CHAPTER I
INTRODUCTION

In this chapter, the writer explains the introduction, which includes the background, project questions, project purposes, project significance, project limitations, and terminology.

A. Research Background

Technology is a key driver of transformation in many sectors of life, including agriculture. One of the significant advances in agriculture is the use of advanced systems that can learn and make decisions independently, known as machine learning. This technology allows computers to analyze information and make decisions without requiring specific instructions for each task, by learning from available data. This has significantly improved the efficiency and accuracy of disease control in agriculture, particularly in managing plant diseases.

The rapid advancement of technology has opened up new opportunities for improvement, and agriculture is a key sector to benefit. With the ability to process and analyze large amounts of data, machine learning can help in monitoring crop health, early disease detection, and better farm management. This technology not only saves time and money but also improves the overall productivity and quality of agricultural products.

Coffee plants have significant economic value in many countries, such as Indonesia, which is widely cultivated in the tropics. The health and

productivity of coffee plants are greatly influenced by the condition of their leaves. Coffee leaf diseases such as rust, miner, and phoma can cause huge losses to farmers, both in terms of economy and yield. Historically, the treatment of coffee leaf diseases requires manual observation, which is error-prone and time-consuming. Therefore, the utilization of machine learning technology for early detection and control of plant diseases is essential to improve the productivity and quality of agricultural products.

The writer as a student participating in Studi Independen Bersertifikat (SIB) at Bangkit Academy which is part of the Kampus Merdeka program is given the opportunity to learn and develop in the machine learning pathway. The program provides extensive educational resources and collaboration opportunities with participants from various fields, such as mobile application development and cloud computing, to develop applications as final projects.

Through this final project, the writer can utilize his knowledge to develop practical solutions that provide direct benefits to society, especially helping coffee farmers. Cross-track collaboration allowed the writer and the team to design and develop the COPTAS application that can detect coffee leaf diseases such as rust, miner, phoma, or in a healthy condition quickly and accurately. In addition, the app offers customized solutions for farmers to manage the health of their coffee plants through access to relevant articles or guides within the app. Based on the above, the writer introduces a project entitled "**DESIGNING COPTAS AS A COFFEE LEAF DISEASE DIAGNOSTIC APPLICATION BASED ON MACHINE LEARNING**".

B. Research Questions

Based on the background outlined above, this project aims to answer several key questions that will guide the investigation and help focus the project to achieve its objectives. These project questions are as follows:

1. How to develop an effective mobile application to detect leaf diseases in coffee plants in Indonesia?
2. What features should be included in the app for disease detection, prevention, and provision of comprehensive information on coffee plants?
3. How to ensure the app is easy to use and accessible to coffee farmers, including those with limited access and technological knowledge?

C. Research Purposes

Based on the background and project questions described above, this project aims to achieve the following objectives:

1. To develop and implement a machine learning model that is able to detect coffee leaf diseases such as rust, miner, phoma, and healthy conditions with high accuracy.
2. To detect coffee leaf diseases, develop a user-friendly application that coffee farmers can easily use.
3. To provide coffee farmers with easy-to-understand articles and treatment guides for each type of disease detected.

D. Research Significances

This project has various significances that can be divided into several aspects, both theoretically and practically, as well as benefits for students, STKIP Persada Khatulistiwa campus, and future developers.

Theoretically, this project contributes to the development of science in the field of machine learning. By introducing the application of Convolutional Neural Network (CNN) for coffee leaf disease detection, this project is expected to serve as a reference for other developers interested in developing similar technologies in agriculture or other fields that require visual analysis and automatic detection.

Practically, the project resulted in the development of the COPTAS application that enables rapid and precise detection of coffee leaf diseases, thereby offering farmers a pragmatic tool for monitoring coffee plant health. This application is expected to reduce losses due to coffee leaf diseases, increase coffee plant productivity, and improve coffee quality. In addition, the application provides farmers with easy access to relevant information for managing plant diseases.

For students, this project provides valuable hands-on experience by applying their college knowledge, particularly in developing machine learning-based applications. Students can improve their technical skills in programming, data analysis, and teamwork through collaboration in cross-disciplinary projects.

For the STKIP Persada Khatulistiwa campus, the project had a positive impact on the campus by enhancing its academic reputation through a major contribution to technological development in the agricultural sector.

Finally, for developers, this project provides a solid foundation for future project efforts aimed at developing similar technologies or applying machine learning techniques in various fields. The documentation and results of this project serve as a reference for further development and a source of inspiration for new, innovative and applicable projects. Thus, this project not only provides direct benefits but also paves the way for various innovations in the future.

E. Limitations of the Research

The COPTAS application developed in this project has limitations in terms of the scope of coffee leaf disease detection. The application can detect three types of diseases: rust, miner, and phoma, and identify healthy leaf conditions. The application cannot detect diseases beyond the specified three types at this time.

Moreover, the application needs an internet connection for image processing and accessing information, posing a challenge for farmers in areas with limited internet connectivity.

F. Terminology

This project uses several key terms that need to be understood to understand the context and purpose of the COPTAS application development. The following are definitions of these terms:

1. COPTAS

Stands for “Coffee Plant Treatment and Analysis System”, which is an application designed to detect coffee leaf diseases using machine learning technology. This application helps farmers in identifying coffee leaf diseases quickly and accurately and provides relevant information for coffee plant health management.

2. Coffee Leaf Diseases

Diseases that attack the leaves of coffee plants, which can cause significant losses to coffee farmers. Some common coffee leaf diseases include rust, miner, and phoma. Early identification and management of coffee leaf diseases are essential to maintain the productivity and quality of coffee plants.

3. Diagnostic Application

A software application designed to diagnose or detect a particular problem or condition based on given data. In the context of this project, the diagnostic application is used to detect coffee leaf diseases based on leaf images uploaded by users.

4. Machine Learning

A branch of artificial intelligence that allows computer systems to learn and make decisions based on data. Machine learning methods, such as Convolutional Neural Network (CNN), are used in this project to analyze images of coffee leaves and detect the presence of disease. Machine learning allows applications to recognize patterns and make accurate predictions without the need for explicit programming for each task.