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CHANDKHEDA,AHMEDABAD

AFFILIATED

NEW LJ INSTITUTE OF ENGINEERING AND TECHNOLOGY

BODAKDEV, AHMEDABAD

A PROJECT REPORT ON

Blood Bank Management System

UNDER SUBJECT OF

DESIGN ENGINEERING – 2A (3150001)

SEMESTER – V (CSE)

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ACADEMIC YEAR
(2024-2025)

NEW L. J. INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF (CSE)

[2024-2025]

Certificate

This is to certify that the project entitled **"Blood Bank Management System"** has been successfully carried out by **Harsh Shah (221430131103), Arman Wadhavania (221430131124), Jenil Thummar (221430131119), Priyanshu Modi(221430131059)** under my guidance in partial fulfillment of the requirements for the degree of Bachelor of Engineering in Computer Science and Engineering, 5th Semester, **New L. J. Institute of Engineering and Technology**, during the academic year **2024-25.**

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SELF DECLARATION

We, the undersigned, hereby declare that we have completed our project report entitled **"Blood Bank Management System"** and have submitted it to our respective guide. As students in the 5th semester, we have strived to give our best effort throughout the project. We affirm that the work presented in this report is our original work, completed with honesty and diligence.

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- Harsh Shah
- Arman Wadhavania
- Jenil Thummar
- Modi Priyanshu

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ABSTRACT

A Blood Bank Management System is designed to streamline the process of blood donation, storage, and distribution. This project aims to enhance efficiency and effectiveness in managing blood inventory, donor information, and transfusion records. Through centralized data management, it ensures accurate tracking of blood units, expiration dates, and donor eligibility. The system facilitates quick access to critical information, such as blood type matching and availability, reducing response time during emergencies. Additionally, it improves communication between blood banks, hospitals, and donors, fostering a collaborative network for blood supply management. Integration of automation features simplifies routine tasks, minimizing human error and optimizing resource utilization. Ultimately, the Blood Bank Management System contributes to saving lives by ensuring a steady supply of safe and compatible blood products for medical treatments and emergencies.

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ABBREVIATIONS

UI - User Interface

UML - Unified Modeling Language

ER - Entity Relationship

DFD - Data Flow Diagram

GUI - Graphical User Interface

CHAPTER-1
INTRODUCTION

1.1 PROJECT SUMMARY & PROFILE

The Blood Bank Management System is designed to streamline the process of managing blood donations, inventory, and distribution for hospitals, blood banks, and donors. It allows users to register, track blood types and availability, and manage requests from hospitals and recipients. The system automates the matching process between donors and recipients based on blood compatibility and ensures timely communication and notifications for donation drives, emergency needs, and inventory levels.

1.2 PURPOSE

- **What is the Purpose of the Project?**

The purpose of a Blood Bank Management System is to streamline and automate the management of blood donation, storage, and distribution processes within blood banks and healthcare facilities. By efficiently tracking blood types, availability, and donor information, the system ensures timely and safe blood supply to patients in need, reduces wastage, and helps maintain optimal inventory levels. Additionally, it facilitates secure data handling, allows for easy donor recruitment and communication, and improves overall transparency and accountability in blood bank operations.

1.3 SCOPE & OBJECTIVES

The scope of the Blood Bank Management System covers the full lifecycle of blood donation and distribution processes, from donor registration to blood stock management, request handling, and distribution to healthcare facilities. It includes modules for donor management, blood inventory tracking, compatibility matching, and real-time notifications. The system is designed to be scalable for use in hospitals, independent blood banks, and emergency health services, ensuring accessibility and operational efficiency.

Objectives:

- Streamline blood donation and inventory processes.
- Enable accurate, compatibility-based donor-recipient matching.
- Ensure secure and reliable data storage.
- Facilitate real-time alerts for donations and urgent needs.
- Provide reports for trend analysis and resource planning.

