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DUAL PAGE LOW COST SCANNER

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ABSTRACT : *Scanning more than one page using a simple scanner is a time consuming and tedious process. The purpose of our system is to use a simple low cost setup to obtain an image which is a representation of multiple pages and use image processing in MATLAB (MATrix LABoratory) software to separate out the pages. The technique used is based on thresholding and subtraction of images. The results of the prototype program are very promising as it was able to separate out the front side of the page used from its back side using thresholding technique. On the separated pages, image compression technique like JPEG (Joint Photographic Experts Group) was used to reduce the image size.*

Keywords – *filter, image processing, scanning, subtraction, thresholding*

I. INTRODUCTION

The field of digital-image processing has experienced dramatic growth and increasingly widespread applicability in recent years. Analysis of document images for information extraction has become very prominent in recent past. Wide variety of information, which has been conventionally stored on paper, is now being converted into electronic form for better storage and intelligent processing. Image processing involves changing the nature of an image in order to improve its pictorial interpretation, efficient storage and quality control. This article examines the various methods used for document image processing such as thresholding, image subtraction and filtering in order to achieve a processed document having high quality, accuracy and fast retrieval.

Limitations of conventional scanners: Previous scanner designs like flatbed scanner [3], can only scan one side of a single page making it extremely slow in processing multiple pages. Sheetfed scanner [7] can scan both sides of a single page but is bulky and expensive. Handheld scanner [8] can only scan single line of a single page or barcodes or QR codes and is extremely slow if used to scan multiple pages. This prototype scanner can extract two sides of a page by using a LED array, software and webcam, instead of expensive CCD arrays, mirrors and roller automations.

II. BLOCK DIAGRAM

The block diagram of our scanner is as shown below:

FIG. (a) Block Diagram

III. COMPONENTS

The following are the components used in the system:

Wooden box: A wooden box of the following dimensions 13x10x18 inches. A slot is made at 10 inches for the glass and paper. The box is painted white from all the sides to enable reflection of the light on the paper such that optimum brightness is achieved.

Glass: It is used for uniform spreading of light all over the document kept on it.

LED Roll: A bright source of light (array of LEDs) is placed below the glass at a suitable distance such that it enables uniform light over the document.
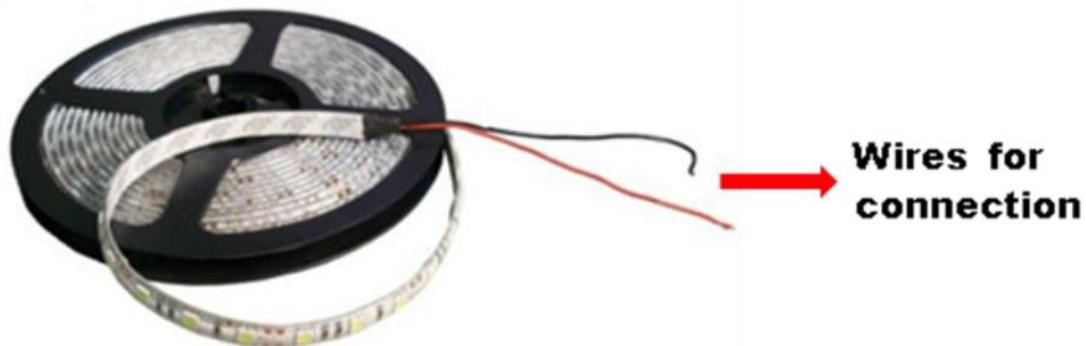
FIG. (b) SMD power LED 5m roll

The LED strips are useful flexible, bright and easy to install. The intensity can be changed with a dimmer or a controller.

Features:

- Continuous length of flexible LED Strip with protective, insulated layer.
- 5 Meter roll can be joined or linked at every 3 LEDs.
- Low Energy use.
- Solid state, high shock and vibration resistant.
- High brightness with 120 Light Beam Angle.
- Strong 3M self adhesive back tape for easy installation.
- Long life-30000hrs.
- Class A energy saving product.
- Requires 12V power supply.

Power supply: Power supply is used to provide 12V constant DC voltage which is shown below:

FIG. (c) Power Supply

This model CC-45A uses 110/250V input AC voltage and 12V voltage & 5A current is obtained as output.

