



# Public Alerting System for Disastrous Events

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## Article Info

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## ABSTRACT

*Public alerting system required to protect the lives of people solely in the cases of major emergency by warning the public of impending disasters, small/medium scaled disastrous events such as Road blocks, woman Suraksha, Ambulance routing, Natural Disaster and many more. In India, small problems exemplify themselves and impact many more people than expected. Getting insights into the current state of our surroundings can prove really helpful in taking the next steps. Crowdsourcing information can be a great way to get these insights. Getting insights into the current state of our surroundings can prove really helpful in taking the next steps. A crowd sourced system where citizens can report incidents, which informs every person in the vicinity of that area about the same. We can then enable the informed citizens with measures that can take to avoid that incident. This paper presents with centralized alert system which provides gather information on incident to rapidly warn the public of imminent or unfolding hazards to life by Employing these systems for more localized, day-to-day, life-at-risk emergencies.*

**KEYWORDS:** public alerting system, Crowd sourced systems, Centralized alert system, Citizens, Incident

## 1. INTRODUCTION

Public alerting system required to protect the lives of people solely in the cases of major emergency by warning the public of impending disasters, e small/medium scaled disastrous events such as Road blocks, woman Suraksha, Ambulance routing, Natural Disaster and many more.

Our goal is to build a centralized system for alerts based on small/medium scale disastrous events and notify the public on such issues around them so that the adversity can be mitigated. Key concepts utilized are:

Geofence - A geofence is a virtual perimeter for a real-world geographic area.

REST api - Representational state transfer is a software architectural style which uses a subset of HTTP. It is

commonly used to create interactive applications that use Web services.

Push notification - A push notification is a message that pops up on a mobile device.

Current Technologies: Google Assistant, Firebase, Twilio, Android Studio, Flask, Google Map API, Keras and TensorFlow.

## STRUCTURE OF PAPER

The paper is organized as follows: In Section 1, the introduction of the paper is provided along with the motivation, constraints, scope and objectives and overall description. In Section 2 we discuss related work. In Section 3 we discuss methodology. Section 4 tells us

about the system analysis and design. Section 5 tells us about the modeling and implementation. Section 6 concludes the paper with references.

### A. MOTIVATION

In India, small problems exemplify themselves and impact many more people than expected. Getting insights into the current state of our surroundings can prove really helpful in taking the next steps. Crowdsourcing information can be a great way to get these insights. A crowd sourced system is one where citizens can report incidents, which informs every person in the vicinity of that area about the same. We can then enable the informed citizens with measures they can take to avoid that incident.

### B. CONSTRAINTS AND REQUIREMENTS

To build a centralized alert system the proposed app should ideally be adopted by all the citizens. This would allow us to gather more information on an incident and assist in further validating the legitimacy of such incidents. We would also need to coordinate with various departments such as the police, hospitals, fire department etc to help in effective handling of the incidents.

### C. PROBLEM STATEMENT

To build a centralized system for alerts based on small/medium scale disastrous events.

### D. SCOPE AND OBJECTIVES

- Road blocks - Due to heavy rain, roads can get waterlogged, interfering with the normal flow of traffic, bikes and vehicles which are unable to move on such a path can be informed about the same. An uprooted tree may be a cause of inconvenience and can be notified to authorities and the public in the vicinity. A major accident involving heavy vehicles can take a very long time to clear, vehicles moving along that path can be informed. Zones blocked by construction vehicles and other materials can be cleared or avoided.
- Woman suraksha - Using the crowdsourced data we set up a heat map with the most intensely coloured regions signifying areas that are most unsafe. A heat map is created based on user submissions which can be used by higher

authorities to take further actions. We can leverage this for the purpose of women safety to notify users of potentially unsafe areas in the city. In addition, the shake gesture feature can be used in case of emergencies as an SOS - which notifies the people in the vicinity and the guardian of the user that they are in danger.

