

GOOGLE MAPS FOR CROWDSOURCED EMERGENCY ROUTING

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ABSTRACT:

Gathering infrastructure data in emergency situations is challenging. The affected by a disaster areas are often large and the needed observations numerous. Spaceborne remote sensing techniques cover large areas but they are of limited use as their field of view may be blocked by clouds, smoke, buildings, highways, etc. Remote sensing products furthermore require specialists to collect and analyze the data. This contrasts the nature of the damage detection problem: almost everyone is capable of observing whether a street is usable or not. The crowd is fit for solving these challenges as its members are numerous, they are willing to help and are often in the vicinity of the disaster thereby forming a highly dispersed sensor network.

This paper proposes and implements a small WebGIS application for performing shortest path calculations based on crowdsourced information about the infrastructure health. The application is built on top of Google Maps and uses its routing service to calculate the shortest distance between two locations. Impassable areas are indicated on a map by people performing in-situ observations on a mobile device, and by users on a desktop machine who consult a multitude of information sources.

1. INTRODUCTION

Effective management of a disaster depends on knowledge about the health and condition of the infrastructure. An important analysis in the response phase of a disaster management operation is the calculation of shortest routes between two locations. Routing, although a simple task on itself, becomes difficult during disaster relief operations where a lack of information is the norm. Collecting information about the state of the infrastructure is a complex task due to the extent of the area and quantity of needed observations. Fortunately, making these observations does not require much specialization as almost everyone can judge whether a street is passable. At the same time numerous people on the ground are not able to directly aid the relief operation due to lack of equipment or knowledge, but nonetheless are willing to help. It comes therefore to mind to leverage the knowledge and large numbers of the crowd in collecting information about the state of the infrastructure and more.

Crowdsourcing and web mapping are becoming increasingly common. Crowdsourcing has shown its strengths in endeavours such as Wikipedia. Web mapping platforms such as Google Maps and Bing Maps have revolutionized cartography and have brought it to the masses. New web technologies have made creating dynamic and intelligent websites easier. The combining of crowdsourcing and web mapping technologies have produced OpenStreetMap. The field of Disaster Management has also benefited from this combination in the form of Ushahidi, a mapping web application used in disaster relief operations to map hazards and people's needs in disaster stricken areas. Using Ushahidi the "crowd" is able to collect, store and share information about events and points of interest in the disaster

area. They can identify blocked roads, shelter locations, people in need of immediate medical attention, etc. Rescue workers use this information to quickly get an overview of the needed aid and plan their operations around that information. However, Ushahidi does not support geospatial analyses. More specifically, it is not possible to perform shortest route calculations.

This paper presents our investigations on crowdsourcing for disaster management purposes. What is crowdsourcing? What constitutes crowdsourcing emergence? The found constituents are implemented in a small WebGIS application that uses the "knowledge of the crowd" to aid the routing challenges rescue workers face during the response and recovery phases of disaster management. The goal of proposed application is twofold: 1) automate the way finding process in a disaster stricken area by 2) enabling volunteers to act as sensors and report on the infrastructure health.

The paper is organized as follows: section 2 discusses what crowdsourcing is and what stimulates its emergence and growth. The section continues by discussing what a WebGIS is and what functionality is expected from it. Section **Error! Reference source not found.** outlines the used technologies. Section **Error! Reference source not found.** show highlights the methodology and obtained results. Section 5 presents some conclusions while section 6 identifies possible research directions.

2. CROWDSOURCED DISASTER MANAGEMENT

The sudden change of urban infrastructure configuration and health immediately after a disastrous event renders much of

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