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A Survey Paper on System Frameworks for Image Processing

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I. INTRODUCTION

Today's world has evolved a lot with respect to the aspects of digital images and their processing. In order to perform processing on images, the need of a software that will give access to the operations for image processing hassle free, wherein it is expected for a system framework to work smoothly, quickly and require less space in PC and laptops, also should not require additional software to process. Image processing involves processing or altering an existing image in a desired manner and also helps in obtaining the image within the readable format. In general, The image processing operations include implementing Color Histogram of an image, image dilation, image erosion ,image cropping, image rotation, gray scale conversion, black and white filters, color to negative and so on. This paper basically deals with the study of different frameworks for image processing.

In the plugin based system framework, a program framework can be created that will help user to develop an image on a PC or a laptop and using a plug-in, given operations can be performed on the image, which can be done using Dynamic Link Library (DLL), wherein a plugin manager plays role of searching and loading the desired .dll file of processing operation which the user had specified to perform on the input image [1].

Another image framework used for image processing is the Hadoop Image Processing Framework. This is primarily a software engineering platform, with the aim of concealing Hadoop's complexity while giving users the ability to use this program to process large images without becoming Hadoop crack engineers. The ease of use of the Java-based framework and semantics will further advance the process of large-scale application and testing. This framework is an excellent tool for novice Hadoop users, image software developers and computer vision analysts, allowing for rapid development of image software that can take advantage of large data stores, rich metadata and global access to current online image resources[2].

One more framework for image processing, Marvin Framework that deals with plugins in Java. Marvin is an expandable, concise and open source image processing tool developed in Java. The main purpose of this framework is to integrate efforts from researchers, software developers and end users to improve the use of image processing systems. It is a Pure Java cross-platform image processing framework that provides features for image and image processing, multi-image processing, GUI integration, extension with plug-ins, unit text automation among other things [3]. The framework provides features such as, using pictures and captured Video frames, process multiple images, integrate plugins with Graphical User Interface (GUI), analyze the functionality of the plugin, Expand features with plugins, Automatic unit testing [4].

II. RELATED WORK

Some of the recent research works related to image processing is discussed as follows:

A plugin framework for image processing was developed by Prof. Shyamsundar Magar et.al., in this they developed a system Framework which was intended to help users to enhance the images on low resolution PC, even computer by employing the application plugin which is a small software to append externally with the Framework by using DLL (Dynamic Link Library) which establishes a connection between the plugin code and existing system Framework. The proposed framework in this system was mainly focused on the usefulness of the image processing which supports various image processing operations like brightness, contrast, Grayscale effects and the operations like histogram, compressions intended to work for the basic implementation stage which will mainly work on gray-scale conversion [1]. The process used in this conversion from RGB to gray-scale image was implemented by eliminating the hue and saturation information, which retained the luminance that in turn can be utilized for various applications in eliminating signal noise in the medical field, aerospace research, engineering, and computer science. They used histogram for enhancing the image brightness .

A case study was presented by White et.al . It represented classification as well as clustering of a collection of billions of standard images using MapReduce[2]. The image pre-processing technique used in a sliding-window approach for object recognition was described in the case study. Certain limitations of the MapReduce model were set out by Pereira et.

Al when working with high speed video encoding, i.e. its relying on NameNode as a single point of failure, and then difficulties involved in the overall design of the framework compatibility with certain problems. It suggests an alternative approach implementation of cloud-based IaaS provision (Infrastructure as a service) solutions. Lv et.al describes the use of the k-means algorithm in conjunction with MapReduce and satellite / aerial images to get a variety of items based on their color.

An implementation was conducted by Tobias Rudolph et.al. on framework in which they described the open source framework of MARVIN for rapid application development in the field of biomedical and clinical research [5]. The modules in MARVIN applications can be linked together to provide the required functionality for a specific test environment. The application modules in this MARVIN framework run on a standard database used to store and organize medical data and captured data. MARVIN provides a flexible input / output system with support for multiple file formats including DICOM, various 2D image formats and additional mesh data. In addition, it uses an advanced visualization system and various 3D tracking channels. As it uses only portable libraries, MARVIN applications run on Unix / Linux, Mac OS X and Microsoft Windows.

