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An Automatic Detection of landing sites for emergency Landing of Aircraft

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Abstract -. . *This paper proposes an automatic computer aided detection (CAD) system to help pilots to find emergency safe landing sites in the emergency situation. The emergency landing can be caused by many reasons due to lack of fuel, whether changing, rain, disaster. So, in the emergency situation landing should be as soon as possible on high priority. The most chances of emergency landing is engine failure and running out of fuel so the aircraft will lose flying capacity so the pilot have to make quick decision of landing in some minutes. so time is another vital critical factor in taking decision of landing because quick decision is important while landing.Therefore,a simple robust and very efficient algorithm is for selecting the landing sites is desired.*

Key Words: Canny detector, K-Clustering, Horizon Detection

1. INTRODUCTION

An emergency landing may occurs due to different reasons eg.exceed level of fuel, fog, rain or sudden medical emergency.so landing is unplanned event should be safe at that situation. This method helps pilot for safe landing it shows number of sites to pilots for emergency landing. Emergency landing is very critical when no runway available. This method helps pilot for emergency landing when no runway available for safe landing. External environment factors also affect to emergency landing so 90%decision of choosing safe landing is depends on pilots. Earlier the pilots used to see 90 degree at terrain surface and choose are for landing but the disadvantage of that manual technique is that is does not covers all surface by human eye. When the pilots look towards left the right side objects gets missed so it is the big disadvantage of that system to overcome this disadvantage our technique helps to recover the entire terrain image. Therefore the vision based automatic safe landing helps to pilots choose safe landing sites. The two factors are taken under consideration first is elevation map and another is landform. The gradient of elevation generally determines the roughness of terrain landform describes terrain covering eg.grass, rock,building forest. The landing sites can be considered safe only if its surface is smooth and if its length and width is in proper ratio. The proposed system designed to automatically detect landing sites that meet both requirements. The safeness of an landing site is mainly determined by its surface roughness and dimensions. The roughness of terrain can be measured by gradient of elevation if we have information of elevation map of terrain the gradient information can be easily found and safeness can be accurately estimated. The vision Based channel is more important which provides real time Paragraph comes content here. Imagery on ground. In practical more aircraft do not have either database of elevation maps. The proposed system helps pilot to choose safe landing sites. The safe landing has to be chosen by pilots it depends on 10% on the pilot and 90% on the system. Pilot has to make quick decision to choose safe landing site[1].

2. BLOCK DIAGRAM

The proposed safe emergency landing sites detection system consists of different modules. In the first module image is acquired by the camera mounted on the aircraft multi-spectrum sensors are presents on the aircraft each camera looks in a specific direction that covers a portion of the region in front of the aircraft

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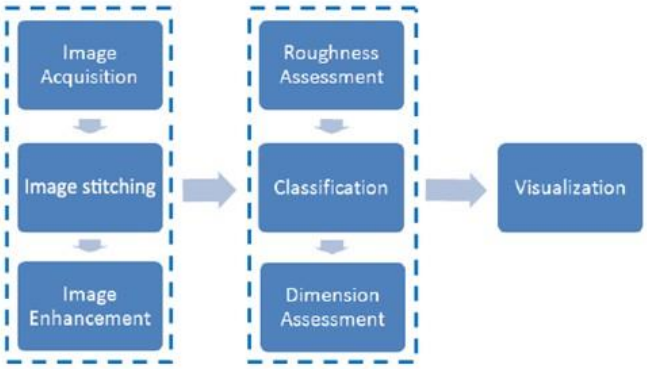

Fig1.Block diagram of proposed System

In the second module, the different images obtain by first Module are combined together to cover all image information. In the aircraft there are three cameras by combining the three Images captured at one instant one image are formed. It is shortly known as panorama creation. Panorama creation can be done by considering different images at same instance. In the third module image enhancement are done. Images are captured under poor weather conditions like rain; fog etc.so to make use

of the nonlinear retinex image enhancement method is used to improve sharpness and contrast of the image. at last the output of this system will be display on the CAD system with number of the sites zone. Depends on the smooth sites pilots has to choose one site for safe landing. Based on number of sites which are detected by CAD tool depends on the smooth surface

3. METHODS

Depending on the roughness and width, length of area safe landing can be detected. The roughness of the ground surface is considered by the gradient of the attitude, so if we have information about elevation map then the information can be easily found and safeness can be eastimated. Safeness also depends on the another factors like tree, rocks, vehicals ,mountain. Generally most of the aircrafts have elevation maps which include all details.

3.1 Image Acquisition

The basic structure of the aircraft is it have three camera mounted on front and right, left side of plane. First process is to capture three images by all camera's in practical it not possible to take real time images so we have taken images from Google map. So by using these images we have done further process.

