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Budhanilkantha School's

Smart Farm and It's Ecosystem

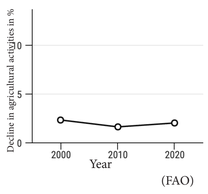
Not just any smart farm, but a farm that is driven with innovation..

INTRODUCTION

A **SMART FARM** is an advanced agricultural system that utilizes cutting-edge technologies to optimize farming operations to increase productivity and efficiency. It incorporates variety of technology such as **IoT (Internet of Things)**, data analysis, **automation** and **machine learning** to create an **intelligent farming ecosystem** which aims to reduce human touch to **almost 0 percent.** Such farms maximize crop yields, ensure efficient resource utilization, reduces waste and the **real-time** data collection and analysis from this farm provides the farmers with valuable insights to their operations.

PROBLEM IDENTIFICATION

DECLINING AGRICULTURAL ACTIVITIES



(FAO)

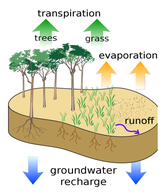
FOOD INSECURITY

811 million individuals (10% of total world population suffer chronic

PESTICIDES AND FERTILIZER

Synthetic fertilizers use have increased significantly over 50 years disturbing different eco-systems.

WATER LOSS IN AGRICULTURE



Ineffective water management system are decreasing crop's yield.

CLIMATE CHANGE

Climate change is decreasing crop's yield by 2% every year.

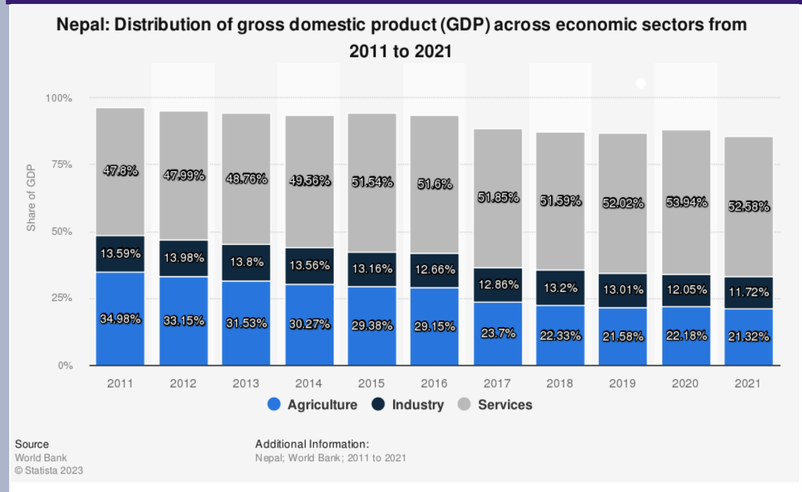
CROPS INFECTED WITH DISEASES

Climate change is decreasing crop's yield by 2% every year.

SIGNIFICANCES

- Promoting **sustainable farming practices** can boost productivity while reducing environmental impact.
- **Precision agriculture** can increase crop yields by up to 14%, according to a Nature study.
- **Precision agriculture** techniques optimize resource use through **GPS-guided machinery** and **remote**
- **Timely interventions** and **optimized resource allocation** improve yields. **Sustainable practices** and **advanced technologies** minimize waste and environmental consequences.
- **AI-powered systems** analyze **satellite imagery**, **drone data**, and **sensor inputs** for **crop monitoring**.
- **Monitoring crop health**, **identifying pests**, and assessing soil conditions allow timely actions.

AGRICULTURE IN CONTEXT OF NEPAL



The specific problem our smart farm prototype aims to address is the **optimization of resource utilization** in the context of agriculture, with the focus on **water management, disease detection** and **maximization of crop yield**.

Traditional farming often results in inefficient resource utilization and **semi-optimal crop production**. Loss of crop due to pest and **disease outbreaks**, limited control over aspects of cultivation, **water scarcity** and **lack of data-driven decision making** is a major issue caused through the use of traditional agriculture.

