

CREATING A COMMUNITY BASED DISASTER RISK MANAGEMENT SYSTEM THAT HIGHLIGHTS RESPONSE METHODS AND RESOURCE ALLOCATION

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Abstract: This paper introduces the use of information technology (IT) in helping a community respond to disasters. The IT solution is a Community Based Disaster Response System (CBDRMS) named PANDORA2 which highlights disaster response and resource allocation for *barangay Banaba* in San Mateo Rizal with the help of Buklod Tao, Inc. -- a non-government organization. To help the community respond effectively during flood and storm disasters, the project aims to support disaster response by managing their current disaster resource allocation and providing post disaster assessments, as well as additional enhancements for disaster preparedness. The project aims to use the concept of mapping using Google Maps technology to plot evacuation routes, facilitate in management of relief good distribution at the evacuation center, improve the existing process of reporting of missing persons, monitoring of the river's water level, and releasing of evacuation warning levels using a push-and-pull SMS messaging technology. The current activities and disaster response processes of Buklod Tao for *barangay Banaba* were studied, supported by interviews with different concerned entities to know which processes need enhancement or improvement. Based on the existing activities of Buklod Tao, findings from other benchmarked community-based IT solutions, and research about the concepts of community-based disaster response efforts, a set of new business process for disaster response was proposed to be used in the CBDRMS solution.

The project is a work-in progress with some of the system's modules currently being developed. After fully developing the project, it is to be implemented as a continuation of PANDORA1, a project focusing on the disaster mitigation and preparedness phase of the Disaster Management Cycle to *barangay Banaba* with the intervention of Buklod Tao, Inc. This way, the project is aimed to serve as a model for national and local government units and non-government organizations in using ICT to help vulnerable communities respond during disasters.

Key Words: Community-based, Disaster Management, Disaster Management Cycle Disaster Response

1. INTRODUCTION

“Disasters are a part of everyday life and they are increasing” (International Federation of Red Cross and Red Crescent Societies, 2010). Be it a natural or a man-made disaster, disasters could happen anywhere in the world. No matter how poor or rich a person is, no one is safe when a disaster strikes, it is everyone’s business. A disaster could strike anytime, anywhere, and when you least expect it.

According to International Federation of Red Cross and Red Crescent Societies, 40% of the natural catastrophes occur in the Asia Pacific region which makes it a disaster-prone region with a disaster occurring daily (at minimum) in the Asia Pacific. Because of this, there is a need for a worldwide solution to reduce the risks brought about by disasters. One solution was developed during the World Conference on Disaster Reduction held last 2005 in Japan

where world leaders constructed the Hyogo Framework for Action 2005-2015. The framework aims to deploy a standard and internationally-recognized set of approach to decrease vulnerabilities and presence of risks in hazards; to make nations resilient to disasters. In the framework, different world leaders are ordered to prioritize the implementation of disaster risk reduction locally and nationwide.

As a response to this Framework, the Philippine Disaster Risk Management Act of 2008 was created. As a result of the Act, National Disaster Management Council was created to be the overseer to develop and implement a National Disaster Risk Management Plan. The act orders the decentralization of disaster management strategies down to the *barangay* level (Senate of the Philippines, 2008); that a community-based approach to disaster risk management must be used. This means that nongovernment organizations, private sectors, community-based organizations, and community members must help each other in doing disaster risk management efforts.

A top-down approach is deployed since the disaster risk reduction strategies are disseminated down to local *barangays* and community-based disaster risk management is encouraged to be practiced in the local communities. Different communities in the Philippines have been practicing efforts in reducing the risks of disasters, and one community is *barangay Banaba* in San Mateo Rizal handled by an NGO, Bukod Tao, Inc. In partnership with Center for Disaster Preparedness (an NGO), Buklod Tao has the *Banaba* Disaster Risk Reduction Project implemented in *barangay Banaba*.

