

EMERGENCY SEARCH USING ANDROID APP

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Emergency Search using Android App

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ABSTRACT

Emergency can occur anywhere anytime. The nature of emergency is unpredictable and it can unveil itself in any form. Whenever disasters occur, people in the location need to have adequate information to minimize the human and financial losses. With the recent evolution of smart phones, such information can be made available to the people much sooner and more reachable. The ESA App strives to distribute information to diverse public around the world. The main goal of ESA App is to provide firsthand information from the people who have experienced or seen the disaster, provide emergency news links which are provided by the social media sites, provide the precautions needed to be taken by the people in the emergency zone or moving to the zone, user can report the emergency incident occurred in his area through the ESA App to twitter.

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TABLE OF CONTENTS

| | |
|---|------|
| ABSTRACT..... | iii |
| ACKNOWLEDGEMENTS | iv |
| LIST OF TABLES | vii |
| LIST OF FIGURES | viii |
| 1. INTRODUCTION | 1 |
| 2. BACKGROUND AND RELATED WORK | 4 |
| 2.1. Introduction | 4 |
| 2.2. Evolution of Social Media and Android App..... | 5 |
| 2.3. Twitter - Online Social Networking Site..... | 6 |
| 3. FEATURES INVOLVED IN THE APP | 8 |
| 3.1. ESA App Home Screen User Interface | 8 |
| 3.2. List View and Map View of Results | 10 |
| 3.3. Quick Search in the ESA App..... | 11 |
| 3.4. Current Trending News | 13 |
| 3.5. Disaster Related News | 15 |
| 3.6. Report Incident | 16 |
| 3.7. FrameWork..... | 19 |
| 4. DESIGN AND IMPLEMENTATION OF ESA APP | 20 |
| 4.1. Geocoding and Reverse Geocoding | 20 |
| 4.1.1. GeoCode an Address | 20 |
| 4.1.2. Reverse Geocode a Location | 20 |
| 4.2. Twitter Search API 1.1 | 21 |
| 4.3. Decoding the Retrieved Response..... | 22 |
| 4.4. Publishing the App..... | 24 |

| | |
|-------------------------------------|----|
| 5. RESULTS | 26 |
| 6. CONCLUSION AND FUTURE WORK | 28 |
| 7. REFERENCES | 30 |

LIST OF TABLES

| <u>Table</u> | <u>Page</u> |
|--|-------------|
| 1. Twitter Search API 1.1 Response. | 22 |

LIST OF FIGURES

| <u>Figure</u> | <u>Page</u> |
|--|-------------|
| 1. Twitter Request and Response..... | 7 |
| 2. Showing Category and Sub Category Selection..... | 8 |
| 3. Home Page of the Emergency Search..... | 9 |
| 4. Tweets based on search keyword, location and Timestamp..... | 10 |
| 5. ESA App with the Google map location pointers..... | 11 |
| 6. ESA App Quick Search Settings page..... | 12 |
| 7. Current Trending News..... | 14 |
| 8. Displaying emergency related page details..... | 15 |
| 9. Search popular tweets based on keyword..... | 15 |
| 10. Popular tweets list..... | 16 |
| 11. Report Incident Feature..... | 17 |
| 12. Tweet posted to Twitter from ESA App..... | 17 |
| 13. Results showing for the search feature..... | 18 |
| 14. Map view of the Reported Incident..... | 18 |
| 15. Overall architecture of the system..... | 19 |
| 16. Publishing the Android App..... | 25 |
| 17. Results showing for the search feature..... | 26 |
| 18. Tracking of the tweet on Google Map..... | 27 |

1. INTRODUCTION

Social Media has emerged as a powerful means of communication for users to share and exchange the information. Social Media is an online communication channel or the website which helps users to participate, input and share content [1, 8]. In recent days social media associated with mobile apps has gained widespread popularity. Mobile Apps are the software programs which can be downloaded and accessed with the phone. Social Media has become the integral part of the life as social websites and applications proliferate the internet.

According to a survey out of 7.2 billion people on the earth, over 3 billion people are active internet users

- Nearly 2.1 billion people have social media accounts
- 3.65 billion people have internet connection on their mobile phones.
- 1.7 billion people have active social media accounts [3].

The most used social websites are Facebook, Twitter, Google+ and Linked-In which allow users to register, send messages and create networks among the users. All these social networking websites are available as Mobile Apps [18].

Most people use social media tools to seek and share emergency related information. There are several emergency information agencies such as Federal Emergency Management Agency and CDEMA who provide the information on emergencies and disasters [7].

In some of the emergency situations these social networking sites like Twitter can be really useful and faster than other media or technology. Examples of the use are

1. Twitter was first to break news when Gorkha earthquake occurred in Nepal. Twitter also provided the firsthand information about the incident [4].

2. In 2013 when Hurricane Sandy occurred, people used twitter as the emergency management media. Twitter allows 140 words to be tweeted and can be a powerful emergency management tool in crisis. Converting emergency criteria into Twitter tweets will have maximum benefits to the people in the affected areas and cut down the loss of life and property damages [2].

The Emergency Search App is mainly built for emergency management whose objective is to get the first hand information from the witness of emergency incident and reduce the potential damage which occurs during the emergency disaster by informing public about the emergency situation [17]. People who witness and affected by any emergency situations can post the incident so that other people who are in that region or travelling to the region can plan accordingly and benefited through this App.

As Twitter contributes so much in the emergency situation, we used the Twitter social networking site as a backbone in developing ESA mobile App. The App has the following features:

1. **Search Feature:** This feature allows user to search for any emergency information based on the search keywords and location of their interest. The search feature provides the information from the twitter based on the user search criteria. Users also have an option to search for information based on the result type. (i.e. recent or popular twitter posts.)

2. **Quick Search:** Users can register with the ESA App. Registered users have a facility to pre-select some emergency keywords. The selected keywords are stored inside the database. When a registered user log-in into the App, he or she has an additional option to select a “Quick Search” option provided on the home screen of the App. This option will return all the emergency results based on the pre-selected search keywords. This one-click quick search option

allows users to quickly get the information they need. Users can update the pre-selected search keywords, based on their current needs.

3. Current Trending News: Twitter is considered as very useful source of emergency related news across the worldwide. Various news channels posts emergency news to twitter. The App has a quick link called “Trending News”, which returns the current most trending news posted to twitter by some top news channels. This option helps all the users to keep themselves informed with the latest worldwide emergency news, collected from multiple sources.