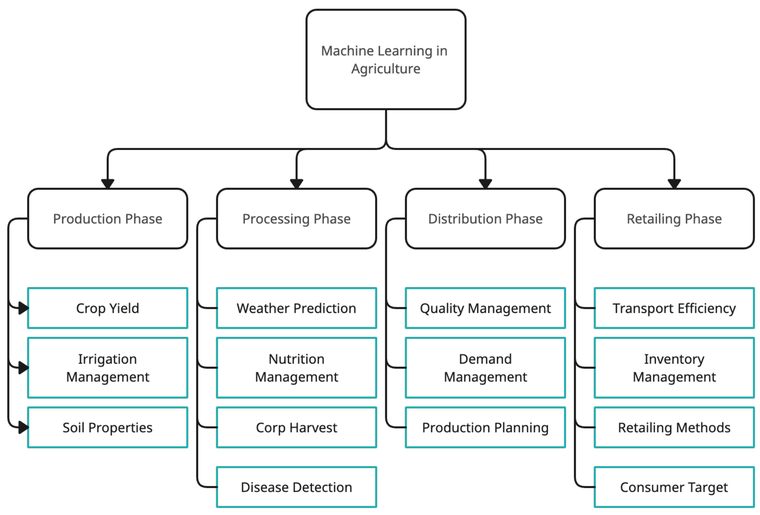
Our smart farm helps tackle all these major issues through **automation and labor efficiency** as it reduces labor costs and enhances productivity and offers significant advantages in terms of **resource optimization sustainability.**

In the context of our country, **agriculture holds a share of 21.32%** in the GDP. With 30% of our land being used for agriculture, we can inference that it holds a major role for our country's economy.

The cost effectiveness of our prototype along with maximizing the crop yield, also tries to **maximize the profit gained**, helping tackle the **economic backwardness.**

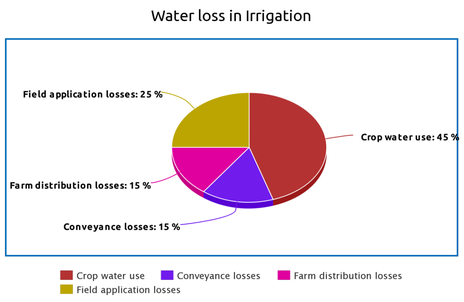
CONCEPT VISUALIZATION

IMPLEMENTATION



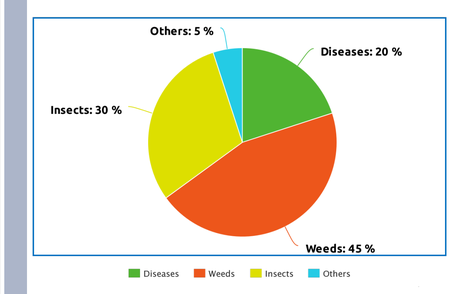
AIMS AND OBJECTIVES

WATER AND RESOURCE MANAGEMENT



Leak Detection: AI algorithms analyze sensor data to detect and locate leaks, while ML models learn from historical data to identify leak patterns, raising alerts for prompt maintenance and reducing water loss.
Smart Irrigation:
AI-powered smart irrigation monitors soil moisture, weather, and plant data to optimize watering schedules. ML models learn from sensor data to minimize water waste by delivering the right amount of water to plants.
Resource Management:
The ecosystem uses IoT, data analytics, and automation to optimize agriculture, enhance productivity, and promote sustainability.