In line with the *Banaba* Disaster Risk Reduction Project, the Disaster Management Cycle is the main concept being followed in the project being discussed in this paper. The first phase of the Cycle is Disaster Mitigation followed by Disaster Preparation, Disaster Response, and Disaster Recovery. The Community Based Disaster Risk Management System (CBDRMS Pandora 2) which focuses on Disaster Response is a continuation of a similar project (Pandora 1) which focused on Disaster Mitigation and Preparedness Phases of the Cycle.

CBDRMS Pandora 2 is to help *barangay Banaba* in responding during flooding and storm disasters by managing their current disaster resource allocation specifically forecasting how many relief goods are to be needed by evacuees, alerting partner NGO donors about the forecast, and managing the relief good distribution. The CBDRMS also provides post disaster assessments to all Buklod Tao volunteers to know which improvements could be made in responding to future storm disasters, provide reporting of missing persons, as well as additional enhancements for Disaster Preparedness by using Google Maps technology to plot evacuation routes for the actual rescue, monitoring of the river's water level for possible evacuation or warning alerts, and releasing of warning levels using a push-and-pull SMS messaging technology both to residents and other involved entities.

2. METHODOLOGY

Rapid Application Development has been used in creating the system. It is a type of methodology that hastens the system development process. RAD relies heavily on prototyping and user involvement which results to the modification of the system based on the different feedbacks given by the user. (Shelly, Cashman & Rosenblatt, 2009)

In developing the system, existing business processes for disaster response of Buklod Tao, Inc. were studied. The project being continued—Pandora Community Based Disaster Risk Management System, was also studied, and interviews with concerned entities were also conducted. Not only that, but the existing business processes of Buklod Tao, Inc. for disaster response were also studied to know which Disaster Response Phase activities needs to be improved or added, then the proponents designed an improved business processes for Buklod Tao, Inc's disaster response efforts, and developed a community based disaster response management information system following the proposed business processes.

The standard number of relief goods that the proposed system will use is benchmarked from the Recommended Dietary Allowances for Filipinos for Energy and Specific Nutrients of Food and Nutrition Research Institute Department of Science and Technology (FNRI DOST). Thus, the following formula was used in creating the Resource Allocation Module of the System.

Getting the total amount of formula milk needed by infants 0 week - 6 months old to meet their energy and nutrient requirement for 1 day:

$$a \times 110 \text{ grams} = \text{amount of formula milk in grams for } a \text{ infants}$$

Getting the total amount of formula milk needed by infants 6 months to 12 months old to meet their energy and nutrient requirement for 1 day:

$$b \times 200 \text{ grams} = \text{amount of formula milk in grams for } b \text{ infants}$$

Getting the total number of diapers that infants 0 week to 12 months old need for 1 day:

$$(a + b) \times 12 = \text{number of diapers needed for } a \text{ and } b \text{ infants in pieces}$$

Getting the total number of bottle feeders for 1 day of infants 0 week to 12 months old:

$$(a + b) \times 1 = \text{number of bottle feeders needed for } a \text{ and } b \text{ infants in pieces}$$

Getting the total number of diapers that children 2-3 years old need for 1 day:

$$c \times 6 = \text{number of diapers needed for } c \text{ children in pieces}$$

Getting the total number of adult diapers that elderly usually 60 years old and above with incontinence, amnesia, or other related problems need for 1 day:

$$g \times 6 = \text{number of adult diapers needed for } g \text{ elderly in pieces}$$

Getting the total amount of water for a & b to meet their daily energy and nutrient requirements:

$$(a + b) \times 1 = \text{amount of water in liters for } a \text{ \& } b$$

Getting the total amount of water for d , e , f , h to meet their daily energy and nutrient requirements:

$$(d + e + f + h) \times 2 = \text{amount of water in liters for } d, e, f, \text{ \& } h$$

