**AI-BASED MEDICINAL PLANT DETECTION**

Minor project report submitted in partial fulfillment of the requirement for the degree of Bachelor of Technology

In

**Computer Science and Engineering**

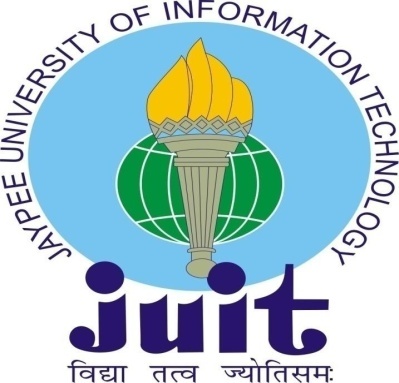
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**UNDER THE SUPERVISION OF**

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**CERTIFICATE**

We hereby certify that the work being presented in the project report titled “AI-Based Medicinal Plant Recognition” in partial fulfillment of the requirements for the award of the degree of B.Tech in Computer Science and Engineering and submitted to the Department of Computer Science And Engineering, Jaypee University of Information Technology, Waknaghat is an authentic record of my work carried out during the period from January 2024 to May 2024 under the supervision of Mr. FaisalFirdous, Department of Computer Science and Engineering, Jaypee University of Information Technology, Waknaghat.

The matter presented in this project report has not been submitted for the award of any other degree at this or any other university.

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This is to certify that the above statement made by the candidate is correct and true to the best of my knowledge.

**Faisal Firdous**

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**AKCNOWLEDGEMENT**

Firstly, we express our heartiest thanks and gratefulness to almighty God for His divine blessing making it possible to complete the project work successfully.

We are grateful and wish my profound indebtedness to Supervisor **Mr. Faisal Firdous, Designation**, Department of CSE Jaypee University of Information Technology, Waknaghat. Deep Knowledge & keen interest of my supervisor in the field of “**Research Area**” to carry out this project. Her endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts, and correcting them at all stages have made it possible to complete this project.

We would like to express my heartiest gratitude to **Mr. Faisal Firdous,** Department of CSE, for his kind help in finishing my project.

We would also generously welcome each one of those individuals who have helped me straightforwardly or in a roundabout way in making this project a win. In this unique situation, I might want to thank the various staff individuals, both educating and non-instructing, which have developed their convenient help and facilitated my undertaking.

Finally, we must acknowledge with due respect the constant support and patience of my parents.

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**ABSTRACT**

The project titled "AI-Based Medicinal Plant Recognition" is a comprehensive project that leverages the power of machine learning and image processing to recognize and classify different plant species The project is built using a combination of C# and Python, two powerful and versatile programming languages. It utilizes several libraries to perform various tasks. Emgu CV, a cross-platform .Net wrapper to the OpenCV image processing library, is used for image processing tasks. TensorFlow, a popular open-source machine learning library, is used for building and training the machine learning models. Npgsql, a .NET data provider for PostgreSQL, is used for database connectivity The project aims to provide an automated and accurate method of plant recognition, which can be particularly useful in various fields such as botany, agriculture, and environmental science.

The project's workflow begins with the collection of plant images, which are then preprocessed using various techniques such as data augmentation and background removal. These preprocessing steps are crucial for improving the performance of the machine learning models by increasing the diversity of the training data and reducing unnecessary information in the images. The preprocessed images are then fed into a machine-learning model for training. Pre-trained models such as InceptioniV3, Inception ResNet V2, and VGG16 are being used in this project. The trained model then be used to classify new plant images, providing the plant's species. The project also includes a database component, where the plant images and possibly the model's predictions are stored and managed. The project demonstrates a successful integration of various technologies and techniques to solve a complex problem.

**Chapter 01: INTRODUCTION**

* 1. **Introduction**

The rapid advancement of technology has opened up new possibilities in numerous fields, including botany. Traditional plant identification methods, which often rely on physical characteristics and expert knowledge, can be time-consuming and prone to errors. This has led to a growing interest in leveraging technology to automate the process of plant recognition. The "AI-based medicinal plant recognition" project responds to this need, aiming to develop an automated system that recognizes and classifies different medicinal plant species based on images.

Image processing technology has the potential to revolutionize several fields. In agriculture, it could help farmers identify crop diseases early by recognizing the affected plant species and the specific symptoms displayed. In botany, it could assist researchers in cataloguing plant species, a task that traditionally requires extensive knowledge and experience. In the field of environmental science, it could aid in monitoring biodiversity by enabling rapid identification of plant species in a given ecosystem. In this project we are focusing on the Indian Medicinal Plant to aid in recognition of such plant help them to use and preserve these plant.

* 1. **Objective**

The primary objective of this project is to develop an automated system capable of recognizing and classifying different medicinal plant species based on the image of its leaf.

