Mobile Disaster Management System Applications
- Current Overview And Future Potential -

Flávio Souza

International University Of Japan

MSA-301

International University of Japan,

777 Kokusai-cho Minami Uonuma-shi,

Niigata 949-7277

E-mail: flako@iuj.ac.jp

http://www.iuj.ac.jp

Ibrahim Kushchu

International University Of Japan

MSA-301

International University of Japan,

777 Kokusai-cho Minami Uonuma-shi,

Niigata 949-7277

E-mail: ik@iuj.ac.jp

http://www.iuj.ac.jp

Abstract: *Based on a series of case analysis of current Mobile Disaster Management Systems applications in different regions of the globe, this paper examines each application in detail. This paper pays particular attention to the value and lessons learned with these applications as well as their limitations and constraints, with the aim of addressing them in the future. The paper begins by defining what a disaster management system is, and explaining its importance. It then follows with a brief description of current Mobile Disaster Management Systems applications available. The paper concludes with suggestions for developing new systems combining the best practices of each of the current systems in order to increase popularity and usage among the public. A particular proposal concerning the Japanese marketing reality is also presented.*

Keywords: Disaster Management System, mobile applications, mobile business, mobile government, mobile technologies, cases studies, SMS emergency broadcasting, Enhance 911, message board service and Japan.

1. Introduction:

According to The Disaster Management Center of The University of Wisconsin, the term Disaster management can be described as *"The range of activities designed to maintain control over disaster and emergency situations and to provide a framework for helping at-risk persons to avoid or recover from the impact of the disaster."*[1], although "range of activities" infer a broad scale of applications which include, for example, pre-disaster activities in order to deliver a more efficient response in the case of a natural disaster. Customarily, the general public has a tendency to conceive disaster management merely in terms of the post-disaster actions.

Natural disasters, such as the latest "tsunami" in Asia and the earthquake in Niigata, Japan, are contributing to enhance citizens' awareness for the need of pre-disaster procedures. There is also a growing recognition by governments and private institutions that a mobile disaster management system

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[1] http://dmc.engr.wisc.edu/courses/aimscope/AA02-01.html

could help to minimize the fatalities of human lives when natural disasters occur. As a result of this recognition, countries such as Australia, The Czech Republic, France, England, Hong Kong, Japan and Singapore, among others, have increased their efforts in developing disaster management applications which make use of mobile technology as a means of enhancing their response capabilities in times of catastrophe.

However, despite the wide recognition of the importance of this management system by public and private institutions, those mobile disaster management systems applications have not, in general, garnered much attention from the general public within these countries.

Consequently, the high costs of developing and implementing such mobile disaster management systems is generally shared only by governments and private corporations. More fundamentally, it is not clear how these costs should be split amongst governments and private institutions, which in turn slows down the process of implementing the systems and making them available to the general public.

This paper describes current mobile applications in a series of countries based upon cases studies. It also suggests a new approach for governments and business groups to minimize their costs by consolidating and enhancing new features in their development of mobile disaster management solutions.

The main objective behind this new concept is to enhance the demand by the general public for those applications which it would reduce the costs involve on developing and managing a mobile disaster system in response.

The methodology used in this paper is based upon an investigation of current mobile disaster management applications in a variety of countries and then comparing those applications in order to suggest improvements. The analysis and final suggestions are made in the context of the Japanese's market reality.

2. Background Material

Current mobile disaster management system can vary from SMS alerts (i.e. UK and Hong Kong) to mobile devices donations to government authorities in crisis situations (i.e. The Czech Republic). However, Hong Kong's SARS SMS emergency alert broadcasting case, for instance, illustrates how mobile applications can provide life-saving support to individuals and organizations in times of need. Though, as it is described in this paper, this case showed us that there is still room for improvement. Therefore, the cases studies explained in this paper can give us concrete examples of technology's potential to save lives in the future as well as reveal the positive and negative points of each solution developed.

A Mobile Disaster Management System Application that reaches all the global population is far from reality. Fortunately, many relevant efforts were already taken in this direction. The cases studies analyses also provide enough evidence of the need to maximize the potential of such technology and primarily reach a larger number of individuals. Japanese reality, for instance, seems to be particular intricate because its current mobile disaster management system application developed by NTT DoCoMo is restricted and targeted only to a specific part of the population (i-mode users) furthermore, it runs only when a disaster occurs which reinforce the erroneous general public's perception of a disaster management merely in terms of the post-disaster actions.

