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A Comparative Study of Different Scanning Applications and Flutter Plugins for the Application Designing

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Abstract : Amidst the tense Indo-China border conditions in North-east India coupled with the 'Atmanirbhar Bharat' initiative, the IT ministry of India had banned 59 Chinese-owned applications, including Cam Scanner, Tik Tok, ShareIt, etc., and thus was also taken down from the Indian Playstore for sovereignty and security. Among all the banned 59 applications, CamScanner had been an integral part of daily documentation which allowed users from organizational, governmental, commercial, and academic backgrounds to convert the simple camera-clicked images of important documents into scanned PDF format digital documents. But after the ban of CamScanner, users faced a lot of inconveniences to create these despite the introduction of other alternative Indian scanning applications as these applications were less satisfactory in comparison to CamScanner. This paper studies various Indian and non-Indian scanning applications and a comparative study of the various features provided by these applications is done. This paper also focuses on the study of various flutter libraries and plugins that will be required to design the features of the scanning application such as multiple image picking, conversion of images into pdf, firebase ML for optical character recognition feature, etc.

Keywords - Document Edge Detection, Firebase ML Toolkit, Flutter Plugins, Images to PDF, Optical Character Recognition

I. INTRODUCTION

Recently, India decided to ban the Chinese application from Indian Google Playstore amidst the tense situation in northeast India and Indo-China border. The action was taken as a countermeasure against security implications on the Indian data and also with another collaborative aim to lead India towards digitalization and self-reliance – 'Atmanirbhar Bharat'. The banned apps also included the CamScanner application which was an integral application for daily documentation. This application was meant for converting camera-clicked images into a scanned digital pdf document that can be shared or uploaded online as per requirements. Since this application dealt with sensitive user data, it was banned to secure the data of the Indian users.

This ban imposed amidst the Coronavirus pandemic encouraged the beginning of India's phase of online document-related activity which included, school and college academic submissions, online documentation, online application for acquiring government identity cards and other documents, online registration of exams, online hiring processes, and many more. This led to the need for a reliable and more primarily, India-originated camera-based scanning and conversion application, nearly comparable to CamScanner. Following this, several Indian scanning applications were developed but were unable to meet the requirements of the users and had a low performance in the scanning and conversion perspective or lesser functionalities.

The application is required to have the basic features of a good scanning application along with the condition that it must be an Indian application as a non-Indian application can be a part of the same security implication and pose a risk of sensitive data being traded out of the country. With this, the success of the application depends on the maximum features it can provide with the basic ones being able to meet the

requirements of users. Many current applications have drawbacks like loading a single image from the folder, lesser filter options, no options for reordering once scanning is done, and not having Optical Character Recognition. The proposed application is aimed at having the following features included along with the basic scanning, conversion, and sharing feature. Also, only the user device accesses the converted file which in turn does not include the user using anything like cloud space of the application or the application server obtaining user data.

II. LITERATURE SURVEY

Fast scan [1], is an application that creates pdf files from photo clips and documents saving descriptive data in the pdf file. The application is equipped with what they say is a genius camera that can read receipts, business cards, and other valuable docs. The application has aimed to replace the heavy table scanner or encoded scanner by using the flexible Android camera. Features of this application include digital signature and storage on the cloud of the scanned files, finalizing correct document borders automatically, and maximum to minimum file size without affecting the printing quality and size. OCR pdf generator is another feature that is images to pdf. Drawbacks of this application are:

a) In single mode, it makes a file of it but in batch mode, the scans are done first and then the editing is done individually on saved images and is time-consuming.
b) Does not have any options to apply filters
c) Scanning issues since complaints about scans having shadows are reported.
d) Too many advertisements.
e) Does not have the feature of reordering

Notebloc [2], creates pdf files from scanned images through the device camera. This application provides different sizes of pdf to the user to choose from it. OCR pdf generator is another feature that is images to pdf form. Editing of the pdf files and sharing are features to the pdf part of the application. This application also allows users to order, add or delete pdf images. Also, the files can be classified based on the date of creation or modification.

