Quest Journals
Journal of Software Engineering and Simulation
Volume 11 ~ Issue 9 (September 2025) pp: 09-15
ISSN(Online) :2321-3795 ISSN (Print):2321-3809
www.questjournals.org

Research Paper

System design and implementation of satisfaction with students' willingness to donate blood again

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Abstract
Blood donation is crucial for securing medical blood supplies. While college students are the primary group of first-time donors, their donation rate remains low. This study targets college students, applying software engineering methodology and Decision-Making Trial and Evaluation Laboratory (DEMATEL) to explore three dimensions—demand, technology, and benefits—that influence their willingness to donate blood again. It constructs a system to boost donation willingness by enhancing demand analysis, clarifying technical implementation paths, and maximizing benefits.
Results indicate that demand dimensions like "blood donation convenience" and "transparency of blood donation knowledge" are key drivers of technical implementation. Meanwhile, technical elements such as "blood donation management platform" and "smart reminder mechanism" promote benefit-related outcomes, including "donor satisfaction" and "higher repeat donation rate."
The study implements a blood donation intention-enhancing system integrating demand, technology, and benefit feedback mechanisms, verifies its feasibility, and aims to provide references for blood centers and universities in promoting blood donation.

Keywords: Decision Making Trial and Evaluation Laboratory (DEMATEL), Planning behavior theory, Influencing factors, School encouragement policies, Satisfaction and willingness

Received 13 Sep., 2025; Revised 25 Sep., 2025; Accepted 27 Sep., 2025 © The author(s) 2025.
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I. Introduction

Blood is a precious resource that cannot be artificially produced. In recent years, the population structure of blood donors in Taiwan has been aging, with college students becoming the main force for new blood donors(Kattner, 2024). Most college students only donate blood once, and the rate of re donation is low, which affects the long-term stable supply of blood. Enhancing the willingness of college students to donate blood again has become an important issue of concern for the Taichung Blood Canter and the Taiwan Blood Services Foundation and society(Hsu et al., 2025; Liu et al., 2022; Minegishi & Nishiyama, 2023; H.-H. Wang et al., 2021).

China with concentrated medical resources—has led to acute shortages, delaying surgeries and compromising patient care. To address this, the Guangdong University of Petrochemical Technology plans to survey student donors, aiming to understand their motivations and attitudes toward campus blood drives. Insights from this study, rooted in the Theory of Planned Behavior, will refine strategies to boost participation, aligning with global efforts by organizations like the WHO and Red Cross to promote non-commercial blood supply(Bosnjak et al., 2020; Latifi et al., 2021; Tsai et al., 2022).

Internationally, successful approaches include educational campaigns (South Korea's school programs to educate youth on donation safety)(Lee et al., 2024), community-driven initiatives (India's NGO-led camps with health checks to enhance accessibility)(Barua et al., 2020), and non-monetary incentives (Japan's commemorative tokens to honor donors)(Yoshioka et al., 2021). Technology also plays a key role: mobile apps for scheduling donations and tracking history improve convenience and encourage repeat giving. Workplace campaigns offering paid time off and targeted drives during disasters or holidays further mobilize donors. Prioritizing inclusivity—

through multilingual support and rural outreach—ensures all eligible individuals can contribute.

By blending insights from student motivations with proven global strategies, universities and healthcare systems can cultivate a culture of altruism, securing a stable blood supply and strengthening collective responsibility for public health.

II. Voluntary blood donation activities

Many countries have implemented policies and programs to encourage blood donation, such as offering incentives for donors and providing information about the safety and benefits of donating blood. Despite these positive developments, there is still much work to be done to increase awareness and participation in voluntary blood donation activities. It is important for everyone to understand the importance of blood donation and to take action to support it(Mantadakis et al., 2022; Myers & Collins, 2025).

Every country has its own designated blood donation policy, for example, in the UK, the content of voluntary blood donation has been included in textbooks since primary school(Ibrahim & Callaghan, 2023). Under the guidance of their teachers, elementary school students will regularly visit the blood center to learn about the entire process from voluntary blood donation to separation of blood products such as plasma, storage, and use. This will enable them to understand the principle that "blood donation does not affect health" from a young age and become voluntary blood donors when they grow up.

They have made voluntary blood donation a traditional habit. The German government has also lifted the age limit for voluntary blood donation. The main force of blood donation is over 40 years old, many of them are Germans with families, especially the German elderly in their fifties and sixties are also active blood donors. One basic principle of their blood donation system is to eliminate all commercial profit-making activities(Greffin et al., 2021; Orru' et al., 2021).