4. Report Incident: This feature helps to report an incident to the ESA Twitter page. When a user witnesses or experiences any emergency situation, he or she can post the incident in our ESA app, which input and gets post it to the ESA twitter page. All the registered users who opted for ESA email alerts will receive an email notification if the reported incident has occurred in their location. Also, when a random user searches for any emergency information in the ESA app, if the location criteria match with the recent reported incidents then the tool provides the reported incident information to the user along with the online results that match matches his search criteria. The reported incidents are listed are prioritized over the online results and are shown on the top of the results list.

All these features in this App make it unique and distinguished from the other Social Media Sites or Apps. In the upcoming chapters we will define the evolution of social media and smart phones, implementation and design and technology used to develop the Mobile App.

2. BACKGROUND AND RELATED WORK

2.1. Introduction

In 19th century emergency disasters used to be handled by federal government on a case by case basis without using any clearly defined system. In recent times most of the incidents are handled without any involvement of the federal government. In 1917 during the World War I, federal government formed disaster relief named as "Regulations governing Flood Relief Work in War Department" which was only formally working for military. By late 1970 several government sectors are involved in emergency disasters [19].

In 1979 after the Federal Emergency Management Agency (FEMA) was established [31]. FEMA's mission is to reduce the loss of life and property and protect communities nationwide from all hazards, including natural disasters, acts of terrorism, and other man-made disasters. FEMA leads and supports the nation in a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery and mitigation [25].

Emergency relief organizations play an integral part in aid following a disaster or emergency, and as such, they are experts in crisis communication [26]. They are first responders in a disaster situation, they facilitate medical care, and they aid in the placement of displaced peoples. Government also plays an important role in disaster relief. Government organizations are, at times, able to provide financial support as well as volunteers in times of disaster.

The purpose of this study is to understand how communication is made throughout a natural disaster situation and the various ways social media can be used to supplement disaster relief efforts. The study based on observation and interviews with people involved in disaster and emergency relief work, sets out the current uses of social media during a disaster. By exploring

current social media practices of emergency relief and government organizations, and their successes and failures during a disaster, best practices will be established [19].

Federal Emergency Management Agency (FEMA) has mentioned that when a hurricane “Sandy” occurred, most phone services were lost, even then more than 20000 twitter tweets were posted about the situation. Even when the 911 emergency services is unavailable twitter posts about the situation can be really helpful.

There are social websites which provides us the information based on the search keyword from the social networking sites. Social network links can be leveraged to improve the quality of search results [24]. Few examples of these sites are WhoTalking and Social Mention.

WhoTalking provides the results based on the search keyword. These websites returns the results based on different social networking sites, but are not dedicated to the emergency related data [20, 27]. WhoTalking returns the results just based on the approximate user location or the location near some city, on the other hand Social Mention does not return the data according to the particular location [28]. Another emergency management tools Ushahidi, Sahana have also become popular. Ushahindi emergency tool is used to manage aid, manage volunteers, track disaster relief camps and victims [29]. Sahana emergency tool addresses common coordination problems during a disaster, such as finding missing people, managing aid, managing volunteers, tracking disaster relief camps and the victims [30].

2.2. Evolution of Social Media and Android App

Human history has seen a continuous need to evolve ways to communicate with each other [8]. The earliest form of communication across the distances is used to be letters which are delivered by hand. In the year 1972 telegraph was invented which is faster than delivering through hand. In 1800 century telephone and radio has been invented which are some of the earliest trends of communication [9].

The earliest form of internet such as CompuServe was developed in the 1960's and an early form of email was also developed during this time. After the invention of blogging in social media, it gained huge popularity within no time. By 2006 Facebook and Twitter have evolved and are still very popular. These micro blogging sites greatly improved and increased the interaction between persons and organizations that have common interest in places, movies, music and education based on social networking [6,10].

Smart phone can be defined as “is able to perform many of the functions of a computer, typically having a relatively large screen and an operating system capable of running general-purpose applications” [19]. From the beginning of this millennium, Mobile Applications have been of tremendous growth. It has been more than 20 years ever since smart phones have been evolved. In 1994 IBM launched Simon mobile phone which has software applications (apps) with a stylus and touch screen [13].

In 2007 launching of iPhone has pushed the smart phones into the main stream, the first commercial smart phone in which usage of finger touch is the main means of interaction.

2.3. Twitter - Online Social Networking Site

Twitter is the most popular micro blogging site in which people can tweet and re-tweet. Twitter allows maximum of 140 words for a tweet.

Twitter is a powerful social networking site through which people can connect through there tweets and re-tweets. Millions of people tweet every day on twitter with every imaginable subject. Lot of people, organizations and communities make use of tweets for their business or to make their presence felt.

Twitter helps users to publish short message updates and status updates. Twitter can also be used in Emergency crisis situation, when people are in the emergency situation they can post the tweet mentioning the situation on where the incident occurred and how the situation can be

handled so that other people planning to visit the place or people who need suggestions can benefit through these posts.

Initially twitters is meant for exchanging of tweets or follow some page, celebrity or a public figure, but gradually it seems to be very useful in emergency situations. Twitter provides various APIs, using which third party applications or websites can communicate with twitter to get their job done. Following diagram shows high level communication flow between ESA app and Twitter Search API v1.1.

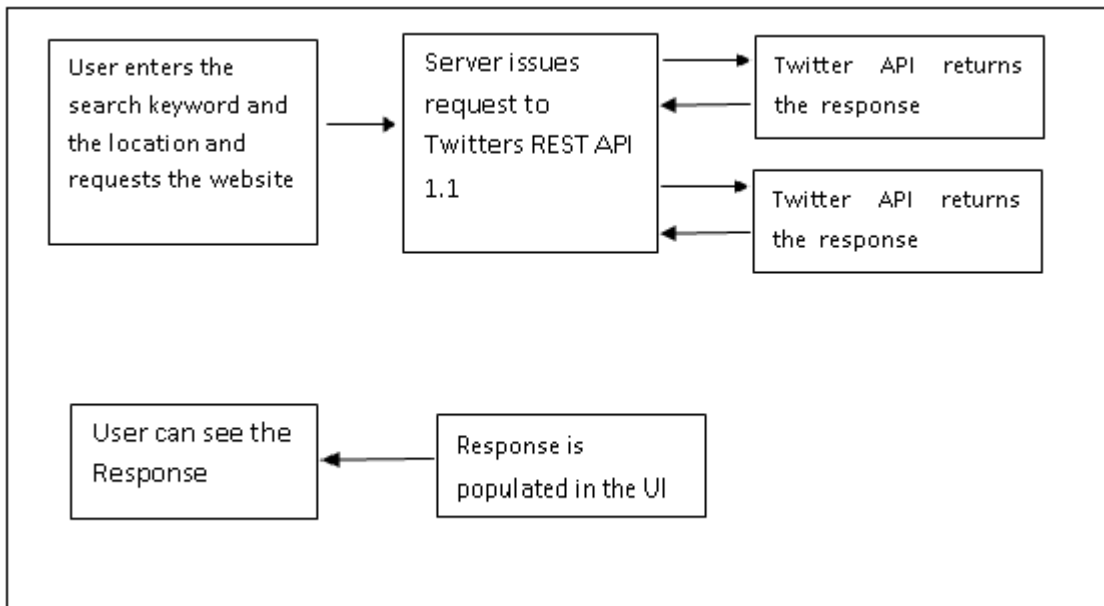


Figure 1. Twitter Request and Response

3. FEATURES INVOLVED IN THE APP

3.1. ESA App Home Screen User Interface

The ESA App has server fields on the home screen through which user can interact with the application.

