



Database Systems I

Assignment 4

(Blood Donation System)

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Database Systems I (CSC371)

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1. Abstract

This report is for Shalamar Hospital, a well-known hospital currently operating thousands of patients. The core focus of this report is the lack of a proper blood bank system as the current situation is analyzed and detailed system requirements specification is produced, based on the user requirements. A database design is presented and recommendations are given to overcome the vacancies.

2. Domain Description

2.1 Company Profile and Operations

Shalamar Hospital is one of the biggest and most well-known hospitals in Pakistan, known for its moderate price range and being affiliated with the government. It is one of the oldest names. There is only one branch and it is in Lahore in Shalamar near Shalamar Bagh. It treats patients with all sorts of medical issues and has a top-level treatment facility. The hospital currently has many departments which also include the area:

- Blood Donation Bank

2.2 Current Situation

At present, since it is an old hospital so the blood bank system is not automated and most of the paperwork and records are being kept by hand. Currently, there is no proper data structure except for PCs working on word or excel to hold data.

Data is entered manually and there is the limited capability of placing and handling requests and getting reports can be time taking and in some cases, not possible. Due to this, the hospital is facing labor overload, slow request handling, and mismanagement of records and it has requested us to automate the system to ease its load.

3. Requirement Specifications

Donate to Blood Bank

An eligibility check is ensured according to the eligibility criteria issued by the concerned department and if only they pass, we add their record to the database and let them donate blood either regularly or on demand. Users who have entered regular donation options are notified after a set interval of days.

Storage in Blood Bank

When blood is received from the donor, it is then packed into blood bags of different capacities sourced from a manufacturer. Then the bags are stored in their respective blood bank refrigerators according to the blood type mentioned on them with the date and time specified (both received and expiration).

Receive from Blood Bank

If we receive a patient, we add their record and check if we have the required blood in the blood bank or the donor list. If blood is arranged, then transfusion occurs and a receipt is generated which has all the information required alongside the bill to be paid. If the required blood is not available in the blood bank, they can notify donors for donation.

3.1 Functional Requirements

ID	Function	Entity	Priority
Donation:			
1	Add/delete/view/update donations.	Donor Blood Bag	High
2	Eligibility check.	Donor	Medium
Storage:			
3	Add/delete/view/update all the storage locations.	Blood Bag Storage Donor	High
4	List of storage refrigerators, blood bags, and other necessary items.	Blood Bags Storage	High
5	Total storage capacity.	Storage	Medium
6	Allocation of utilities.	Blood Bag Storage	Medium
7	Minimum stock level check.	Storage	Low
8	Blood expiration control and disposal.	Blood Bag Storage	Medium
Request:			
9	Post/update/delete a request.	Request Patient Employee	High
10	Required time.	Request	Medium
11	Statistics for required and unrequired blood.	Patient Request Blood Bag	Medium
12	Discard expired or completed requests.	Request Patient	Medium
Receipt:			
13	Create/update/delete a receipt.	Receipt Donor Patient Employee Blood Bag	High
14	Receive Bill	Employee Patient Receipt	Medium

15	Duplicate Receipt	Employee Receipt	Low
16	List of Receipts	Employee Receipt Donor Patient	High

3.2 Non-Functional Requirements

- The DataBase System should be allowed to only authorized personnel.
- Reports should be available to concerned department
- Any change in database will send an email automatically to the concerned department
- The system should be able to handle future growth and expansion
- It should be well protected with a FireWall to protect from Hackers.

4. Assumptions

Donor

- Blood can only be donated to the blood bank
- All queries about the handling of blood and billing will be handled by the responsible employees
- The staff is responsible for mismanagement of donors
- A donor must be above 18 and healthy with no issues
- A donor cannot donate blood if he donated blood less than 3 months ago

Storage

- Storage Rooms must hold only a specific type of blood
- Storage Rooms must have suitable temperature
- Storage Rooms should only be accessible to the employee
- Expired Blood is always disposed away from storage room

