

# STAMPEDE DETECTION AND PILGRIM TRACKING

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**ABSTRACT:** At present, there are so many issues regarding the crowd control, medical emergencies, security issues, identification and tracking of the pilgrims in the holy areas. Especially during pilgrimage, the pilgrimage authority finds it difficult to manage the situation. Thus, in order to identify, track and monitor pilgrims a system is needed. In this system camera is used to monitor continuously and to find high density with the help of image processing. The communication with base station is done through Global system for mobile communication (GSM). As soon as pre-stamped starts, people around pre-stamped, camera detect the picture and compare the density and message is sent to the police if very high density is found. This embedded system is divided into two parts stamped detection and pilgrim monitoring unit. In Stamped detection unit, continuous monitoring of the stamped scenario by taking snapshots at regular intervals and will analyze the scenario for stamped threshold. If the people gathered in a particular area are more than the threshold, then stamped warning is sent and simultaneously an indication to the Pilgrim unit via GSM is also sent. In Pilgrim monitoring unit, continuous monitoring of the status of pilgrim using the health parameters of pilgrim and sending the Global Positioning System (GPS) co-ordinates along with the health parameters is initiated. The IOT module is installed to view the details and data obtained. The GPS co-ordinates are also sent to remote helpers for fast emergency response using Bluetooth module and Android application. At base station, data can be viewed using IOT.

**Keywords:** stampede detection, crowd control, Global Positioning System, computer vision, automated analysis, closed circuit television, people tracking,

## 1 INTRODUCTION

Pilgrimage has a great importance in India. Each pilgrimage session attracts a huge crowd. Usually the pilgrims move simultaneously in large groups. Getting lost in crowd is very common. Finding the lost person among hundreds and thousands of pilgrims causes a lot of trouble for his relatives and the authorities. Such a setup faces a real challenge to the authorities in managing the crowd, and tracking people. It poses many challenges to the authorities responsible for facilitating this annual event. The following are some of the common difficulties faced by the pilgrims and the authorities like identification of pilgrims either lost, dead, or injured, medical emergencies, guiding lost pilgrims to their respective camps, congestion management. But they

are unable to provide those facilities in a full fledged manner. However, providing a solution to solve the problems completely is difficult.

Passive and active RFID systems have been tested in the past with limited success. Other approach was using WSN to track the pilgrim. The GPS/GSM Based System is one of the most important systems, which integrate both GSM and GPS technologies. It is necessary due to the many of applications of both GSM and GPS systems and the wide usage of them by millions of people throughout the world. The pilgrims may have health problems in severe situations, especially in large crowds and congestion, causing even death in some cases. Unfortunately, it is difficult for local and international authorities to monitor and aide them in time to save their lives. Numerous existing applications are focused just on the identification of pilgrims and listing their details while some other applications focus only on the location of pilgrims lost.

Thus, in order to identify, track and monitor pilgrims a system is needed. In this a camera is used to monitor continuously and to find high density with the help of image processing. This embedded system is divided into two parts stampede detection unit and pilgrim monitoring unit. In Stampede detection module, continuous monitoring of the stamped scenario using MATLAB software is implemented. In Pilgrim monitoring module, continuous monitoring of the status of pilgrim using the health parameters of pilgrim and sending the GPS co-ordinates along with the health parameters is initiated. The GPS co-ordinates can be sent to remote helpers for immediate emergency response using Bluetooth module and IOT module

## 2 LITERATURE SURVEY

Previously some engineers have proposed solutions for problems faced by pilgrims and authorities during the holy events. There are many systems under development used for tracking and monitoring which are using different means, protocols and facilities according to the need and convenience of the system. Some sites and journals were checked for literature survey of the project and the following information was acquired. The following mentioned below are the reference papers.

The base paper was prepared by Sharley Kulkarni and S. K. Shah on "Monitoring and Safety of Pilgrims Using Stampede Detection and Pilgrim Tracking", Vol 4, issue 7, July 2015.