Dimmer: The figure below is a voltage regulator or dimmer:
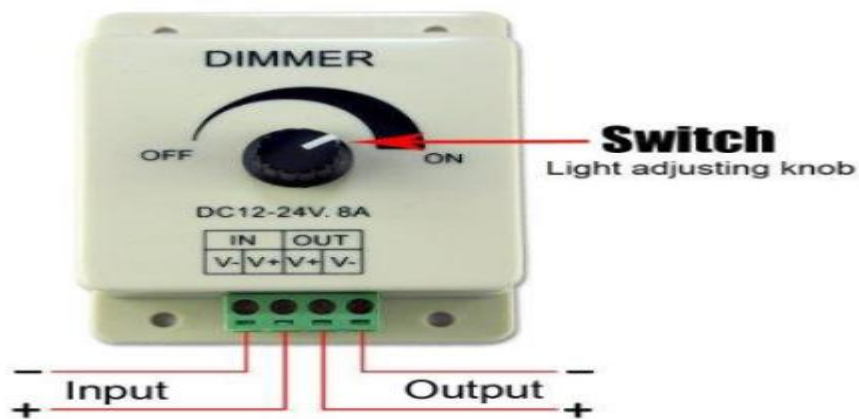
FIG. (d) Dimmer

It is the accessory product for the LED lighting controlling used to control a variety of LED lighting as the light source brightness, such as: LED soft light strip, LED rigid light strip, LED modules and so on.
Features:

* manual adjustment knob to adjust the lighting brightness

* wiring convenient

* Simple and intuitive.

Use the knob control method. Rotate the knob clockwise for brightness enhancement and rotate the knob counter clockwise to decrease the brightness.

Webcam: It is used to capture image of the document kept on the glass, from where it can be transferred on the computer.

FIG. (e) Webcam

Features

* Reaches 40 mega pixels resolution by software

* LED control knob so that the light can be adjusted as per user's convenience.

* 300k Pixels Resolution

* Excellent Quality & Fashionable Styles

* High-Quality CMOS sensor

* Auto White Balance & Exposure.

IV. IMPLEMENTATION
These are the steps followed by the scanner:
Step 1: Place a sheet of paper on the glass plate with bright light source on.
Step 2: Capture Image via webcam.
Step 3: Store raw picture data on PC.
Step4: Apply Image Processing Technique.
Step 5: Separate out each page.

The back page text will be projected on the front side of the page as its mirror image. So using brightness i.e. Luminance component as threshold, the image is separated into front (first side) image and back (second side) image.

Step 6: Compress image.

Step 7: Store image in folder.

Requirements: Sufficient memory for processing, sufficient storage capacity and high resolution image display.

ANALYSIS

The system analysis is based upon subjective efficiency of the output. The designed scale is of 0 to 10 where the range of '0-4' means 'not separable', '5-8' means 'readable' and '9-10' means 'perfectly separated'.

Based upon analysis of various images it was observed that the extracted first side had more efficiency than the extracted second side. The second side was affected by the pixels removed in first side which acts as noise in second side. As the number of sides increases the efficiency keeps on decreasing drastically.

The efficiency also depends upon the brightness of the light source. As the brightness increases from lowest intensity the efficiency of both sides also increases. It reaches in optimum point in the brightness intensity where we obtain maximum efficiency in both sides. As the brightness intensity keeps increasing from that optimum point the efficiency keeps decreasing.

The reason for low efficiency in the low intensity region is because the second side is not completely superimposed on the first side.

The reason for low efficiency in the high intensity region is because there is very little difference between the gray levels in first side and second side.

The reason for high efficiency in the optimum (medium low intensity) region is because of the high but not highest difference between the gray levels in first and second side.
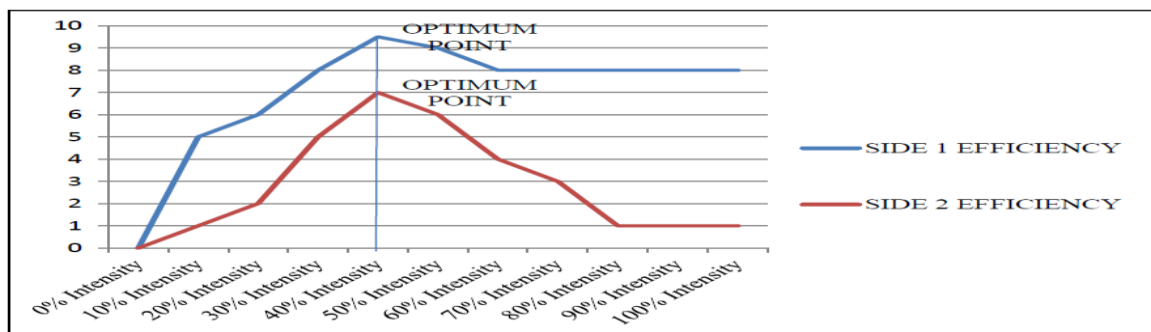

FIG. (f) Graph of Brightness Intensity vs. Side Efficiency

VI. RESULTS

The results obtained are satisfactory.

