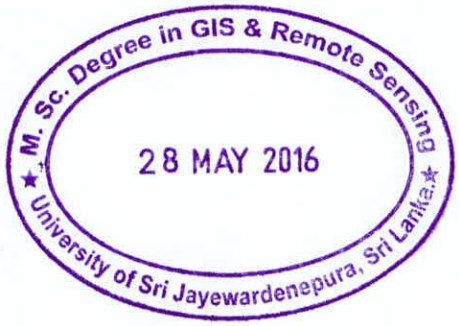
Utilization of Mobile and Communication Technology for Geospatial Data Collection: with Special Reference to Disaster Incident

By

Narasingha Kesara Bandaralage Chamira Lasantha Karunarathne



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Narasingha Kesara Bandaralage Chamira Lasantha Karunarathne

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DECLARATION OF THE CANDIDATE

I do here by declare that work described in this thesis was carried out by me under the supervision of Dr. Shirantha Heenkenda and Mr Prabath Malavigeand report on this thesis has not been submitted in whole or in part to any University or any other institution for another Degree/Diploma.

Date 20/03/2016

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NKBCL Karunarathna

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GIS	Geographical Information System
CRD	Center for Research and Development
CPU	Central Processing Unit
ARM	Architecture Acorn RISC Machine
LG	Life's Good
GPS	Global Positioning System
GLONASS	Global Navigation Satellite System
GNSS	Global Navigation Satellite System
API	Application Program Interface
WWW	World Wide Web
HTML	Hyper text markup language
MYSQL	structured Query Language
GPRS	General Packet Radio Service
OS	Operating System
MGIS	Mobile GIS
XML	Extensible Markup Language
ICT	Information and Communications Technology
SDK	System Development Kit
CSS	Cascade Style Sheets
LBS	Location Based Service
A-GPS	Assistant GPS
MDCS	Mobile Data Collection System
PDA	Personal Digital Assistant
SMS	Sort Message Service
ICT4D	Information and Communication Technologies for Development
DEX	Dalvic Executable
ECG	Electrocardiogram
IDE	Integrated Development
ADT	Android Development Tool
HTTP	Hyper Text Transfer Protocol
WAMP	Windows Apache Mysql PHP
JRE	Java Runtime Environment
JDK	Java Development KIT
CAD	Computer Aid Development

ABSTRACT

The scope of information technology is leveraged in every aspect of society. Spatial data and related information is a major requirement in disaster management. During rescue operations, availability of real-time information on a portable device would prove useful. The aim of this research was to develop and test a GIS-based mobile application on the Android platform with disaster specific software modules. This mobile application is expected to serve disaster management teams during the rescue operations for better co-ordination and information exchange.

When consider about the urgent and time sensitive nature of disaster situations it is compulsory to collect and use spatial information of the relevant disaster during a short period of time. This would be achieved in a collaborative effort by all the parties involved in disaster management process. But there are substantial problem with collection, access, dissemination and usage of required spatial data for disaster management. Such problems become more serious during disaster management phase with its dynamic and time sensitive nature. In other words any problem of delay in data collection, access, usage and dissemination has negative impacts on the quality of decision making and the quality of disaster response. In this regard disaster situational reporting system would be much important to succeed in collecting and sharing such spatial data in relation to disasters.

With the purpose of succeed the above intention smart phone is the ideal equipment. Today smart phones are becoming the primary computing and communication platform for people's daily tasks. Since these smart phones have the functions of installing applications and provide users with more diversified mobile value added services. Most of these smart phones are inbuilt with GPS technology. Since the current mobile communication follows the development trends of GPS technology, make users can retrieve location data by using map applications and navigational applications. Hence mobile application would be a feasible route for disaster communication. On this purpose of field data collecting and real time updating about disasters can be highly improved by using geographical information

technologies. Since then this new source of information, has been found to be especially useful in disaster management.

This paper aims to address the role of Mobile GPS as an integrated application forfacilitating disaster management by improving field data collection and in-fielddecisionmaking by using Android technology.

Keywords: Disaster management system, Mobile communication, Disaster situational report system, Mobile GPS, Spatial data,

Chapter One

INTRODUCTION

1.1. Introduction

The processing capability on today's smart phones has almost doubled over the past few years. For example the Apple 3GS iPhone uses a 600 MHz CPU 256MB of RAM ARM chip, while the iPhone 4 uses the A4 chip which runs at 1GHz. With the introduction of multi-core phones in late 2010 mobile software can take advantage of increased speed and performance. Many of 2010's top smart phones had a 1GHz processor - devices such as Apple's iPhone 4, HTC's Desire HD and the Windows Phone 7 handsets that arrived towards the back end of 2010. After this dual-core phones such as the LG Optimus 2X came on the market. The 2X has aNvidiaTegra 2, 1GHz processor - a dual-core system-on-a-chip based on ARM architecture. The Tegra chip still promises 1GHz of processing power however, dual-core chips enable more power to be squeezed out of the processor because the chips contain two 1GHz cores - meaning there are two 1GHz processors that can be used in parallel to speed up performance, provided the mobile software has been optimized to take advantage of the parallel processing power. Dual-core chips should enable a noticeable speed and performance increase, particularly when it comes to multitasking. In 2013 the latest smart phones feature multi-core processors with dual and quad-core processors available.

