An image processing based digital scarecrow

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***Abstract*—Orchard fruits and vegetable crops are vulnerable to wild birds and animals. These wild birds and animals can cause critical damage to the produce. More than 70 percent of Bangladesh's population and 77 percent of its workforce lives in rural areas. Nearly half of all of Bangladesh's workers and two-thirds in rural areas are directly employed by agriculture. The searching activities of cropland bird species like house crow have caused a lot of damage to wheat, grain, fruits and other crops. Traditional methods of scaring away birds such as scarecrows are one of the solutions. Though there are several methods available like chemical repellent, net, spike guards, shooting the birds with gunshot, and making loud noise by fragment fire crackers in order to scare the birds which is costly or lethal. Image processing methods can be effectively applied to detecting the birds with motion detection in video footage or taking snaps. In our system the bird will be detected and an alarm will raise towards pest birds to drive them away. The proposed system has been simulated in MATLAB software.**

Keywords— Background subtraction, Median filter, Filter, Histogram, Motion

I. INTRODUCTION

Agriculture is an important sector in any country to make the country sufficient of food as well as for the employment. There are some issues regarding growing good crops. Many areal birds like crows, bird, ant, weevil, aphid, and grasshopper destroy the crops, seeds for which people use scaring crow technique. An old scarecrow technique is a decoy or mannequin, often in the shape of a human. Humanoid scarecrows are usually dressed in old clothes and placed in open fields to discourage birds from disturbing and feeding on recently cast seed and growing crops. In modern time an image processing approach can implement for scaring crow and it is now very common in many countries. In our project we also made a system to scare the birds and the system is fully done with software. The system is designed to detect pest birds from a real time video frame after it detects the birds then it generates a loudly sound to chase them.

II. APPROACH OVERVIEW

Digital image processing is always an interesting field as it gives improved pictorial information for human interpretation and processing of image data for storage transmission, and representation for machine perception

Image Processing is a technique to enhance raw images received from camera in normal day-to-day life for various applications. This field of image processing significantly improved in recent times and extended to various fields of science and technology. The image processing mainly deals with image filtering, noise removal for Background Subtraction of an image, Histogram, image segmentation, feature extraction, image classification, motion detection etc.

A. BACKGROUND SUBTRACTION

Background subtraction is a technique of image processing where an image's background is extracted for the object recognition for further process. It is particularly a commonly used technique for motion detection. It attempts to detect moving regions by subtracting the present image pixel-by-pixel from a reference background. Most frequently used color models in image processing are GRAY, RGB, and HSV. Thresholding is an initial step in any image-processing algorithm for background subtraction.

- CONVERT RGB TO HSV: Color vision can be processed using RGB color space or HSV color space. RGB color space describes colors in terms of the amount of red, green, and blue present. HSV color space describes colors in terms of the Hue, Saturation, and Value. In situations where color description plays an integral role, the HSV color model is often preferred over the RGB model. The HSV model describes colors similarly to how the human eye tends to perceive color. RGB defines color in terms of a combination of primary colors, whereas, HSV describes color using more familiar comparisons such as color, vibrancy and brightness.

- CONVERT RGB TO GRAY: rgb2gray (RGB) converts the true color image RGB to the grayscale intensity image I. The rgb2gray function converts RGB images to grayscale by eliminating the hue and saturation information while retaining the luminance.

- CONVERT GRAY TO BINARY: Images are composed of Pixels and in Binary image every pixel value is either 0 or 1 either black or white. It is called bi-level or two level image while in gray scale; image can have any value between 0 to 256 for 8-bit color (every pixel is represented by 8 bits) i.e. It can have transition between pure black or pure white. It only have intensity value. So, Gray Scale image can have shades of grey varying between Black and white

Binary image can either of two extreme for a pixel value either white or black.

- NOISE REMOVAL: The nature of the noise removal problem depends on the type of the noise corrupting the image. Generally linear filters are used for noise suppression. The Median filter is a nonlinear digital filtering technique, often used to remove noise. It is widely used as it is very effective at removing noise while preserving edges. The median filter works by moving through the image pixel by pixel, replacing each value with the median value of neighboring pixels.

