
Software Requirements Specification

for

RFID for Blood Banks

Version 2.0

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● Revisions

Version	Primary Author(s)	Description of Version	Date Completed
1.0	Deepthi Warriar Swarna Shenoy	Initial draft	11/01/2019
2.0	Deepthi Warriar Swarna Shenoy	Final Version	12/06/2019

1 Introduction

One of the major challenges medical laboratories/Blood Banks face is to keep track of the blood samples collected over time and to avoid any errors during this process. A simple error in recording the details of the blood sample can cost a human life.

Radio Frequency Identification or RFID is a method that automatically identifies people, animals, inventory or objects using radio waves. To accomplish the identification process, an RFID device (called tag) is required to be attached to any object that requires identification. The process of attaching RFID tags to objects is known as tagging. An object that is registered or has an RFID tag attached to it is called a tagged device.

In this document we will be exploring the options on how to use RFID Technology for the benefit of tracking the blood samples in a Blood Bank. The RFID Tag is attached to each blood sample and an RFID Reader is used to keep track of the intricate details of the blood samples all at once, like the donor details, the time the sample was collected, the temperature of the sample which otherwise would have to be read manually by a human operator. Using RFID technology for tracking the blood samples would not only make the process easier but also reduce the occurrence of human error.

1.1 Document Purpose

The document addresses the requirements of the RFID used for managing the blood samples in Blood Banks. The document version is V2.0. The scope of this product is automating the monotonous work done by the lab technicians in the data entry side for the blood bags. Some of the obvious benefits of using RFID in Blood Banks are the improved and efficient Inventory Management, security, scalability, nearby hospitals/blood banks, easy maintenance and less errors.

1.2 Product Scope

The scope of this product is to provide an automated means through RFID in labelling the blood samples and keeping track of the sample details, temperature maintenance etc. which is currently a manual process done by the laboratory technicians. This is not only a tedious process but very much prone to error. This would require each blood sample to have an RFID tag that would have the details of donor – Name, Blood group, Blood Component Type(Red Blood Cell count, platelets, and plasma), the date when the sample is collected, the temperature of each collection. The date of collection is very important since red cells are stored refrigerated for 42 days, platelets are stored at room temperature for 5 days (Agitated everyday to avoid coagulation) and plasma for a year in a freezer.

We also need to keep track of the blood sample distribution in the blood bank. This would help in better replenishment of the blood bags as and when they get used up. The temperatures of the blood bags can also be maintained using the RFID when there is any change in the temperature within the refrigerators where these blood bags are placed thereby avoiding wastage of blood bags due to improper temperature maintenance. Feature to locate the hospitals near to the blood bank has also been

provided with the help of Bing maps. Additionally, real time stock prices of the top five medical firms are also featured in this system.

1.3 Intended Audience and Document Overview

This document is intended for developers, testers, project managers, marketing staff, Blood bank Laboratory Technicians, Non-profit Organisations like Red Cross and Individual Customers - Eyhab Al-Masri (PhD). The rest of the SRS document is organised to provide more details of functionality, design and implementation details, business, functional & performance requirements, software & hardware requirements, external interface requirements, user documentation in the form of manuals & tutorials that are available for the user reference.

1.4 Definitions, Acronyms and Abbreviations

RFID – Radio Frequency Identification
GUI - Graphical User Interface

1.5 Document Conventions

This document adheres to IEEE formatting requirements. The text is in Arial font size 12. The document text is single spaced and maintains the 1" margins.

