

AI-Based 'Forest Identifier' Mobile Application Development for Rare Tree Education (Bold, Trebuchet MS 14 pt)

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(Bold, Trebuchet MS 11 pt; author names without titles)

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ABSTRACT

The decline of rare tree populations in Indonesia is often exacerbated by a lack of public knowledge, particularly among the younger generation, regarding the identification of these species in the field. This research aims to develop a mobile application named 'Forest Identifier' that utilizes Artificial Intelligence (AI) technology based on Machine Learning to facilitate the real-time identification of rare trees. The system development follows the Software Development Life Cycle (SDLC) model, involving the collection of image datasets of leaves, barks, and flowers from 20 endangered tree species. The identification process employs the Convolutional Neural Network (CNN) algorithm to achieve high object recognition accuracy. Beyond identification, the application integrates interactive educational features, including conservation status information, ecological benefits, and distribution mapping. The results are expected to demonstrate that the 'Forest Identifier' can improve identification accuracy for lay users to over 85% and significantly increase public awareness of biodiversity conservation. This innovation merges digital technology with forest conservation efforts to create an accessible and relevant educational platform for the digital era. (Trebuchet MS 11 pt, *Italic*)

Keywords: artificial intelligence, digital conservation, species identification

INTRODUCTION (Bold, UPPERCCASE, Trebuchet MS 11 pt)

Indonesia is one of the world's megabiodiversity centers, possessing thousands of tree species, many of which are classified as rare and endemic. However, the existence of these trees is continuously threatened by high rates of deforestation and land-use changes. Conservation efforts are often hindered by a lack of public awareness and the difficulty of accurately identifying tree species in the field (Kusuma & Pratama, 2023). Without adequate identification skills, the public tends to overlook rare trees that should be protected from illegal logging activities (IUCN, 2025). (The first paragraph of each section should not be indented; use Trebuchet MS, 11 pt)

The level of botanical literacy among the public, particularly the younger generation, has experienced a significant decline. Conventional identification methods using dichotomous key guidebooks are often considered too technical and difficult for laypeople to understand (Gaston & O'Neill, 2021). Dependence on botanical experts also poses a challenge due to the limited number of personnel compared to the vast forest areas that must be monitored. Therefore, a bridge is needed between scientific knowledge and ease of access for the general public to recognize the biodiversity surrounding them (Waliidean, 2023). (The second and subsequent paragraphs should be indented; use Trebuchet MS, 11 pt)

The rapid development of Artificial Intelligence (AI) technology, specifically in the field of computer vision, offers transformative solutions for the forestry sector. The use of Machine Learning algorithms allows computer devices to learn visual patterns from leaves, bark, and

flowers to identify species with high precision (Adhikari, Kim, & Chan, 2024). Utilizing this technology within mobile devices enables the identification process to be carried out independently and instantly, dramatically reducing technical barriers in field botanical data collection (Prawira, 2024).

The development of the 'Forest Identifier' application is a strategic step in integrating digital technology into conservation efforts. This application is designed not only as an automated detection tool but also as an educational medium providing conservation status information according to the IUCN Red List and national regulations. With interactive educational features, users can understand the ecological role of each tree they find, thereby creating an emotional connection and a moral responsibility toward forest preservation (Waliidean, 2023).

This research aims to develop and test the reliability of an AI-based rare tree identification system within the 'Forest Identifier' application. Through this approach, it is hoped that a new culture of participatory conservation or citizen science will emerge. The successful development of this application is expected to serve as a new model for modern, engaging forestry education that is relevant to today's digital lifestyle, ensuring that the sustainability of Indonesia's rare trees is better secured for future generations.

METHODOLOGY

This research (or community service activity) employs the Research and Development (R&D) method, focusing on the integration of artificial intelligence systems into a mobile platform. The first stage began with the collection of a digital image dataset of 20 target rare tree species through field observations and secondary data extraction from global botanical databases. Primary data collection was conducted using multi-angle imaging techniques to cover morphological variations of leaves, bark, and flowers, ensuring the richness of visual information to be processed by the system (Adhikari, Kim, & Chan, 2024).

The second stage involved image data pre-processing to enhance input quality before model training. At this stage, all images were converted to a standard resolution and underwent data augmentation processes such as rotation, contrast adjustment, and flipping. This augmentation technique is crucial to prevent overfitting, ensuring that the AI model maintains stable performance despite varying lighting conditions in forest environments (Prawira, 2024).

Subsequently, the Artificial Intelligence architecture was developed using the Convolutional Neural Network (CNN) algorithm based on the MobileNetV2 model. The selection of this model was based on its lightweight and efficient characteristics, making it suitable for implementation on mobile devices with limited computational resources. The model was trained using the TensorFlow Lite framework until it reached an optimal accuracy convergence point, enabling the system to perform instant species classification without requiring an active internet connection at the research site.

