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Optical Mark Recognition System Using Open-CV

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ABSTRACT: The term "Computer Vision" refers to the procedure of translating an analogue image into a digital format and then processing that image in order to improve its clarity or to extract useful information from it. This technique has now spread rapidly all over the world and implemented in both colleges and schools. As a result of using this technology, organising exams has become a way easier. It's growing cheaper, stronger, and less complicated while the old approach requires specific hardware that proves to be extremely expensive. According to the proposed system, the layout of the answer sheet is developed using a sheet design based on requirements. The OMR technology merely checks to see if designated areas are blank or marked and evaluate the paper.

I. INTRODUCTION

A technology known as OMR (Optical Mark Recognition) is commonly employed in the education industry. It is widely used in schools, colleges, and tests. It has grown considerably more powerful and automated with the use of OMR in the answer sheet verification system. For the time being, the responses are being evaluated by the authorities using a specific scanner, special OMR software, and sheets. Using an ordinary scanner to scan optical forms printed on regular sheets of paper recognise and evaluate the marks from multiple-choice tests on those images [1]. Data from multiple-choice forms can be captured using a technique known as optical mark recognition. Python and an image processing package were used to construct the recognition programme. When the answer sheet is entered into the application, the incorrect answers are highlighted in red while the correct ones are highlighted in green, and the result is written on the optical form image after the answers and blanks are calculated [2].Training and recognition phases of the OMR based on Modify Multi-Connect Architecture (MMCA) associative memory. Multiple or no choices were detected using the approach [3]. OMR cannot be used by small organisations, institutions, or government agencies since it requires a dedicated system to assess the OMR sheet, which is not an economically viable alternative for small organisations. An Image Processing-based method for evaluating the OMR sheet is presented in this paper, which does a good job of finding up OMR answers [4]. It is our goal to make OMR correction smart, clever, and cost-effective by automating the task. If we use this technique, we can create a free solution where the OMR sheet image is fed into an algorithm that evaluates it and returns the scores. It is able to handle images of various orientations, identify responses, and deliver scores in real time. A standard image of an OMR sheet can be used as input; a specialised scanner and special OMR paper are not required.

II. DESIGN AND IMPLEMENTATION CONSTRAINTS

OMR makes data collection more difficult when collecting vast amounts of text. Scan errors, such as those caused by improperly or unnumbered pages can cause data to be lost or scans to be performed in the wrong order. It is possible that a page could be rescanned without controls in place, leading to redundant data and inaccurate results. Because of the extensive use and ease of use of OMR, multiple-choice questions can now form the majority of standardised examinations.

FEATURES OF THE SYSTEM
OMR is a method for automatically capturing and evaluating data in the form of small bubbles or squares in order to generate the precise knowledge needed for a given task. As a result of this work we have developed computerised software and a system that can be used in almost any environment. It is difficult to find a cost-effective

solution in the current market because of the high cost of dedicated scanners, as well as a number of other factors, such as paper and print quality. Scan images of the completed forms are used as input into a computer, which does the calculations and saves the results in a spread sheet that can be easily accessed by end users. The system's platform independence is because towards its hardware independence. Exam evaluation, automated attendance, and surveys are just a few of the many uses for the technology.

III. PROPOSED SYSTEM

Due to the fact that OMR answer sheets are available in a variety of colours, our proposed solution requires students to enter a picture of their response sheet, which must be converted into a single uniform colour before moving on to the next step. As a result, the command RGB to grey is used to create a grayscale version of the original colourful image. We need to apply a padding array of ones and zeros to both rows and columns in order to accurately detect edges. Using this method, we can apply a median filter on the image. As the grey image is converted to black and white, where white represents one and black represents zero.

ADVANTAGES

1. Faster processing and result preparation

Due to the restricted amount of information that is marked on these sheets, this technique gives a wonderful processing speed during evaluation.To determine the final scores, the processed sheet packets can be examined.

2. Optimum Efficiency

The analyzed set of sheets would meet premium quality benchmarks. The result calculation can be verified using simple forefront analysis.

3. Efficient System

The method guarantees convenient storage of these files while being extremely secure. Once the data has been examined, it can be saved online for easier access.

4. Minimal error quotient

The organising authorities utilise an OMR-based application to process the sheets because they are in large bundles. With a zero error count, the data analysed will have an accurate figure.

5. Highly Reliable with minimized cost

The method is quite trustworthy and provides a quick cycle of conducting, gathering, grading, assigning scores, etc. To get a candidate's response, however, only one response sheet is used, which lowers the overall cost of administering the test.
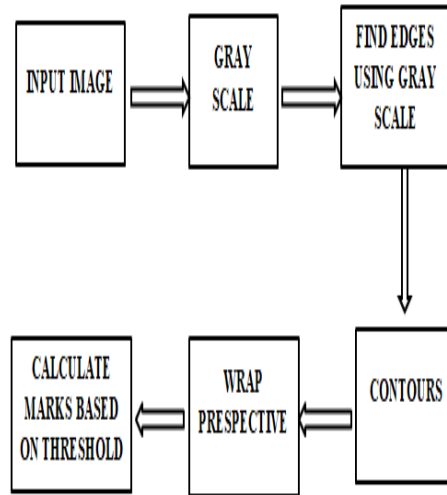
IV. METHODOLOGY

