ISSN 2475-529X

Research Article

Journal of Nursing & Healthcare

Blood Mobile Application: A Blood Transfusion Management Technology

Sonia Rejane de Senna Frantz[1], Nathalie Rezende Batalha Gomes1* and Maria Luiza Carvalho de Oliveira1

[1]*Amazonas State University - UEA*

***Corresponding author**
Nathalie Rezende Batalha Gomes, Amazonas State University – UEA,
E-Mail: natyrezende15@gmail.com

Submitted: 15 Sep 2021; **Accepted:** 22 Sep 2021; **Published:** 29 Sep 2021

Citation: *Sonia Rejane de Senna Frantz, Nathalie Rezende Batalha Gomes and Maria Luiza Carvalho de Oliveira (2021) Blood Mobile Application: A Blood Transfusion Management Technology, Journal of Nursing & Healthcare V6 (3): 1-9.*

Abstract

Objective: *Describe the development of the BLOOD mobile application as part of a Development and Innovation Project.*

Methodology: *Methodological study of technological innovation, developed with financial resources from the information technology law: Law No. 8.387/1991 (13), by the Laboratory of Technology in Health and Education of the School of Health Sciences of the University of the State of Amazonas.*

Results: *For the development of the BLOOD mobile application, the basic structure of technological product development was used. The mobile application development lifecycle used was the Scrum Agile model, divided into three phases: planning, development, closing. In the planning phase, the functional and non-functional requirements of the product were defined. The construction phase involved the development of the visual identity, and the development of the product's features, as well as the integration with existing systems in the healthcare facility. In the closing phase, the tests developed, licenses for use and the product validation process were described.*

Conclusion: *The BLOOD app will bring to the market an innovation in blood transfusion management, a procedure that is still mostly performed empirically by health professionals, as it is a daily routine, especially in large hospitals and blood centers.*

Descriptors: *Health Sciences, Technology, and Innovation Management; Blood Transfusion; Blood Component Transfusion; Health Information Systems;*

Abbreviations

UEA –Amazonas State University
LABTECS –Health and Education Technology Laboratory
ESA – College of Health Sciences
MVP - Model View Presenter PHP - Hypertext Preprocessor
HTML - HyperText Markup Language
CSS - Cascading Style Sheets
API - Application Programming Interface UX - User Experience

Introduction

Blood transfusion is a therapy that consists of administering blood cells from a donor–the one from whom the blood comes – to a recipient, the one who will receive it. It is a procedure that requires careful attention from health professionals who perform it, due to the potential risk of fatality caused by iatrogenics [1-9].

From the capture of blood donors to their administration to the patient, the entire process that involves the manipulation of blood with its ultimate goal is called the Blood Cycle, a process in which we focus on the transfusion act, where the nursing professional performs the transfusion. However, it is necessary to visualize the moments before the beginning of the transfusion to understand the blood transfusion process as a whole [1-10].

The medical professional is responsible for evaluating and prescribing patients in need of a blood transfusion. When making the prescription, the doctor must be careful to fill in the appropriate fields of the blood transfusion request prepared by the health service in which he/she is located. Such request must not contain errors and must contain all the necessary information about the patient and the blood product that should be administered. It is also important to know the patient and their history, especially the transfusion history [1, 2, 4].

Regardless of the procedure adopted by different health institutions, the process of requesting and processing a request occurs

in a simplified manner: the transfusion request is sent to the laboratory together with a blood sample from the recipient, where pre-transfusion tests will be performed for verification of the blood type of the recipient and concomitant preparation and separation of blood products in stock, which will be destined for the recipient. Once the tests are completed and the blood compatibility between the recipient and the blood bag has been verified, this blood will be sent to the transfusion site. Both the correct execution of the request and its processing to carry out the compatibility and separation tests of the requested blood component are extremely important for transfusion safety [3-4].

The transfusion act, which is the moment of the transfusion itself, can be divided into 3 stages: The pre-transfusion, peri-transfusion and post-transfusion stage. In the pre-transfusion stage, the nursing professional performs all the procedures for checking and checking data related to the patient and the blood component that will be transfused, and where he prepares the materials and the blood component bag for the transfusion. In the peri-transfusion stage, the transfusion occurs as expected, with an assessment of the patient being carried out within the first 10 minutes, and depending on the blood component transfused, within 1 hour of the procedure [5, 9].

A transfusion demands specific nursing care regarding the infusion time, checking the patient's vital signs and observing the patient regarding the occurrence of transfusion reactions. In the post-transfusion stage, the procedure ends, the patient is evaluated for 30 minutes for the possible occurrence of post-transfusion reactions, the materials are properly discarded, and the documentation related to the nursing process is finalized [5, 9].

