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Efficient Road Detection and Traffic Monitoring for Unmanned Aerial Vehicle

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***Abstract*—An unmanned aerial vehicle (UAV) has many applications in a variety of fields. In the field of aerial photography detection and tracking of a specific road in UAV videos play an important role in automatic UAV navigation, traffic monitoring, and ground–vehicle tracking, and also is very helpful for constructing road networks for modeling and simulation. In this paper we used Edge detection, differentiation & median filtering, gray threshold estimation. By apply morphological area condition and remove objects smaller than 100 pixel per square. Then label objects & extract region properties (Bounding Box, Centroid, Area). Then object showing area greater than 100 pixel square plot bounding box & print centroid. With the result we not only can detect the road and track them but also find the coordinates of the moving vehicles. Which provide real time traffic movement and surveillance. This method provides better result with maximum precision and accuracy. With some modification in road we can also determine the velocity of vehicle and real time density of traffic in particular area.**

***Index Terms*— Unmanned aerial vehicle (UAV), aerial photography, road detection, road tracking, edge detection.**

I. Introduction

Aerial photography

Technique of photographing the Earth's surface or features of its atmosphere or hydrosphere with cameras mounted on aircraft, rockets, or Earth-orbiting satellites and other spacecraft. For the mapping of terrestrial features, aerial photographs usually are taken in overlapping series from an aircraft following a systematic flight pattern at a fixed altitude. Each photograph depicts an area that includes several control points, the locations of which are determined by ground-surveying techniques. A technique known as photo grammetry (*q.v.*), which involves the simultaneous projection of the overlapping views, makes possible the preparation of contour maps or three-dimensional models of the terrestrial surface that has been photographed.

Unmanned aerial vehicle

UAV (or uncrewed aerial vehicle, commonly known as a drone) is an aircraft without a human pilot on board and a type of unmanned vehicle. UAVs are a component of an unmanned aircraft system (UAS); which include a UAV, a ground-based controller, and a system of communications between the two. The flight of UAVs may operate with various degrees of autonomy: either under remote control by a human operator or autonomously by onboard computers.

In the process of road detection and tracking, most approaches use the color (texture) and/or structure (geometry) properties of roads. Among them, the combination of road color and boundary information have achieved more robust and accurate results than using only one of them in road detection, as shown in the work [1], []. Therefore, we are in more favor of using both types of information. Because real time is required in many UAV-based applications, our major target is how to effectively combine both types of information for road detection/tracking in an efficient way. Intuitively, there are two rules to make one integrated framework efficient. First, each component of the framework should be fast. Second, if one component is faster than the others in achieving the same purpose, it would better make use of the fastest component as much as possible.

II. LITERATURE SURVEY

In the first step, UAV should take aerial pictures along the focused road field captured by mounted-camera. In the present study, anonymous videos are employed for a defined task. Considering the flight speed of the UAV, the time-period between two successive pictures are estimated. Therefore, redundant calculations causing time wasting are avoided. We need to keep in mind that assigned images are not the real images at world coordinate system, but they are images at image plane. Hence, projective geometry plays a significant role in the present scheme. Further, anonymous UAV images may be distorted due to possible vibrations in motion. In such situations, captured images are enhanced by proper noise filters. After reducing noises, we can try to eliminate shadows from the road images using minimum entropy method [3]. Then, present images are converted to binary ones via thresholding.

In this paper we have investigated handling maneuvering targets in clutter when image-based information are available in addition to 2D LMS data. We have used image-based observations in data association as it correctly reflects the future trends of the road. We also used laser measurements as well as image measurements in our Kalman filter to make it more robust. We compared the laser-alone tracking method with image-enhanced tracking method and concluded that the image-enhanced tracking method is capable of tracking maneuvering targets in clutter. In contrast, the laser-alone tracking method is only capable of tracking straight-line road segments reliably. [4]

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A system has been described that detects and tracks lane markers and road boundaries using color vision and ladar. The system makes use of a continually updated world model to predict where the sensors should focus their attention to ensure that the vehicle can drive fast enough. By predicting which regions of future images will contain the most useful information based on the current world model, the complexity of sensor processing is reduced and the signal to noise ratio of the sensor data is increased. By dynamically selecting the most appropriate sensory processing algorithms for achieving a given task, the system is able to track lanes and different types of road boundaries as appropriate. Therefore, the system can track lane markers on paved roads and switch to tracking road boundaries on unpaved dirt and gravel roads.[5] In this paper, a principal direction of multi-dimensional voting scheme using edge points whose texture orientation is main direction of the road, is proposed to locate the position of vanishing point. Then, a fast directed search method speeds up the vanishing point updating step based on the multi-dimensional voting result. After that, a simplified road boundary detection method is used to detect dominate road edges. Quantitative and qualitative experiments on real-world road images have shown that the proposed method in this paper is robust to varying imaging condition, road types, and scenarios. [6]