III. WORKING OF SYSTEM FRAMEWORKS

A. Plugin Framework using DLL

In this proposed system framework, plugins were implemented with the concept of Dynamically linking static libraries created for each operation. Rather than downloading the application file they gave an API so that users can directly install. The tool was intended to get ready to use as soon as it gets installed automatically without explicitly restarting the whole system.According to authors perspective this system seemed to be simple to work on low resolution computers as it is developed using C language, therefore has low processing power and the delivery of highly configured results within minimum time was achieved [1]. In this they had developed a static library and API which contained the features for the image processing which can be embedded by the user into their system Framework and then use it for the further processes.

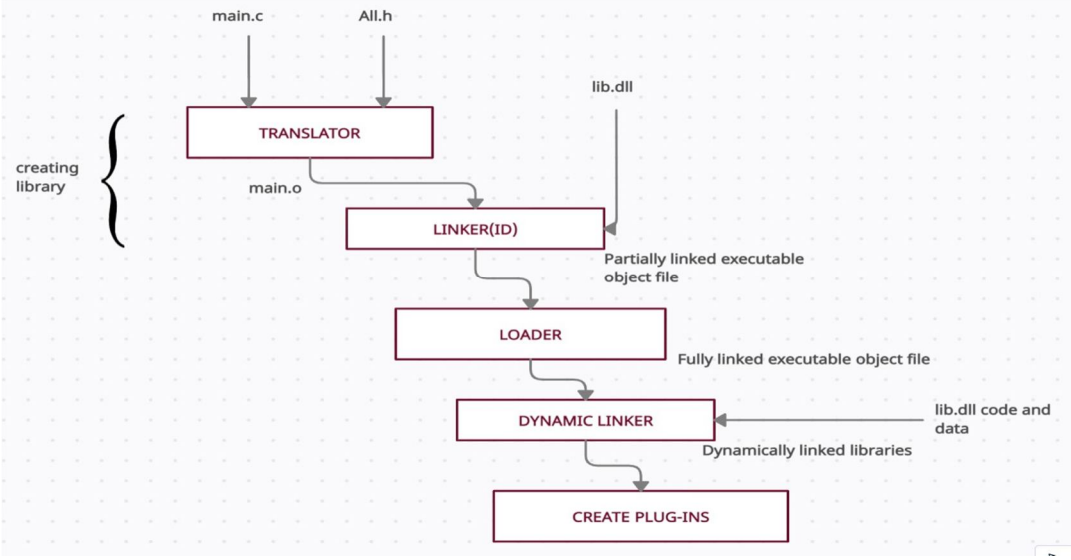

Fig:1 Library Creation and Dynamic Linking in C

In Fig.(1), the diagram represents the implementation of the DLL plugin. At the beginning they created a main.c, where the actual program resides then next they included All.h , which is a header file that contained a small method for compiling both object file main.o & lib.dll. After that they loaded that file into the loader and linked the .dll file to the main program dynamically, this way they created a plugin.

B. Hadoop Image Processing Framework

For developing large-scale image processing applications, the framework of Hadoop Image Processing was designed to provide users with easy access and tools which are easy to use [2]. The main objectives of the Hadoop Image Processing Framework are:

1) To provide an open source framework with Hadoop MapReduce
2) Enable to store images easily in various Hadoop file formats
3) Allow interaction between various image processing libraries.

a) *Download and Store Image Data:* In order to store files in various nodes throughout the cluster,Hadoop uses the Hadoop Distributed File System (HDFS) throughout the cluster. Hadoop has an issue to store small file.A small file can be referred to as the files that are extremely smaller than the HDFS block size.Small image files are grouped together in order to get Large image datasets, which HDFS handles. By providing a container to group the file this problem can be solved.The Downloader Module of our Hadoop Image Processing Framework performs the following operations:

- Input a URL List
- Split URLs across nodes
- Download image data from URLs.
- Store images in an image bundle.

