



Monitoring and Safety of Pilgrims Using Stampede Detection and Pilgrim Tracking

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ABSTRACT: At present, there are so many problems 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 send 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 using Image processing via Matrix Laboratory (MATLAB) software is implemented. The MATLAB software continuously takes snapshot at every 10 seconds and will analyse the scenario for stamped threshold. If the people gathered in a particular area are more than the threshold then stamped warning is sent to ARM microcontroller via RS232 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 GPS co-ordinates are also sent to remote helpers for fast emergency response using Bluetooth module and Android application. At base station, data from GSM and GPS will be monitored using Visual Basic. As each pilgrim will be given a GSM unit they all will have unique cell numbers so it is easy to track them through it.

KEYWORDS: crowd control· pilgrims; tracking· Global positioning system· global system for mobile communication· ARM· Visual basic· Bluetooth Matlab · RS232· android application

I.INTRODUCTION

Pilgrimage has a great significance in India. Each pilgrimage session attracts a huge crowd. Usually the pilgrims move simultaneously in a large group. Getting lost in crowd is very common. Finding the lost person among thousands of pilgrims causes a lot of trouble for his relatives and the authorities.

Such a setup poses a real challenge to the authorities in managing the crowd, and tracking/identifying People. What makes it even more challenging is that all pilgrims move at the same times and to the same places. While such events are a unique spiritual experience for all pilgrims, it poses major challenges of all sorts 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 (lost, dead, or injured), Medical emergencies, Guiding lost pilgrims to their respective camps, Congestion management. The respective authorities of the holy areas are facing many problems. But they are unable to provide those facilities in a full fledge manner. However, providing a solution to solve the problems completely is impossible. For such a scenario, there is a need for a robust tracking system for pilgrims. Passive and active RFID systems have been tested in the past with limited success [1]. Other approach was using WSN to track the pilgrim [2]. Thus, the idea of using GSM/ZigBee for tracking pilgrims is initiated. 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. This system can be designed for users in land construction and transport business, provides real-time information such as location, speed and expected arrival time of the user is moving vehicles in a concise and easy-to-read format. As the elderly people participating in such events health related issues of them arises. Those have health problems may arise in

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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severe situations, especially in large crowds and congestion, causing death in some cases. Even before efforts in health services by local and international authorities, unfortunately, it is difficult to monitor and intervene in time to save lives. Numerous existing applications using GSM are focused just on the identification of pilgrims and listing their information. Others focus only on the localization of pilgrims lost.

II.SYSTEM ARCHITECTURE

This chapter describes the implementation of ARM architecture that can perform the tracking and monitoring of pilgrim along with stampede detection using GSM /GPS and MATLAB image processing. In implementation process, android application is also designed to send data remotely using Bluetooth module.

1. Block diagram of proposed system

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. Volunteers are given with Bluetooth enabled android cell phone so that they can assist the pilgrims as required and immediately.

The proposed block diagram is shown is figure 1. It consists of ARM controller, GSM/GPS module, Android cell phone, SD card, loudspeaker, LCD display, pulse rate monitoring sensor and temperature sensor. Figure 2 shows the server block diagram. It consists of PC server and GSM module.

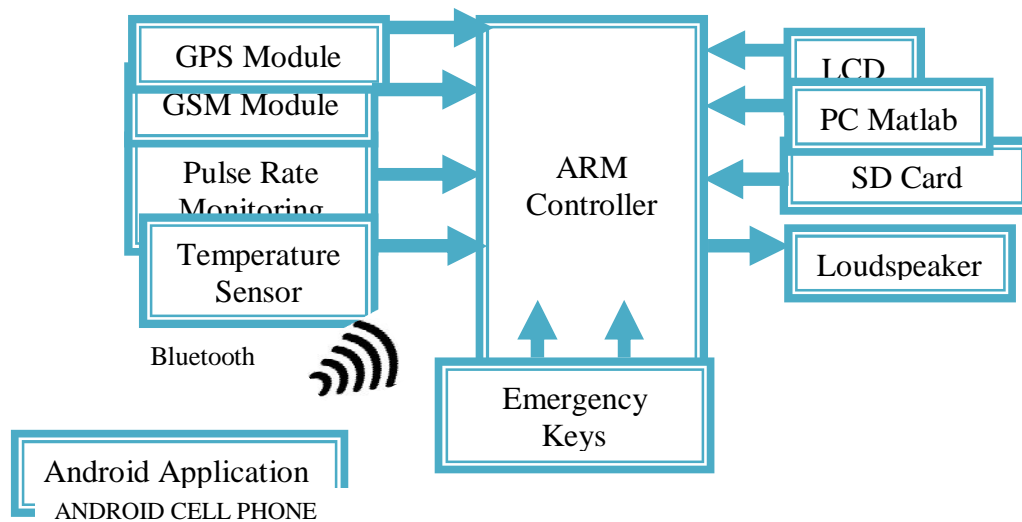


Figure 1: Block Diagram of Stampede Detection and Pilgrim Tracking With Health Monitoring