1.4 TECHNOLOGIES

Software:

- **Frontend**: HTML, CSS, JavaScript for user interface design.
- **Backend**: PHP or Python for server-side processing.
- **Database**: MySQL or PostgreSQL for data storage and retrieval.
- **Frameworks**: Laravel (PHP) or Django (Python) for faster development.
- **Additional Tools**: Bootstrap for responsive design, Apache or Nginx as the web server.

Hardware:

- **Processor**: Minimum dual-core processor (Intel i3 or equivalent).
- **Memory (RAM)**: At least 4GB for smooth operation.
- **Storage**: 250GB HDD or SSD for data storage.

1.5 GANTT CHART

Figure 1.5.1 Gantt Chart

CHAPTER-2
PROJECT MANAGEMENT

2.1 PROJECT PLANNING

2.1.1 Project Development Approach and Planning

The development of the Blood Bank Management System will follow the Agile methodology, allowing for iterative progress through collaborative planning and regular feedback from stakeholders. This approach will involve breaking the project into manageable sprints, focusing on core functionalities such as donor management, inventory tracking, and request handling in each cycle to ensure continuous improvement and adaptability to user needs.

Planning will involve defining project milestones, allocating resources, and establishing a timeline that includes phases for requirements gathering, design, development, testing, and deployment. Regular meetings will facilitate communication among team members and stakeholders, ensuring that the project remains aligned with its objectives and allows for timely adjustments based on feedback and testing outcomes.

2.1.2 Roles and Responsibilities

The roles and responsibilities are divided based on individual strengths and interests to ensure a collaborative and efficient workflow.

- Project Manager: Oversees project planning, coordination, and communication among team members and stakeholders, ensuring that milestones are met on time and within budget.

- Developers: Responsible for coding, testing, and implementing the system features, including frontend and backend development.
- Database Administrator: Manages database design, implementation, and maintenance, ensuring data integrity, security, and performance.
- Quality Assurance Tester: Conducts testing to identify bugs and ensure the system meets functional and performance requirements before deployment.