Fig 1: Workflow

GRAY SCALING

In order to eliminate high-frequency noise, we load the image and convert it to grayscale, before blurring it. There are many ways to grayscale an image. For example, an RGB image can be converted to grayscale by using a grayscale converter. It might be completely black or completely white at any particular time. As an example, the implemented Canny edge detection function in the OpenCV library works only on grayscale images.
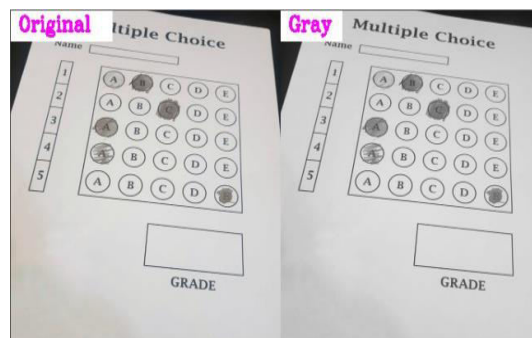

Fig 2 : Original to Grayscale Image

CANNY EDGE DETECTOR

Canny edge detection is used after grayscaling to identify the image outside borders and contours. [5]. There are several steps in the Canny edge detector method that allow it to detect different sorts of edges in images [8].

imgCanny = cv2.Canny(imgBlur,10,70)

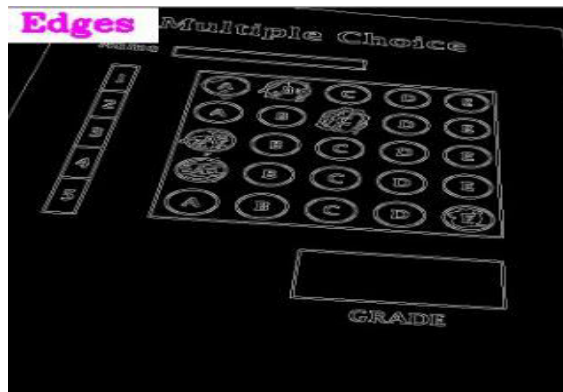**Fig 3 : Edge Detection**

CONTOUR DETECTION & EDGE DETECTION

The cv2 Contours function can now be used to locate the lines that correspond to the image's outline. We accomplish this by classifying our contours according to their total surface area (from largest to smallest). Using this presumption, we can "filter" our contours by looking at their area and assuming the contour that most closely resembles the image will be at the top of our list of candidates. However, in addition to the area and size of the contour, we must also consider the number of vertices [7]. Checking to verify if our approximated contour has four points leads us to believe that we have located the images.
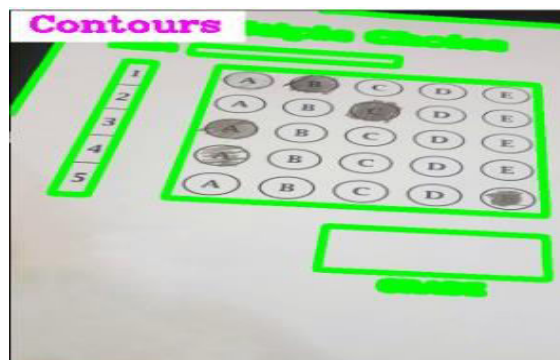

Fig 4 : Contour Detection

THRESHOLD

We now have a binary image as a result of Otsu's thresholding approach. We will be able to use contour extraction techniques to identify each of the bubbles in the image as a result of this binarization [6]. In order to identify bubbles in an image, we first loop over the contours. We can calculate the aspect ratio, or the width-to-height ratio, for each of these contours by computing the bounding box. Finally, we can use our OMR system's "grading" feature to determine a student's final grade based on the answer key.

Fig 5 : Threshold Image

PERSPECTIVE TRANSFORMATION

To get a clear view of our paper, we can apply a perspective transform to the image after tracing its shape. Warp An evaluation that seems "skewed" when seen from the perspective function is transformed into a top-down view of the document. To get a 90-degree view of the document, we first performed a perspective transform to the image, which is a method of separating the foreground from the backdrop.
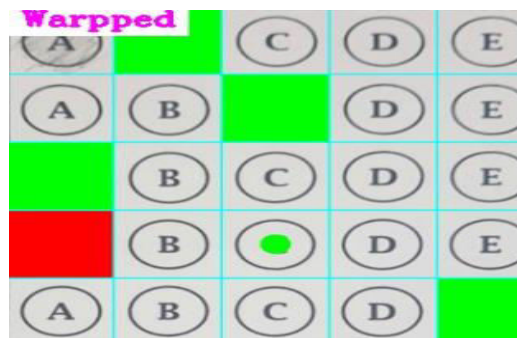

Fig 6: Warpped Image

V. RESULT

Using an OMR device, you can evaluate if specified regions are blank or have been inscribed in any manner based on the threshold value. This software program can reduce the cost and it can analyse the image and locate the answers given by students. The answer key is also used to determine the student's score in this system.
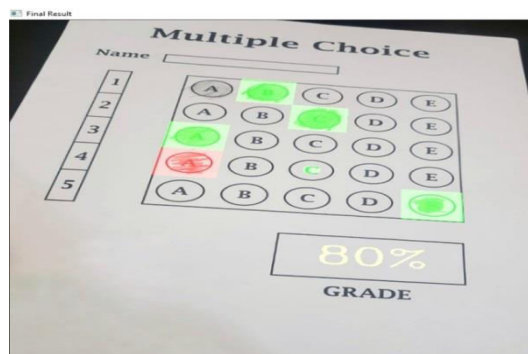

Fig 7 : Output Image

VI. CONCLUSION

We have developed low-cost and high-accuracy software for evaluating OMR forms. Current heavy equipment, which includes expensive customized scanners that accomplish the same goal with various dependencies and severe limits, can readily be replaced by this approach. Images are fed into a computer system, which then does the computations and stores the results in a spreadsheet that can be understood by the common people. The system is platform-independent because it is isolated from the underlying hardware and software. Uses for the system include exam evaluation, automated attendance tracking, and surveys. Results from the experiments show that the suggested system is robust and correct, and therefore it is invariant to colour, brightness, and affine transformations.

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