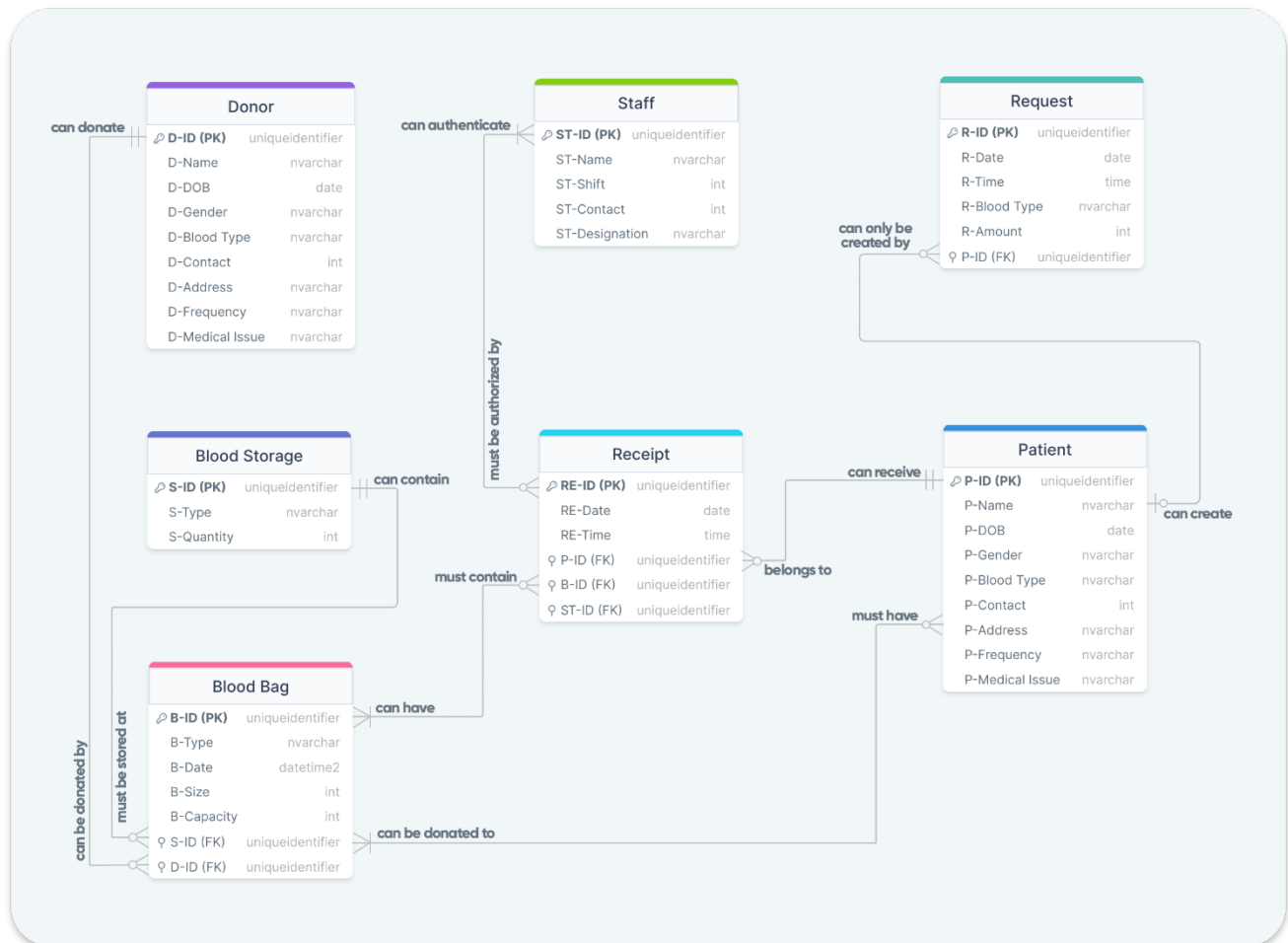
Receipt

- A receipt must contain all the necessary information
- A duplicate of receipt must always be allowed to the patient if necessary
- The employee present at the time of receipt printing is responsible for any mishappening
- The staff will be responsible for mishandling of receipts

Request

- A request should be handled by the Blood Bank personnel
- A request must be discarded after its completed or expired
- A completed request should still exist in the database


5. Entity Relationship Diagram (ERD)



5.1 Entities and Attributes


Donor:

The donor entity consists of information about blood donor. D-ID is the primary key and holds unique identification for every blood donor. Other attributes contain information such as donor's name, date of birth (for age), gender, blood type, contact number, address. The D-Frequency attribute tells about the regularity of the blood donor. D-Medical Issue holds the medical report of the blood donor. This attribute only contains issues that are permissible to be stored in the database.

Donor	
 D-ID (PK)	uniqueidentifier
D-Name	nvarchar
D-DOB	date
D-Gender	nvarchar
D-Blood Type	nvarchar
D-Contact	int
D-Address	nvarchar
D-Frequency	nvarchar
D-Medical Issue	nvarchar


Patient:

Patient entity holds information about the patient which receives the donated blood. P-ID is the primary key for this entity that is unique for every patient. It also holds information about the patient such as patient's name, date of birth, gender, blood type (for cross-matching) and other things such as patient's contact, address. The P-Frequency attribute is similar to the donor's as it holds the amount of times the blood is required for the patient. P-Medical Issue attribute includes patient's medical issues

Patient	
 P-ID (PK)	uniqueidentifier
P-Name	nvarchar
P-DOB	date
P-Gender	nvarchar
P-Blood Type	nvarchar
P-Contact	int
P-Address	nvarchar
P-Frequency	nvarchar
P-Medical Issue	nvarchar




Staff:

Staff entity holds the information regarding the staff and workers who are employees in the hospital. ST-ID is the primary key for this entity that is unique for every staff member. It holds the basic information of every worker employee of the hospital such as the name, the shift timings and the contact number. ST-Designation attribute tells us about the department of the staff member and this can be used as level of clearance and authorization given to the respective staff member.