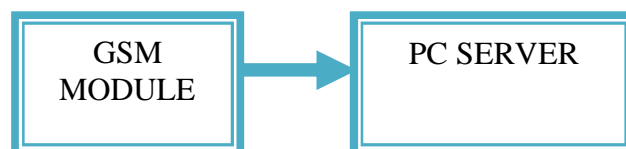


Figure 2 Block Diagram Monitoring System



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2. Operation of the system

Stampede detection and pilgrim tracking is implemented on same controller.

a) Stampede detection unit:

This unit comprises of SD card, loudspeaker, Webcam, PC and LCD. Continuous monitoring of the stamped scenario is done using Image processing via MATLAB software. Webcam will capture the live scenario of the target area. The stampede threshold will be set to monitor the different stampede like conditions. The MATLAB s/w will continuously take snapshot at every 10 seconds 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 to μC via rs232 and simultaneously announcements are done through loudspeaker from previously saved video clips.

b) Pilgrim detection unit:

Pilgrim detection unit comprises of GPS module, GSM module, and pulse rate monitor and temperature sensor. Pulse rate and temperature sensor monitor the status of pilgrims using the health parameters of pilgrim continuously. GPS co-ordinates along with health parameters of pilgrims are sent through GSM.

c) Monitoring System: In monitoring system Visual basic software will be used in personal computer as shown in figure 2. Programmers can not only create simple GUI applications, but to also develop complex applications. Display windows are created using drag-and-drop techniques. Pulse rate and temperature send by pilgrim unit can be display. The location of pilgrim is also displayed using Google Map. ARM controller in system will be programmed using Keil UV3 of Embedded C programming.

III. LOGIC FLOW

1. Webcam: Generally CCTV are used for video surveillance. In proposed system webcam is used do the video surveillance of the pilgrim area continuously.
2. PC: the surveillance video is inputted to PC. Snapshots are taken and are processed through MATLAB software.
3. Image Processing: the images are processed to get the required format. The processed image is then compared with the threshold set previously. If the threshold value found is high then warning is sent to μC .
4. Microcontroller: the controller then accesses the SD card and data is out according to the particular threshold value set for a particular voice clip though loudspeaker.
5. GPS: Global Positioning System finds the location of pilgrim by considering the longitude and latitude and these co-ordinates are sent to other GPS module on the server side.
6. GSM: Global System for Mobile Communication is used to send the data related to pilgrims location and health.
7. Pulse rate sensor and temperature sensor: These sensors sense the pulse rate and body temperature of the pilgrim.
8. Mobile application: to give the pilgrims information to volunteers an android cell phone is used with Bluetooth connectivity. An android application is developed so that all the required information of the pilgrim is with volunteer.