In an outpatient clinic, patients present themselves for transfusion on site, undergo the procedure, are evaluated after the same at a given time, and are instructed about the occurrence of transfusion reactions within 24 hours after the transfusion, only then being released. When hospitalized, the post-transfusion patient is kept under observation by the nursing staff. Thus, it is observed that medicine is responsible for adequately providing for the patient's needs according to their physical and laboratory assessment, the professionals in the laboratory where the blood supply is located are responsible for the separation of the blood component and for its quality, and the nursing is the executor of the transfusion process, being responsible for administering the blood component and monitoring the patient at the bedside during all stages of the transfusion [1, 5, 6, 9].

The blood transfusion process is a flow that occurs systematically in accordance with the internal regulations of each institution, governed by posted legislation, which are periodically reviewed and revised to ensure the quality of healthcare services in hemotherapy, and patient safety. Despite the extensive regulation involved, studies show that, in health systems, errors still occur by health professionals in requests for blood components, in transfusion procedures and in records involving the procedure [7].

Such errors can be potentially fatal and cause complications for patients, therefore they must be avoided, and ways must be found to update professionals on the blood transfusion process, provide the same uncomplicated and understandable care methods that facilitate the process, and strict supervision procedures and records. It is observed that nursing generates a large amount of data from its care activities, which require the use of new tools for their capture, storage, and observation, which must be concise and objective enough so as not to harm the care flow, with the excess or lack of information. Therefore, it is essential to implement strategies that favor the methodical compliance with the necessary requirements at each moment of the blood transfusion process, aiming at improving care and transfusion safety [8-10].

Health technologies have proven to be an effective way to contribute to this end, with the advent of information technologies - with hardware, software, database management systems and communication technologies - information management has become more effective and safer. Through these technologies, it is possible to streamline assistance, ease of recording and storage of data, standardization of information, the implementation of the assistance process in a satisfactory manner, and also the ease of access and use by end users, health professionals. By decreasing the use of physical information and increasing the use of digital methods that consume less time and resources to be used and filled out, health care becomes even more patient centered [9].

The use of mobile apps in today's reality is constant and is part of the day-to-day life of all smartphone users, it is only natural that it would advance to the health area, where the agility and practicality of new technologies are the necessary evolution for reduce the procedures involving care, ranging from computerizing the patient's medical record to using the nursing process via mobile application, all digitally generated information is accessible to health professionals and become important allies in the mitigation and prevention of Adverse events [11, 12].

Based on reflections on the usefulness of new technologies available in the context of patient care, and on observations regarding the blood transfusion process, it is essential to understand how to apply an information technology based on recording and storage of related data blood transfusion and monitoring of the transfusion process in a health institution that regularly performs transfusion procedures, so that the process can be systematized, improving the method of recording and access to information, and providing the health professional with a new tool that, in addition to being practical, will provide a guide service in the stages of the transfusion Act, promoting safe and efficient care practice.

Considering this, a group of nurses from the Health Technology and Education Laboratory of the State University of Amazonas conceived and developed a web system and mobile application to ensure the safety and quality of transfusions for use in hospital institutions, called BLOOD. Therefore, the purpose of this article was to describe the development of the BLOOD mobile application as part of a Development and Innovation Project.

Methodology

Methodological study of technological innovation, developed with financial resources from the Brazilian information technology law: Law No. 8,387 / 1991 [13], by the Laboratory of Technology in Health and Education - LABTECS of the School of Health Scienc-

es of the University of the State of Amazonas - ESA-UEA.

For the development of the BLOOD mobile application, a basic technological product development structure was used. The mobile application development lifecycle [14] used was the scrum agile model, divided into three phases: [15]

- **Planning**

This phase is defined by the initiation of the product, which corresponds to the definition of the functional and non-functional requirements of the product. Requirements express the characteristics of the product from the point of view of satisfying user needs and can be functional or non-functional requirements. Functional requirements are those that describe the behavior of the system, its functionalities and actions for each input. Non-functional requirements are those that express what must be done and are related to quality standards [16].

To define the requirements of the BLOOD application, results of a field research that sought to observe, analyze and describe the nursing care used by nurses in their care in a hematology and hemotherapy hospital, and a technical visit to observe the cycle of blood from the laboratory.

Following the Scrum model, the defined requirements are described in the document called Product Backlog, which refers to a list that contains the functionalities to be implemented in the product. Product development is divided into a sprint backlog that consists of the list of features that will be developed in each sprint. Sprint, on the other hand, is the development of features selected according to the priority for building the application to be developed [17].

