## Final Year Project Proposal

## Department of Software Engineering

## School of Systems and Technology

1) **Project Title**

**PlantTaxa: AI-Driven Solutions for Plant Identification and Climate Adaptation**

#### 2) **Names and IDs of Students**

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#### 5) **Project Description**

**Overview of Topic/Domain:**  
The rising impacts of climate change on plant growth and health are becoming increasingly evident. As unpredictable weather patterns challenge traditional methods of plant care, there is a growing need for innovative solutions. These solutions should aid in plant identification, disease detection, and adaptation to climate changes.

**Description of Project/Problem:**  
Traditional plant management methods struggle to cope with the fast-paced environmental shifts caused by climate change. Plant enthusiasts, gardeners, and landscapers often face difficulties in identifying plants, diagnosing new climate-driven diseases, and adjusting care strategies. The problem becomes more pronounced as many plants look similar under different environmental conditions, making accurate identification difficult. Moreover, adapting plant care to shifting climates is a complex and resource-intensive task. There is a gap in the market for a comprehensive solution that combines accurate plant identification, disease diagnosis, and climate adaptation advice.

**Solution to Explore:**  
PlantTaxa aims to develop an AI-powered web platform that provides:

* **AI-based Plant Identification**: Users can upload images of plants or describe symptoms to get accurate plant identification.
* **Climate Adaptation Recommendations**: Based on the geographical and climatic conditions, the platform will offer tailored care advice.

**Expected Results/Product:**  
The expected product is a user-friendly platform that combines AI capabilities for plant identification and disease diagnosis, with personalized advice on climate adaptation. The platform will empower users to better manage plants, helping them identify species, detect diseases, and make informed decisions to adapt to environmental changes.

#### 6) **Major Features/Requirements/Objectives (Tentative)**

#### **Functional Requirements:**

The **functional requirements** for the PlantTaxa platform are designed to provide users with essential tools and features to effectively manage and care for their plants. A central component of the platform is the **User Management System**, which ensures secure user registration, login, and profile management. This system will allow users to create accounts, receive email verification, and recover passwords if forgotten, thus maintaining a secure and personalized experience. Once logged in, users can easily update their profiles and manage settings, ensuring a tailored platform experience while also protecting their personal data.

A primary feature of the platform is the **AI-based Plant Identification System**, which will enable users to upload images of plants or describe their characteristics to identify plant species. The system will leverage advanced machine learning models, particularly **Convolutional Neural Networks (CNNs)**, to accurately process the images and offer plant identifications. The AI model will be trained on a diverse collection of plant data, allowing it to recognize a wide range of species even when they appear similar. This feature aims to make plant identification faster and more accurate, even in cases where the plant is under various growth conditions, helping users identify new plants and ensuring they provide proper care.

The platform will also incorporate a **Disease Detection Component**, where users can upload images of plants displaying symptoms of illness, such as leaf spots, discoloration, or wilting. The AI will analyze these images to detect potential plant diseases by comparing the symptoms to an extensive database of common plant health issues. Once a disease is identified, the system will suggest effective treatments and care strategies to help users address the problem promptly, which can prevent further damage to the plants. This functionality is vital for early disease detection and provides a proactive approach to plant care.

Additionally, the platform will feature **Climate Adaptation Advice**, offering tailored care recommendations based on the specific plant species and the local climate. By using information such as the user’s geographical location and the plant’s needs, the platform will provide advice on how to adjust watering schedules, sunlight exposure, temperature management, and other care practices according to the weather patterns in the user’s area. This feature will ensure that plants can thrive even in regions with extreme weather or shifting environmental conditions, contributing to more sustainable plant care practices.

The platform will also include **Community Features** to foster interaction among users. These features will consist of discussion forums where users can ask questions, share experiences, and offer advice on plant care. Whether users are seeking help with identifying a plant, solving a plant health issue, or learning new tips for plant care, the community forums will offer a space for valuable knowledge exchange. Users will also be able to post their experiences and plant care success stories, helping to create a collaborative learning environment for plant enthusiasts of all levels. By participating in these forums, users can not only gain insights but also build connections with others who share similar interests in plant care.

