

Implementation of Anti-stampede System to Control Crowd Using Image Processing

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Abstract

With the development of society in recent years, frequent crowd stampede accident occurs in public security and many other places. A number of people die due to occurrence of stampede. Crowd density analysis is very efficient for monitoring and controlling crowd for safety. The relative density provides reliable information where stampede occur. The density estimation is based on morphological operation using image processing. In this system the camera used to monitor crowd continuously and compare the density of crowd with reference image. If people gathered in a particular area crossed threshold then stampede warning system gets alerted. Thus we can prevent stampede.

Keywords: *Crowd control, Image processing, MATLAB, PIC controller, GSM.*

Introduction

Stampede can be described as a disruption of the orderly movement of crowd resulting in dangerous movement for self-protection leading to injuries. Human stampede are among the most feared crowd disasters. At present there are so many problems regarding the crowd control. Crowd occurs frequently usually without serious problem. Between 1980 to 2017 more than 350 human stampede events have been reported, having caused over 10,000 deaths and 22,000 injuries and this is believed to be an underestimation. With the large scale events being held more and more frequently, the possibility of stampede is also increasing. The main objective of this system is to monitoring and prevent stampede before a major incident take place at public places.

Related work

Different works are done to estimate the crowd density. Based on the traditional video surveillance technology, making full use of computer vision, image processing,

pattern recognition and other related technology to detect target and recognize abnormal human behavior in monitoring scene as well as conducting a risk assessment of the state of crowds in public places for timely warning has been the focus of attention around people.^[2] But there is more aspect to be improved including the more accurate stampede detection result.^[2] Another method is to estimate the crowd density by video image processing. This method is based on Gaussian background modeling and binary image to estimate the crowd density.^[1] The Discrete Cosine Transformation is used to transform the motion status of the measured area into the frequency domain to recognize the frequency distribution.^[3]

So we will conduct the implementation of anti-stampede system to detect the stampede by two dimensional monochromatic algorithms and generate the alert by the hardware implementation including PIC microcontroller, RF module transmitter and receiver, LCD and GSM.

Proposed Method:

The proposed method includes the Block diagram of the system. The block diagram of system is as follow.

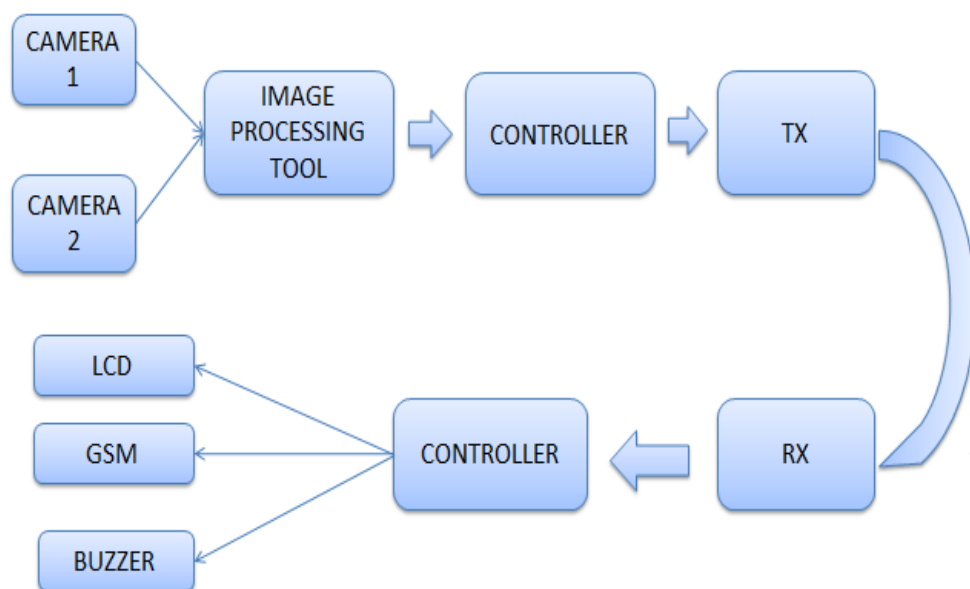


Figure 1. Block Diagram of Proposed Method.

The fundamental step for Image processing as processing is possible only when there is an image. Here images of crowded area are used as input image. The position of camera is inclined. A reference image captured by the camera then it will run monitor the area. A system takes snapshot continuously after 10 second. Image processing tool is used to process on the captured image. Here morphologic operation is used to process the image.