For the development of the BLOOD mobile app, 14 sprints were defined with an average of 27 days of development. In all sprints, sprint planning, sprint review and retrospctive sprint were elaborated, sprint events that should happen as follows: At the beginning of a sprint, a meeting should be held with the development team to plan the sprint activities, define the difficulty of these activities and both presenting the sprint backlog and discussing it. At the end of the sprint, during the sprint review meeting, the activities performed are presented completed and the eventualities that occurred during the sprint course are discussed. In the sprint retrospective developers can evaluate their strategies considering what was done, how it was done, what decisions were made, if they were effective, and there is the possibility of discussing the development process to discuss the development process in order to improve.

The product was built over a period of 1 year and 6 months, by a team consisting of developers divided into the following categories: Backend, Frontend, Mobile and Database. Also, by a health team, formed by professionals and a student in the area, to establish the connection of the team of developers with the universe of health and its specificities, and work with the project documentation. At the end of this phase, a software architecture proposal was elaborated. (Figure 1) For the development of the project, the MVP Architecture (Model View Presenter) was adopted, aiming at facilitating communication with the target audience. The system architecture diagram was created divided into WEB and MOBILE groups, working with PHP and Slim Framework technologies in the Backend, HTML, CSS, JAVASCPRIT, Vue.JS, Vuetify, and Axios in the Frontend, and Android, Kotlin and SQLite in the Frontend Mobile.

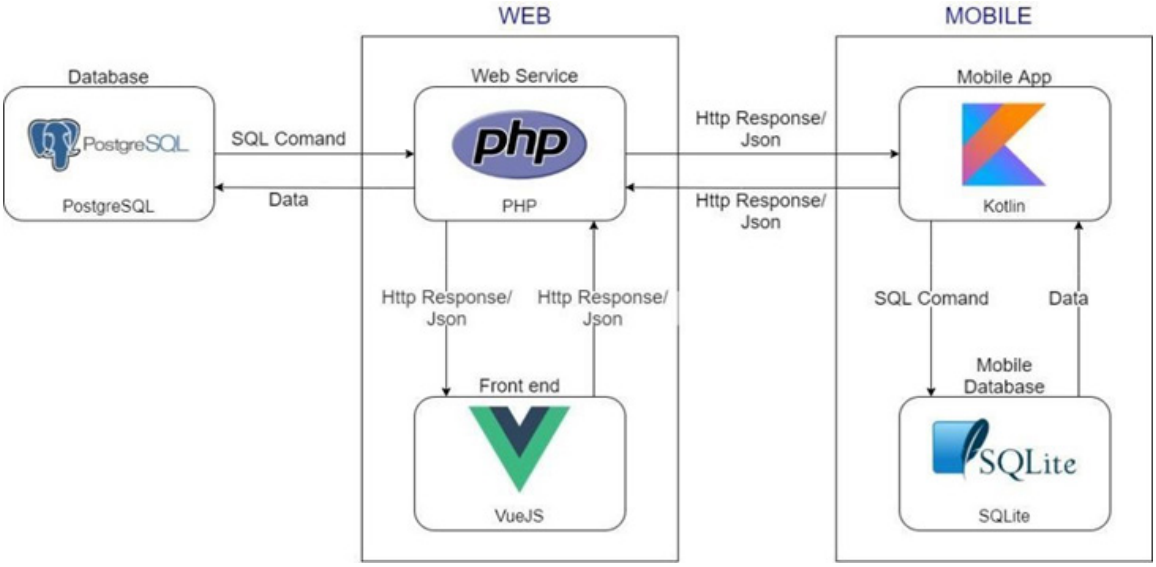

Figure 1 – System Architecture Diagram

- **Development**

This phase is defined by the construction of the product. The development environment is defined, which in relation to the BLOOD mobile app was determined from the Android Smartphone model Samsung Galaxy S20 system.

The UX (User Experience) or user experience of the application, of the BLOOD Application is designed for healthcare profession-

als who perform transfusions in their day-to-day care: it seeks to be practical, complete, with accessible features that meet reality of a blood transfusion procedure. The system is designed to guide professionals in carrying out their activities, thus being intuitive, following a checklist of activities model, logically dividing the moments of transfusion, and understanding each particularity involving these moments: data and assessment of the patient that must be completed and that can be provided by the system's database, facilitating communication with the user and communication between users and thus reducing the waiting time for blood products, alerts for activities that must be performed, for the procedure time, special fields for patient assessment that facilitate their handling and recording, the system aims at transfusion safety and the prevention of adverse events, which is of interest to managers of health institutions and to professionals themselves who are surrounded by the risks of care to the patient.

Here, too, there is a concern with the conservation and better use of blood products, which is of interest to blood centers, since such products are valuable, and their rational use should be advocated. The organization of system functionalities according to each user profile is represented by the Use Case Diagram (Figure 2).

