DATABASE DESIGN

PRJ381

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BELGIUM CAMPUS IT-VERSITY

Database and Analytics

ANALYTICS

Below are some analytics that could be ran related to hyacinth tracking:

- **Seasonal Water Hyacinth Growth Analysis**
  Track seasonal growth patterns of the water hyacinth by tracking the area covered by water hyacinth over different seasons and years.

- **Analyse NDVI/EVI trends across different seasons and year for vegetation analysis**
  The average NDVI and EVI values of each image will be stored in the database.

$$NDVI\ (mean) = \frac{\sum NDVI\ values}{Number\ of\ pixels}$$

  This will allow a new column called "Vegetation Density " to be created:

  - $NDVI < 0.2$: Low vegetation density (no vegetation)
  - $0.2 \leq NDVI \leq 0.5$: Moderate vegetation density
  - $NDVI > 0.5$: High vegetation density

- **Investigate weather factors**
  Investigate the influence of weather factors on the growth and distribution of the hyacinth mat (look at % or area of dam covered by the mat, $\frac{\sum binary\ pixels}{number\ of\ pixels}$) . Factors to consider:
  - Temperature,
  - Season,
  - Humidity**? (ask Thandeka if humidity I available)**

- **Analyse historical data to forecast potential future infestation hotspots.**
  Use clustering algorithms (like DBSCAN or K-Means) to detect spatial hotspots where hyacinth is likely to grow based on historical spatial distribution data.

DATABASE DESIGN:

Raw images will be stored in the cloud.
It is not practical to store raw images in the database, due to the file sizes that may reduce performance.

Tables:

1. Image Table

Columns:

- image_id (Primary Key)
- date
- satellite_name (Landsat 8)
- NIR_band
- RED_band
- BLUE_band
- file_location

2. Weather Table

Columns:

- weather_id (Primary Key)
- date
- temperature
- wind_speed
- wind_direction
- humidity

3. NDVI_EVI Table

Columns:

- ndvi_evi_id (Primary Key)
- image_id (Foreign Key to the Images Table)
- pixel_x (X coordinate of the pixel)
- pixel_y (Y coordinate of the pixel)
- NDVI_value
- EVI_value
- vegetation_density

4. Seasonal_Analysis Table

Columns:

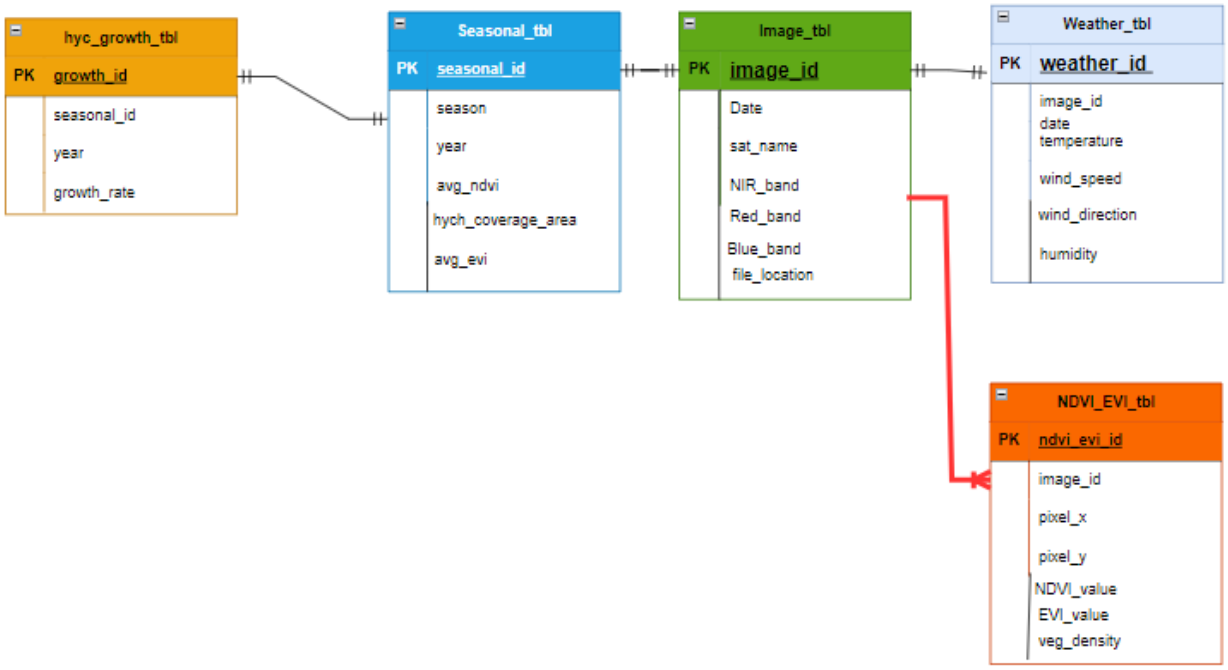
- seasonal_id (Primary Key)
- season (e.g., Summer, Winter)
- year
- average_ndvi
- average_evi
- hyacinth_coverage_area

5. Hyacinth_Growth_Analysis Table

Columns:

- `growth_id` (Primary Key)
- `seasonal_id` (Foreign Key to Seasonal_Analysis Table)
- `year`
- `hyacinth_growth_rate` (Percentage increase or decrease)

ERD Design:



The relationship between the NDVI_EVI table is yet to be finalised; the manner in which the pixels are stored will determine the nature of the relationship.

*__Suggested storage: text file holding pixel values.__