

Social Media as Crisis Response Tool

by

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B.Tech., Anna University 2011

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University of Victoria

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ABSTRACT

With emergency situations and natural disasters occurring frequently around the world, internet is what people instinctively turn to for help, specifically using social media through smartphones, tablets and computers. Federal Emergency Management Agency (FEMA) in 2013 mentioned that, immediately following Hurricane Sandy users sent more than 20 million Sandy-related Twitter posts, or “tweets”, despite the loss of network services during the hurricane. That is just one example, of many ways people use social media and internet in times of need [14]. With nearly 2.1 billion people having social media accounts out of a total 7.210 billion population of earth, using social media as an effective tool for disaster management should be researched more [24]. Recently, though the number of papers that had research subject as “social media data for emergency management” did go from 4 papers in 2008 (4.2% of total) to 13 in 2013(12.9% of total) [23] which is encouraging more research is required. And with that in mind, a model web application has been proposed in this dissertation which can be used in times of emergency to collaborate and coordinate relief efforts. It makes use of famous social media websites like Facebook and Twitter and RSS news-feed by accessing and displaying the data from them.

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Dedication

To my Parents and my Uncle and Aunt Mr & Mrs Jeyaraman.

Chapter 1

Introduction

The evolution of the mobile phones from basic services which allows users to make calls and send texts to smart phones over the past two decades is one of the milestones that the society was most affected by, and this mixed with the impact of social media through different mediums (including smartphones) on humanity had a greater effect. Social media are web 2.0 internet based applications. According to Wikipedia “Social media are computer mediated tools that allow people or companies to create, share or exchange information, ideas and pictures/videos in virtual communities and networks”. Social media use is on the rise. Current popular social media sites are Facebook, Twitter, Instagram, YouTube, etc., with just Facebook having an estimated 1.71 billion users and counting. Considering the fact that Facebook is banned in China this is a magnificent achievement on the part of the company. Social media sites like Twitter and Facebook had such an impact on our daily life that sometimes they are credited with drastic changes in society, for example; social media played a significant role during the Arab Spring [1] with many referring to the uprising as a Twitter Revolution or Facebook Revolution as the use of modern technologies facilitated the communication and interaction between participants of political protests. The Arab spring caused regime change and uprisings in many Middle Eastern and North African countries, this is just one example of many. With the help of social media sharing and dissemination of information has become easier around the world. With the amount of data available to the public social media mining is common nowadays for analyzing and extracting actionable patterns from social media data. Financial districts in prominent cities around the world use social media mining to predict markets and stock prices. People around the world have never been connected like today and never there was in history of human civilization this much data available for the public to

access, process and view. With that in mind this web application has been designed as a crisis response tool during natural disaster. An infographic released by University of San Francisco titled “Social Media: The New Face of Disaster Response” [2] in which it details that, there are 867,406 number of people are affected by disasters each year in USA with \$ 17.6 billion as the average economic impact. And during a disaster the survivors use social media with 25% downloading social media apps, 76% contact friends to make sure they are safe, 24% let loved ones know they are safe, 37% use info on social media to buy supplies and find shelter and 18% retrieve emergency information through Facebook. 35% directly post a request for help Facebook, 80% of Americans expect emergency response agencies to monitor and respond to social media platforms. Another interesting fact from the infographic is that during disasters, social networks often replace 911 as the go to source for help. This statistic shows that social media sites are the tool people use when stuck with a natural disaster.

1.1 Motivation and Purpose

These statistics are based upon the population of United States of America, a country which is a global superpower and a highly developed country with the world's largest economy by nominal GDP and a leader in scientific and technology research. So, the actions mentioned above from the infographic are to be expected from a population of USA. But what if cities of developing countries like India are stuck with an unexpected natural disaster, a country with second largest population of the world but an infrastructure which lags many years compared to the developed countries. A country where there are approximately 400 million smartphone users and 30% of the population having access to internet. This creates a unique situation in times of natural disaster and emergency. We are going to see the case study of Chennai to see that unique situation when people took the rescue efforts in their own hands.

1.1.1 Chennai Floods

Chennai is the capital city of the Indian state of Tamil Nadu. It is the biggest cultural, economic and educational center in South India. It is the fourth largest city and fourth most populous metropolitan area in India and 36th-largest urban area. Chennai has one of the highest literacy rate which stands at 90.33%. Chennai has one of the balanced populations of all age groups, with most of the population having access to internet and are active in social media sites like Facebook and Twitter. Chennai has a tropical wet and dry climate and relies on monsoon season to replenish water reservoirs as no major river flows through the city [25].

On 13 November 2015, continuing rains led to low-lying parts of Chennai becoming inundated, resulting in the evacuation of over 1000 people from their homes. Consecutive rainy days followed and by 17 November 2015, rainfall had largely ceased. But much of the city had remained flooded due to inadequate levels of flood preparedness by the city. The rainfall resumed on 29 November 2015, and by December 1 heavy rainfalls had led to inundation in many areas of the city. Almost 60% of the city suffered from power cuts. Railway services were suspended and Chennai International Airport was closed. Chennai was officially declared as a disaster area on the evening of 2 December 2015. Many areas of Chennai were cut off from the rest of the city.

With no electricity around most of the city and water logged everywhere, getting information through television or newspapers was not possible for few days. With the recent advent of smartphones among the diaspora of the city, social media and internet accessed through mobile phones became the most popular means of staying in touch with the world. Even with limited connectivity having a mobile phone proved to be crucial for ordinary citizen's survival [4]. Mobile connectivity was limited but when they did improve everybody tried to reach out to their loved ones by posting on Twitter and Facebook.

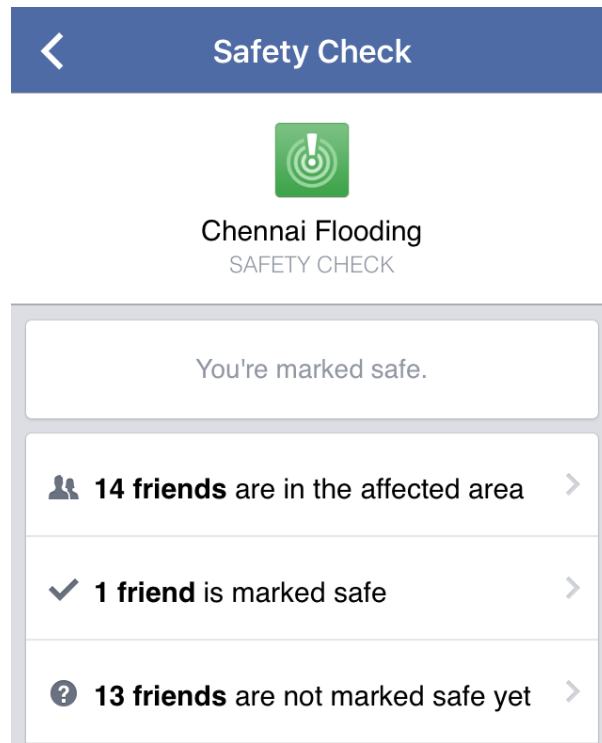


Figure 1.1: Facebook Safety Check

As shown in Figure 1.1 Facebook enabled the 'Chennai Flooding Safety Check' whereby marking yourself safe, allowed all your friends to know that you are safe. It is one of the famous and innovative initiatives taken by Facebook to make use of the social media in times of emergencies.

