

Dug-Uhay: A Blood Donor Finder Application

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ABSTRACT

This study was conducted to provide a possible solution to the unceasing problem of finding willing blood donors with the use of mobile technology and location-based services. The blood donor finder application aimed to provide a means to easily locate a willing blood donor through a mobile application. Using the mixed method of conducting a research, the researchers were able to develop the application. Two groups of randomly chosen respondents participated in this study to assess the technical quality and quality of using the application. This study utilized and followed the Spiral Model with the following stages: Planning, Risk Analysis, Engineering, and Evaluation. After the development of the project, the application was subjected to the assessment of Information Technology (IT) professionals and residents in one of the municipality in the province of Nueva Ecija, Philippines. The assessment on the technical qualities were based on the following criteria: Usability, Effectiveness, Efficiency, Accessibility, and Assistive Technology. On the other hand, the assessment on the quality of using the application was based from the following criteria: Perception of the respondents on the usefulness of the application, perception of the respondents on the ease of using the application, and the intentions of the respondents in using the application. In general, the application was successfully developed following the stages of the Spiral Model and the application passed the assessment made by the IT professionals and the residents with some suggested enhancements and improvements for the betterment of the application. The results of this study proved the possibility of having a blood donor finder application and such application can aid in locating a possible willing blood donors.

KEYWORDS: *Blood Donor Finder, Mobile Application, Spiral Model, Location Based Services*

1. INTRODUCTION

Information technology (IT) continuously evolved at a very fast pace. Over the years, different facets of the society have witnessed enormous changes and have greatly affected the way people live. Berisha-Shaqiri (2015) have cited several impacts of information technology and the internet in the business sector, stating that the use of IT have opened up new opportunities such as the emergence of electronic business forms like electronic market, electronic marketing, electronic banking transactions, e-procurement and e-government. In the education sector, Raja and Nagasubramani (2018) explains the different impacts of Information Technology and its use in the educational context. Positive impacts include the enhanced teaching and learning process, increased globalization and reduction of geographical limitations. However, negative impacts of Information Technology in the educational context has been mentioned which include the declining writing skills of the students, the increasing incidents of cheating through the use of different IT tools, and students' lack of focus. In the healthcare sector, digitalization of health records, increased capacity to monitor patients, improved means of managing public health through reliable data and information, ease of workflow and lower healthcare costs are some of the positive impacts of IT (Banova, B., 2019). Forbes.com in February published the top five digital health technologies of

2019. Artificial Intelligence (AI) help radiologists in performing their tasks using AI algorithms for image analysis. Augmented Reality (AR) revolutionizing surgeries greatly aid surgeons in performing surgical operations. The data-driven advantages for health insurance and the block chain technology greatly affect the healthcare industry. Lastly, the emergence of virtual clinical trials by integrating wearables are some of the possibilities that could happen in the near future (Das, 2019). While these IT solutions are continuously evolving, the use of mobile and web applications constantly improve to cater the needs of the community.

Mobile applications are application software that are design to run in a mobile device, typically developed to perform specific tasks. On the other hand, web applications are design to run on a web-browser and utilizing web technologies to perform its functions. Islam, M., et al. (2010) explains mobile application and its global impact indicating that mobile application have different use and effects to individuals, businesses, and social area. Today, new mobile and web applications have integrated the use of Location-Based Services (LBS) to identify the location of the service provider. LBS started in 1487, when the Spanish Army, followed by the emergence of Yellow Pages in 1886, and the

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first local weather and traffic broadcast in radio and TV in 1960s, made the first recorded use of ambulance. At present, wireless carriers have integrated the use of location-based services, as well as the integration of such in different mobile and web applications (Wang, S., Min, J. and Yi, B. K., 2008). Though several mobile and web applications have incorporated the use of location-based services, there is still a gap in terms of improving the way of finding blood donors. Many people rely on different social media platforms such as Facebook and Twitter to look for blood donors. Although, there are many people in the locality who are willing to donate, the difficulty still lies on how to locate them, thus there is a need to develop a platform that can allow local residents to communicate and extend help in terms of donating blood to the needy. In 2017, the Philippines, was reported by Rappler.com to have blood supplies which were below the target number of stored blood in the blood bank, thus resorting for people to locate and ask for willing donors over social media (Francisco, 2017). To increase the number of blood supply in the country, the Department of Health (DOH) advocated voluntary blood donation. The agency encourage Filipinos to be involved in blood donation drives in order to help extend the lives of many people (Montemayor, 2019). The need to increase the blood supplies in the country is very high, thus, the government continues to strive for willing donors to donate and help increase the probability of extending the lives of patients in need of blood.