Drawbacks of this application are:

a) Too many advertisements after each scan thus time-consuming.
b) Does not have the feature of reordering
c) Does not retake or rescan any scanned image from all the images scanned without resulting in the loss of scanned images after that

Kaagaz Scanner [3], is an Indian scanning application that creates pdf files from scanned images through the device camera. This application comes with no signup and advertisement-free access and is also available in Hindi. It also provides batch mode scanning and has an Applock feature for better document and data security. Auto Page-edge detection along with manual adjustment for boundaries and sharing features. No watermark on the scanned image.

Drawbacks of this application:

a) Quality of the scanned image is low and is blurry and the quality of the pdf of the scanned image is too low and unreadable.
b) Does not have features like reordering and signature and OCR.
c) Takes load after scanning a few documents and crashes.
d) Not many filters are available (Only 4) and Colour filters are bad.

Adobe Scan [4] creates pdf files from scanned images through the device camera. This application stores scanned documents on the cloud and can be downloaded anytime. OCR pdf generator is another feature that is images to pdf form. Editing of the pdf files and sharing are features to the pdf part of the application and also provide a preview, reorder, rotate, and color. Scanning of business cards can also be done and linked with contacts.

Drawbacks of this application:

a) Uploads directly to the cloud. Files need to be downloaded to use from the device.
b) It has only 4 filters.
c) Even crops screenshots and images imported from the gallery which explains that the application does cropping even when not required.

Document Scanner [5], is an Indian scanning application with advanced scanning options with 50 or more tools for performing scanning. This scanner application can store your application in folders and subfolders

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in image or pdf format on the internal storage of your scanning device. It can upload documents on google drive or dropbox like clouds. It has a QR code scanner and QR code generator as well as a barcode scanner.
Drawbacks of this application:

  a) The User Interface of the application is not user-friendly.
  b) Lot of advertisements.
  c) Does not have features like reordering and signature.

Tapscanner [6], is a scanning application with scanning options and making pdf files. This application has a QR code scanning and then converting them to email, text, and links feature. This application also has a feature of Optical character recognition with a total of 110+ languages support. This application is not very useful in the unpaid version since one cannot scan or share more than 5 pages in a single day. The document signing is simplified by adding a custom field to the documents.
Drawbacks of this application:

  a) Free users get a 5-page share per day and not more than that and also many features and filters are locked.
  b) Lot of advertisements.
  c) The application has a huge watermark which is unfavourable for certain or all documents in unpaid version.

Doc Scanner - Phone PDF Creator [7], is a simple scanning application that scans the images through the device camera and converts them into pdf format. It detects the page edges automatically and can set page sizes for the pdf file. It can print or fax the files directly from the device. It has the feature to share files in pdf or jpeg formats.
Drawbacks of this application:

  a) Does not allow selection of more than one picture.
  b) Does not have OCR and signature features.
  c) Lots of advertisements.
  d) Takes too much time for processing.

Li Xuan et. al. [8] has stated that Digital image technology is widely used in image processing by extracting edge detection to get the feature attribute of the image and have proposed the improved Canny Edge Detection algorithm. The traditional algorithm, which cannot adaptively determine the filtering threshold value and cannot separate targets from the background, when filtering the lower contrast image, and also the Gaussian filtering is sensitive to noise. Therefore, in response to these problems, they proposed an improved method on the Canny algorithm. In that, they use a median filter to smooth the image, and adaptively get double thresholds. After that, the edge points are linked and the generalized chains are obtained, and a criterion is put on the generalized chains. In this way, false edge points, which have the approximate gray value with real edge points are eliminated. The median filter algorithm is used to replace the Gaussian filtering method. The pixel value of a certain point in an image is substituted by the median value in its neighborhood, this method not only reduces the influence of noise, but also can eliminate the isolated point 8-neighbor by the center method of point 0, and we define the line connecting of each point and the center point. The process of this method is to scan 8 neighboring points to the center to avoid a double threshold.

Derrick Mwiti et. al. [9] has proposed in this article about ease of ML incorporation for mobile app development toolkit which allows user models importing. Firebase ML kit enables users to recognize or detect multiple languages from receipts, credit cards, business cards, etc. This article explains how to extract text from the images where its necessary condition is that the image which is chosen via its gallery or camera should not be blurred and should be clear enough to extract the text. When the image is proposed by the text recognizer it can extract the text it gives by looping through the blocks and appending the words to the text variable as textblock. Textblock represents a rectangular block of text, which contains 0 or more lines where each line contains an element, an object which represents words like entities so for each textblock the line, element, and object can be bound to the coordinates of the region.