- Pedestrian mode - A category that alerts the pedestrians about lack of street lights, stray dogs, garbage menace around them. Pedestrians can also report the issue that they come across which can be brought to the notice of higher authority.
- Ambulance routing - The app notifies the people of the nearby ambulances and its routes, which they can be used to clear the way so the ambulance can reach the hospital without any hindrance.
- Natural disaster - Usually in case of flash floods, people residing in low lying areas usually aren't aware of the hazard of the situation. In such cases, there is no other means of communication apart from the news. Flash floods may cause various issues such as traffic congestion, trees being uprooted etc. Through crowdsourcing, we seek to find a solution to this problem. Citizens can report such incidents with the help of which others can avoid entering such areas. Authorities can leverage this information for extraction and disaster prevention.

## 2. RELATED WORK

Malaysia has been a county which has shown alarming signs as number of children still missing are increasing. Though recently the number is gradually decreasing as it involves teenagers majorly. The reason behind teenagers missing are abduction, peer pressure and many other social problems. Geofencing is a technique which enables us to monitor a predefined area remotely, which is covered by a virtual boundary. The system is built in such a way that if the user who is targeted is detected in the virtual boundary, the parents of the targeted user gets notified automatically. The alerted parents can track their children's location [1]. If a child goes out of the area assigned, in the time pre-specified this would logically mean that the child probably is in danger and should be tracked down as soon as possible. The proposed prototype is validated by UAT. When it comes to saving

teenagers from missing the above explained mobile application has been proved as an aid.

This paper proposes information about the technology of geofencing which helps in detecting the movement of the targeted user and gives information of the danger they might face. The proposed system comprises of client-server based architecture, the server gathers dangerous information from several information sources and the client gets notified as the risk is detected, to track the movement of user, the client sets a virtual predefined fence called geofence based on the area which is identified as risky which is stored in the server, and keeps track of the user's movement in and out of the virtual boundary. The system we proposed prototypes and helps in assessing the correctness of the system. The accuracy of the proposed system tends to be high when the user enters as compared to the user's exit [2].

Recently "Child Abuse" has been appeared as one of the universal issue. To take control over this problem, many of the countries formed their own organization privately. Through these organizations they design child abuse policy that assist in elimination of child abuse. This paper includes technologies like Geo fencing, mobile, digital mapping that helps child protection for the government. With these mechanisms parents can trace their children's activities. The main objective of this model is to cease increasing rate of child missing and abuse [3].

Disaster mitigation is an activity which reduces the loss and assets. Benefits and values of Information Technology (IT) to human are like helping human in problem solving, efficiency gaining and effectivity and taking decision. This paper uses IT technologies like geofencing and mobile techniques, concept of smartphone ad hoc networks (SPAN) and Optimizing Link State Routing Protocol (OLSR) that ensures the information regarding disaster mitigation [4].

This research paper offers economical and effective way of notifying a group to all kinds of emergency securities. It absorbs use of Community Emergency Alarm System. This application has a button called "Panic Button" which supplies inhabitants of the community with the means of activating two SMS activated central alarms. First alarm is placed at community center and second one is placed at police station. Whenever there is a security threat the alarm system is started by pressing the "Panic Button" [5].

The present risk communication literature proposed fundamental mechanisms as efficacy beliefs, information sufficiency, social rooms, perceived message quality and perceived threat. Outcome specifies that adaptive behavior and behavioral avoidance will be forecasted by subsets of the determinants. The important predictors are the affective and social predictors, socio cognitive predictors. This research proposes on the behavioral effects of NL=alerts (n=643) and used as warning tool in emergency situation are discussed [6].