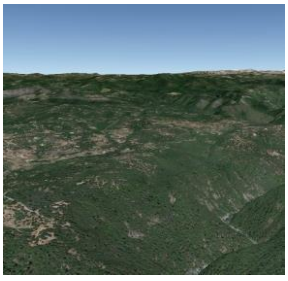

Fig 3(a)Sample image 1

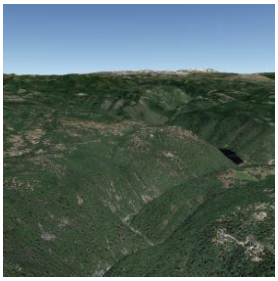

Fig 3(b) Sample image 2

Based on the number of the inputs images panorama is created by using this images. As in one image is it not possible to captured all surface are which is required for processing so panorama creation helps to covers all surface of the ground by combing all input images.

3.2 Panorama Creation

Captured by the camera of the aircraft by using different angles. The need of panorama creation is that to gather all information and to cover all surface area of ground. It is not possible to cover all the required are of ground surface by the Human eye so panorama takes under consideration. Following Figure shows the panorama created image.

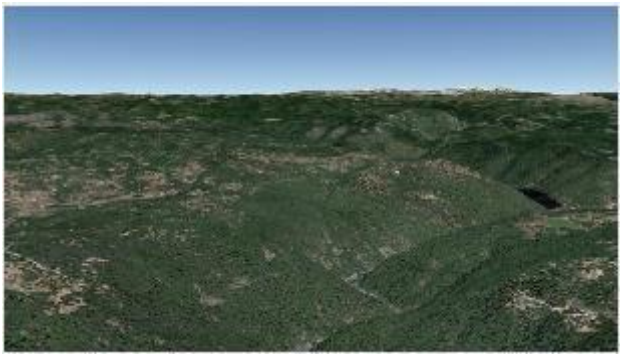

Fig 3.1 Panorama Image

As shown in the above figure panorama is created by using different images. Panorama image helps to find features of all images that cannot cover in the single image.

3.3. Horizon Detection

To differentiate sky region and ground region is a difficult
thing so horizon detection carried out. By using horizon detection we can simply classify the sky region and ground region. This algorithm proposed by Williams and Haward for particular ground based rover application for differentiating sky area and ground area. Considering this algorithm some assumption needed (a) as camera is always mounted on the ground side rover so bottom third of picture is considered as the ground.(b)the second assumption is ground is always appears all white with the little change because the rover present is different glacial environment. So based on the two assumption horizon is detected. Following figure shows the horizon detected line which differentiates the sky region and ground region[5].

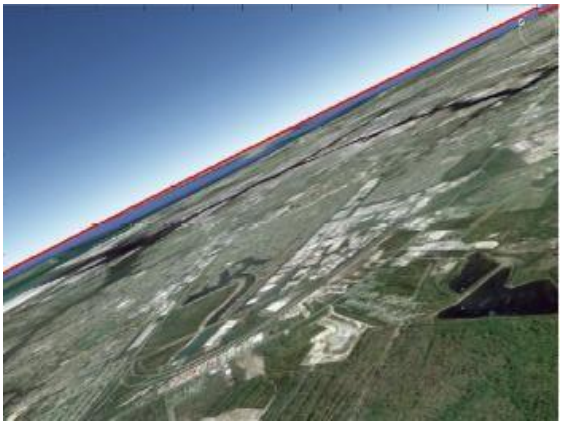

Fig.3.3.Horizon detected line

It is very important to find out ground region from the image sometimes both considerations fails so the Edge detection is help to detect the line between it.

3.4 Edge Detection

By using canny edge detector operator Edge detection is carried out. To characterize the difference, the edge map is first divided into different blocks. For each block the cumulative hazards strengths (CHS) is defined as follows,

$$CHS = \sum_{p \in B} (Esp_p), \quad (1)$$

$$H(Esp_p) = \{1 \; Esp_p \geq \varepsilon, 0 \; Esp_p \leq \varepsilon\}, \quad (2)$$

Where p is a pixel in block B and Esp. is the edge strength ofeach pixel. If the blocks give value zero or very low it means area is smooth. If the block value of CHS is high then it is considered as the rough area is high [4].

Fig3.4.1.Sample image

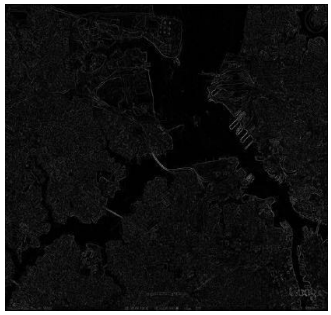

Fig3.4.2.Edge detected image

3.5 Classification

The classification module utilizes the K-mean clustering method. It is use to classify CHS of the each block into number of cluster. The data with similar characteristics are grouped together in this method. Clustering algorithm is used for unsupervised classification of remote sensing data[5]. The Kmean method is efficient method. Figure 3.5 shows the clustering method's output.