Category/Sub Category [Dropdown]: The category dropdown displays the type of disasters and the subcategory dropdown has the possible emergency names. The user can select the desired category/subcategory pair from the available choices. In the below figure category is selected as ‘Geophysical’ and the subcategory is selected as ‘Earthquake’.

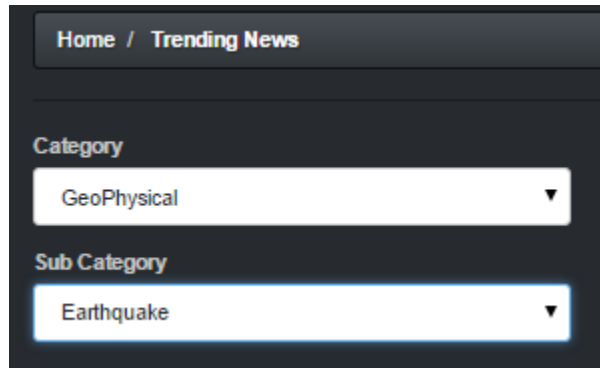


Figure 2. Showing Category and Sub Category Selection

Search [Text Box]: In this Text Box user can enter any relevant search keyword which he is interested in.

ZipCode/City [Text Box]: The user can enter either the city or the zip code to get the emergency details of the location he is interested in. The ZipCode/City field is optional. If the user does not enter any location information, then the ESA App gets the user current location.

Distance [Dropdown]: Using this dropdown user can select the distance around the selected city or zipcode, from which the emergency news can be accessed. The results are organized based on the location and the distance selected.

Result Type [Drop Down]: Users can select the Type of emergency data they wants to retrieve. A sample of the Result Type with three options is described below.

- (i) **Recent:** The emergency news results are sorted based on the timestamp when they are posted to Twitter. By selecting this option the latest news are displayed on top of the list.
- (ii) **Popular:** This option sorts the results based on the popularity of the tweet. Most popular tweets are displayed on top of the list.
- (iii) **Mixed:** This option displays the results as is, in the order they are fetched from online. A mix and match of the recent and popular results are displayed based on the matching search criteria.

The Home page of the ESA App looks like in the below figure.

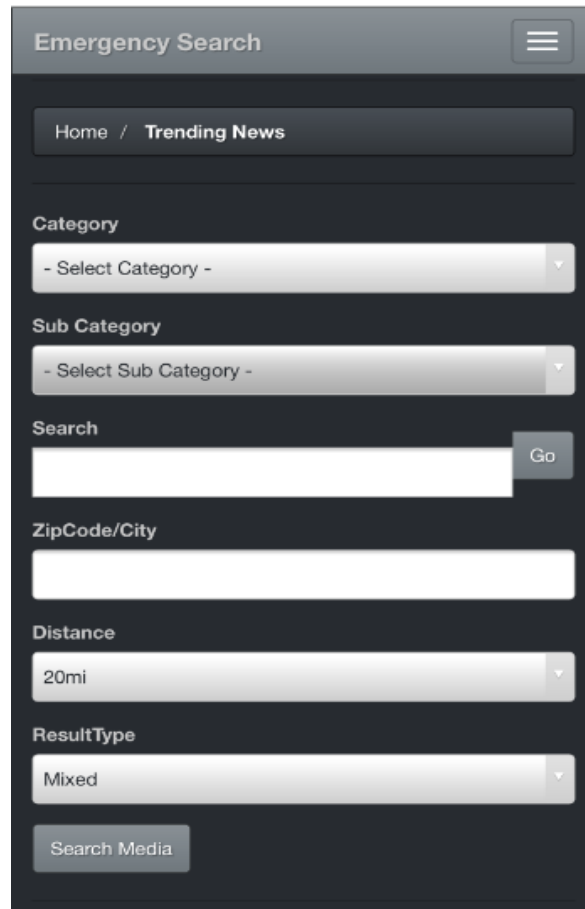


Figure 3. Home Page of the Emergency Search

3.2. List View and Map View of Results

There are two ways in which the ESA app displays the results based on the users search criteria such as keywords entered by the user in the search field and the user selected emergency categories from the ‘Category’ and ‘Subcategory’ dropdowns.

‘List View’ provides all the results as an ordered list based on the time when the tweet is created. Each result include details like tweet message, location of the user where the tweet is posted, time when the tweet was created, user name of the twitter account from which the tweet is posted, display picture of the twitter account, and the URL link to the actual post on the internet where additional information can be found regarding the post.

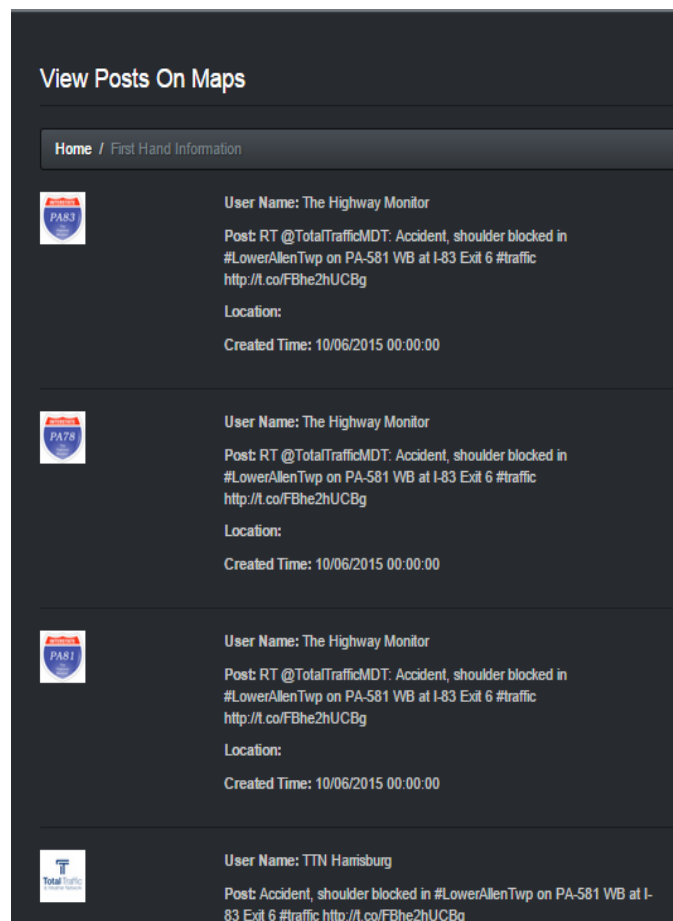


Figure 4. Tweets based on search keyword, location and Timestamp

‘Map View’ shows a Google Map, with flags placed on the map where the posts are tweeted from. This view is very helpful for the users to understand where exactly the emergency situation has occurred and how far they are geographically separated from that area. Each pointer on the map is clickable, and when clicked a message box pops up with additional information like tweet text, user details and location details of the tweet.

