

Role of Urgent Situation Communication Services during Disasters

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Abstract: *Natural disasters, calamities and catastrophes are cohabiting phenomena of human civilization. ICT and telecommunications technologies can play a life saving role in natural and man-made disaster preparedness, management and response. The optimum use of all relevant means of telecommunication in the event of a disaster is a complex multidimensional problem. Even simple use of ICT enable technologies would alert people before a disaster strikes and could give clear advice about what action should be taken. An effective disaster plan, combined with efficient use of mobile telecommunications, can help to minimize the impact of natural disasters, simplify the delivery of aid to victims, and help nations get back on their feet as quickly as possible. However not in all nations that are affected by natural disasters are able to use mobile technology. Case in point is Bangladesh where mobile penetration is only 16%, network coverage has not yet widely expanded to the remote and inaccessible areas and poor people can not also afford mobile phones. Such situations require an innovative approach that may use different telecommunication technologies for disaster management. The case study, new services such as communication and information sharing in remote areas of developing countries, dissemination of early warning and forecasting during disasters have been analyzed. OLPC (One Laptop Per Child) and the mesh communication models have been proposed as the vehicle for implementing a set of services for disaster response. Cost, power and wireless mesh networking are the most prominent features of OLPC that encouraged selecting OLPC as a tool to be used in communication purpose in remote areas that are lacking mobile networks.*

Keywords: ICT, OLPC, Mesh network, communication services

1. Introduction

Major disasters, emergencies and catastrophic incidents include floods, earthquake, hurricanes, tornadoes etc. There are also other deadly and devastating incidents (like fire, oil spills, transportation accidents, hazardous material releases) that threaten the environment. Like any other disaster, a flood disrupts the normal life patterns and individuals, families as well as the nation are exposed to great material and personal losses. Bangladesh is one of the disaster prone countries of the world. Flood is a regular phenomenon in Bangladesh which occurs more or less every year. It claims more life and property than any other natural disaster and also shatters the economic backbone of the wage-labourers and sharecroppers, as many become practically unemployed for certain period of time and this poor section of the society suffers more than any other group. One flood is not only a single disaster event, but creates a cumulative loss from related small and medium sized events. The incidence and intensity of floods has grown alarmingly over the years, rendering the numerous coping mechanisms people have developed over the past decades no longer sufficient. This was tragically highlighted during the devastating floods of 2004. The damage caused by floods can at best be minimized and not altogether eliminated or in other words, there can really be no such thing as 'foolproof protection' or 'absolute flood control' for all magnitudes of floods.

Any kind of natural disaster needs proper attention and planning to reduce the multifaceted losses in terms of socio-economic, environment and health of affected population. A change to proactive management of natural disasters requires identification of risk, development of strategies to reduce that risk, and the creation of policies and programmes to put these strategies into effect. In order to establish a comprehensive approach to incident management, different type of activities like prevention, preparedness, response and recovery are required. The concept of flood management, therefore, aims for such planned measures which ensure profitable and economic utilization of the flood plains for the benefit of mankind and at the same time emphasizing that during high floods, there is no severe damage to the extent possible.

2. Objective

The main objective is to conduct research on the existing services available in disaster response and propose new services to improve disaster management situations.

3. Methods

In order to accomplish the aforementioned goal, following sequential methods have been used:

- Information about overall flood situation, its impact and consequence in Bangladesh from secondary and unpublished sources like media, government ministries and agencies, private sector etc.
- Study and review existing services provided by first aid and emergency kit.
- Identifying new services which can be added with existing disaster response system.
- Interviewing experts involved in disaster management.
- Design of a set of related components to provide these services.