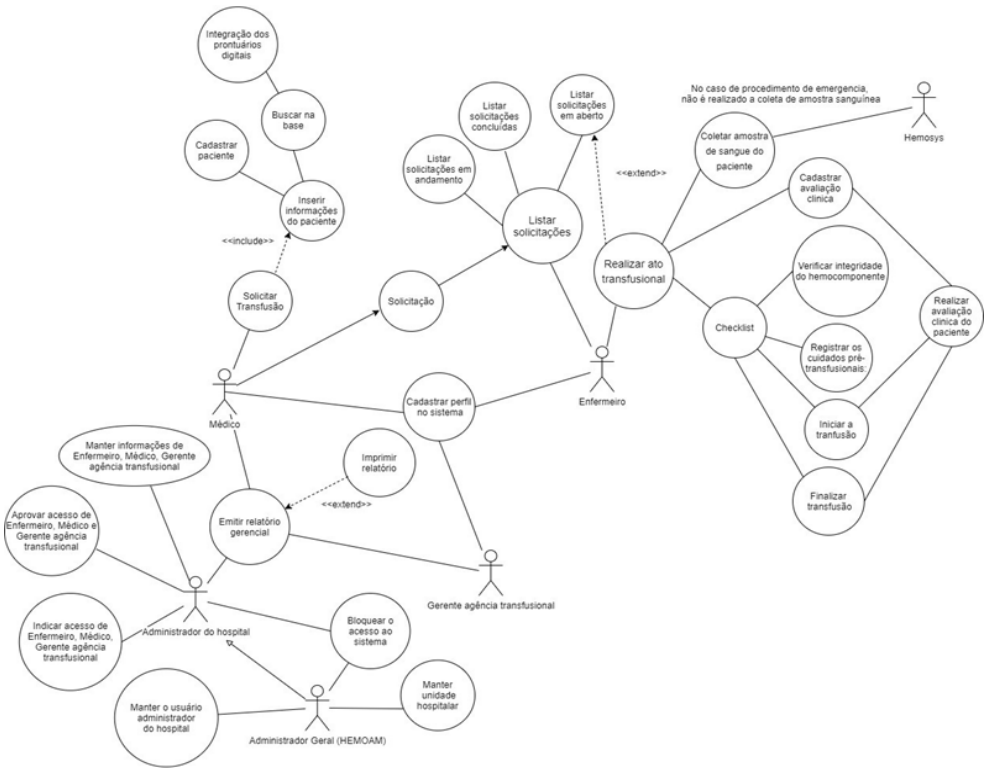

Figure 2 – Use Cases Diagram

• Closing

This phase describes the software integration, final tests and product delivery documentation. The BLOOD mobile application API integration with hospital systems in use is one of the specific goals of the system development, this communication between systems is essential for providing information that is not found in the BLOOD system database, so that both the systems work in cooperation, allowing for an integration between health professionals (users) and the blood center.

During the application's final testing phase, the system goes through a test plan developed by a company responsible for carrying out the tests through its team of testers, in order to understand the system's requirements, the use of development technologies and evaluate the behavior of the system under different conditions of use. Focusing only on the construction of the product, this manuscript will not be limited to the complexity of the tests to which it is submitted, so the application's testing phase will be described in detail in another scientific production.

Results

• Planning

After discussions and studies of the use cases raised, it was possible to define which features would be part of the mobile application to be developed, divided into Functional Requirements (Table 1) and Non-functional Requirements (Table 2).

Table 1– BLOOD Mobile System Functional Requirement

ID	Functional Requirements
R001	The system must allow users to log in to the system
R002	The system must allow keeping of registration information of hospital units
R003	The system must allow maintaining of user registration information
R004	The system must allow defining of a user's role in the system
R005	The system must allow the system administrator to block user access
R006	The system must allow users to change their access password
R007	The system must allow the system administrator and the hospital administrator toview and print management reports on the transfusion processes performed
R008	The system must keep information on transfusion operations
R009	The system must allow the doctor to make transfusion requests
R010	The system must indicate recommendations on the use of blood components
R011	The system must allow doctors/nurses to cancel transfusion requests
R012	The system must allow doctor to view the list of transfusion requests performed in open/in progress/completed
R013	The system must allow nurses to respond/start/proceed with a transfusion request
R014	The system must perform a time count to ensure that the product is administered at the right time, during the transfusion process
R015	The system must allow the nurse to conduct the transfusion process through a checklist that indicates the steps to be taken so that the administration of the blood component is done correctly. The checklist includes the following activities: Record bag/blood component integrity, conduct clinical patient assessment, record pre-transfusion care, install blood component, clinical patient reassessment, and finish procedure
R016	The system must issue alerts and requests information necessary to take place systematically
R017	The system must allow the nurse to print the patient's medical record after the transfusion operation

Within the product's functionalities, there is the possibility of performing a login in the system after registration (R001) which will be done through the Web, saving this registration, which will be according to the hospital unit in which the user is located (R002) and the saving of registration information in the system, not being necessary to log in multiple times to access the application (R003). The user's role in the system must be defined by the user with Administrator profile, these profiles being System Administrator, Hospital Administrator, Doctor, Nurse (R004). The user with Administrator profile having the power to allow the entry of new users into the system will also have the power to block active users (R005).