1.6 References and Acknowledgments

1. Aqua Lush Irrigation System Overview – Eyhab Al-Masri (PhD)
2. [https://www.medica-tradefair.com/en/News/Archive/RFID in Blood Banking: Errorless Handling and Automatic Inventory of Samples](https://www.medica-tradefair.com/en/News/Archive/RFID%20in%20Blood%20Banking%3A%20Errorless%20Handling%20and%20Automatic%20Inventory%20of%20Samples)
3. <https://www.mlo-online.com/home/article/13008632/the-case-for-rfid-in-blood-banking>
4. <https://www.redcrossblood.org/donate-blood/blood-donation-process/what-happens-to-donated-blood.html>

2 Overall Description

2.1 Product Perspective

Our system would let the donors to register whenever they plan to donate blood. RFID enabled tag is attached to every blood bag which would store information like blood group, the temperature of blood, donor ID, blood component, the day sample was collected and expiration date, its availability in the blood bank. This way when the blood bags are placed in the refrigerator or removed, based on the number of RFID tags the

system would be able to maintain the count of blood bags. Temperature where the blood bags are placed can also be tracked by our system during this time. List of the hospitals near the blood banks can also be located on the Bing Maps. Real time price of stocks belonging to the top medical firms are also included in our system.

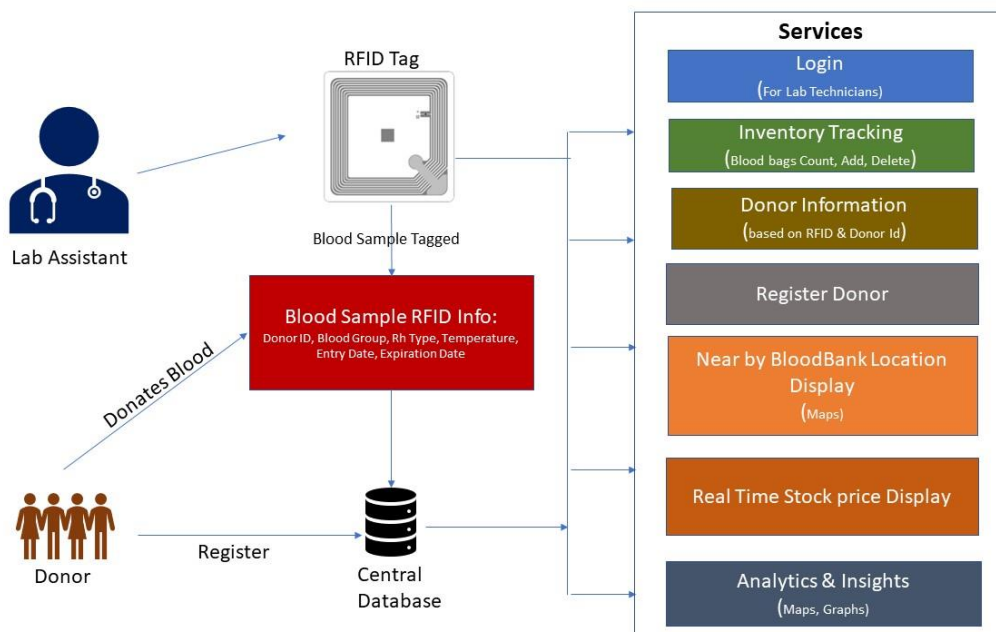
This RFID enabled blood banks is an existing system. This system increases the efficiency by simplifying the process.

2.2 Product Functionality

Following are the functions our product shall perform:

1. Feature to register for the donors.
2. The system is accessible to only the registered members for e.g. Lab Technicians of the blood bank/hospitals. Donors must not have access to blood sample related information in the system. They are authorized to use the registration option only.
3. RFID shall track the supplies in a blood bank.
4. RFID should also read the temperature where the blood bags are placed.
5. Graphical representation of the supplies available at a blood bank center.
6. Real-time stock prices of the top medical firms.
7. Locating hospitals near to the blood bank on Bing Map.

Below is a pictorial representation of our system.



2.3 Users and Target Markets

The primary users of our product are the lab technicians of the blood bank. The product is aimed at both first-time buyers and for those who are ready to replace their existing software to an enhanced version of blood bag tracking. The following table provides the reference guide of the users and the target markets involved.