Staff	
 ST-ID (PK)	uniqueidentifier
ST-Name	nvarchar
ST-Shift	int
ST-Contact	int
ST-Designation	nvarchar


Blood Bag:

Blood Bag entity gives us the information about the blood type, the blood size (3 different sizes), and the Blood capacity tells us the capacity of each blood bag with different size. B-Date gives us the date on which the blood was stored so that according to that date, the expiry date of the blood can be calculated. Foreign key of S-ID gives us the information in which the blood storage the respective blood bag is stored. Foreign key of D-ID specifies about the information of the blood donor, whose blood is stored in the blood bag.

Blood Bag	
 B-ID (PK)	uniqueidentifier
B-Type	nvarchar
B-Date	datetime2
B-Size	int
B-Capacity	int
 S-ID (FK)	uniqueidentifier
 D-ID (FK)	uniqueidentifier

Blood Storage:

Blood Storage entity gives us the information regarding the type of blood storage freezer type and the quantity of blood stored in different blood storage. S-ID is the unique primary key which is used to differentiate between different storage rooms. S-Type gives the type of blood the freezer contains. S-Quantity is the quantity of blood bags in the freezer.

Blood Storage	
 S-ID (PK)	uniqueidentifier
S-Type	nvarchar
S-Quantity	int

Receipt:

Receipt is the receipt for either donation or receiving blood to the blood bank. RE-ID is the id of the receipt. RE-Date is the date on which donation/receiving occurred. RE-Time is the time at which the process occurred. P-ID is a foreign key describing the patient who will receive blood if it is a receiving process. B-ID is the blood bag id which is used in the process. ST-ID is the staff id which tells us the employee which was present and responsible for the process.

Receipt	
⚡ RE-ID (PK)	uniqueidentifier
RE-Date	date
RE-Time	time
♀ P-ID (FK)	uniqueidentifier
♀ B-ID (FK)	uniqueidentifier
♀ ST-ID (FK)	uniqueidentifier

Request:

Request is the plead of patient for blood to the blood bank. The request is received by the blood bank from which they check their storage or the donor list for the required blood. R-ID is the request ID. R-Date is the date at which

Request	
⚡ R-ID (PK)	uniqueidentifier
R-Date	date
R-Time	time
R-Blood Type	nvarchar
R-Amount	int
♀ P-ID (FK)	uniqueidentifier

5.2 Relationships and Labels

Donor:

- A Donor can donate one or more blood bags
- A blood bag must only be donated by a single donor

Storage:

- A Blood Bag must be stored in only one Storage Freezer
- A Storage Freezer can hold one or many Blood Bags

Receipt:

- A Receipt can have many Blood Bags
- A Receipt must be authorized by one or many Employee
- A receipt must belong to a patient
- A receipt can have many donors

Request:

- A request can be only from one patient
- A request can be handled by one or many employees

5.3 Validation

The database completes all the necessary objectives it had to fulfill. System is automated and request is handled by the server and sent to Blood Bank. Patient and Donors are handled on time and wastage of blood is reduced. Employee's Shift are easily identifiable and viewable by the authorized personnel. Hence the completeness and correctness of the model can be validated by multiple experiments.

It exemplifies all the relationships required to create this complex Database Structure and simplifies it for further maintenance and changes. It works well with other departments of the hospital and does not interfere with their performance. Hence the validity is proved.

It has the least amount of entities which still has the complete functionality of the required objectives and scope. It has ability to grow with the change in technology and scales with the passage of time

Every effort is made to keep the data in natural form and its hierarchy. Hence, it is easier to learn and understand the working of the database for the employee and related personnel.

5.4 Description

The ER-Diagrams may have many entities but it can be summarized down to four main processes the Blood Bank performs

- Donation
- Storage
- Receiving Blood
- Receipt

On donation, it is an absolute requirement which forms the whole database hierarchy. Since donor should be eligible with the eligible criteria, it should be cross checked and then store the data of the donor. Since a Donor can have many donations throughout the time, he can produce multiple receipts. Since each blood bag is associated with a donor who gave the blood present, it should be a mandatory requirement of the database.

