|| Volume 3 || Issue 10 || October 2018 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH AND ENGINEERING TRENDS

Survey on Video Stabilization System Based on Raspberry Pi

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Abstract— **In Today's world, Micro Air Vehicles (MAVs) equipped with digital cameras are increasing in number for real time applications. MAVs are widely used because of small, low weight, low cost and flexibility in the design. However, the video captured by MAVs will consist of unwanted translations and rotations due to atmospheric conditions. Hence, a video stabilization algorithm is needed to compensate the frames and then to avoid losing of any valuable information in video. In this paper, we study on stabilizing the unstable videos; raspberry pi 2 is used to process these videos. The main goal is to identify motion distortion between two consecutive frames. Harris-Stephens corner detection is used to identify the features in each frame. The Sum of Squared Differences (SSD) is used to measure the matching degree betweenpoints.This video stabilization mainly involves estimation of the camera motion path and smoothing the motion path.**

Keywords: *Micro Air Vehicles (MAV), Digital Video, Stabilization Algorithm, and Raspberry Pi 2.*

I INTRODUCTION

Micro air vehicles (MAVs) are a class of Unmanned Aircraft Vehicles (UAVs) significantly smaller than typical UAVs. UAV is an aircraft without a human pilot on board. It is controlled either automatically by on board computers or by the remote control pilot on the ground or by another vehicle [1]. The MAVs provide video surveillance during military exercises, firefighting, and weather monitoring, policing and border control. However the video captured by MAVs consist of unwanted shakes and jitter due to low weight, inexpensive cameras that are accomplished on vibrating engine and weather conditions. Hence implementation of video stabilization algorithm for MAVs is a unique challenge. Video stabilization is a process used to improve video quality by removing unwanted camera shakes and jitters. The removal of unwanted vibrations in a video sequence induced by camera motion is an essential part of video acquisition in industry, military and consumer applications.

The video stabilization can be achieved either by hardware or digital image processing approach. Hardware approach can be further divided as mechanical or optical stabilization. Mechanical stabilizer uses gyroscopic sensor to stabilize entire camera. Optical stabilization activates an optical system to adjust camera motion sensors [2].These techniques are not suitable for small camera modules embedded in mobile phones like devices due to lack of their compactness and also the associated cost. The image processing approach tries to smooth and compensate the undesired motions by means of digital video processing. Digital image stabilization (DIS) techniques without resorting to any mechanical device (like gyros) or optical devices (like fluid prisms) are popular due to their low cost, fast response and compactness.

In general, any digital video stabilization algorithm consists of three stages: motion estimation (ME), motion smoother (MS) and motion compensation (MC) as in Figure 1 ME estimate the motion between the frames, and send the motion parameters to MS, which removes the unwanted camera motions. MC then computes the global transformation necessary to stabilize the current frame.

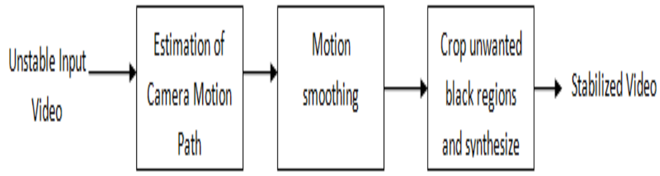

Figure 1 General Block diagram of Video Stabilization

II LITERATURE REVIEW

In this section discuss the literature review in detail about the video stabilization system on raspberry Pi:

Yue. Wang, Zu.Hou [1] they propose real-time video stabilization method for Unmanned Aerial Vehicles (UAV). In this they firstly keyponits are detected and matched. Then, the motion between two consecutive frames is estimated. And finally, the cumulative distortion of a frame relative to the first frame is generated and the parameters are smoothed by cubic spline smoothing. The proposed method was tested for video stabilization in the real video captured by camera installed on UAV; the experimental results show the efficiency and accuracy of the proposed algorithm.

A method is proposed in [2] to remove the annoying shaky motion and reconstruct a stabilized video sequence with good visual quality. The scale invariant features (SIFT) is applied to estimate the camera motion. The unwanted vibrations are separated from the intentional camera motion with the combination of Gaussian kernel filtering and parabolic fitting. In addition, to reconstruct the undefined areas, resulting from motion compensation, the mosaicing method with Dynamic Programming was adopted. However, no processing speed has been mentioned in this paper.

Sebastiano Battiato, Giovanni Puglisi and Giovanni Gallo [3]they propose a video stabilization algorithm based on the extraction and tracking of Scale Invariant Feature Transform features through video frames. In this infers interframe motion tracking SIFT features through consecutive frames: particularly, features are used in a motion estimation algorithm that individuates camera jitter and therefore allows stabilizing the video sequence. Iterative Least Squares method is adopted to avoid estimation errors and intentional camera motion is filtered with Adaptive Motion Vector Integration.