FOOD SECURITY

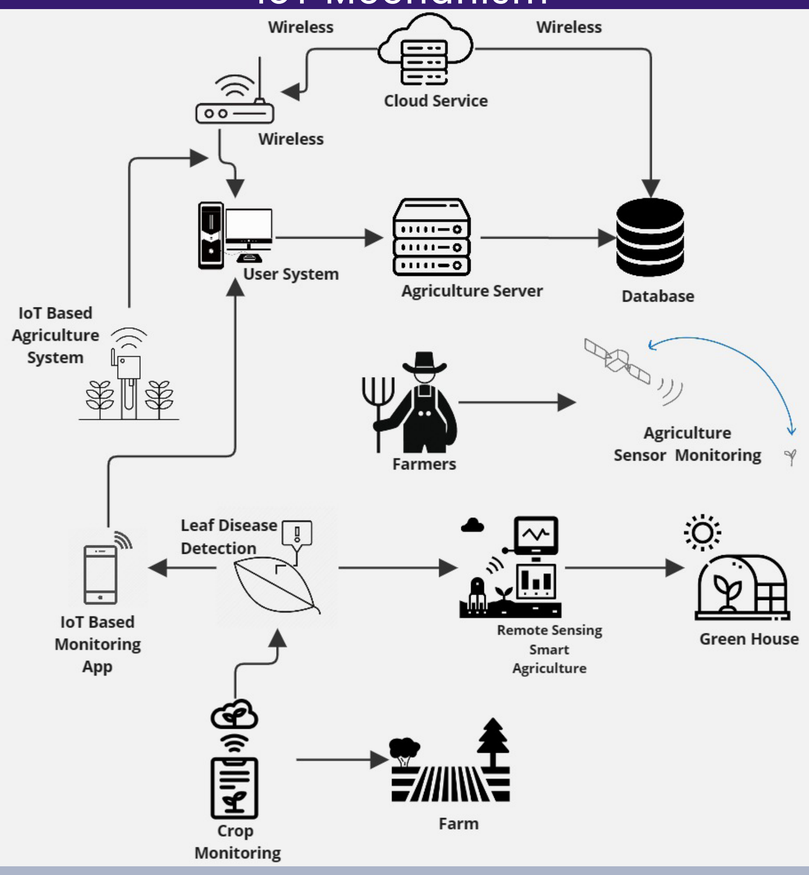


An estimated 10-16% of **global harvest (or US$220 billion worth) is lost** to plant pests every year, according to the Food and Agriculture Organization of the United Nations (FAO)

- **Precision Agriculture**: AI utilizes data from sensors, satellites, and drones to optimize irrigation, fertilizer usage, and pest control, leading to increased crop yields and reduced resource waste.
- **Crop Monitoring**: AI enables farmers to monitor crops, soil conditions, and weather patterns, providing valuable insights for informed decision-making and efficient farming techniques.
- **Food Safety Assurance**: AI assists in identifying contaminants, pathogens, and quality issues in food products, ensuring the safety and quality of food before it reaches consumers, reducing the risk of foodborne illnesses.
- **Enhanced Efficiency**: By integrating AI, agricultural processes become more efficient, enabling early detection and prevention of issues, resulting in improved productivity and reduced costs.

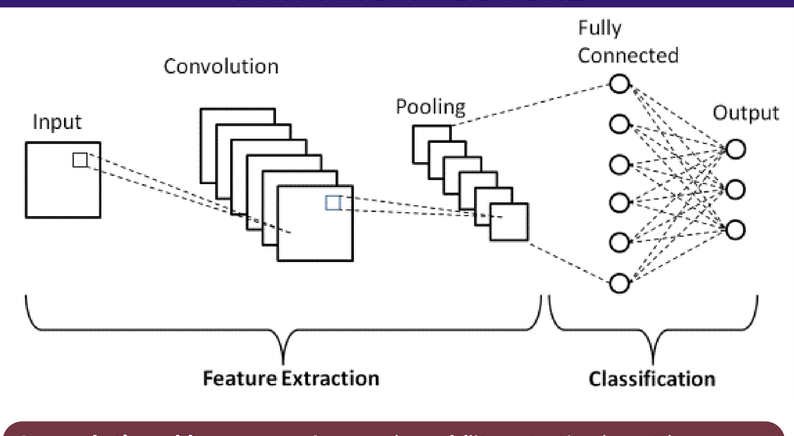
METHODOLOGY

IoT Mechanism



MACHINE LEARNING

CNN ARCHITECTURE



Convolutional layers apply a series of filters to the input image, extracting features and aspects of the image.

Pooling layers reduce the spatial dimension whilst preserving important information and reduces **computational complexity**.

The fully connected layers perform the classification task combining features from the previous layers to **make a prediction.**

INCEPTIONV3 MODEL

The **InceptionV3**, an image **recognition model** demonstrated higher than **78.1%** accuracy on the ImageNet dataset. The model is a synthesis of numerous concepts created over time by numerous academics.