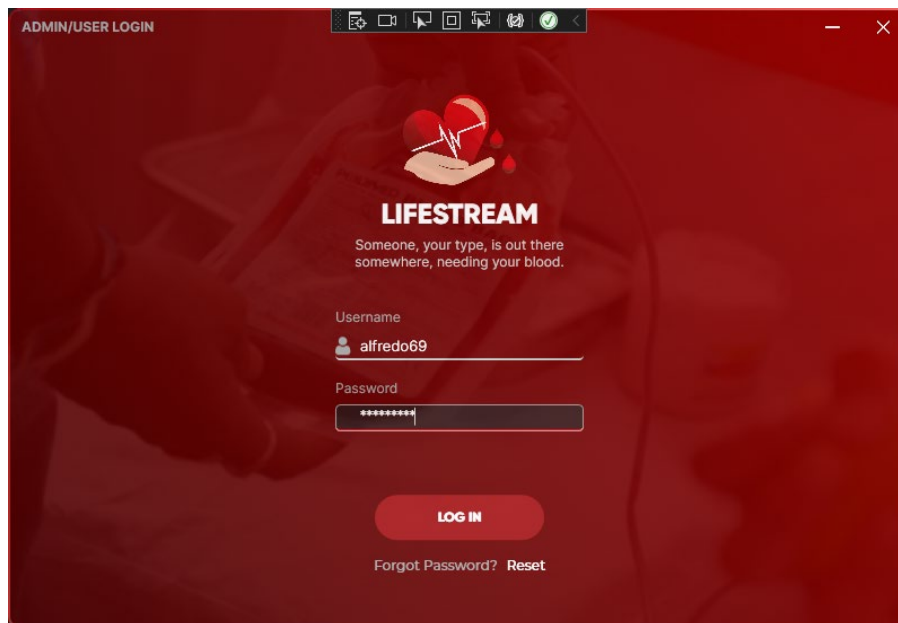
On Storage, it is required that blood bag must be stored appropriately for proper retrieval of the required blood. Since a second can be a matter of life and death, it is compulsory that the Blood Bank System has proper information of the storage of Blood in their inventory. Therefore, it is a must needed requirement of the Database.

On Receiving, it is essential that patient can place requests for blood describing the amount and time required for the treatment. A patient's record is necessary if they require multiple transfusions of blood either regularly or with the passage of time. Therefore, the request is handled by the Blood Bank system in which they first check in their Storage if they have the required blood or they contact the donor list who are eligible to donate(who have not donated since 3 months)

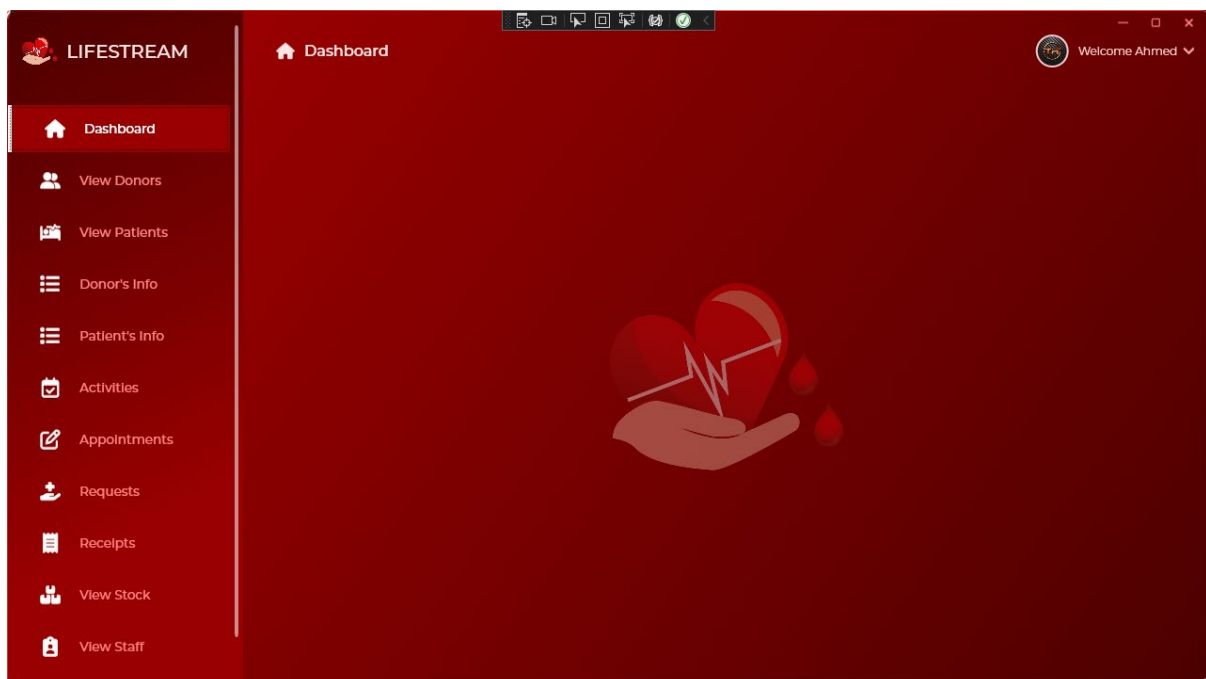
On receipt, it is a record of transfusion between the donor and the patient. The receipt can either be a donation or a transfusion as it contains both the data of the patient and the donor. A Bill is presented which is payable by the patient and it must be processed before transfusion occurs and verified. A receipt is the complete description of the process that occurred within the time elapsed and a record for future data holding.