This study focused on developing and evaluating *Dug-uhay: A Blood Donor Finder Application* to understand the possibility of having a mobile and web platform as a tool in helping to locate potential blood donors. This study aimed at filling the knowledge gap about new technologies that can be develop to aid the community in relation to Blood Donor Finder Application. The researchers developed a prototype to understand how a mobile and web application could be a possible solution to increase the number of willing blood donors through the integration of location-based service.

1.1. Statement of the Objectives

In general, this study aimed to develop and assess *Dug-uhay: A Blood Donor Finder Application*. More specifically, this study sought the following:

1. Describe the activities undertaken following the stages of the Spiral Model in terms of:
 - A. Planning;
 - B. Risk Analysis;
 - C. Engineering; and
 - D. Evaluation
2. Describe the results of the assessment made on the technical quality of the application with the following criteria:
 - A. Usability;
 - B. Effectiveness;
 - C. Efficiency;
 - D. Accessibility;
 - E. Assistive Technology
3. Describe the assessment made by the respondents on the quality of using the application based on the following
 - A. Perception of the respondents on the usefulness of the application;

- B. Perception of the respondents on the ease of using the application; and
- C. Intentions of the respondents in using the application

1.2. Methodology

This study utilized a mixed method of quantitative and qualitative research. Wisdom, J. and Creswell, J. (2013) explains that a mixed method is the combination of two methodologies in research within a single investigation. This is use to compare the results gathered in the quantitative aspect into the qualitative component. Mixed method was also use to reflect the participants' point of view. In this study, the researchers were able to reflect their point of view in the process of explaining the processes undertaken following the spiral model. Another, mixed method is perform to foster scholarly interaction and to provide a more flexible method of conducting a research. Through mixed method, the researchers were able to collect rich comprehensive data in the development and assessment of a blood donor finder application.

Quantitative method was use to evaluate the application using a rubric as a scoring guide to understand how the respondents assessed the technical qualities and the quality of using the application. The qualitative method was use to describe the processes undertaken following the stages of the spiral model. Thirty respondents composed of twenty randomly chosen residents in a municipality and ten IT professionals participated in this study. Two groups of respondents were randomly chosen to answer the two types of questionnaires used in this study. This was done to represent two different perspectives assessing two different areas.

The IT professionals assessed the application's technical qualities while the residents assessed the quality of using the application.

A. Research Instrument

The instruments used in this study was designed for the information technology professionals to assess the technical qualities of the application. The instrument covered the following technical criteria: Usability, Effectiveness, Efficiency, Accessibility, and Assistive Technology. On the other hand, to assess the quality of using the application, another set of instrument was used. This contained the following criteria: perception of the respondents on the usefulness of the application, perception of the respondents on the ease of using the application, and the intention of the respondents in using the application. The items in the two questionnaires were answered using a five-point Likert scale with the following description: 5 – Excellent, 4 – Very Good, 3 – Good, 2 – Fair, and 1 – Poor.

After the application was developed, the researchers subjected it to the assessment made by the respondents using the questionnaires.

B. Procedure of the Study

The procedure of the study followed two phases: the application development phase, and the assessment phase. In the application development phase, the researchers followed the stages of the spiral model while in the assessment phase; the researchers subjected the developed application to the assessment of the IT professionals and

residents. The researchers asked the respondents if they are willing to participate in this study. After the researchers got the approval of the respondents, the developed application was presented. The respondents were able to use and see how the application worked. After using the application, the respondents assessed the application using the questionnaire given to them. The researchers ensured the respondents that the results of the assessment was confidential. In addition, the researchers ensured that the respondents understood the content of the questionnaire to gather a more meaningful information.

The items in the questionnaire were answer using a five-point Likert scale with the following descriptions presented in Table 1.

Table 1: Scoring Rubric

Numerical Rating	Qualitative Rating	Verbal Description
4.20-5.00	Excellent	The application met all the quality standards of application development. No or very minimal modification is required.
3.40 – 4.19	Very Good	The application met almost all the quality standards of application development. Minimal modification is required.
2.60 – 3.39	Good	The application met some of the quality standards of application development. Some revisions are required.
1.80 – 2.59	Fair	The application failed to meet the quality standards of applications development. Major revisions are required.
1.00 – 1.79	Poor	The application failed to meet the quality standards of application development. Needs to be re-done to serve its purpose.