A group of students from International Islamic University Malaysia, Malaysia demonstrated their project in 'Hajj

Crowd Tracking System in a Pervasive Environment'. This paper proposes a structure for following Hajj pilgrims in a swarmed inescapable environment utilizing a framework called Hajj Locator. A talk on the model of Hajj Locator, as a framework to track and screen pioneers while performing Hajj and to spare lives, with an SOS component, is additionally displayed in this paper. Accessibility is identified with the accessibility/ presence of the association either by utilizing WiFi, GSM/GPRS or SMS to send the upgrade area information from a PDA/Smart Phone to the Hajj Locator server. Hajj Locator has the capacity to track the pilgrims in both indoor and open air environment which gives smooth tracking procedure. Accelerometer that will catch information that could be imperative during the time spent following pilgrims in indoor situations which incorporate the position, speed, controlling point and movement [1]. The main disadvantage of this is that it does not detect people before stampede begins and does not aide them during medical emergencies.

A computer vision framework is used that recognizes abnormal crowd occasions and basic circumstances from video streams and in this manner cautions security work force so as to take essential activities is used. Firstly, it works in real-time and, secondly, the privacy of the people being monitored is preserved. It coordinates the watched movement designs into models for mimicking person on foot movement and demonstrate that the proposed simulation model. This model mimics substantial human group and utilize methods from computer graphics to render manufactured recordings for further assessment of our programmed video observation framework [2].

Crowd behavior can be observed utilizing two methodologies, initial one is breaking down people conduct in a group which is named as question based and the other one is dissecting the group all in all which is named as comprehensive based approach. Distinguishing and following the group movement is a noteworthy fascinating exploration theme in vision investigation, swarm progression and visual observation fields. Framework will permit just approved individual to utilize it by entering the "Username and Password". The recordings comprise of numerous quantities of edges and this framework will remove those edges in the info video. Threshold optical flow values are chosen in such a way that the tracking of congested region in video is easily performed by comparing it with respective estimated optical flow values. The embedded system will by default detect the stampede scenario and also depict the results on a graph [3].

In another paper, Wireless Mobile Networks are used to track pilgrims during pilgrimage. Every pilgrim is given a WMN for tracking them and settled system is utilized for observing the pilgrims. The model comprises of the accompanying segments, for example, Tmote Sky module for following when GPS not in range, GPS module for proficient following, PIC Nano microcontroller for handling the signs, ISM band radio for correspondence to closest help focuses, Lithium particle batteries for WMN to work, RF handset and Personal PC [4].

A paper which relies on Wireless Sensor Networks aims at tracking lost people and aiding during accidents. WSN comprises of appropriated self-ruling sensors to screen physical conditions, for example, temperature, sound, weight and so on. These parameters are detected and helpfully transmitted through remote system to principle area. Every pilgrim is furnished with a portable unit. When server, gets the answer transmitted by portable unit, it will redesign the information of separate traveler in its stockpiling memory and re-transmit the data about the person to their separate relative and Guardian. As the portable unit held by traveler is inserted with keypad, the push catches gave on keypads can be utilized to create and transmit the caution/message in case of any emergency faced by the pilgrim [5].

Automated analysis of crowd activities using surveillance videos is a significant technique for communal security, as it permits location of perilous group and where they are going. Open places, for example, strip malls and airplane terminals are observed utilizing shut CCTV keeping in mind the end goal to guarantee ordinary working conditions. Computer vision based crowd analysis algorithm can be divided into three groups; people counting, people tracking and crowd behavior analysis. These methods could lead to a better understanding of crowd behavior and increased safety from stampede [6].

A WSN network of fixed units is installed in the Holy area for receiving and forwarding data. Periodically, each mobile unit sends its user identification (UID), latitude, longitude, and a time stamp. A centralized server maps the latitude and longitude information on a geographical information system (GIS). The developed system can be used to track a specific or a group of pilgrims [7].

Another paper put forwards methods that resolve the problems related to the transportation and tracking of the pilgrims throughout the pilgrimage journey. This is done by installing a RFID tag on the bus in which the pilgrims are boarding and the pilgrims can be tracked by individually by the tags given to them. Another use of the RFID tags is that the traveler agency or bus driver can identify authorized passengers by providing the RFID tags [8].