3. Issues in Disaster Management System:

If we consider that there is a growing belief that "tsunamis' toll might have been lessened if an early warning system similar to one that exists for the Pacific Ocean had been in place"[2] (Shankar Vedantam, 2004). Consequently, if we also reflect on the fact that "The world will have almost two billion mobile telephone users by 2006." (Carl-Henric Svedberg[3], 2004), it seems clever and feasible if such early warning system runs were accompanied by a mobile application.

As the mobile disaster management systems start to proliferate in various nations, and as the mobile's growth trend continues, it seems just a matter of time for early warning system to become available in everyone's pocket. The pre-disaster actions must be strengthening to the general public by developing mobile disaster systems applications that is appropriate and valuable to the customers.

The best way to add value to these customers is by blending the mobile disaster system application with new features such as customizing information in order to adapt each customer's need or (i.e.: sending a mass general SMS SARS panic alerts to the population without considering the user's location, wealth condition / age and other peculiar information could just generate more panic[4]), on top of that the merger of mobile disaster management systems application with other mobile applications in other fields such as personal security and wealth care. By doing that the mobile disaster management system applications will probably become more appealing to the public and as a result increase people's desire to pay for such services.

By paying for such mobile services / applications, the general public would join the governments and private corporations in sharing the system costs and actively contribute to bringing down this existing high costs of developing and implementing such mobile disaster management systems and as a consequence become also better prepared in case of a major disaster occurs.

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[2] http://www.washingtonpost.com/wp-dyn/articles/A27552-2004Dec26.html

[3] Ericsson's Chief executive

[4] http://lair.xent.com/pipermail/fork/2003-April/019650.html

This move would also contribute to speeding up the process of the introduction of the disaster management systems amongst the general public in other nations as the cost drops.

It is a typical "win-win situation" where the general public, the governments and the private corporations cooperate with one other not only by sharing the implementation costs but also by improving even further the current mobile disaster management applications (R&D costs).

By simultaneously enhancing the services provided and expand it to the entire global population in the future is the perfect scenario. However, prior to that ideal stage, it is mandatory to understand what the current cases on the mobile disaster management systems are and how they can affect the future developments and contribute towards the perfect scenario described above.

Case 1 – A Message Board System

Application Name	The i-mode® Disaster Message Board service.
Country	Japan
Operating since	Japanese version – January 2004 English version – September 2004
Application Description	A Disaster Message Board service that permit i-mode subscribers within the disaster area to place and check messages in order to inform relatives and associates of their security and situation.
Application Drivers/Purpose	The overall intention behind this application is to avoid excessive network congestion during major natural disasters as well as minimize panic among the general public due to lack of information.
Stakeholders	There are two key stakeholders for this system: The i-mode users (victims or families/friends) and the authorities.
Limitations	• System only activated in the event of a major calamity. • Only available for DoCoMo's users. • Users can place up to 10 messages (maximum 100 Japanese or 200 alphanumeric characters) each to be saved for up to 72 hours.
Evaluation: Failure or Success?	There has been no formal evaluation of the project to date however, due to the limitations listed above the system seems to not reach success up till now.
Constraints/Challenges	1. Increase user's awareness of the system. 2. Expand the system to other's operator users (compatible with other carriers). 3. Activate / run the system in a 24 hours basis.
Further Information	http://www.nttdocomo.com

The i-mode® Disaster Message Board service must overcome its current constraints in order to make this application more valuable to their i-mode users. Due to the high possibilities of a major natural disaster occurring in Japan and the fragility of the network that undoubtedly will be extremely busy (according to NTT DoCoMo August 2003 report[5], "*under the present network system, there may be instances in the case of a major disaster where the flow of both voice calls and data packet transmissions would have to be controlled. This would be necessary to prevent degradation in network performance due to congestion from the anticipated flood of calls*"). DoCoMo is aware that earthquakes could also interfere with the message board service, which relies on data packet transmission and is not immune to a major tremor.

