Blood Bank Management System

Introduction

In healthcare facilities, the availability of safe and effective blood transfusions relies heavily on the efficacy of the blood donor system. The creation of a comprehensive database is essential for enhancing the administration and efficiency of these systems. Building a comprehensive database for the blood donation system that can store important data on donors, recipients, and blood banks is the primary objective of this work. This database will help medical personnel simplify their processes, keep tabs on real-time data, and make educated judgments that will lead to more effective blood transfusions.

The major goal of this project is to provide a simple and effective system for finding compatible donors and receivers. The database will greatly reduce the time needed for transfusions by centralizing data on donor eligibility requirements, blood type compatibility, and available blood inventory. Donor profiles in the database will include detailed information such as medical history, contact details, and donation history. With this data, blood banks can more easily manage its donors by setting up appointments, keeping tabs on how often they provide, and keeping in regular contact with them.

The database for the blood donation system will be designed and implemented using a relational database management system (RDBMS) to facilitate these aims. Data integrity, less duplication, and maximum efficiency may all be achieved by following standard conventions for database architecture and normalization. If this database is successfully implemented, it will lead to better blood transfusion procedures, more efficient inventory management, and higher quality care for patients.

Assumptions

As part of the project, I assume that

1. Eligible blood donors have been pre-screened and deemed suitable for blood donation by medical professionals.
2. The blood bank system will be used by authorized personnel with appropriate access privileges.
3. The database will be regularly backed up and secured to prevent data loss or unauthorized access.
4. The system will maintain historical data for tracking blood donation records, patient transfusions, and financial transactions.
5. The system will be implemented within a single organization or network of blood banks.
6. Each blood bank location has a unique blood serial number (BLOOD_SL).
7. Blood bags have a unique bag serial number (BAG_SL) for identification purposes.
8. Donor IDs, employee IDs, and patient IDs are unique and assigned within the system.
9. The system will only track blood types compatible with the ABO system (A, B, AB, O) and the Rh factor (positive or negative).
10. Payment transactions can be made either in cash or through debit/credit cards.

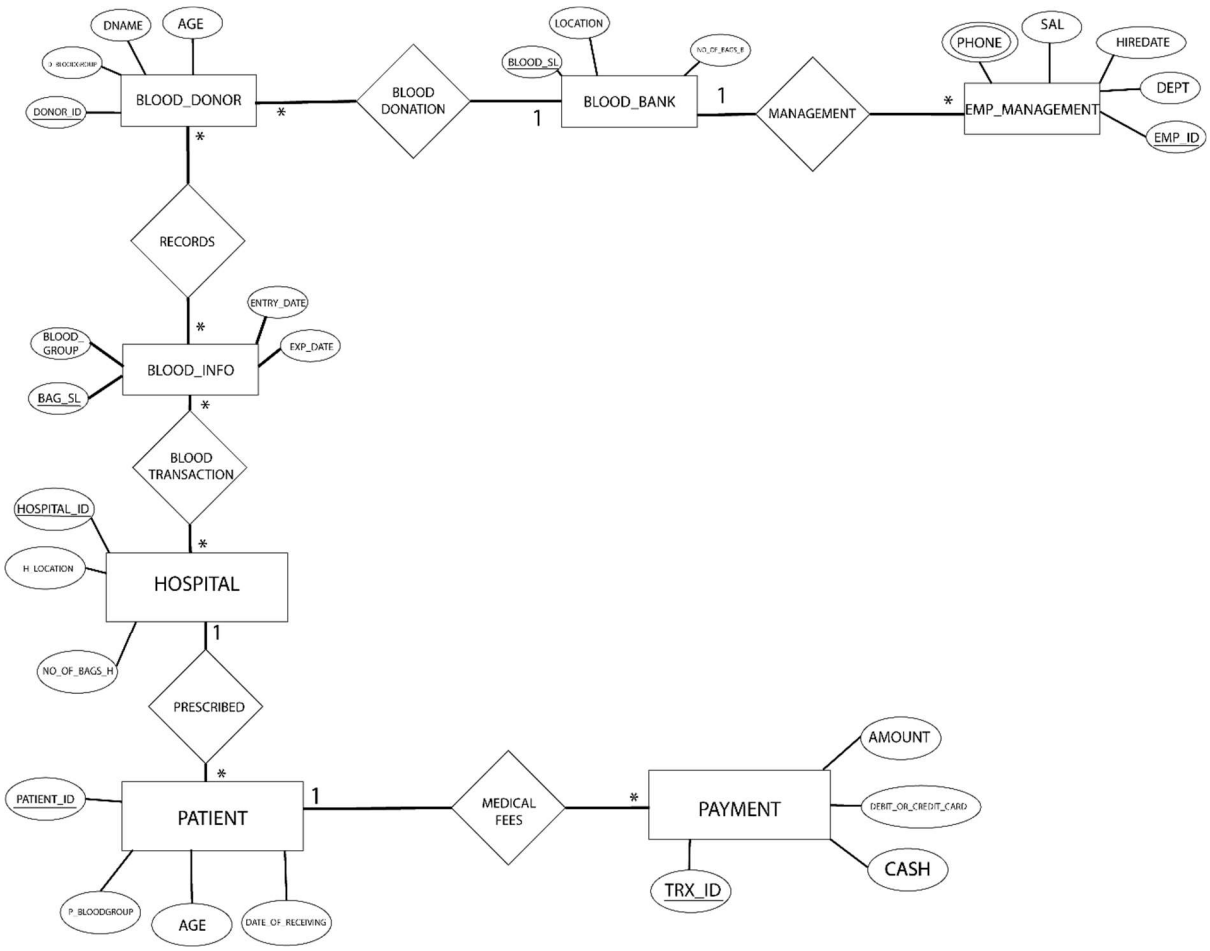
Business Rules

Various business rules are

- Blood donors can have multiple donations, and each donation is associated with a unique blood bag (BAG_SL) and donor ID (DONOR_ID).
- Each blood bag (BAG_SL) has specific blood group information (BLOODGROUP), entry date (ENTRY_DATE), and expiration date (EXP_DATE) stored in the BLOOD_INFO table.

- The BLOOD_TRANSACTION table records the transaction of blood bags from the blood bank to hospitals. Each transaction is associated with a unique transaction ID (BH_ID), blood bag (BAG_SL), and the respective hospital (HOSPITAL_ID).
- Employees (EMP_ID) working in the blood bank are managed in the EMP_MANAGEMENT table. Each employee belongs to a department (DEPT) and has a hire date (HIREDATE) and salary information (SAL).
- Employee contact information is stored in the EMP_CONTACT table, with each employee having one or more phone numbers (PHONE).
- Each hospital is identified by a unique hospital ID (HOSPITAL_ID) and has a location (H_LOCATION). The NO_OF_BAGS_H attribute in the HOSPITAL table represents the number of available blood bags at the hospital.
- Patients are identified by a unique patient ID (PATIENT_ID) and have attributes such as blood group required (P_BLOODGROUP), age, date of receiving (DATE_OF_RECEIVING), and associated hospital (HOSPITAL_ID).
- Payment transactions are recorded in the PAYMENT table, where each transaction has a unique transaction ID (TRX_ID), payment method (CASH_OR_CARD), amount paid (AMOUNT), and is associated with a patient (PATIENT_ID).

ER- DIAGRAM:


DNAME
AGE
B_BLOODGROUP
DONOR_ID
BLOOD_DONOR
*
BLOOD DONATION
1
LOCATION
BLOOD_SL
NO_OF_BAGS_B
BLOOD_BANK
1
MANAGEMENT
*
PHONE
SAL
HIREDATE
DEPT
EMP_ID
EMP_MANAGEMENT
*
RECORDS
*
ENTRY_DATE
BLOOD_GROUP
EXP_DATE
BAG_SL
BLOOD_INFO
*
BLOOD TRANSACTION
*
HOSPITAL_ID
H_LOCATION
HOSPITAL
1
NO_OF_BAGS_H
PRESCRIBED
*
PATIENT_ID
PATIENT
1
MEDICAL FEES
*
AMOUNT
DEBIT_OR_CREDIT_CARD
CASH
PAYMENT
TRX_ID
P_BLOODGROUP
AGE
DATE_OF_RECEIVING

Normalization

Blood Donation: (**DONOR_ID**, DNAME, AGE, D_BLOODGROUP, **BLOOD_SL**, LOCATION, NO_OF_BAGS_B)

1NF: NO MULTI ATTRIBUTE EXISTS.