4. Brief Overview on Flood and Flood Management Structure in Bangladesh

Disasters like flood, cyclone, and drought are common phenomenon in Bangladesh. "Its tropical monsoon climate is influenced by the Himalayan, the Assam, and the Burmese mountain ranges in the north and the northeast and the Bay of Bengal in the south. The strong monsoon rains, coupled with Bangladesh's location in the delta of the world's second largest river basin, make it extremely vulnerable to recurring floods. In addition to this, approximately 600 kilometers coastline of the country leave huge tracts of land open which causes destructive effects to cyclones and storm surges". Bangladesh has experienced seventeen highly damaging floods in the 20th century. Since independence in 1971, Bangladesh has suffered floods of a vast magnitude and required external emergency assistance in 1974, 1984, 1987, 1988, 1998 and 2004. In 1988, Bangladesh experienced the largest recorded flooding in the history and almost 70% of the country went under water for several months. Most of the districts were moderately affected (approximately 44% of all districts under flood) in 1988, while in the flood of 2004, though the area under flood was only one-third of Flood 1998, most of the districts were severely affected (almost 35 districts under flood). In recent years, improved early warning systems and preparedness measures have helped reduce the number of lives lost due to natural disasters in Bangladesh.



Figure 1: Location of Bangladesh in South Asian Region

5. Factors Contributing to Flooding Propensity

Despite all the flood control measures taken by the government and the money spent for building embankment and drainage system, the flooding propensity in Bangladesh is still increasing, so now the question arises how the level of

such damage can be reduced in future. In order to do this, all the factors (i.e. short and long term) influencing frequency and duration of floods should be analyzed and preventive measures should be taken to reduce future damage caused by floods.

"The possibility of flooding in an area can vary greatly with a change in the: (a) amount of runoff that results from rain in a watershed, (b) water carrying capacity of a drainage basin, and (c) change in land elevations with respect to riverbeds and sea level. An increase in runoff component of the hydrologic cycle in a watershed, a decrease in water carrying capacity of a drainage system, and a decrease in land elevations will increase flooding propensity in an area. Therefore, the flooding problem and the solutions to such problems can be analyzed in the context of these three fundamental parameters: runoff, water carrying capacity, and land elevation changes. What is needed is analysis of land use practices in watersheds during the last few decades that have the potentials to impact hydrodynamic behaviors of rivers, affecting three vital parameters mentioned above and all these factors have been elaborated below".

6. Disaster Management Structure in Bangladesh

Following the devastating flood of 1988 and the cyclone of 1991 and due to the old-age experience of dealing and coping with natural disasters, the Government of Bangladesh has established a multilayered institutional mechanism for disaster management, with formal recognition of the role of various stakeholders. "A series of inter-related institutions have been developed to ensure that planning and coordination of disaster episodes have been performed in accordance with the Standing Order on Disasters (SoD). Specific codes have been developed to address cyclones, floods, drought and famine. These codes are brought to the forefront when articulated at institutional levels from the Union Disaster Management Committee (lowest community level) to the apex institution level of the National Disaster Management Council headed by the Prime Minister. The development of Union, Pourashava, Upazila, District, City Corporation and National Disaster Management strategies are all broad-based and comprehensive". In order to manage the consequences of natural disasters, Bangladesh has developed institutional mechanism at the national and field levels. At the national level, there are three high-profile bodies for multi-sectoral coordination: the National Disaster Management Council (NDMC), headed by the Prime Minister; the Inter-Ministerial Disaster Management Coordination Committee (IMDMCC), led by the Minister of Food and Disaster Management; and the National Disaster Management Advisory Committee (NDMAC), headed by a specialist who is nominated by the Prime Minister. Besides, there is a Parliamentary Standing Committee on Disaster Management, whose function is to supervise policies and programs taken for disaster management all over the country. The main objective of these bodies is to provide policy and management guidance as well as coordination of activities relating to relief and rehabilitation. The principal body in disaster management is the Ministry of Food and Disaster Management (MFDM), which was known as the

Ministry of Disaster Management and Relief (MDMR) until 2002. It has the responsibility of inter-ministerial coordination, planning and response to disaster management.