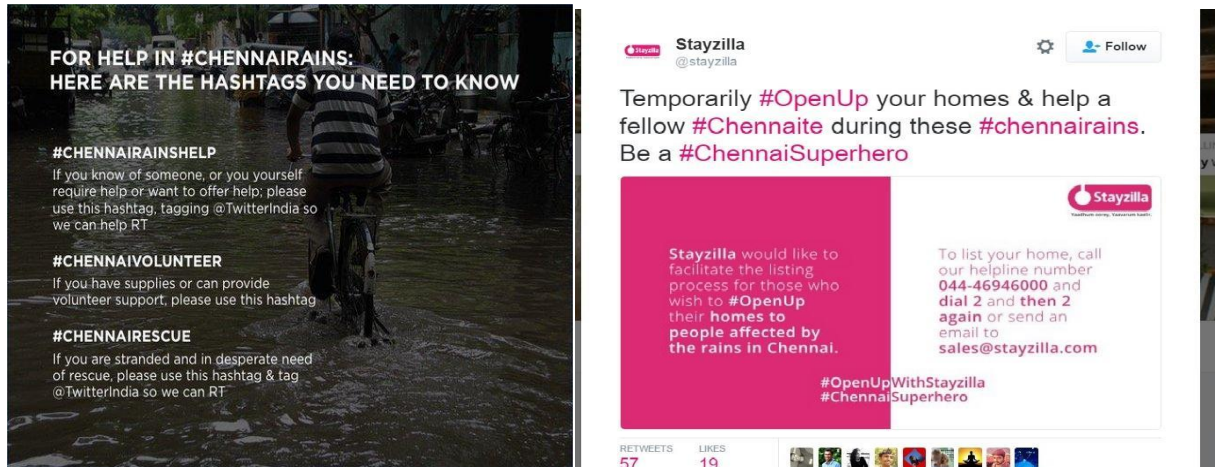


Figure 1.2: a) Hashtags used during Chennai Floods (left) b) Stayzilla Emergency Message (right)

HashTags with #chennairains #chennai floods were used during the disaster. Social media was used extensively by the people in the city. With government, unable to provide immediate help, people of the city used social media sites to either send or seek help. Social media brought in help from not only residents but also from people across India and the world. Social media became the primary source of time- sensitive disaster information. 12,000 strong force of the National Disaster Response Force (NDRF) received and responded to more than 339 tweets on its official handle @NDRFHQ. Influential personalities in Twitter mostly celebrities were able to volunteer and redirect the disaster efforts as much as possible thereby implementing a chain of command style communication. Social media played its role in making ordinary citizens understand the effects and scale of the disaster. And both for travelers and locals who wanted to get out of the city, information was given about the safety of the roads through social media and information about public and private transportation services availability as shown in the Figure 1.3 below were posted by random people. Since the city is a coastal city boats were used extensively for rescue operations by locals who also used social media to communicate and transport goods and people.



Figure 1.3: Example Facebook posts and statuses during natural disaster

People posted statuses on Facebook and wrote messages for help as depicted in the above figure.

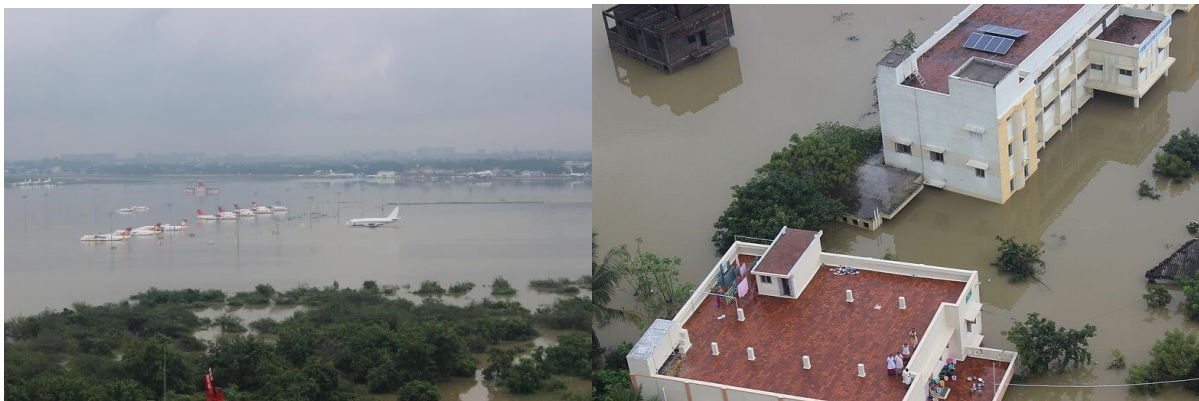


Figure 1.4: a) Chennai International Airport during Chennai floods (left) b) People stranded on rooftops during Chennai floods (right)

Volunteers arrived from neighboring states of Andhra Pradesh, Kerala and Karnataka with necessary aids ranging from foods, clothes and medicines. Temporary command centers were

established by ordinary citizens of the city to organise the volunteer efforts and social media played a big role by sending assistance where it was needed in the city. This scenario heavily influenced the “Social media as crisis response tool” project and this dissertation.

Social media was used extensively during the search and rescue operations by locals and later by the Indian Army. The proper use of social media by the population of this developing city led to saving many lives of humans. With people more connected currently, people have it in their own hands to help themselves and others. As mentioned in the introduction section, the change of regimes and government using social media has become a norm and does not surprise us anymore. There were tens and thousands of tweets and Facebook posts during Chennai Floods which saved many lives.

The scenario that influenced this web application model heavily is that when people who worked in the software industry present in the city organized a temporary command centre in the city to direct the rescue efforts among citizens of the city, in which providing access to multiple social media sites and data's. Social media was used heavily in the rescue efforts as explained above and this model helps us in accessing multiple social media streams and how a design and model and more research is needed in using social media sites and its data during emergencies and natural disasters.

Chapter 2

Related Study and Works

A natural disaster is the effect of a natural hazard; examples include floods, volcanic eruptions, earthquakes, tsunamis and other geologic processes. According to Wikipedia “a natural disaster can cause loss of life or property damage, and typically leaves some economic damage in its wake, the severity of which depends on the affected population's resilience or ability to recover”. In recent years, the natural disasters that have been noticed by the world are Hurricane Katrina in USA, earthquakes in Haiti and Asia, the tsunami in Indonesia, earthquake and tsunami in Japan. Reasons for these may be many but mostly blamed on global warming. Due to natural disasters, there is an increased effort from everyone even from people who are remotely related to the incident in the wake of a natural disaster in one way or another try to communicate with their loved ones [1]. The people, who are at ground zero try to contact family, try to seek information regarding food, shelter, transportation and the details about rescue efforts that’s happening around them. Social media are becoming an important tool for survival. The role played by smartphones and social media are there for everyone to see in today’s world by observing the refugees who are migrating to Europe from war stricken countries and travel in foot with the help and assistance of GPS in smart phone and social media through people giving guidance online posting the safest to route to travel in Europe [5].