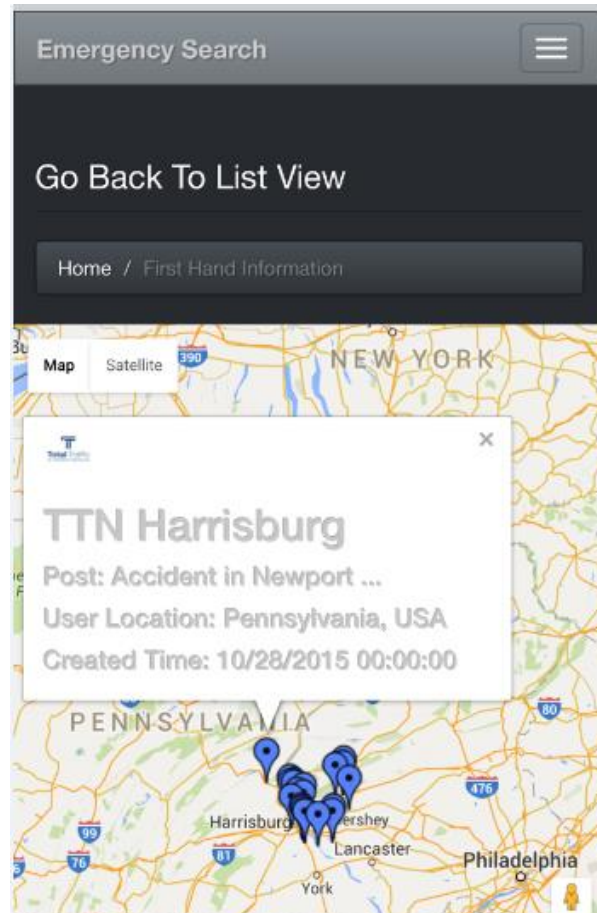


Figure 5. ESA App with the Google map location pointers

3.3. Quick Search in the ESA App

Users can register with ESA App, registered users have a facility to pre-select some emergency keywords. The selected keywords are stored inside the database. When a registered user log-in into the App, he or she has an additional option to select a “Quick Search” option provided on the home screen of the App. This option will return all the emergency results based

on the pre-selected search keywords. This one-click quick search option allows users to quickly get the information they need. Users can update the pre-selected search keywords, based on their current needs. Quick Search displays the emergency related information from current location the user is located and within the 30 miles of radius is displayed.

The registered user can also unselect the emergency related search if he feels he no longer needs. Also he can select new emergency related categories.

Please find the below screen shot of the settings page which user can save for Quick Search.

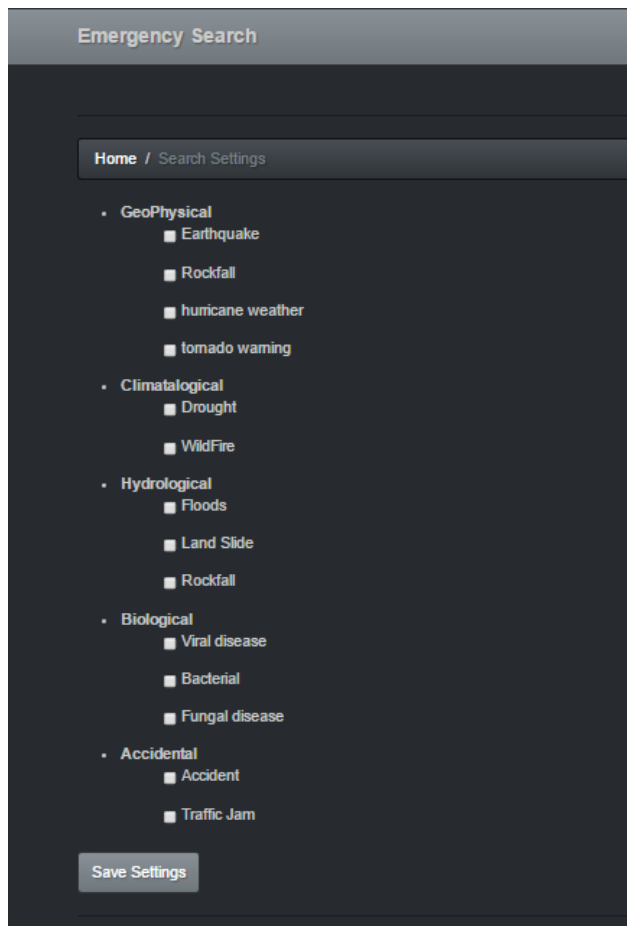


Figure 6. ESA App Quick Search Settings page

3.4. Current Trending News

Current trending news is about the breaking news happened due to the natural disaster or calamities or due to the human made disaster i.e. accident or murder etc. Twitter is an amazing forum for the breaking news.

Breaking news, interchangeably termed late breaking news and also known as a special report or news bulletin, is a current issue that broadcasters feel warrants the interruption of scheduled programming and/or current news in order to report its details. Its use is also assigned to the most significant story of the moment or a story that is being covered live. It could be a story that is simply of wide interest to viewers and has little impact otherwise.

Currently in our App we are providing the News feeds from the Breaking News Channel which generally posts its tweets to Twitter. The breaking News results which are used in our App are 1. Breaking News 2. Breaking News Storm, Accu Weather.

We have provided a link Current Trending News in the Home page. By clicking on it we are redirected to the breaking news. We have restricted each breaking News channel up to 25 posts and overall of 100 tweets.

Below is the figure showing the current trending News.