Thus, DoCoMo started to consider combining its disaster message board service with technology that allows separate control of voice calls and data packet transmissions. At the same time, text sent to the i-mode Disaster Message Board can be expected to arrive safely despite the probable network congestion or other troubles. In the long run, the DoCoMo's disaster message board service could prove to be extremely useful and have a greater reception by the Japanese population in general. It could also drive new users to DoCoMo's services while attracting its rival users' attention for a switch in the provider carrier as the application gets more popular. On the other hand, there is a lot of room for improvement to the DoCoMo's system. For example, DoCoMo could use its influence as one of the main mobile players in Japan to "convince" others stakeholders (i.e. mobile manufacture, government) to join their efforts in developing a better solution for the future. DoCoMo should also avoid being the only operator responsible to develop a solution; it is more cost-effective to convince other operators (i.e. Vodafone, KDDI, Tuka …) in order to share the developing costs and expand the population coverage.

Case 2 – Beyond the 911

Application Name	"Enhanced 911"
Countries	USA, Australia and UK
Operating since	USA version – September 2004 (Phase I)
Application Description	The wireless E911 program is divided into two parts - Phase I and Phase II. Phase I requires carriers, upon appropriate request by a local Public Safety Answering Point (PSAP), to report the telephone number of a wireless 911 caller and the location of the antenna that received the call. Phase II requires wireless carriers to provide far more precise location information, within 50 to 300 meters in most cases. Basically, this system "piggybacks a cell phone's location details onto 911 emergency calls".
Application Drivers/Purpose	The overall intention behind this application is for rescue operations propose and national security.

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Stakeholders	There are two key stakeholders for this system: The general public and the authorities.
Limitations	• Only available for GPS-enabled phones users. • Yet most local call-centers lack the technology needed to pinpoint callers' location come from wireless phones.
Evaluation: Failure or Success?	Due to its currently limited implementation stage (phase1), the system can not be complete evaluate yet.
Constraints/Challenges	1. Broad definition on the concept of "emergency services" which can excessive cause network congestion in the future. 2. The set-up costs involved were cited as a constraint to be solved by the US operators (i.e. Sprint) regarding further phases of the system. 3. Private Issues.
Further Information	http://www.newscientist.com/article.ns?id=mg18324663.700

This mobile disaster management system shows how the technology could work in order to make people safer after September 11th terrorist attack in the U.S. Basically, this mobile application connects public emergency services with citizens in need. What differs from the ordinary 911 dial emergency number is the fact that the call can be tracked down for the user accurately location (GPS-enabled phones users required) which saves precious time for rescuing since users do not need to explain where they are at the moment but just what kind of assistance they need. However, this system is still not fully implemented yet, just recently 911 enhance system got the final approval by the US congress (phase 2 and beyond).

This means that the 911 enhance system still needs a mass of investment to overcome its limitations on the wireless callers, in particular on Public Safety Answering Point (PSAP) that still need improvement, at the moment the location position to the users is still inexact and it will perhaps take a little longer to have such a system implemented and working with minimum errors and restrictions.

Case 3 – SMS disaster Alerts

Application Name	SMS Alerts
Countries	UK and Hong Kong
Operating since	March 2004
Application Description	In UK: SMS sends alerts to businesses in London about security threats, including bomb alerts. The 24-hour service contacts all users in real time with a message that is sent within 30 seconds of the alert being received by the police. In Hong Kong: SMS was used in emergency broadcasting. At the height of the SARS incident, the Hong Kong government sent a blanket text message to 6 million mobile phones in a bid to scotch

	uncertainties emanating from rumours about planned government action to stop the syndrome.
Application Drivers/Purpose	The overall intentions behind these applications are to protect the employees in the firms and guide them in case of an evacuation procedure (UK case) and to give real time information about hazardously locations in order to avoid the population to go to those places along with controlling the possible mass hysteria caused by rumours (Hong Kong case).
Stakeholders	There are three key stakeholders for this system: The business corporations and the authorities (UK case) and the general public and the authorities (Hong Kong case).
Limitations	In UK case: The system is targeted to corporate users which leaves the general public without any information in case of an emergency situation or evacuation. In Hong Kong case: Mass information only, lack of customization or treatment of the message for different type of users.
Evaluation: Failure or Success?	In UK case: The system seems to have a good acceptance by the business corporations despite the fact it has a monthly fee for the pager/SMS service in contrast of its email service delivered to computers in the office which is free of charge. Corporation have a preference to sign up for the pager/text message alerts (1,121 firms in total) than for the free email alert system (589 firms). In Hong Kong case: Although, some mistakes were committed by the authorities while sending the SMS messages across the nation as commented before, the concept was proved that if it is well implemented can effectively reach the population and avoid unnecessary human life risk because of lack of information, it can also impede rumours to multiply.
Constraints/Challenges	In UK: 1. Expand the system to the general public. In Hong Kong: 2. Customize the SMS alerts by group of individuals.
Further Information	(Emmanuel C. Lallana, 2004) http://www.egov4dev.org/mgovapplic.htm http://www.e-devexchange.org/eGov/mgovapplic.htm