Once a user creates their account in the system and has their registration accepted, they will be able to make changes in their login information in the future, such as changing their access password, for example (R006). The system also provides that users with management profiles (administrator profiles) will be able to view transfusion reports and print them, as their profile gives them access to the entire management part of the system, including access to these reports (R007) that will be obtained from the information of the transfusion records that will be kept in the system's databases (R008). Such data will be obtained directly from the transfusion process itself, which in the system will start from the blood transfusion request, generated by the Doctor user profile (R009), which will have at its disposal several features to facilitate the creation of a request for transfusion: the system will give you options and recommendations for choosing blood components (R010) and will allow you to observe and list requests that have already been made, that are in progress, and that have been completed (R012).

Both Doctor and Nurse user profiles will have the power to view the listing (R013) and cancel requests in progress, due to errors found after the request (R011). When the request is evaluated by the professionals and considered correct, it proceeds to the laboratory where the blood products are separated (whose visualization is not part of the project scope), and then to the receipt of the blood product, and the beginning of patient care and blood transfusion by the Nurse user profile (R014). To ensure that the transfusion is performed within the recommended time of 4 hours, the system will have the functionality of counting time, starting from the installation of the blood component by the Nurse profile (R015). All nursing care during the blood transfusion procedure will be carried out with the monitoring of the system, through features that allow you to: follow the steps of the procedure correctly, through a checklist of steps to be performed, containing the product integrity record blood (if the blood component bag is within the compliant standards for the transfusion), clinical assessment of the patient (data record of the patient's physical examination, vital signs, venous access for transfusion), installation of the blood component and clinical reassessment of the patient, all included within the Pre-transfusion, Transfusion and Post-transfusion moments, ending with the end of the time counting to signal the completion of the procedure (R016).

The system will also be able to issue alerts for the nursing professional to perform specific activities at specific times during the transfusion, such as checking the patient's vital signs after 01 hour of transfusion (R017). At the end of the procedure, the Nurse user profile can also print the data from the patient's medical record, a complete report of the transfusion performed via the application (R018). Within it, you can still have access to the Ministry of Health manual on the rational use of blood, for guidance and clearing up doubts during the procedure (R019).

Table 2 – Non-functional requirements of the BLOOD Mobile System

ID	Non-functional requirements
RNF001	The system will allow the monitoring of the transfusion steps through: Mobile device and Web.
RNF002	The system must be available in the languages: Portuguese and English
RNF003	The system must allow fast and practical recording of transfusion procedures
RNF004	The system must provide professionals with important information about ideal transfusion practices to be performed
RNF005	The system must issue risk alerts regarding inappropriate requests and inadequate conditions of administration of products/blood components

Since the main objective of the BLOOD system is to carry out and monitor the transfusion in each of its stages, this will be the central point of the mobile application (RNF001) where the health professional will have at his disposal all the tools for this, agile and practical way, taking into account that the recording of information and monitoring of the procedure will occur in real time in the assistance, which requires an understandable and fluid usability of the system (RNF003) and seeking to assist and instruct the professional in the correct performance of the procedures. Therefore, the system must constantly evaluate the ideal conditions of blood component requests to prevent errors in the request phase (RNF005) and direct the user to follow the transfusion and check-list steps to prevent errors in the blood administration phase (RFN004). The application must be available in Portuguese and English to ensure accessibility for foreign professionals as well (RFN002).

- **Development**

In system development a navigation flow is established to provide the UX according to the selected user profile (System Administrator, Hospital Administrator, Doctor, Nurse). Each profile allows a journey that the user will go through within the application, generating a usage scenario with several specific functionalities (Figure 3).

