# Development The Online Job And Volunteer Mobile Application For People With Disabilities Based On Matching Algorithm

**Kunyanuth Kularbphettong, Suphachai Nranit, Nareenart Ruksuntorn**

**Abstract:** The improvement of the quality of disabled life is a better way to enhance people with disabilities become more self-reliant and live happily with others in society and this research aims to develop the online job and volunteer application for people with disabilities. The proposed application acts as a central platform among entrepreneurs, volunteer and disabled people to meet their requirements. The proposed system based on Gale-Shapley algorithm was consisted of two functions: matching the jobs and finding volunteer service. In the matching the jobs, the application matches the suitability of disabled and job with various factors like background education, age range and etc. In the finding volunteer service, the request of disabled meets the information of volunteer based on diverse elements and the system is divided into two parts: Web Application and Android Application. The Web Application is applied progressive web apps technique and uses MySQL to store the database and the Android Application is written in JAVA and connects to the same MySQL. The results shown that the proposed application can work correctly and meet the user requirements and the satisfaction was at a good level.

**Index Terms**: online job, volunteer, mobile application, web application, Stable Marriage Matching Algorithm, Disabilities

## 1. INTRODUCTION

National Statistical Office (NSO), Thailand, announced to the Disability Survey 2017, based on questioning the population of all age groups, found that there are 3.7 million people with disabilities, or 5.5 percent of the country's population but more than half of those who do not register as a disabled person [1]. According to the report of the situation of the disabled in Thailand by Department of Empowerment of Persons with disabilities for the year 2019 [2], it was found that 841,408 people with working age between 15-60 years were categorized into 42.16 percent of the disabled, 25.85 percent had occupation and People with disabilities in working age do not have an occupation (17.96%). In addition, 1.9 million people with disabilities receive education representing a percentage 95.80 (for the disabled with a disabled identity card). The survey results above shows that the disabled population has not received the assistance in careers. Finding a job for people with disabilities is difficult because people with disabilities are different from normal people. There are many limitations in terms of communication, vision impairments and etc.

In aspects of the entrepreneurs, there are two types of the entrepreneurs that support the disabled. The first has complete facilities for disabled operations and the latter is entrepreneur that requires legal employment law. Nowadays, smart phones or tablets are one of the popular devices intended for daily use and mobile applications has been developed to meet the consumer's requirements. The development of the application is a convenient and easy way to reduce communication steps. Therefore, with the benefits of the advanced technology development, not only for normal people who use to communicate and follow the news but also for people with disabilities, smart phones are one of the important devices that helps to facilitate the lifestyle as well.

Therefore, the objectives of this research is to develop the system for finding jobs and matching volunteers for disabled and it can be a significant center for communication among disabled and related support services that will come to take care and help the disabled.


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## 2 THE RESEARCH METHODOLOGY

To development the online job and volunteer application for people with disabilities, the research was conducted by studying the principles and theories of various technologies related to system development as following:

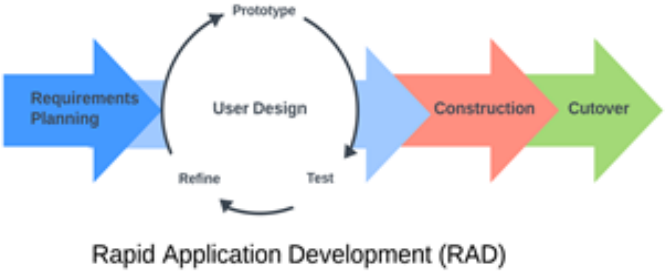


***Fig 1.*** *RAD Model [3]*

### 2.1 Rapid Application Development (RAD)

Rapid Application Development (RAD) is a fast application development that often uses CASE Tools and techniques, like diagram charts, documentation, analysis and design tools and etc., to support and reduce the cost and time of software development. RAD Model is modified from the traditional software development model and JAD approach by grouping the relevant processes together, like analysis, design, construction, and testing. There are four main phases as follows: Requirement planning, User design, Construction and Cutover as displayed in fig1. In requirement planning phase, it is the crucial step to define the goals and the objectives of the project and it identify the requirement specification. User design phase is the analysis step to design prototype and refine the prototype until the finalization step. The next step is

the construction phase to convert the prototype to the working model and get the feedback from users. Finally, the cutover phase is to implement the final software and deliver to users [3]-[4].