In this framework, .jpeg/.jpg, .png and .ppm file formats are supported mostly [8].

b) *Processing image bundle using MapReduce:* The Hadoop MapReduce system manages input and output data very well, but their native data exchange formats are not ready to represent or manipulate image data. For example, distributing images across map nodes requires translating images into strings, and decoding later these image strings into specific formats for accessing pixel details. This is ineffective and disruptive. To overcome this issue, images should be represented in as many different formats as possible, which increases flexibility. The user is responsible for creating InputFormat and RecordReader classes to distribute input among the nodes in the standard MapReduce program. This task is very hard and accompanied by mistakes; Hadoop Graphics Framework provides Input Format and RecordReaders for ease of use of the system. Images are distributed as a variety of image data types as well users have instant access to pixel values. If the pixel values are randomly extracted from image byte formats, which are important image header data i.e. JPEG EXIF data or IHDR image titles are then lost from it. The framework holds image data in HImageHeader data type before converting an image byte to the pixel values. After processing pixel data, images of the headers are reattached to the processing results.

The functionality of the framework's Processor module is described below:

- Devise the algorithm.
- Split image bundle across nodes.
- Process individual image
- Store processed images in an image bundle.

c) *Extracting image bundles using MapReduce:* Moreover the framework provides a way to extract and view these images along with making and processing image bundles. Usually, Hadoop extract images from an image bundle iteratively and ineffectively using a single node for a task.To deal with this inefficiency, we have developed an Extractor module rendering images uniformly across all available nodes. The Hadoop Image Processing Framework provides this functionality for extraction tasks which provide much greater ease of use for the development of image processing applications. This developed framework provides the functionality of organizing and specifying the final location of extracted images in a large distributed task and allows the user simply to specify whether images should be extracted to a local file system or reside on the Hadoop DFS. The process of the Extractor module is listed below:

- Input the image bundle to be extracted
- Split Image bundle across nodes.
- Extract individual image.

C. Marvin Framework for Image Processing

We can say that Marvin is basically another tool for image manipulation and image processing algorithm development. Also it is an image manipulation program, but focuses more on the development of image processing algorithms due to this reason Marvin provides an easy-to-use white box framework that requires knowledge of the internal framework from the plug-in developer [3]. The main purpose of the framework is to integrate efforts from researchers, software developers and end users to improve the use of image processing systems. The framework provides features to facilitate the development of image processing algorithms, and it is open source and multi-platform which is considered to be developing in Java. Marvin's features of manipulation of images are made externally by using plugins. The frame describes the merging and provides features for deceptive images.

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The image files format supported by Marvin framework are .bmp, .png, .jpeg/.jpg,.gif,.tif [9]. Marvin's plug-in should use the MarvinPluginImage interface that specifies which methods should be used to manipulate the image. Once the plug-ins are installed in Java, after the plug-in compilation, the class file must be copied to the plug-ins folder inside Marvin's folder. All plug-ins available on that folder will be automatically uploaded to the Marvin image manipulation program in the next execution. In most cases, it is interesting to use the plug-in within one Marvin framework, it is interesting to use a plug-in inside another and the Marvin framework allows plug- ins integration. The Software developers can use Marvin plug-ins in their applications to provide image processing features. Marvin applications provide features like Gaussian blur, color intensity histogram, brightness and contrast manipulation, sepia, flipping, crop, gray scale and negative colors conversion, and many more.