According to the regulations of Jiangsu, Zhejiang and Anhui provinces in China, blood donors who have won the China Voluntary Blood Donation Award can enjoy the "three free" policy. This includes free rides on urban public transportation, free entry to government-funded parks and attractions, and free outpatient registration fees at non-profit medical institutions. Guangdong University of Petrochemical Technology has also implemented similar policies, such as providing free breakfast and water to students who donate blood to relieve hypoglycemia; issuing blood donation certificates to students, with which students can apply for volunteer service hours and moral education credits to stimulate their enthusiasm for blood donation(Y. Wang et al., 2023). Figure 1 Practice of encouraging blood donation.

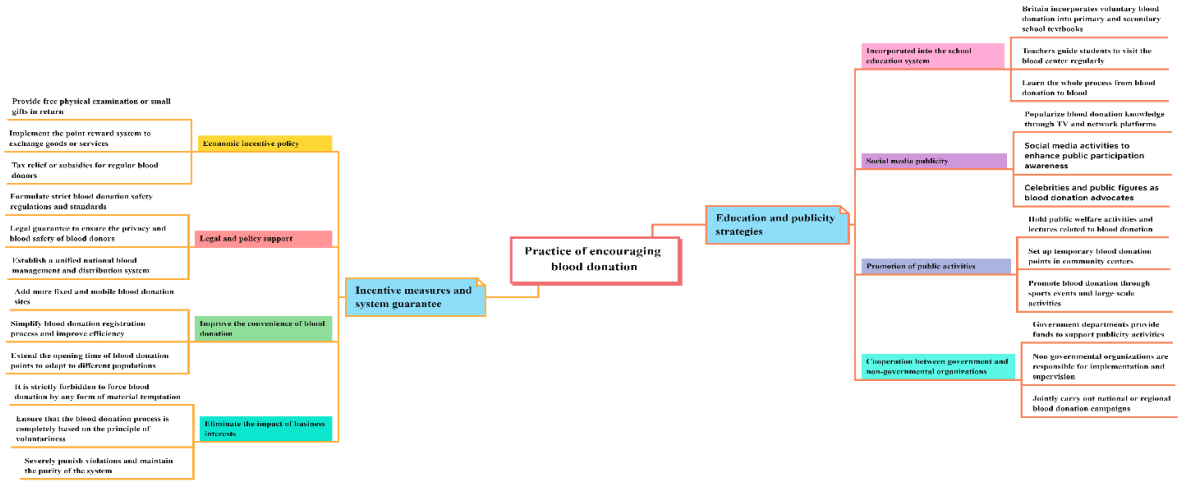


Figure 1 Practice of encouraging blood donation.

III. Research Methods and Implementation

Blood donation safety should be given top priority. Before donating blood, professional medical staff will conduct a health assessment and one-on-one consultation for you. The entire blood collection process uses disposable sterile equipment to ensure zero risk. All blood undergoes strict testing and a comprehensive traceability system is established. Special attention is paid to the privacy of blood donors, with an independent consultation space and a 24-hour confidential hotline. After donating blood, you will receive professional nursing guidance and health care. Professional guarantees ensure that blood donors can donate blood with peace of mind. From health assessment to sterile blood collection, from strict testing to privacy protection, we are responsible for the safety of every bag of blood. Your love needs professional protection. We use the most rigorous process to make blood donation safer and blood use more reassuring. Spread hope for life, starting with safe blood donation. Protect love with professionalism and deliver life safely. Every time you donate blood, it is the most precious gift

to life(Y.-Y. Chen et al., 2025; Huang et al., 2022).

3.1 Blood donation procedure

There are five steps to donate whole blood, and the whole process (excluding waiting time) takes about 30 minutes. The whole process of blood donation separation (excluding waiting time) takes about 1.5-2 hours, and the interval between blood donation is more than 2 weeks. Because it takes a long time, blood donors usually need to make an appointment with the blood donation center. Figure 2 Five parts of blood donation procedure.

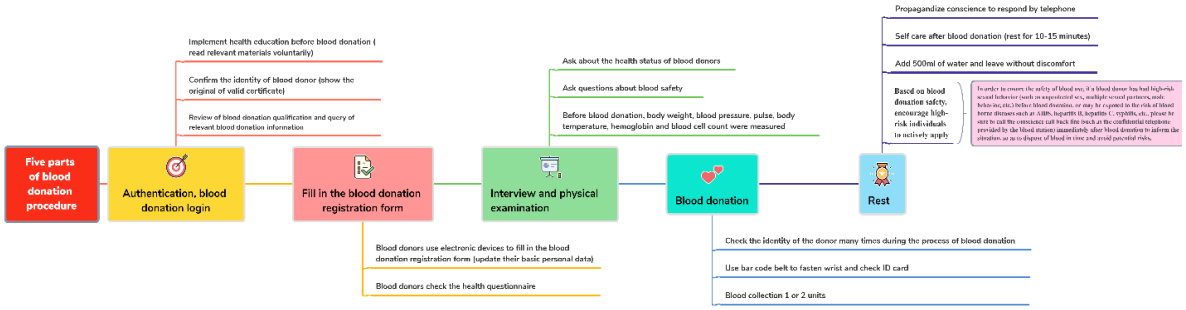


Figure 2 Five parts of blood donation procedure.