### 2.2 Progressive Web Apps (PWA)

Progressive Web Apps is a way to make a website to look like an application and it is based on standard from Google that combines with the strengths of Website and Application. Users can access the website and use it as if it were a software application. The main features of Progressive Web Apps is to use in every browser and every mobile platform and developers can identify what functions will be stored in cache so that it make possible to service both online and offline [5].


***Fig 2.*** *Service worker [6]*

ServiceWorker and Manifest are the important features of Progressive Web Apps. ServiceWorker is used to determine how to handle caching and provides it on websites and Manifest is a JSON file that tells what our website looks like and specifies properties our apps needed [6]-[7].

### 2.3 Stable Matching Algorithm

The stable marriage problem is one of the well-known problems in mathematics, economics, and computer science. The problem solves the matching between the n pairs of men and women that each has his/her preference. The set of men and women will be assigned with no unstable pairs and the participants feel satisfy with their partner in the minimal of algorithm complexity. The Gale-Shapley algorithm, designed by David Gale and Lloyd Shapley in 1962 [8], is the solution to prove the stable marriage matching problem in which each participant has hierarchy of preference. Let w be a woman and w will be a pair when the men come to match for the first time. An order list of men will gradually be matched from the preferences of w. The Pseudocode of GALE–SHAPLEY algorithm was presented in figure 3 [9].

```
Pseudocode GALE–SHAPLEY {
Initialize all m ∈ M and w ∈ W being single
While  ∃ free man m who is unmatched and hasn't
       proposed to {
          w = first woman on m's list to whom m has not
          yet proposed
          if w is free
                (m, w) become engaged
          Else some pair (m', w) already exists
                if w prefers m to m'
                      m' becomes free
                      (m, w) become engaged
                else (m', w) remain engaged
       }
  }
```

***Fig 3.*** *The Pseudocode of GALE–SHAPLEY algorithm [9]*

This research applied GALE-SHAPLEY algorithm to match the requirements between a disabled person and an employer based on criteria assembled in the preference tables as displayed in table 1 and 2. The figure 4 was demonstrated the process of this research based on GALE-SHAPLEY algorithm.

***TABLE 1***

*PREFERENCE OF DISABLED PERSONS*

| | Preference1 | Preference2 | Preference3 | . . . | Preference m |
|---|---|---|---|---|---|
| Disabled user 1 | | | | | |
| Disabled user 2 | | | | | |
| Disabled user 3 | | | | | |
| … | | | | | |
| Disabled user n | | | | | |

***TABLE 2***

*PREFERENCE OF EMPLOYERS*

| | Preference1 | Preference2 | Preference3 | . . . | Preference m |
|---|---|---|---|---|---|
| Employer1 | | | | | |
| Employer2 | | | | | |
| Employer3 | | | | | |
| … | | | | | |
| Employer n | | | | | |

```
Pseudocode GALE–SHAPLEY (preference lists from disability
and employers) {
Initialize        all d ∈ D and e ∈ E being free
While             ∃ free d who is unmatched and hasn't
                  proposed to every employer {
                  e = first employer on e's list to whom d has
                  not yet proposed
                  if e is free
                        add (d, e) become matched
                  Else some pair (d', e) already exists
                        if e prefers d to d'
                              d' becomes free
                              (d, e) become matched
                        else (d', e) remain matched
          }
}
```

***Fig 4.*** *The Pseudocode of this research*

## 3 SYSTEM ANALYSIS AND DESIGN

To develop the proposed application, this section presented

the details of operation methods and software development, including system analysis and design approach. Figure 5 shows the Use Case Diagram of the system in which users can register for membership and search for jobs, including applying for jobs through career portal. In addition, entrepreneurs can post job applications and manage job applications. The application still let volunteers receive requests from people with disability through the volunteer system.