The research conducted after the earthquake and tsunami in Japan (2011) found that there was a predictable increase in the usage of phone and email after the natural disaster especially the use of Twitter, Facebook and mixi (a Japanese social networking site) which surpassed even the use of more conventional methods of communication such as fixed phones [7]. Emergency services use

social media to instantly broadcast and amplify emergency warnings to the public. After the catastrophic Haiti earthquake, affected people in ground zero shared their personal experiences via social media and thus in just 48 hours, the Red Cross received US\$8 million in donations directly from texts [8]. During natural disasters events, such as the Haiti earthquake and Russian wildfires in 2010 and the 2013 tornado in Oklahoma, humanitarian workers have set up live web based crisis maps for the public to see [9].

A study by the American Red Cross shows more people are turning to sites like Facebook and Twitter to learn about emergencies, get information and check on friends and family. Facebook, Youtube, MySpace and Twitter were the most popular social network sites when nature strikes. We should always remember that different types of disasters can influence varied tweets. For example; during a flood, people tend to tweet about specific locations like buildings, roads and geographical features such as parks, rivers and beaches [10]. Tweet reports are a mixture of a few first-hand reports and many retweets and comments on third party incident reports [10].

According to research and reviews, four primary reasons were identified as the cause for the use of social media technologies during natural disasters [6].

- Family and Friends Communication - To connect with family members between affected and unaffected communities/areas (or within affected communities) for situation updates and planning responses. This is the most popular use. Primary tools used are Twitter, Facebook and/or a blog.
- Situation Updates - Neighbors and communities share critical information between each other such as; road closures, power outages, fires, accidents and other related damages.
- Situational/Supplemental Awareness - in a number of cases citizens rely less and less on authority communication, especially through traditional channels (television, radio, phone.)

- Services Access Assistance - Citizens would use social media channels to provide each other with ways and means to contact different services they may need after a crisis.

Social media helps in bringing community together to discuss events and share information and to coordinate recovery efforts and get information's about aid. After a disaster, social media helps bring the community together to discuss the event and share information, coordinate recovery efforts and get information about aid. Let us look at some of the web applications that are used during a natural disaster and emergency situations.

2.1 Ushahidi

Ushahidi, Inc is a non-profit software company that develops free and open-source software for information collection, visualisation and interactive mapping. Users basically can select the representative sampling or crowdsourcing to map it on a map. But the mapping itself is not specific to a crisis, it can be non-events like a match in a football stadium. According to Wikipedia “The organization uses the concept of crowdsourcing for social activism and public accountability serving as an initial model, a combination of social citizen activism, citizen journalism and geospatial information”.

Ushahidi is a website created during the 2007 presidential election crisis, the website collected information through eyewitness reports of violence sent by email or text message and mapping that information on a Google map. After the Kenyan crisis Ushahidi was also used in various parts of Africa for various reasons. For example: Anti-immigration violence in South Africa - May 2008, Violence in eastern Congo -2008. Additionally, Ushahidi has helped people to use cell phones and the internet to track the availability of medicines in pharmacies in Kenya, Uganda, Malawi and Zambia. The platform allows ordinary people to report vote tallies as they are compiled. Even in 2009, US capital relied on the software to help organize snow removal during a massive storm.

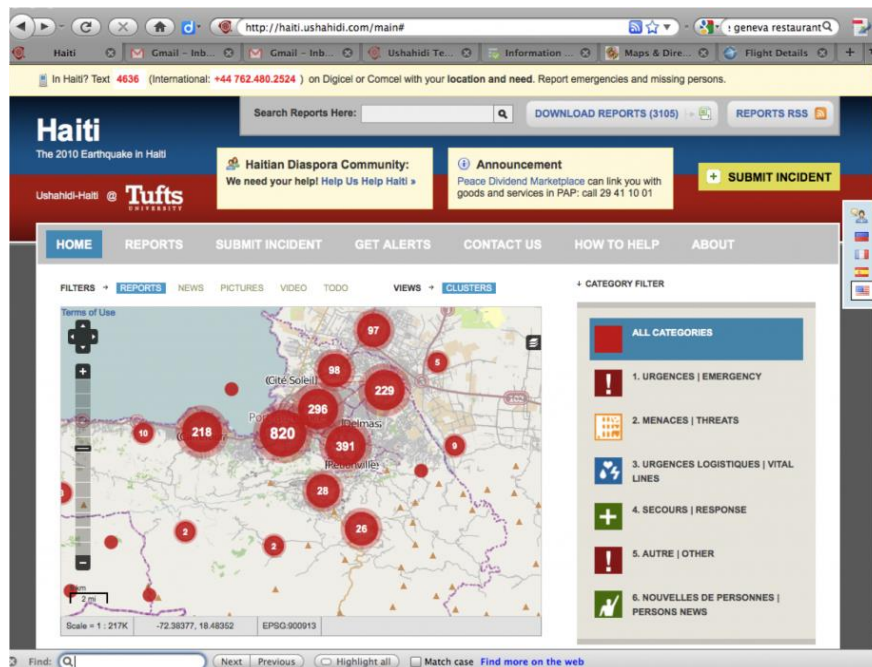


Figure 2.1: Ushahidi Dashboard

It was used extensively during Haiti earthquake - 2010 relief efforts. The information from variety Of sources like SMS, Web, Email, Radio, Phone, Twitter, Facebook, Television, List-serves, Live streams, Situation Reports were a mapped in near real time [15] which helped with the relief efforts. In 2008 Ushahidi was deployed in the Democratic Republic of Congo, at that time the zone was classified as a crisis zone and the affected people were invited to report incidents of violence occurring in the country which are to be collated into an online map [16]. People on the ground were asked to report directly on the website by logging to the website or by sending a text to the website. The reports were organised into categories such as riots, looting and sexual assault. These were mapped on to the map in terms of the categories mentioned above to get an overall sense of what kind of violence happening in the area. The project itself had its own complications with false reports and people refusing to file a report because of the environment or in fear of persecution by

the authorities. But data were gathered and analysed.

Recently Ushahidi is used to track displacement of people across the world, in particular the refugees fleeing the countries from persecution of war. Syrian refugees leaving their country because of the country's civil war is an example in the modern time. Ushahidi is also used as early warning systems to predict in terms of people moving towards a particular destination and the volunteers can be prepared to assist them effectively.

The challenge in this technology is data collection and the authenticity of the reports being collected [12]. Steps are being taken to improve the software and the methodology to address the challenges in the technology.

2.2 Hootsuite

Hootsuite is a software used to manage multiple social media sites from a single dashboard. On August 28th, 2012 Hurricane Isaac a deadly and destructive tropical cyclone hit U.S state of Louisiana. At the time of this crisis the energy company Entergy enacted an emergency plan making use of social media to keep communication open during the crisis [13]. It was during this time of crisis and uncertainty people go online to look for information. And as expected the people affected by the Hurricane got on their computers and phones to access social networks like Twitter and Facebook to get information and to connect and share news with other people. Entergy had a social media outreach plan during this crisis and due to that the company was able to stay in touch with its customers in gulf coast which numbers in 1000's. Entergy made use of the HootSuite dashboard as a social media management centre to oversee the handling of communications through social media [13]. Alex Schott Entergy's Manager of Social Media & Digital Communications Strategy said that "HootSuite lets me lay everything out on a big screen and

multi-task. I was using multiple tools, had a number of people that were geographically separated from me, helping me monitor. I was able to have a social media center.” in an interview. He stresses the importance of setting up a social media centre in advance of crises to be better organised and prepared.