3.2 Investigation Methods

Refer to the blood donation service satisfaction questionnaire of Taichung Blood Canter in Taiwan(Qureshi et al., 2020). We used the online open questionnaire platform Wenjuanxing to design the "Voluntary Blood Donation Information Questionnaire" for students at Guangdong University of Petrochemical Technology. By scanning the QR code with their mobile phones, participants could complete the electronic questionnaire on-site. This allowed us to collect data promptly. Figure 3 Blood donation service satisfaction questionnaire and Questionnaire star network platform QR code.

Figure. 3 Blood donation service satisfaction questionnaire and Questionnaire star network platform QR code

3.2 Investigation content and reasons

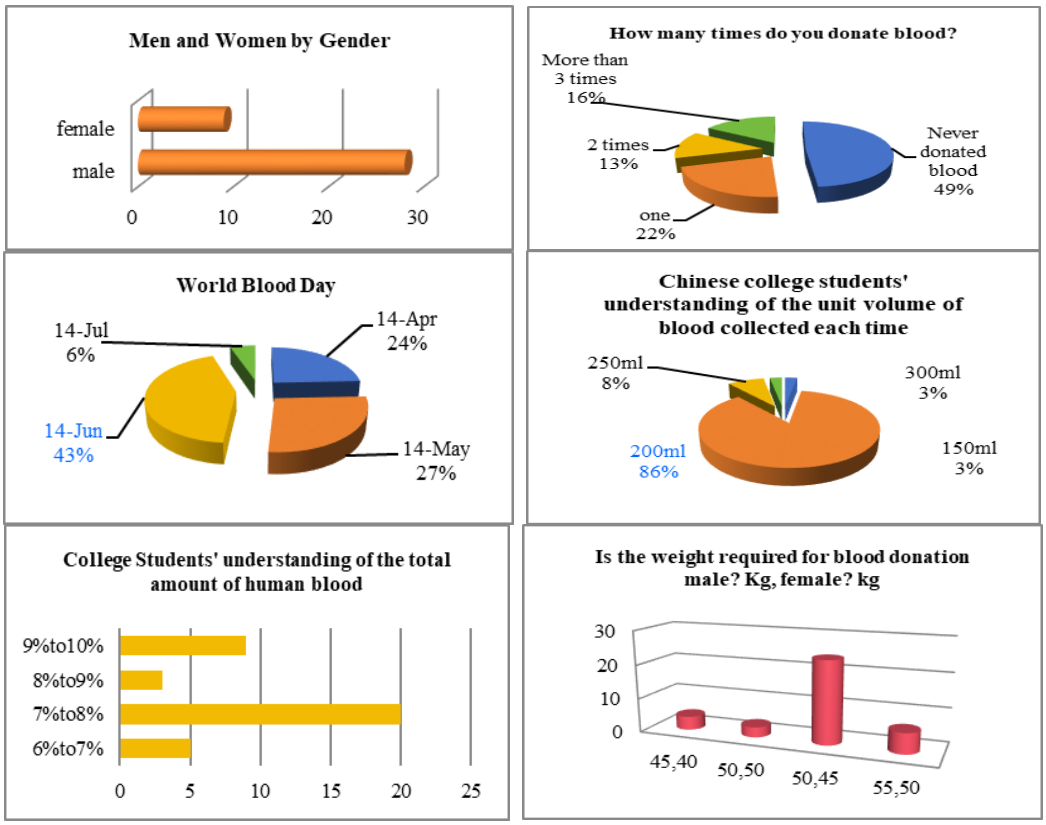
The first type of question focuses on personal basic information, including grade, gender, and occupation. This information is valuable for analyzing survey results. Different people have varying opinions on blood donation. Analyzing diverse data statistically enhances the objectivity and feasibility of survey outcomes.

The second type of question assesses the basic knowledge of blood donation, aiming to understand individuals' perspectives on this activity. By integrating personal circumstances with their knowledge, we can identify reasons behind differing understandings of blood donation. This enables us to promote blood donation more effectively and increase publicity efficiency.