Type	Description	Examples
Developers	Developers who would be developing the system	Software developers of the system, Testers, Managers of Universal RFID Inc.
Consumer	Mass Consumer Markets	Blood Bank Centers, Hospitals
Custom	Individual Consumers	Independent Blood centers, American Red Cross, & Eyhab Al-Masri (PhD)

2.4 Stakeholders

1. **Management** - The board of directors of Universal RFID Inc.
2. **Developers** – Developers of Universal RFID Inc. & Deepthi Warriar, Swarna Shenoy
3. **Marketers** – Marketing Section of Universal RFID Inc. & Deepthi Warriar, Swarna Shenoy
4. **Purchasers** – Blood Banks, Hospitals, Private Clinics, American Red Cross, Eyhab Al-Masri (PhD)
5. **Users** – Blood Bank Employees, Laboratory Technicians, American Red Cross Employees, Universal RFID Inc & Eyhab Al-Masri (PhD)

2.5 Operating Environment

The system should be able to run on any OS platform. The website shall function on most of the common browsers - Microsoft edge, Google Chrome, Mozilla Firefox, Safari, Internet Explorer. The system should be able to communicate with the servers where our web services would be hosted. Since we are using the Maps to locate hospitals nearby the blood bank as well and to get real time price of stock, our system should be

able to communicate with external services like Bing Maps and World trading data API respectively.

The minimum system requirements shall be:

1. RFID System installed within the refrigerators, blood bags.
2. Temperature sensors installed in the refrigerators.
3. Database.
4. Uninterrupted connectivity within the blood bank.
5. System shall be able to communicate using TCP and HTTP protocols.

2.6 Design and Implementation Constraints

Some of the implementation constraints shall be:

1. The whole of RFID system is simulated.
2. Also, the temperature sensors are simulated.
3. The database should not be accessible to the users - Proper data encryption should be used to protect the data.
4. Backup needs to be taken for the database to account for unforeseen circumstances to prevent the loss of data.
5. Since we are using external APIs they need to be up and working whenever the user tries to fetch the data.

2.7 User Documentation

The user documentation components listed below shall be provided at the end of the project:

- User Manuals - The user manual consists of the detailed description of the functionalities provided by the RFID for Blood Bank system such as Registering a donor, details of the process for login for the lab assistants to the rfid system, Inventory tracking, getting the details of the inventory.
- Tutorials shall be provided for registration of the donor, login process for the lab assistants.

2.8 Business Requirements

Today transfusion is one of the most promising sectors for deploying RFID technology as blood components are assets with high value and to facilitate patient safety. RFID enabled process would also reduce risk, wastage of blood bags and thereby increases the efficiency by simplifying the process. Currently, UHF technology RFID is used worldwide as they perform better in terms of multiple tag readings and reading distances.

RFID based solution for blood bank is built using service-oriented approach. This solution is beneficial in the long run as there will be fewer human errors and the data related to the blood bags would be updated frequently despite the RFID installation cost.

- The first version of RFID for Blood Banks must be brought to market within 3 months of development project launch.
- The graphical user interface of the RFID system is user friendly, clear and concise.
- RFID for blood banks retail price must be no more than 10% greater than the current manual human labor involved in the data entry and tracking system.
- RFID for Blood Banks must provide a Web-based simulation that at least 70% of users agree provides an accurate representation of the actual product and its use

2.9 Assumptions and Dependencies

The following basic assumptions are made for the product/software to function properly:

- RFID is attached to the blood bags.
- Temperature sensors are installed in the refrigerators used for storage of the blood bags.
- External APIs never fail.
- No connectivity issues with the internet. Constant Internet connection should be available for the proper functioning of the RFID.
- All the Lab Technicians have proper authorization for the use of the RFID system.

3 Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

- The User Interface should be user-friendly and easy to understand.
- THE GUI should be self explainable.
- The actions that the user take on the GUI should correspond to the same operation in the database. For e.g. if there is an update button on the UI, the corresponding action would be to update the data in the backend.
- Standard buttons like Submit, Update should be used for easy understanding of the operations.
- Generic, easy to understand error messages must be displayed to the user and not the Error Codes.

3.1.2 Hardware Interfaces

- RFID Readers should be installed in the refrigerators where the blood bags are placed in order to read the information on the blood bags.
- RFID Tags should be attached to every blood bag.
- Temperature sensors should be placed in refrigerators and in the unit that is used to place the blood bag when taken to different locations in order to keep track of the temperature of the blood bags.
- Database.
- Main Station or HTTP Server.