6. Frontend / GUI

- **Login Screen:**



- **Home Screen:**



- **CRUD Operations:**

- Dashboard
- View Donors
- View Patients
- Donor's Info**
- Patient's Info
- Activities
- Appointments
- Requests
- Receipts
- View Stock
- View Staff

Donor's Information

Welcome Ahmed

Enter Donor's Information

Name

Lindsay S Long

Date of Birth

Tuesday, 6 April 1971

AB+

Female

Contact

708-200-8275

Last Donated

Tuesday, 8 February 2022

Address

4474 Butternut Lane, Granite City, Illinois(IL), 62040

Frequency

Add Donor

Cancel

Update or Delete Donor's Information

Enter Donor's ID

5

Update

Delete

- Dashboard
- View Donors
- View Patients
- Donor's Info
- Patient's Info**
- Activities
- Appointments
- Requests
- Receipts
- View Stock
- View Staff

Patient's Information

Welcome Ahmed

Enter Patient's Information

Name

Destree S Congdon

Date of Birth

Friday, 12 June 1981

A+

Female

Contact

904-716-9722

Regular

Address

1299 Spirit Drive, Jacksonville, Florida(FL), 32258

Add Patient

Cancel

Update or Delete Patient's Information

Enter Patient's ID

12

Update

Delete

LIFESTREAM

Dashboard

View Donors

View Patients

Donor's Info

Patient's Info

Activities

Appointments

Requests

Receipts

View Stock

View Staff

Staff's Info

Staff's Information

Welcome Ahmed

Enter Staff's Information

Name

Alfredo J Casler

Date of Birth

Thursday, 3 March 1977

Morning

Male

Contact

901-340-5176

Designation

Salary

200,000

Username

alfredo69

Password

Profile Picture

Add Staff

Cancel

Update or Delete Staff's Information

Enter Staff's ID

3

Update

Delete

LIFESTREAM

Dashboard

View Donors

View Patients

Donor's Info

Patient's Info

Activities

Appointments

Requests

Receipts

View Stock

View Staff

Staff's Info

Manage Operations

Welcome Ahmed

Manage Appointments

Donor ID

5

Appointment Date

Sunday, 15 January 2023

Appointment Time

12:00:00pm

Create Appointment

Enter Appointment ID

Edit Appointment

Delete Appointment

Manage Donations

Appointment ID

5

Bag Quantity

20

Generate Receipt

Manage Requests

Patient ID

5

Required Date

Sunday, 15 January 2023

Required Quantity

20

Create Request

Enter Request ID

Edit Request

Delete Request

Manage Transfusions

Request ID

5

Generate Receipt

7. Reports

- Donors:

The screenshot shows the LIFESTREAM application interface for the 'Donors' report. The left sidebar contains navigation links: Dashboard, View Donors (selected), View Patients, Donor's Info, Patient's Info, Activities, Appointments, Requests, Receipts, View Stock, and View Staff. The main content area is titled 'Donors' and features a search bar with the text 'Be' and a dropdown menu set to 'AB+'. A 'Search' button is located to the right of the search bar. Below the search bar is a table with the following data:

ID	Name	Blood Type	Date of Birth	Gender	Frequency	Contact
513	Betty J Cruz	AB+	7/6/1972	Female	Regular	215-435-7455
424	Bernard H Rossiter	AB+	11/5/1997	Male	Occasional	215-435-7455

- Patients:

The screenshot shows the LIFESTREAM application interface for the 'Patients' report. The left sidebar contains navigation links: Dashboard, View Donors, View Patients (selected), Donor's Info, Patient's Info, Activities, Appointments, Requests, Receipts, View Stock, and View Staff. The main content area is titled 'Patients' and features a search bar with the text 'A' and a dropdown menu set to 'A+'. A 'Search' button is located to the right of the search bar. Below the search bar is a table with the following data:

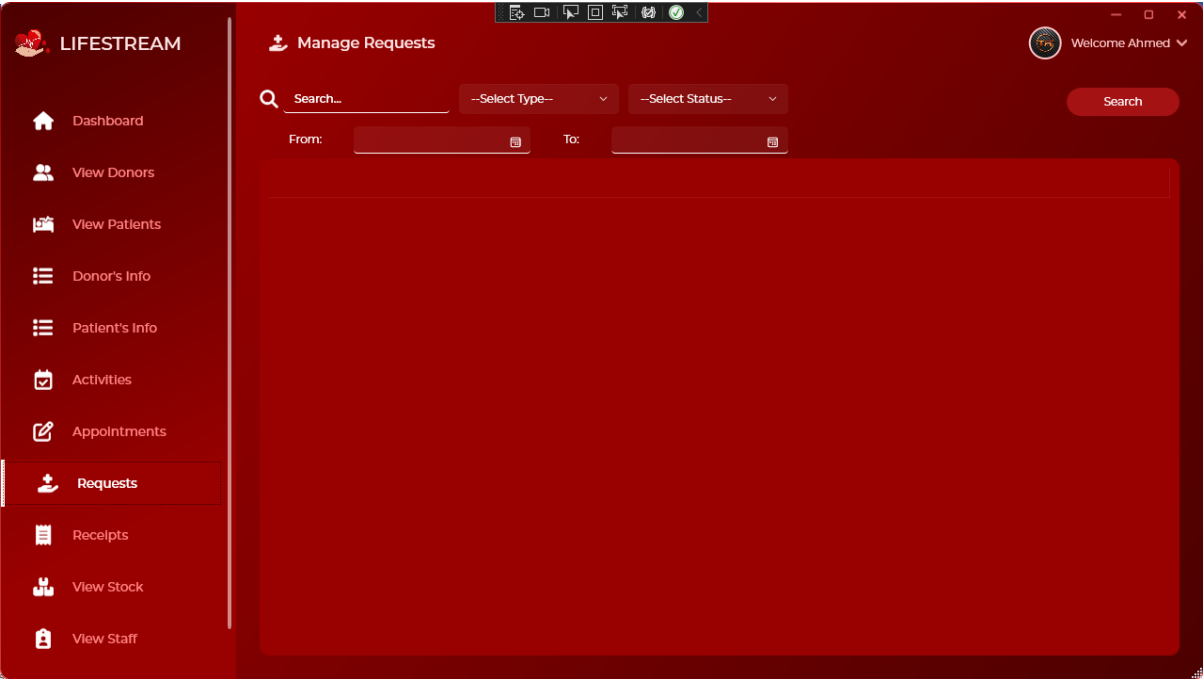
ID	Name	Blood Type	Date of Birth	Gender	Frequency	Contact
756	Andrea G Fuget	A+	7/6/1972	Female	Regular	215-435-7455
143	Amelia H Horrender	A+	11/5/1997	Female	Occasional	215-435-7455

- **Staff:**

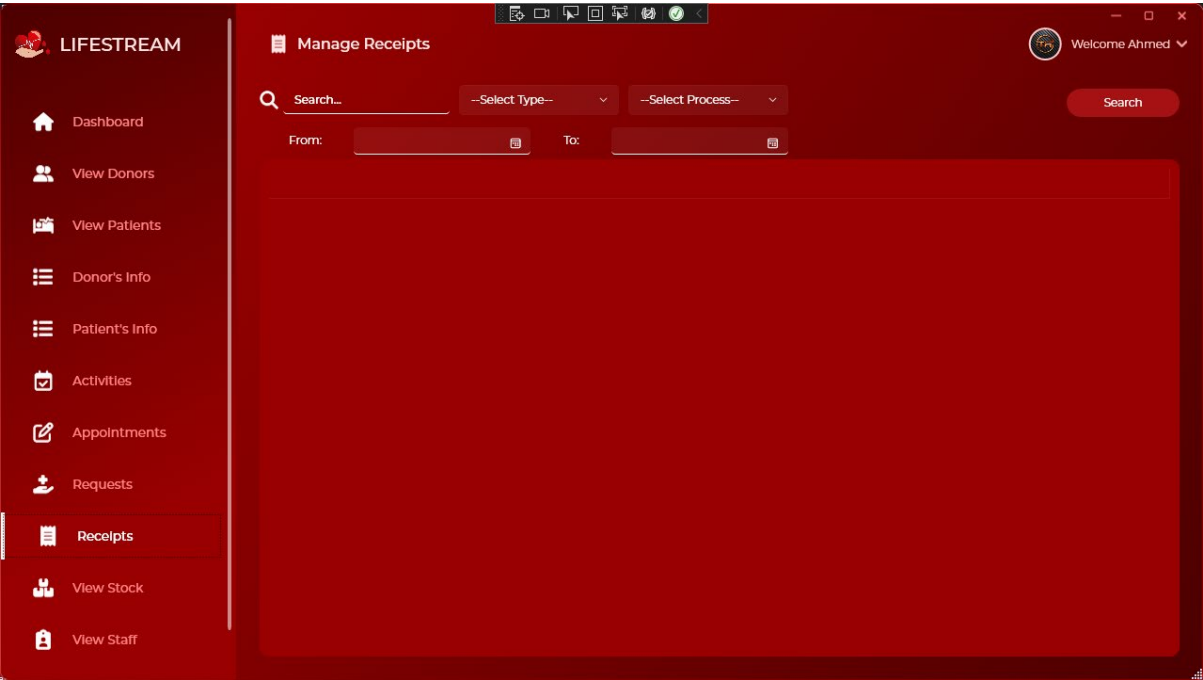
ID	Name	Designation	Shift	Username	Salary	Contact
874	Diane J Browning	Doctor	Morning	diane1122	\$100,000	408-476-1769
843	Ruth R Vogt	Doctor	Evening	ruthvogt22	\$120,000	318-307-0358
657	Mary J Coronado	Doctor	Morning	meetmary616	\$115,000	773-614-4672