HootSuites portability and mobility as a software really adds to its advantage. By being able to use the software on various device like tablets, computers and mobile phones it is a flexible option. Listening and engaging via social media “on-the-go” was key while customers were still without power and traditional lines of communication could not be relied on [13]. HootSuite can be used by just logging on their website which can be done through mobile phones, computers and tablets.

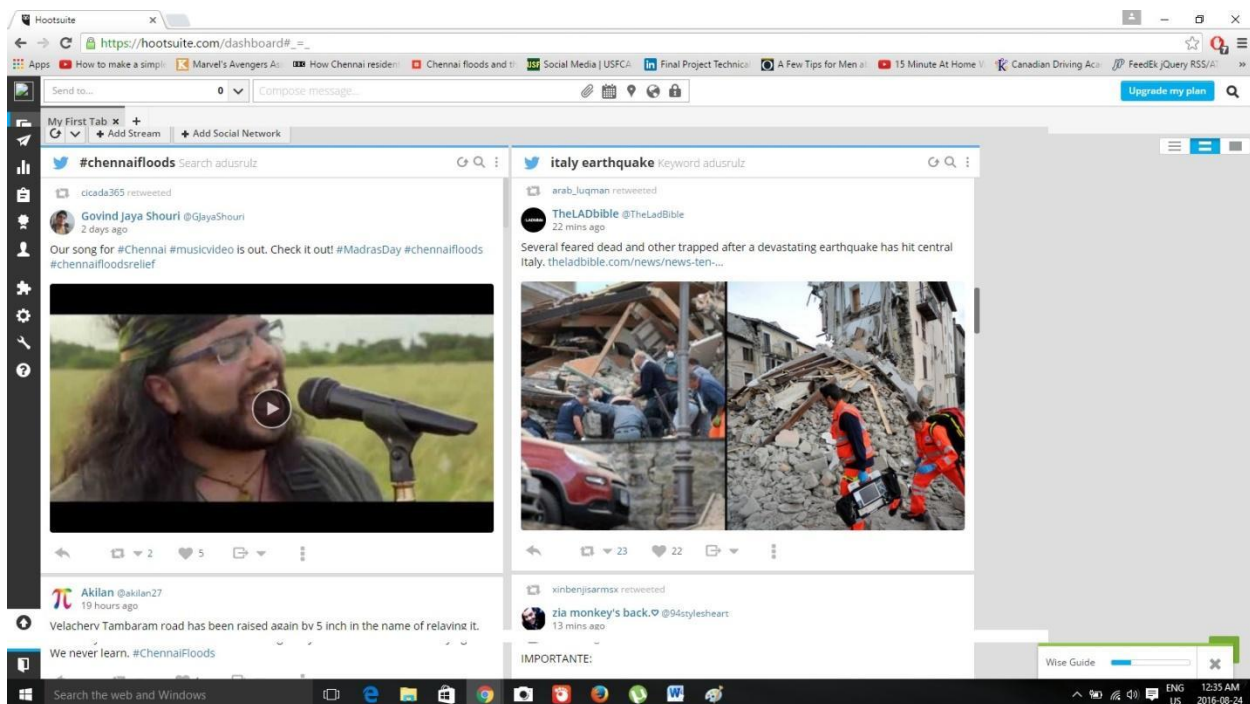


Figure 2.2: Hootsuite Dashboard

Many companies are considering HootSuite as an integral part for communication during natural crisis.

The Federal Emergency Management Agency (FEMA) in its 2013 National Preparedness report mentioned that following Hurricane Sandy “users sent more than 20 million Sandy related Twitter post or “tweets,” despite the loss of cell phone service during the peak of the storm.” [14]. After the Boston marathon bombings, according to The Pew Research Center one quarter of the population of Americans reportedly looked to social media sites for information. When the Boston Police Department posted its final “CAPTURED!!!” tweet of the manhunt, more than 140,000 people retweeted it. Each disaster spawned its own and unique complex fast-paced information exchange. Using social media effectively in time of emergency is an important factor now-a-days.

This project shows us a webpage that can be easily built and deployed to monitor social media sites. The website itself is exclusively designed for use during natural disaster or emergency situations.

Chapter 3

Crisis Response Tool Design Methodology and Tools

3.1 Application Programming Interface (API)

Application Programming Interface (API) is a crucial tool for Crisis Response Tool project without which access to the publicly available data on social media websites would not be possible. Application Programming Interface (API) is a set of routines, protocols and tools for building software applications. It consists of a formalized set of software routines and protocols which helps in accessing network's services or information through application programming. Social media sites in particular have API integrated in them so sharing of information from sites like Facebook and Twitter is made easier. These API's comes under the REST API category.

3.1.1 REST API

The REST (Representational State Transfer) API uses HTTP requests to GET, PUT, POST and DELETE data. The REST APIs provide programmatic access to read and write Twitter data. The REST API identifies Twitter applications and users using OAuth, which is available in Python as a library. A function of OAUTH and flow of OAUTH is described in the infographic Figure 3.1.