In the morphologic operation captured image s are converted into Gray image. Then after Gray images are converted into Black & White image or Binary image. The crowd density algorithm is based on pixel based algorithm. The system continuously counts the black pixel and white pixel. In Binary image 0 is consider as a black pixel

and 1 is consider as a white pixel. If any object or person is there in captured image, it is consider as a black pixel in Binary image. If number of black pixels are increased or number of white pixels are decreased and crossed the threshold value then the stampede detected.

The camera will continuously run monitor the area. According to that the black pixels and white pixels will also change. This change of pixels is also compared with the reference image. If pixel change from black to white or white to black then it will consider as an object or person is there compare to the reference image. This change of pixels is also considering as black pixel and if it is crossed threshold then stampede detected.

This stampede detected data transferred to the transmitter after every 5 second. The transmitter receives the data from both the camera which is located at different place. Based on that it will transmit this data to the Receiver. Thus we can monitor many areas and check the crowd density estimation.

The receiver receives the data from the transmitter. It will initialize the GSM and LCD display. IF stampede detected at area then it will display on LCD and also GSM will pass this message to control room or authorized person. The flowchart of receiver is as follow:

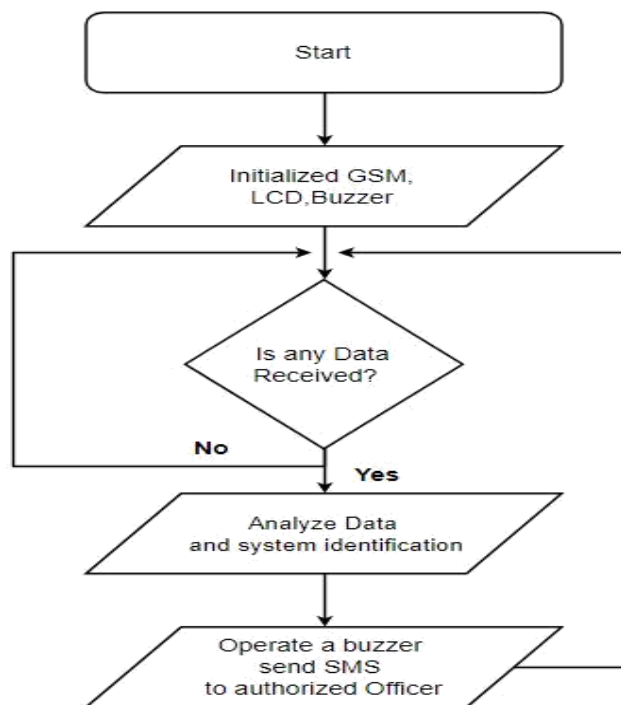


Figure 2. Flow chart of Receiver

Result Analysis:

The proposed method is implemented on MATLAB software and hardware contain the PIC controller, RF module transmitter and receiver, LCD and GSM.

