

# PRE-STAMPEDE MONITORING SYSTEM

<sup>1</sup>Mahitha Krishna Sappa, <sup>2</sup>Keerthana Kurna, <sup>3</sup>Ravali Bojja, <sup>4</sup>Udaya SreeRevu, <sup>5</sup>C.Anisha

<sup>1</sup>Student, <sup>2</sup>Student, <sup>3</sup>Student, <sup>4</sup>Student, <sup>5</sup>Assistant Professor

<sup>1</sup>Electronics & Communication Department,

<sup>1</sup>B. V. Raju Institute Of Technology, Narsapur, India

**Abstract:** Stampedes have been common to populous India, which occurs mostly during religious gatherings which was taking away many people's life. According to research stampedes occur due to two vital reasons such as insufficient place and weak crowd management system. We can't change place but if we manage the crowd efficiently then we can save lives. It is not possible to have high security in every situation, therefore an automatic system has been proposed to manage crowd. So, here in this paper, we obtain the density of the region with the help of image processing techniques. According to the density identified the actions were taken to maintain the crowd.

**Keywords:** Stampede, Image processing, GSM, Raspberry pi.

## I. INTRODUCTION

Stampedes or crowd crushes usually start in places that are crammed beyond capacity with people (10 people per square meter or more). Jeff Wise, a science writer, classifies stampede into two categories- 'negative change in force' and 'positive change in force'. The 'negative change in force,' is described as the opening up of a gate that suddenly releases the accumulated crowds, which can cause a unidirectional stampede. For example during MahaPushkaralu, In case of a positive change in force, people come up against a barrier, while halting the front of the crowd, does not stop those in the back from advancing as they cannot see the section of the crowd that has stopped moving. As more and more individuals continue to enter the area, they get compressed against each other with very little breathing space [3]. Consequently, several people can die due to suffocation, or the weight of the crowd could break the barriers holding them back, causing people to fall over and prompt a stampede. On the other hand, in tightly packed situations, people are already on the edge due to the lack of space. Any disruption can provoke a sense of threat in the gathering, whose prime goal then becomes personal safety. A person slipping or an unfounded rumor can throw them into panic and without enough officials to reassure the crowd and ensure safe and orderly movement, the situation spirals out of control. In order to avoid this situation, in this paper, we are proposing the idea of pre-stampede preventer which identifies the density of people and alarms the situation. A message is also sent to the concerned authorities using GSM module, so that the authorities takes the decision at right time preventing the stampede to occur.

## II. PRE LITERATURE

The study in the International Journal of Disaster Risk Reduction found that religious gatherings pose a lot of problems that relate to infrastructure and location. India however, is home to some of the most dangerous locales for pilgrimages, including events like the KumbhMela, which is the largest religious festival in the world. A 2014 guide prepared by the National Disaster Management Authority titled "Managing Crowds at Events and Venues of Mass Gathering" recognizes the need for crowd control mechanisms in the backdrop of recurring stampedes and comprehensively outlines the role of each stakeholder agency including the media. It notes: "The crowd disasters, in general, are man-made disasters which can be completely prevented with proactive panning and flawless execution by dedicated groups of well-trained personnel [4]. So, we our idea isto prevent the stampede before occurring. The below statistics has encouraged us to implement the project so we can save human kind to some extent.

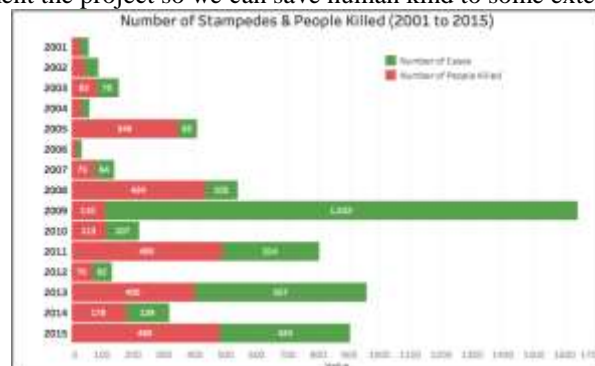


Figure1: Statistics of stampede

### III. HARDWARE

The Hardware components that are required are of low cost and the main advantage of using these components are low power consumption and performs the task correctly. The Hardware components required are:

- A. Raspberry Pi
- B. Camera
- C. GSM Module

#### A. Raspberry pi:

Raspberry pi is a credit card sized processor and the main reason to go with Raspberry pi is it has many inbuilt modules as CSI camera port, micro SD card slot and many other features and has open source software called raspbian. These added features are useful for implementing image processing algorithms which helps us to use less hardware [6]. Here in this proposed system raspberry pi is used for taking the image and process it according to the algorithm.

#### B. Camera:

Camera is the main part in this project as it takes the images which were used for surveillance. The image read from this camera was taken as input and used to get people count. A high definition camera is used for real time application. As it can be able to take pictures accurately and it increases the efficiency of this system as blur images can be decreased by the high definition cameras.

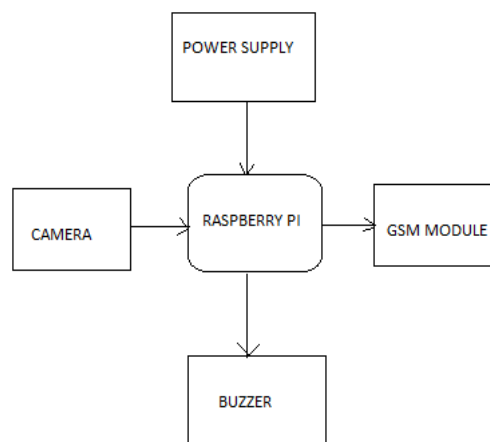
#### C. GSM Module:

GSM (Global system for mobile communication) . It is a wireless system and mainly used to send text message to a mobile through wireless media and GSM Module [7] consists of a Sim card slot that is a way how it communicates with other mobile through different commands [5]

### IV. SOFTWARE.

Software that used to develop this design are python, open CV, raspbian. We used python 2.7.14 version. Python library provides a wide range of image processing operations. OpenCV is (Open source computer vision library) is an open source. Open CV–python is a library of python binding design to solve computer vision problems. It combines the best qualities of OpenCV/C++ API and python. Python-open CV makes use of NUMPY, including this gives highly optimized numerical operations. Raspbian is the operating system based on debian optimized for the raspberry pi hardware

### V. PROPOSED SYSTEM



**Figure2: Block Diagram**

To detect the crowd in the area there is a need of monitoring system, for monitoring one has to know the density of the area. So, to find the density at certain area there is a need of surveillance cameras. Now those cameras are modified with some extensions so that they can manage the crowd automatically. For that we were counting number of people in certain area using image processing algorithm i.e., with haar cascades technique which detects face. By detecting the face it counts the people and monitors the area. If the crowd was more then it gives a buzzer and sends an automated message for the authorities that the condition was uncontrollable and need more security for the concerned location.

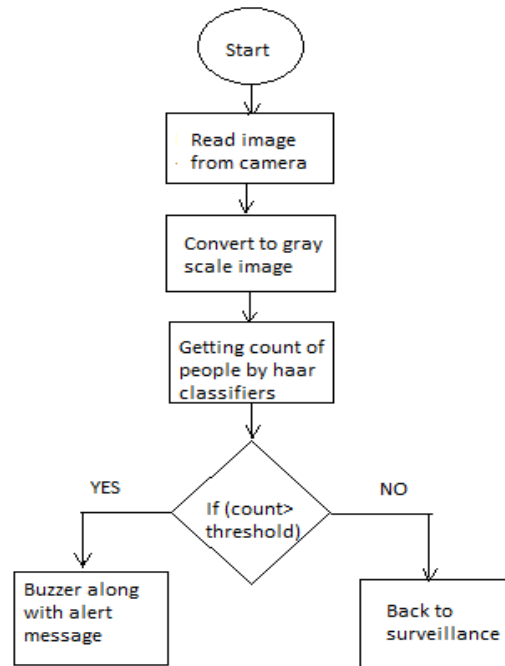
This system can find applications in crowd management in pilgrimage areas - crowded shopping areas- heavy transportations regions-crowd prone regions.