2NF: DONOR_ID, D_BLOODGROUP, DNAME, AGE

BLOOD_SL, LOCATION, NO_OF_BAGS_B

3NF: NO TRANSITIVE DEPENDENCY

DONOR_ID, D_BLOODGROUP, DNAME, AGE

BLOOD_SL, LOCATION, NO_OF_BAGS_B

Final table for **Blood Donation:**

1. DONOR_ID, D_BLOODGROUP, DNAME, AGE, BLOOD_SL
2. BLOOD_SL, LOCATION, NO_OF_BAGS_B

MANAGEMENT: (BLOOD_SL, LOCATION, NO_OF_BAGS_B, EMP_ID**,** DEPT, SAL, HIREDATE, DEPT, PHONE)

1NF: PHONE IS A MULTI VALUED ATTRIBUTE.

2NF: BLOOD_SL, LOCATION, NO_OF_BAGS_B

EMP_ID**,** DEPT, SAL, HIREDATE, DEPT, PHONE

3NF: NO TRANSITIVE DEPENDENCY

BLOOD_SL, LOCATION, NO_OF_BAGS_B

EMP_ID**,** DEPT, SAL, HIREDATE, DEPT, PHONE

Final table for **MANAGEMENT:**

3. BLOOD_SL, LOCATION, NO_OF_BAGS_B

4. EMP_ID**,** DEPT, SAL, HIREDATE, DEPT, BLOOD_SL

5. EMP_ID, PHONE - Composite PK

RECORDS: (DONOR_ID, D_BLOODGROUP, DNAME, AGE, BAG_SL, D_BLOODGROUP, NO_OF_BAGS_I, ENTRY_DATA, EXP_DATA)

1NF: NO MULTI ATTRIBUTE EXISTS.

2NF: DONOR_ID, D_BLOODGROUP, DNAME, AGE

BAG_SL, BLOODGROUP, ENTRY_DATA, EXP_DATA

3NF: NO TRANSITIVE DEPENDENCY

DONOR_ID, D_BLOODGROUP, DNAME, AGE

BAG_SL, BLOODGROUP, ENTRY_DATA, EXP_DATA

Table for RECORDS:

6. **DONOR_ID,** D_BLOODGROUP, DNAME, AGE

7. BAG_SL, BLOODGROUP, ENTRY_DATA, EXP_DATA

8. D_B_ID, **DONOR_ID,** BAG_SL

BLOOD TRANSACTION: (BAG_SL, BLOOD_GROUP, ENTRY_DATE, EXP_DATE, HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H)

1NF: NO MULTI VALUED EXISTS.

2NF: BAG_SL, BLOOD_GROUP, ENTRY_DATE, EXP_DATE

HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H

3NF: BAG_SL, BLOOD_GROUP

DATE_ID, ENTRY_DATE, EXP_DATE

HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H

Final table for Blood TRANSACTION:

9. BAG_SL, BLOOD_GROUP
10. DATE_ID, ENTRY_DATE, EXP_DATE
11. HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H
12. BH_ID, BAG_SL, HOSPITAL_ID

PRESCRIBED: (HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H,

PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING)

1NF: NO MULTI VALUED EXISTS.

2NF: HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H

PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING

3NF: NO TRANSITIVE DEPENDENCY.

HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H

PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING

Final table for PRESCRIBED:

13.HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H

14. PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING, HOSPITAL_ID

MEDICAL FEES: (TRX_ID, CASH_OR_CARD, AMOUNT,

PATIENT_ID, P_BLOODGROUP, AGE, DATA_OF_RECEIVING)

1NF: NO MULTI ATTRIBUTE EXISTS.

2NF: TRX_ID, CASH_OR_CARD, AMOUNT

PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING

3NF: NO TRANSITIVE DEPENDENCY

TRX_ID, CASH_OR_CARD, AMOUNT

PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING

Final table for **MEDICAL FEES**:

15 TRX_ID, CASH_OR_CARD, AMOUNT, PATIENT_ID

16. PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING

Final Table:

1. DONOR_ID, D_BLOODGROUP, DNAME, AGE, BLOOD_SL
2. BLOOD_SL, LOCATION, NO_OF_BAGS_B
3. BLOOD_SL, LOCATION, NO_OF_BAGS_B
4. EMP_ID, DEPT, SAL, HIREDATE, DEPT, BLOOD_SL
5. EMP_ID, PHONE - Composite PK
6. **DONOR_ID**, D_BLOODGROUP, DNAME, AGE
7. BAG_SL, BLOODGROUP, ENTRY_DATA, EXP_DATA
8. D_B_ID, **DONOR_ID,** BAG_SL
9. BAG_SL, BLOOD_GROUP
10. DATE_ID, ENTRY_DATE, EXP_DATE
11. HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H
12. BH_ID, BAG_SL, HOSPITAL_ID
13. HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H
14. PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING, HOSPITAL_ID
15 TRX_ID, CASH_OR_CARD, AMOUNT, PATIENT_ID

16. PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING

Evaluated Final Table:

1. **BLOOD_DONOR:** DONOR_ID, DNAME, AGE, D_BLOODGROUP, BLOOD_SL
2. **BLOOD_BANK:** BLOOD_SL, LOCATION, NO_OF_BAGS_B
3. **EMP_MANAGEMENT:** EMP_ID**,** DEPT, SAL, HIREDATE, BLOOD_SL
4. **EMP_CONTACT:** EMP_ID, PHONE - Composite PK
5. **BLOOD_INFO:** BAG_SL, BLOODGROUP, ENTRY_DATA, EXP_DATE
6. **BLOOD_DONATION:** DB_ID, DONOR_ID**,** BAG_SL
7. **EXPIRATION:** DATE_ID, ENTRY_DATE, EXP_DATE
8. **HOSPITAL:** HOSPITAL_ID, H_LOCATION, NO_OF_BAGS_H
9. **BLOOD_TRANSACTION:** BH_ID, BAG_SL, HOSPITAL_ID
10. **PATIENT:** PATIENT_ID, P_BLOODGROUP, AGE, DATE_OF_RECEIVING, HOSPITAL_ID
11. **PAYMENT_ID:** TRX_ID, CASH_OR_CARD, AMOUNT, PATIENT_ID

Tables and Columns

Various Entities observed are BLOOD_DONOR, BLOOD_BANK, EMP_MANAGEMENT, EMP_CONTACT, BLOOD_INFO, BLOOD_DONATION, EXPIRATION, HOSPITAL, BLOOD_TRANSACTION, PATIENT, PAYMENT_ID

