UNIVERSITI TEKNOLOGI MARA

JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM 2024

PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIIICaS 2024)

"Flourish and Nurturing Sustainable Innovation for a Prosperous Nation"

JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM

Editorial Board

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Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.

Foreword Rector

Assalamualaikum warahmatullahi Wabarakatuh, Salam Sejahtera, Salam Malaysia MADANI and Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most Merciful.

It is a great honor to welcome you to the Johor International Innovation, Invention, Competition, and Symposium 2024 (JIIICaS 2024). This event connects various disciplines, focusing on education and engaging educators, students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and determination to turn those ideas into reality. The remarkable projects showcased today highlight the dedication and spirit of all participants. Initiatives like this not only explore new technologies but also cultivate skills and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor Branch, we are fully committed to fostering a dynamic culture of innovation, promoting the commercialization of new products, and encouraging meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all sponsors, judges, the College of Computing, Informatics and Mathematics, UiTM Pasir Gudang Campus as the event organizer, as well as to the researchers and participants for their hard work in making this event a success. Let us continue striving for innovation and excellence. May the ideas presented today inspire us and lay the groundwork for future achievements.

Thank you.

Associate Professor Dr. Saunah Zainon
Rector
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(A-ST116) RESOURCE DISTRIBUTION SYSTEM POST-DISASTER

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ABSTRACT

In the aftermath of disasters, resources play a crucial role in aiding affected communities who have likely suffered substantial losses. The assistance provided can be immensely beneficial, particularly for those in dire need. Post-disaster resources are limited and require careful distribution to maximize their impact. However, organizations involved in relief efforts may face difficulties in distributing resources efficiently. Numerous organizations operate independently without coordinating with each other, leading to duplication of efforts such as resource oversupply in some areas and inadequate support in others. Moreover, current distribution methods where resources are distributed randomly do not consider factors indicating recipient's level of needs. This may lead to resources potentially reaching those who do not require assistance and overlook those who do. The mobile application developed for this project utilizes an intelligent algorithm called Genetic Algorithm to allocate resources based on factors including income, number of dependents, senior citizen status and disabilities, prioritizing distribution to those most in need. The application also enables an organization to access information on current and past relief operations of other organizations, fostering coordination and strategic planning of resource distribution. In addition to enhancing the efficiency of resource distribution through priority-based allocation and strategic planning among organizations, the system was developed with the objective to streamline the process of providing and receiving resources, benefitting both organizations and affected populations. This system offers advantages that are of great importance in improving the landscape of post-disaster relief operations.

Keywords: resource allocation, post-disaster, genetic algorithm, mobile application

1.0 INTRODUCTION

In the aftermath of a disaster, the loss of personal belongings and damage to homes can be extensive. The financial burden to repair or replace these items is substantial, particularly for individuals with lower incomes or larger households. Additionally, senior citizens and disabled individuals may face increased challenges in accessing essential items post-disaster due to their conditions. For those living on the edge financially, resources provided by relevant organizations can make a significant difference. However, due to limited resources, it becomes crucial to ensure that aid reaches those who truly need it. Efficient allocation is essential to maximize the impact of the limited resources available for disaster relief.

Multiple agencies are involved in providing relief and rescue efforts after disasters. Aside from governmental agencies that are responsible in managing and handling disasters, there are multiple non-governmental organizations (NGOs) in Malaysia that

provides relief effort such as National Disaster Management Association (NADIM) Malaysia, and MERCY Malaysia.

Due to a lack of coordination between organizations in relief efforts, there may be duplication of efforts in some areas, while other areas may receive little to no attention at all. As an example, some affected areas might have an abundance of resources for smaller number of victims as they received resources from several agencies which may lead to resources going to waste. Meanwhile, there might be some areas that receive inadequate resources compared to the affected population as there is only one agency providing resources. This will inevitably lead to an inefficient allocation of resources, particularly when those resources are limited.

Moreover, post-disaster relief operations often involve providing sets of similar resources distributed either randomly among households or through an application. However, the distribution is usually done without considering factors that may signify receivers' level of needs. Consequently, these distributions may result in limited resources potentially reaching individuals not requiring assistance while overlooking those who genuinely need support.

The mobile application developed in this project aims to address these issues by creating a system that allocates resources more efficiently by fostering coordination between organizations and implementing priority-based allocations, prioritizing victims based on criteria including income range, number of dependents, senior citizenship, and disability status.

2.0 OBJECTIVE

1. To develop a system that optimizes priority-based resources allocation to disaster-affected families and individuals that are most in need.
2. To create a platform that fosters coordination among NGOs to strategically distribute disaster relief resources, reducing duplication of efforts and maximizing aid coverage of affected areas.
3. To create a user-friendly and accessible interface for organizations and individuals, streamlining the process of providing and receiving resources after disasters.

3.0 METHODOLOGY

The mobile application's functionalities are organized into three modules: the User Module, Resource Module, and Information Module. Figure 1 below illustrates the module diagram, highlighting each module and its respective main features.