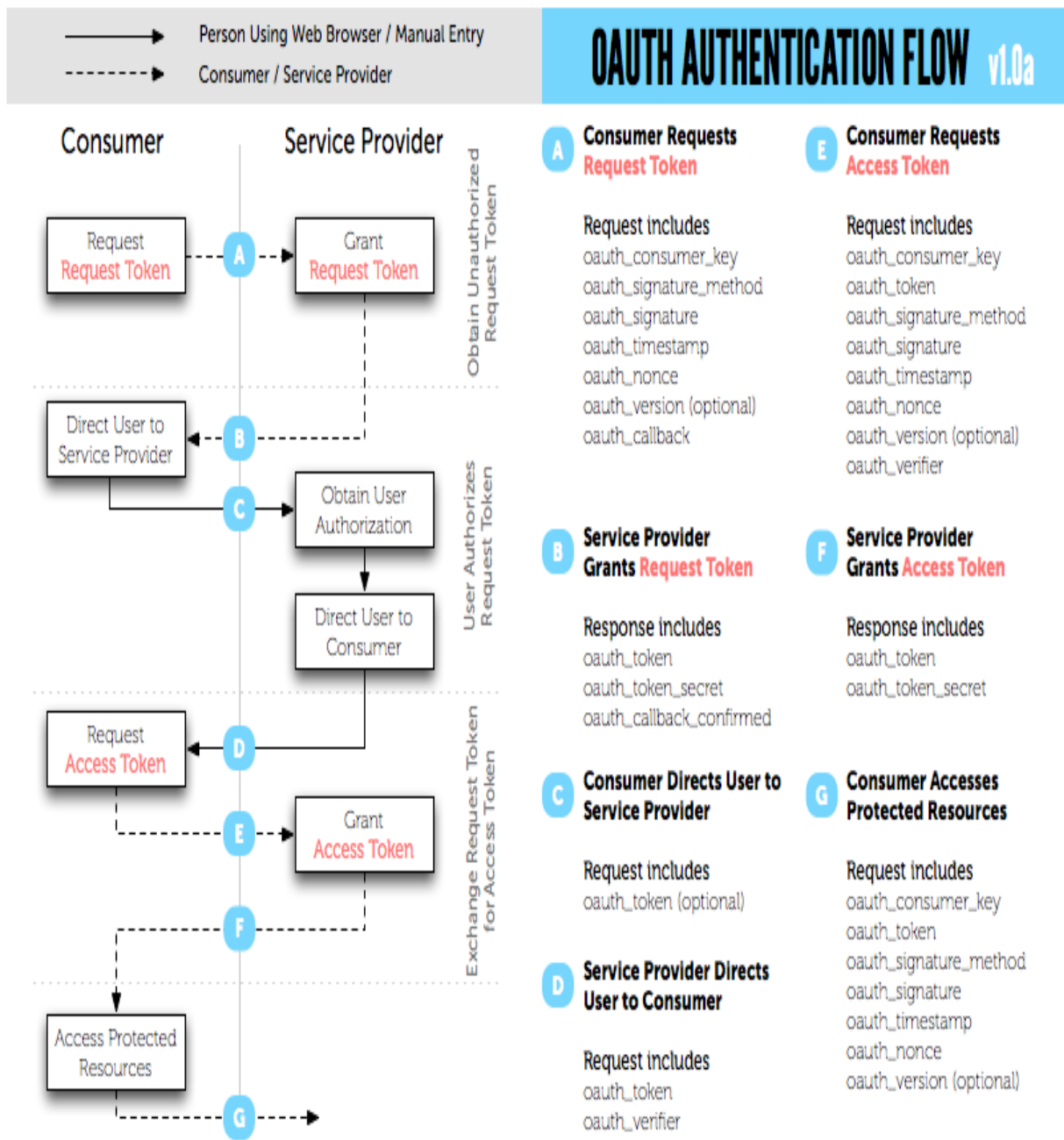


Figure 3.1: OAUTH Authentication Flow [15]

3.1.2 Twitter API

TweetMineEx

Details Settings **Keys and Access Tokens** Permissions

Application Settings

Keep the "Consumer Secret" a secret. This key should never be human-readable in your application.

Consumer Key (API Key)

Consumer Secret (API Secret)

Access Level Read and write ([modify app permissions](#))

Owner

Owner ID

Application Actions

Regenerate Consumer Key and Secret Change App Permissions

Your Access Token

This access token can be used to make API requests on your own account's behalf. Do not share yo

Access Token

Access Token Secret

Figure 3.2: Twitter API Dashboard

The first step is the registration of the app in Twitter to make use of the Twitter API. And then log into Twitter at the site <https://apps.twitter.com/> and register a new application. The application is named and a description is given. And then a consumer key and a consumer secret is produced. Also the access token and an access token secret are produced and the default permissions are set

at read and write. Figure 3.2 shows a sample Twitter API dashboard.

```
def twitter():
    hashtag = request.args.get('hashtag', 0, type=str)
    access_token = '720064526192758785- BpJAVy8K17cy8cN1XRgqK9SVE1gBM7'
    access_token_secret = 'hHk5eApjGTylZZQTf3qUZSfynMQSM2k5q7UCUbcrHWVr4'
    consumer_key = 'p6F7uXZGzIH5EtjNZeeD2pVXO'
    consumer_secret = 'FPBpRhvEdjYYNXqRCT4z7cVfGTdt3MmWYLTkNfL0eCt8YWHjsl'
    twitter = Twitter(auth=OAuth(access_token,
    access_token_secret,consumer_key,consumer_secret))
    results = twitter.search.tweets(q=hashtag, count=30)
    return jsonify(result=results.get('statuses'))
```

The above mentioned code is used in authenticating and accessing the data from Twitter, code is explained as below,

The function twitter() is written in Python which makes use of the OAuth library function. The OAuth makes use of access token and consumer id. The variables are named as access_token, access_token_secret, consumer_key, consumer_secret. The consumer in OAuth is an application or web service that wants to use functions of the Service provider through OAuth authentication [16]. The Access Token is a value that contains a key for the Consumer to access the resource of the Service [16]. Once the authentications is done through the variables described above we search for the tweets for the keyword entered in the WebApp. The results are returned in JSON (JavaScript Object Notation) format. This code is written in app.py python file.

3.1.3 The Graph API (Facebook API)

```
def facebook():
    page_id = request.args.get('link', 0, type=str)
```

```

app_id = "1717188741826592"
app_secret = "e3490a08c71ee8539b987fdb25ed0861"
get_auth_token =
'https://graph.facebook.com/oauth/access_token?grant_type=client_credentials&client_id=
'+app_id+'&client_secret='+app_secret
authToken = urllib2.urlopen(get_auth_token).read()
feed_url = "https://graph.facebook.com/" + page_id + "/feed?" + authToken
page_feed = urllib2.urlopen(feed_url).read()
return jsonify(result=page_feed)

```

The way a third party application can read and write Facebook posts is using Graph API. The Graph API is accessed using urllib2 Python module. The urllib2 are used for fetching URLs. It defines functions and classes to help with URL actions like to provide access through authentication, redirections, cookies, etc [17]. Urllib2 can accept a Request object.

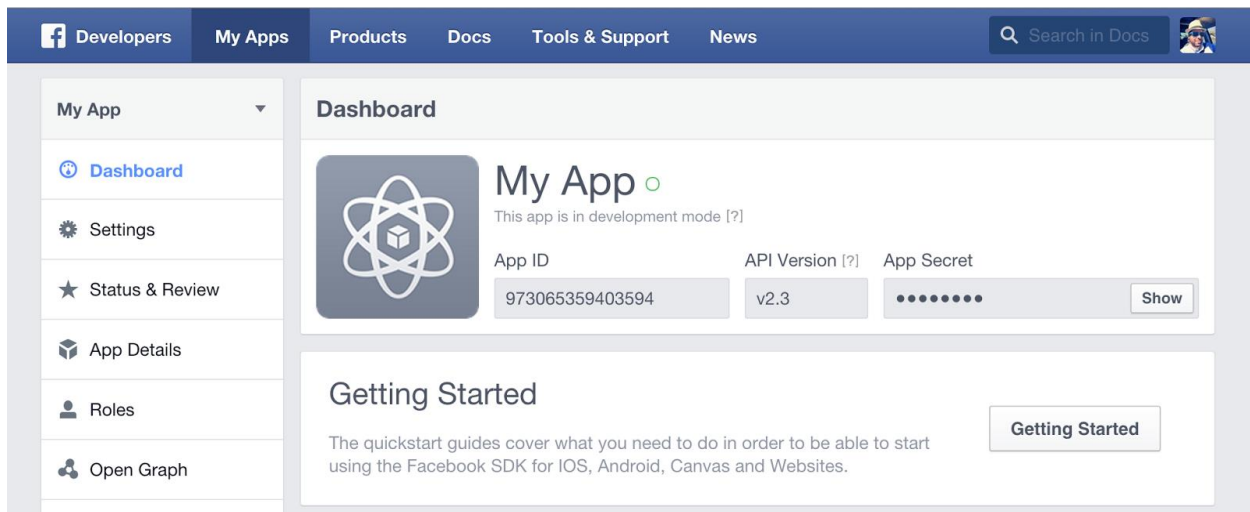


Figure 3.3: Graph API Dashboard

Figure 3.3 above shows how the dashboard of GraphAPI looks. It consists of an APP ID, API version and APP Secret (key). A user gets this information if he is registered on Facebook. And as shown in facebook() function we have the APP ID and App Secret to access the Facebook pages and we use the Urllib2 for authentication and the facebook page is returned in JSON format. The Facebook page name is stored as variable page_id. These codes are also written in app.py python file.

