and demonstration using a simple automatic counting tool, involving residents of Karang Besuki village, students, and the proposing team.

Practical Applications: This initiative simplifies organic waste processing for residents, allowing the waste to be used as fertilizer, thus promoting a healthier community environment.

Conclusion: The community service activities made it easier for residents to process organic waste into fertilizer, enhancing waste management practices and environmental awareness in Karang Besuki village, Malang city, Indonesia.

Introduction

Waste management is a complex and urgent challenge in this modern era, especially in big cities around the world, including in Indonesia (Wiranata et al., 2023). Along with rapid

population growth and urbanization, the volume of waste generated from various municipal activities, including kitchen waste, continues to increase (Mellyanawaty et al., 2018). Kitchen waste, which consists of food scraps, vegetables, fruits, and other organic materials, is one of the main components in the formation of household waste (Rahmawati, 2018). Unfortunately, kitchen waste management is not conducted optimally. Many people do not have an adequate understanding of the importance of waste management and effective ways to do it (Rahmawati, 2018). As a result, kitchen waste often ends up in landfills without adequate treatment. So that kitchen waste ultimately pollutes the environment and harms the health of the surrounding community (Hakim et al., 2023).

The problem of kitchen waste management in Karang Besuki Village, Malang City, Indonesia, is one of the things that becomes a serious concern. Although there have been efforts to increase awareness of the importance of waste management, there are still challenges in encouraging active community participation in utilizing kitchen waste as a useful alternative energy source (Kompasiana, 2023). Factors such as a lack of knowledge on the proper way to utilize kitchen waste, limited access to technology that can assist in waste management, and the need for a deeper understanding of the environmental benefits of individual actions in waste management are barriers to efforts to improve the role of society (Evi et al., 2023).

To overcome this problem, we realize the importance of using appropriate and simple technology to help the community to manage kitchen waste more efficiently. One of the technologies that has great potential to be used in this case is the waste shredder based on the Arduino Uno Microcontroller (Islamiyah & Kala'lembang, 2018). Arduino microcontrollers are used to control all components, both input and output components (Pramartaningthyas et al., 2023). Arduino, as an affordable and easy-to-use open-source platform, offers an innovative solution for monitoring and automating various processes, including waste management. Through this community service program, we intend to socialize the use of Arduino waste shredders as a concrete effort to increase the role of the community in the use of kitchen waste. The virtue of this Arduino waste shredder is that it has the speed of rotating the blade to destroy organic food waste. The output of this waste shredder is in the form of liquid that can be used as organic fertilizer for plants around the house. The maximum weight of one crush can be up to approximately 3 kilograms, and the electric power used is very economical.

By understanding the importance of community involvement in environmental conservation efforts, this project not only aims to provide technological solutions, but also to build community awareness and capacity in managing waste responsibly. Thus, it is hoped that this community service program can make a real contribution in efforts to build a more sustainable and environmentally conscious society in Karang Besuki Village, Malang City, Indonesia. By increasing awareness of environmental issues and climate change, people are increasingly aware of the importance of taking concrete actions to reduce their carbon footprint and improve environmental sustainability. Efficient kitchen waste management can be one of the easy ways and can be adopted by every individual to contribute to positive changes to the environment.

In this community service program, we have the potential to become a model that can be adopted by other communities throughout Malang City in particular. By combining an innovative technological approach with a participatory and educational approach, the program not only focuses on short-term solutions, but also aims to build community capacity in the long term. In addition to the obvious environmental benefits, this program also has the potential to create new economic opportunities for local communities (Pratiwi et al., 2019). By teaching new skills in the manufacture and use of Arduino waste shredders, the community can open opportunities to develop sustainable small businesses in the field of waste management (Yulindawati et al., 2024).

Thus, the purpose of this service is not only limited to reducing kitchen waste, but also involves broader aspects of community development, including improving economic

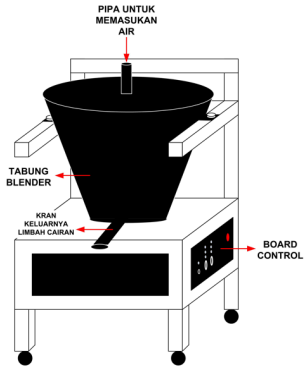
welfare, community empowerment, and increasing awareness of environmental issues. Through collaboration between universities and the community, it is hoped that this program can create a sustainable positive impact on Karang Besuki Village, Malang City, Indonesia and become an inspiration for other communities to achieve sustainable development.
The problems of partners are the lack of public awareness about the importance of kitchen waste management, the lack of knowledge on effective ways to utilize kitchen waste as an alternative energy source, and the limited public access to technology that can help in waste management.