Push Messaging Service, Google Cloud Messaging (GCM) applications for Android platform are look into this research. Android platform commonly retain Data Synchronization between Android Device and Server-side using Pulling Method. Every Android Device Should Poll Server for updated data that leads Irrelevant Network Traffic and diffusion of Mobile Battery. Data Pushing Service, GCM are established to overcome this frailty. Internet-Based Communication is described by Push, where request for a specified Transaction is commenced by the Publisher or Central Server [7]. GCM is a lightweight push notification service that enables sending data from the application engine to application powered device and notifies application related to data fetching from the server. Message Queuing and Delivery of Messages to the targeted running application is also managed by the GCM.

Speech and Writing are the two ways where Human beings communicates. Speech is the most common way of communication since it doesn't take longer time to transfer the information from source to destination. This research module explains a technique which uses Auto Associative Neural Network (AANN) for recognizing speech-based features with the help of Mel Frequency Cepstral Coefficients (MFCC). AANN is a modeling technique for modeling each independent word that is instructed to the system. The test input speech is matched with every isolated word segment using Voice Activity Detection (VAD) for finding semantic representation. AANN has the good performance rate results in recognizing [8].

From the real-time FPS data collected in GPS trackers, the system detects traffic congestion and incidents. GPS traces are pre-programmed and located in the road map. The system assigns a traffic state to every road map segments based on vehicles speed. Traffic alerts are generated using Spatiotemporal analysis of the classified

segments and user gets these alerts. Every traffic alert consists of traffic state, affected area and estimated vehicle velocity in that area. The presented system is planned to be an efficient support tool for the citizens in the traffic management [10].

### 3.METHODOLOGY

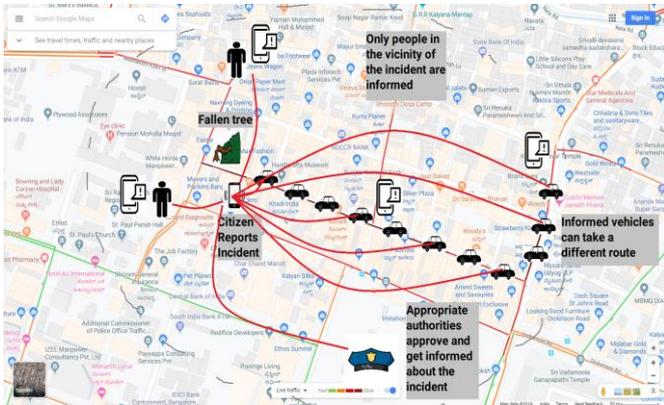


Fig 1: Proposed Model

Our goal is to try to achieve what existing disaster alert systems manage to accomplish but on a finer scale. To this end we aim to make an app which sends alerts based on the undesirable events in and around a geofence as shown in Fig 1.

Example: A road block caused due to an uprooted tree causes a traffic jam that can stretch for up to 2kms, people on route can be informed via a push notification about the incident and thus can take a different path.

### 4.SYSTEM ANALYSIS AND DESIGN

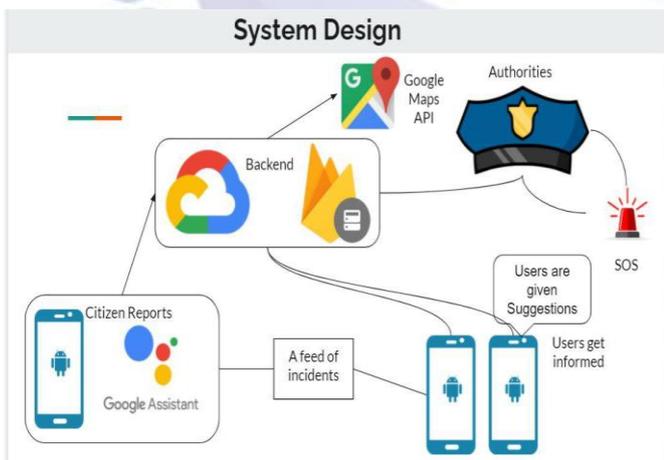


Fig 2: System Design

The System architecture and structure flow consists of an application through which citizens can make reports. Reports can also be made through the google assistant. The report consists of relevant images, along with text

about incidents. This report is then sent to the backend for further processing. From the backend, relevant reports are sent to relevant users in a dynamic geo-fence. Authorities are also sent reports for verification in case of relevant use cases.