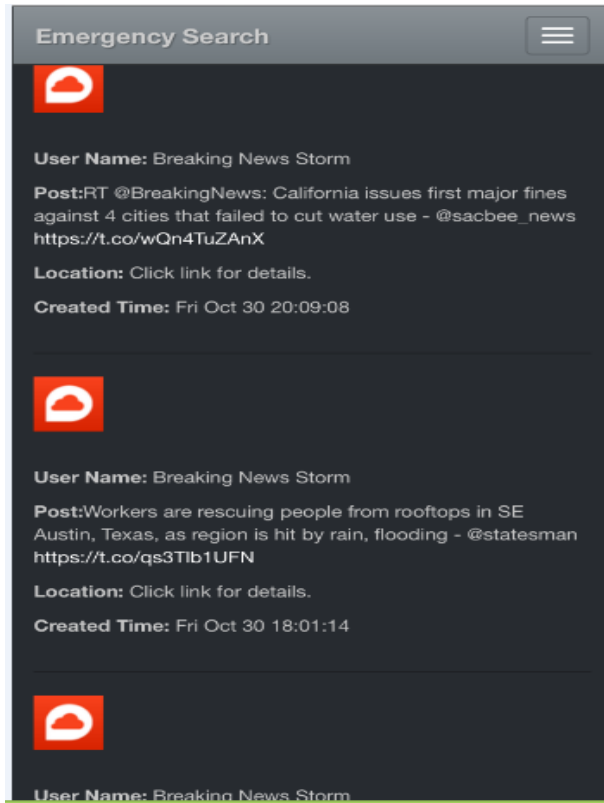


Figure 7. Current Trending News

In the above diagram for each of the posts the user has provided a link. When we click on the link it redirects to the corresponding page which the user of the post has shared with twitter.

Below is the image after clicking on the link provided



Figure 8. Displaying emergency related page details

3.5. Disaster Related News

For user to get the news about a natural disaster or incident happened, but when user does not know the location exactly where it has happened then, to get the twitter tweets about disaster/incident the user can enter the emergency keyword in the Search [TextBox] and click on GO [Button].

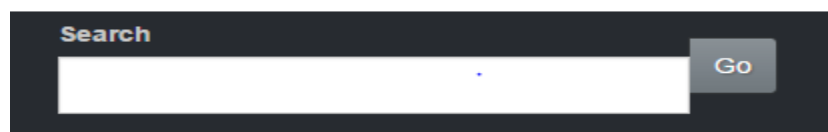


Figure 9. Search popular tweets based on keyword

The output is the list of popular tweets based on the search keyword are displayed from all across the world.

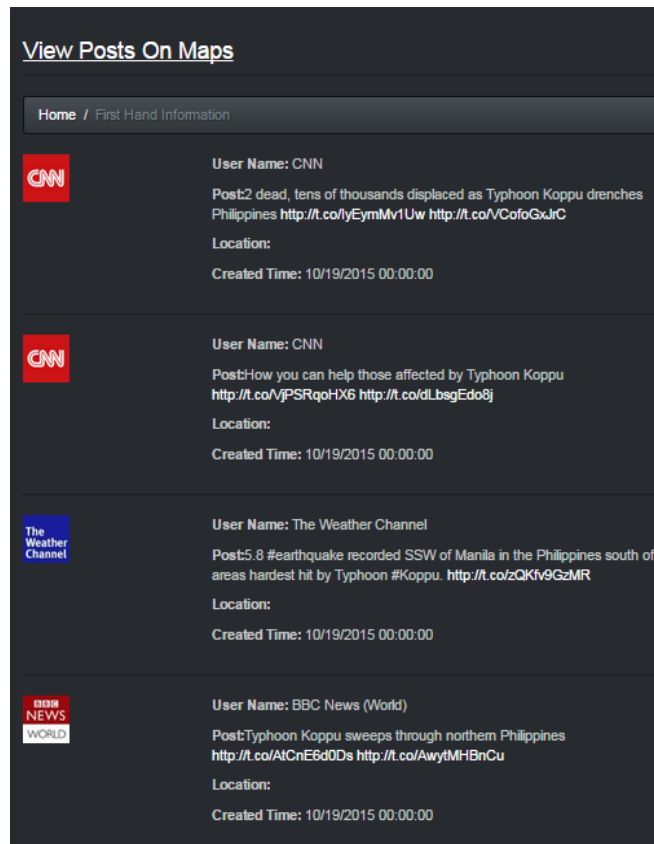


Figure 10. Popular tweets list

3.6. Report Incident

ESA App allows user to report an emergency incident to ESA twitter page. This report incident is used to record the incident which the user has entered about an emergency situation to the records. The user has to enter the emergency data and location of the incident and post the data to twitter. After user has posted the data the tweet can be seen on the Twitter page.

There are two fields in the page for the Tweet and the location. In the Tweet [Text Area] user enters the Message which needs to be posted to twitter, in the Location [Text Box] user can enter either a city name or the Zip code which the emergency incident has been occurred. When

user clicks on the Tweet [Button], the data is posted to twitter as well as an email is send to the users who have registered with their email id.