Multi_image_picker [10] is a flutter plugin that helps in selecting multiple images from the gallery at the same time. This plugin comes with lots of features such as the programmer can restrict the limit of selecting images. Also, a grid type of view is displayed which gives the user an efficient and more compatible look. The programmer can customize the UI and localization of the view as per his requirements. This plugin also supports a thumbnail optimization of the original image which can be useful when inserting an image in the document.

Other than the mentioned features, the multi_image_picker also specifies the quality of the images either be original or thumbnail. Since it is a native flutter plugin, it can be used in IOS and android as well.

Photofilters [11] is a flutter plugin that provides the user a wide range of filters that can be used on the image. This plugin has some set of default filters but also gives the developer the ability to create new filters as well according to his need. Mainly this plugin doesn't require any configuration to perform the desired task. There are two types of filters in it. They are Image Filter and Color Filter. Image Filter requires more computation and memory as it keeps on applying all the subfilters one by one. But in Color Filter there is less computation and memory required since it traverses all the pixels at once only. Since it is a native flutter plugin, it works on both the platforms that are IOS and android as well.

Firebase_ml_vision [12] is a flutter plugin that lets the developer integrate the TensorFlow models in his application. Using this plugin he can either integrate some of the existing TensorFlow models such as Optical Character Recognition, Face detection, Barcode detection, or image classification. Other than the existing models, the developer can simply create the TensorFlow models and upload them on his firebase storage. Then using this plugin, the application can be able to communicate with the model and can process the heavy memory consuming tasks easily. This a native flutter plugin due to which it is available on both the platforms IOS and Android.

Flutter_share [13] is a flutter plugin that allows the user to share the desired document on other applications like WhatsApp, telegram, etc., It also allows the user to send it through email services like Gmail and many more. Other than this, it provides a choice to the user to store that document on his Google Drive as well which is very helpful and memory efficient. With the help of this plugin, you can also share written texts or messages as well. Even you can copy the written texts and messages in the clipboard for later use. This plugins works on both the platforms either be IOS or android.

Images_to_pdf [14] is a flutter plugin using which the developer can convert a list of images into pdf. It also provides the ability to change the size of the pdf pages as well as the compression quality can also be controlled. This can be used to lower the size of the pdf when the number of pages is a lot more and due to which less memory of RAM will be used. It also allows the user to give the desired filename to the pdf. Image_to_pdf is a very simple and easy-to-use plugin that eliminates many of the internal processing memory issues with simple fine tunings. This plugin is also supported on both the platforms which are IOS and Android.

III. ANALYSIS

Table 1 summarizes the review study of a few scanning applications and plugins that will be used to design the application.

Table 1: Analysis table I

Sr. No.	Reference	Description	Advantages	Limitations	Relevance
1.	Fast Scan: Free Document Scanner HD, PDF Scanning [1]	A scanning application that converts scanned images in a pdf document file	Digital signature, Optical character recognition pdf generator	Multiple image scanning is time consuming since each image is to be edited, no options to apply filters, no reordering advertisements	Can overcome the drawback by using plugins of flutter like photofilters.
2.	Notebloc: Scanner App - Scan, save & share as PDF [2]	A scanning application that converts scanned images into a pdf document file	Pdf editing, choice of file size for the pdf, classify the files by the date of creation	Loss of scanned images on rescan, no reordering, low image quality, advertisements	Can overcome the drawback of low scan quality using a better edge detection pipeline.