### 5. MODELING AND IMPLEMENTATION

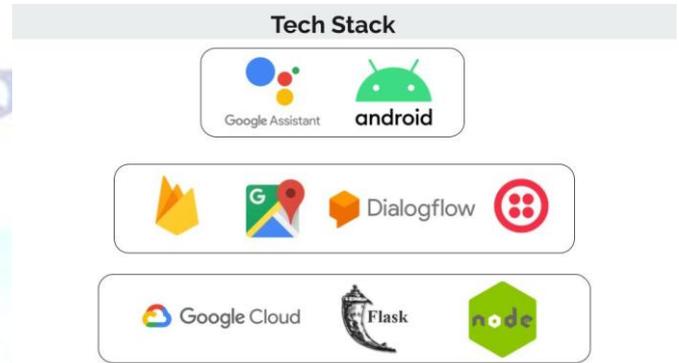


Fig 3: Tech Stack

As discussed earlier, our implementation consists of an android app or a phone which is capable of accessing the Google Assistant and a backend server to process these requests. The android app is capable of both receiving and creating alerts. When a user makes a report either with the android app by providing details like location, pictures etc or with the Google Assistant using voice, it is written onto a Firebase Firestore database which is a no-SQL database consisting of collections and documents to store the data. This is done on the client side. The Android app is written in java and the Google Assistant action is written in javascript which is then deployed onto a Firebase function that is called on a trigger basis.

Dialogflow is used to incorporate NLP techniques to make sense out of ordinary conversations. When the report is created in the Firestore database, the server which is written in python listens to the changes made in the database and takes action on it, on a trigger basis. The python backend then tries to classify the report as a legitimate report or a spam report by taking into account many factors like report density from a particular location for example, spam is further eliminated from the fact that we use SIM verification to on board people onto our app. The python backend also communicates with a machine learning model to instantly categorize a report as an emergency by detecting features like fires etc and instantly alert the fire department. Once the backend flags the report as a genuine report, authorities are

informed and now we prepare to send the notifications out to the users.

Many things happen during this stage, first we see which users actually need this report and is relevant to them, this is decided based on priority of the report and distance or location. Once we get that, we have to remove the notifications already sent that are no longer relevant. Once that is done, we start preparing the payload for the android app to receive and parse as a notification; we use the Firebase cloud messaging service to send these notification payloads to the app. Some reports need the backend to prepare a call to be sent out, for example - women security. We send out calls using the Twilio service. We also use this service to send and receive SMS messages, where a user can make a report even when there is no internet connection, which is often the case during a disaster.

The android app receives this payload and builds a notification with relevant information to the user and they can take action based on that. Once that information is no longer relevant, it is swiped off and removed. The authorities are provided with a simple functional web page to intervene manually and approve or reject reports, this page has an overview of the whole system and acts like a dashboard with statistics by region with a heatmap etc. The android app is equipped with an easy way to make distress alerts easily by shaking the phone beyond a reasonable threshold.

## 6. CONCLUSION

This system therefore shows a scalable system where there is a centralized triaging mechanism to classify reports based on various parameters and taking action on it by providing users relevant information based on where they are. The system achieves what it sets out to do by sending concise and targeted notifications to increase the amount of information a user has before he makes a decision.

The future work for alerting system to better integrate this system with already existing systems providing a smoother and more seamless movement of information. The system can also have an automated report verification method based on the density of location and sentiment of the report description. Certain quick events can be added such that in case of fire or an accident, certain specific authorities can be informed instead of

informing only the police authority. For example, a report of a fire can notify the fire department after the server verifies that the report contains a fire that may be a danger to property and life.

## Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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