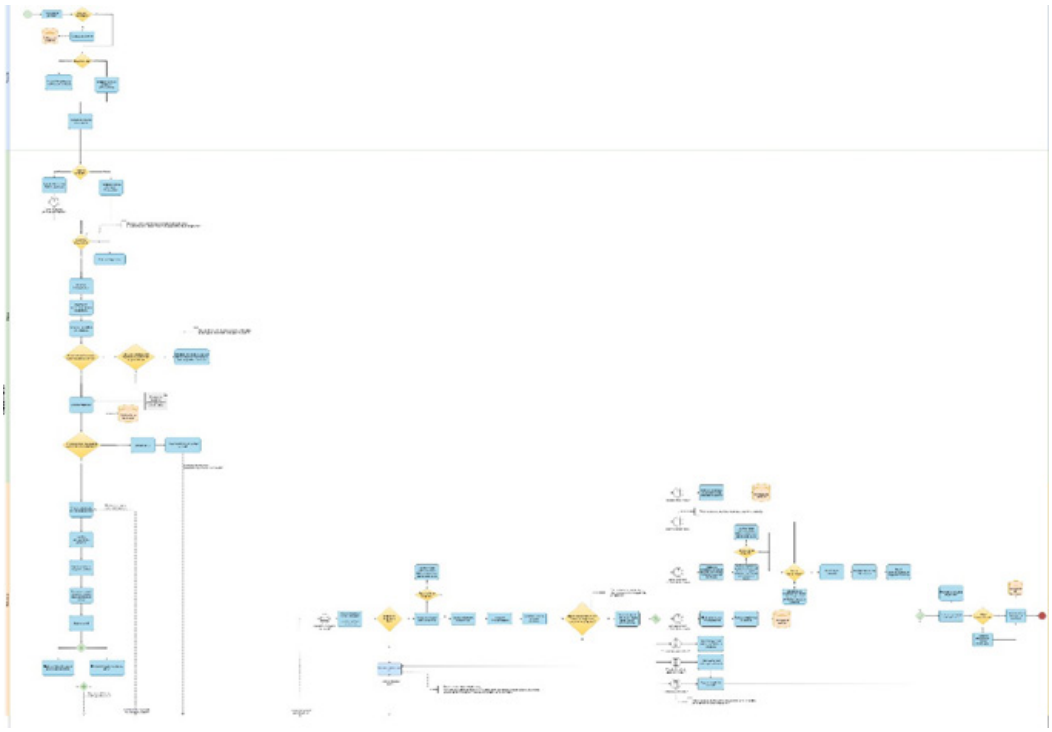

Figure 3– BLOOD's Navigation Flowchart

The construction of application screens through design considered the set of functional requirements, developing a navigation flow focused on UX or User Experience, practical and intuitive usability. The initial screen of the application presents the visual identity of the system inserted in the blue color chart defined to compose the product, as can be seen in Figure 4.

Figure 4– Application home screen when installed on Android mobile.

After the initial screen, the user authentication screen is presented. This screen includes the login functionality – performed by email – and password definition, with the "Enter" button. There is also an access recovery feature called "Forgot my password" (Figure 5).

Figure 5- Authentication screen

When the user logs into the application, they have access to a list containing the list of blood transfusion requests that the user has already performed (Doctor profile) or that are being attended to (Nurse profile). This list includes the patient's name, clinic, and bed number. Requests will be marked with status such as: In preparation, Awaiting Sample Collection, Awaiting Service and Partial Service. The screen also has a button with a "+" symbol in the lower right corner, which allows access to a screen for new transfusion requests (Doctor profile) (Figure 6).

Figure 6– Blood transfusion requests screen

When clicking on a request from the list, the user is directed to the screen where he will have all the information about that transfusion request, which the user fills in the request in the service steps, procedure, request and requisition items (Doctor profile). In addition to identifying by previous status whether the transfusion is in progress or completed, the request summary includes information such as: patient data, request data, transfusion modality and requested blood components (Figure 7).

Figure 7– Blood transfusion request summary screen

Discussion

The agile software development methodology adopted in the BLOOD application development through the Scrum Framework can be divided into the following phases: Inception, Elaboration, Construction and Transition, these phases being respectively responsible for defining, elaborating, building and deliver a product [14, 16].

The first phase of the agile development process is Inception, where the project scope is outlined, the project artifacts and the system's functional requirements are built. It is known that the stage of research and deepening of the subject is essential for the development of a system, with the objective of successfully meeting its purpose. Therefore, it is necessary to immerse oneself in the environment that one seeks to know in order to capture its reality and, therefore, understand the vision of the end user, to whom the system is directed [15-17].

Considering that nursing care is the key point of blood transfusion, understanding it better proved to be essential for the visualization of the system to be created. Of nursing in transfusion, going directly to users - health professionals - and confronting their interpretations of the transfusion act with the literature and updated legislation on this theme, thus allowing the definition of system requirements, with the research being a survey of everything that the system must understand in its functionalities [16].

As a basis for understanding the blood transfusion process in its entirety, following both the laboratory and nursing assistance, a technical visit to the blood center in the region was carried out with part of the team of developers, responsible for analyzing the blood process, from the request for transfusion, pre-transfusion tests, to the preparation and separation of the blood component in the laboratory, to the transfusion itself. Subsequently, this process was presented to the team in a flowchart format, paying attention to the main requirements already established so far.