2. RESULTS AND DISCUSSION

2.1. Description of the processes undertaken following the stages of the Spiral Model

Planning Stage

The main objective of this stage was to develop a solid foundation in order to come-up with the blood donor-finder application. This stage includes the process of identifying how the application was developed, the scope included, and how it worked. In this stage, the researchers conducted a series of extensive review of related studies and works, came up with plans on the essential requirements needed, and developed a timeline of activities using Gantt chart. Gantt chart is an effective tool to manage and monitor the activities vis-à-vis time, which helped the researchers to execute the needed tasks. Stepanov (2019) explains that a Gantt chart helps in visualizing the big picture, allowing the project members to understand the essence of the activities undertaken. Aside from that, it allows breaking big project parts into smaller tasks that is much easier to manage. The progress of the project can also be track easily, allowing not

only the project team members to know the activities that were accomplish but also informing stakeholders about the completed tasks in the project. Gantt charts were also used to follow dates and deadlines, creating dependencies between tasks, and strengthening team and resource management through transparent and effective time and schedule management.

Aside from utilizing Gantt chart, understanding the requirements was vital in this stage. Requirements gathering played an important role in the development of the Blood Donor Finder Application. Stephen Lane, Paidi O'Raghallaigh & David Sammon (2016) explains that requirements gathering involves the collaboration of different people with different perspectives, working together to come-up with a solution to the problems needed to be solve. It is a multidisciplinary activity where members of the team must be able to utilize the available resources, identify the needed components to solve a problem and look at the situation from different perspectives to generate a more effective solution. This view about requirements gathering is in line with the view of Christel & Kang (1992), asserting the importance of multidisciplinary views to capture relevant information to solve a problem and to come up with a solution. The Blood Donor Finder Application was developed following the processes of a successful requirements gathering procedure under the planning stage of the Spiral Model.

Risk Analysis Stage

The analysis stage was the continuation of the processes undertaken during the planning stage. The requirements gathered in the planning stage were further analyzed and studied to identify the potential risks to come-up with a mitigation plan. Gurendo, D. (2015) asserts that this stage of the spiral model was one of the key in the overall success of a project. In the development of the blood donor-finder application, the researchers continuously reviewed and analyzed the project so that possible errors and risks were easily solved and further avoided. The practice of early detection of risks and potential errors have helped researchers to successfully developed the application, thus in application development, developers must pay attention to identifying the risks in the earlier stage of development.

While Chowdhury and Arefeen (2011) explains that risk cannot be eliminated from software or application projects, it can still be managed, thus the researchers tried to minimized the potential risks by utilizing software and application development tools such as Entity-Relationship Diagram (ERD), Data Flow Diagram (DFD), Database Normalization, and Flowcharting. These tools allowed the researchers to further analyze the requirements for the development of the application.

Engineering Stage

In the engineering stage, the actual development and testing of the application took place. Using the results from the risk analysis stage and the diagrams developed, the researchers were able to develop the application. In the development stage, the researchers developed a web portal using Microsoft Visual Studio environment and C# as the programming language. The web portal of the application as shown in Figure 1 serves as the platform for the web application.

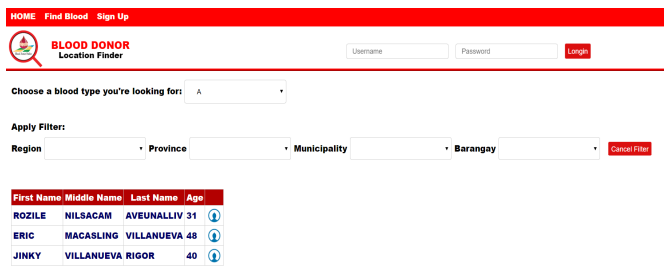


Figure1. The Web Portal for the Blood Donor Finder Application

Figure 2 on the other hand presents the application for mobile devices.