Getting the total amount of rice for d to meet their daily energy and nutrient requirements:

$$d \times 0.2 = \text{amount of rice in kg for } d \text{ children}$$

Getting the total amount of rice for e , f , & h to meet their daily energy and nutrient requirements:

$$(e + f + h) \times 0.5 = \text{amount of rice in kg } e, f, \text{ \& } h \text{ persons}$$

Getting the total amount of instant noodles for d & e to meet their daily energy and nutrient requirements:

$$(d + e) \times 3 = \text{number of instant noodles in pieces for } d \text{ and } e \text{ persons}$$

Getting the total amount of instant noodles for f to meet their daily energy and nutrient requirements:

$$f \times 7 = \text{number of instant noodles in pieces for } f \text{ adults}$$

Getting the total amount of instant noodles for h to meet their daily energy and nutrient requirements:

$h \times 5$ = number of instant noodles in pieces for h women

Getting the total amount of instant noodles for d , e , & h to meet their daily energy and nutrient requirements:

$(d + e + h) \times 1$ = number of canned sardines in pieces for d , e children and h women

Getting the total amount of instant noodles for f to meet their daily energy and nutrient requirements:

$f \times 2$ = number of canned sardines in pieces for f adults

Getting the total amount of powdered milk for d , e , f , & h to meet their daily energy and nutrient requirements:

$(d + e + f + h) \times 30$ = amount of powdered milk for d , e , f , & h persons in grams

where: a = number of infants 0-6 months

b = number of infants 7-12 months

c = number of children 1-3 years old needing diapers

d = number of children 1-6 years old

e = number of children 7-12 years old

f = number of adults 13 years old and above including elderly

g = number of elderly needing adult diapers; usually 60 years old and above

h = number of pregnant and lactating women

3. RESULTS AND DISCUSSION

Based on the existing activities of Buklod Tao, findings from other benchmarked community-based IT solutions, and research about the concepts of community-based disaster response efforts, a set of new business process for disaster response was proposed to be used in the CBDRMS solution.

CBDRMS was divided in two sections: disaster preparedness, and disaster response. The Disaster Preparedness Module handles one main activity which is the monitoring of the river water level. The river water level monitoring is concerned about the releasing of the different warning levels. This module would need the SMS code with the corresponding *San Mateo* river water level. This SMS code would be sent by the watcher assigned near the *San Mateo* bridge who is constantly monitoring the water level with the use of the height marker along the bridge's pillar. After the code has been sent, the code will be converted to the corresponding water level and the vulnerability map will be updated by placing a color-coded indicator or marker on the river illustrated on the map (ex: SMS code 17 means the water level is 17 meters high and means a green color indicator on the map).

The escalation of the water level is reflected on the changing colors of the indicator on the vulnerability map which aids the Emergency Operation Center to release warning levels. It would help the Emergency Operation Center be informed when they would release a certain warning level and when they would deploy their rescue teams. After receiving updates from the watcher and seeing the river indicator change its color in the vulnerability map, the Emergency Operation Center releases a certain warning level and is announced to the rescue

teams, Ka Noli, Barangay Captain Renato Sulit, the different partner NGOs, and the community members through SMS.

For the rescue teams, this SMS alert message would serve as their signal as to when to deploy to rescue. For Barangay Captain Renato Sulit, the water level SMS alert would be his signal to sound the siren. For the partner NGOs, the SMS alert would serve as their guide so that they would be able to decide when is the right time that they would deliver the relief goods to Buklod Tao. For the community members, the SMS alert would tell them what actions they have to do (if they have to prepare for evacuation, and other similar reminders).

Another part of the Disaster Preparedness Module is the post disaster assessment where each Buklod Tao volunteer involved in the disaster is asked to do an assessment (answer a survey) of his performance during the disaster, as well as a Focus Group Discussion to talk over which improvements from the past disaster will be added in their plan on responding for the next disaster to come.

