Real Time Detection of Emergency Events and Monitoring Structural Health of Roads using Crowdsourcing

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Abstract- *Crowdsourcing is a concept when someone may it be an entity or an individual or organization requests knowledge from a group people. It is a process of acquisition and integration of big and heterogeneous data generated by a diversity of sources on which a lot of analysis can be done to generate useful results of our importance. Information about emergency events, like - fires, storms, traffic jams is of hugely important and can be used to protect humans. Recently, social media feeds are rapidly emerging as a novel platform for providing this information. The content from social media includes references to emergency events happening at specific locations of affecting people. But all the users don't get notified about emergency at the same time since these messages remain to specific group. In this paper we propose a model wherein if some users post an emergency then this information will be conveyed to all the users surrounding that area also a emergency notification will be sent to authorities concerning that area. In the end a 5W (What, Where, When, Who, and Why) report will be available. The Smartphone contains an in-built tri-axis accelerometer which is capable of detecting three-dimensional motions of the smart phone. Every movement of the Smartphone is detected and expressed in x, y and z directions which represents the direction in which acceleration occurred. X-axis indicates lateral movement, y-axis represents acceleration or deceleration of the vehicle and z-axis indicates any vibration resulted from a pavement defect. Using this functionality of accelerometer of android devices passing through roads we can monitor the structural health of the road and notify users of the same.*

Keywords- Emergency, Real-Time, Emergency Event, Crowdsourcing, Potholes, Structure of Road, Health of Road.

I. INTRODUCTION

Crowdsourcing is a process of acquisition, integration, and analysis of big and heterogeneous data generated by human sensors (social media). With the help of crowdsourcing and analytics we can create solutions that improve, human life quality, and operation systems. Especially, nowadays, no countries, no communities, and no person are im- mune to emergency events.

An emergency event is a sudden, urgent, usually unexpected incident or occurrence that requires an immediate reaction or assistance for emergency sit- uations faced by social group (e.g., the corporations) or the recipients of public assistance.

For example, the resident may face fires, storms, traffic jams and so on.

Also, nowadays we see a lot of potholes on roads due to which there are delays in transportation and rising number of accidents. So it is very important to choose appropriate route.

A. Social media

Social media is a catch-all term for a variety of internet applications that allow users to create con- tent and interact with each other. This interaction can take many forms, but some common types in- clude:

- Sharing links to interesting content produced by third parties.
- Public updates to a profile, including informa- tion on current activities and even location data.
- Sharing photos, videos and posts.
- Commenting on the photos, posts, updates, videos and links shared by others.

Recently due to availability of internet and smart-phones for affordable prices social media activity is on a rise. Large numbers of people are using social media to get connected to each other.

Because of this a huge amount of data is getting collected every day. This data is generally used to personalize user experience or generate personal- ized advertisements.

We can use this data to analyze and detect real time emergency events. But there are a lot of chal- lenges involved in taking benefits of social media. Some are as follows:

- Due to large volume and high velocity of incom- ing data real time analysis becomes a challenge.
- Social media data contains a lot of noise.
- The phenomenon of "high volume, low value" from the big data area also exists in the social media data.
- The social media device is with fast data in/out. The velocity of collecting social media data is faster than that of processing and analyzing them. The high velocity of social media devices

brings the big challenges for processing and analyzing social media data.

B. Accelerometer

The smartphone contains an in-built tri-axis ac- celerometer which is capable of detecting three- dimensional motions of the smartphone. Every movement of the smartphone is detected and ex- pressed in x, y and z directions which represents the direction in which acceleration occurred. X- axis indicates lateral movement, y-axis represents acceleration or deceleration of the vehicle and z-axis indicates any vibration resulted from a pave- ment defect. In this proposed system, the inbuilt accelerometer in a smartphone is used for pothole detection. The z-axis of accelerometer corresponds to different road profiles. Any fluctuation in the accelerometer z-axis signal corresponds to a pothole or a bump on the road if it exceeds the threshold limit set to indicate any abnormalities on the road. A deviation in the accelerometer value in the nega- tive direction corresponds to pothole and a positive deviation corresponds to a bump.

C. GPS

It is a global navigation satellite system that pro- vides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. Global Positioning System (GPS)(accuracy typically 5m) is used for location finding.

- To make a meaningful inference from the gath- ered pavement anomaly data, speed as well as the location of the vehicle are essential. This can be accessed using GPS.
- Moreover, on receiving the pothole/bump data, this system can identify the pavement defect location on the GPS map using the coordinates received along with it.
- GPS is also used to tag social media posts which reduces the amount of data required to mine or analyse for the detection of emergency events.
- GPS data is also used to differentiate between connected and distinct events

D. Motivation

We have decided to do research on this topic be- cause of seeing different types of emergency events and people not properly responding to them.

For example people often shoot videos of accidents rather than calling the police or emergency services. Also, a lot of times people do not have a correct contact for Emergency services.

The second part of our system is also very impor- tant because we have seen a lot of accidents happen because of potholes on the road. So the selection of correct roads is very necessary. The system uses the accelerometer in the any person's phone to detect potholes and map them.

II. RELATED WORKS

In [1] a simple and precise way to detect urban emergency events using 5W(What, Where, When, Who, Why) model is suggested. Firstly, users of social media are set as the target of crowdsourcing. Secondly, the spatial and temporal information from the social media are extracted to detect the real time event. Thirdly, a GIS based annotation of the de- tected urban emergency event is shown. The study of this paper helped us to understand and develop our proposed model.