Yue Wang, Karianto Leman and ZuJunHou [4] present a method to combine the advantages of appearance-based method and key-point-based method for affine ND image detection. It consists of three steps: firstly, the key-points of images are extracted and then matched. Secondly, the matched key-points are voted for estimation of affine transform based on an affine invariant ratio of normalized lengths. Finally, to further confirm the matching, the color histograms of areas formed by matched key-points in two images are compared. This method is advantageous in handling the case when there are only a few matched key-points.

Sheng-Fu Liang, Sheng-Che Hsu and Kang-Wei Fan [5], robust in-car digital image stabilization (DIS) technique is proposed to stably remove the unwanted shaking phenomena in the image sequences captured by in-car video cameras without the influence caused by moving object (front vehicles) in the image or intentional motion of the car, etc. Skyline can generate more reliable GMVs for image sequences with irregular conditions such as containing large low-contrast area (sky). It can reduce the steady-state lags of motion trajectory without affecting the effective image size for image sequences with constant motion. Experimental results, the proposed technique demonstrates the remarkable performance in both quantitative and qualitative (human vision) evaluations compared to the existing approaches.

Hailin Jin and Feng Liu [6] proposed technique that allows a user to transform their hand-held videos to have the appearance of an idealized camera motion, such as a tracking shot, as a post-processing step. Given a video sequence from a single video camera, our algorithm can simulate any camera motion that is reasonably close to the captured one. They mainly focus on creating canonical camera motions, such as linear or parabolic paths, because such paths have a striking effect and are difficult to create without extensive equipment. This method can also perform stabilization using low-pass filtering of the original camera motion to give the appearance of a steadicam. Given a desired output camera path, proposed method then automatically warps the input sequence so that it appears to have been captured along the specified path.

III COMPARATIVE ANANLYSIS

Table 1 Survey Table

Sr. No	Paper Name	Author	Method Proposed	Limitations
1.	Real-Time Video Stabilization for Unmanned Aerial Vehicles	Yue. Wang, Zu.Hou	Real-time video stabilization method for Unmanned Aerial Vehicles (UAV).	Accuracy of estimated transform between two consecutive image is highly depends on the accuracy of key-points detected.
2.	Video Stabilization using scale invariant features	R. Hu, R. Shi, I. Shen, W. Chen	Technique to remove the annoying shaky motion and reconstruct a stabilized video sequence with good visual quality.	In this they do not solve the motion deblurring.
3.	SIFT Features Tracking for Video Stabilization	SebastianoBattiato, Giovanni Puglisi and Giovanni Gallo	Video stabilization algorithm based on the extraction and tracking of Scale Invariant Feature Transform features through video frames.	Improvements needed in the SIFT extraction.
4.	Key point-Based Near-Duplicate Images Detection Using Affine Invariant Feature and Color Matching	Yue Wang, Karianto Leman and ZuJunHou	Key point-based approach to near duplicate images detection.	They don't use a color matching of images.
5.	A Robust In-Car Digital Image Stabilization Technique	Sheng-Fu Liang, Sheng-Che Hsu and Kang-Wei Fan	In-car digital image stabilization (DIS) technique is used.	The undesired shaking effect cannot be eliminatedin the constant motion condition.
6.	Content-Preserving Warps for 3D Video Stabilization	Hailin Jin and Feng Liu	Techniques to effectively recreate dynamic scenes from a single source video.	This is not-physically-correct approach to novel view interpolation.
7.	Evaluation of Image stabilization algorithms	R. Chellappa And A. C. Morimoto	A set of measures to evaluate image stabilization algorithms based of their fidelity, displacement range, and performance.	This techniques is more complex and more sensitive to tracking errors, causing them to perform worse than the simpler models.

R. Chellappa and A. C. Morimoto [7] proposed a simple procedure for evaluating the fidelity, range of displacements, and performance of EIS algorithms. Although these measurements are not absolute since they depend on the sequence being stabilized, and on particular system configurations, they can be used to compare different systems, even those based on different transformation models. They can also be used to evaluate other image registration or global motion estimation techniques, or as development tools to evaluate different configurations.

III CONCLUSION

In this paper study on stabilizing the unstable videos; raspberry pi 2 is used to process these videos. This video stabilization mainly involves estimation of the camera motion path and smoothing motion path. This system is based on SVD based grayscale image value and graphical measurement. Here, identify the motion distortion between two consecutive frames. Singular Value Decomposition (SVD) that can express the quality of distorted images either graphically that is in 2D measurement or numerically as a scalar measurement both near and above the visual threshold.

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