



PROJECT YOLO: A Disaster Response Coordination System

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Abstract: Project YOLO is a Disaster Response Coordination System that assists MCDRRMO in exchanging essential disaster information and coordinating with the supporting agencies. Concepts such as disaster management, information quality, information visualization, crowdsourcing and coordination are integrated by the system. Disaster management consists of four phases, however, the system only focused on the response phase. Also, information quality allows the system to improve the quality of information and avoid insufficiency. Information visualization is being used to present data about the status of the area with the use of photos. Crowdsourcing, with the help of mobile technology, enables a source of reliable information and is composed of high-quality information. Coordination allows the involved stakeholders to communicate and collaborate when performing disaster response activities and have available information to identify opportunities.

The researchers are currently using the agile methodology in completing the system, it follows the software development life cycle which includes requirements gathering, analysis, design, coding, testing and delivers a prototype and waits for the customer feedback. It is often used for short-term projects with a team that wills to achieve a successful project by exerting sufficient effort to complete it. The team dedicated the first weeks of project development in analyzing the organization's background, problems, processes, and has come up with a proposed solution from these pieces of gathered information.

Project YOLO will provide advantages to the involved agencies in disaster management especially MCDRRMO. Numerous instances of miscommunication and information errors will be avoided, thus, a more efficient and dependable response will be pooled for the city's residents. The project can also be a basis for other local government units that wish to improve disaster response coordination. Other units consider ICT to be a solution when it comes to improving operations in disaster management and government units as a whole.

Keywords: Disaster Management; Disaster Response; Coordination; Information Quality; Crowdsourcing

1. INTRODUCTION

Generally, disaster is considered a "low probability-high impact" event (Burstein, 2007). It challenges both societies and

governments. Disaster challenges government in terms of their legitimacy by bringing up disruptions and calling attention to their limits. Likewise, it also leads to deaths, damage and destruction to every part of



society. It's a big challenge to the poorer countries that they see disaster to wipe out years of their development and takes years to take it back (Egeland, 2006).

There are natural disasters that have struck all parts of the Philippines for a long time now, and strong typhoons were one of those tragedies that have caused a huge number of death and destruction. Since the 1990, five most destructive typhoons that have hit the Philippines have affected a total of 23 million people (Alojado, 2010).

A report made by the World Health Organization (2009) says that there was a tropical storm last September 2009 that is called Ondoy or also known as Ketsana internationally, has affected a total of 4, 918, 503 individuals in the country. It has been reported that Ondoy has brought a month-value of water in a 12-hour period, breaking the previous record set in the year 1967. This tremendous disaster has caused several landslides and flooding all around the country.

According to the World Confederation for Physical Therapy, disaster management can be defined as the organization and management of resources and responsibilities for handling all humanitarian aspects of emergencies. All organizations responsible for handling disaster management operations follow the disaster management cycle which includes mitigation, preparedness, response and recovery.

According to an article written by Comfort on 2007, the disaster response phase aims to provide mass care. Mass care basically includes rescuing victims from danger and stabilizing the physical and emotional condition of the victims such as providing food, shelter and first aid. Coordination among government agencies in this phase is

highly-required for them to be able to save human lives and decrease destruction.

During disaster response, information quality plays an important role in responding to disaster. According to Lee (2002), the accessibility of information from various sources by managers and information users have increased the need for and awareness of high quality information in organizations. Decisions are based on available information. If the information given is inadequate whether it encounters problems in communication or the integration of data, the decision based on that is more likely to fail. The whole process of information exchange affects the response initiative itself. Crowdsourcing is another concept that was used in validating the quality of data and the reliability of source. When all the required information have been consolidated, information visualization will now be used to serve as an effective means of representing huge amount of data that can easily be understood by its readers.

Using all of these concepts the group's working definition of disaster response is being able to attend to people in need using high-quality data to focus on communication and efficiency. Coordination between organizations is a huge part of disaster response because organizations depend on each other for information regarding the situation of areas and the affected people. Communication is a big process that the organizations need to ponder on and prioritize. The proponents figured a way to maximize current technology trends to aid in disaster response and enable functions that will focus on information quality and coordination.

The Malabon Disaster Risk Reduction Management Office (MCDRRMO) is



responsible for monitoring the situation in Malabon city and its barangays. The MCDRRMO is under the governance of the Public Safety Transportation Management Office (PSTMO). The office operates on a 24/7 basis to ensure the safety of all the communities. The MCDRRMO can be categorized into 3 different branches namely operation, administrative training, and research planning. MCDRRMO was established in the year 2010. Currently, they have a total of 21 barangays and they have 21 CCTV cameras.