In [2] social media users are analogous to a hu- man sensor network in the crowdsourced initiative. To ensure the credibility of the crowdsourced infor- mation, GIS (Global Information System) annotated description are considered for clustering. Then the cluster centers denoting latitude and longitude of the calamity area are visualized via Maptive tool notified via SMS (Short Messaging Service) to the rescue task force from an area outside the disaster. This study gave us an idea how to map area of emergency and also inform emergency services.

In [3] analysis for sentiment behavior of Twitter data. The proposed work utilizes the naive Bayes and fuzzy Classifier to classify Tweets into positive, negative or neural

behavior of a particular person. This study helped us to segregate emergency posts from normal posts.

In [4] work presents an analytical model of a sys- tem that detects pavement deformities. The system presents a mobile application that captures the ac- celerometer profile using the in-built accelerometer in smartphone, to obtain the location of pavement deformities. The variations in the accelerometer val- ues with respect to the vehicle speed are taken into account. The study of this paper is used to detect potholes and bumps in the roads.

[5] proposes Crowd-Sourcing based Android Application to detect damaged roads and generate a report which will assist the vehicle driver for safer driving by providing an early warning system to warn the driver of any abrupt discontinuities on the road. A model is designed and implemented using layered approach that consists of sensor data collected from the users, cloud based data analytics and a response model for the mobile which is inte- grated with Google Maps. The study of this paper is used to detect potholes and bumps in the roads and integrate it with Google Maps.

III. PROPOSED MODEL

In this model we are proposing a social media network which is used to detect emergency events

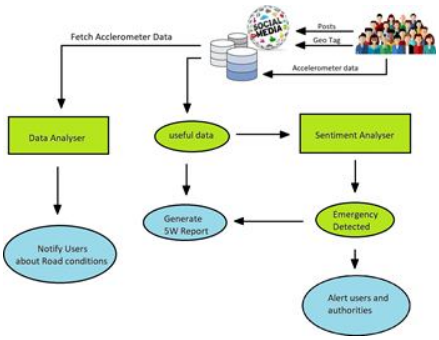

Fig. 1. System Architecture

and monitoring the structural health of roads using the data collected from the users.

This model proposes considering the users as social sensors. The data is collected by different methods :

- Individual posts on social media.
- Automatic data collected from different mobile devices.

This collected data is analysed and classified using different techniques such as sentiment analysis, SVM, Clustering.

A. Sentiment Analysis

We define the Semantic Orientation (SO) of a word as the difference between its associations with Emergency words. We will build our own list of Emergency terms called as dictionary. Use of this dictionary for good and bad words is the modest form of sentiment analysis.

Each word in a sentence has a score, typically

1) +1 for a high emergency word
2) 0 no emergency word.

Then, we merely merge scores of each word in sentence to get a concluding sentiment total.

For example: There is a fire at Akurdi railway station.

In the above Example Here fire is an emergency word and the rest are not, so the score of the given sentence is +1. This is an emergency event and is selected for further analysis.

B. Mathematical Model

Let S be the Whole system which consists: S = {IP, Pro, OP}.

Where,

- IP is the input of the system.
- Pro is the procedure applied to the system to process the given input.
- OP is the output of the system. IP = {LOC, AX, AY, AZ, GX, GY, GZ}.

Where,

1) LOC is user current location.
2) AX is value of accelerometer axis X
3) AY is value of accelerometer axis Y
4) AZ is value of accelerometer axis Z
5) GX is value of accelerometer axis X
6) GY is value of accelerometer axis Y
7) GZ is value of accelerometer axis Z

C. Support Vector Machine

Sequential minimal optimization (SMO) is an algorithm for solving the quadratic programming (QP) problem that arises during the training of support vector machines.

Initially, k-means clustering is done on the training data for feature extraction.

Using this a classifier model is built. SMO classi- fier will be used to evaluate model on testing data. Using the fitted model obtained from the training dataset prediction of potholes as well as the severity of pothole can be obtained.

IV. CONCLUSION

Crowdsourcing is when an entity whether an indi- vidual or an organization requests specific resources from a group of people. It is a process of acquisition and integration of big and heterogeneous data gen- erated by a diversity of sources on which a lot of analysis can be done to generate useful results of our importance. Detection about urban emergency events, e.g., fires, storms, traffic jams is of great importance to protect the security of humans. Re- cently, social media feeds are rapidly emerging as a novel platform for providing this information. The content from social media usually includes references to urban emergency events occurring at, or affecting specific locations. But all the users don't get notified about emergency at the same time since these messages remain to specific group. In this paper we propose a model wherein if some users post an emergency then this information will be conveyed to all the users surrounding that area also a emergency notification will be sent to authorities concerning that area. In the end a 5W (What, Where, When, Who, and Why) report will be available. The smartphone contains an in-built tri-axis accelerometer which is capable of detecting three-dimensional motions of the smartphone Every movement of the smartphone is detected and expressed in x, y and z directions which represents the direction in which acceleration X-axis indicates lateral movement, y-axis represents acceleration or deceleration of the vehicle and z-axis indicates any vibration resulted from a pavement defect. Using this functionality of accelerometer of android devices passing occurred X-axis indicates lateral movement, y-axis represents acceleration or deceleration of the vehicle and z-axis indicates any vibration resulted from a pavement defect.

Using this functionality of accelerometer of android devices passing through roads we can monitor the structural health of the road and notify users of the same.

Future scope of this system is to add the Image processing feature. We will use image processing to recognise the emergency events and identify the severity of emergency events.

ACKNOWLEDGMENT

We express my heartfelt gratefulness to Prof. Ram Joshi, Head of Information Technology Department, JSPM's RSCOE for their stimulating supervision whenever required during our project work. We are also thankful to the staff of information technology department for their co-operation and support. We would also like to put forward my heartfelt acknowledgement to all our class mates, friend's and all those who have directly or indirectly provided their overwhelming support during our project work.

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