* 1. **Motivation**

The motivation behind the " AI-based medicinal plant recognition " project stems from the increasing need for efficient and accurate recognition systems specifically for medicinal plants. Medicinal plants play a crucial role in healthcare, with an estimated 70-80% of the world's population relying on traditional medicine, primarily plant-based, for primary healthcare. However, the identification and classification of medicinal plants can be a challenging task due to the vast diversity of plant species and their morphological similarities.

Traditional methods of medicinal plant identification often rely on expert knowledge and can be time-consuming, making them impractical for large-scale applications. Furthermore, these methods can be prone to errors due to the subjective nature of visual identification and the variability in plant appearance due to factors such as growth stage and environmental conditions.

The advent of machine learning and image processing technologies presents an opportunity to address these challenges. These technologies can automate the process of medicinal plant recognition, making it faster and more accurate. They can also handle large amounts of data, making them suitable for large-scale applications.

In the field of healthcare and botany, an automated medicinal plant recognition system could have significant benefits. For instance, it could enable early and accurate identification of medicinal plants, assist in cataloging medicinal plant species, and aid in biodiversity monitoring. However, developing such a system presents several challenges, including the need for large amounts of annotated medicinal plant images for training the machine learning models and the need to handle variations in plant appearance.

The " AI-based medicinal plant recognition project was motivated by the potential of these technologies to revolutionize medicinal plant recognition and the desire to overcome the associated challenges. The project aims to develop an automated system that can recognize and classify different medicinal plant species based on images, providing a valuable tool for various fields**.**

* 1. **Language Used**

The project is built using a combination of C# and Python programming languages, leveraging their respective strengths. It utilizes several libraries to perform various tasks, including Emgu CV for image processing, Tensorflow for machine learning, and Npgsql for database connectivity. The project employs several image processing techniques, including data augmentation and background removal, to preprocess the plant images. The preprocessed images are then used to train a machine-learning model.

* 1. **Technical Requirements**

1. **Programming Languages**: The project is developed using C# and Python. C# is used for its robustness and extensive support for object-oriented programming, making it ideal for building the project's structure and handling database operations. Python, renowned for its simplicity and extensive support for scientific computing and machine learning, is used for implementing machine learning models and image processing tasks.
2. **Machine Learning Library**: Tensorflow and Timm, the open-source machine learning library, is used for building and training machine learning models. It provides a comprehensive ecosystem of tools, libraries, and community resources that allows researchers to push the state-of-the-art in machine learning.
3. **Image Processing Library**: Emgu CV, a cross-platform .Net wrapper to the OpenCV image processing library, is used for image processing tasks. It provides extensive functionalities for processing images and is widely used in real-time image processing.
4. **Database Connectivity**: Npgsql, a .NET data provider for PostgreSQL, is used for database connectivity. It allows the project to interact with the PostgreSQL database, enabling efficient storage and retrieval of plant images and potentially the model's predictions.
5. **Python Runtime for .NET**: Python.Runtime, a part of the Python for .NET package, is used to run Python scripts from the C# code. It provides a powerful application scripting tool and allows C# to use Python libraries.
6. **Operating System**: The project is developed and tested on a Windows operating system. However, with minor modifications, it can be made compatible with other operating systems like Linux or MacOS.
7. **Hardware Requirements**: The project requires a computer with a minimum of 8GB RAM for smooth operation. For training the machine learning models, a GPU is recommended for faster computation, although it's not mandatory as the models can also be trained on a CPU.
8. **Software Requirements**: The project requires a Python environment with Tensorflow installed for running the machine learning scripts. It also requires a PostgreSQL database for storing and managing the plant images and potentially the model's predictions.
   1. **Deliverables/Outcomes**
9. **Automated Medicinal Plant Recognition System**: The primary deliverable of this project is a system that can automatically recognize and classify different medicinal plant species based on images. This system will leverage machine learning and image processing techniques to provide accurate and efficient plant recognition.
10. **Preprocessed Image Dataset**: The project will produce a dataset of preprocessed medicinal plant images. These images will undergo various preprocessing steps such as data augmentation and background removal to improve the performance of the machine learning models.
11. **Trained Machine Learning Model**: The project will deliver a machine learning model trained on the preprocessed image dataset. This model will be capable of classifying different medicinal plant species based on images.
12. **Database of Plant Images and Model Predictions**: The project will set up a PostgreSQL database for efficient storage and retrieval of plant images and potentially the model's predictions. This database will be managed using the Npgsql library in C#.
13. **Project Report**: A comprehensive report detailing the project's methodology, results, and implications will be produced. This report will serve as a record of the project's findings and a guide for future research in this area.
14. **Source Code**: All source code developed for this project will be provided. This includes C# code for the project structure and database operations and Python code for the machine learning models and image processing tasks.