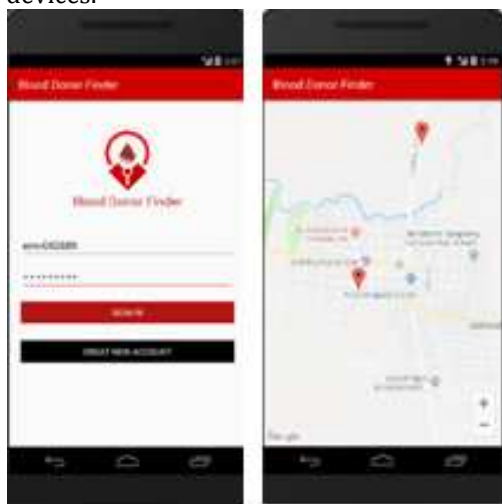


Figure2. The mobile view of the Blood Donor Finder Application

After the successful development of the web and mobile applications of the blood donor finder application, the researchers conducted a series of testing to check if the application can perform well, and to see the possible errors that may occur. Guru99 (2019) posted the importance of testing in software and application development. Testing is performed to avoid software glitches and to prevent software failure. Testing is also conducted to check the functionality and the overall quality of the project. Further, testing is a means to ensure that the application conforms to the requirements set and identified in the planning stage. The researchers found out that among the different testing techniques, unit testing, performance testing, and error testing were the common activities performed during the development of the application.

Evaluation Stage

Evaluation is performed to determine if the developed application conform to the standards set for its technical qualities and quality of using the application. This stage of the spiral model allows the prospective customers and the respondents of this study to evaluate the application. The initial result of the evaluation was the basis to continuously improve the quality of the output. After several consultations with the prospective customers, the researchers handed out the questionnaires to assess the technical qualities and the quality of using the application. While it’s true that the feedback of the respondents were the basis for enhancements, the researchers continued to look for additional measures on how to further enhance the application.

2.2. The results on the evaluation made on the technical qualities of the application

Criteria	Mean Rating	Verbal Description
Usability	3.93	Very Good
Effectiveness	3.97	Very Good
Efficiency	4.03	Very Good
Accessibility	3.84	Very Good
Assistive Technology	3.95	Very Good
Grand Mean	3.94	Very Good

The characteristics of the blood donor finder application in terms of usability was rated “very good” ($\mu=3.93$) by the IT professionals because they viewed the application as easy to use, user-friendly, and with user interface that was pleasing to eyes of the users. ISO 9241-11 (1998) defines usability as the “degree to which a software can be used by specified consumers to achieve qualified objectives with effectiveness, efficiency, and satisfaction in a quantified context of use”. This means that usability is an application’s feature that covers the capacity of an application to be easily learned and used by the customers. Further, Nielsen, J. (2012) explains that usability is an attribute of quality that evaluates how user interfaces are easy to use. Usability is composed of five quality components which include learn ability, efficiency, memorability, errors, and satisfaction. Usability is an important criteria to be monitored continuously because it is one of the key factors why users continuously use an application, thus the developed blood donor finder application must be continuously checked and further enhanced in terms of usability so that the users will continuously use it. In relation to usability as a criteria, the results implied that the application met the quality standards based on the evaluation made by the IT professionals. The results suggested that the application can be improved, but have already achieved an acceptable response from the respondents.

Effectiveness is another criteria being assessed in the developed application. In terms of the characteristics on the application’s effectiveness, the blood donor finder application got a rating of “Very Good” ($\mu=3.97$). Effectiveness is the practice of getting things done properly by utilizing a reasonable and appropriate amount of time and effort (Lynn, 2011). Based from the assessment made by the respondents, the IT professionals viewed the application having the ability to maintain electronic personal information, ability to locate user’s location and send blood donor requests, and the ability to record blood donation made by the donors. The capacity of an application to serve its purpose and achieve utmost effectiveness is very important to consider when developing an application. Guinness (2018) asserts that effectiveness has something to do with performing a specific task accurately regardless of the time it takes, thus the blood donor finder application was perceived to be effective for it serve its purpose of locating blood donors in the most effective way possible – by using a location-based technology.

In terms of efficiency, the assessment made by the IT professionals got a mean rating of 4.03 with verbal interpretation of “Very Good”. Among all the criteria for assessing the technical quality of the application, efficiency got the highest mean rating. This implied that the IT professionals viewed the application as efficient in terms of

performing its intended functions. More specifically, the application was perceived to have the capability to produce stored electronic data and information, ability to respond to user’s requests, and the ability to withstand the duration of use in performing its functions. ISO 9241 (2002) defines efficiency as the “resources expended in relation to the accuracy and completeness of goals achieved”. Efficiency is the ability of the application to perform its function using the available resources such as the location-based technology. Also, the utilization of web portal and mobile technology contributes to the overall efficiency of the application. Overall, the application was viewed to be performing efficiently according to its intended functions.