- **Appointments Report:**

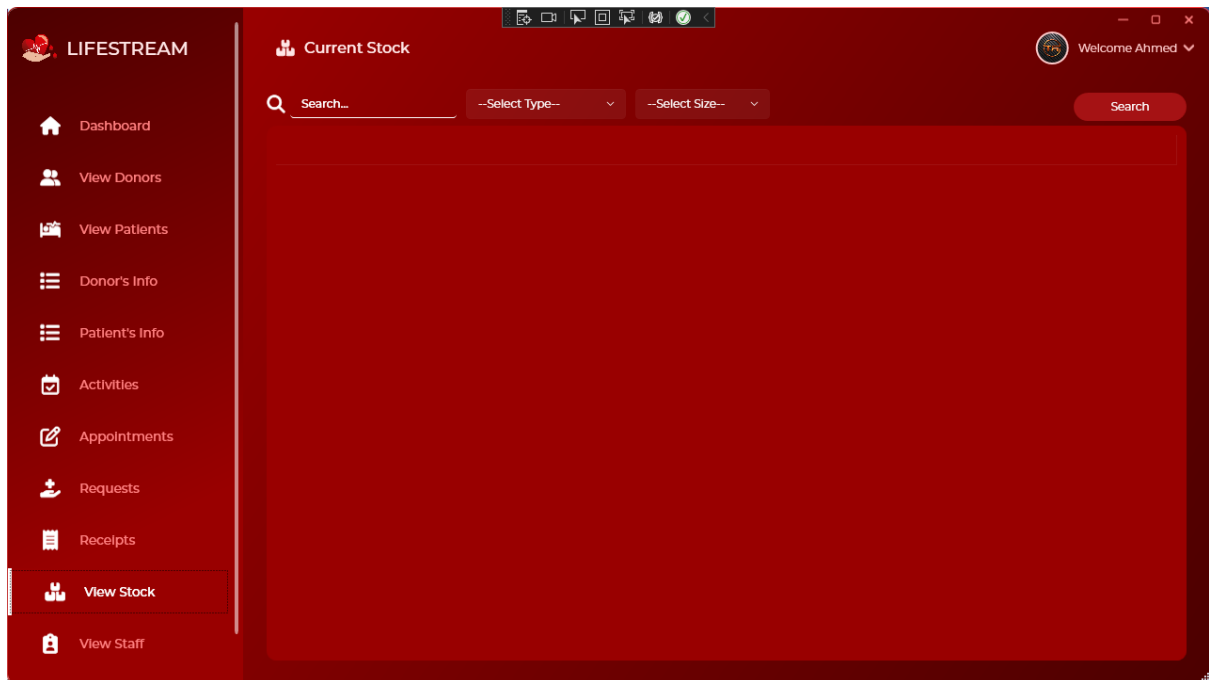
• **Requests Report:**



• **Receipts Report:**



- **Stock Report:**



8. Normalization

2nd Normal Form (Removing Partial Dependencies)

Request:

<u>Req-ID</u>	Req-Date	Req-BloodType	<u>Patient-ID</u>	Patient-Name	Patient-Info
---------------	----------	---------------	-------------------	--------------	--------------

Composite PK: Req-ID && Patient-ID

Partial Dependencies: Req-BloodType, Patient-Name, Patient-Info

Modified Table

<u>Req-ID</u>	Req-BloodType
---------------	---------------

<u>Patient-ID</u>	Patient-Name	Patient-Info
-------------------	--------------	--------------