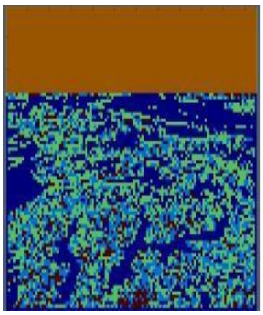

Fig 3.5.1. Clustering result

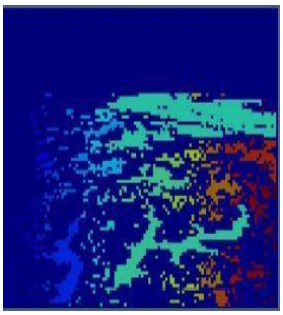

Fig3.5.27.Multi region

The length and width of each area calculated by measuring its minor and major axis boths in units of pixels as follows,

$$\begin{aligned} PS_V &= \frac{2h_c}{N_V} \tan\left(\frac{FOV_V}{2}\right), \\ PS_H &= \frac{2h_c}{N_H} \tan\left(\frac{FOV_H}{2}\right), \\ L &= a\sqrt{(PS_H \cos(\theta))^2 + (PS_V \sin(\theta))^2}, \\ W &= b\sqrt{(PS_H \cos(\theta))^2 + (PS_V \sin(\theta))^2}, \end{aligned}$$

3.6 Segmentation

Segmentation is method of dividing image into number of blocks.[5]The main purpose of segmentation is to extract the features from segmented image. By using pixel matching technique after segmentation we can easily find rough and smooth area.

$$L = \sqrt{(d_H(x_{a2} - x_{a1}))^2 + \left(\sum_{k=y_{a1}}^{y_{a2}} d_k\right)^2}$$

$$W = \sqrt{(d_H(x_{b2} - x_{b1}))^2 + \left(\sum_{k=y_{b1}}^{y_{b2}} d_k\right)^2}$$

3.7 Dimension Assessment

The dimensions of each landing site are estimated by measuring both major and minor axis of ellipse. Once major and minor axis found then length L and width W can be gained as,

Fig 3.7.Landing sites are indentified and dimensions sites

3.8.Visualization

The Visualization module is a basic view designed to help pilots to choose landing site. Visualization is a main module designed in this system as it indicates name visualization it means landing sites are detected pilots have to choose its. Depends on the input given by pilots the number of sites displays on the CAD tool.

Fig.3.8landing sites

3.9 Results

In this method by using K-mean clustering algorithm classification has done on images taken by Google map. We have not taken into account the factor maneuverability. At last pilot will able to see the window with the number of landing sites. Pilot has to choose one landing site manually.Figure10 shows the final output image

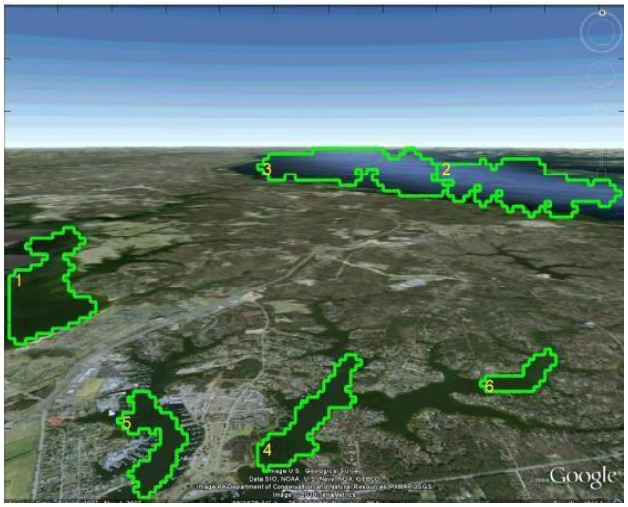

Fig 3.9.Number of landing sites

As shown in figure the vision based emergency landing sites are detected in the CAD system. Pilot have to select one sites for safe landing.

4.Conclusion

This paper proposes an automatic detection of landing sites with analysis algorithm to detect smooth areas and measurements of dimensions of areas. Pilots can choose efficient site for safe landing. In case of emergency landing pilot can save time and devote to other necessary activites.So it is an efficient and robust method to find safe landing of aircraft in emergency case. So it is an effective method for pilots to choose safe landing sites within a low time.

5.REFERENCES

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