3.1.3 Software Interfaces

- Our system would communicate with database (SQLServer) via REST and SOAP web services for most of the features as we are simulating for the RFID.
- Microsoft Visual Studio and IntelliJ IDE is used to implement the product.
- The Operating System used is Windows 10.

3.1.4 Communications Interfaces

- The Communication protocols used for the product are HTTP, TCP
- The browsers that would support the User Interface for the product would be Microsoft edge, Google Chrome, Internet explorer & Safari.

3.2 Functional Requirements

1. **Donor Registration:** The system shall provide a Registration option for any donor who is willing to donate blood.
2. **Lab Assistant Login:** The system shall have a login page for the Lab Assistants who has access to all the information related to our system.

3. Home Page/View Blood Details:

- a. Blood Availability Information: The RFID system must provide a high-level information on the blood bags available in the Blood Bank.
- b. When clicked on 'Blood bags available at the center', all blood groups and its count shall be retrieved.
- c. When clicked on 'Blood bags available for a group', count of the selected blood group along with the blood component shall be retrieved.

4. Analytics & Insights for the RFID System:

- a. Graphical Representation shall display the information of the currently available blood bags in the blood bank.
- b. The information regarding the availability of blood at a blood bank center shall be shown on mouse over on the nearby hospitals/blood banks.

5. Adding & Updating Blood Bags:

- a. On 'Add Details', new blood bag would be entered into the system.
- b. On 'Update Temperature', for a given RFID the new temperature needs to be updated.
- c. On 'Update Reason', for a given RFID the reason why this blood bag would be unavailable (Expired, Transfusion, Transferred) can be updated.

6. Locating Hospitals:

- a. Using Bing Maps, locate the nearby hospitals.

7. Temperature Control:

- a. Check on the temperature of the refrigerators where the blood bags are placed.

8. Donor Information:

- a. By RFID: Get the DonorID associated with RFID and shall retrieve donor details.
- b. By DonorID: Retrieve donor information.

9. Stock Details:

- a. Retrieve real time stock prices for the top five medical firms.
- b. Chart that displays these stock prices.

4 Other Non-functional Requirements

4.1 Performance Requirements

- The system should be up and working all the time to avoid the risks involved.
- For location of hospitals and real-time stock price, the external APIs should be working fine.
- The response time for any request should be less.
- The RFID System should be scalable.

4.2 Safety and Security Requirements

- Lower quality RFID tag could give access to unauthorised sources.
- Only Lab Technicians should have access/permissions to view/ handle the blood sample data in the system. Authorisation for the users should be handled.
- Database failure & there by the data loss should be handled - Regular back ups for recovery of data should be taken care of.
- The donor information details should not be exposed. Data Encryption should be used to protect data at rest.

4.3 Software Quality Attributes

Reliability: The software should be tested thoroughly and should be bug free. It should be tested for the performance and efficiency as well.

Availability: The software should be easily available for the users. It can be deployed on cloud environment for high availability.

Scalability: Deployment of the software on the cloud environment makes it easily scalable.

Usability: The GUI Interface for the Donor Registration & Login Page should be simple, easy to understand and easily accessible to the users.

Maintainability: The RFID tags associated with the blood bags can be read all at once using an RFID Reader and hence makes it easy to maintain data which would otherwise be a tedious process to manually enter and maintain.

5 Other Requirements

While our system simplifies the process of managing blood bags, there are certain technological shortcomings. RFID tag which has built-in sensor and battery are expensive. To preserve the temperature of blood bags during transportation it would be ideal if the container can be controlled thermostatically.

6 Appendix A – Glossary

User: Any Lab Technician who has access to the blood sample data in the system

Donor: A person who would like to donate blood and register with a blood bank.

SQL - Structured Query Language is used to retrieve data from the database.

RFID - Radio Frequency Identification

GUI - Graphical User Interface. The User Interface through which the users can interact with the backend system.