README - IoT-Integrated Leaf Area Measurement System

This project implements a Python-based graphical interface and image processing pipeline for real-time groundnut leaf area measurement. The system integrates a camera, GUI (via Tkinter), motor control (via Arduino), and a trained CNN model to detect leaf boundaries, calculate dimensions, and control imaging hardware.

It is part of the research paper:

"IoT-Integrated Image Processing for Precise Groundnut Leaf Area Measurement in Agriculture"

FEATURES

- Graphical UI with image visualization
- Real-time camera input using OpenCV
- CNN model integration using Keras & TensorFlow
- Dimension checking (in cm) using contour analysis
- Motor control via Arduino using pyfirmata
- Interactive capture, measurement, and control system

REQUIREMENTS

- Python 3.7+
- Arduino board connected via COM port (e.g., COM3)
- Required Python packages:

  pip install opencv-python imutils numpy tensorflow keras pillow pyfirmata pygame

MODEL

- Uses a pretrained ResNet50-based CNN model

- Load your model as 'nabhan1.model' in the root directory

FOLDER STRUCTURE

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??? code.py # Main Python application with GUI and image processing

??? nabhan1.model # Pretrained CNN model file

??? dataset_link.txt # Link to external dataset

??? img0.png - img22.png # Image assets used in GUI

DATASET

The dataset used for training the CNN (10,000+ images of groundnut leaves) can be accessed here:

[Google Drive Dataset Link]

See dataset_link.txt for more information.

HOW TO RUN

1. Ensure the Arduino is connected and assigned to COM3 or modify the port in the script.

2. Place the CNN model file as 'nabhan1.model' in the same directory.

3. Launch the app:

   python code.py

4. Use the GUI buttons to:

   - Enter leaf ID

   - Turn on camera

   - Capture and analyze leaf

   - Move camera up/down

   - Save measurements

CITATION

If you use this code or dataset in your work, please cite:

Manvani, R., Rajput, M., Yousef, N., Sata, A.

"IoT-Integrated Image Processing for Precise Groundnut Leaf Area Measurement in Agriculture", The Visual Computer (Under Review)

LICENSE

CONTACT

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