$$y[m,n] = median\{x[i,j], (i,j) \epsilon w \quad (1)$$

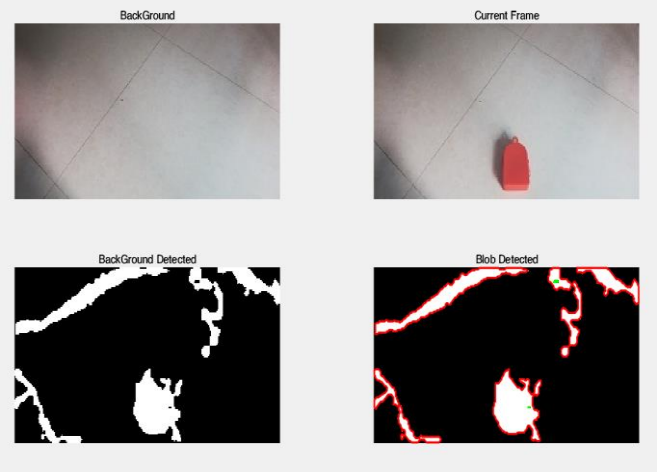

Figure 1: Noise removal

B. OBJECT DETECTION:

Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class such as human, birds or cars in digital images. For detection of object from the binary image we have to count the 0's and 1's. The 1's represents the white and the black represents the 0's. Then we check if the blob size is in less than the zeros and greater than the ones then the object is detected. And when the object is detected then it will notify by a sound. Otherwise the object is said to be not detected.

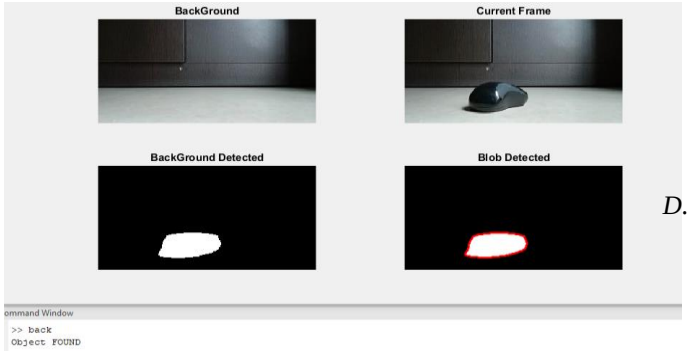

Figure 2: Object Detection

C. HISTOGRAM:

An image processing context, the histogram of an image normally refers to a histogram of the pixel intensity values. Image histogram is a graph plotting the frequency of occurrence of different color intensities in the image. It decide what value of threshold to use when converting a grayscale image to a binary one by thresholding.
Image histograms are present on many modern digital cameras. Photographers can use them as an aid to show the distribution of tones captured, and whether image detail has been lost to blown-out highlights or blacked-out shadows. This is less useful when using a raw image format, as the dynamic range of the displayed image may only be an approximation to that in the raw file.

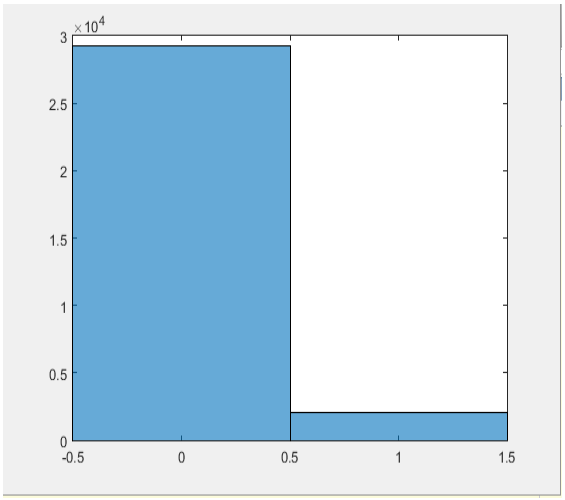

Figure 3: Image histogram graph 1

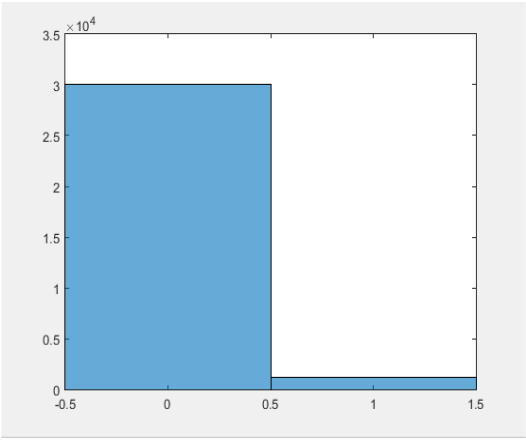

Figure 4: Image Histogram graph 2

D. MOTION DETECTION

Motion detection is the process of detecting a change in the position of an object relative to its surroundings or a change in the surroundings relative to an object. By taking two images convert the images RGB to double then again convert RGB to gray. Then do the

histogram of both gray scale images and the find the difference of the histogram. Then finally getting the output make the decisions that Motion of the object is changed or not. After processing the images for motion detection, we have analyzed a data for motion detection.