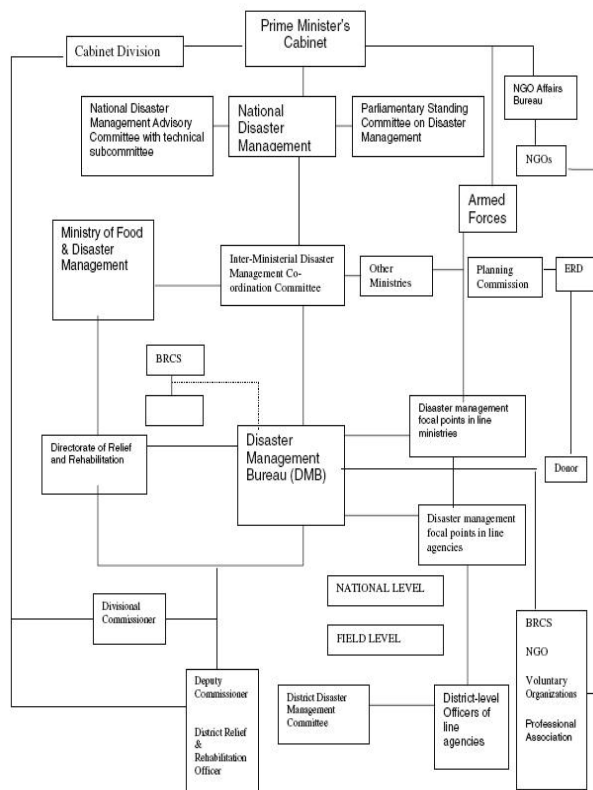


Figure 2: Organizational structure and institutional arrangements for disaster management at the national level.

7. Emergency Preparedness

In order to be prepared for unexpected natural and man-made disasters, some of the things can be done before, such as making an emergency supply kit and developing a family communication plan. Emergency preparedness is crucial because knowing what to do during an emergency is an important part of being prepared and it can make a huge difference when emergencies occur. In order to prepare for flooding as a part of emergency preparedness, the following things can be taken into consideration:

- Be prepared to evacuate and make a plan of how you will leave and where you will go if you are advised to evacuate.
- If you do not have a car, plan alternate means of evacuating.
- Plan places where your family will meet, both within and outside of your immediate neighborhood.
- Identify several places you could go in an emergency, a friend's home in another town or public shelter.
- Become familiar with alternate routes and other means of transportation out of your area.
- If time allows, move your valuables to higher places in your home.

- Unplug electrical appliances, moving them to higher levels, if possible. However, do not touch an electric appliance if you are wet or standing in water.
- If feasible, construct barriers to stop floodwater from entering the building and seal walls in basements with waterproofing compounds.
- Familiarize yourself with the terms that are used for flood warning.
- Get a portable kit of emergency supplies.
- Listen to weather broadcasts for updated information.
- Stay out of flood waters since the water may be contaminated or electrically charged.
- Stay away from downed power lines to avoid the risk of electric shock or electrocution.
- Do not return to your home until local authorities say it is safe since roads may be weakened and could collapse, buildings may be unstable, and drinking water may be contaminated.

8. Emergency Kit

There are lots of commercially prepared emergency/survival kits available in the market which differs in content. These kits include only the items that are essential during emergencies and it may be adjusted little bit to fit the environment. For example, if someone lives in a very cold place, then more stuff may be needed to keep someone warm. The most basic essentials that are needed to survive for short term are water, food and shelter. Human can live and function quite well for few days without food, but it is tough to exist without water in many environments. This is why water is one of the fundamental elements in emergency kit. Enough non-perishable food is needed to sustain for at least one day and those foods should be selected that require no refrigeration, preparation or cooking, and little or no water. Other necessary items include first aid, flashlights, radio, communication equipments etc. Flash light is needed to find the ways if the power is out and radios are essential to get news of the emergency which may change rapidly as events unfold. The following section describes some of these emergency kit and the items included in these kits.