3.1.4 Command Line Installations

Pip is used to install the software packages in our linux environment. After confirming the installation of python 2.7 in our Linux environment we use 'pip' to install the following packages flask, virtualenv, Bootstrap, cookie cutter.

3.2 Architecture

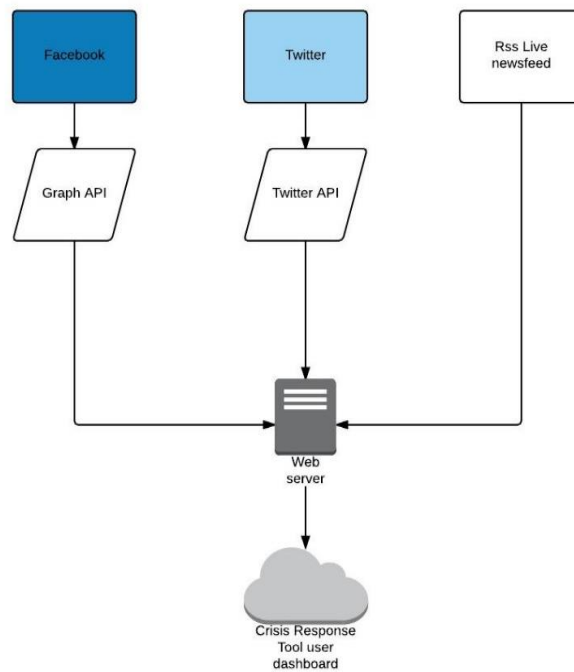


Figure 3.4: Architecture of Crisis Response Tool

The Crisis Response Tool user dashboard monitors the Social media sites Twitter, Facebook. It displays CNN news headlines using RSS live news feed and displays the results in the WebApp. The Twitter and Facebook API are accessed using the Python code and the results are returned as JSON results.

- User interface known as the “Crisis Response Tool Dashboard”.

- Facebook and Twitter sites are accessed using their respective API.
 - RSS newsfeed uses standard web feed formats to publish frequently on the WebApp.
1. A web server is at the heart of the high level architecture. The web server can be Node.js for example. In our application we are using the local built in server which served the purpose for testing the WebApp. The WebApp can be deployed on Heroku, OpenShift, Webfaction, Google App Engine, Azure, etc.
 2. The Crisis Response Tool user dashboard displays all the social media information retrieved from Twitter and Facebook in a presentable format.
 3. The Graph API and Twitter API provides the access to retrieve the tweets and Facebook posts in a JSON format.
 4. The WebAPP uses JavaScript and JQuery to represent the JSON data in a presentable manner.

3.3 Technologies and Tools

The Crisis Response Tool uses various technologies and tools to provide a scalable optimized dashboard for social media sites monitoring.

3.3.1 Python and Flask Framework

Python provides the access to the social media API and gets the data needed from these sites in JSON format. According to Wikipedia Flask is a micro web framework written in Python and based on the Werkzeug toolkit and Jinja2 template engine. The following code shows a simple web application that prints “Hello World” [10]

```
from flask import Flask
app = Flask(__name__)
@app.route("/")
def hello():
    return "Hello World!"
```

```
if __name__ == "__main__":
    app.run()
```

In this code we first import the Flask class. Use of `route()` decorator to tell Flask what URI should trigger our function. The function is given a name which is also used to generate URLs for that particular function, and returns the message we want to display in the user's browser [10]. Flask has a default web server location addressed at <http://0.0.0.0:8080/> once you run the web app. As mentioned before we can use AWS, Heroku and Azure type of cloud services to deploy the crisis response tool web application.

Node.js can also be considered as it uses the event-driven, non-blocking I/O model that makes it lightweight and efficient for data-intensive real time applications. For now the WebApp runs in the C9 or Cloud9IDE

3.3.2 Cloud9 IDE

Cloud9 IDE or C9 is an online integrated development environment. It provided with Linux environment needed to create the Web Application. C9 supports various programming languages, including PHP, Ruby, Perl, Python, JavaScript, etc. C9 is written almost entirely in JavaScript and uses Node.js on the back-end. It is hosted on Google Compute Engine.

3.3.3 Bootstrap

Since we have Flask as the web framework it supports Bootstrap which is used for designing the website. It is provided with the HTML and CSS based design templates and also supports JavaScript extensions. Bootstrap compatibility with the latest version of the Google Chrome, Firefox, Internet Explorer made it an ideal choice for designing the web application. Bootstrap comes with several JavaScript components in the form of JQuery plugins [19].

```
<link rel="stylesheet" href="{{ url_for('static', filename='css/bootstrap.min.css') }}">
```

In Crisis Response Tool web application, we have the above bootstrap link provided in the layout.html for making use of the HTML and CSS based template.

3.3.4 JavaScript, JQuery and AJAX

AJAX (asynchronous JavaScript and XML) is used to create the asynchronous web application that is used on the client side. AJAX allows the web application to send and retrieve data from a server asynchronously.

JavaScript has been used extensively with JQuery library used for event handling.

A stack using variable `post` was created to display the Twitter tweets and Facebook posts in a format which would include the image, username, link, text. The `post` variable consists of all the items pushed in an order so that a tweet and Facebook post are displayed in order as shown in the dashboard. The items in the stack are joined using the `post.join('\n')`.

A function called `setInterval(function()..)` is used to control the refresh rate at which the tweets and Facebook posts are received. For our Web Application the refresh rate is 30 seconds.

```
<script type=text/javascript>
    function makePost(image,username,link,text){
        post = [];
        post.push('<div class="media">');
        post.push('<div class="hide media-left">');
        post.push('<a href="'+link+'"></a>');
        post.push('</a></div>');
        post.push('<div class="media-body"><h4 class="media-
heading">@'+username+'</h4>');
        post.push('<p>'+text+'</p></div>');
        return post.join("");}

```

We are using the placeholders for the respective functions. For example; as shown in Figure 3.5,

“#facebook_submit2” represents the second Facebook stream in our web application while the Twitter streams function is placeholder “#twitter_submit”. and the respective functions are written. Facebook modules named as “#facebook_submit” and “facebook_submit2” have the same functionalities and share the same code.

So from figure 3.5 “#facebook_submit” function is bound to a click function on the submit button and on the event of click `$.getJSON (..` is used to get the JSON data and the function (data) is used to parse the JSON data depending on the attributes and values present. In our case we take message and story value from a Facebook page and display them in the webapp. And then the data is pushed using makepost function to display them in order.