This availability of increased processing power coupled with smart phones that have numerous inbuilt sensors such as GPS positioning sensors, Wi-Fi, Bluetooth, camera, pressure, temperature, humidity, light and inertia sensors such as digital compass, accelerometers and gyros, has created a powerful tool which can be used for surveying and geographical information data collection. In addition many top end smart phones are starting to use multi-constellation GNSS chips for example the iPhone 4S, iPhone 5 and Samsung Galaxy Note use a GPS+GLONASS GNSS chipset. This hardware does not exist in isolation but benefits from advances in computer science, in particular the emergence of Web 2.0, as well as the availability of broadband and 3G communication networks. Smart

Phone platforms such as Apple or Android provide an API for developers to write their own software with additional APIs in Android to utilize Google maps. There are also APIs available for use with Open source maps such as OpenStreetMap.

Figure 1.1: android capabilities

Geospatial data collection is one of the important tasks for many spatial information users. Geospatial data collection may include remote sensing data, field data and other in-house GIS data conversion processes (*i.e.* scanning, georeferencing, digitizing, etc). Among them, field data collection is one of the first steps for spatial information users, especially for geographers, geologists, biologists, crop scientists, ecologists, etc. Field data collection is required for several reasons, such as collecting Ground Control Points (GCPs), ground truth data collection for result validation, collecting soil contaminated sites, plant or animal species, and gathering public opinions for retail market analysis in order to analyze the spatial distribution patterns of objects and information on their associated attributes.

Accurate field data collection is also necessary for adequate spatial data analysis and proper decision making. While much of the underlying technology is already available, there are challenges with respect to the usability of mobile applications. Traditional field data collection (*i.e.* pen-and-paper based) is a time consuming and bulky task. For example, need to prepare base maps, collect secondary dataset, and other paperwork. This is not practical to use in real-time disaster information collection, which occurs in unpredictable places and requires a quick emergency response. However, recent developments in mobile communication, Global Navigation Systems, the Internet and portable computational devices such as Notebooks or Ultra Mobile Personal Computers (UMPC) allow us to conduct field data collection in a timely manner. More-over, under the client-server setting for field data collection, a field user may take advantage of digital repositories prepared for data collection (*i.e.* base maps, satellite), as well as information resources more generally available via the Web. For example, use of Web Map Service (WMS) to access Google Maps or Microsoft Bing Maps data from GIS applications via a HTTP interface. It can provide Google Map or Microsoft Bing Maps image data to any GIS applications that can use a WMS service for raster data. This can eliminate the time for baseman preparation and other image processing tasks.

This project investigates the usability of a mobile application for field data collection in a disaster situation. And also construct a Web-based GIS system to integrate, store, share and retrieve the collected data in real-time, which could be used for example in metro-logical data collection (i.e. surface temperature, wind speed/direction) and damage information in disaster areas at various locations.

1.2. Study Area

The study area of this application covers WebGIS application, Geographic Information System (GIS), GPS, GSMCartography and Android application. In this research, I present a set of algorithms and web tools for automating analysis and comparing the results with experienced intelligence analysis. The system has been implemented by using ESRI ArcGIS software, World Wide Web (WWW), as well as querying attributes, display data layers, zooming, and planning.

Throughout history, advances in capability have been fueled by innovation. This study focused on introducing high technology which can be used by the soldier.

High speed mobile broadband is an essential factor in modern society. People have ability to communicate as well as exploit the capabilities of the latest smart phones. People require the same technology that powers high speed commercial cellular networks so they can send photos, video and keep track of their unit's location. This study was to introduce latest communication technologies and live tracking systems using GPS and existing commercial GSM connections.

Special this system was design to collect field information in very efficiency and accurate manner. Basically this research was concern in the disaster information gathering but it can be incorporate into any kind of field data collection systems.

The main advantages gained from working with this system are fast diffusion and efficient management of geographic information system. It is, in fact, well known that works are depending on the ground analysis.

The internet technology adopted for GIS application has been indispensable in spreading basic knowledge. The combination of software and data standards realized in this work has enabled the management of vast amounts of geological, geophysical and territorial data.