Both the field research and the technical visit to visualize the process were vital for the construction of the system through the junction between the product owner's vision, the users' needs, and the possibilities presented by the developers. In the Elaboration phase, some of the values of the agile method are essential for this convergence of information to become the mature system: interactions between individuals and collaboration with the customer. During extensive meetings promoted both by the project's funders and by the development team with stakeholders and team members with different roles, the debate and review of the concepts presented so far were key points for the design of the system. In the BLOOD system development project, the Elaboration phase was incorporated into the Inception phase [14].

From the point where the team is properly integrated into the project and aware of its purpose, the techniques and methods that will be used, then the Construction phase enters, where the development of the system itself will begin, with the configuration of the software architecture and tool customization. The joint work of programmers is essential for the success of each stage of this phase, divided into Sprints, according to the S-Agile Scrum model. The delivery of results in short periods of approximately one month per Sprint, allows developers to adapt to changes in the product, correct and improve it according to the needs expressed by the Product Owner, the owner of the final product, and through the numerous events of Scrum, such as the daily meeting, planning meeting and results review meetings, the Scrum Master, who is responsible for ensuring that all Scrum events are held and that the framework is followed correctly, can assist in building this product together with the team, making the connection between the client and the developer [14, 16].

BLOOD application will bring to the market an innovation in blood transfusion management, a procedure that is still mostly performed empirically by health professionals, as it is a daily and routine thing, especially in large hospitals and blood centers. However, its severity is comparable to that of a transplant since blood is a tissue. This gives rise to the importance of systematizing this process, removing it from the pages of the protocols and bringing it to a new technological reality, where the registration and monitoring of transfusions will be portable and accessible.

The possibility of making a transfusion request in a matter of minutes with your smartphone will certainly bring the medical professional practicality in this regard, however, it is necessary to assess whether the speed with which this procedure can be performed will not lead the professional to error, when clicking on a wrong item, and since the system is in the palm of your hand, pay attention not to its use, but the use of other apps. As well as following several transfusions in the palm of your hand, the Nurse can also at some point be led to confuse or exchange information regarding different patients. The human component will always be present regardless of the scenario, and failures should be avoided, and in its design, the system should be designed to predict them.

Application validation tests, both technical validation and content, usability, and security validation, are of great importance to ensure the legitimacy of the system. They occur concurrently with the development in the Construction phase, as well as the possibility of correcting bugs, technical errors, and inconsistencies, by professionals responsible for the System Test, and the scientific part of the system, which is validated or invalidated by health professionals who will have access to the application. Focusing only on building the product, this manuscript will not address the complexity of validation tests, so the application testing phase will be described in detail in other scientific production [14-16].

The final phase of the agile development process is Transition, where the completion of the system's development activities takes place, which will be formally finalized, with the preparation of a term of closure and rendering of accounts for the development project. It is also the time of the last Scrum event, which corresponds to the closing meeting (Lessons learned). This phase is marked by the conclusion of a cycle, where all development results must be delivered to the client – finalized system, corresponding documentation, and foreseen scientific products [14, 15].

Conclusion

The construction of a technology project in health care provides professionals with the opportunity to learn about a technological universe that they can add to their work process through the prac-

ticalities that technology provides in daily activities in health care, as it suits perfectly to the search for improvement in the quality of care, by facilitating planning, management control and communication through digital platforms. Development and innovation projects in health technologies make these records practical and computerized and ensure patient safety by acting as assistance care guides for the health professionals.

It is known that nurses occupy strategic leadership positions in the managerial and organizational dimension in health services worldwide. In this context, health professionals unveil the importance of their role in the development of entrepreneurial actions in the construction of technological products in nursing aiming at improving care. Therefore, is a need to encourage the participation and collaboration of nurses in the production of technologies and development research to promote entrepreneurship in nursing and enrich knowledge in the technological area, as well as the advancement of science in health.

It is concluded that, thanks to the efforts of health and technology professionals working together, the BLOOD mobile application achieves its goals when providing subsidies for health professionals working in blood centers to manage, organize and document the procedures of blood transfusions performed quickly and conveniently, and at the same time performing these transfusions in a way that aims at the safety of the professional and the patient, and the best use of this blood component, since it is a valuable product and should be used sparingly and carefully, thus observing all transfusion safety protocols.

