Development of prioritization algorithm for community evacuation system

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Abstract – *The proponents discussed the study within the municipality of Rosario, Cavite with the most-commonly encountered problems. The researchers decided to develop a prioritization algorithm in the town's web-based Community Evacuation System. The proposed study developed a fast and reliable new unit of prioritization algorithm that will be based on different aspects such as the amount of population, land measure of disaster prone areas, and rate measures of the disaster prone areas. The methodology includes developing the proposed algorithm, and studying the existing processes of developing algorithms. The validity of algorithm was tested to see if it will be given positive ratings in terms of effectiveness. In the summary of the project's findings, the algorithm, and system evaluation the system has an extremely satisfied rating. In relation with the evaluation result, the proponents conclude that the system successfully achieved its objective.*

Keywords – *Algorithm, APARA, community evacuation, prioritization, prioritization algorithm.*

Introduction

A community evacuation area is one of the most common measures used in disaster preparedness (Government of British Columbia, 2009). This is the most common way in preventing casualties during and after a disaster. However, many lives have been lost due to an evacuation area being limited and very unsafe to move in.

Community evacuation is also the permanent solution to avoid massive casualties when a disaster strikes in a certain community (Renne, 2012). However, the problem is that municipal officials do not have enough people and equipment to move the community to safety. In such cases, they need to collaborate with officials from all barangays to identify their statuses before any disaster strikes. Another problem is that municipalities do not have enough manpower to monitor the status of every barangay, and the manpower to organize the information necessary so that the municipal government can decide certain measures. In this desperate kind of situation, loss of life is very likely. For quick response to these situations, a Community Evacuation System is ultimately necessary to prioritize certain communities, so that the municipal government can focus its limited manpower on them and safely move citizens into evacuation areas.

A Community Evacuation System will help municipal personnel to specify the prioritized community and the reason why it is the first community to be evacuated. The system will provide reliable information based on the gathered community data, and the decision will also be based on a certain community's level of priority.

The Philippine Disaster Management System implements a "First come, first served" policy when it comes to prioritization in community evacuation. It means that wherever a community has accessibility, it will be served immediately. However, communities without the capability to request for an immediate evacuation will have to wait.

Methodology

The study uses the process of APARA, or, “A Priorization Algorithm for Resource Allocation” as a reference for its methodology. The De La Salle University developed a prioritization algorithm for an undergrad thesis related to disaster preparedness. Entitled, “A Prioritization Algorithm for a Resource Allocation”, it deals with answering the question, “what community should we first provide resources to?”. The answer to this was a new prioritization algorithm for community resource allocation. In their framework, algorithms had been proposed based on two aspects: human nutritional factors and economic factors.

These two factors have been considered based on how these affect the vulnerability of a community (Brown, 2012). The algorithms were implemented in the municipality of Lian, Batangas. The methods of testing that were performed to gauge the readability of the algorithms results were though user acceptance and simulated testing using the APARA reusable libraries. The simulated testing was made possible through the creation of reusable java libraries for the prioritization algorithms.

This resulted in the generation of priority levels that changed during the simulation. However, these same results were said to have inconsistencies. This determines that they are non-replicable, but can still be used for further testing in other community scenarios.

The modified waterfall model was followed as seen in figure 1. It provides a step flow in finishing each of the phases. Its overlaying structure allows phases to be done concurrently and allow revisions of previous phases if an error or a better solution is found.

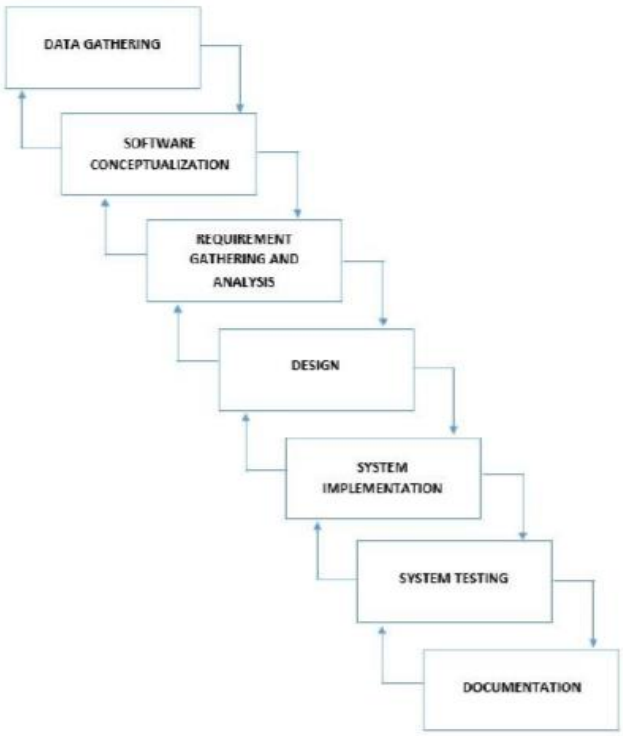

Figure 1. Modified waterfall or APARA

This modified waterfall model is used as a basis of the suggested resource allocation. It has been incorporated to the ACID system, utilizing the output generated from the said system to create barangay prioritization. This would suggest the amount of resources to be allocated to each barangay. The resources covered by the proposed algorithm were food items, while ACID is a decision support tool which manages the info on resources available for use of a barangay as well as evacuation centers.

Results and Discussion

The first set of test cases were conducted in all barangays, meaning that all barangays had their values subject for changing. The second set of test cases were done for one barangay only, particularly a barangay which was moved between the topmost, middle, and bottommost rankings. This test was conducted so that the researchers could observe the barangay movement across the ranks, as well as to check for inconsistences in the resulting priorities.

These results were tested through simulation. The result was calculated by getting the head count population of every barangay, then dividing it by the total amount of children per barangay. The proportional constant of the flood rate, defined as low-middle-high, are then taken into account, resulting in the barangay's evacuation percentage.

However, certain factors have to be still carefully taken into account:

1. The ratio and proportion of the barangay head count and the barangay population of children must be considered. Even if the head count population is higher than the population of children, the population of children must still be prioritized.

2. The algorithm contains data that would sort the list based on high flood rates instead of its original sorting measure. In that case, the system will use an "If Statement" in validating and comparing each barangay based on flood rate.

Conclusions and Recommendations

Based on the output of the research final result in prioritizing the barangays, the proponents conclude that the evacuation percentage has been prioritized properly.

In order for the algorithm to become more advanced, the aspects that are being considered should be improved:

1. Barangay equipment and utilities should be improved in order to optimize the use of the new prioritization algorithm and the improvement of Rosario, Cavite's community evacuation system.
2. The prioritization algorithm could also take into account transportation and travel time per barangay in making calculations.

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