Vehicle tracking system is used generally for improving overall productivity which offers better return on your investments. For handling larger job loads within a time route planning is important. both for personal as well as for business purpose, Vehicle tracking improves safety and security, communication medium, performance monitoring and it will increase productivity. So in future it will play a major role in our day-to-day living. [7]

III. MATHODOLOGY

A system is designed for road detection and route determination, which is implemented on aerial images captured by UAV camera. The system diagram of the proposed method is given in Fig. 1. In accordance with the proposed algorithm, it is assumed that UAV is initially deployed at the start point of the subject road. Then, UAV starts capturing aerial images as soon as it comes to a specified altitude after taking perpendicularly off. These assumptions limit the underlying problem clarifying the simulation by means of anonymous experimental videos. Therefore, aerial image frames are received as inputs. Video frames are consecutively taken with regular intervals. The frequency of this operation should be changed according to the flight speed of the UAV. For example, if the UAV flies along the road at higher speed than the specified one, capturing time period of frames should be adapted to decrease. Otherwise, it may not capture some of successive road portions, and UAV cannot correctly follow the road.In this study, UAV needs a route suggestion rather solely detecting road portion pixels. For this reason, we have focused on estimating road direction. In other words, this work develops an aerial route-planning model

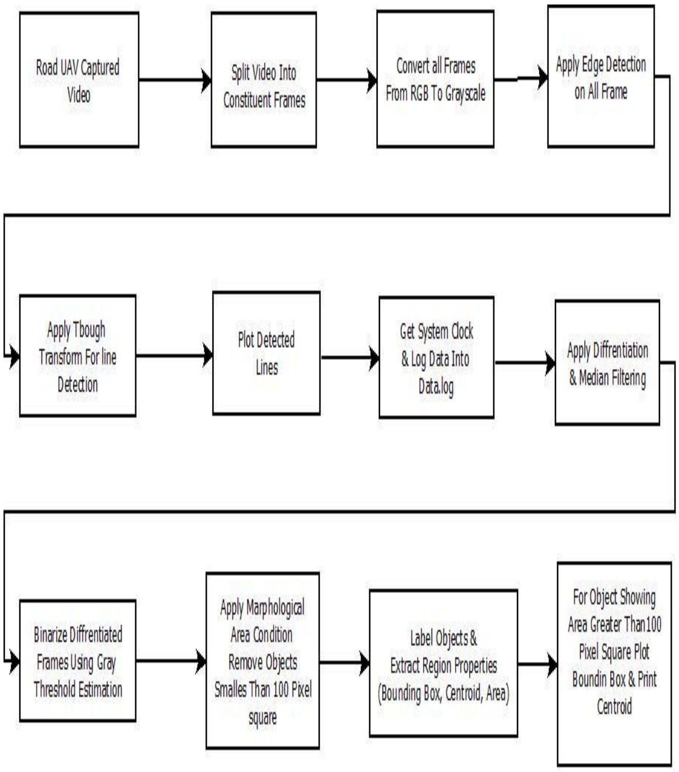

Fig1: Block Diagram Of Applied Operations

In this block diagram we can see 1st road UAV captured the video then split this video into constituent frames then convert all frames from RGB to gray scale then apply edge detection on all frame then apply **tbough** transform for line detection ten plot detected lines. Then get system clock & log data into data.log. Then we apply differentiation & median filtering then binaries differentiated frames using gray threshold estimation then apply morphological area condition and remove objects smaller than 100 pixel square. Then label objects & extract region properties (Bounding Box, Centroid, Area). Then object showing area greater than 100 pixel square plot bounding box & print centroid.

1st main code starts then get video file from user. Then extract all frames in image while playing original video. Then a condition will be checked that is i<number of frames if it is true then set images frames wise in images. Then create new figure window. Then read all images then a condition will be checked that is i<length (sorted image names) if it is true then open data log file. Then sort images frames wise in GImages then create new figure window figure (3). Then read all images from GImages. Then next condition will be checked that is i<length (sorted image names) if it is true then open data log. Then create new figure window figure (4). As same create figure window figure till (9). Then read all images from LImages, & obtain region properties, & plot bounding box & centroid. Then next condition will be checked that is i<length(Sorted Image Names) -1 if it is true then algorithm will be stop.

IV. RESULTS

In the simulation stage, an anonymous video stream previously captured by UAV is experimented to assess the performance of the underlying system for different roads.