For Twitter tweets we use the function “#twitter_submit” and the function is bound to a click function on the submit button and the keyword entered in the web application is stored as tags and then the tags are split and parsed and concatenated with a # so that the tweets retrieved with only the keyword present in them. And the `$.getJSON (..` is used to get the JSON data and each data is parsed on index and value and the data is pushed using the makepost function to display them in order.

```
<script type=text/javascript>
$SCRIPT_ROOT = {{ request.script_root|tojson|safe }};
</script>
```

This script tag sets a global variable to set the prefix to the root of the application and this script tag is added in the layout.html file. `$.getJSON(url, data, func)`

The `getJSON (url,data,func)` sends a GET request to url present and will send the contents of the data objects as query parameters. It is used along with function written for Facebook and Twitter as shown in the Figure 3.5. Once the data arrives the given function is called with the return value as argument. And the `SCRIPT_ROOT` variable that has been set in Layout.html file is used here for the above mentioned reasons.

```

100 .....
101 ..... $('#facebook_submit2').bind('click', function() {-
102 ..... $.getJSON($SCRIPT_ROOT + '/facebook', {-
103 .....   link: $('#input#facebook2').val()-
104 ..... }, function(data) {-
105 .....   $('#facebook_result2').html('');-
106 .....   $.each(JSON.parse(data.result).data, function( index, value ){-
107 .....     if(!value.message)-
108 .....       message = value.message-
109 .....     else if(!value.story)-
110 .....       message = value.story-
111 .....     $('#facebook_result2').append( makePost('http://graph.facebook.com/v2.6/' + $('#input#facebook2').val() + '/picture', $('#input#facebook2').val(), 'facebook.com/' + $('#input#facebook2').val() );-
112 .....   });-
113 .....   return false; ..... });-
114 .....
115 ..... $('#twitter_submit').bind('click', function() {-
116 .....   var tags = $('#input#twitter').val();-
117 .....   if(!tags)-
118 .....     {-
119 .....       if(tags.split(' ').length > 1)-
120 .....         tags = tags.split(' ').join(' AND #'); //OR-
121 .....         tags = '#' + tags;-
122 .....         console.log(tags)-
123 .....     }-
124 .....   $.getJSON($SCRIPT_ROOT + '/twitter', {-
125 .....     hashtag: tags-
126 .....   }, function(data) {-
127 .....     $('#twitter_result').html('');-
128 .....     $.each(data.result, function( index, value ){-
129 .....       $('#twitter_result').append( makePost(value.user.profile_image_url, value.user.screen_name, value.user.url, value.text) );-
130 .....     });-
131 .....     return false; ..... });-
132 .....

```

Figure 3.5: Facebook and Twitter Function

3.4 Crisis Response Tool Dashboard

Social Media Aggregator WebApp

Crisis Response Information Tool

Social Media Live feed

Hashtag:	Facebook page:	Facebook page 2:	RSS Newsfeed:
quake italy	timescolonist	dailymail	
Submit	Submit	Submit	
 <p>@rasadkhanezam #Quake alert for #Italy ML2. Depth: 14.2km 2016-09-04T04:26:44Z https://t.co/g5Db7nx0oo ^bc</p> <p>@lukasxy74 RT @Debnicolina: Before- &-after shots reveal #devastation of #Italy's #earthquake: https://t.co/j52fN871gi #Amatrice #ItalyEarthquake #Quak...</p> <p>@rasadkhanezam #Quake alert for #Italy ML3. Depth: 9.8km 2016-09-03T21:20:16Z https://t.co/3nDib0WfUv ^bc</p>	 <p>@timescolonist UPDATE: One person is in custody, West Shore RCMF say. We'd like to speak with anyone who was in the area for our story — send us a message at localnews@timescolonist.co</p> <p>@timescolonist Officers found a red Acura upside down in a wooded area a short distance from the road. The male driver was outside the vehicle and injured. But the 17-year-old passenger was trapped inside.</p> <p>@timescolonist A proposal to borrow up to</p>	 <p>@dailymail Holiday Brits face chaos in Calais migrant protest</p> <p>@dailymail Having a whale of a time!</p> <p>@dailymail A terminally-ill woman who defied doctors' expectations to mark her 40th birthday has died</p> <p>@dailymail What causes the great gender temperature divide?</p> <p>@dailymail</p>	 <ul style="list-style-type: none"> Missing boy's remains found after 27 years 09/03/2016 The remains of Jacob Wetterling, a Minnesota boy abducted from a rural road 27 years ago, have been ... Parents recall the night Jacob Wetterling was abducted 09/03/2016 Patty and Jerry Wetterling recall the night their 11-year-old son Jacob was abducted in 1989. Hermine dumps on holiday weekend 09/03/2016 Tropical Storm Hermine drenched the East Coast, knocking down trees and causing blackouts. NASA grabs stunning footage of three hurricanes 09/01/2016 Cameras on the International

Figure 3.6: Crisis Response Tool Dashboard

The dashboard is divided into four streams (a stream represents the feeds from respective social media pages and news feed represented in their respective columns). Each stream is represented by respective social media feeds from Facebook and Twitter. One stream represents RSS Newsfeed.

- Twitter: Hashtag stream represents Twitter feed. The stream retrieves tweets based on the keyword entered in the Hashtag textbox and once the submit button is clicked the tweets

with the keyword prefixed by a hashtag is retrieved. For example: ‘quake Italy’ retrieves tweets that have the keyword in them.

- Facebook: The Facebook stream is represented by two streams Facebook Page and Facebook Page 2 retrieves post from the Facebook pages as shown in the dashboard. The Facebook page id should be entered in the textbox

For example, Times colonist Facebook page posts can be retrieved

<https://www.facebook.com/timescolonist/?fref=ts> by entering the exact page id we find in the particular Facebook pages link, ‘timescolonist’ as shown in the Facebook page link.

- RSS NewsFeed: An RSS NewsFeed stream displays the recent headlines with a brief description and date. Clicking on the link will take you to the news websites.

Every stream is refreshed at an interval of 10 seconds to retrieve new posts and tweets. The same applies for the newsfeed too.

25 tweets and 25 Facebook status on each of the respective streams can be displayed on the web application at a refresh rate of 10 seconds. And five headlines are displayed with a brief description.

3.4.1 RSS Live News Feed

RSS Live news feed makes use of the JQuery library to access the RSS feed from a website. In our case we can use the RSS feeds of most famous news websites for example; CNN News Feed. FeedEk is used for RSS live news feed stream in the web application. FeedEk is a jQuery plugin for parsing and displaying RSS. FeedEk uses YQL API to retrieve feeds. Feeds are easily obtained from any domain.

Include FeedEk plugin along with jQuery plugin in layout.html file.

```
<script src="https://cdnjs.cloudflare.com/ajax/libs/FeedEk/3.0.0/js/FeedEk.min.js">
```

A placeholder for the RSS plugin is added in the home.html file. And the following script is added to the home.html page.

```

$('##rsslive_result').FeedEk({
    FeedUrl : 'http://rss.cnn.com/rss/cnn_topstories.rss',
    MaxCount : 5,
    ShowDesc : true,
    ShowPubDate:true,
    DescCharacterLimit:100,
    TitleLinkTarget:'_blank',
    DateFormat:'MM/DD/YYYY'
});

```

The various parameters for the above code are as follows:

- FeedUrl –which makes use of a website's rss link to get the rss feed from.
- MaxCount - Feed Item Count, number of headlines that are displayed.
- ShowDesc- Option shows Feed Item description, the headlines displayed (item)
- ShowPubDate-Published date are shown
- DescCharacterLimit- Enables a brief description of the headlines to be displayed.
- TitleLinkTarget- Enables feed Title Link Target.
- DateFormat- Shows the published date.

We make use of the date format options to display the date.