In UK case:

This system shows us how security issues or treats (i.e. bomb alerts) can be employed into a disaster management system which expand its basic definition of a disaster that not necessary needs to be the

coming from the nature. It also give us an idea how adapting a solution to suit each country's reality can result in enhancing the current value of the disaster management system to the local customers.

The City of London Police alert pager system initially started in 1993, but has been upgraded and expanded due to the delicate state of alert after the terrorist attacks on September 11th, the threat of a new bombing campaign in Britain by Irish republican groups as well as due to technology progress of mobile phones handset that is making obsolete the pagers and creating new business opportunities.

The UK system, for instance, has a monthly fee for the pager/SMS service at £8.25 and it is targeted mainly at firms and corporations in London. Consequently, it is wise if this system consider in the near future its expansion to the public users (normal citizens) in order to avoid unnecessary casualties in case of a bomb explosion and also expand and generate higher revenues.

In Hong Kong:

At the height of the outbreak in early April 2003, Hong Kong was reporting 60 to 80 new cases of the previously unknown disease per day; today Hong Kong is SARS-free.

However, not everything worked smoothly during this time. *As the virus, for which there is still no known cure or vaccine, began to claim the lives of formerly healthy patients, Hong Kong became a virtual ghost town with schools closed, cinemas, restaurants and bars empty and the streets deserted.*[6]

The Hong Kong government's SMS alerts tried to minimize this problem but generated some anxiety situations because of the lack of customizing services which negatively contributed to generating uncertainness amongst some segments of the population.

The concept of "one message serves it all" may not fit the necessity of some groups of users that for instance can not evacuate immediately due to mobility limitations (i.e.: elder population) as a consequence, this application should be improved to adapt to the user's condition or location at the moment. However, overall this case illustrates very well how mobile can be useful in disaster management situations that require rapid dissemination of information.

Case 4 – Diverse Applications

Application Name	Other Types of disaster efforts / systems (differing from mobile applications)
Countries	The Czech Republic, France and Turkey
Operating since	N/A
Application Description	In The Czech Republic, mobile device with prioritized telephone numbers were given out to 18,000 government personnel in the time of emergency. In France, New emergency response system helps fight disasters (EGERIS) was intended to increase the safety and the efficiency of

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[6] By Madeleine Coorey

Agence France-Presse http://www.inq7.net/wnw/2003/jun/24/wnw_1-1.htm

	civil protection organisations and authorities involved in risk management operations. The system allows emergency services to have, in real time, an up-to-date knowledge of the situation in order to take the right decision to minimise the consequences of the disaster. In Turkey, Disaster Emergency Management Information System (AFAYBIS) is based on TABIS (Turkey Disaster Information System); A Catalogue developed for the topography and disaster management data in the accuracy of 1/5000 scaled map (ITU, 2002)
Application Drivers/Purpose	The overall intentions behind these applications are speed up decision on a disaster crisis (The Czech Republic case), relieve for victims (Taiwan case), better coordination of emergency rescue teams (France case) and by collecting data before a disaster occur the government can create a database that can be use to compare with the disaster situation later on (Turkey case)
Stakeholders	There are three key stakeholders for these systems: The Telecom companies, the general public (indirectly) and the authorities.
Limitations	These systems are aim to help the authorities in their rescue efforts, it is not necessary focused on the general public which limit their application.
Evaluation: Failure or Success?	N/A
Constraints/Challenges	Besides Turkey's case, all the system is focusing on the post-disaster actions. The challenge will be to develop a pre-disaster system in coordination with these actions in the future.
Further Information	The Czech Republic: http://www.jsce-int.org/Report/report/flood_euro.pdf France: http://www.innovations-report.com/html/reports/communication_media/report-29094.html Turkey: http://www.isprs.org/istanbul2004/comm4/papers/339.pdf

These efforts demonstrate how broadly the concept of a disaster management system can be applied and show us how the authorities all over the world are compromise with this issue.