BLOOD_DONOR entity contains the following attributes

- DONOR_ID
- D_BLOODGROUP
- DNAME, AGE
- BLOOD_SL
- AGE

BLOOD_BANK entity contains the Following attributes

- BLOOD_SL
- LOCATION
- NO_OF_BAGS_B

EMP_MANAGEMENT entity contains the following attributes

- EMP_ID
- DEPT
- SAL.
- HIREDATE
- BLOOD_SL

EMP_CONTACT entity contains the following attributes

- EMP_ID
- PHONE

BLOOD_INFO entity contains the following attributes

- BAG_SL
- BLOODGROUP
- ENTRY_DATE
- HIREDATE
- EXP_DATE

BLOOD_DONATION entity contains the following attributes

- DB_ID
- DONOR_ID
- BAG_SL

EXPIRATION entity contains the following attributes

- DATE_ID
- ENTRY_DATE
- EXP_DATE

HOSPITAL entity contains the following attributes

- HOSPITAL_ID
- H_LOCATION
- NO_OF_BAGS_H

BLOOD_TRANSACTION entity contains the following attributes

- BH_ID
- BAG_SL

- HOSPITAL_ID

PATIENT entity contains the following attributes

- PATIENT_ID
- P_BLOODGROUP
- AGE
- DATE_OF_RECEIVING
- HOSPITAL_ID

PAYMENT_ID entity contains the following attributes

- TRX_ID
- CASH_OR_CARD
- NO_OF_BAGS_H
- AMOUNT
- PATIENT_ID

ER Diagram

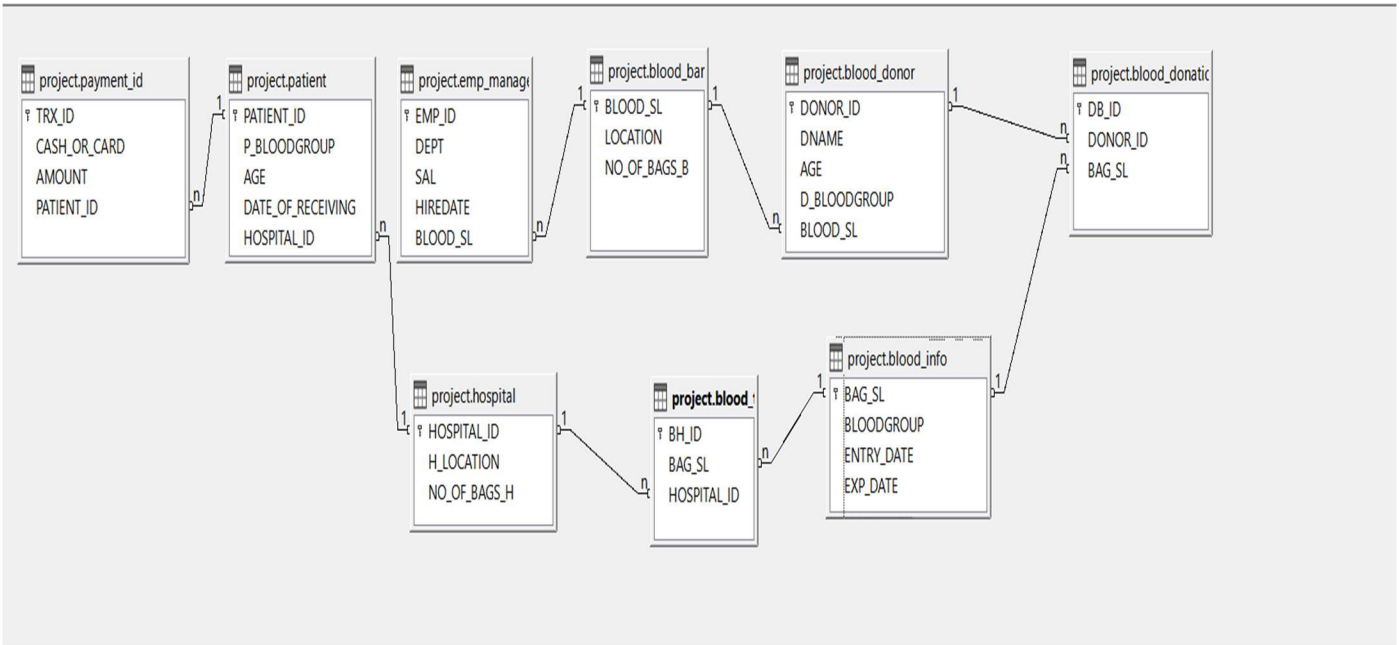


Figure: ER diagram

Implementation

I selected MariaDB to implement the database. The tables and queries are done on HeidiSQL.

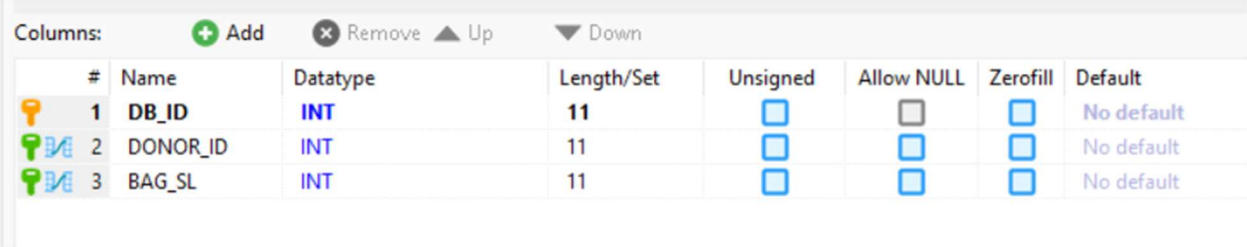
The form and reports are created using LibreOffice.

Creating tables

Columns: Add Remove Up Down

#	Name	Datatype	Length/Set	Unsigned	Allow NULL	Zerofill	Default
1	BLOOD_SL	INT	11	☐	☐	☐	No default
2	LOCATION	VARCHAR	50	☐	☐	☐	''
3	NO_OF_BAGS_B	INT	11	☐	☑	☐	'0'

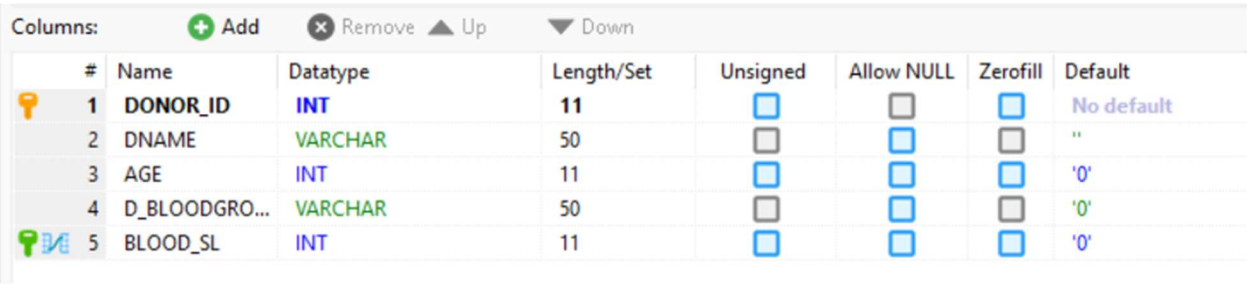
Figure 1: Table created for blood_bank



Columns: Add Remove Up Down

#	Name	Datatype	Length/Set	Unsigned	Allow NULL	Zerofill	Default
1	DB_ID	INT	11	☐	☐	☐	No default
2	DONOR_ID	INT	11	☐	☐	☐	No default
3	BAG_SL	INT	11	☐	☐	☐	No default

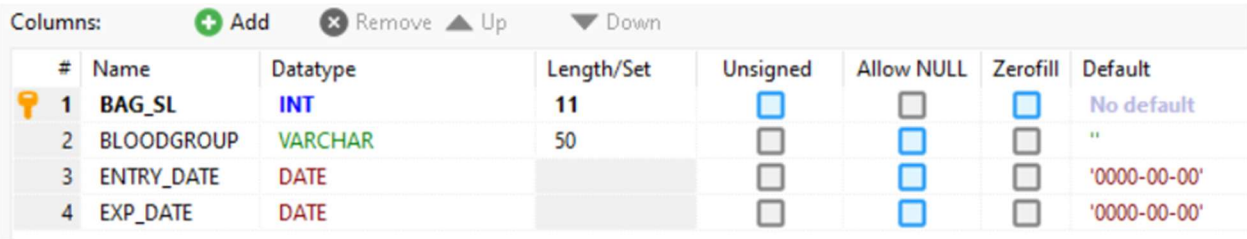
Figure 2: Table created for blood_donation



Columns: Add Remove Up Down

#	Name	Datatype	Length/Set	Unsigned	Allow NULL	Zerofill	Default
1	DONOR_ID	INT	11	☐	☐	☐	No default
2	DNAME	VARCHAR	50	☐	☐	☐	''
3	AGE	INT	11	☐	☐	☐	'0'
4	D_BLOODGRO...	VARCHAR	50	☐	☐	☐	'0'
5	BLOOD_SL	INT	11	☐	☐	☐	'0'