References

1. Flausino, Gustavo et al. The blood production cycle and transfusion: what the doctor should know. Rev Med Minas Gerais, Belo Horizonte, MG - Brazil, v. 25, no. 2, p. 269-279, 2015. DOI 10.5935/2238-3182.20150047. Available at: http://bases.bireme.br/cgi- bin/wxislind.exe/iah/online/?IsisScript=iah/iah.xis&src=google&base=LILACS&lang=p&nextActi on=lnk&exprSearch=758335&indexSearch=ID Accessed on: May 4 2020.
2. Redefine O Regulamento Técnico De Procedimentos Hemoterápicos. Portaria Nº 158, De 4 De Fevereiro De 2016 Nº Portaria Nº 158, De 4 De Fevereiro De 2016, De 4 De Fevereiro De 2016. Ministério Da Saúde. [S. L.], 4 Fev. 2016. Available at: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2016/prt0158_04_02_2016.html Accessed on: July 18 2020.
3. Vieira CMAS, Santos KB. The knowledge of the nursing team in transfusion of blood components: an integrative review. Rev Fun Care Online. 2020 Jan/Dec; 12:517-524. DOI: https://pesquisa.bvsalud.org/portal/resource/pt/biblio-1096967 . Accessed on: July 19 2020.
4. SEKINE, Leo et al. Analysis of the profile of requests for transfusion of blood components at the Hospital de Clinicas de Porto Alegre in 2005. Rev. Bras. Hematol. Hemoter., São José do Rio Preto, vol. 30, no. 3, p. 208-212, 2008. Available from http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1516- 84842008000300009&lng=en&nrm=iso. Access on 06 May 2021. https://doi.org/10.1590/S1516-84842008000300009.
5. Mattia Daiana, Andrade Selma. Nursing care in blood transfusion: a tool for patient monitoring. Text Context Nursing [Internet]. 2016 [cited 2020 Jul 19];25(2):1-8. DOI 10.1590/0104- 07072016002600015. Available at: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-07072016000200308. Accessed on: July 19 2020.
6. Oliveira, Sueli Mendes de. Guidelines for clients undergoing outpatient blood transfusion: creation of a care protocol. 2016. 102 f. Dissertation (Professional Master in Nursing Care) - Aurora de Afonso Costa Nursing School, Niterói, 2016. Available at: https://app.uff.br/riuff/handle/1/2558. Accessed on: September 14 2021.
7. Oliveira, Fabiano. Reflection on the knowledge and actions of nursing professionals facing the hemotherapy process. Multitext Magazine, [s. l.], year 2016, v. 4, ed. 01, 2016. Available at: http://www.ead.unimontes.br/multitexto/index.php/rmcead/article/view/185/114. Accessed on: Jan. 13 2020.
8. De Medeiros Lima, Luciana; Ribeiro Santos, Sergio. Prototype of a software for nursing records in a neonatal intensive care unit. Aquichan, Bogota, v. 15, no. 1, p. 31-43, Jan. 2015. Available from <http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S1657- 59972015000100004&lng=en&nrm=iso>. Accessed on: 05 May 2021. https://doi.org/10.5294/aqui.2015.15.1.4.
9. Gurgel Amanda, Melo Verônica, et al. Critically ill patient: safety in transfusion therapy through a checklist. Brazilian Journal of Health Sciences [Internet]. 2019 [cited 2020 Jul 18];23(4):525-534. DOI 10.22478/ufpb.2317-6032.2019v23n4.37205. Available at: https://periodicos.ufpb.br/ojs2/index.php/rbcs/article/view/37205. Accessed on: July 18 2020.
10. Frantz, Sonia et al. Nurses' work and competence in hemotherapy services: an ergological approach. Brazilian Journal of Nursing [Internet]. 2020 [cited 2020 Jul 18];73(3):1-9. Available at: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0034- 71672020000300162&lng=pt&nrm=iso&tlng=pt. Accessed on: July 18 2020.
11. Caldas MM, Tourinho FSV, Radünz V, Fermo VC, Ilha P, Alves TF. Mobile application for error prevention in medication: Prevmed. Cienc y Enferm. 2020;26(4):1–9. Avaliable at: https://pesquisa.bvsalud.org/portal/resource/pt/biblio-1114713. Accessed on: September 14 2021.
12. Sickseg A, La EN, Móvil P, La P, Lesiones PDE. App "SICKSEG" in mobile platforms for the prevention of skin injuries. J Nurs UFPE line. 2020;14(0). Avaliable at: https://periodicos.ufpe.br/revistas/revistaenfermagem/article/view/244152. Accessed on: September 14 2021.
13. Brasil. Presidência da República. Casa Civil. Subchefia para Assuntos Jurídicos. Lei N° 8.248, de 23 de outubro de 1991. Brasília, 1991. Avaliable at: http://www.planalto.gov.br/ccivil_03/leis/l8248.htm. Accessed on: September 14 2021.
14. PMI. A knowledge guide in project management: PMBOK Guide. Project Management Institute, 6th Edition, 2018.
15. Koscianski, A., Soares, Santos, M. Qualidade de Software, São Paulo, Novatec Editora, 2006.
16. Machado FNR. Análise e gestão de requisitos de software: onde nascem os sistemas. 3ª ed. São Paulo: Érica; 2016.
17. Pressman, R. S. Engenharia de software. São Paulo: Pearson Makron Books. 2009.