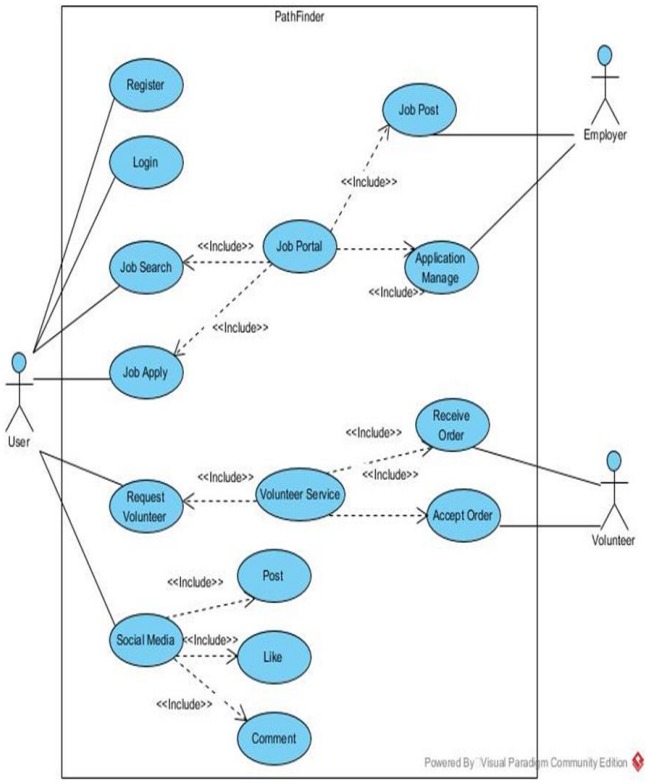


***Fig 5.*** *Use Case Diagram*

Also, users can access the Social Media section to communicate and post their comments. In the volunteer system, volunteers use the Google Map API and GPS on their smartphones to determine the user's location by storing the latitude and longitude position information into the database and the application determines the specified location information on the map in which the total distance is not far from 2 kilometers.

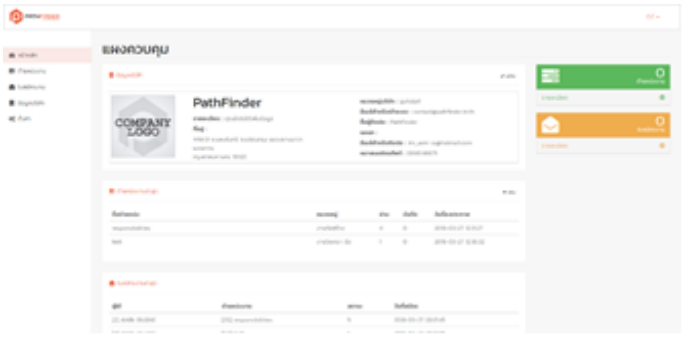


***Fig 6.*** *The part of employer page*

The user interface design is to enable easily use and understand the application quickly and the example of user interface was displayed in figure 6 shown the part of employer page. Also the figure 7 and 8 were shown the data base of the proposed application.

## 4 THE RESULTS

After the 5 experts have tested the proposed system, the results found that the averages of the system performance topics were 3.93, 3.86 and 3.76 respectively which represented the acceptance of system performance at a high level.

***TABLE 3***
*The Results of the software performance*

| | Level of Proficiency | | |
|---|---|---|---|
| | $\bar{X}$ | SD | Result |
| 1. Speed of data search | 4.05 | 0.71 | High |
| 2. Speed of data access | 4.16 | 0.76 | High |
| 3. Accuracy of information | 4.11 | 0.74 | High |
| 4. The update of information | 4.05 | 0.71 | High |
| 5.Easy to use the proposed system | 3.95 | 0.78 | High |
| 6.The appropriate of the application form | 3.84 | 0.69 | High |
| 7.The accuracy of the management | 4.11 | 0.88 | High |
| | 4.04 | 0.75 | |

The results from table III presented that users satisfied the proposed in all aspects issues and the average was 4.04 which displayed the satisfaction at a high level.

