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Camera Based Fod Detection Using Image Processing Technique

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Abstract:*FOD is stands for Foreign Object Debris, the FOD like nut, stone, animals, birds, even human being or any small objects. These FOD may leads to damage the aircraft system. There are different system developed for FOD detection in the airfield namely Tarsier system, iferret monitoring system, FOD finder monitoring system. These system uses a RADAR which is very costly and it affects the equipment such as localizer. Our proposed system consists of High resolution camera and the monitoring system. The High resolution camera which is less costly as compared to the RADAR. The main purpose of this design is to perform real-time FOD detection and crack detection for 24 hours in all weather conditions using Image processing technique. In addition, the system consists of multiple High resolution camera to cover the entire airfield.*
Keywords: *FOD, object detection, image processing, high resolution camera.*

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I. Introduction

FOD stands for Foreign Object Debris, which refers to a foreign substance or object that may damage the aircraft system. FOD can be nuts, flying objects, wild animal, leaves, sand, connecting pieces, wrappers, paper, bottle caps, wire and stone etc. Presently, most of the domestic airports are using manual methods like visual inspection for detection of FODs which is neither efficient nor safe [1]. For example, On 25 July 2000, Air France flight 4590 crashed near Paris at Charles de Gaulle International Airport where 100 passengers, nine crew members and four people on ground were killed which was caused by FOD [1]. Foreign object debris are hazardous when on runway. FOD Hazards are of two types- (a) External FOD hazard (b) Internal FOD hazard. External FOD hazard includes conditions like fog, sandstorms, hail bird strike object left on the runway. Internal FOD includes jam moving part, short out electrical connections etc. Equipment used to combat FOD are Airfield sweeper which periodically cleans the runway, ramp, and parking areas of small debris. Disposal cans and bags: cans and containers are used for storage of found debris. Aircraft and wheel covers, used to protect equipment from rain, wind, dust and other environmental hazards. Usually FOD detection systems consists of radar based system which scans runway for the presence of debris. The proposed project is a camera based system which is designed to build an automatic, fast, and accurate monitoring alert system. In this, a high resolution camera is interfaced with the system using image processing in MATLAB. It will continuously monitor, if any object or crack is detected it sends out an alarm sound.

II. Problemformulation

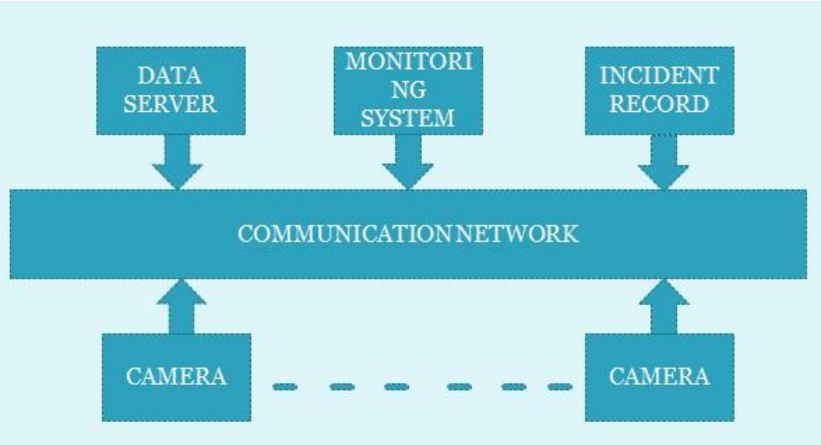

Fig. 1 Block Diagram

1.1 Camera

In this system, high solution multiple camera is used where it captures the images of runway for every seconds and it compares the image with the clean reference image of the runway. Initially the camera captures the clean pictures of the airfield runway depending upon the weather conditions. And all the camera are connected in cascade form with the monitoring system.

1.2 Monitoring System

Monitoring system uses the MATLAB software where the image processing technique is used for FOD detection and crack detection in the airfield runway. Monitoring system gives all information about the detected object with the determine distance such as reference image, detected image with Distance, and crack if any.