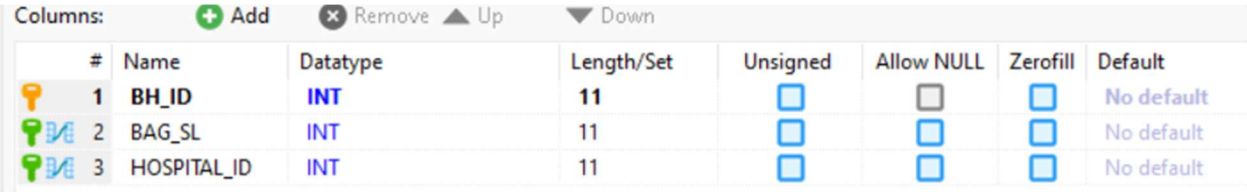
Figure 3: Table created for blood_donor



Columns: Add Remove Up Down

#	Name	Datatype	Length/Set	Unsigned	Allow NULL	Zerofill	Default
1	BAG_SL	INT	11	☐	☐	☐	No default
2	BLOODGROUP	VARCHAR	50	☐	☐	☐	''
3	ENTRY_DATE	DATE		☐	☐	☐	'0000-00-00'
4	EXP_DATE	DATE		☐	☐	☐	'0000-00-00'

Figure 4: Table created for blood_info



Columns: Add Remove Up Down

#	Name	Datatype	Length/Set	Unsigned	Allow NULL	Zerofill	Default
1	BH_ID	INT	11	☐	☐	☐	No default
2	BAG_SL	INT	11	☐	☐	☐	No default
3	HOSPITAL_ID	INT	11	☐	☐	☐	No default

Figure 5: Table created for blood_transaction

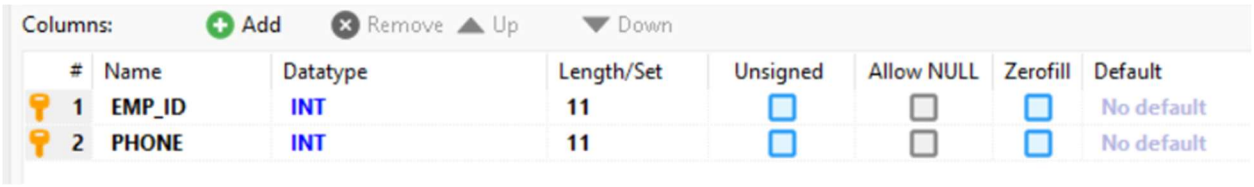


Figure 6: Table created for emp_contact

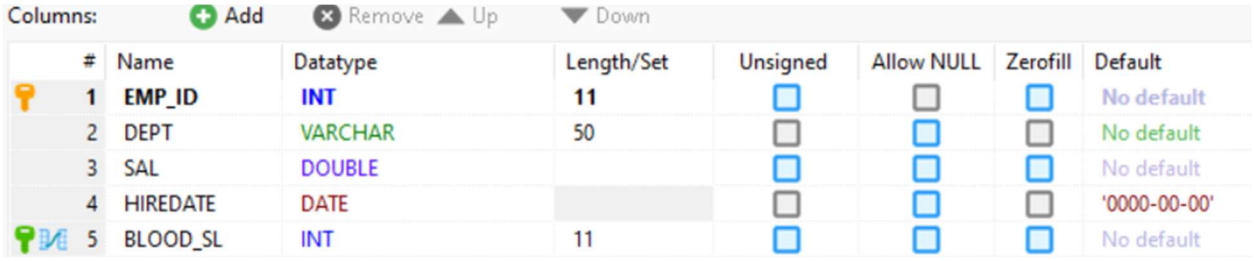


Figure 7: Table created for emp_management

Figure 8: Table created for expiration

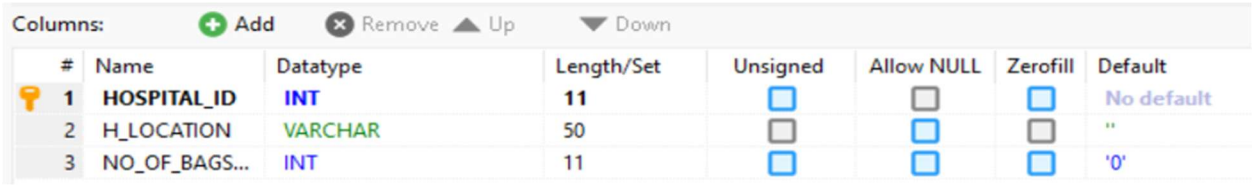
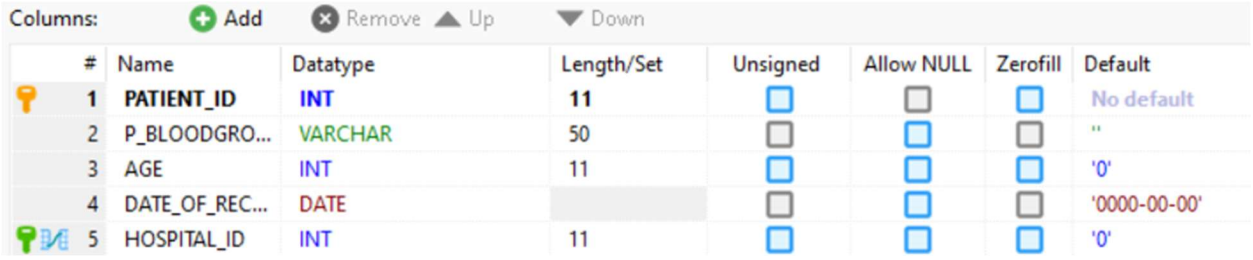
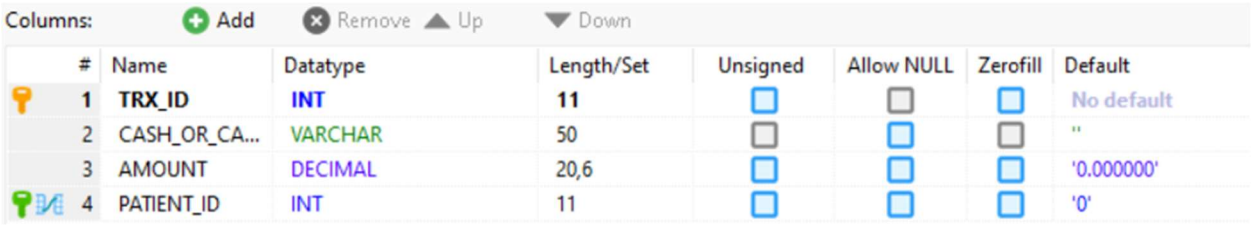


Figure 9: Table created for hospital



#	Name	Datatype	Length/Set	Unsigned	Allow NULL	Zerofill	Default
1	PATIENT_ID	INT	11	☐	☐	☐	No default
2	P_BLOODGRO...	VARCHAR	50	☐	☐	☐	''
3	AGE	INT	11	☐	☐	☐	'0'
4	DATE_OF_REC...	DATE		☐	☐	☐	'0000-00-00'
5	HOSPITAL_ID	INT	11	☐	☐	☐	'0'

Figure 10: Table created for patient



#	Name	Datatype	Length/Set	Unsigned	Allow NULL	Zerofill	Default
1	TRX_ID	INT	11	☐	☐	☐	No default
2	CASH_OR_CA...	VARCHAR	50	☐	☐	☐	''
3	AMOUNT	DECIMAL	20,6	☐	☐	☐	'0.000000'
4	PATIENT_ID	INT	11	☐	☐	☐	'0'

Figure 11: Table created for payment_id

Forms

Various forms are created to enter the data.