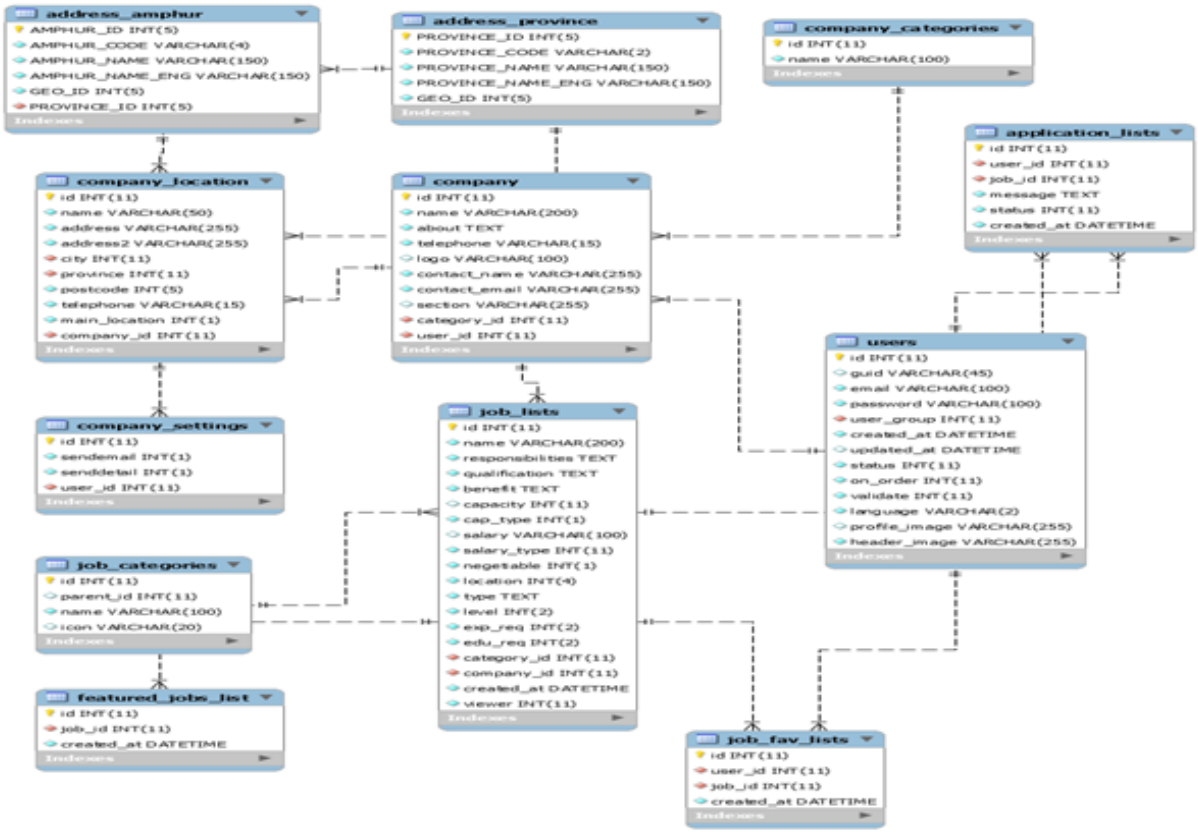


***Fig7.*** *The data base of finding the job section*

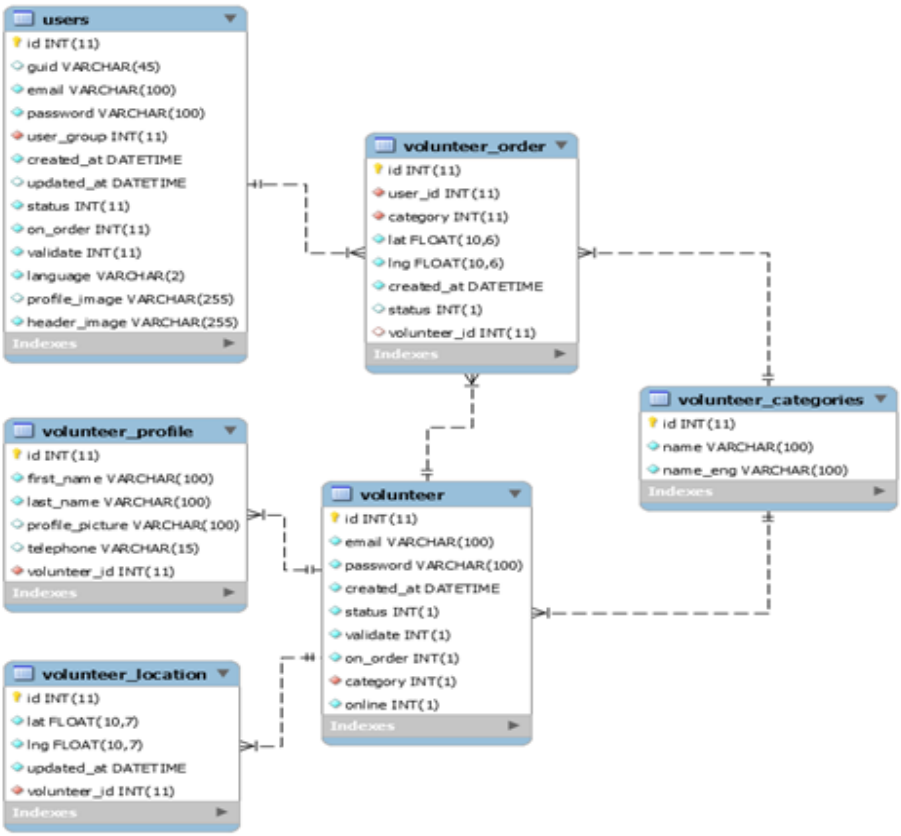


***Fig 8.*** *The data base of matching the volunteer section*

In the evaluation the system performance, this section focuses on software testing the online job and volunteer application for people with disabilities in terms of accuracy and software quality and assesses the results of the user acceptance of software as follows: To evaluate the software performance, this system was assessed the suitability of the application in 3 issues including function test, usability test, and security test [10].

***TABLE 4***

*The Results of the software performance*

| | $\bar{X}$ | SD | Result |
|---|---|---|---|
| Function Test | | | |
| 1. Accuracy of storing data | 3.93 | 0.53 | High |
| 2. Accuracy of information search | 3.93 | 0.53 | High |
| 3. Correctness in updating information | 4.00 | 0.46 | High |
| 4. Accuracy of data deletion | 4.00 | 0.46 | High |
| 5. The accuracy of the results obtained from processing in the program. | 3.79 | 0.49 | High |
| | 3.93 | 2.47 | |
| Usability Test | | | |
| 1. Ease of use of the system | 4.00 | 0.31 | High |
| 2.Appropriateness of the font size | 3.93 | 0.38 | High |
| 3. Appropriateness of using colors of text and images | 4.00 | 0.31 | High |
| 4. Appropriateness in using text Symbol or picture | 3.79 | 0.49 | High |
| 5. The standard in screen design | 3.86 | 0.44 | High |
| 6. Suitability for user interaction | 3.57 | 0.26 | High |
| | 3.86 | 0.365 | |
| Security Test | | | |
| 1. User and password for user authentication | 3.92 | 0.53 | High |
| 2. Checking the right of users to access information at various levels | 3.71 | 0.67 | High |
| 3. Prevention User control | 3.64 | 0.54 | High |
| 4. Password change | 3.85 | 0.58 | High |
| 5. Appropriateness of the check and accuracy | 3.71 | 0.23 | High |
| | 3.76 | 0.51 | |

## 6 CONCLUSION

To enhance the quality of life of disability, the development of the online job and volunteer application for people with disabilities is the proposed project to increases opportunities for career path and society for the disabled. The application works correctly at a good level and can be used effectively in online communities, job search systems, and volunteer systems. This research has evaluated the efficiency of the system by 5 experts with an overall system performance evaluation at a good level and user satisfaction was evaluated from 30 users and the evaluation results found that the overall satisfaction score was at a good level.

## ACKNOWLEDGMENT

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