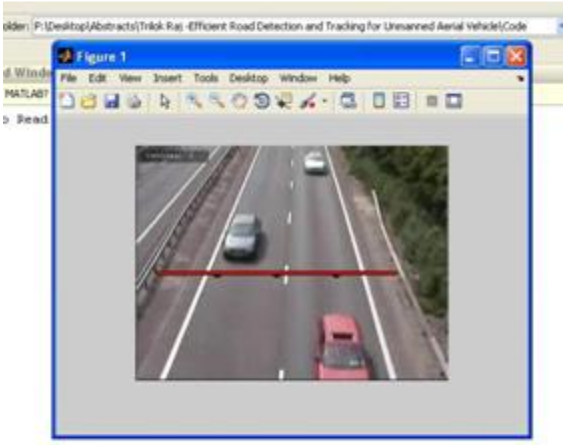

Fig 2: Original Video By UAV

After reading the video successfully we perform the fragmentation of video to get frames form it and then perform the RGB to gray scale conversation of the given video.

Fig 3: RGB to gray scale conversation

After grayscales conversation we apply Edge detection to find the boundary of road

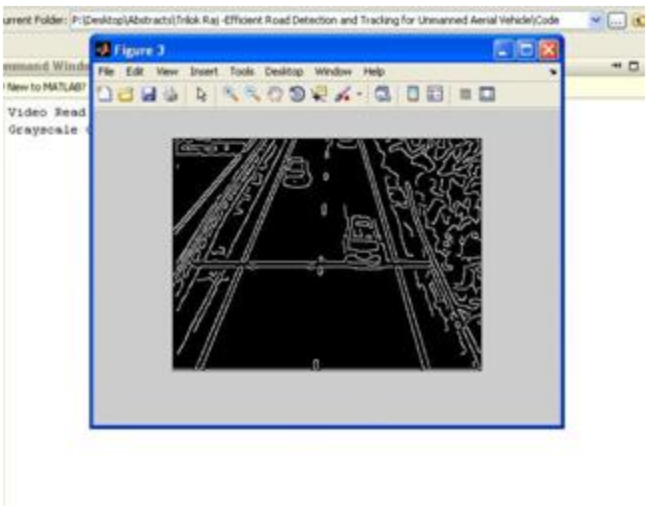

Fig 4: Edge Detection

Above method helps us in detecting road which indicate border of the road in green lines.

Fig 5: Road Detection

After detections of road out next task is to find vehicle movement on road and with the help of frame differentiation, frame binarization and frame morphology was implied on the video through witch coordinate of the vehicles are detacts.

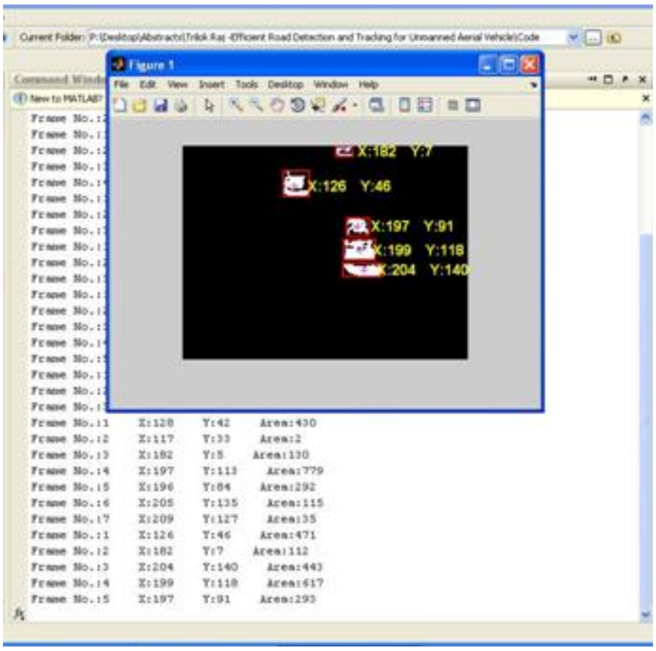

Fig 6: Coordinates of Vehicle

The above fig gives the coordinate of the moving vehicle by which we can find the density of traffic on the given road. Since the used video is an anonymous video stream previously captured by UAV we are unable to find the real time traffic density but it is suitable for real time operations too.

V. Conclusion

Some assumptions have been taken by the proposed approach. The UAV is considered to be moving at a fixed altitude and the speed is 50 km/h. It is assumed that the start and end points of the UAV are known. This work was achieved by an anonymous streaming video captured from UAV for simulation purposes.

In this paper, a novel approach for road detection and tracking in UAV videos has been proposed. We utilize the static Edge detection to extract initial road areas. Fast road detection and tracking is achieved in our proposed method. Efficiency and effectiveness of the proposed tracking technique are demonstrated in our experiments.

Other than that we used frame differentiation, frame binarization and frame morphology to detect the coordinate of moving vehicle and mark them to find out the traffic density of particular part of the road at a given time.

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