

## **Objective:**

The goal of this project is to monitor and quantify the work progress on a solar site by analyzing drone images captured periodically (daily or weekly). The analysis will classify various elements on the ground (e.g., land, poles, solar panels) and calculate the percentage of work completed based on a comparison of images over time.

## **Process Workflow:**

### **1. Image Capture:**

Drone images are captured over the entire field of solar modules. These images should cover all areas to ensure accurate progress tracking.

### **2. Image Stitching:**

The individual drone images are stitched together using an algorithm to form a single large, comprehensive image of the site. This ensures that the entire field is represented in a unified view.

### **3. Image Slicing:**

The large stitched image is divided into smaller, lightweight sub-images. This step facilitates easier processing for segmentation by reducing the computational load.

### **4. Image Segmentation:**

Each sub-image is processed through a trained segmentation model (e.g., U-Net). The model classifies and segments different objects on the ground (e.g., unlabelled areas, boundaries, land, poles, solar panels).

### **5. Reassembling Sub-Images:**

After segmentation, the sub-images are rejoined to form the large segmented image, ensuring that each segment is placed in its correct position according to the initial slicing pattern.

### **6. Pixel Analysis for Classification:**

The segmented image is then analyzed at the pixel level. Each pixel is classified into predefined categories, such as:

- a. Unlabelled areas
- b. Boundaries

- c. Land
- d. Poles
- e. Solar panels

Based on this classification, the area covered by each class is calculated.

#### **7. Data Storage:**

All relevant data, including image analysis results and pixel classifications, are stored in an Excel file. This file is updated dynamically with each new set of images.

#### **8. Class Weight Assignment & Work Percentage Calculation:**

Weights are assigned to each class based on their contribution to overall work progress (e.g., 100% for solar panels, 40% for poles, etc.). The percentage of work done by each class is calculated using the pixel distribution and class weights.

#### **9. Work Progress Comparison:**

The total work completed is summed up, and the difference between two sets of images (e.g., weekly comparison) is calculated. This allows for tracking incremental progress over time.

#### **10. Progress Storage:**

The calculated differences in work done are stored in the Excel file as separate columns for each image set, enabling easy tracking of progress across multiple time periods.

#### **11. Completion Date Prediction:**

Based on the cumulative work progress and rate of change, the system predicts the estimated completion date for the project. This prediction can be used for project management and scheduling.