The third type of question explores family background and motivations for donating blood. Factors like income, parents' education level, and occupation are considered to understand what influences awareness of blood donation. A comprehensive analysis of how family affects personal views and motivations toward voluntary blood donation provides insights into public perception and supports future initiatives in this area.

IV.Research Results

Questionnaire survey and collection. After 37 students completed the exam, the system generated visual records through statistical analysis. Based on students' input and conclusions, analyze and summarize the following quantifiable data.



In this study, male voluntary blood donors accounted for the majority of the analysis. The psychological characteristics of women are prone to negative emotions such as anxiety and fear before donating blood, which may affect their potential as voluntary blood donors.

The total blood volume of a normal person accounts for approximately 7% to 8% of their body weight. Many people are still unclear about the blood donation cycle date or blood composition. Research data shows that college students who participated in the survey have a high level of understanding of the basic knowledge of blood donation. However, there are still differences and uncertainties in the blood donation awareness and willingness of college students, which will directly affect their willingness and behavior to donate blood. The encouragement mechanism of universities will affect their willingness, motivation, and behavior to donate blood.

Data survey analysis shows that the majority of parents have a lower level of education. This leads to a lack of understanding about blood donation, but it has almost no impact on their children who are college students. In this class survey, nearly 50% of people have never donated blood, indicating that they also want to donate blood, but lack peer encouragement and assistance for blood donation.

V.Planning of voluntary blood donation system and improving blood donation enthusiasm

5.1 Understanding and Analysis of Blood Donation Knowledge

Conduct specialized promotional activities for students to eliminate their concerns about blood donation. Organize a health lecture to introduce the benefits and precautions of blood donation for health. Organize relevant activities to strengthen the popularization of knowledge in this area, and focus on explaining questions with a high number of incorrect answers (such as blood donation volume and interval); Utilize campus activities, lectures, bulletin boards, and other forms to promote blood donation knowledge and importance to college students; Create easily understandable promotional materials, such as charts and videos, and post them on campus social media platforms. This is of great help to blood donation work; Establish a campus blood donation volunteer team, train volunteers to become blood donation promoters, and help promote and organize blood donation activities. The resources of blood banks in Maoming City are still scarce, and organizing activities in schools is also beneficial for increasing blood bank resources. Blood donors are of great help to themselves and others(Fung et al., 2023).

Encourage students to invite their families to participate in blood donation activities and hold "Family Blood Donation Day"; Share blood donation stories among relatives through social media to enhance the affinity and appeal of blood donation; Establish a blood donation reward system, such as providing souvenirs, blood donation certificates, free admission tickets for on-campus activities. Cooperate with internal and external enterprises to provide discounts or promotions for blood donors; Organize a blood donation knowledge

competition, and the winner will receive prizes to increase students' interest in blood donation knowledge.

5.2 System Design and Implementation

The sustainability of college students' willingness to donate blood has attracted much attention. Based on questionnaire surveys and in-depth interviews, four core needs of college students for blood donation systems have been summarized: convenience (query of blood donation point distribution, online appointment system), information transparency (explanation of blood donation process, query of personal blood donation records), personalized services (reminder of blood donation cycle, multiple incentive mechanisms), and sense of achievement (blood donation honor badge, display of social contribution). Based on actual needs, a blood donation management system with mobile applications will be constructed. During the system testing phase, 37 college students will be invited to participate in the trial. Feedback will be collected from the dimensions of convenience, information transparency, and functional practicality to verify the usability of the system and user satisfaction, and to enhance the willingness to donate blood again(Xie et al., 2023).