9. Analysis of the Features of Some Devices Developed for Usage in Developing Countries

In order to provide communication and early warning services like maps and directions to flood victims in remote areas, dissemination of early warning during disasters, some kind of devices are required which are appropriate in social and economic conditions of developing countries, since the governments of those countries are not capable of investing a handsome amount for disaster management and most of the people in those countries are poor and illiterate. As a result, some devices developed for usage in developing countries are badly needed.

10. OLPC (One Laptop per Child)

One Laptop per Child (OLPC) is a project supported by the Miami-based **One Laptop per Child Association**

(OLPCA) and the Cambridge-based **OLPC Foundation** (OLPCF), two U.S. non-profit organizations set up to oversee the creation of affordable educational devices for use in the developing world. The project was originally funded by member organizations such as AMD, Chi Mei, eBay, Google, Marvell, News Corporation, Nortel, Red Hat, and Quanta. In the first years of the project, the Association managed development and logistics, and the Foundation managed fundraising such as the Give One Get One campaign. In 2010 the Association set up a new office in Miami under Rodrigo Halaby, and currently oversees deployment and support for the XO-1.5 laptop and its successors, and country partnerships. The foundation, led by Chairman Nicholas Negroponte, currently oversees development of future software and hardware, including the ARM-based OLPC XO-1.75 laptop and the OLPC XO-3 tablet.

At the 2006 World Economic Forum in Davos, Switzerland, the United Nations Development Program (UNDP) announced it would back the laptop. UNDP released a statement saying they would work with OLPC to deliver "technology and resources to targeted schools in the least developed countries". The project originally aimed for a price of 100 US dollars. In May 2006, Negroponte told the Red Hat's annual user summit: "It is a floating price. We are a nonprofit organization. We have a target of \$100 by 2008, but probably it will be \$135, maybe \$140." A BBC news article in April 2010 indicated the price still remains above \$200.

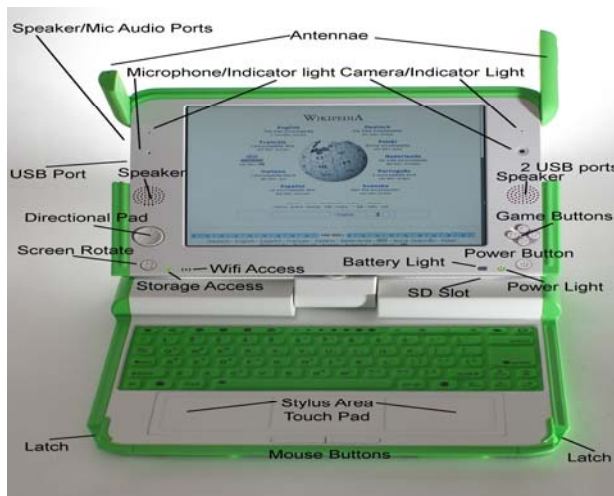


Figure 3: Production Prototype of OLPC Laptop

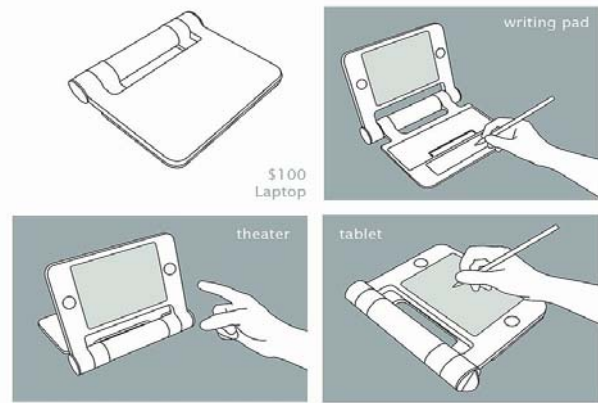


Figure 4: Prototype of OLPC Laptop

These rugged, low-power computers contain flash memory instead of a hard drive and use Linux as their operating system. Mobile ad-hoc networking is used to allow many machines Internet access from one connection. The XO-1 is low-cost, small, durable, and efficient. It will be shipped with a slimmed down version of Fedora Linux and a GUI called Sugar that is intended to help young children collaborate. The XO-1 includes a video camera, a microphone, long-range Wi-Fi, and a hybrid stylus/touch pad. According to Mary Lou Jepsen, CTO of OLPC, The design goals of the laptop are as follows:

- Minimal power consumption, with a design target of 2–3 W total power consumption;
- Minimal production cost, with a target of \$100 per laptop for production runs of millions of units;
- A 'cool' look, implying innovative styling in its physical appearance;
- e-book functionality with *extremely* low power consumption;
- The software provided with the laptop should be open source and free software".

11. Conclusion

Telecommunications technologies can play a vital role in disaster preparedness by carrying broadcast messages to radio and television, alerting the population before a disaster strikes and giving clear advice about what action should be taken. An effective disaster plan, combined with more efficient use of telecommunications, can help to minimize the impact of natural disasters, simplify the delivery of aid to victims, and help nations get back on their feet as quickly as possible.

But network coverage of most of the mobile operators in nations such as Bangladesh has not yet reached the remote and inaccessible areas and poor people can not also afford mobile phones. Bangladesh ranks among the most densely populated countries on the globe and its fixed-line teledensity remains the lowest in South Asia.

Although the overall situation has been improved to some extent by a rapidly expanding mobile market, the mobile penetration was still only a little over 16% at end-2009. Bangladesh has one of the most underdeveloped

telecommunications infrastructures in the world. So it is realistic to use any other means for communicating during disaster instead of telecom network in Bangladesh as it is not yet widely spread all over the country. The optimum use of all available means of telecommunication is indispensable to effective disaster preparedness. It is worthwhile to remember that the telecommunications network on which we all rely so unthinkingly is a fragile structure. The communications capabilities we take for granted every day can be lost in a matter of minutes during a disaster.

More effective use of existing technologies, as well as the implementation of new technologies is very much needed to improve disaster response and to save many lives. One of such new technology for the developing world can be OLPC which is comparatively inexpensive, requires very little power to operate, wireless mesh networking facility to communicate with other OLPC nearby and no internet connection is required to communicate between them and if any one of them has internet connection, others on the mesh network can share that facility.

12. Limitations

OLPC has been proposed as a disaster response tool in the emergency situation but not yet has been deployed in the real emergency situation as disaster response tool. Unless and until it is installed in the real world situation, its pros and cons could only be projected.

Another limitation is the absence of disaster management experts' opinion. Although substantial efforts have been spent to contact such experts, validation of this study by disaster experts remains a future work task.

13. Future Work

Socio economic conditions of developing or under developed countries are not the same as the developed countries of the world. Lots of factors like infrastructure, economic stability, technical aspect, skilled manpower etc. should be considered before implementing any technology in the developing countries. Lot of things can be done to make this study forward. The first thing would be to implement OLPC in the real disaster situation for building communication network and find out how much effective it is as a disaster response tool. Some research could be done to extend the capacity of OLPC Wi-Fi Repeaters. Although it works up to 1 km right now, it could be improved further. As much as the transmission range increases, the wireless mesh network will be larger. New features like GPS tracking and navigation can be added with the OLPC which may help the affected people of remote areas to find their way out towards a safe destination. OLPC users in a mesh network can communicate among themselves through text messaging or voice; can share files or documents with the help of existing software. In addition to that a central database can be created with the help of all OLPC users working in different flood affected areas and it may be maintained by Central Flood Control Room. Database will contain information about the real scenario of those areas, such as how much people have been affected so far, how much relief

required, how much damage done to infrastructure etc. It should be updated on daily basis and it will help all government and non government organization working on those areas for relief and disaster management which in turn will minimize the sufferings of distressed people. All the above mentioned works can be considered as future task in this arena.

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