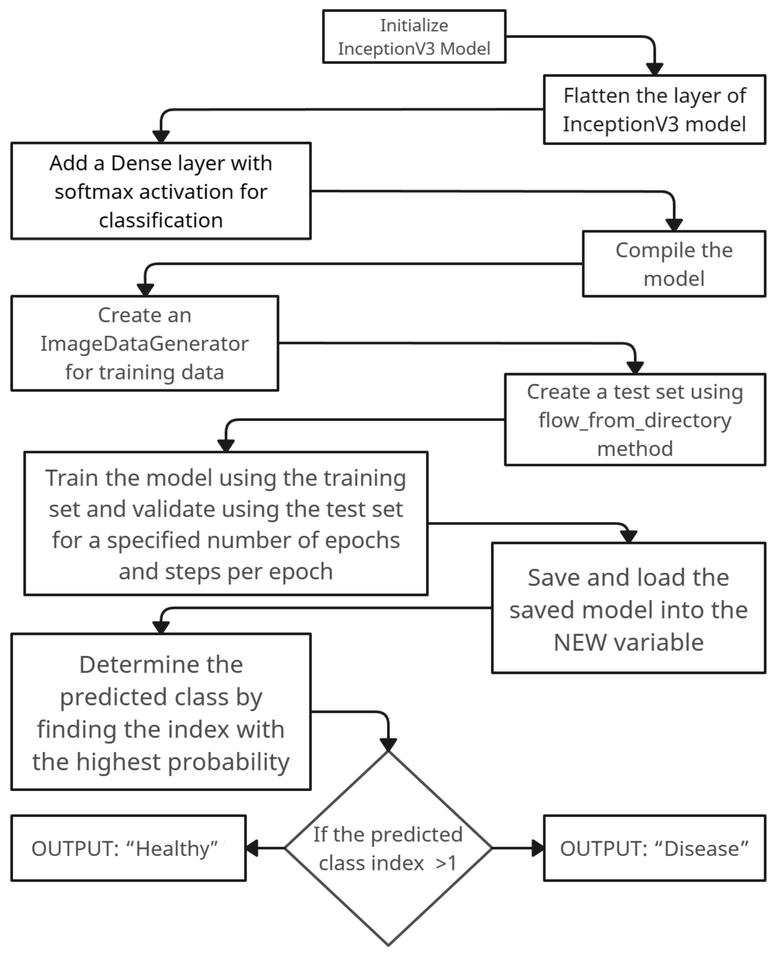


IMAGE CLASSIFICATION WITH MACHINE LEARNING

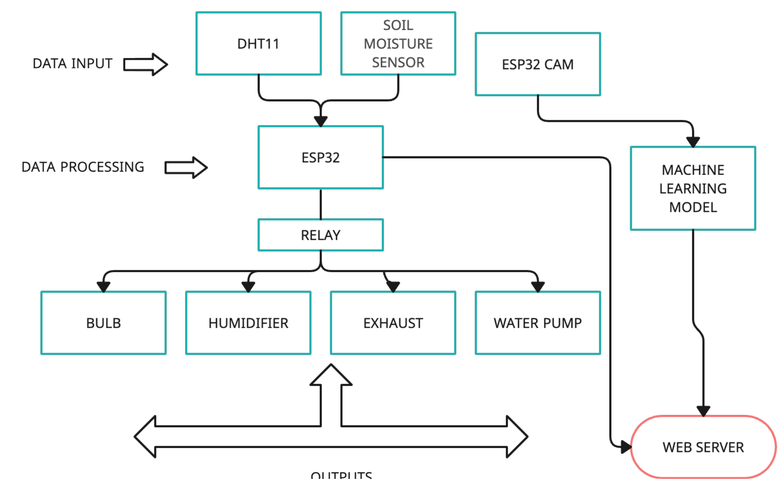
CLASS INDEX > 1 (HEALTHY PLANT)

CLASS INDEX < 1 (DISEASED PLANT)

WITH THE HELP OF **MACHINE LEARNING (ML)** WE CAN CLASSIFY PLANTS AS HEALHTY OR UNHEALHTY.

DATAS LIKE **TEMPERATURE** AND **HUMIDITY** ARE ANALYSED AND MAINTAINED FOR THE PREVENTION OF REDUCED YIELD OF CROPS

OUR PROTOTYPE



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ACKNOWLEDGEMENTS

Budhanilkantha Administration
Makerspace
Knowledge Park
Faculties of Budhanilkantha School
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