**CSE / EEE / ETE 499A (Section 4)**

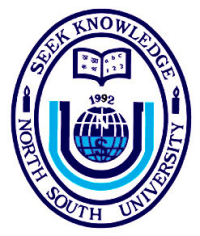
**Project Impact and Constraints (CO4)**

**Project Title:** Plant Diseases Detection Using Image Processing

**Submitted To**

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**Group No: G-3**

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# **Economics (cost) impact:**

Our project is entirely software-based and operates virtually, so traditional tax incentives like those for renewable energy or carbon reduction aren’t directly applicable. These incentives typically focus on physical products that reduce environmental impact through sustainable materials or energy efficiency. However, because our tool supports sustainable agriculture by helping to reduce the use of pesticides and improving crop health, we might explore research and development (R&D) tax credits if we decide to commercialize the project in the future.

As for economic costs related to environmental aspects, we’re keeping these minimal by using resources that are either freely accessible or already available. We’re using datasets that are freely accessible online, so there’s no cost for data acquisition, and our existing high-end personal computers meet the project’s computational demands. However, since the project involves continuous training and refinement, our devices will be in regular use, which could eventually lead to wear and require backup hardware if anything goes wrong. While ongoing costs for power and internet are minor, the environmental and economic impact of our project remains low, making it a cost-effective solution for virtual deployment.

# **Environmental impact:**

**Reduction in Emissions:**

Since the system promotes a data-driven approach to disease management, farmers can reduce the number of trips and machinery use for manual inspections or preventive treatments. This shift lowers fuel consumption and, subsequently, emissions from farm equipment, creating a more environmentally friendly approach to field management. It also reduces the need for excessive chemical treatments, such as pesticides and fungicides, which are often applied preventively and in excess due to uncertainty about disease spread. This reduction in chemical use lowers greenhouse gas (GHG) emissions linked to the production and application of these chemicals. Additionally, the decreased need for large-scale chemical production and transportation translates into reduced industrial emissions, further benefiting air quality and lowering overall agricultural emissions.

**Changes in Resource Use Patterns:**

The plant disease detection system encourages more targeted application of water, nutrients, and pest control substances. By pinpointing areas affected by disease rather than applying resources uniformly, this technology helps conserve water, reduce pesticide use, and optimize nutrient application. This precision application minimizes waste, conserves valuable resources, and mitigates the runoff of agricultural chemicals, thus protecting surrounding ecosystems from contamination and preserving water quality.

**Reliance on Abundant Resources:**

The system relies primarily on accessible resources, including open-source datasets and existing hardware, to process and classify images. This approach avoids dependence on rare materials and scarce resources, making it scalable and sustainable. The computational tools used in model training and deployment do not require resource-intensive or specialized hardware, ensuring that the project remains cost-effective and environmentally sustainable.

# **Social impact:**

**Impact on People's Lives:**

The plant disease detection system has a significant positive impact on farmers, agricultural workers, and communities by enabling early detection and targeted intervention for crop diseases. By reducing crop losses, it helps improve farm productivity and economic stability for farmers, contributing to local food security and sustainable livelihoods. This system also allows small-scale farmers with limited resources to access precise, efficient disease management solutions, potentially leveling the playing field in agriculture.

**Addressed Community and Personal Needs:**

**Community Needs**: The technology supports food security at a community and regional level by enhancing crop yield and reducing the risk of food shortages caused by undetected plant diseases. Additionally, the system’s capacity to optimize resource use (like water and pesticides) resonates with sustainable community goals, contributing to reduced environmental degradation, which benefits the community at large.

**Personal Needs**: For individual farmers, this technology provides a tool for maintaining healthier crops with less guesswork. Reduced crop loss means greater financial stability and decreased dependence on costly pesticides, which is particularly beneficial for smallholder farmers. This also meets a personal need for farmers to ensure their crops are safe, healthy, and market-ready.

**Safety Aspects and Health Concerns:**

**Reduced Chemical Exposure**: By decreasing the need for widespread chemical pesticide applications, the system reduces potential health risks to farmers and workers exposed to these chemicals. This also benefits consumers by reducing chemical residues on food products, supporting safer food consumption.

**Enhanced Crop Health Management**: The technology promotes a preventive approach, reducing the likelihood of severe disease outbreaks that could lead to drastic and hazardous treatments. Early intervention minimizes heavy pesticide use, contributing to safer agricultural practices and reducing potential health impacts for surrounding communities.

**Regulation Constraints Addressing Social and Environmental Concerns:**

**Adherence to Environmental Standards**: The system aligns with regulations aimed at reducing chemical usage and pollution in agriculture. By limiting the need for pesticides, the product aligns with regulatory efforts to minimize chemical runoff and its environmental impact.

**Compliance with Health and Safety Standards**: The technology also adheres to safety regulations by supporting responsible pest management practices, helping farmers reduce exposure to potentially harmful chemicals. This proactive alignment with agricultural regulations may simplify adoption and compliance with local and international agricultural policies.

# **Legal considerations and constraints**

The legal considerations and constraints for our plant disease detection system involve adhering to various regulatory standards to ensure efficiency, security, and compliance. Key aspects include designing for energy efficiency and protecting sensitive crop data according to privacy regulations. The limitations of current CNN technology will inform model optimization for reliable detection. We will follow IEEE standards and best practices to maintain quality and scalability in our system. If we implement network access, standardized protocols like IPv4/IPv6 and secure SSL/TLS measures will be used for safe data transfer. The development will utilize tools such as Python, TensorFlow, and Keras, which are open-source and widely supported, ensuring accessibility and community backing. Additionally, adhering to ISO 9001 quality guidelines will help create a robust design process. By leveraging these legal and standardization considerations, we aim to develop a reliable, secure, and compliant system for plant disease detection.