1.3 Computer Vision

Computer vision toolbox is used for video streaming where the snapshots are taken .From the snapshots the image processing technique is applied.

1.4 Image Processing Technique

Image processing is a technique which is used to convert an analog image into digital image and performs some operations like segmentation, enhancement, restoration etc. in order to extract the region of interest or any information. In the above technique, initially it takes the clean reference image of the airfield runway and stores it. Until or unless the user prefers to change it the stored image will be considered as the reference image. Then, the camera captures the image continuously by comparing with the reference image. During the operation if any difference is found that image will be converted into binary form and applying the 2-D median filtering to remove noise .Thus, helps in detection whether FOD found or not and crack is detected or not

Case1: if FOD is detected - It sends out the alarm sound which is interfaced with the monitoring system and image of the FOD will be displayed until it is removed from the runway

Case2: if FOD is not detected - It continuously takes an image of the runway keeps comparing until the FODs detected.

Similarly, both case1 and case2 are repeated for crack detection.

1.4 Graphical User Interface

Graphical user interface (GUI) is created for easy handling of the user as well as gives the accurate result of FOD detection in different climatic conditions.

III. Workflow

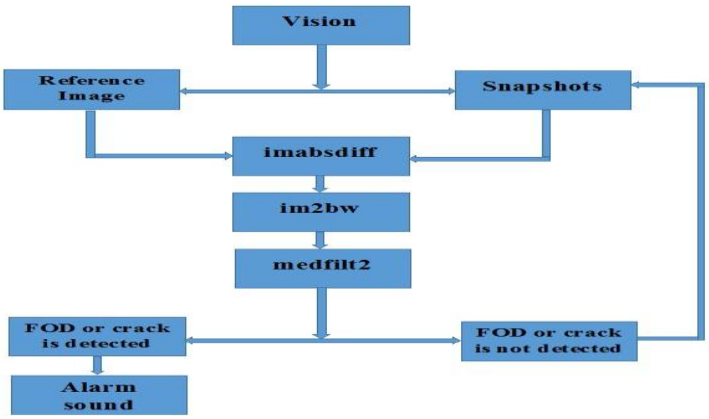

Fig.2 work flow

Using computer vision the video streaming started. It starts taking snapshots. It will take difference of the reference image and current image, that image will convert into binary image and applying the 2-D median filtering in it .If any difference will be found the FOD or crack is detected .If not it will take continuous snapshots and compare with the reference image.

IV. Graphical User Interface (Gui)

There are different push buttons which are used as per different seasons and shifts i.e. start or run push button where it initially takes reference image, Depending upon the conditions user click the required pushbutton and it automatically detects similarly, if user want to check any crack in runway, the user clicks on the crack detection push button .Exit push button is used to exit from the program. Close button is used to stop the program.

V. Observation

High resolution camera captures clean reference image as shown in (A) and it compare with the current frame and the resultant image after taking difference is shown in (C) and it is converted into binary form and performs median filtering which is shown in (D).If any object or crack is detected there is a message box will appear for indication at the same time, sends out alarm sound and to determine the object distance the user can set the endpoints and observe the distance which is shown (E).