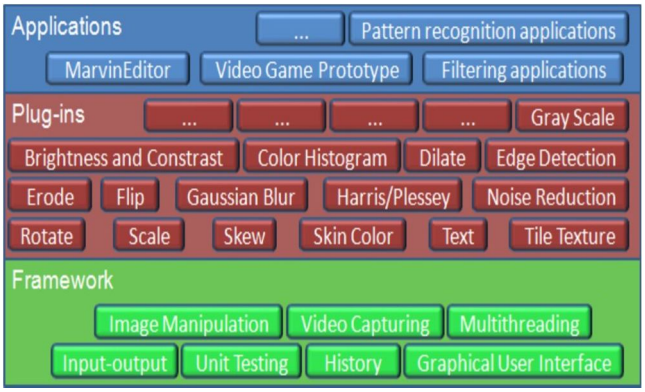

Fig:2 Architecture of MARVIN framework

The figure.(2) shows the architecture of Marvin framework. In the green layer are the features provided by the framework, developed by the Marvin team.The Red layer consists of the plug-ins which is the second layer, developed by third-parties using the interfaces provided by the framework. Finally, on the blue layer are the final systems, built by third parties using the framework interfaces and plugins.

Comparative Analysis

Parameters	Plug in based Framework	Hadoop framework	Marvin Framework
1. Definition	The plug-in in C is loaded dynamically using DLL.	It is an open source framework with Hadoop Map Reduce	It is an open-source image processing framework which runs on java
2. Features Provided	Provides image processing features like histogram creation, dilation, erosion, image cropping etc.	Provides an easy way to access complex image processing algorithms.	It provides features such as image processing, multi-threading , video frame processing and so on.
3. File format supported	.bmp, .jpg, .png	.jpeg,.png,.ppm formats	bmp, png, jpg, gif, tif.
4. Flexibility	It is flexible	It is flexible for online framework	It is flexible.
5. Extensibility	The framework is extensible	The framework is not extensible from the users side as multiple files cannot be accessed as well as executed.	The framework is extensible through plugins.
6. Download Plugins	The user can download plugins offline if required and can also add plugins manually.	No such option is present here.	The user can download plugins online and can also add plugins manually.

IV. CONCLUSION

Upon exploring above mentioned methods with respect to the author's perspective, we hereby conclude that the framework for image processing developed in the said systems managed to provide successful working in the intended way. Mentioning about Plugin based system framework for image processing using DLL in C language, delivered a high performance, and extensive work at Proceedings, low processing time. Also, the model gave fast results within minimum time duration. In this the most focused feature was that the user can add downloading the unavailable feature into the system which gets automatically installed. But the only disadvantage of the DLL is the need of "glue code" in the executable program to access the shared segment. In the Hadoop framework for image processing, the system provided users with easy access and tools which are easy to use with objectives such as an open source framework with Hadoop MapReduce, Enable to store images easily in various Hadoop file formats, allow interaction between various image processing libraries. Drawbacks faced by the system are, system not extensible from the users side, no user customization available and multiple files cannot be executed or accessed. In the case of Marvin Image processing framework , provided open source platform purely designed in Java with several plugins for image and video frame processing, multi-threading image processing, GUI integration, image extraction, real time video processing,unit text automation among other things [7]. The drawbacks faced in the system are that, the user need to download all the required plugins needed to perform specific task which takes up memory space, according to [10],even after having download all requirements for executing the program, users need to load all plugins along with the plugin dependencies for smooth execution of Marvin plugin used in the desired image processing program. According to the comparative analysis done by us in this paper, we conclude that a plugin based system framework for image processing would be efficient as compared to Hadoop and Marvin frameworks for image processing.

V. ABSTRACT

This paper describes the study of the framework for Image processing to conclude with a system which is efficient from users point of view. Image processing is mainly the modification of the image in order to obtain the required information from it. Considering this image processing aspect to fulfil user's needs, here we have done analysis of three frameworks: Plugin based Image processing framework using C, Hadoop based image processing framework and Marvin framework for image processing using Java. Our paper shows brief working of each mentioned image processing framework, along with that we have concluded this study with comparative analysis of the above mentioned frameworks.

A. Index Terms

Color intensity histogram, Dynamic Link Library (DLL),Gaussian blur, Graphics user interface (GUI),Hadoop Distributed File System (HDFS), Hadoop Image Processing Framework, Library Creation, MapReduce, Marvin Image Processing Framework, Plugin, Plugin framework, RGB color model.