Method

This service activity was carried out in Karang Besuki Village, Malang City, Indonesia. Participants in the activity consisted of local residents, especially the members of PKK organization at RT 10 in Karang Besuki Village, Malang City, Indonesia.

The materials used in this waste processing are organic food waste (vegetables, fruits, food scraps) for fertilizer. Meanwhile, the tool used to destroy organic waste with Arduino Uno Microcontroller technology is in the following image.

Figure 1. Organic Waste Shredder



The way this waste shredder works is designed for a maximum capacity of three kilos of organic waste with a ratio of water and organic waste is 1:1. When it is done, the organic waste dissolves and turns into liquid that can be used as organic fertilizer for surrounding plants.

The methods used in this service activity are as follows:

1. Socialization and Education. The service team held an interactive socialization to provide information about the importance of kitchen waste management and introduce Arduino-based waste shredders to the members of PKK organization.
2. Training. Practical training on how to operate the Arduino waste shredder by demonstrating firsthand the use of the waste shredder in kitchen waste management.

Result

The results of the service activities carried out by the team on PKK organization in RT 10 Karang Besuki Village, Malang City, Indonesia are as follows:

1. Preparatory Activities

   The service team managed to coordinate with all parties involved, including the chairman and team members as well as the members of PKK RT 10 Karang Besuki village. The service activity's plan was well prepared, resulting in a joint agreement attended by 21 participants. The program was designed and implemented on May 11, 2024, including the opening, socialization of waste education, recycling strategies, income diversification, and training on waste shredders.
2. Socialization and Education about Waste

This socialization succeeded in providing understanding to the members of PKK organization about the difference between organic and anorganic waste and the importance of good waste management. This activity increases public awareness of the negative impacts of poor waste management and introduces effective management techniques, such as waste sorting, compost use, and the implementation of a waste bank system.

3. Waste Recycling Strategy Socialization Activities

   This socialization succeeded in providing practical skills to the members of PKK organization regarding the importance of waste recycling. The community was introduced to the types of recyclable waste, the recycling process, and the concept of a waste bank. As a result, the members of PKK organization get better understanding about waste recycling strategies and are expected to be able to apply them in their daily lives.

4. Income Diversification Socialization Activities

   Socialization about income diversification from waste processing has succeeded in providing insight to the members of PKK organization about the economic potential of waste management. They were introduced to the sample of businesses that can be run using waste as raw materials, as well as practical steps to start the business. The public is invited to understand the market and marketing strategies for recycling products (products from waste).

5. Arduino Waste Shredder Training Activities

   This training provides participants with practical skills on the use of Arduino technology to manage waste. Participants were introduced to the concept of Arduino, how waste shredders work, and the use of sensors to detect the volume of garbage. This training is expected to improve the ability of participants to utilize technology for more effective waste management.

Discussion

In this community service activity program, there are several activities that have been carried out and given to partners, namely the members of PKK organization RT 10, Karang Besuki Village, Malang City, Indonesia.

The service team coordinated with all parties involved. The parties involved include the chairman and several members of the community service team. This activity aimed to prepare a plan for service activities to be carried out and the division of tasks. The head of the service team produced a joint agreement attended by 21 participants, and the implementation was carried out on Saturday, May 11, 2024, in accordance with the mutual agreement. No less important is the discussion of the design of the activities that will be carried out. The schedule of community service activities was as follows:

Table 1. Schedule and Description of Community Service Activities

No	Time	Material
1	09.00-09.30	Opening and MOU
2	09.30-10.30	Socialization and Education to Partners about Waste
3	10.30-11.00	Socialization of Waste Recycling Strategies
4	11.00-11.30	Income Diversification Socialization
5	11.30-12.00	Arduino Waste Shredder Training

In this activity, the community service team conducted socialization and education to the partners about the difference between organic and anorganic waste, which was also attended by the members of PKK organization in RT 10, Karang Besuki Village, Malang city, Indonesia. The purpose of this activity is to provide insight to the entire community, especially the members of PKK organization RT 10 about the importance of good and correct waste management in order to create a clean and healthy environment.