Due to the fast development in the use of telephones in nowadays, nearly each pilgrim will have an android advanced phone which involves GPS and a tracking application introduced in it. An embedded framework with a GSM module is put in the Holy territory for accepting the data about the pilgrim's area furthermore to send additional data about the rescue area to the missing traveler. A RFID reader will be interfaced to the framework furthermore, when the traveler needs to get a ticket he/she needs to demonstrate his/her paid ahead of time RFID card, the balance will be deducted and an affirmation message will be send to registered client mobile [9].

There are various systems for tracking the position of a vehicle but there is no such system made for tracking a human being. The main aim of the project is to track an intruder or criminal or a person which can be caught doing illegal job. GPS (Global Positioning System) is used to track

the location and time information of the person. The aim is to reduce the overall cost of tracking system based on Global Positioning System (GPS) which is a satellite system based service. GPS system is nothing but Global Navigation Satellite System (GNSS). This system works as the person having the tracker which is having GPS Technology, GSM technology and battery which is compatible for this system [10].

### 3 SYSTEM ANALYSIS

#### 3.1. EXISTING SYSTEM

There are various systems developed to detect and control abnormal crowd behavior. Passive and active RFID systems have been tested in the past with limited success. Other approach was using WSN to track the pilgrim. The GPS/GSM Based System is one of the most important systems, which integrate both GSM and GPS technologies. Automated analysis of crowd activities using surveillance videos is an important issue for communal security, as it allows detection of dangerous crowds and where they are headed. Public places such as shopping centers and airports are monitored using closed circuit television in order to ensure normal operating conditions. Computer vision based crowd analysis algorithm can be divided into three groups; people counting, people tracking and crowd behavior analysis. The purpose of these methods could lead to a better understanding of crowd activities, improved design of the built environment and increased pedestrian safety but these experimental results achieved by these systems are of very low accuracy.

#### 3.2. PROPOSED SYSTEM

Studying the requirements, this system was proposed to identify, track and monitor pilgrims to regulate stampede due to overcrowd, to track missing pilgrims and to ensure aide at medical emergencies. This is a very efficient and convenient system. In this system camera is used to monitor continuously and to find high density with the help of image processing. The communication with base station is done through Global system for mobile communication (GSM). As soon as pre-stamped starts, people around pre-stamped, camera detect the picture and compare the density and message is send to the respective authorities for necessary action if high density is found. This embedded system is divided into two parts stamped detection and pilgrim monitoring unit. In Stamped detection unit, continuous monitoring of the stamped scenario by taking snapshots at regular intervals and will analyze the scenario for stamped threshold. If the people gathered in a particular area is more than the threshold, then stamped warning is sent and simultaneously an indication to the Pilgrim unit via GSM is also sent.

In Pilgrim monitoring unit, continuous monitoring of the status of pilgrim using the health parameters of pilgrim and sending the Global Positioning System (GPS) co-ordinates along with the health parameters is initiated. The IOT module is installed to view the details and data obtained. The GPS co-ordinates are also sent to remote helpers for fast emergency response using Bluetooth module and

Android application. At base station, data can be viewed using IOT.

## 4 DESIGN AND DEVELOPMENT

### 4.1 MODULE DESIGN

In the proposed system, GPS and GSM is used to track the pilgrim location and sent the location data to server. CCTV camera used continuously monitors the pilgrim area. A temperature sensor is installed to detect the temperature in a locality. If the population in an area begins to get crowded, then the temperature also begins to rise abnormally.

