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Earth Orbit Prophylaxis

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Abstract
Considering the space research development of our country India, it has been maintaining its path to the highest peaks of achievements. A recent mission known as MISSION SHAKTI has been coded to test an Anti-Satellite Weapon that would destroy the unused satellites in the orbit. The target of this test was on a satellite in the Low Earth Orbit, that was stricken out by a kinetic kill vehicle. Even though the test was completely successful the test sparked concerns regarding the space debris. The Indian government tried to address these issues by saying that the debris generated from the ASAT test would not last for long duration. But there stayed the negative stain in the minds of other countries. To solve the above issues, this proposal has developed a payload theoretically that cleans the earth orbit from space debris caused by unused satellites and its broken parts. An ***algorithm*** *has been developed with* ***MATLAB*** *that aims to sense the unused satellites in the earth orbit, through* ***Image Processing Technique*** *combined with* ***Convolution Neural Network Technology (CNN)*** *using* ***Grey scale Complex Matrix (GLCM) extraction.*** *The algorithm has been designed to capture the logo / structure of the unused satellite to make sure that it belongs to our country after confirming that whether it is in working condition by means of analyzing the output from thermal camera. It also has the technique to calculate the height and weight of a space debris from the image captured by the camera where the image gets binarized.*
Keywords: *Image Processing - Convolution Neural Network algorithm – Grey Level Co-occurrence matrix (GLCM) feature extraction for accuracy inputs.*

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I. INTRODUCTION

A network that consists of interconnected nodes or neurons with the format of layered structure which reflects the structure of human brain that can analyse the patterns, classify the data's and forecast the future events is called as the neural network. In this network there are two types which is called as Artificial Neural Network (ANN) and Convolution Neural Network (CNN). In general, this network has 3 layers the input layer, the hidden layer and the output layer interconnected by nodes. The CNN replaces the ANN because of the size and time consumptions along with accurate results that it consumes for a task. The feature extraction process is carried with a technique called as GLCM which examines the spatial relationship of pixels of an image under image processing technique. A special method known as Bounding Box technique is used that helps to find out the area and weight of an object using the image of it, which is based on its pixel values. Hence the above-mentioned techniques combine together to give a confirmation to the controller about the space debris that revolves in the low earth orbit.

II. CONVENTIONAL METHOD

2.1 ANN in Leaf Disease Detection

The ANN is used in detection of diseases in leaf that begins with clipping the image of a leaf and its colour features are then extracted using feature extraction process called HSV which is then processed with the trained ANN that contains a greater number of samples stored in them. This method initially carried over with a cotton plant leaf and the test results were 80% successful. The remaining 20% reflects the disadvantages in time and space consumption due to the usage of artificial neural network.

III. PROPOSED SYSTEM

3.1 CNN in Space Debris Analysis

The proposed system consists of a payload or a satellite that has some inbuilt facility such as thermal camera, radiation sensor and a normal camera of higher quality each along with the power system for the propulsion of the satellite.

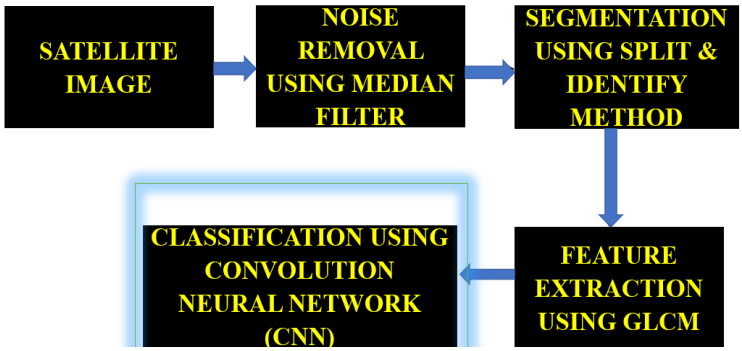

Figure I : Block diagram for proposed system

The satellite when put into the low earth orbit, it begins its process by capturing the debris in space and the image is considered as input image. Initially the thermal camera captures the image of the PV panel of the stranger satellite to confirm whether the stranger satellite is working or not. After the thermal imaging process gets over, it is then rechecked for emission of any radiations from it by means of radiation sensor. If both rays and heat traces are found then it will be considered as working satellite. If anyone of the case fails it is then put forth to image processing technique. Now the normal camera captures the image of satellite or space debris in 3 cases.

Case-I : **Analysing the unused satellite with the LOGO present on it.**

With the help of a logo present on the stranger satellite, the satellite can be analysed to which country it belongs to. For some security reasons the study of stranger satellite is required.

Case-II : **Analysing the unused satellite with its design architecture.**

The CNN is trained with a greater number of designs of various satellite along with its name. Hence the results will be accurate when the comparative process is done.