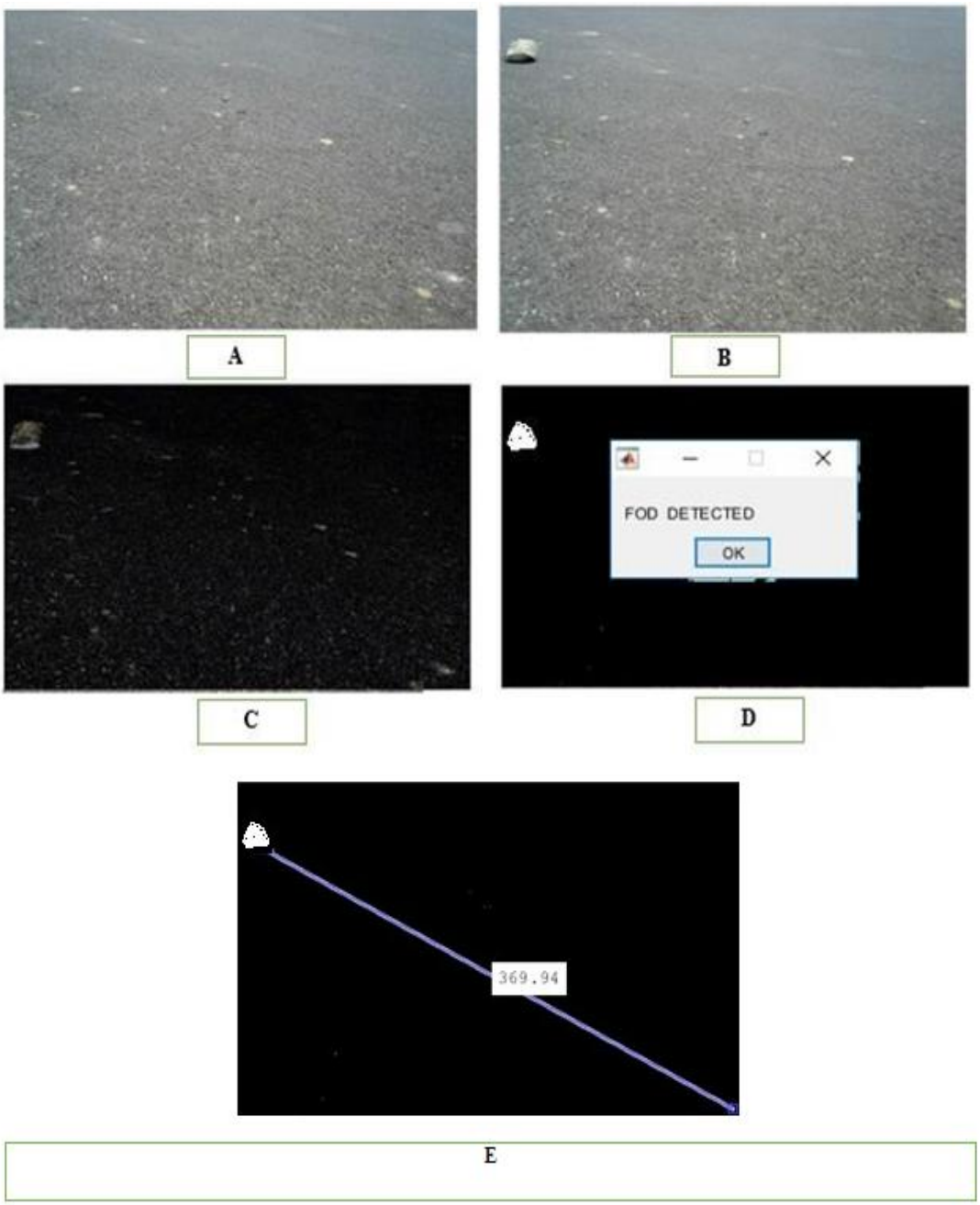

Fig .3 A) Reference Picture B) FOD Picture C) Difference Image D) Median Filtering With A Message Box E) Distance Of The Detected Object

VI. Conclusion

The present day FOD detection system uses a radar especially millimeter wave radar .In this paper, uses a multiple high resolution camera and monitoring system .This high resolution camera reduces complexity, cost and it does not affect the equipment like localizer and the monitoring system consists of MATLAB software were the GUI was made as per the different seasons namely summer and rainy , shifts namely morning,

afternoon, evening and night and crack analysis using image processing technique. So, depend of the situation it will continuously monitors and alarm sound sends out if any object or any crack detected.

Futureenchancement

There are many aspects to study and improve this FOD detection system. How to extract the detected object automatically in an image needs a further study. How to find the distance of the object automatically rather than specifying the coordinates in an image also requires further study.

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