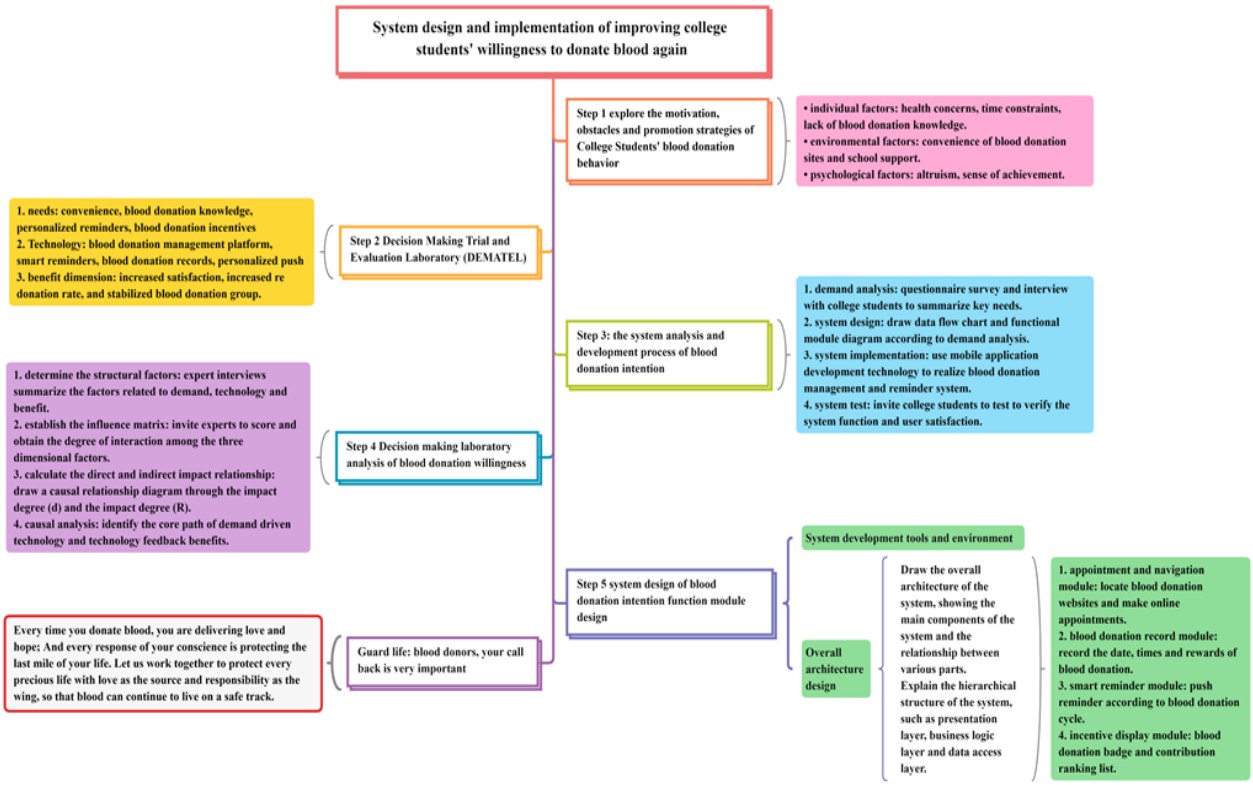


Figure 4 Implementation Architecture Diagram for Blood Donation System Analysis and Design

In the system design research, Decision Laboratory Analysis (DEMATEL)(J.-K. Chen, 2021; W. Chen et al., 2023) is introduced to determine the influencing factors of "requirements", "technology", and "benefits" through expert interviews. The Android Studio development platform is used, combined with Java languages, and Firebase is selected as the backend database to ensure cross device compatibility and data security of the system. Real time data feedback service upgrade, user behavior trajectory recorded in the database (such as appointments or cancellations). Personal blood donation records (frequency, blood volume). Incentive display module, with social features such as electronic points for gift exchange and annual blood donation ranking list. The LINE group's "reminder function" indirectly promotes the improvement of "satisfaction" and "blood donation rate" by enhancing user participation frequency, forming a core path of "demand driven technology feedback benefits" to meet the self-realization needs of blood donors. The future development direction of the system can be replicated in other public welfare fields, such as organ donation registration and volunteer service management, to promote the application of "technology empowering public welfare". Figure 4 Implementation Architecture Diagram for Blood Donation System Analysis and Design.

VI.Conclusion

The 37 students participated in this survey by filling out a survey questionnaire. There are relatively few female students in the School of Computer Science, and this data can only reflect the blood donation survey of one class. After a comprehensive analysis, it was found that most college students have a very correct basic knowledge of blood donation and have a high willingness to donate blood without compensation. The motivation for blood donation is voluntary blood donation, making contributions to society, and being very positive about blood donation. Guangdong University of Petrochemical Technology has established a campus blood donation volunteer club, actively accompanying and training volunteers to become blood donation promoters, and improving students' awareness and participation in blood donation. If the number of questionnaire data can be increased, it will have a more significant reference value for the survey and provide reference for schools and blood donation centers.

Acknowledgments

Thanks to the nurses at the Taichung Blood Canter and the Taiwan Blood Services Foundation for their encouragement and project counseling support. Guangdong University of Petrochemical Technology (Maoming, Guangdong, CN) Project Number: 2019rc076 (702-519186, 702-72100003102, 702-71013303119, 702-72200010122, 702-72200010358), (7103513124128, 71013407126, 71013407136, 71013407130,71013513124258,24B130,24B131,24C207)

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