Given below are the images obtained of both the sides:

Not A Law- Supporters of this view are-

- **John Austin-** a leading English writer on Jurisprudence answered the question in negative. According to him, International Law is not true law, but a code of rules and conduct of moral force only. He holds that International Law is no law as it does not emanate from a law giving authority and has no sanction behind it. Austin described International Law as positive international morality consisting of opinion or sentiments current among nations generally.

- **Hobbes And Pufendorff-** also answered the question in negative by saying that there is no positive law of nations properly invested with true legal force and binding as the command of a superior.

- **Holland-** observed that International Law differed from ordinary law and not supported by the authority of a state. According to him, the law of nations is but private law 'writ large'. In this view of the matter, he called "International Law as the vanishing point of Jurisprudence". According to him, rules of International Law cannot be kept into the category of law because it lacks sanction, which is an essential element of municipal law.

- **Jeremy Bentham And Jethro Brown** are the other prominent jurists who also deny the legal character International Law.

International Law Is A Law- supports of this view are-

- **Hall And Lawrence** on the other hand answered the question in affirmative. According to them, International Law is habitually treated and enforced as law, like certain kind of positive law, it is derived from custom and precedent which form a source of International Law.

- **Pitt Cobbett** observed that International Law must rank with law and not with morality.

- **Sir Frederick Pollock** writes the only essential conditions for the existence of law are the existence of political community and the recognition by its members

FIG. (g) Original Grayscale Image

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FIG. (h) Extracted Side 1

question depends upon the definition of law, which one may choose to adopt

6. Subjects Of International Law - The word 'subject' literary means 'under ru jurisdiction or control'. It is an object, which is subject to control and governance. In other words, subject is an object (living or non-living) over wh law confers certain rights and duties. Municipal law or state law provides for certain rights and duties to individuals in the state, so individuals are called subjects of state law. Similarly, international Law is concerned with the rights and duties of the nations or states. There are three theories as to the subjects o international Law as explained below-

· States alone are the subjects of International Law
· Individuals alone are the subjects of International Law
· States are the main subjects of International Law but to a lesser extent. individuals and certain non-state entities are also subjects of International Law

1. States Alone Are The Subjects Of international Law- According to this theor states alone are the subjects of International Law. The supporters of this theory opined that international law regulates the conduct of states and states alone ar the subjects of international law.

· Prof. L. Oppenheim, strong supporter of this theory holds that, since the law o nations is primarily a law between states, states are, to that extent, the only subjects of the law of nations.

· Percy E. Corbett opined that, states are the only subjects of international law and individuals are only incumbents of rights and duties at international law in so far as they are objects and not subjects.

Criticism- This theory is subject to criticism on the ground that it failed to explain the cases of slaves and pirates. Under international law, slaves have been conferred some rights by the community of states. Similarly, pirates are treated as the enemies of mankind and states may punish them for piracy.

FIG. (i) Extracted Side 2

As observed the first side extracted has more efficiency than the extracted second side.

VII. APPLICATIONS

Following are the applications of our scanner:

Useful in extracting two pages which are superimposed due to damage (sticky material, floods, water smudging, etc.).

In any department of any company that has to deal with massive amount of paperwork.

Correction of university papers.

Companies that may benefit from our document scanning services: Accounting Firms and Individual Accountants, Government Facilities - Schools, Universities, Banks and Any company still filing paper in a filing cabinet.

VIII. CONCLUSIONS AND FUTURE SCOPE

Our method of scanning has two advantages over conventional Flatbed scanner. Firstly, as we use WEB CAM to take snap of document, lot of time for scanning is saved. Comparison also shows that conventional scanner takes about 30 to 60 seconds while our scanner takes fraction of that per document. Second advantage is that we extract two sides of the document in one shot thus speed of scanning doubles. Our present scanner can scan one page with both sides which can be improved to scan multiple pages by improvement in program to automatically select suitable threshold and increasing intensity of background light.

Improvement to the program to increase efficiency to 100%.

Improvement in the setup/hardware to have more automation.

Saving the sides extracted in their original form rather than black and white form.

Presently our scanning system is tested for Black and white documents, improvements can be carried out to extend it for colored documents.

Also our scanner's software can be tweaked to detect fake currency notes.

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