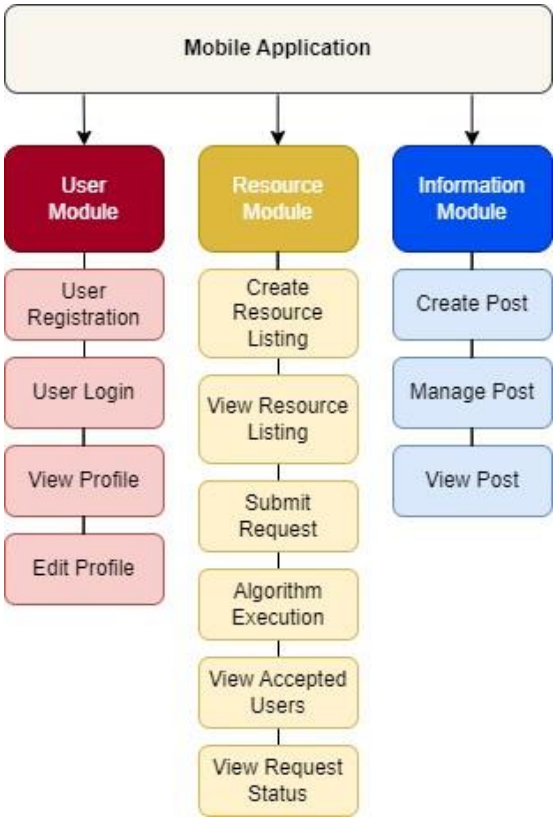

Figure 1: Module Diagram

The User Module is designed to handle account registration, login and profile management for three different user types which are Organizations, Public Users, and Administrators. Organizations are affiliated with NGOs or humanitarian organizations actively involved in disaster relief efforts. Public users are individuals or family representatives who register on the platform to request resources. They must provide personal and household information that will assist in the priority-based resource allocation. Administrator will be responsible for managing and overseeing the entire platform.

The Resource Module is the core component of this application where the resource distribution actually takes place. Organizations can upload detailed resource listings, including information such as location, distribution date and time, quantity, and resource type. To promote coordination and strategic planning, organizations can view both past and ongoing resource listings from other organizations.

Given the priority-based allocation system, which also prioritizes senior citizens and people with disabilities, organizations are responsible for delivering resources directly to the homes of successful recipients. To facilitate the resources delivery for organizations, public users can only view nearby listings within 5km of their home address. Public users can easily browse and request resources from the available listings.

Resource listings will stop accepting requests 24 hours before the specified distribution time. At this 24-hour mark, a genetic algorithm is triggered to optimize resource allocation for the listing. Users can then check the status of their requests to see

whether they have been accepted or rejected. Meanwhile, the organization in charge can view the details of all successful recipients.

The genetic algorithm (GA) used in this system is an intelligent algorithm for solving optimization problems by emulating the process of natural selection to iteratively evolve potential solutions. It works by generating a population of possible solutions, allowing them to evolve through recombination and mutation over multiple generations, much like natural genetics. Each solution's fitness, determined by its fitness function, influences its likelihood of reproducing and creating "fitter" offspring, in line with the "Survival of the Fittest" principle from Darwinian Theory. The GA's ultimate goal is to find optimal or near-optimal solutions.

In the context of this system's resource allocation optimization, the genetic algorithm seeks to identify the most efficient distribution of resources to prioritized families or individuals based on specific criteria. The process begins by initializing a population of potential solutions (resource allocations), represented as chromosomes. A fitness function is then applied to evaluate how well each resource allocation solution meets the priority criteria. The fitness function used in this system considers several factors:

- Income: Income ranges are predefined with corresponding scores; lower income ranges receive higher scores, while higher income ranges receive lower scores.
- Number of Dependents: Scores are allocated based on the number of dependents within the requester's household.
- Disability Status: Requesters with disabilities receive an additional score.
- Senior Citizen: Requesters aged 60 and above receive an additional score, following the age definition for senior citizens in Malaysia.

The fitness score for each chromosome (solution) is calculated by summing the scores for each criterion within the chromosome's genes and then totalling the scores across the entire chromosome. The selection of the fittest chromosomes, based on their fitness scores, simulates the natural selection process. Higher fitness scores indicate better resource allocation. This process is repeated iteratively over a defined number of generations to evolve progressively better solutions. When the algorithm terminates, the optimal solution will represent the most effective resource allocation for requesters in the specific listing.

The last module in this system is the Information Module which serves as a platform for all users to create and share posts on disaster-related topics, including disaster preparedness, safety measures, and others. These posts are publicly accessible, allowing all users to view and benefit from the shared knowledge. The module is designed to enhance awareness and provide valuable information on disaster-related issues, fostering a more informed and prepared community.

4.0 RESULTS

The project involves a unique approach to disaster resource management by utilizing an intelligent algorithm to optimize priority-based resource allocation. Implementation of Genetic Algorithm in the system ensures that resources allocation is optimized and ensuring that resources reach those most in need based on the priority criteria. This

approach enhances the effectiveness and efficiency of resource distribution, especially for limited resources.

Furthermore, the system allows organizations to access details of ongoing and previous relief distributions conducted by various other organizations throughout affected regions. Traditionally, organizations conduct their relief efforts independently without coordinating with one another. This is an original approach that has not been previously implemented in existing method or system. It allows organizations' strategic planning by offering insights into areas already assisted, enabling more effective coordination to optimize aid coverage and reduce redundancy in relief efforts.

The application also significantly impacts disaster relief efforts by offering a centralized platform which streamlines the process for organizations and affected victims alike. For organizations, it facilitates the efficient management and distribution of resources, while victims benefit from an accessible system for requesting aid. This centralized platform ensures a smoother and more coordinated response after disasters, ultimately making the relief process easier and more effective for all parties involved.

5.0 CONCLUSION

In conclusion, this mobile application is designed to optimize the distribution of disaster relief resources using a Genetic Algorithm. It considers factors such as income range, number of dependents, senior citizen status, and disability status among affected individuals. The primary goals of the application are to optimize priority-based resource allocation to ensure the resources directed to those most in need, and to foster better coordination among organizations, thereby reducing duplicated efforts and maximizing coverage in disaster-affected areas. By integrating these objectives into the application's functionalities and incorporating intelligent component in the system, the project seeks to offer an innovative solution that significantly improves the landscape of post-disaster relief operations.