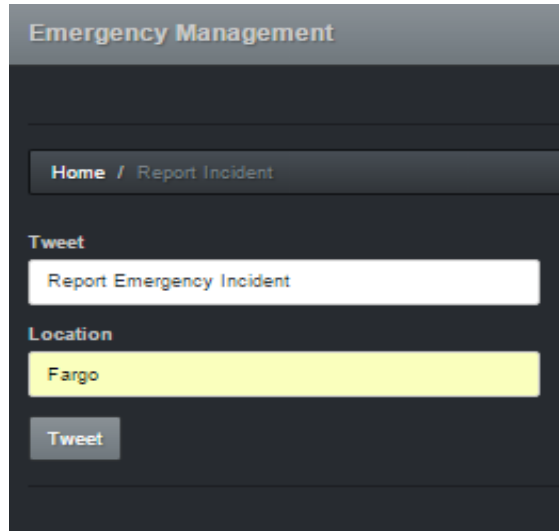


Figure 11. Report Incident Feature

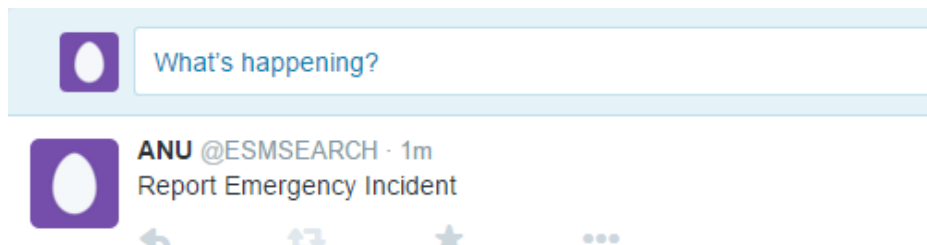


Figure 12. Tweet posted to Twitter from ESA App

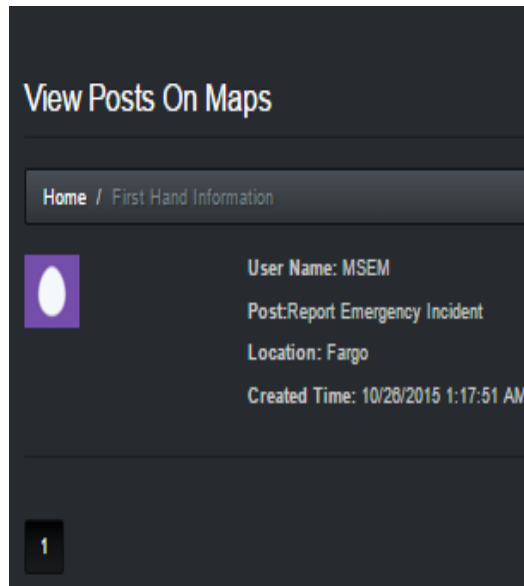


Figure 13. Reported incident displayed in ESA App

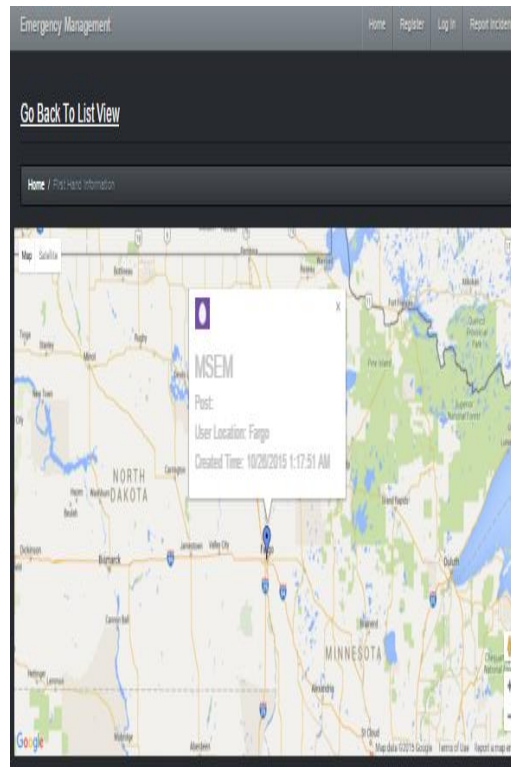


Figure 14. Map view of the Reported Incident

3.7. Framework

Below figure shows overall architecture of the ESA App.

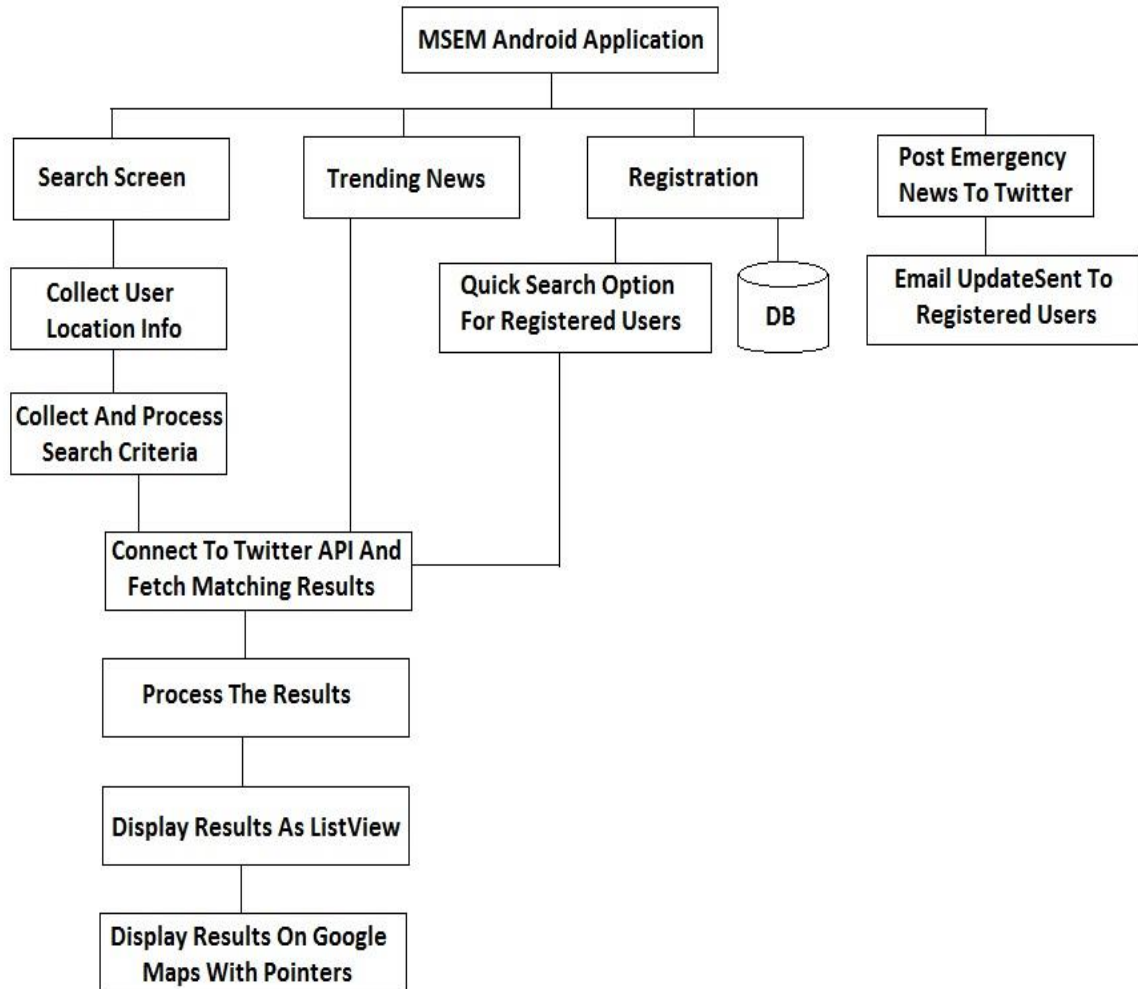


Figure 15. Overall architecture of the system

4. DESIGN AND IMPLEMENTATION OF ESA APP

4.1. Geocoding and Reverse Geocoding

Initially we need to declare the permissions needed for location services in AssemblyInfo.cs page

```
[assembly: UsesPermission(Manifest.Permission.AccessFineLocation)] [assembly:  
UsesPermission(Manifest.Permission.AccessCoarseLocation)]
```

Below is the variable used to get the current location latitude and longitudes

```
Location _currentLocation;  
Latitude = _currentLocation.Latitude, Longitude = _currentLocation.Longitude [5].
```

4.1.1. GeoCode an Address

Geocoding an address is converting zipcode or human readable address to latitude and longitude.