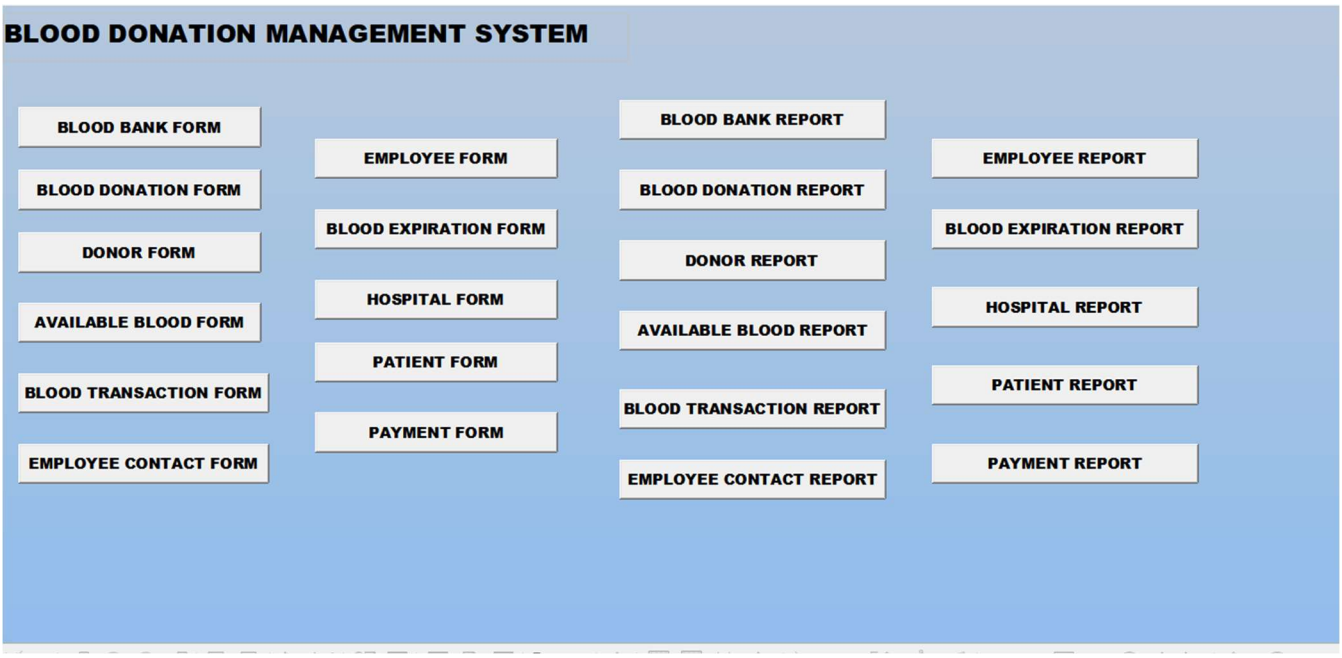


Figure 1: FORM FOR THE FRONT PAGE OF THE BLOOD DONATION SYSTEM

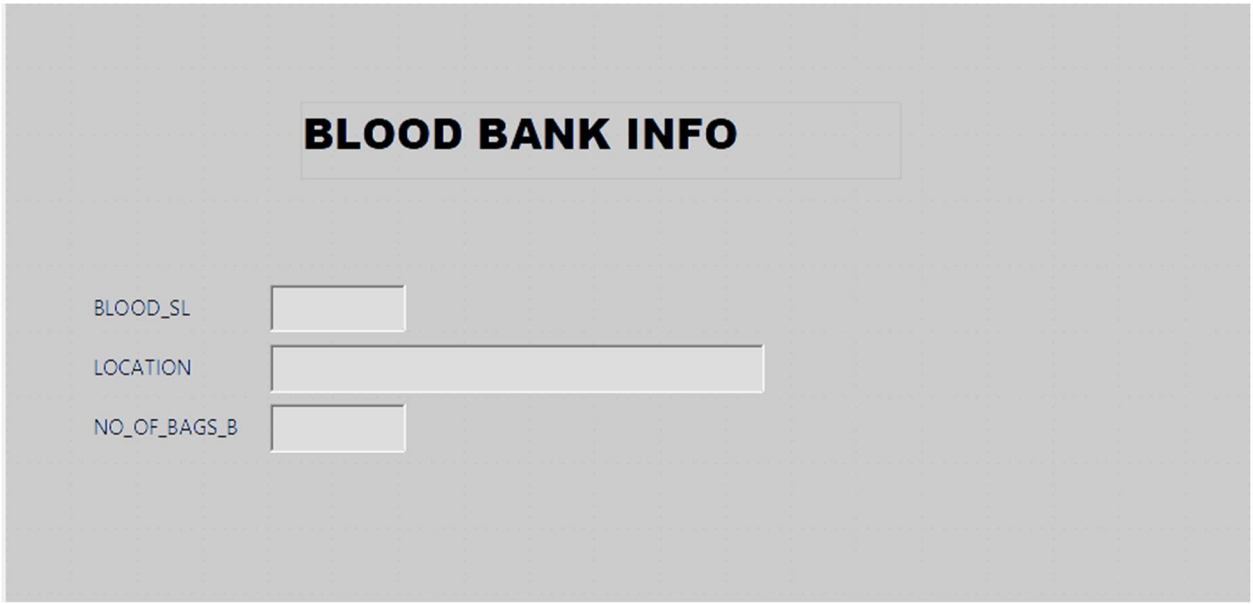


Figure 1: Form to enter blood bank details

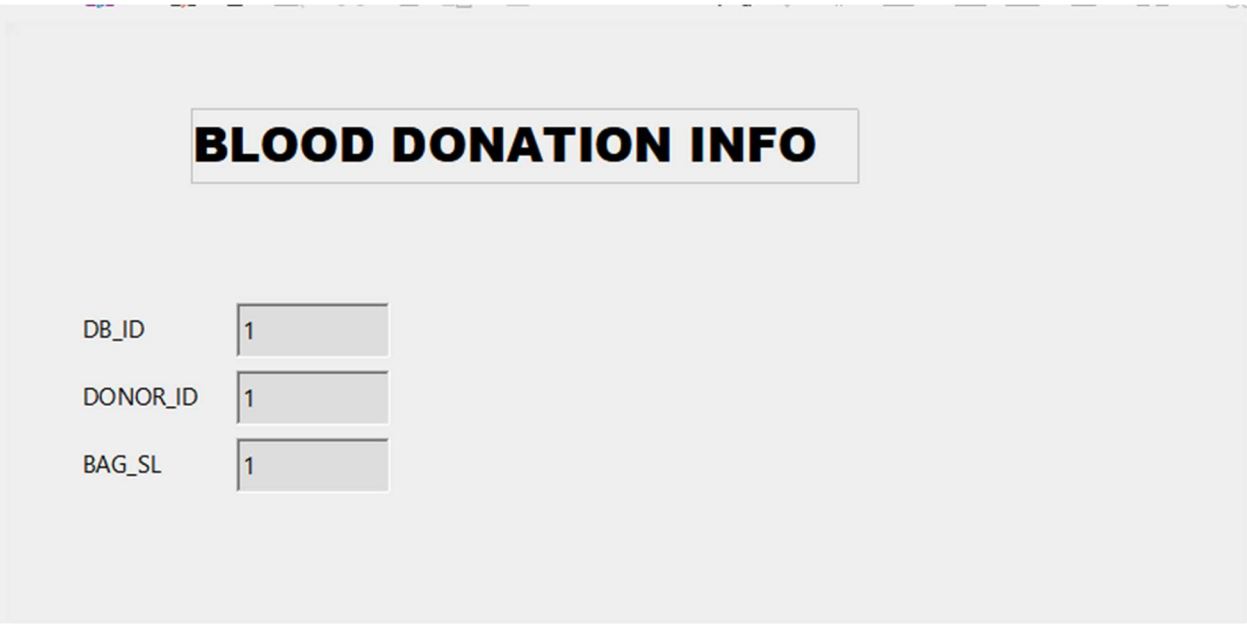


Figure 2: Form to enter blood donation details

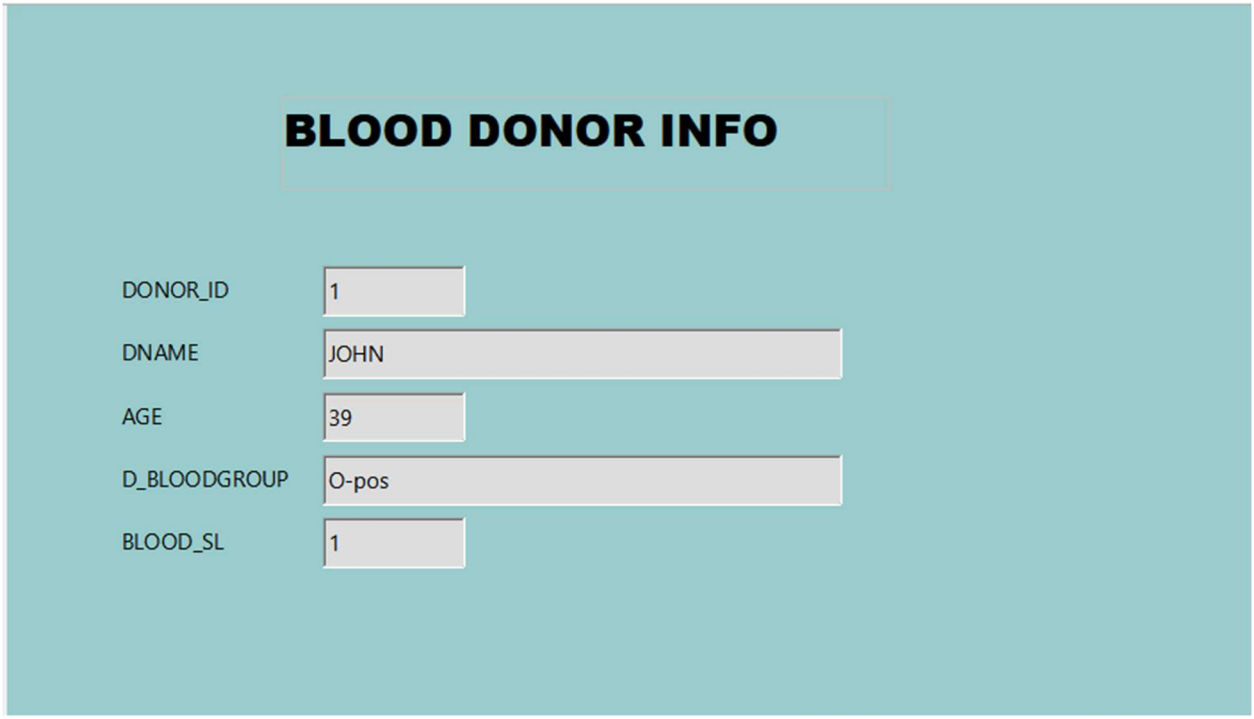


Figure 3: Form to enter blood donor details

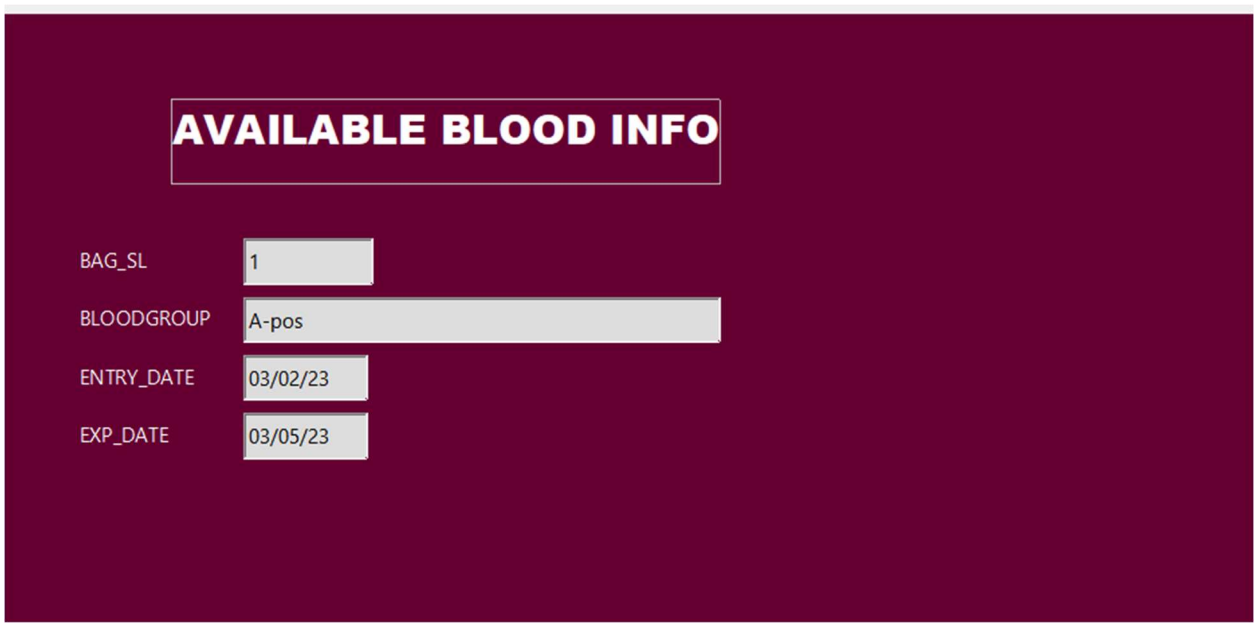


Figure 4: Form to enter blood details

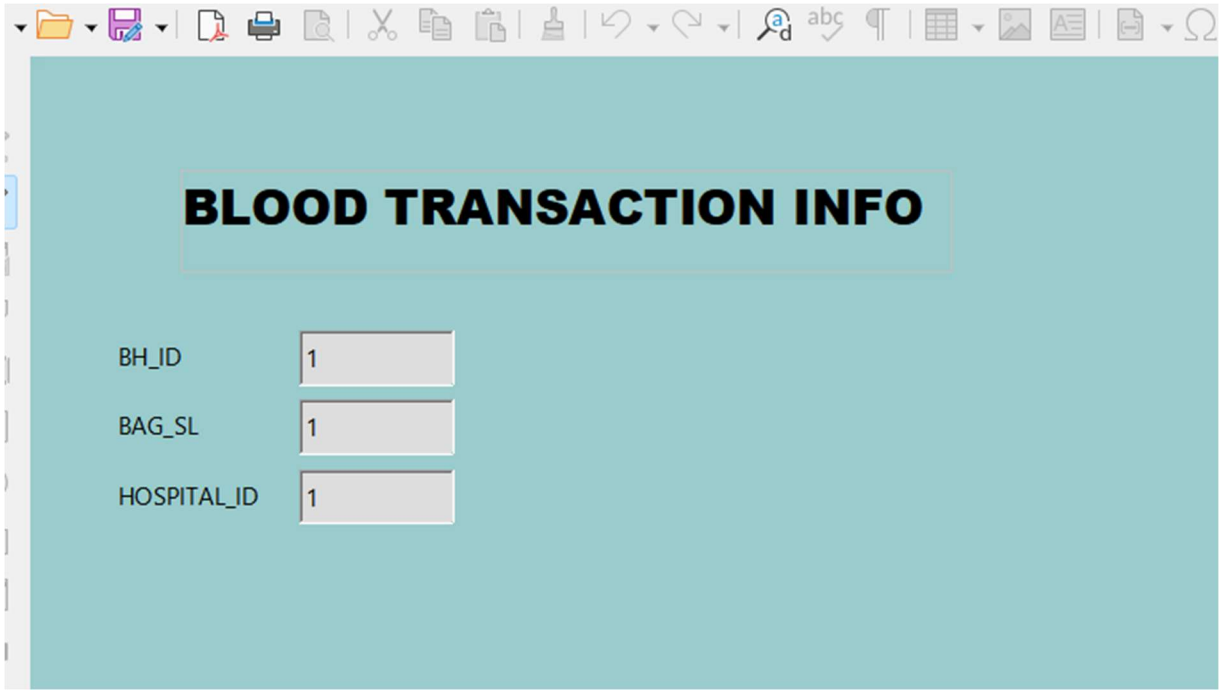


Figure 5: Form to enter blood transaction details

Figure 6: Form to enter employee contact details

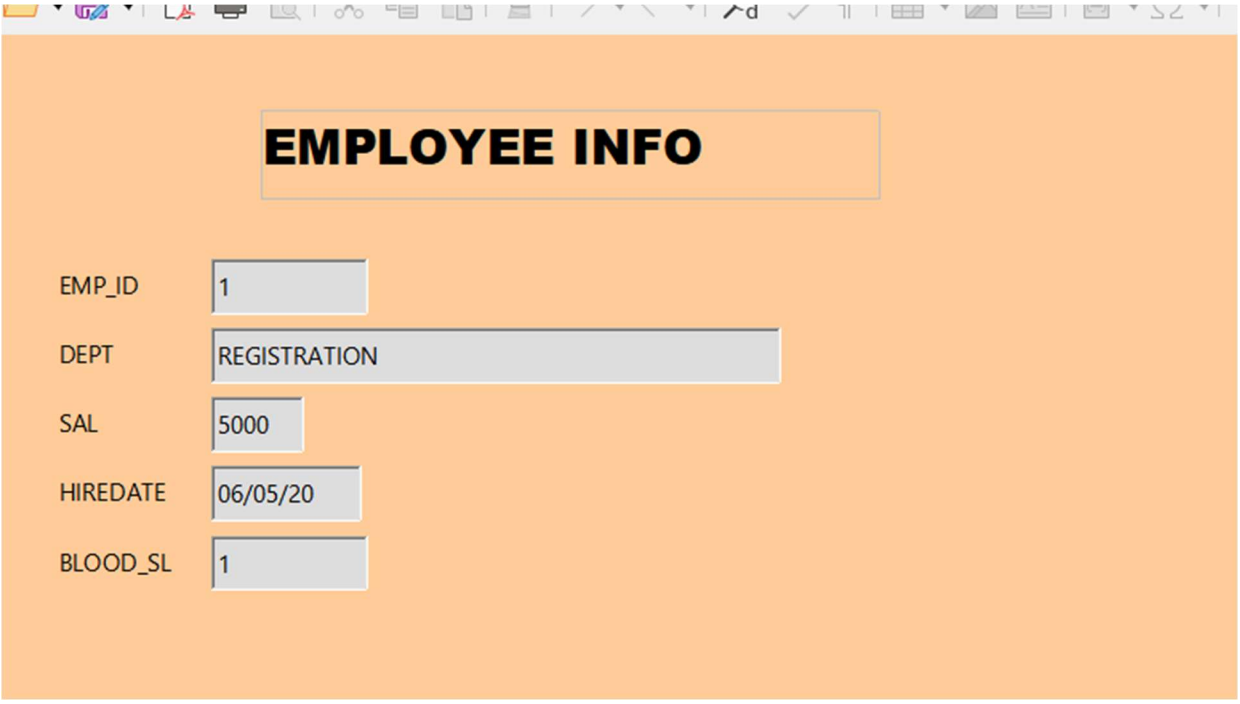


Figure 7: Form to enter employee details

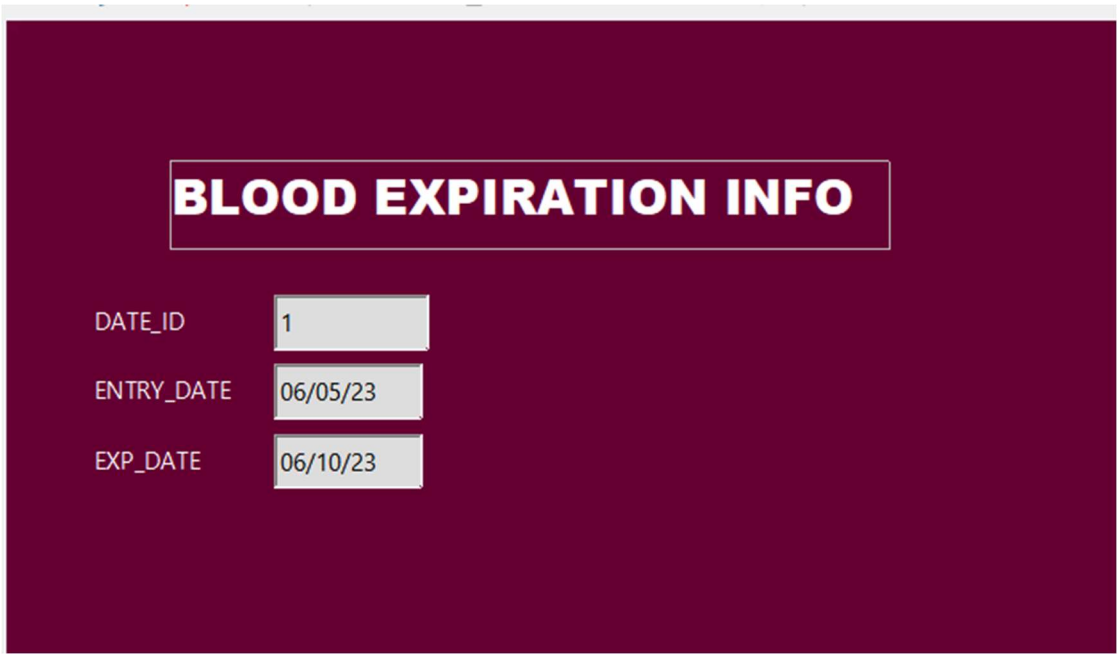


Figure 8: Form to enter blood expiration details

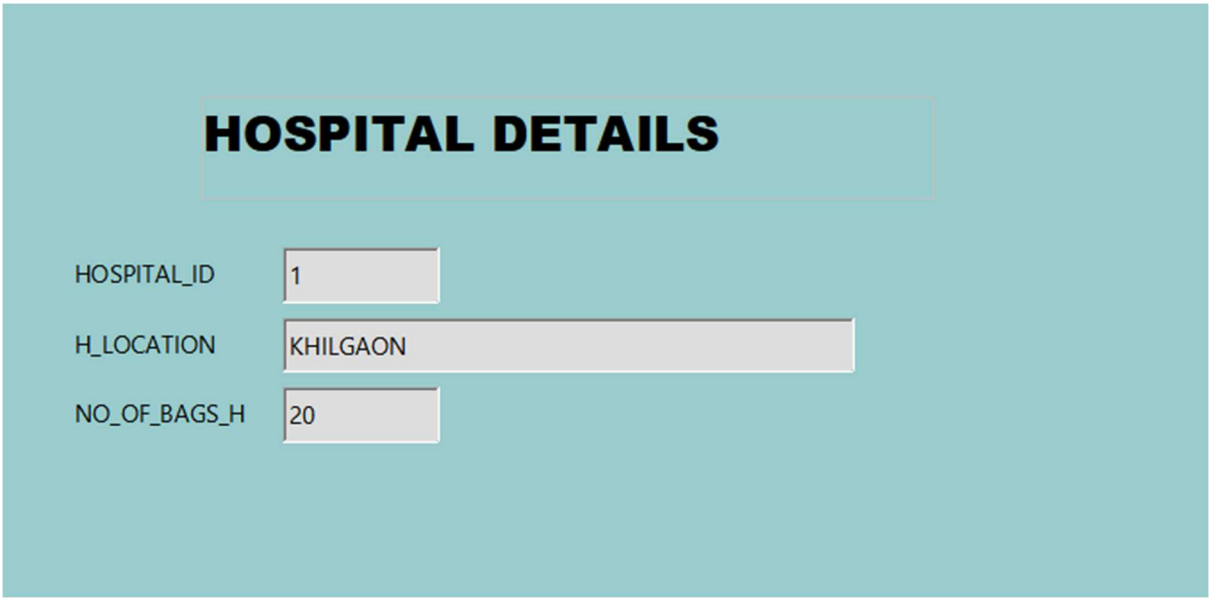


Figure 9: Form to enter hospital details

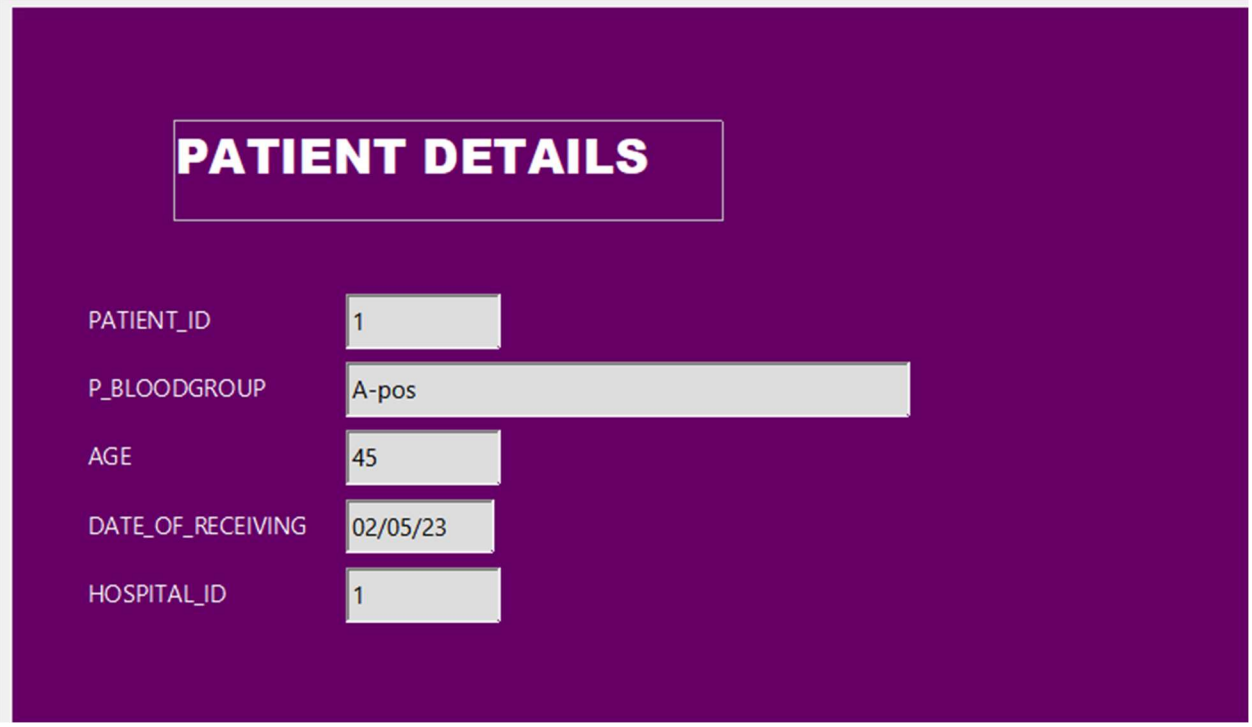


Figure 10: Form to enter patient details

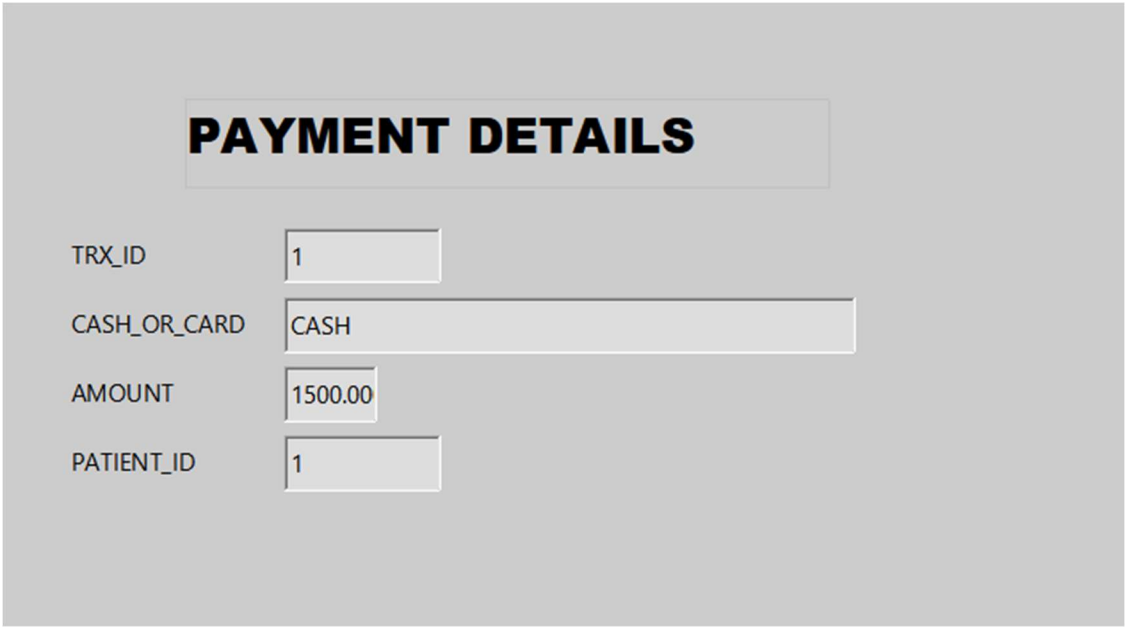


Figure 11: Form to enter payment details

Reports

Various reports created.

BLOOD BANK INFO

BLOOD_SL	LOCATION	NO_OF_BAGS_B
1	DHANMONDI	30
2	KURATOLI	40
3	MOTIJHIL	20
4	GULSHAN	10
5	BANANI	70

Figure 1: report that shows blood bank info and availability of blood

BLOOD DONATION INFO

DB_ID	DONOR_ID	BAG_SL