Case	Object detect	Object Not Detect	Motion Detect	Motion Not Detect
1	2	0	1	0
2	4	0	3	0
3	2	1	2	0
4	5	0	4	0
5	0	2	0	2
6	3	0	3	0
7	7	0	6	0
8	6	0	5	0
9	6	0	5	0
10	6	0	5	0
11	7	0	6	0
12	0	5	5	0
13	6	0	4	1
14	5	1	4	1
15	8	0	7	0

Figure 5: Object detected with motion analysis

III. FLOW DIAGRAM

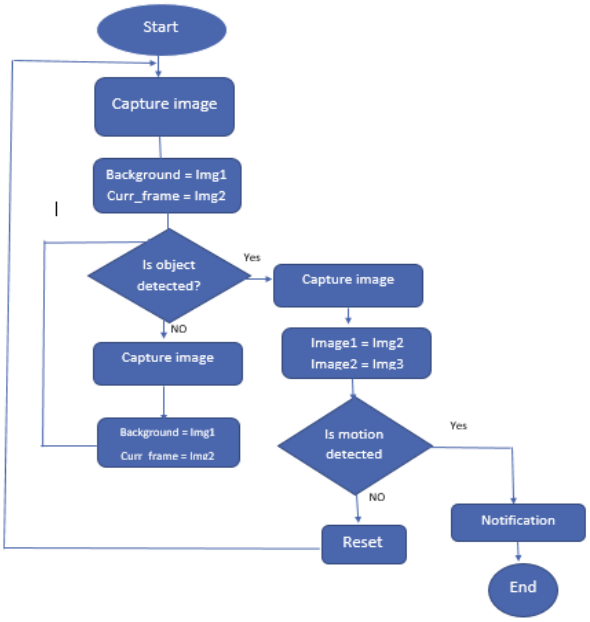

Figure 6: Flow Diagram

We have showed the flow diagram of our project. As per the flow diagram in our system, the camera will take two pictures with the name of background IMG 1 and Current frame IMG 2. The IMG 2 will be taken for background subtraction. After the object is detected by doing background subtraction it will go to the motion detection part. Then if the object can be detected through motion detection, the system will notify by that an object is found. If the object is not found then the camera will take the picture again and do the same process until the system can detect the object again.

IV. RESULTS AND DISCUSSION

Instead of bird we have done image processing on different objects to detect the birds with motion changes. The approach is same to detect the bird in real life frame. With motion detection, we have done a case analysis on different motion of objects to see the accuracy rate of detection.

Case	Object Detection	Motion Detection	Accuracy
Case 01	02(out of 2)	1	91.7007%
Case 02	04(out of 4)	3	
Case 03	02(out of 3)	2	
Case 04	05(out of 5)	4	
Case 05	00(out of 2)	0	
Case 06	03(out of 3)	2	
Case 07	07(out of 7)	6	
Case 08	06(out of 6)	05	
Case 09	06(out of 6)	05	
Case 10	06(out of 6)	05	
Case 11	07(out of 7)	06	
Case 12	00(out of 5)	04	
Case 13	06(out of 6)	04	
Case 14	05(out of 6)	04	
Case 15	08(out of 8)	07	

Figure 7: Case Analysis

By doing the case analysis it is found that the accuracy of detection the object with motion is 91.7%. So on the base of accuracy of the system, it can say that our image processing based digital scarecrow is highly effected and applicable for the real purpose.

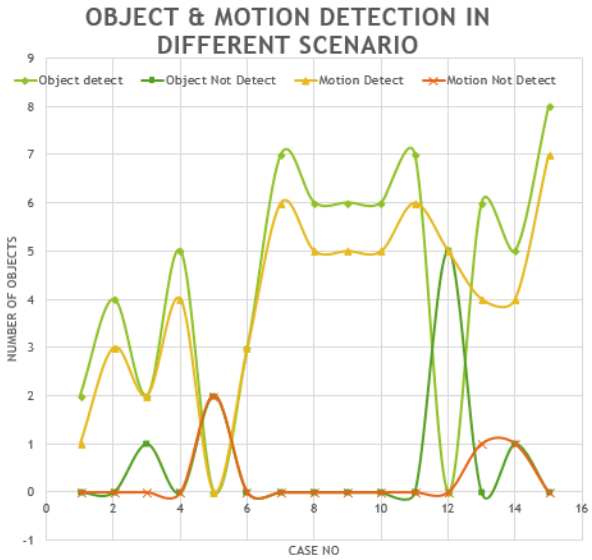

Figure 8: Case analysis graph representation

V. CONCLUSION

Different image processing techniques have been trained and tested to recognize birds in an image efficiently. Image Processing based digital scarecrow is a system, where we have used the background subtraction, object detection, histogram and motion detection. Analyzing the different case of image the accuracy rate has been high. In our approach we have done with MATLAB software. But this approach can be implement on hardware with a high processor like Raspberry pi and a good camera which can connect with the processor.

FUTURE CONSIDERATION

Our digital scarecrow system have been tested on different objects instead of real birds. The system can be applied on real bird for detecting the crow or birds. Future research will also focus on testing the recognition algorithms in natural or aquaculture settings on autonomous boats. Finally, the efficacy of using this system in guidance of the autonomous vehicle needs to be evaluated, especially with regards to the speed of operation of each algorithm.

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