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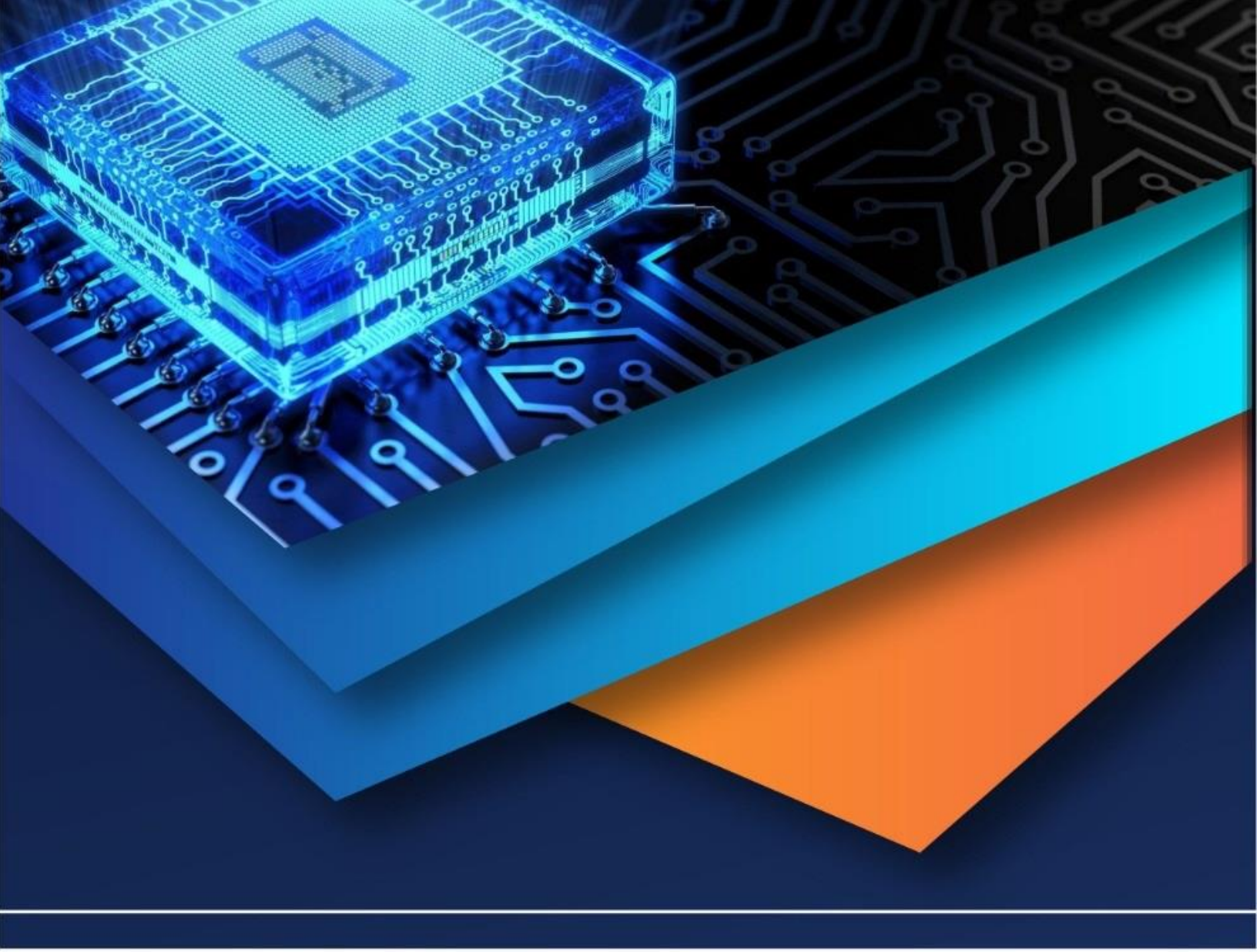

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