Case-III : **Analysing the space debris by calculating its area occupied and its weight.**

Here comes the Bounding Box technique that is used to calculate area and weight of a space debris from the image captured by the camera where the image gets binarized.

After getting the input image from camera, the image is then sent to Median Filter where the removal of noise takes place. Median filter is particularly chosen as it has the ability to remove the noise without disturbing the edges of the image. After then it undergoes split and identification process where the 3D images get converted into 2D image i.e., Gray scale image and then GLCM feature extraction begins to extract the statistical features such as contrast, co-relation, energy, homogeneity with CNN algorithm along with less time, memory space and 100% accurate results.

3.2 Advantages of CNN Over ANN

CNN automatically detects the important aspects without the control of instructions from any human supervision. Moreover, CNN prevents the fraudulent activities and detect them. It also has the ability to handle larger unstructured data.

IV. RESULTS AND DISCUSSION

4.1 Case-I : Analysing the unused satellite with the LOGO present on it.

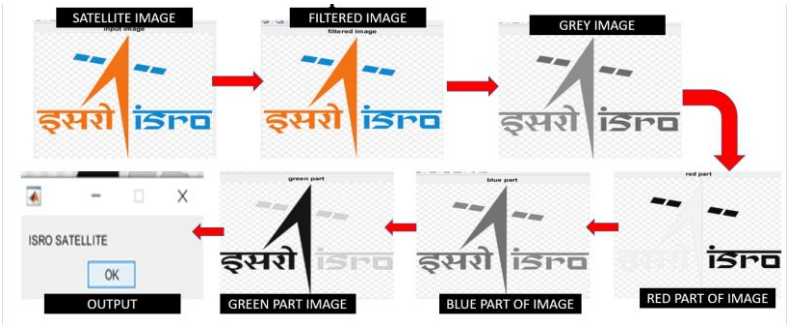

Figure 2 : Simulation Results for Case I

4.1.2 Case-II : Analysing the unused satellite with its design architecture.

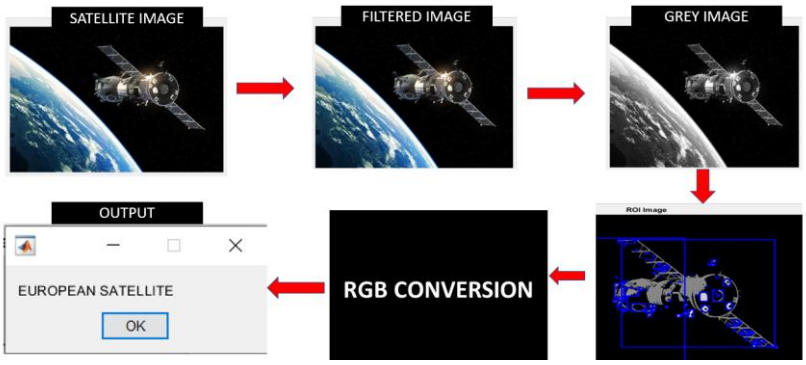

Figure 3 : Simulation Results for Case II

4.1.3 Case-III : Analysing the space debris by calculating its area occupied and its weight.

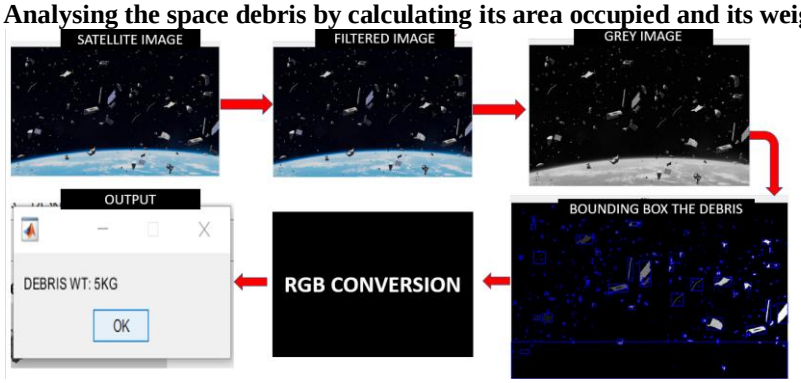

Figure 4 : Simulation Results for Case III

V. CONCLUSION

Clearing of space debris is the challenging criteria for today's scientific world and the most needed concept to save the earth orbit from getting polluted by space junks. The above explained project proposal has been successfully simulated the payload to analyse the debris in space along with the consideration of some security reasons. The future work has to be carried over with the power system for the propulsion of the above developed payload that paves a way to increase the energy availability to the electric propulsion system from the connected solar module array at any time during its operation using Maximum Power Point Tracking (MPPT algorithm) using Incremental Conductance Perturbation technique.

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