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5

Figure 2: report that shows blood donation info

BLOOD DONOR DETAILS

DONOR_ID	DNAME	AGE	D_BLOODGROUP	BLOOD_SL
1	JOHN	39	O-pos	1
2	CLARK	35	A-neg	2
3	TONY	45	B-pos	3
4	BRUCE	31	B-pos	4
5	STEVE	32	A-neg	5

Figure 3: report that shows blood donor info

AVAILABLE BLOOD INFO

BAG_SL	BLOODGROUP	ENTRY_DATE	EXP_DATE
1	A-pos	03/02/23	03/05/23
2	A-neg	05/21/23	05/28/23
3	O-pos	08/27/23	09/05/23
4	O-neg	06/02/23	06/05/23
5	B-pos	09/05/23	09/10/23

Figure 4: report that shows blood info

BLOOD TRANSACTION INFO

BH_ID	BAG_SL	HOSPITAL_ID
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5

Figure 5: report that shows blood transaction info

EMPLOYEE CONTACT INFO

EMP_ID	PHONE
420101	1784620145
420102	1915605894
420103	1315605894
420104	1815605894
420105	1615605894

Figure 6: report that shows employee contact info

EMPLOYEE INFO

EMP_ID	DEPT	SAL	HIREDATE	BLOOD_SL
1	REGISTRATION	5000	06/05/20	1
2	GUARD	700	05/06/19	2
3	RECEPTION	3500	08/10/22	3
4	INVENTORY	2500	06/01/21	4
5	IT	6000	01/05/23	5

Figure 7: report that shows employee info

BLOOD EXPIRATION INFO

DATE_ID	ENTRY_DATE	EXP_DATE
1	06/05/23	06/10/23
2	09/10/23	09/15/23
3	08/01/23	08/07/23
4	04/06/23	04/10/23
5	03/11/23	03/17/23

Figure 8: report that shows blood expiration details

HOSPITAL INFO

HOSPITAL_ID	H_LOCATION	NO_OF_BAGS_H