On the other hand, two modules fall under disaster response: Resource Allocation Module, and Report a Missing Person Module. Resource Allocation handles 5 activities: (1) verifying the persons admitted to stay at the evacuation center to have a more organized distribution of relief goods and to make sure that relief packs are distributed in a 1:1 ratio (the number of family members are according to the quantity of relief goods inside the relief pack, and that per family has 1 relief pack to ensure that each evacuee meets their daily nutritional requirement); (2) forecasting how many relief goods are needed to be requested to partner NGOs as donations after evacuees have entered the evacuation center by making use of the community profile; (3) handling of relief goods by recording the number of relief goods before and after delivery, and before relief pack distribution as well as how many families received a relief pack after distribution to make sure that every family has received a relief pack and if in short of relief goods; (4) disseminating of information to the partner NGOs wherein a message could be sent to the other NGOs for relief good “replenishment” for the distribution of the relief packs itself; (5) and disseminating information to the local government that a certain NGO of Buklod Tao has given donations to them.

The Report a Missing Person Module provides a reporting facility when community members inform Buklod Tao’s rescue teams to find their missing family members. A community member sends an SMS message to Buklod Tao with a specific format so that Buklod Tao could inform their rescue teams to search for that reported person. After receiving the SMS message, Buklod Tao blasts out an SMS message both to the local *barangay* and to the rescue teams. The local *barangay* needs to be informed so that they would also know who of their citizens are missing and record how many persons are missing. The rescue teams need the SMS message so that they will know where and who to search.

In most of the information relayed to the concerned users, push-and-pull SMS messages (messages being sent to the partner NGOs from the system software and vice versa) are produced. For the local *barangay*, they would receive SMS messages about the water level alert, the donations given to Buklod Tao, and the reported missing persons by the community members. For the partner NGOs of Buklod Tao, they would be receiving SMS messages about the water level alert, and the forecasted relief goods courtesy of Buklod Tao. After receiving the request for donations, they will reply the relief goods that they pledge to donate to Buklod Tao. The rescue teams would be receiving SMS messages about the water level alert, and the reported missing persons that they need to search and find.

4. CONCLUSIONS

The project is a work in-progress with the disaster preparedness module, SMS reporting, and plotting of maps currently being developed. After fully developing the project, it is to be fully integrated to Pandora 1. Specifically, the suggested evacuation routes which are changed according to each water level being released as a result of real-time monitoring update via push-SMS messaging will be connected to the vulnerability map produced in Pandora 1. The vulnerability map is an output from Pandora 1 which divides the area of *barangay Banaba* according to different color-coded sections. Each color indicates a certain hazard and vulnerability (risk) level present on that area which is helpful in knowing which areas are the most vulnerable to be flooded first when a disaster happens. This map is very important to be tied with the evacuation routes that Pandora 2 will produce because it will be used by the rescue volunteers during the disaster.

Another continuation of Pandora 1 is the use of the community profile gathered in Pandora 1 to be used in the resource allocation of Pandora 2. Information about the evacuees (number of evacuees, gender, age, and other needed information) will be needed to know how many relief goods are to be forecasted to the partner NGO donors. The community profile is needed to ensure that each evacuee belonging in a family is counted and gets the needed relief goods according to his daily nutritional requirement during the stay in the evacuation center as well as upon returning back to their homes.

An area that could be further researched on this project is regarding the connection of a machine or another system (ex: the DOST-Nationwide Operational Assessment of Hazards [NOAH]) that is directly-connected to the system project which provides regular real-time river water level updates thus surpassing the push-and-pull SMS messaging technology coming from the volunteer river watcher.

This project not only enables Buklod Tao, Inc. to benefit with regards to their Disaster Management Program for *barangay Banaba*, but it could also help the residents of the community in evacuation and rescue during disasters. This project could also serve as a model for national and local government units, and non-government organizations in using ICT to help communities to respond during disasters and this could also serve as a reference in furthering studies about disaster response in communities for the academic community.

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