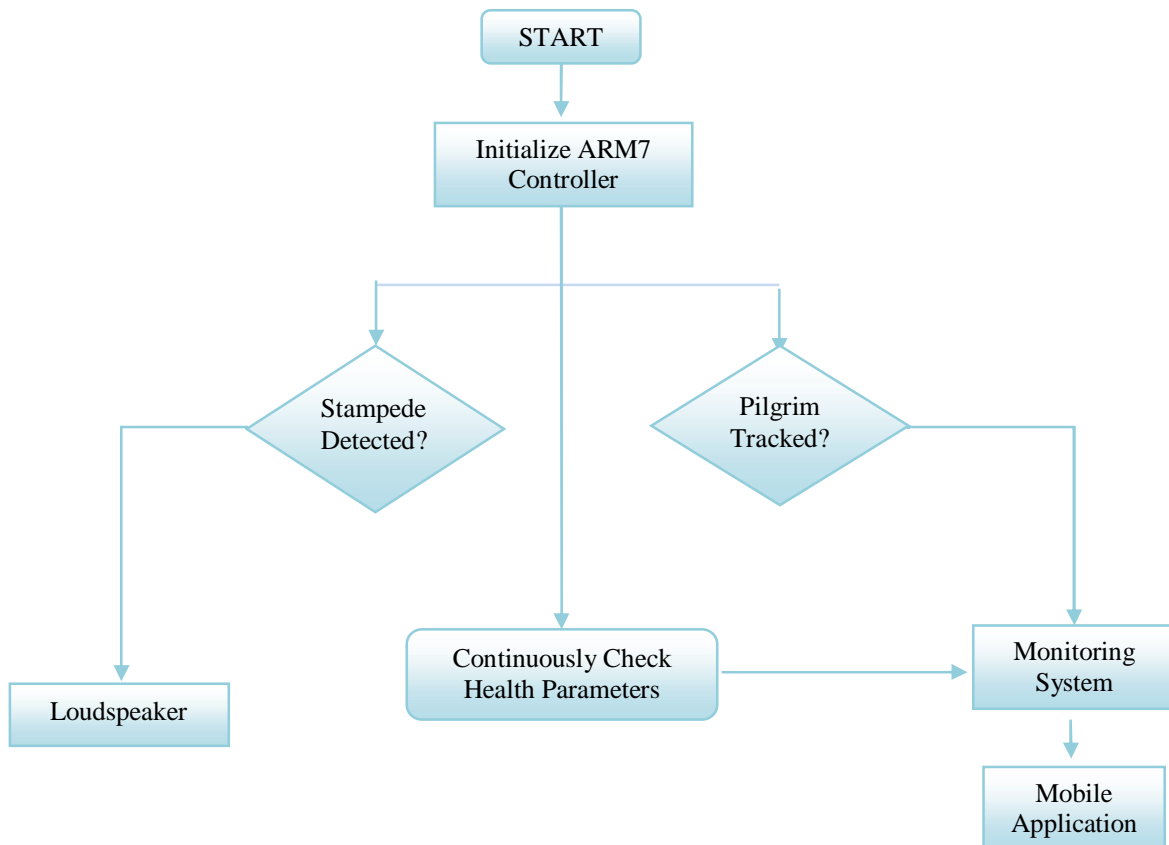


Figure 3: Logic flow for the system

IV. RESULT AND DISCUSSION

The performance of the proposed tracking and stampede detection system was validated by using text message, Bluetooth android application and MATLAB tool.

1. Stampede Detection

Stampede detection is done using MATLAB computer vision toolbox. As shown in figure 4 a frame is acquired from video. In figure 5, yellow bounded box shows the person detected. The experiment was carried on with four persons in a video. The threshold for stampede detection was set to 3 persons. Addition of 4th person led to stampede detection as shown in figure 6. In figure 6, red rounded circle indicates stampede detection.



Figure 4 Frame Acquired From Video under Surveillance

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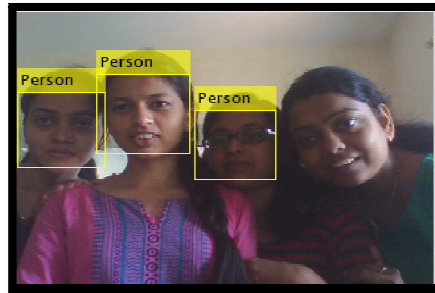