## VI. FLOWCHART

Stampede it occurs mainly due to the pressure between the people who were uncontrollable due to more people in a confined area. This condition was mostly seen at pilgrimage areas in festival time. According to survey many people were losing their life humans basing on features present in adaboost[4]. There were above 160000 features gives the results of human detection but the algorithm has been further minimized to 6000 plus features, but in this the best 200 features gives accuracy in detecting a human.

So, we were applying those features which were grouped to minimize the running time. If the first grouped features satisfy the conditions it goes for further more features to conform as a human or else it discards in one shot as non-human

According to the count obtained through the above algorithm required decisions were taken, which were shown in the below flow chart.



**Figure3: Flow Chart of Stampede preventer**

The algorithm used here was haar cascade for counting people. By identifying the picture as human face, it counts. Initially the algorithm needs a lot of positive images (faces) and negative images (non faces) to train the classifier. Then we need to extract features from it. In haar we have different features some of them are shown below in picture [2].

They are just like our convolution kernel. Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle. There were plenty of features which are involved in identifying faces and while we apply all of the features there will be some error and even it takes much time. So, cascading of classifiers was came into picture.

In cascade classifier we have integral image feature, Instead of applying all the 6000 features on a window, group the features into different stages of classifiers and apply one-by-one. (Normally first few stages will contain very less number of features). If a window fails the first stage, discard it. We don't consider remaining features on it. If it passes, apply the second stage of features and continue the process. The window which passes all stages is a face region.

## VII. DESIGN IMPLIMENTATION

As discussed earlier, people counting has been done using haar classifiers [1]. The images which were taken are converted into gray scale images once they are given as inputs. The gray scale images are easy to process and efficiency is very high when compared to RGB images. As gray scale images have pixels ranges from 0-255. The conversion of a color image into a grayscale image is converting the RGB values (24 bit) into grayscale value (8 bit).

Predefined techniques are provided by Open CV. Haar features are loaded with the help of open CV for applying on images which were taken as inputs. Using those features faces are detected in the picture, depending on number of faces detected the count value is given.

The input images are as shown below



**Figure4: Input Image**

Output of detected faces: The face are detected using the image processing technique, detected faces are shown below.



**Figure5: Output Image**

Message displayed:  
The message has been send to concerned authority through gsm



**Figure6: Alert message**



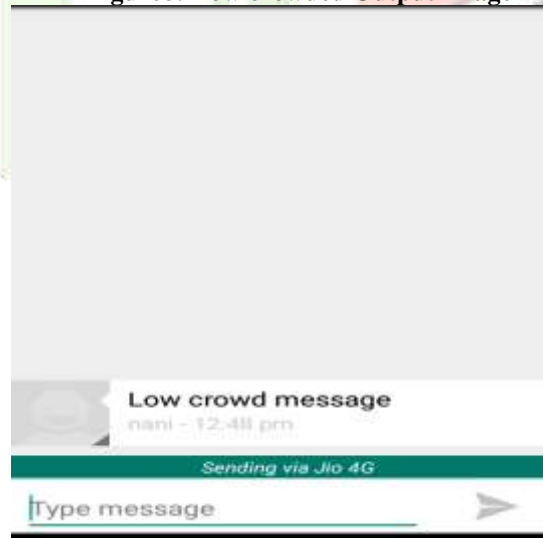


**Figure7: Low crowded input Image**

The results of less people are shown below if this results continues, after certain delay message will be sent as under control.



**Figure8: Low crowded Output Image**



**Figure 9: Control Message**

### VIII. FUTURE SCOPE

The present system mainly concentrates on identifying the situation of stampede and alerting people and authority. This system even can develop as it can take some decisions to control the crowd. This can be further implemented using Quad-Copter in open area spaces.

## IX. CONCLUSION

The project is concerned about controlling stampedes, which can indirectly save life of some people. It is developed taking the consideration of the pilgrimage areas in India.

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