However, post-disaster actions such as those ones listed above should not prevent the governments and other stakeholders (i.e. telecom providers) from developing a Mobile Disaster Management Solution focused on pre-disaster actions, because only by having a pre-disaster system in place a better emergency action can be provided to the citizens.

4. Conclusions

All the cases described are valid attempts towards creating solutions that minimize disaster situations. However, it seems that each application could benefit more from its counterpart if they exchange their findings or incorporate each others' strengths. Hence, the different governments in each country should provide and stimulate this integration in view of their own citizens' safety.

One example of this exchange of findings and adaptation could be formed by, for instance, integrating the SMS disaster alert (Hong Kong case) with The Disaster Emergency Management Information System (Turkey Case) which could certainly contribute to broadcasting a more precise information (avoiding for example a "guestimation" of the real situation and generate confusion which would contribute to rumours and consequently chaos among the population and the authorities) in the event of a major disaster. It is also observed that the concrete examples of technology's potential to save lives expressed in this paper through the case analyses of the current Mobile Disaster Management System applications demonstrate that *now that a quarter of the world has cell phones, disaster prevention may be a real-time reality*[7]

However, until we reach that stage, the mobile disaster management systems should become more popular and attract enough users in order to cut its costs down and provide a viable solution for every country. Therefore, the best approach towards this direction seems to be by making the Mobile Disaster Management System a default application in the users' handsets. In order to accomplish that this application should merge with others such as GPS location (currently some attempts were made) and even integrate with different applications that might generate demand and interest within the population.

As examples of those different applications, personal-security (to protect individuals against social crimes that may put his life in risk), payment-systems (in order to speed up disbursement in emergency situations), health data applications (it can be useful in the post-disaster actions) seems to be the areas that offers the best possible outcome or business opportunities today. By expanding the concept of "Disaster" in the direction of "Self-Protection" and customizing it to groups or individuals. Disaster Management System would become part of a package solution for personal safety.   If we consider that more and more security issues is becoming an important concern not only for countries but also for the citizens too.

This "Self-Protection" package application would generate a great business opportunity for every stakeholder involved in the implementation of the concept. Japan, in particular, due to their current mobile development stage offers the greatest opportunity for advancement on this "Self-Protection" direction. The Japanese handsets, due to their cutting edge state and its new fourth generation (4G) technology that is currently in the developing stage by DoCoMo, offer a greater number of possibilities

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[7] http://www.jeffooi.com/archives/2004/12/tsunami_wsj_pic_1.php

than can be found elsewhere. If we add the fact that the current network speed is faster enough to permit features such as short video download and music swapping, the applications to be developed in the "Self-Protection" can be very appealing.

As the population gets older in Japan, the need for such "emergency" mobile system tends also to increase which would open up an opportunity for health data applications. For instance, having specific health information data such as blood type, what kind of medication is being taking at the moment, patient's allergic symptoms among others could be stored in the mobile handset and in case of an emergency rescue this data could be used efficiently by doctors. Those possibilities give us an idea about the future applications that could financially support the development of an enhanced Mobile Disaster Management Systems. Based on its current attempt, it is clear that Japan has the potential to improve its current system and must do so due to its geology fragility.

A Global Mobile Disaster Management System is the final destination that everyone in the society should aim for. Only by having such system in place, "tsunami" and other natural disasters can be manageable and loss of human life be minimized. Because our society suffers from other harms such as high crime rates, terrorism attacks just to name a few. There is an opportunity to expand the concept of a Mobile Disaster Management System in the direction that can help to minimize these society's harms.

A society where the citizens are safer by counting on a 24hours vigilance system in their pockets can only be beneficial to the world.

For that reason, depends on us, normal citizens, to be responsible in carrying and spreading these valuable benefits to other societies in the world, only by doing that we will have a world that no one would be left out and a Global Mobile Disaster Management System that can works everywhere.

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