Geocoder class is used to get the address.

```
Geocodergeocoder=newGeocoder(this);  
var address = geo.GetFromLocationName("Enter address here");
```

4.1.2. Reverse Geocode a Location

Reverse Geocoding is converting the latitude and longitude to human readable address.

Geocoder class is used to get the address.

```
Geocodergeocoder=newGeocoder(this);  
Address = awaitgeocoder.GetFromLocationAsync(_currentLocation.Latitude,  
_currentLocation.Longitude, 10);  
Address address=addressList.FirstOrDefault();
```

4.2. Twitter Search API 1.1

The Twitter Search API 1.1 is designed for searching against the real-time directory of latest Tweets and fetch tweets that meet specific criteria [15]. In API 1.1 the response of the search API has been improved to return Tweet objects. Also authentication mechanism has been introduced, so that every request to the twitter API v1.1 is authenticated using the twitter app credentials for increased security.

This Search API can be accessed by sending an URL. For ex:

<http://search.twitter.com/search.json?q=earthquake&lang=en&geocode=46.922343,96.840133,10mi>

The first word 'search' specifies the service that is requested. Second word 'search' is the .json extension. The results will be returned in the JSON encoded format. Twitter provides an option to select the result type to be either json or in xml format. The parameter 'q' is query where we pass our keyword, 'lang' is language, and 'geocode' is for geo-coordinates of the location from where the tweets need to be retrieved [11].

Below are the Twitter Search API 1.1 query parameters which needs to be passed [12].

Table 1. Twitter Search API 1.1 Response

| | |
|------------------------------|---|
| 'q' (required) | The emergency keyword to be searched is passed to this parameter. |
| Geocode (optional) | <p>Geocode</p> <p>Location parameter is optional. If user does not specify any location then worldwide tweets are returned.</p> <p>When Latitude, Longitude are passed to Geocode parameter it returns tweets within given radius. Radius must is either "mi" (miles) or "km" (kilometers).</p> |
| result_type(optional) | <p>Optional.</p> <p>Mixed: Returns popular and real time tweets in the response</p> <p>Recent: Returns recent tweets in response</p> <p>Popular: Return popular tweets in the response</p> |
| Lang | We can select the language of the tweets returned. |

4.3. Decoding the Retrieved Response

The response from Twitter Search API 1.1 is in Json encoded format. JSON stands for JavaScript Object Notation. The Json encoded form of data is human readable but may not be

projected as required [16]. This JSON encoded data can be easily decoded by JSON function.

Below is the code used for decoding.

```
HttpResponseMessage responseUserTimeLine = await
httpClient.SendAsync(requestUserTimeline).ConfigureAwait(false);
var serializer = new JavaScriptSerializer();
dynamic json = serializer.Deserialize<object>(await
responseUserTimeLine.Content.ReadAsStringAsync().ConfigureAwait(false));
var enumerableTwitts = (json as IEnumerable<dynamic>);
```

After decoding the data we need to arrange the data in the format we want to present it. The response from Twitter Search API is parsed IEnumerable collection. IEnumerable has the objects which have the values, and the values that the EMSM user is interested in are sent out for display, while the geographical coordinates information in the tweets are sent to the Google Maps Loading Component of the ESA App. Below is the code in which the values are assigned.

```
foreach (var item in enumerableTwitts)
{
    UserName = status.User.Name,
    TweetText = MakeLink(status.Text),
    UserLocation = status.Place.FullName,
    GeoLat = status.Coordinates.Latitude.ToString(CultureInfo.InvariantCulture),
    GeoLong = status.Coordinates.Longitude.ToString(CultureInfo.InvariantCulture),
    CreatedTime = status.CreatedAt.Date,
    ProfileImageUrl = !string.IsNullOrEmpty(status.User.ProfileImageUrl) ?
    status.User.ProfileImageUrl : string.Empty});
```

4.4. Publishing the App

After the development is done, the next step is publishing the App. For publishing the App, the App needs to be compiled and make sure that it can be installed on other devices. After compiling publishing the Android App can be divided into two tasks.

- (i) **Prepare for the Publication:** A release version of the Android (.apk file) needs to be generated.
- (ii) **Distribution of the Android App:** The Android App can be downloaded and installed from different distribution channels like Google play store, Email and Server. In Google play store there are numerous Android Apps which can be downloaded and installed. Also using Amazon App market store we can download and install the App. The second option is that we can install the Android App through email by forwarding the Android powered application. The third option is that the Android app can be made available on a server, from which users can install using a link.

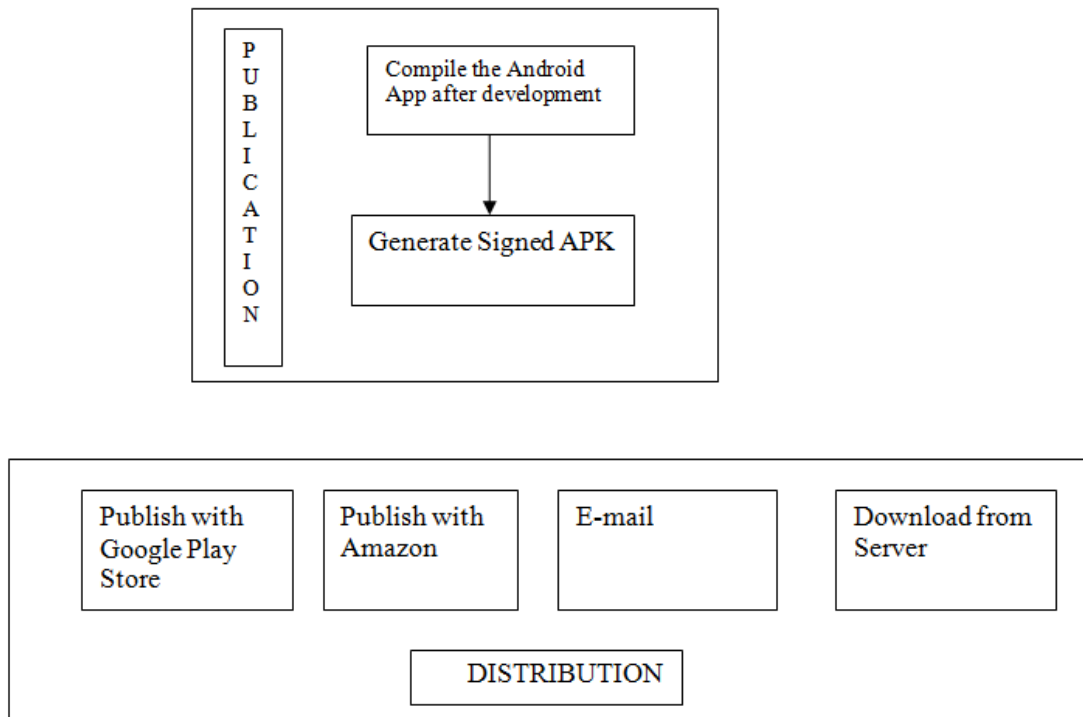


Figure 16. Publishing the Android App

5. RESULTS

In this section we will explain how the results are displayed by the ESA App. Basically when we enter the search key word like “Earthquake” in the search [Text box], and enter the location as ‘Lahore’ and select result type as Recent and click on Go [Button], the results are displayed against the search keyword and the entered location.