2. METHODOLOGY

The proponents are using the agile methodology that follows the software development life cycle which consists of these following steps: requirements gathering, analysis, design, coding, testing and delivers a prototype and waits for the customer feedback. Agile methodology is often used for short-term projects with a team that exerts sufficient effort for the project to be a success (Sharma, S., Sarkar, D., & Gupta, D., 2012).

The team studied the disaster management processes of MCDRRMO. The organization governs the disaster management processes in Malabon City which is prone to flooding. Problems were also identified through interviews and further analyzed through benchmarking with other existing disaster systems. Disaster response was a focus for the team because the information need is crucial in this phase of the cycle. The coordination that existed in the current system was presenting information problems. The team developed and planned an ICT solution for MCDRRMO and the features and modules were patterned and checked if it will solve the problems identified.

The modules being constructed by the proponents are namely *Disaster Information Board, Information Exchange, Task Manager, Disaster History*. First off, the *Disaster Information Board* provides a common operational picture of the current situation to all the involved agencies to avoid redundancy of response efforts. The common operational picture is where the agencies can view the details, status, and actions taken on the different situation in the city. This module is supporting agencies to know the information they can work with and recognize opportunities which they may contribute on. This module also enables the different stakeholders to have a centralized database containing the pieces of information relating to the status of each incident which includes but not limited to the water level, evacuation centers and the number of individuals in each evacuation center. These pieces of information are essential to the different agencies and MCDRRMO to help them in providing victims the adequate response and in the relief activities they need. The status of each rescue team that responds to an incident in each barangay is being updated from time to time to avoid duplication of response operations. This module includes an infographic feature, which helps the MCDRRMO to better understand the situation thru data visualization. Data visualization is a pictorial representation of data that may take the form of an animation, a cloud, a map, a chart, or a simple picture (Reeves, 2009). The dynamic infographic contains information about the current disaster such as the flooded areas, number of evacuees in each evacuation center and the obstacles the rescue teams have encountered. These pieces of information can greatly support the MCDRRMO and other agencies in providing the adequate response and monitoring the current situation.



The *Information Exchange* module provides a better reporting method through the incorporation of information quality by standardizing the format of reporting and capturing the required essential information needed to perform an assessment of the disaster. It also enhances the information exchange between organizations by adding this module as a new means of communication and implementing this module as the preferred communication channel until available. The module implements templates for reports. It enables a better identification and collation of the information contained in the report. The templates also ensure that the information received has reduced the time consuming process of collating data. The module was also able to filter the reports to detect duplications, inconsistencies and incompleteness. It helps the organization to have a unified report regarding an incident or area. Additionally, the system not only enables agencies and barangays to view different support requests but also highlights the priority requests depending on the nature of organization. The prioritization of reports were handled by the system through the use of a formula, it considers four factors in evaluating the urgency of the report, these are the level of flood, number of individuals, type of victims and urgency. Distinguishing the height of the flood, the total number of individuals and the various types of victims in each area can aid responders in knowing which situation is the most urgent one, and quickly deploy teams to their assigned response operations. Upon conducting the interview with the users of the system, another factor, urgency, was considered by the proponents to acknowledge subjectivity in prioritizing requests. The constructed formula is as follows:

Formula:

$$\text{Weight/Rating} = \text{Partial Score} + \text{Partial Score}(\text{Level of Flood}) + \text{Partial Score}(\text{Number of Individuals}) + \text{Partial Score}(\text{Type of Victims}) + \text{Partial Score}(\text{Urgency}) = \text{Total Score}$$

The *Task Manager* focuses on allocation of tasks for the different agencies. This helps MCDRRMO to track the status of the rescue effort made by the different agencies. This module can help in allocation of tasks better and MCDRRMO can track the operations of the different agencies to avoid redundancy of rescue operations. The process of pre-positioning resource teams is also being supported by the system. Once the weather forecast is received, MCDRRMO and agencies can create their teams in the system ready to be deployed to attend to different aid requests. This also enables accessibility of information regarding the status of the deployed teams in different areas to reduce duplication of response efforts.

The *Disaster History* module serves as a documentation of the full report of a disaster. This includes all the details of a disaster (e.g. impact level, number of health casualties, number of families affected, and etc.) and the details of the response activities (e.g. what actions are made, number of relief goods distributed, what went wrong and etc.). These reports are filterable by date or searchable by name of disaster for easy scanning of the documented disasters. Reports are being generated even if the disaster response phase is still going on. It can also help to react to adhoc reports that are needed in the middle of the disaster.