The term accessibility pertains to the capability of the application to be utilized by different types of end-users. Based from the assessment made by the IT professionals, the application was perceived to be “Very Good” ($\mu=3.84$). Specifically, the application was viewed by the IT professionals having the ability to be executed in different platforms, ability to accommodate multiple users at the same time, and ability to be used in different types of working environment. The results of the assessment implied that the application was accessible, but it was suggested that the application be further improved so that the quality of using it can be elevated.

Christensson, P. (2017) explains that the term assistive technology refers to the feature of an application that caters to the needs of people with special requirements. Differently abled people requires additional assistance, thus the application must also conform to the basic needs of differently abled persons such as the over-all look of the application, the way of manipulating it, and the performance of the application that suits to the needs of such special group of end-users. The developed application got an over-all rating of “Very Good” ($\mu=3.95$) in terms of its assistive technology features. More specifically, the application was perceived to have the ability to trap, prompt, and inform the end-users if errors occur. Also, the application was perceived to have the capability to guide the end-users on what to do after a specific action or activity. While the assessment made by the IT professionals regarding the assistive technology feature of the application was acceptable, it was suggested that this feature be continuously improved to further cater the needs of other end-users.

Based from the assessment on the technical qualities of the application, IT professionals viewed it as “Very Good” ($\mu=3.94$). Over-all, the application passed the assessment made but further enhancement and continuous improvement was suggested so that the application could provide a better experience for the end-users.

2.3. The results on the assessment made on the quality of using the application

Criteria	Mean Rating	Verbal Description
Perception of the respondents on the usefulness of the application	4.29	Excellent
Perception of the respondents on the ease of using the application	4.01	Excellent
Intentions of the respondents in using the application	4.25	Excellent
Grand Mean	4.18	Excellent

The assessment on the quality of using the application was made by the randomly chosen residents in a municipality. Overall, the application was rated “Excellent” by the respondents and viewed to have been possessing the acceptable quality of standards in terms of using it as evident in the mean rating of 4.18. More specifically, the residents perceived that the application has an “Excellent” quality in terms of its usefulness ($\mu=4.29$). The respondents viewed it as useful because they thought that the application was easy to learn and operate, has instructions that were clear and easy to understand, possess an interactive user interface, accessible, and aid the end-users to easily locate possible blood donors. However, though the respondents perceived that the application was useful, they suggested that continuous enhancement can be made to elevate the quality of using it.

On the other hand, the applications’ feature on being easy to use got a rating of “Excellent” ($\mu=4.01$). The respondents viewed the application as a solution that provides an easy means to locate for blood donors. According to the respondents, they were satisfied with the performance of the application and perceived that the application was easy to access and input information. The respondents suggested that the application can still be enhanced and future improvements can still be made.

The results show that the respondents’ intention to use the application got a rating of “Excellent” ($\mu=4.25$). This implied that the residents has positive response in terms of accepting and using the application. Further, the respondents would use the application because they thought that the project enables them to easily locate prospective blood donors. The easy retrieval of donor’s information was also one of the reasons why the users would use the application.

In line with the assessment made by the respondents, the application passed the criteria for the quality of using it. However, to ensure continuous users acceptance, it was suggested that the application continuously be improved and enhanced to ensure utmost user experience.

3. CONCLUSIONS

This study entitled Blood Donor Finder Application was developed following the Spiral Model with the following stage: Planning, Risk Analysis, Engineering, and Evaluation. It underwent two types of assessment. The technical quality was assessed by the IT professionals with the following criteria: Usability, Effectiveness, Efficiency, Accessibility, and Assistive Technology. On the other hand, the quality of using the application was assessed by a randomly chosen respondents from the municipality. The quality of using the application has the following criteria: Perception of the respondents on the usefulness of the application, Perception of the respondents on the ease of using the application, and Intentions of the respondents in using the application. Overall, the assessment on the technical qualities and the quality of using the application got an acceptable passing mark implying that the application passed the standards set for this study. It was suggested that the application be continuously improved and enhanced the betterment of the output.

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