3.4.2 Assumption and Dependencies

1. The web application depends on the API provided by the respective social media websites.

2. It is further assumed that after a natural disaster people on ground zero are still able to connect to the internet so that they post statuses and reach out for help using Twitter and Facebook.

Chapter 4

Evaluation

It is important to evaluate the Crisis Response Tool dashboard, as it is a web application model proposed for use in times of natural disaster and related emergency incidents. We evaluate the web application based on the following criteria as follows,

4.1 Evaluation Criteria

Usability: This criterion is used to evaluate the extent to which an interactive system is easy and pleasant to use. We evaluate the dashboard on this criterion to assert the ease of use of the Crisis Response Tool dashboard. The dashboard is evaluated against the parameters like user experience, scalability and security.

Scalability: This criterion evaluates the ability of a computer application or product to function properly when there is change in size or volume to meet a user need [20]. The capacity of the web application to handle as the audience user varies, since this application will be used extensively during an emergency where the users using the web application may range from thousands to millions. That makes scalability one of the important criteria.

Documentation: This report can act as the documentation needed to use the web application. For novice users who are not familiar with the web application this document will prove to be useful.

Performance: The performance of the dashboard is evaluated based on the response time it takes to retrieve data from social media sites and RSS news feed. There is an initial loading time of 20 -

40 seconds to retrieve and display the data in the website depending on the internet speed but in general it is fast enough.

Security: Security is one of the important factors that is to be considered when evaluating the web application. Since there is the factor of accessing the REST API of each social media website's by the web application which requires an account holder's credentials to log in to Facebook and Twitter, it makes the web application vulnerable. This needs to be addressed. An alternative way of accessing the API needs to be researched. There is also the need for verification and validation of data from social media sites.

Refresh Interval: It is the time interval defined between the previous data that is being displayed by the dashboard and updated data in the dashboard. The refresh interval is controlled using the `setInterval ()` function in the `home.html` with now the time interval being set at 10 seconds. This can be changed and controlled from the back-end i.e, making changes in the code directly.

4.2 Experiment 1: Scalability

The experiment for this criterion was done with the help of an online testing tool called <https://loadimpact.com/>. For the purpose of testing, the web application was deployed using Google App Engine. Google App Engine is a platform as a service cloud computing platform for developing and hosting web applications in Google- managed data centers [21]. The www.loadimpact.io site was used to measure the load and performance test. It added multiple virtual users and tested the scalability and performance of the web application. The results were as follows

Number of Users	Delay (seconds)
40	no delay

80	no delay
150	no delay
200	no delay
300	no delay

Table 4.1: Time taken to respond by the website with multiple users

The web application is deployed through Google App Engine and the results are as displayed on Table 4.1. There was no delay for various number of virtual users.

The conclusion from this experiment is that the web application's capability to serve many users will depend on the capacity of the server in the end as is the case with any website which serves millions of people at any given time. For eg; Facebook.

The number of users on crisis response tool web application will be easily range between thousands to millions. A sudden spike in traffic in the web application during a natural disaster is to be expected but we can be prepared. A generic suggestion for this scenario would be to add data centers and using load balancers to distribute the traffic among the data centers. This though would involve spending considerably on the hardware. Large-scale data management technology will be necessary to maintain a system's scalability. For Example: During US presidential election in 2016, Canada's immigration web site (CIC) crashed due to the traffic increase from people searching the website to migrate to Canada from USA. A government website crashed because of the unexpected scenario. So, a dedicated data centers may be required to handle various traffics during a natural crisis.

4.3 Experiment 2: User Experience

In this experiment, we evaluate the user experience or the measure of ease of use of the web

application. The dashboard was provided to users and their ease of use on the web application was noted. An experiment where around 25 people were asked to use the web application and instruction was given on how to use the web application and feedback was taken from them. Following factors were measured on a scale of 1 to 10. With value 1 representing unsatisfactory and value 10 representing satisfactory.

- Useful: The content should fulfill the goal that it was meant to serve.
- Usability: Ease of use of the dashboard of the web application
- Accessible: Accessible contents of the web pages.
- Credible: The credibility of the data's that are shown in the web application.

From the experiment, we could identify some shortcomings on the user interface of the dashboard. There is room for improvement on the user interface aspect of the dashboard. But since this is a model proposed as an example these suggestions will be taken into consideration for future model and design of the web application.

Authenticity of messages: In the scenario, we suggested in chapter 2 there is a problem on authenticity of messages, because some users may retweet help messages even after the concerned person who had tweeted for help had been rescued or fake messages of needing help may be circulated. A solution for this scenario would be the use of drones to monitor and confirm certain situations.

Advantages of Crisis Response Tool web application: The biggest advantage of the Crisis Response Tool web application over Hootsuite and Ushahidi is the model of the web application itself. The tool is based on a scenario that is mentioned in Chapter 2. Our addition of RSS news feed to monitor the local news will be helpful. Apart the source of information from public, we will also monitor the new channels through their RSS feeds. The RSS feeds can be changed from the back end of the web application. The use of the tool by an ordinary citizen is easy compared to Hootsuite and Ushahidi which may sometimes get complicated.

Chapter 5

Conclusions and Future Work

5.1 Summary

The project provided a useful tool and proposed a model for how a crisis response tool can be designed. Chapter 1 of the report provides an introduction to the tool and the idea of why and how social media data need to be used effectively during natural disasters and crisis. Chapter 2 looks at related works including research papers and the web applications that are currently in use for natural disasters which includes HootSuite and Ushahidi. Chapter 3 discusses the web application that has been proposed in detail, with the technologies and tools that are used are also discussed and explained. Chapter 4 is evaluation of the web application where we discuss the scalability and the usability of the web application. Chapter 5 discusses future work.

5.2 Future Work

The constant change and evolution of technology leads us to new solutions for problems we face. For example; peer-to-peer communications, i.e. smartphone to smartphone communication should be possible. A smart phone as it is today cannot do peer-to-peer communication because a smartphone transmits on the same frequency but receives on a different frequency. But an application called FireChat enables you to do a peer-to-peer communication on smart phones. Firechat uses a decentralized “off-the-grid” private messaging using an adhoc mesh network established between users of the app [22]. It uses the Bluetooth and WiFi radios in the mobile applications to create a private mesh network and connect to other users of the Firechat app [22]. It has been used at various times of crisis by the people across the world as a means of communication. Making the web application more portable and integrating Firechat with the web

application is a future idea that needs to be considered seriously. There are many research areas in using social media as a crisis response tool. According to disaster sociologist Jeannette Sutton, a senior research scientist at University of Colorado “Drawing up an effective social media strategy and tweaking it to fit an emergency, however is a crucial part of preparedness planning”. A great number of lives will be saved as Governments and NGOs find different and better ways to use the social media as an effective tool in disaster relief system. And with ever increase use of smart phones and its users around the world this application should support portability in future for better use in smartphones, and Firechat application integration in the Crisis Response Tool application will make the application robust and flexible. More features can be added like crowdsourcing and maps in future to the tool but more research may be needed, because the tool itself may evolve over time and over different scenarios that may arise during different types of natural disasters.

There is a vast amount of data that are available publicly which if used efficiently can save many lives and with Internet of Things happening there is a great scope for future work and research on this field. The social media sites are the best place to start the research and efficient model and design for a software that can be used during emergency needs to be discussed and researched.

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