Credit Hours System
CMPS446-Image Processing and Computer Vision

Cairo University
Faculty of Engineering

STEP Faculty ID Scanner and Excel Mapper

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1) Introduction

1.1 Overview:

Our project seeks to simplify the process of collecting student data for administrative purposes by developing a system that extracts the student name and ID from images of faculty ID cards. This system is intended to speed up the data entry process for students accessing resources in university spaces, where filling out forms manually can be time-consuming.

1.2 Motivation:

Currently, students need to manually fill out a Google form to access a working space in the Faculty of Engineering, which can take 5-10 minutes. By using our ID scanner, students can simply take a picture of their ID, and the system will automatically process the information, saving time.

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2) Problem Statement

2.1 Description:

The main challenge addressed by this project is the time-consuming nature of manually entering student information for accessing university resources. The project automates this process by extracting the relevant details from faculty ID cards in real-time.

2.2 Challenges:

- Image quality issues (noise, lighting variations, misalignment).
- Presence of Arabic text on IDs which adds complexity for Optical Character Recognition (OCR).

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3) Objectives

The primary goals of this project are:

- Preprocess images to correct distortions and handle lighting changes.
- Locate and segment text areas, specifically student names and ID numbers.
- Recognize characters and store the extracted data in an Excel file.

4) Methodology

4.1 Step-by-Step Approach:

1. **Image Acquisition**: Capture images of the ID card under various conditions (different angles, lighting, noise).
2. **Image Preprocessing**: Use techniques like dilation and erosion to highlight wanted areas in the image and histogram equalization to handle lighting issues.
3. **Text Localization**: Apply edge detection (Canny filter) and contour detection to locate text areas.
4. **Character Recognition**: Implement Optical Character Recognition (OCR) to extract names and ID numbers.
5. **Data Storage**: Store the extracted information in an Excel file using the `openpyxl` library or the `pandas` library

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5) Expected Challenges & Outcomes

- **Lighting Variability**: Dealing with inconsistent lighting conditions.
- **Text Segmentation**: Accurately detecting and isolating text regions.
- **Recognition Accuracy**: Ensuring accurate character recognition, especially for Arabic text.

The system should be able to process faculty ID card images and extract the student's name and ID number. The data will be stored in an Excel file, ready for use in administrative tasks.

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6) How It Works

6.1 Sequence

- Input: The system will take as input an image of the faculty ID card.
- Process: It will locate and extract the student's name and ID number using image processing and OCR techniques.
- Output: The processed data will be stored in an Excel file containing the student's details.

Figure 1 Input Example

7) Non-ideal Input Scenarios

Non-Ideal Situation	Relevant Course Concept	How We Plan to Handle It (Implementation Focus)
Random/Additive Noise (e.g., Gaussian noise from a poor camera)	Use a **Gaussian Filter** to smooth the image and suppress high-frequency noise.	**Linear Filters** (Averaging/Mean, Gaussian Filter)
Impulsive Noise (e.g., Salt and Pepper noise)	Use a **Median Filter**, which is specifically good for impulsive noise and helps preserve sharp edges better than a simple mean filter.	**Non-Linear Filters** (Median Filter)
Uneven Illumination (e.g., shadow across the ID, bright spot from flash)	**Pixel Brightness Transformation - Histogram Processing**	Use **Histogram Equalization** to automatically redistribute the grey levels and effectively "stretch" the contrast across the full range. This compensates for overall poor contrast due to uneven lighting.
Images that are too dark (e.g., taken in a low-light environment)	**Gamma Correction / Log Transformation**	For images that are too dark (details stuck in the low end of the histogram), applying a **Log Transformation** or a **Gamma Correction** with will expand the dynamic range of the dark values, making hidden detail visible
Low Contrast Images (e.g., flat, washed-out appearance)	**Contrast Stretching** (Linear Transform)	Implement a piece-wise linear **Contrast Stretching** function to map a narrow range of input intensity values to a wider range of output intensity values, enhancing the contrast of the important regions (like the text and image area).

Non-Ideal Situation	Relevant Course Concept	How We Plan to Handle It (Implementation Focus)
Skew/Rotation (Image taken at a slight angle/tilt)	**Hough Transform** for line detection	Use **Edge Detection** followed by the **Hough Transform** to find the straight lines forming the border of the rectangular ID card. Once the card's lines/angle are found you can apply an **affine/geometric transformation** to "de-skew" the image so the text is horizontal before passing it to OCR.
Touching/Broken Text/Boundaries (Imperfections that confuse OCR or detection)	**Morphological Operations** (Dilation & Erosion)	Apply **Dilation** to "thicken" the text to help bridge small breaks in broken characters. Apply **Erosion** to "shrink" the text, which can remove small blobs of noise or thin connections between characters. **Opening** (Erosion then Dilation) removes small bright noise features without large scale blurring.

8) Block diagram

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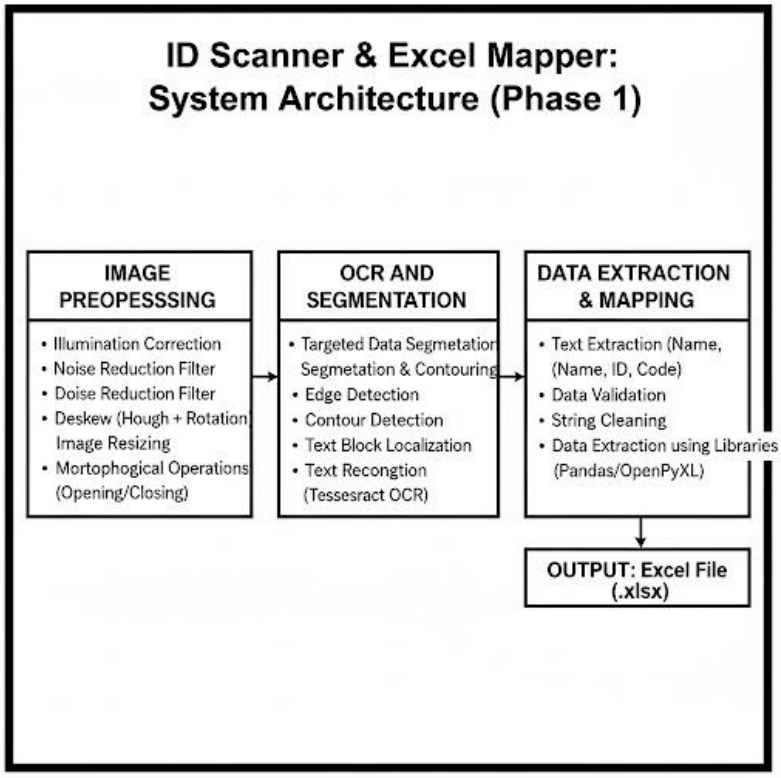

Figure 2 Block Diagram

9) References

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