

A platform to integrate crowdsourced, physical sensor and official geographic information to assist authorities in emergency response

Diogo Fontes^{1,4}, Cidália C. Fonte^{2,4}, Alberto Cardoso^{5,3}, José Paulo Almeida^{2,4}, Jacinto Estima⁶
 (dds.fontes@gmail.com; cfonte@mat.uc.pt; alberto@dei.uc.pt; uc25666@uc.pt; jacinto.estima@gmail.com)

- ¹ University of Coimbra, Portugal
- ² Department of Mathematics, University of Coimbra, Portugal
- ³ Department of Informatics Engineering, University of Coimbra, Portugal
- ⁴ Institute for Systems and Computers Engineering at Coimbra, Portugal
- ⁵ Centre for Informatics and Systems of the University of Coimbra, Portugal
- ⁶ NOVA Information Management School



Abstract

In this work, a prototype GIS-based platform to integrate Volunteered Geographic Information from various sources with other spatial data is presented, aiming at assisting civil protection authorities in emergency response situations. The platform is now in the implementation phase. Some aspects about its development and preliminary results to demonstrate the potentialities of the proposed approach as presented here.

Introduction

In the event of extreme disasters, such as floods, earthquakes or wild/urban fires, rapid security plans and mitigation actions are necessary.

Relevant Information about a natural disaster or accident



The goal of this work in progress is to provide both human and physical sensor data through a GIS-based platform, along with official GI sources, where authorities can search for information related to occurring or past disaster events.



Sources of VGI

The platform will gather and integrate information from various sources of VGI, with different data types and collected using very different protocols.

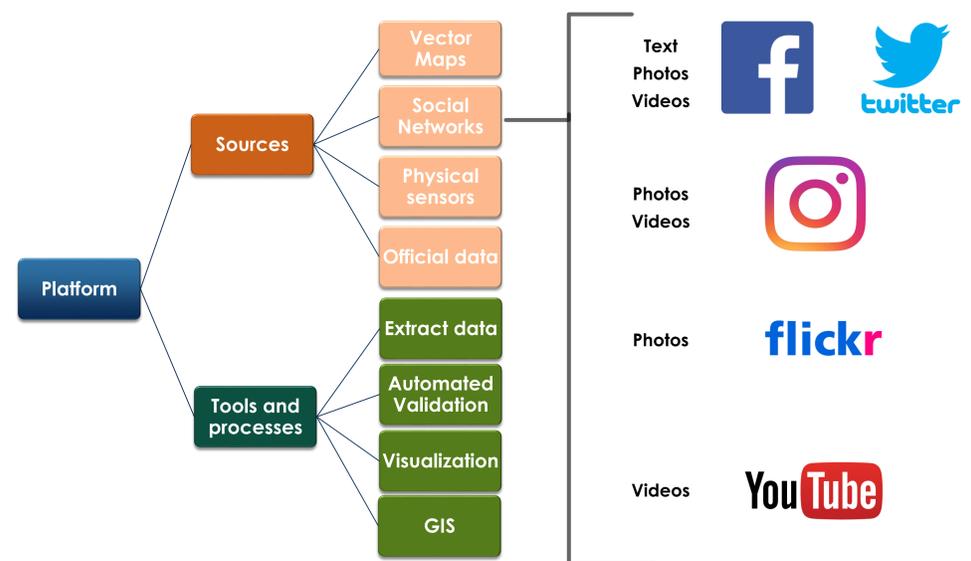
For this application, VGI needs to provide at least the following:

- Location data
- Data about events or contextual data

In this work the following types of VGI were considered:

- photographs
- videos
- text
- vector-based maps

Besides the sources presented below, **OpenStreetMap** was also chosen because it is the vector-based volunteer map with more users (three million-registered users in January 2017). Nevertheless, because the procedures to create these data are very different from the other mentioned platforms, no further analysis of OSM data characteristics is undertaken in this paper.



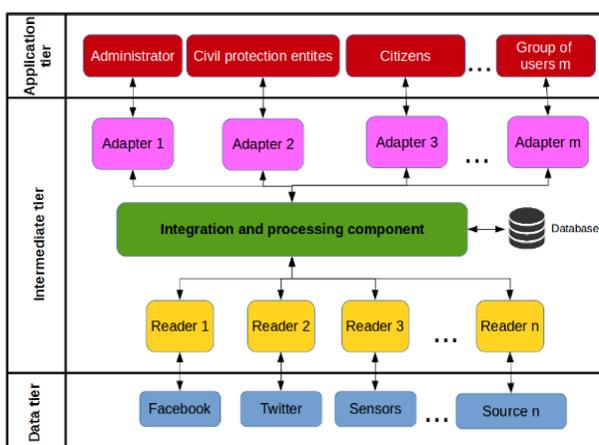
The **minimum requirements** for uploading photographs, text and videos were identified to compare the information available in each platform with the data required for the application at stake.

To increase the amount of usable data, implicit geolocation data (geonames) are searched through the analysis of text data and descriptions associated to photos and videos, because:

- Geospatial location is not a minimum requirement for uploading any of the data types indicated
- The amount of useful data collected from these data sources is less than the total data available

| Type of data | Platform | Protocols |
|--------------|-----------|--|
| Text | Facebook | Minimum: none Optional: tag friends; add comments; add location |
| | Twitter | Minimum: none Optional: add inquiry; tag users; add location |
| Photos | Facebook | Minimum: none Optional: tag friends; add comments; add location of the photo; refine and apply filters |
| | Twitter | Minimum: text from tweet which might describe the photo Optional: tag users; add location |
| | Instagram | Minimum: none, but can only upload from mobile devices Optional: tag users; add location; add legend; apply effects and/or filters |
| Videos | Flickr | Minimum: none Optional: add title; add description; add tags; add location; assign photo to a group |
| | Facebook | Minimum: none Optional: tag friends; add comments; add location |
| | Twitter | Minimum: text from the tweet which might describe the video Optional: tag users; add location |
| | Instagram | Minimum: none, but can only upload from mobile devices Optional: tag users; add location; add legend; apply effects and/or filters; add a cover |
| | YouTube | Minimum: none, but it's automatically added a title with the upload date Optional: add title; add description; apply filters; add music; add location video |

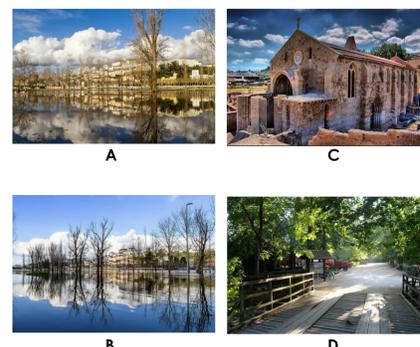
Platform architecture



Example

A point shapefile was created using the coordinates of the obtained photos, including the following attributes for each photo:

- “title of the photo”,
- “taken date”
- “photoURL”



Keyword: Flood
Radius of search: 5 km
Coordinates:
 Lat: 40,22996
 Long: -8,431268
 (City center of Coimbra)



Conclusions and future work

This work presents a platform under development to integrate VGI with data collected by physical sensors and official information, to assist authorities in supporting their response to emergency events. An example is presented with the current version of the prototype using photographs extracted from the Flickr initiative. The results show that potentially useful data may be obtained, but also the need of additional automated validation and filtering processes to obtain the relevant data.