Figure 5 Image Showing Person Detected

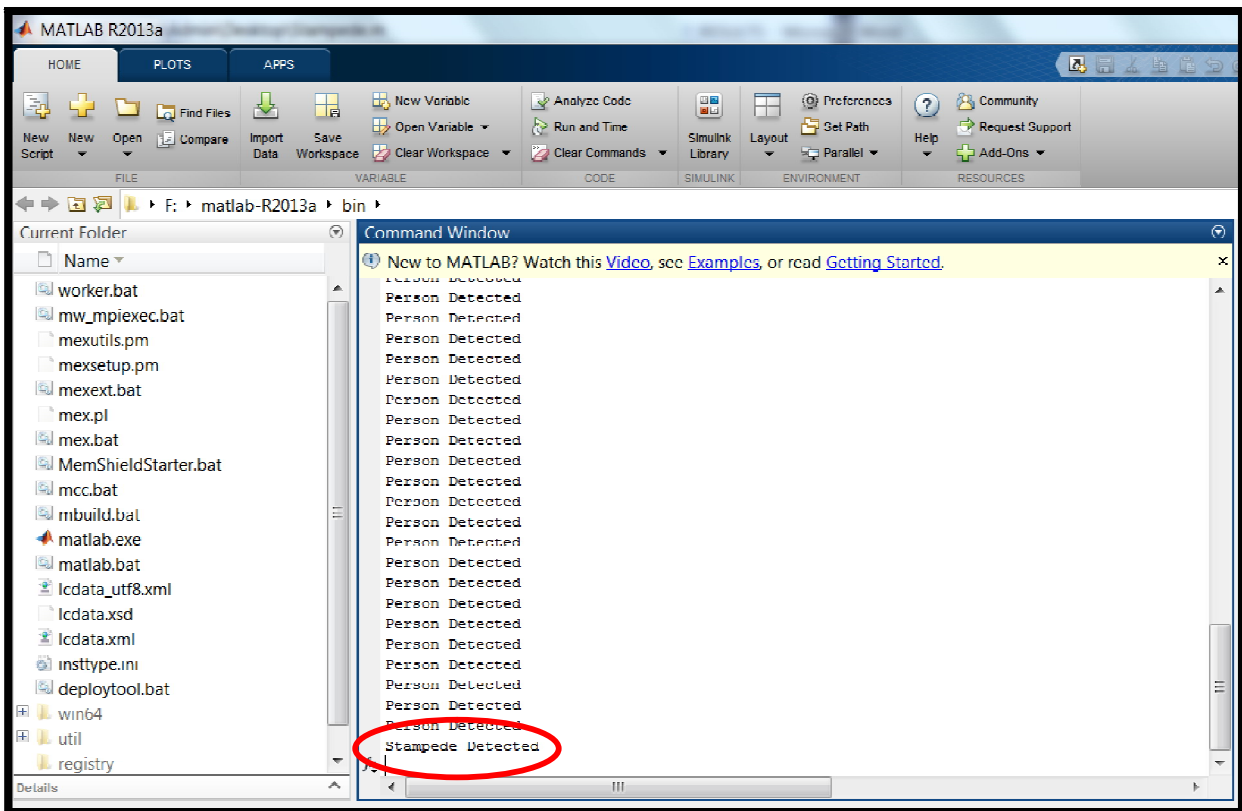


Figure 6 Output showing stampede detection

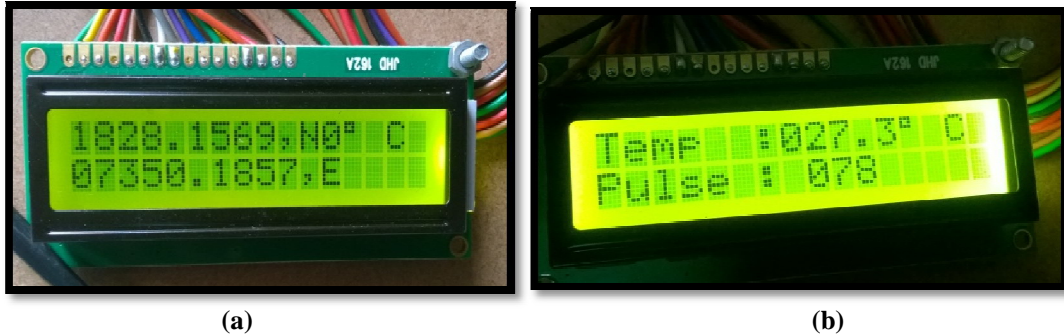
2. Location and Health parameters of pilgrim

The data from GPS is sent to sever side through GSM. GPS data sent contains the pilgrim's location in terms of longitude and latitude. Longitude and Latitude is displayed on LCD at server side as shown in figure 7 (a).

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(a) (b)
Figure 7 (a) LCD showing Longitude and Latitude Values calculated by GPS
(b) LCD Showing Temperature and Pulse Rate Sensor Values

3. Data monitoring using Visual Basic

The received location and health parameters are monitored using Visual Basic platform. Also pilgrim's cell number is also displayed. Following figure 11 depicts the Visual Basic user interface.

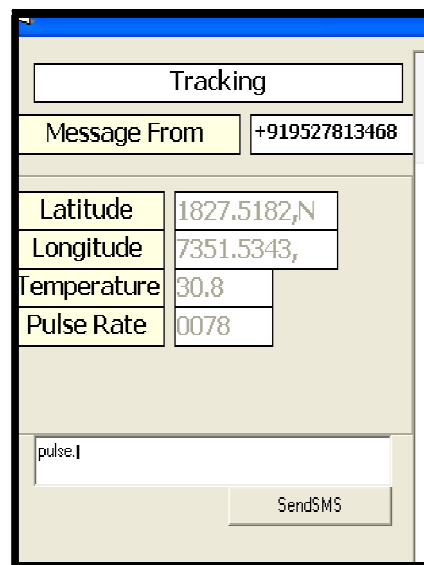


Figure 8 Output on VB

V.CONCLUSION

The proposed architecture 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

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