Once the AI model was successfully validated, the next stage was the development of the application interface using a cross-platform framework. The application design prioritized User Experience (UX) aspects capable of presenting educational information interactively, ranging from botanical descriptions to conservation status based on the latest IUCN data. The integration between the AI inference engine and the user interface was performed to ensure that identification results could be directly linked to relevant educational content for the user (Waliidean, 2023).

In the final stage, a comprehensive system evaluation was conducted, encompassing both technical and user testing. Technical testing focused on measuring the precision and error rate of the model in identifying tree species in the field. Meanwhile, user testing was conducted through structured questionnaires to measure the application's effectiveness as a

digital learning medium. The results from both tests were analyzed descriptively to provide a comprehensive overview of the 'Forest Identifier' application's success in enhancing public conservation literacy.

RESULTS AND DISCUSSION

Demographic Characteristics of Respondents (Bold, Trebuchet MS 11 pt)

Based on the results of the research conducted with a sample of 73 housewives, data regarding the demographic characteristics of the respondents, such as age, education, and occupation, were obtained.

Table 1. Demographic Characteristics of Respondents (Trebuchet MS, 9 pt)

Characteristics	Frequency	Percentage (%)
Age		
24-35	32	43.8
36-45	22	30.2
46-55	19	26.0
Total	73	100

Table 1 presents the characteristics of the respondents in this study. In terms of age, the majority of respondents were between 24 and 35 years old (43.8%). According to Shamekhi et al. (2019), age influences roles, particularly for mothers. Individuals within the productive age range (younger) tend to acquire new knowledge more easily compared to those in the non-productive age range (older). This group was followed by the 36 to 45 age group (30.2%) and the 46 to 55 age group (26.0%). Regarding education, the majority of respondents were high school (SMA/SMK) graduates (47.9%). This indicates that the largest group responsible for managing medication consists of individuals with a good education level. According to Mandala et al. (2022), a higher level of education correlates with better medication management. This was followed by Bachelor's degree holders (46.6%), junior high school (SMP/MTs) graduates (4.1%), and elementary school (SD) graduates (1.4%). In terms of occupation, the majority of respondents were housewives (60.3%); this is because housewives are considered to have more time at home, thus having more awareness of home medication management (Suherman & Febrina, 2018). This was followed by civil servants (26.0%) and entrepreneurs (13.7%). Information regarding medication management was primarily obtained through electronic media (58.9%). This is because electronic media provides easier access to information and exerts a significant influence on shaping individual opinions and beliefs. The presence of new information provides fresh knowledge, thereby influencing public awareness and behavior (Hanaditia et al., 2020). Other sources included healthcare professionals (26.0%), while friends/acquaintances and print media contributed only 9.6% and 5.5%, respectively.

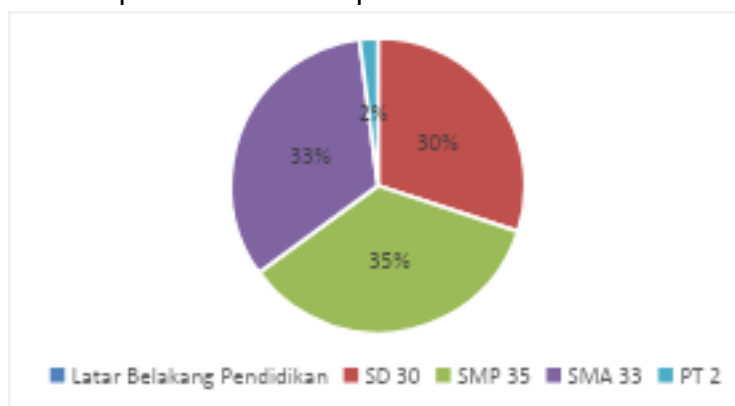


Figure 1. Respondents' Educational Characteristics (Trebuchet MS, 9 pt)

Based on the research conducted, the majority of the community in Biga Village, North Kotamobagu District, Kotamobagu City, possesses a moderate level of knowledge regarding the management of leftover, damaged, and expired medications. This 'moderate' level stems from the fact that the community does not yet fully understand the comprehensive procedures for managing such medicines. In the modern era, information regarding the management of leftover, damaged, and expired drugs is widely accessible, either directly through healthcare professionals or indirectly via available information media, such as the internet. Furthermore, this moderate level of knowledge may be influenced by educational factors, specifically the prevalence of senior high school (SMA/SMK) graduates among respondents. Education level significantly impacts an individual's capacity to comprehend information; generally, a higher level of education correlates with better knowledge acquisition.

CONCLUSION

The majority of housewives in Biga Village have a moderate level of knowledge regarding the management of leftover, damaged, and expired medicines, while their behavior is also categorized as moderate. The analysis results indicate that there is no significant relationship between the level of knowledge and behavior in managing leftover, damaged, and expired medicines in Biga Village, North Kotamobagu District, Kotamobagu City.

SARAN (Optional)

The recommendations derived from this research are as follows:

- a. For the public: To increase their understanding of the importance of home medication management through any available media.
- b. For future research: To conduct similar studies using a qualitative approach, including in-depth interviews with respondents to measure research variables more thoroughly, gain deeper insights, and involve a larger sample size.

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