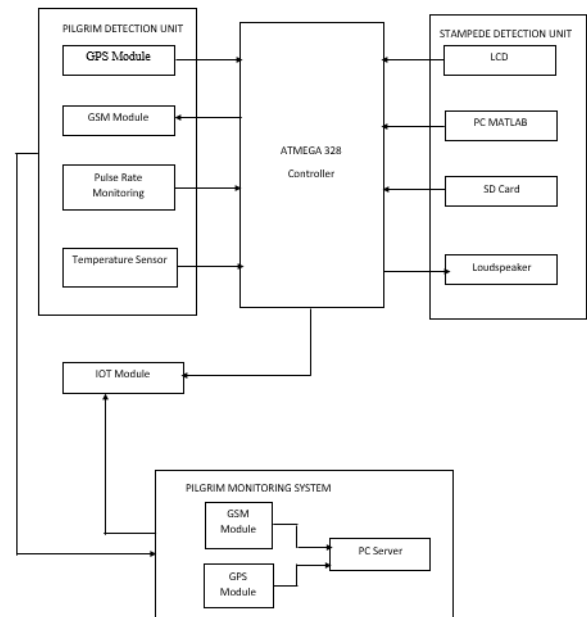


Figure 4.1 Block Diagram of Stampede Detection and pilgrim Tracking System

It consists of ATmega328 controller, GSM/GPS module, IOT module, SD card, loudspeaker, LCD display, pulse rate monitoring sensor and temperature sensor. It consists of PC server to monitor the data obtained. The continuous monitoring of the stamped scenario using Image processing is done via Matrix Laboratory (MATLAB) software. The MATLAB software continuously takes snapshot at every 10 seconds and will analyze the scenario for stamped threshold. If the people gathered in a particular area, is more than the threshold, then stamped warning is sent to ATMEGA 328 microcontroller.

### 4.2 MODULE DESCRIPTION

Studying the requirements, this system was proposed to provide security to the pilgrims. The system is proposed to identify, track and monitor pilgrims to regulate stampede due to overcrowd, to track missing pilgrims and to ensure aide at medical emergencies. This is a very efficient and convenient system.

#### 4.2.1 Stampede detection unit

The system is implemented on ATmega328 controller. Today the ATmega328 is commonly used in many projects

and autonomous systems where a simple, low-powered, low cost micro-controller is needed. Perhaps the most common implementation of this chip is on the ever popular Arduino development platform, namely the Arduino Uno and Arduino Nano models. The monitoring of the stamped scenario is done using Image processing via MATLAB software. Webcam will capture the live scenario of the target location. The stampede threshold will be set to monitor the different stampede like conditions. If the people gathered in a particular area are more than the threshold, then stamped warning is sent to the ATmega328 controller.

#### 4.2.2 Pilgrim detection unit

The temperature sensor is used to detect the temperature in the target location. LM35 is a precision IC temperature sensor with its output proportional to the temperature in degree C. The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also has low self-heating capacity. The operating temperature range is from  $-55^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ . If the temperature shoots up abnormally high, it indicates overcrowd and warnings are immediately sent. Pulse rate and temperature sensor monitor the status of pilgrims using the health parameters of pilgrim continuously. GPS coordinates along with health parameters of pilgrims are sent through GSM.

IOT module is used. It is connected to the personal computer. Pulse rate and temperature send by pilgrim unit can be monitored on the PC via website facilitated by the IOT module. The location of pilgrim is also displayed using Google Map if needed. ATmega328 controller in system will be programmed using Embedded C programming.

#### Major module Components

- i. Webcam: Usually, CCTV are used for video surveillance. In proposed system webcam is used to detect the stampede live scenario of the pilgrim area continuously.
- ii. PC: The stampede scenario obtained is inputted to PC. It is connected using a Level Shifter. The MAX232 IC is a level shifter that is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. Snapshots are taken and are processed through MATLAB software. The images are processed to get the required format via image processing algorithms. The processed images are then compared with the threshold set previously. If the threshold value found is to be high, then warning is sent to the ATmega328 Controller.
- iii. ATmega328 Microcontroller: The ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed. The controller accesses the SD card. If the people gathered in a particular

area are more than the threshold, then stamped warning is sent to the ATmega328 controller.

- iv. GPS: Global Positioning System finds the location of pilgrim by considering the corresponding latitude and longitude and these co-ordinates are sent to other GPS module on the server side.
- v. GSM: Global System for Mobile Communication is used to send the data related to pilgrims' location and health.
- vi. IOT module: Internet of Things is a hardware module which provides a website that displays the details obtained like the temperature of the locality, pulse rate, location of the pilgrims, etc.

#### 4.3.3. FLOWCHART

A flowchart is a type of diagram that represents an algorithm, workflow or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows. This diagrammatic representation illustrates a solution model to a given problem.