Figure 2. Socialization and Education on the Difference between Organic and Anorganic Waste

The service team provides information on various important topics. First, the definition and difference between organic and anorganic waste, along with examples. Second, the environmental impact of waste that is not properly managed, including soil, water, and air pollution and threats to health. Third, effective waste management techniques, such as waste sorting, compost use, and recycling. Fourth, the implementation of the waste bank system as a collective and economical solution in managing waste. Finally, the importance of continuous campaigns and education, by involving various parties such as schools, community organizations, and local governments to increase public awareness and participation. It is hoped that through this activity, the residents of Karang Besuki Village, especially the members of PKK organization in RT 10, can become agents of change in waste management, so as to create a cleaner, healthier, and more sustainable environment.

In this activity, the community service team conducted socialization about waste recycling strategies with the aim of providing understanding and practical skills to the members of PKK organization about the importance of waste recycling as part of sustainable environmental management efforts. On this occasion, the service team explained various key topics related to waste recycling.

Figure 3. Socialization of Waste Recycling Strategies

First, it explained the types of waste that can be recycled, such as plastic, paper, metal, and glass, as well as how to separate the waste from other waste. Second, participants were introduced to the commonly carried out recycling processes, ranging from collection, sorting, cleaning, to processing into new products. Third, it was also conveyed about the importance of public understanding in reducing the volume of waste by recycling, which not only helps reduce environmental pollution but also saves natural resources. Finally, the concept of waste banks was introduced as one of the strategies to facilitate the recycling process, which not only has a positive impact on the environment but also provides economic benefits for the community. Through this activity, it is hoped that the residents of Karang Besuki village, especially the members of PKK organization RT 10, can adopt and implement waste recycling strategies in their daily lives, so as to create a cleaner, healthier, and more sustainable environment.

The community service team conducted socialization about income diversification from waste processing with the aim of providing understanding and practical skills to the community on how to turn waste into a sustainable source of income. On this occasion, the service team conveyed various topics related to income diversification from waste.

First, it is explained about the economic potential of waste management, including the understanding that waste can be turned into goods that have economic value. Second, the team provided examples of businesses that can be run using waste as raw materials, such as handicrafts from used goods, compost production from organic waste, or processing plastic waste into finished products such as bags or other crafts.

Figure 4. Socialization of Income Diversification Strategies

Third, participants were invited to understand practical steps in starting a business to diversify income from waste, starting from waste collection, sorting, to the processing process into finished products. Fourth, it was also conveyed about the importance of understanding the market and marketing strategies for products from waste, so that businesses can develop and be sustainable. Through this activity, it is hoped that the residents of Karang Besuki, especially the members of PKK organization, can see waste as an opportunity for income diversification, so as to create a more independent, creative, and economically sustainable community.

The community service team held a training course on Arduino-based waste shredders. This event was held at Karang Besuki and was attended by the community and technology and environmental activists.

Figure 5. Arduino Waste Shredder Training

The purpose of this activity is to provide participants with an understanding and practical skills about the use of technology to manage waste effectively and efficiently. In this training, various topics related to Arduino waste shredders were presented in detail. First, participants were introduced to the concept of Arduino as a flexible programmable hardware development platform. Second, it was explained about how the Arduino waste shredder works, including the sensors used to detect and measure the volume of garbage. Discussions and Q&A were also an integral part of this training, in which participants can share experiences and gain a deeper understanding of the potential and benefits of using technology in waste management. Through this training, it is hoped that participants can use technology more effectively in overcoming environmental problems, especially in terms of waste management, so as to create a society that is more concerned and responsible for the environment.

Conclusion

This service activity highlights the challenges of organic waste management, especially kitchen waste in Karang Besuki Village, Malang City, Indonesia. Despite efforts to raise awareness, there are still obstacles in knowledge and access to technology. To overcome this, a community service program is implemented by utilizing an Arduino Uno-based waste shredder. Through a series of socialization, education, and training activities, the community, especially the members of PKK organization, are empowered to manage kitchen waste efficiently using the technology. The results show positive participation from PKK women in the hope of adopting sustainable waste management practices. This activity not only provides technological solutions, but also builds awareness in environmental conservation. It is hoped that this program can be an example that can be applied by other communities to create a cleaner, healthier, and more sustainable environment.

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