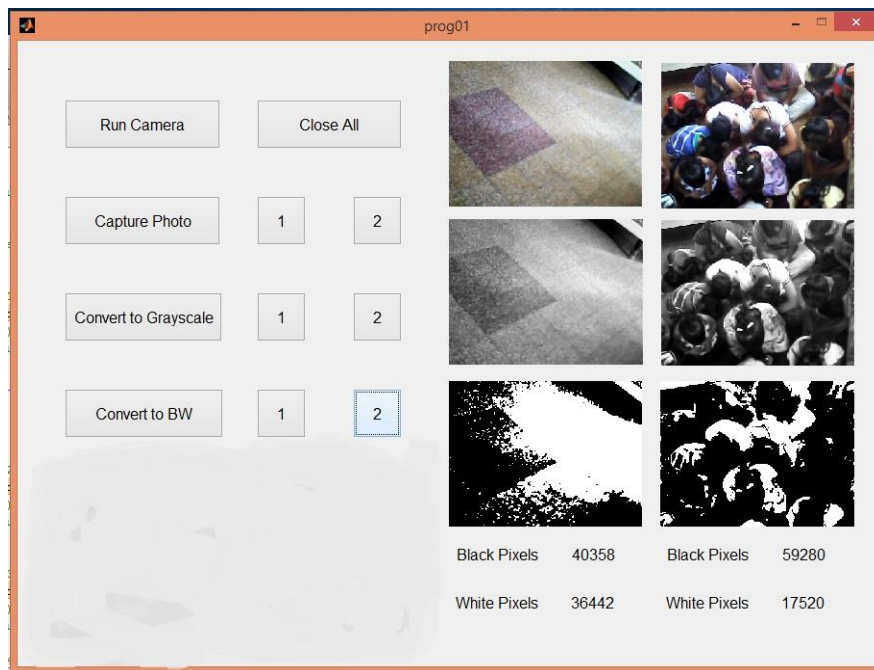


Figure 3. GUI of stampede detection

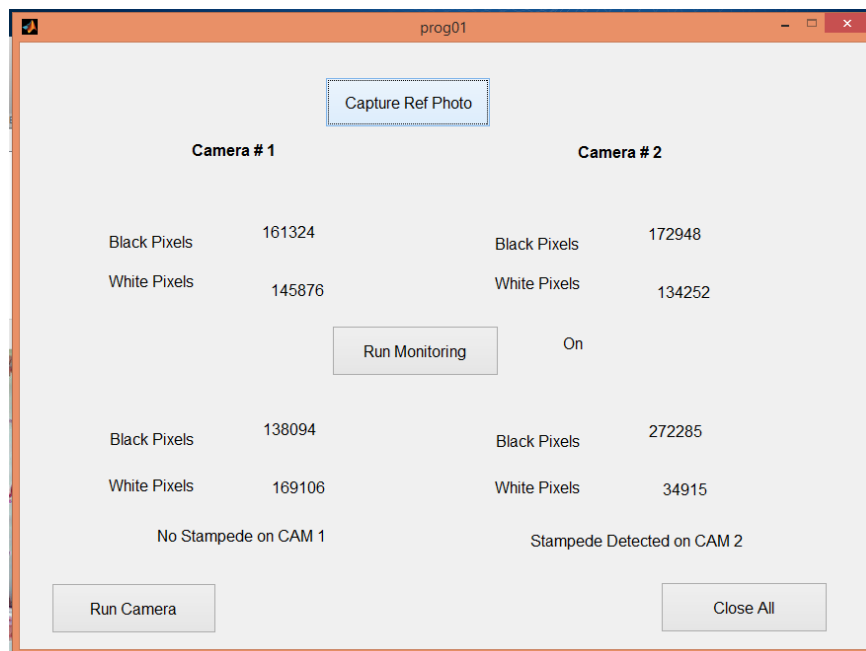


Figure 4. Real time implementation

In above figure the first black and white pixels are considered as reference image pixels. By the run monitoring button the Webcam will capture the live scenario of the target area. According to that pixels will continuously change. If it is crossed the threshold it will give the indication of stampede detection. At the receiver side the LCD shows the status of stampede.

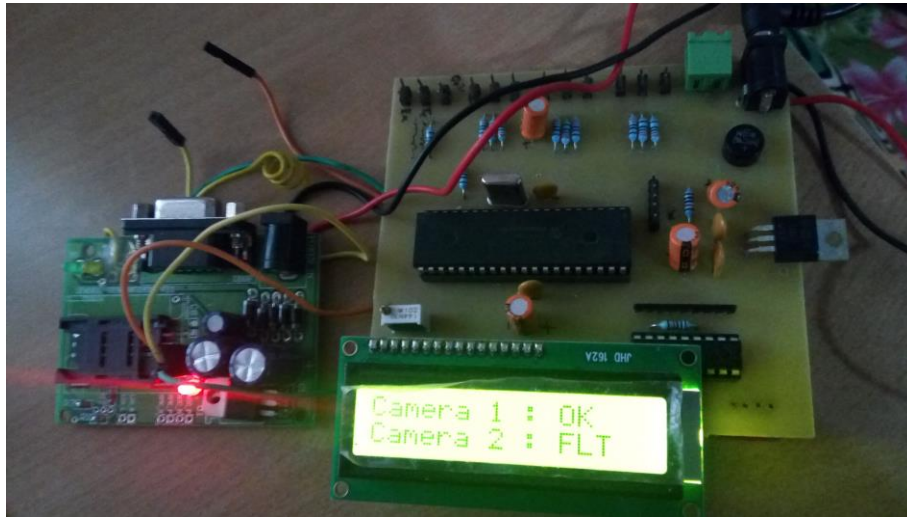


Figure 5. LCD display

CONCLUSION:

Stampede occurs due to many reasons while they become more and more difficult to avoid. By this system we can monitoring and control the crowd and also prevent stampede before a major incident take place at public places. The main advantage of this algorithm is that the system will become fast and generate the alert of stampede detection.

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