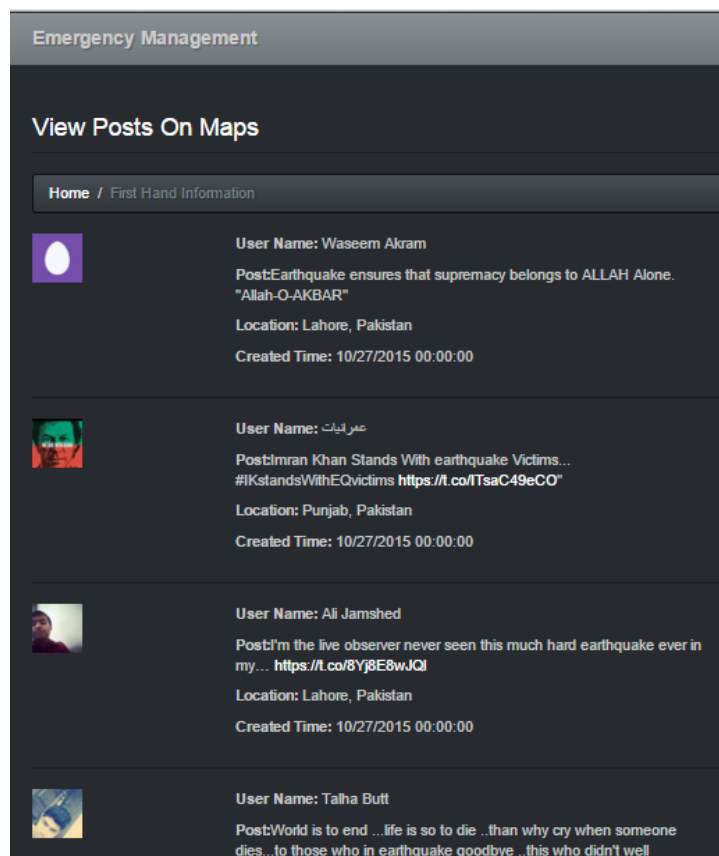


Figure 17. Results showing for the search feature

In the above figure when we click on View Posts on Maps the second part of the results Map view is displayed. On the map pointers are shown for the location. When we click on the pointer the location from where the tweet has been posted is displayed. We can track the location on the map only if the user who posted the tweet enables his location.

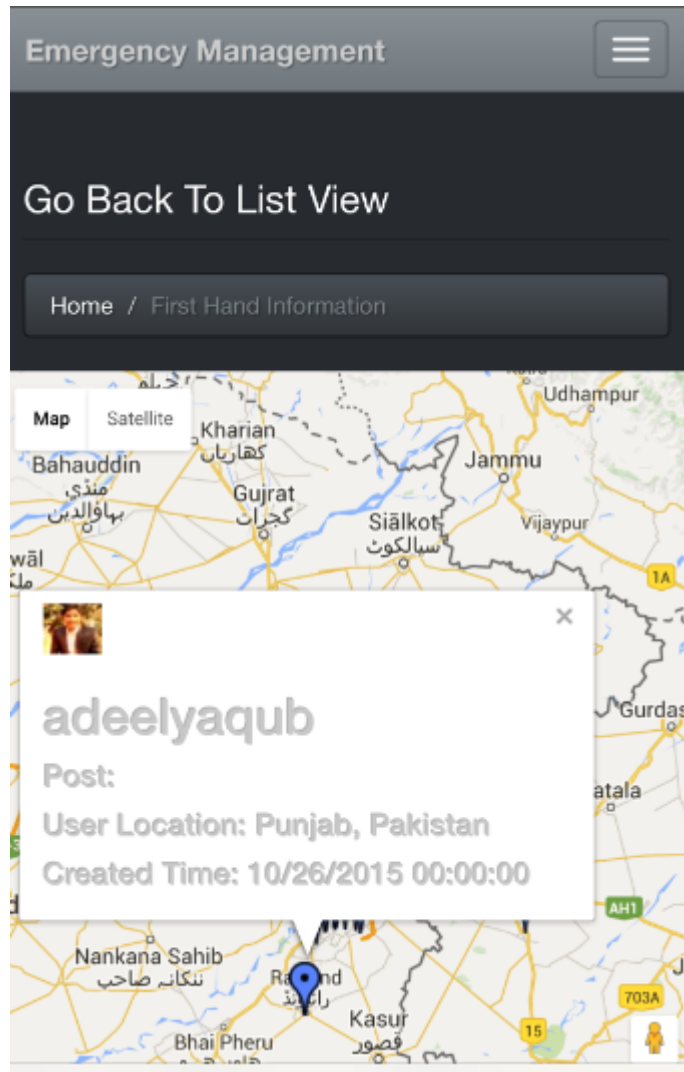


Figure 18. Tracking of the tweet on Google Map

6. CONCLUSION AND FUTURE WORK

The Emergency Social Media Android App and website share the emergency and vital information about an emergency disaster. The App provides the twitter tweets based on the user submitted information and also the emergency related news which occurred worldwide. It provides the information with the user location (through Map) so that we could know where exactly the incident has occurred. There are many other social networking sites but we decided to use Twitter due to its ease and can be easily integrated with our app or website.

We predict based on above observations that this app is very useful in the emergency and disasters where public is in need with the information. The normal people who wants to react to the emergency situation i.e. provide Medicaid facility or financial help also can go through this emergency management App to get the news of the people sufferings.

Ranking the results based on the trusted sources of information and by tracking the “current most trending” words related to the emergency in a particular geographic location. Additionally the types of emergencies and disasters can be further classified at a micro level.

In this ESA App lot of improvement and enhancements can be done. In Future Work we can also implement the same C# code for different Mobile Apps such as Windows mobile and ios mobile. And also apart from Twitter other social media sites can be added to the App which will provide the larger range of emergency information.

We can integrate other social media websites which allows us to access the information of the websites through our Android App.

Based on all the above observations we believe that the ESA App as well as the website would be really very useful for the emergencies like natural calamities or the manmade emergency such as road accident where the firsthand information is needed. Further

developments of the current App/website, as discussed in future work, can greatly enhance its acceptability and reach among the users.

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