

# Irrigation Water Management

This project focuses on optimizing irrigation water use in Egypt, specifically in a farm located in **El Nobaria**, to address the critical issue of water scarcity. Irrigation is essential for agriculture, particularly in regions with insufficient rainfall, and plays a crucial role in increasing crop yields and mitigating climate-induced challenges. Our approach combines linear programming and machine learning techniques to develop an efficient irrigation management system.

Drip irrigation, a water-efficient method that delivers water directly to plant roots, is the irrigation system used in this study. This method helps conserve water and nutrients by minimizing evaporation and runoff, making it ideal for arid regions like Egypt. The project aims to enhance water use efficiency and reduce water costs by minimizing the total quantity of irrigation water used throughout the season, thereby contributing to sustainable agriculture and food security.

The historical evolution of irrigation methods highlights the shift from ancient techniques like surface and basin irrigation to modern methods such as sprinkler and drip irrigation. Drip irrigation, in particular, offers significant advantages in terms of water use efficiency and crop yield.

By leveraging machine learning, we aim to predict crop water needs accurately, optimize irrigation schedules, and detect anomalies in irrigation systems. This innovative approach not only improves water use efficiency but also enhances crop productivity and sustainability in the agricultural sector. The project underscores the importance of advanced technologies in addressing the pressing challenges of water management and food security in Egypt.

Throughout the project, agricultural experts provided close oversight, accurately validating each step to ensure the results aligned with agricultural principles and yielded practical applications. This rigorous oversight by agricultural specialists guaranteed the project's adherence to sound agricultural practices. Their meticulous validation at every stage ensured the results were not only accurate but also directly applicable to real-world agricultural scenarios.