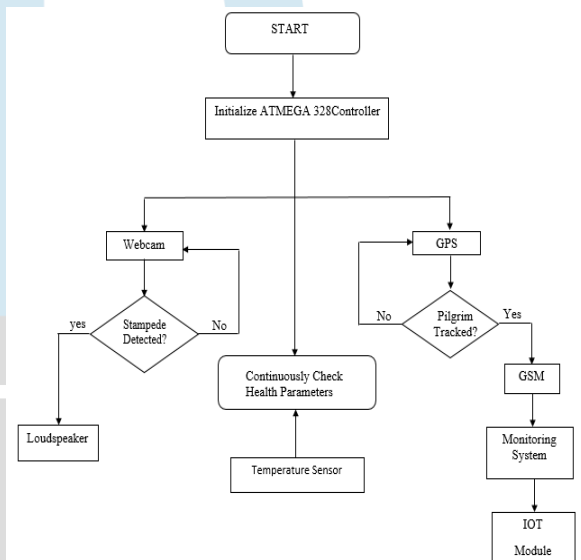


Fig 4.3.3 Flow Chart of the proposed system

#### 5 CONCLUSION

From the research, it is found that there are several techniques used to detect stampede at huge gatherings of people and to track people to get their location details to aide them at emergencies. Image processing algorithms can be used to detect crowd behavior. There are different types of image processing algorithms. GPS and GSM module can be used to track people and send notifications or messages during emergencies. Another effective method is to use IOT (Internet of Things) module. But in the case pf PIC microcontroller, ZigBee, transmitter and receiver, which will more effectively detect the stampede before it starts. We concluded that more effective way is using ATMEGA controller, GPS and IOT module for stampede detection and people tracking during huge massive crowd in public places.

After, a thorough analysis we conclude that the proposed framework uses the single GPS /GSM modem which provide exact location of pilgrims and high speed communication instead of using separate GSM and GPS modems. Stampede conditions can be detected beforehand to take necessary action in time to prevent it and thus provide security to pilgrims. Apart from tracking and detecting stampede detection, the proposed system has a great advantage. It presents an option for a pilgrim in case of medical emergency. The developed system automatically monitors the body conditions of the pilgrim which helps in getting medical aid in no time. Thus, the system can satisfy the need of pilgrim without any objection.

## 6 FUTURE ENHANCEMENTS

The proposed architecture uses the single GPS /GSM modem which provide exact location of pilgrims and high speed communication. Stampede conditions can be detected beforehand to take necessary action in time to prevent it and thus provide security to pilgrims.

Apart from tracking and detecting stampede detection, I would like to extend the proposed system such that it provides an additional benefit to the pilgrims. In the future, I would present an option for a pilgrim to get aide in case of medical emergency. The system would be developed to automatically monitors the body conditions of the pilgrim which helps in getting medical aid in no time. Thus, the system can satisfy the need of pilgrim without any objection. The GPS co-ordinates are also sent to remote helpers for fast emergency response using Bluetooth module and enhanced features of IoT.

## REFERENCES

- [1] Kawathar Moria, Alexandra Branzan Albu, Kui Wu, “Computer Vision-based Detection of violent Individual actions witnessed by crowds”, in Computer and Robot vision, IEEE, 2016
- [2] Hiba H. Alqaysi and Sreela Sasi, “Detection of abnormal behavior in Dynamic Crowded Gatherings”, Department of Computer and Information Science, Gannon University, IEEE, 2015.
- [3] Weiqi Zhao, Zhang Zhang, Kaiqi Huang, “Joint crowd detection and semantic scene modeling using a Gestalt laws-based similarity”, CRIPAC & NLPR, Institute of Automation Chinese Academy of Sciences, University of Chinese Academy of Sciences, Beijing, China, IEEE, 2016
- [4] A. C. Davies, J. H. Yin, S. Velastin et al., “Crowd monitoring using image processing,” *Electronics & Communication Engineering Journal*, vol. 7, no. 1, pp. 37–47, 1995.
- [5] N. Paragios and V. Ramesh, “A mrf-based approach for real time subway monitoring,” in *Computer Vision and Pattern Recognition*, 2001. CVPR 2001. Proceedings of the 2001 IEEE Computer Society Conference on, vol. 1. IEEE, 2001, pp. I–1034.
- [6] M. Li, Z. Zhang, K. Huang, and T. Tan, “Estimating the number of people in crowded scenes by mid based foreground segmentation and head-shoulder detection,” in *Pattern Recognition*, 2008. ICPR 2008. 19th International Conference on IEEE, 2008, pp. 1–4.



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