1	KHILGAON	20
2	KERANIGONJ	45
3	UTTARA-01	35
4	SHAHBAGH	50
5	KARWAN BAZAR	55

Figure 9: report that shows hospital details

PATIENT DETAILS

PATIENT_ID	P_BLOODGROUP	AGE	DATE_OF_RECEIVING	HOSPITAL_ID
1	A-pos	45	02/05/23	1
2	B-neg	31	01/10/23	2
3	O-pos	23	03/11/23	3
4	O-neg	60	03/16/23	4
5	B-pos	55	02/20/23	5

Figure 10: report that shows patient details

PAYMENT DETAILS

TRX_ID	CASH_OR_CARD	AMOUNT	PATIENT_ID
1	CASH	1500.000000	1
2	CARD	1000.000000	2
3	CARD	1200.000000	3
4	CASH	1400.000000	4
5	CARD	1800.000000	5

Figure 11: report that shows payment details

Conclusion

Throughout the course of this project, I have embarked on a transformative journey of learning and skill development in the field of database management and have gained a solid understanding of their principles, design methodologies, and practical applications. This project provided me with a valuable opportunity to apply my knowledge and showcase my proficiency in developing a comprehensive blood donation system database. The implementation of this database brings forth several advantages to the healthcare ecosystem and society as a whole. The benefits of this database extend to healthcare professionals, donors, and patients alike, facilitating efficient donor-recipient matching, enhancing donor management practices, and ultimately improving the overall quality of blood transfusions. This project exemplifies the

transformative power of databases and underscores their pivotal role in driving positive change in the medical field.

Future Work

In the future, there are several avenues for expanding and enhancing the blood donation system database. Firstly, integrating advanced analytics and data visualization capabilities can provide valuable insights into donor patterns, blood supply-demand dynamics, and overall system performance. This would enable proactive decision-making, optimization of resource allocation, and identification of areas for further improvement. Additionally, incorporating mobile applications or web interfaces can enhance accessibility, allowing donors to conveniently schedule appointments, receive notifications, and track their donation history. Moreover, exploring interoperability with existing healthcare systems and external databases can further streamline processes, enable seamless data exchange, and promote collaboration among different stakeholders in the blood donation ecosystem. Continual updates and enhancements to the database system will ensure its long-term relevance and effectiveness in meeting the evolving needs of the healthcare industry.

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