### **Non-Functional Requirements:**

The non-functional requirements for PlantTaxa ensure that the platform operates efficiently and provides a high-quality user experience, even as the user base grows. First and foremost, the platform must be **scalable**, meaning it should be capable of handling increasing amounts of data and user traffic without compromising on performance. As the platform attracts more users and processes more plant images, it should maintain responsiveness and efficiency. **Security** is another crucial aspect of the platform. User data, including personal information and images, must be protected using industry-standard security measures. The platform should implement **SSL encryption** for secure communication, **JWT tokens** for user authentication, and adhere to best practices for data protection, ensuring the safety and privacy of all users. In terms of **user experience**, the platform must offer a **responsive UI/UX**, which means it should function seamlessly across both desktop and mobile devices. The interface should be intuitive, easy to navigate, and provide a smooth user journey, ensuring users can quickly and efficiently access the platform’s features. **Reliability** is another non-functional requirement, which ensures that the platform is always available with minimal downtime. The system should be able to recover swiftly from any issues, providing fast response times and maintaining its functionality under heavy use. Lastly, the platform must be fully compliant with **privacy regulations**, such as **GDPR**, to protect user data and ensure transparency. This includes giving users control over their personal information, with options to manage or delete their data as required by law.

**Objectives:**

1. **Enhance Plant Care Management**: Provide users with accurate, AI-powered plant identification and climate-adaptation advice.
2. **Provide Personalized Recommendations**: Offer tailored plant care recommendations based on the user's climate and plant health status.
3. **Increase User Engagement**: Foster a community of plant care enthusiasts who can interact and share advice.

#### 7) **Artificial Intelligence Features/Requirements/Objectives (Tentative)**

**AI Functionalities:**

* **Image Recognition for Plant Identification**: Use Convolutional Neural Networks (CNNs) to identify plant species from images.
* **Disease Detection via Symptom Analysis**: Implement machine learning algorithms to detect plant diseases based on uploaded images or symptoms described by users.
* **Climate Prediction and Adaptation**: Develop AI models that use weather data to predict environmental stress and offer care recommendations (e.g., drought-resistant practices or disease management).

**AI Requirements:**

* **Deep Learning Models** for image recognition and disease diagnosis.
* **Data Collection and Preprocessing**: Gather diverse datasets of plants and diseases to train the AI models.
* **Model Evaluation and Tuning**: Ensure the AI models provide accurate predictions and improve over time.

#### 8) **Research-related Projects Features/Requirements/Objectives (Tentative) (Optional)**

For this project, we will investigate:

* The effectiveness of AI-based plant identification systems compared to traditional plant identification methods.
* How accurately AI models can diagnose plant diseases in varying climatic conditions.
* The impact of climate-specific recommendations on plant health, growth, and disease prevention.

The software developed will be used to test these hypotheses by providing users with real-time plant care suggestions and analyzing plant health data collected through the platform.

#### 9) **Target Users/Beneficiaries of the Proposed System**

**Target Users:**

* **Plant enthusiasts and hobbyists**: Individuals passionate about growing and maintaining plants.
* **Professional gardeners and landscapers**: Users who need to manage plant health across a range of conditions.
* **Environmentalists and sustainability advocates**: People interested in managing plants in line with climate change adaptation strategies.

**Importance:** This project will provide plant owners with an innovative tool to identify plant species and diagnose diseases, crucially addressing the challenges posed by climate change. The platform’s tailored climate adaptation advice can help users better care for plants, potentially improving their yields, health, and overall sustainability. The platform will also contribute to environmental conservation efforts by encouraging responsible and informed plant care practices.

#### 10) **Tools/Technologies (Tentative Listing)**

**Development Tools:**

* **Visual Studio Code**: IDE for coding.
* **Git & GitHub**: Version control and collaboration.
* **Jira**: Project management and task tracking.

**Frontend Technologies:**

* **React.js**: For dynamic user interfaces.
* **Redux**: For state management.
* **HTML5 & CSS3**: For webpage structure and styling.

**Backend Technologies:**

* **Node.js**: Server-side JavaScript environment.
* **Express.js**: Web framework for RESTful APIs.
* **MongoDB**: NoSQL database for plant data storage.

**AI Integration:**

* **TensorFlow or PyTorch**: For building AI models (e.g., CNN for image recognition).
* **OpenCV**: For image preprocessing and manipulation.

**Security:**

* **JWT (JSON Web Tokens)**: For user authentication.
* **SSL Encryption**: For secure communication between clients and servers.

#### 11) **Cloud Platform Being Used (Tentative Listing)**

We plan to use **Amazon Web Services (AWS)** for hosting and **Google Cloud AI Services** for implementing machine learning models, particularly for plant identification and disease detection. If needed, we may also consider **Microsoft Azure** for its machine learning and database services.

#### 12) **External Collaboration/Funding (if any) + Paid or Unpaid (Confirmed or Expected)**

Currently, we are exploring potential partnerships with local nurseries and environmental organizations to enhance our dataset and receive real-world feedback on the platform's efficacy. There is no confirmed external funding at this point, but we anticipate possible collaboration with environmental organizations for future scalability.