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3.	Kaagaz Scanner: Free Documents & PDF Scanner [3]	A scanning application that converts scanned images into a pdf document file	Available in the Hindi language	Low quality of the scanned image and converted pdf, fewer filters, no OCR and signature	Can overcome the drawback of filters and signature using flutter plugins.
4.	Adobe Scan: PDF Scanner, OCR [4]	A scanning application that converts scanned images into a pdf document file	Pdf editing, OCR, scanning business cards, and linking with contacts	Uploads directly to the cloud, fewer filter options	Can overcome the drawback by using plugins of flutter like photofilters.
5.	Document Scanner (Made in India) - PDF Creator [5]	A scanning application that converts scanned images into a pdf document file	Store in folders and subfolders on the device, Upload files on clouds like google drive	Non-user-friendly UI, no signature and reordering options	Can overcome the problem of UI using flutter themes.
6.	Scanner App to PDF – Tapscanner [6]	A scanning application that converts scanned images into a pdf document file	QR code scan and convert in text, link, or email, OCR with 110+ language support	Huge watermark, advertisements, unpaid version allows only 5 pages per day and fewer features	Can overcome the drawback by using plugins of flutter which won't create a watermark during the creation of pdf.
7.	Doc Scanner - Phone pdf creator[7]	A scanning application that converts scanned images into a pdf document file	Print or fax files directly from the device	Selects one image at a time, no OCR and signature features, advertisements doesn't save the file on the device	Can overcome the drawback by using plugins of flutter which would let us select multiple images at a time.
8.	An Improved Canny Edge Detection Algorithm(IEEE-2017) [8]	This paper proposed the improved Canny Edge Detection algorithm to the traditional algorithm.	It improves the anti-noise ability and keeps the edge image more clearly.	None	It will help to reduce the anti-noise ability and have clear images for the text identification

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9.	Text Recognition in Flutter Using Firebase's ML kit [9]	It is proposed that how ml is easy to incorporate to mobile app development toolkit which allows importing users' models.	Firebase ML Kit makes it useful for giving a clear, understandable text image.	Right API access rights should be given to use cloud-based API.	ML kit will be helpful in flutter as it would allow us to implement high processing tasks such as OCR through a mobile application.
10.	Plugin - multi_image_picker [10]	It helps to select multiple images from the gallery.	It displays the images in a grid view. It lets you select multiple images at a time	None	Can select multiple images at a time for creating a pdf using this plugin.
11.	Plugin – photofilters [11]	It provides a wide variety of filters for images.	It provides more than 40 filters to apply to images. Also by combining two or more filters, you can create different types of filters.	It requires more processing memory when you combine lots of filters to create a different type of filter.	Can define a few filters for the scanned documents using this plugin.
12.	Plugin - firebase_ml_vision [12]	It enables us to use various TensorFlow models in the application.	It provides some default TensorFlow models like face detection, object detection, text recognition, etc.	None	Can implement an Optical Character Recognizer in our application using this plugin.
13.	Plugin - flutter_share [13]	It enables the sharing of documents over other applications.	It lets you share the documents through other applications or save them on your drive.	None	Can share the created pdf document through Whatsapp, Gmail, etc., using this plugin.
14.	Plugin - images_to_pdf [14]	It converts the stack of images into pdf.	The size of the pdf pages can be changed according to the need. Also, the compression quality can be altered.	It consumes a lot of internal processing memory if the number of images is more.	Can convert a stack of images into pdf using this plugin

Table 1 primarily is a study of some applications, and contributes to the planning and designing of the application. The various plugins above will be responsible for building some functionalities of the application and thus are required to be studied with their uses and limitations posed by them.

Table 2: Analysis table II

Sr. No	Reference	Is Indian ?	Filters	Multi Image Picking	Reordering	OCR	Signature	Advertisement	User Friendly UI
1	Fastscan	NO	NO	YES	NO	YES	YES	YES	MED
2	Notebloc	NO	2-3	YES	NO	YES	YES	YES	NO
3	Kaagaz	YES	4	YES	NO	NO	NO	NO	MED
4	Adobe	NO	4	YES	YES	YES	YES	NO	YES
5	Document Scanner	YES	4	YES	NO	YES - Paid	NO	YES	NO
6	Tapscanner - unpaid	NO	9-2 paid	YES	YES	YES- Paid	YES- Paid	YES	MED
7	Doc Scanner	YES	4	NO	YES	NO	NO	YES	NO

The analysis table, Table 2, is a confusion matrix of the applications studied against some of the important features. Features such as Optical Character Recognition, Signature, Reordering, and Multiple Image picking are compared for the various applications.

IV. CONCLUSION

The need for an Indian scanning application after the ban of Camscanner and increasing reliance on online documentation resulted in the development of many applications but they lacked the required features or were incompatible for the user. The proposed system performs a combination of edge detection, four-point cropping, and four-point perspective transform for getting better-scanned images and eliminates the issue of multi-image picking and more filter options by using flutter plugins multi_image_picker and photofilters. It also provides key features such as inserting signatures in the scanned copy and performing OCR. Thus, the application will be able to meet user requirements.

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