<u>Req-ID</u>	<u>Patient-ID</u>	<u>Req-Date</u>
---------------	-------------------	-----------------

3rd Normal Form (Removing Transitive Dependencies)

Receipt:

<u>Rec-ID</u>	Rec-DateTime	Rec-Type	<u>Donor-ID</u>	Donor-Name	Donor-Info	<u>Patient-ID</u>	Patient-Name	Patient-Info
---------------	--------------	----------	-----------------	------------	------------	-------------------	--------------	--------------

Primary Key: Rec-ID

Modified Table

<u>Donor-ID</u>	Donor-Name	Donor-Info
-----------------	------------	------------

<u>Patient-ID</u>	Patient-Name	Patient-Info
-------------------	--------------	--------------

<u>Rec-ID</u>	Rec-DateTime	Rec-Type	<u>Donor-ID</u>	<u>Patient-ID</u>
---------------	--------------	----------	-----------------	-------------------

9. Denormalization

3rd Normal Form (Staff and Login Details):

<u>St-ID</u>	St-Name	St-Shift	St-Designation
--------------	---------	----------	----------------

<u>St-ID</u>	Username	Password
--------------	----------	----------

Denormalized Table

<u>St-ID</u>	St-Name	St-Shift	St-Designation	Username	Password
--------------	---------	----------	----------------	----------	----------

10. SQL Server Properties

Triggers:

Delete Bags:

```
USE [BloodBank]
GO
/***** Object:  StoredProcedure [dbo].[delbag]    Script Date: 10/01/2023 11:15:54 pm
*****/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
```

```

ALTER procedure [dbo].[delbag]
@use int ,
@type nvarchar(5),
@freshness varchar(10)
as
begin
if @freshness = 'Fresh'
begin
delete top(@use) from BloodBag where BloodBag.Bag_ID in(select top(@use) Bag_ID from
BloodBag where BloodBag.Bag_Type=@type AND BloodBag.Bag_DateTime > DATEADD(day,-
3,GETDATE()) order by Bag_DateTime asc)
end
else
begin
if @freshness='Any'
begin
delete top(@use) from BloodBag where BloodBag.Bag_ID in(select top(@use) Bag_ID from
BloodBag where BloodBag.Bag_Type=@type AND BloodBag.Bag_DateTime <= DATEADD(day,-
3,GETDATE()) order by Bag_DateTime asc)
end
end
end

```

Update Last Donated:

```

USE [BloodBank]
GO
/***** Object: Trigger [dbo].[updatelastdonated]    Script Date: 10/01/2023 11:17:34
pm *****/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
ALTER trigger [dbo].[updatelastdonated] on [dbo].[Receipt]
after insert as
begin
declare @flag varchar(15)
set @flag = (select i.Receipt_Process from inserted i)
if(@flag = 'Donation')
begin
update Donor
set Donor_LastDonated = DATEADD(day,0,GETDATE())
where Donor.Donor_ID = (select i.Donor_ID from inserted i)
end
end

```

Functions:

Eligible Donors:

```

USE [BloodBank]
GO
/***** Object: UserDefinedFunction [dbo].[eligibledonors]    Script Date: 10/01/2023
11:20:43 pm *****/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
ALTER function [dbo].[eligibledonors]()
returns table as
return(select * from Donor where Donor_LastDonated < DATEADD(day,-42,GETDATE()))

```

Stored Procedures:

Refresh Request:

```
USE [BloodBank]
GO
/***** Object:  StoredProcedure [dbo].[refreshrequest]    Script Date: 10/01/2023
11:19:46 pm *****/
SET ANSI_NULLS ON
GO
SET QUOTED_IDENTIFIER ON
GO
ALTER procedure [dbo].[refreshrequest]
as
begin
update Request
set Request_Status='Incomplete'
where Request_RequiredDate < GETDATE() AND Request_Status != 'Completed'
end
```

Views:

Visible to Employees:

```
SELECT  s.Staff_ID, staff_name, staff_shift, s.Staff_Contact, s.Staff_Designation,
s.Staff_Gender
FROM    dbo.Staff AS s
```

11. Conclusion

This Database system is presented in view of the Blood Bank Department, as many department will be associated with the Blood Bank. If other departments will also get Database system like this, modifications will be required with respect to the other newly added requirements.

12. Recommendations

Based on the user requirements, it is advised that the other department of the hospitals should also be automated with a database system so that all the smaller database can be synchorized and work together so that the hospital's labour is efficient and cut short. With the amount of patients in the hospitals going in and out, a web server should be established to show results on the web so that printing is lessened and desired results are provided on time.

Word Count: 2,605