3. DISCUSSION

Maintaining coordination is the primary challenge during disaster response. The proponents identified problems that cause



MCDRRMO to perform inappropriate response effort for different incidents.

The first problem identified by the proponents is the delay in executing response operations. Incident reports are recorded in a logbook; the problem comes in when these reports are recorded in a manner that the one who would use the information to assess it and determine the resources needed is having a hard time to collate and analyze it. Extraction of data in these logbooks takes time to have an adequate decision or assessment above the incident. Summarizing and connecting fragments of information relating to one event consumes the response time.

Another problem identified is the duplication of response efforts. Two causes of these problems are the difficulty in establishing shared situational awareness, and the difficulty in balancing response efforts. Shared situational awareness simply means that MCDRRMO and its lead agencies should have a common picture of the whole situation. There's difficulty in establishing this since information is not always available; agencies must have efficient access to current information. Moreover, difficulty in balancing response efforts stirs up to having a duplicated effort. This is when response efforts of MCDRRMO are also done by the agencies. Other problems encountered are idling of responders and the difficulty in generating summary reports.

With these identified problems, the proponents are developing a system that would help in the coordination among agencies in the disaster response phase. Project YOLO, a disaster coordination response system, can be used through web browsers or mobile-web browsers. MCDRRMO officers, higher officials and all other agencies

that are involved during the response phase will use the web application. On the other hand, the mobile side of the system will be used by traffic enforcers, response teams, and barangay representatives. The system is composed of four modules. The first module is the Disaster Information Board module which uses data visualization, specifically infographics to summarize the whole situation. This module can also help agencies to know what information they can work with and recognize opportunities which they might contribute to. The system also includes Information Exchange Module to provide better reporting method through the incorporation of information quality by standardizing the format of reporting and capturing the essential information needed to perform an assessment. Additionally, the Task Manager module is included which focuses on allocating of task for the different agencies. This would also enable accessibility of information regarding the status of the deployed teams in different areas to reduce duplication of response efforts. Lastly, the Disaster History module serves as a documentation of the full report of a disaster. This includes all the details of a disaster (e.g. impact level, number of health casualties, number of families affected, and etc.) and the details of the response activities (e.g. what actions are made, number of relief goods distributed, what went wrong and etc.).

In relation to the mentioned modules, the factors to consider in accurately prioritizing the reports will follow a table where possible inputs have been carefully sorted to corresponding ratings.

Rating	Level of Flood (ft.)	Number of Individuals	Type of Victims
4	1-2	1-3	None



3	3	4-6	None
2	4	7-9	Pregnant
1	5-6	10-12	PWD, Traumatized, Elderly, Infant

Each category is given a weight, the category, level of flood, is given 30% of the whole, number of individuals, 10% and type of victims 30%, while urgency is given 30% of a hundred. The weight will be divided by the rating, so each category will have a partial score, these partial scores will all be added to gain the total score, the total score will be used to identify which request is the most urgent one.

For example, the level of flood is 2 ft., it falls under the rating of 4, and this category has a weight of 30%. The number of individuals reported seen in the area is 3, which falls under the rating of 4 as well, and there are no PWD, pregnant, traumatized, elderly, infant among the individuals, which also falls under the rating of 4. The user may choose if this particular request falls under which rating, assuming the user has chosen 4, being the least urgent request, applying the formula in this example is as follows:

$$30\%/4 + 10\%/4 + 30\%/4 + 30\%/4 = 25.25\%$$

The total score of this example has an equivalent of 25.25% and falls under the rating of 4, which means this example is considered a low priority request. This formula was tested and it has provided results that were indeed helpful for the system to successfully manage the reports.

4. CONCLUSIONS

Project YOLO focused highly on the response phase of managing a disaster. The project is still developing in the mobile application side that will be very usable to people in the field. All other agencies will be able to maximize the features and functions of the project for their own use, but the system focuses on coordination between agencies in Malabon.

The preparedness phase was also considered in this research, however, not concentrated on. Putting more attention to the preparedness phase of a disaster may be one of the areas wherein this paper can be more researched on. Another area where the project can be studied further is integrating or accommodating data from the different national agencies and including in the system processes. It will help MCDRRMO to focus more on the more important parts of the disaster response.

Generally, Project YOLO will benefit the agencies that are involved in disaster management especially MCDRRMO. A lot of miscommunication and information errors will be avoided, thus, a more efficient and reliable response will be provided for the locals of Malabon. The project can also be a basis for other local government units that wish to improve disaster response coordination. Other units consider ICT to be an option when it comes to improving operations in disaster management and government unit as a whole.

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