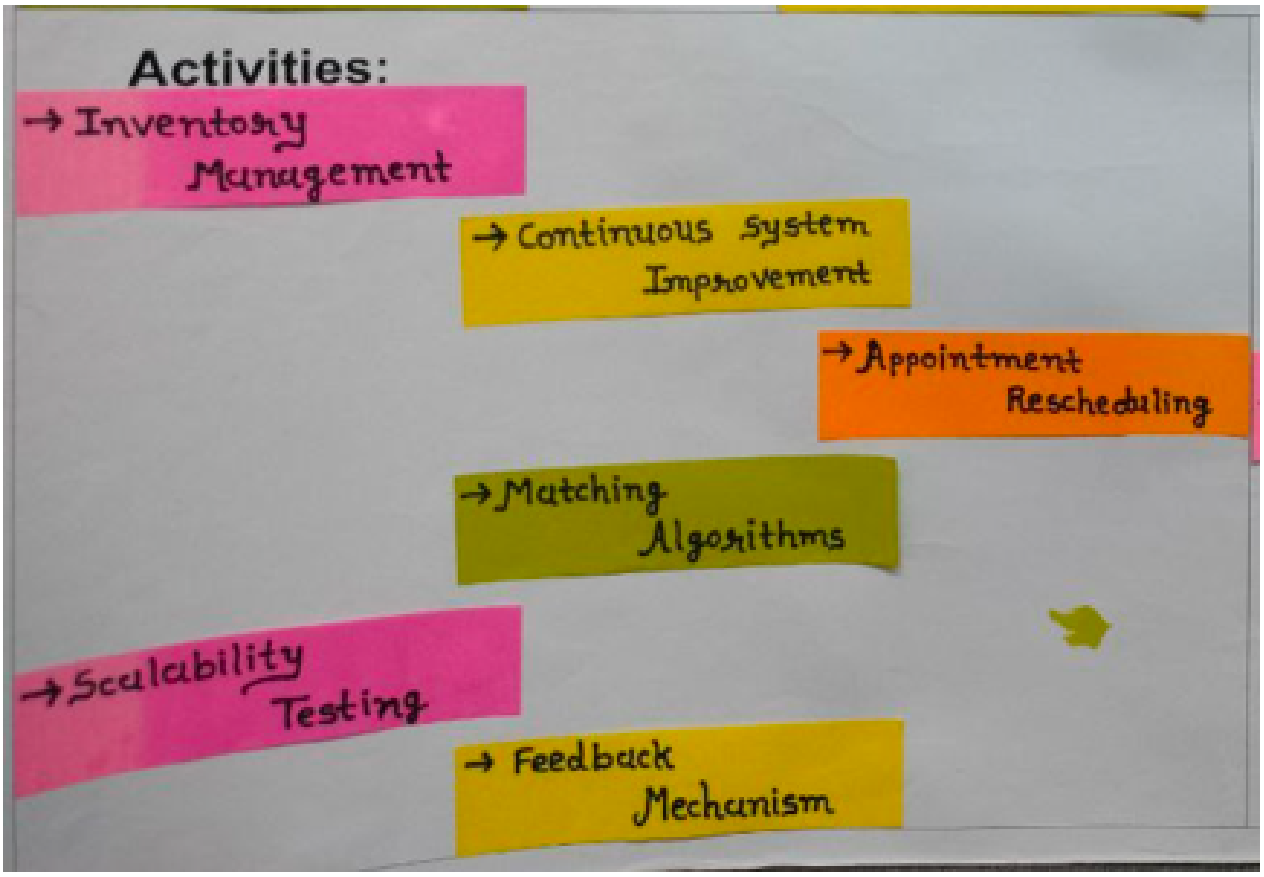

Figure 2.1.1 Activity canvas

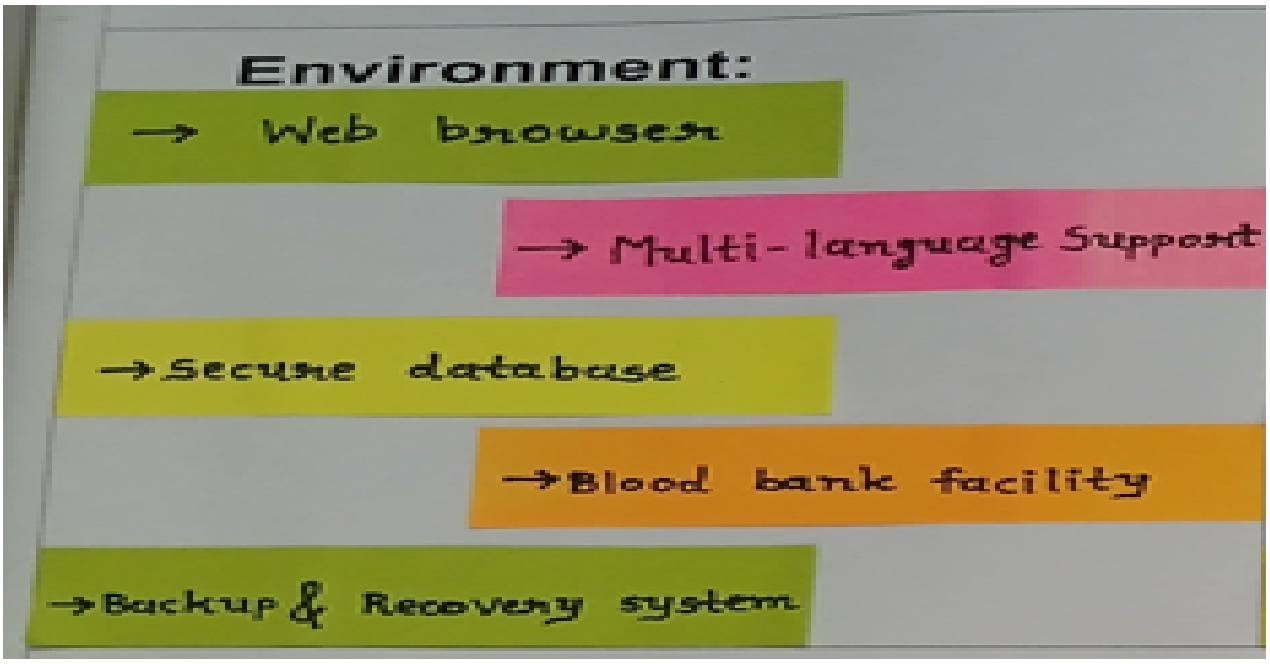

Figure 2.1.2 Environment Canvas

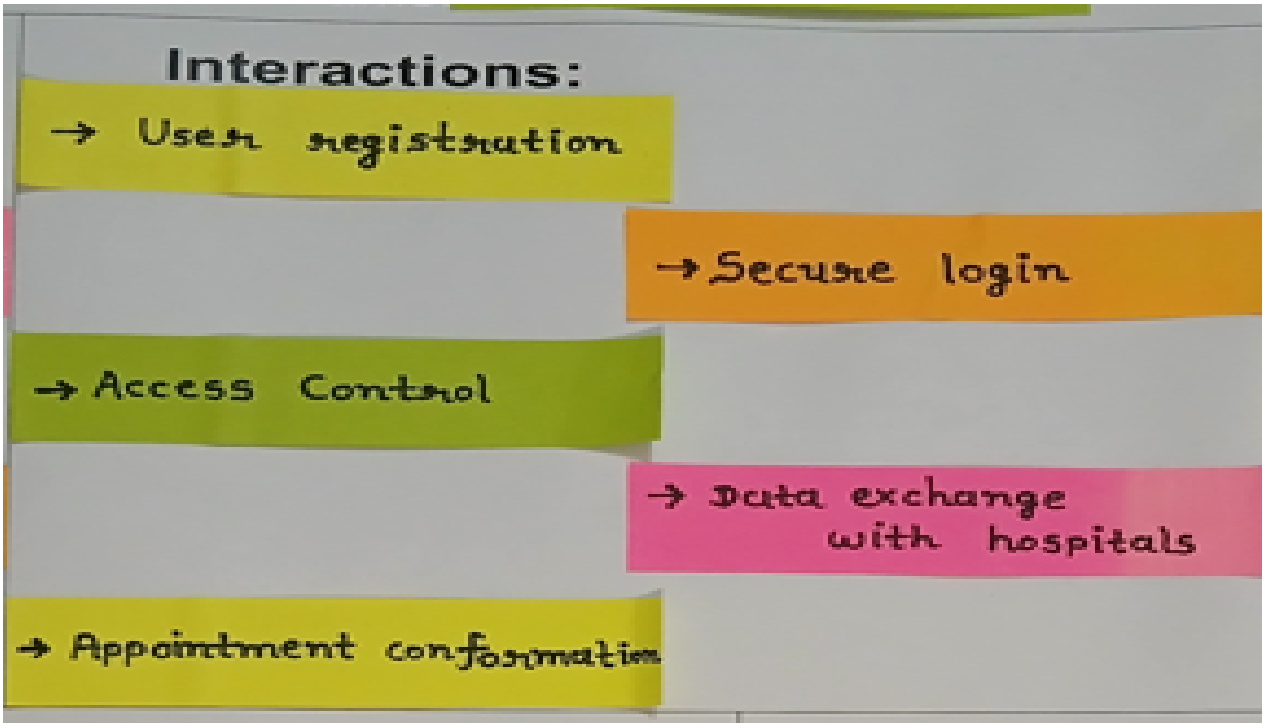

Figure 2.1.3 Interaction Canvas

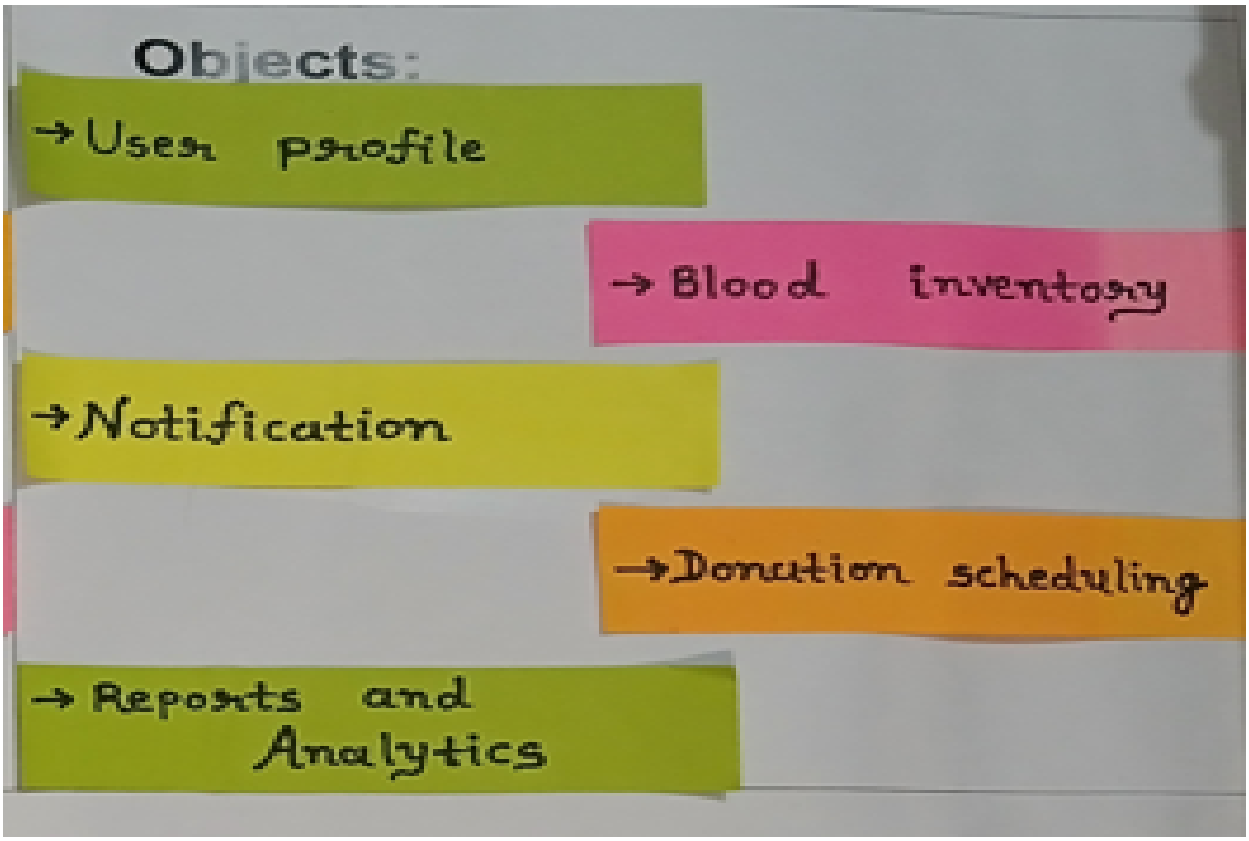

Figure 2.1.4 Object Canvas

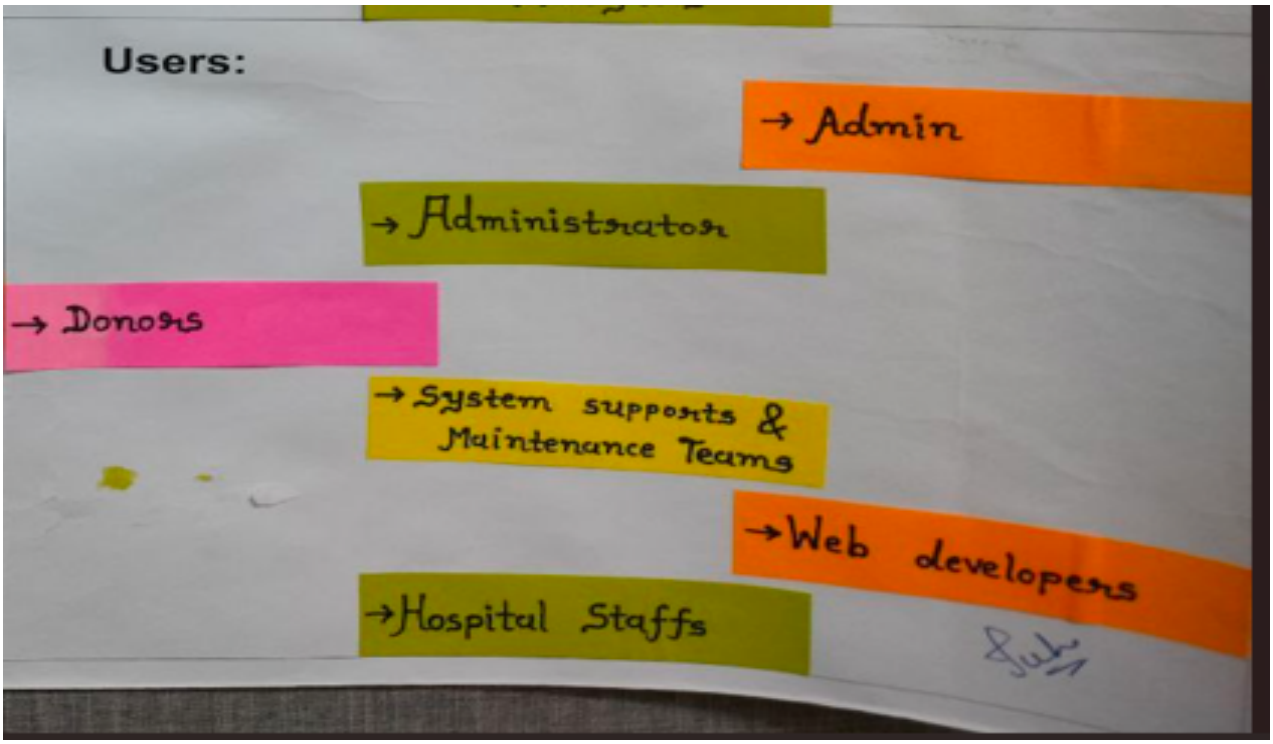

Figure 2.1.5 User Canvas

2.2 PROJECT SCHEDULING

The project follows a clear schedule with specific milestones to ensure timely completion:

- Phase 1 (Aug 1 - Aug 4, 2024): Project Setup – Research, resource allocation, and setup of development environment.
- Phase 2 (Aug 5 - Aug 11, 2024): Data Collection & Preprocessing – Gather and prepare data for training the gesture recognition model.
- Phase 3 (Aug 12 - Aug 31, 2024): Model Development – Build and train the CNN for hand gesture recognition.
- Phase 4 (Sep 1 - Sep 14, 2024): Testing & Evaluation – Test the model under real-time conditions and evaluate its accuracy.
- Phase 5 (Sep 15 - Sep 30, 2024): Integration – Integrate the model with the mouse control system and design the GUI.
- Phase 6 (Oct 1 - Oct 15, 2024): Final Testing & Deployment – Perform final tests, fix bugs.

2.3 RISK MANAGEMENT

To ensure smooth execution, potential risks are identified early on, and mitigation strategies are implemented:

- **Data Security Risks**: Implement strong encryption and access controls to protect sensitive donor and patient information from unauthorized access and breaches.
- **System Downtime**: Establish a robust backup and recovery plan, including regular data backups and a failover strategy, to minimize downtime and ensure business continuity in case of system failures.
- **Regulatory Compliance**: Stay updated with health regulations and standards (such as HIPAA) related to blood donation and management, ensuring that the system adheres to legal requirements to avoid penalties and maintain trust.

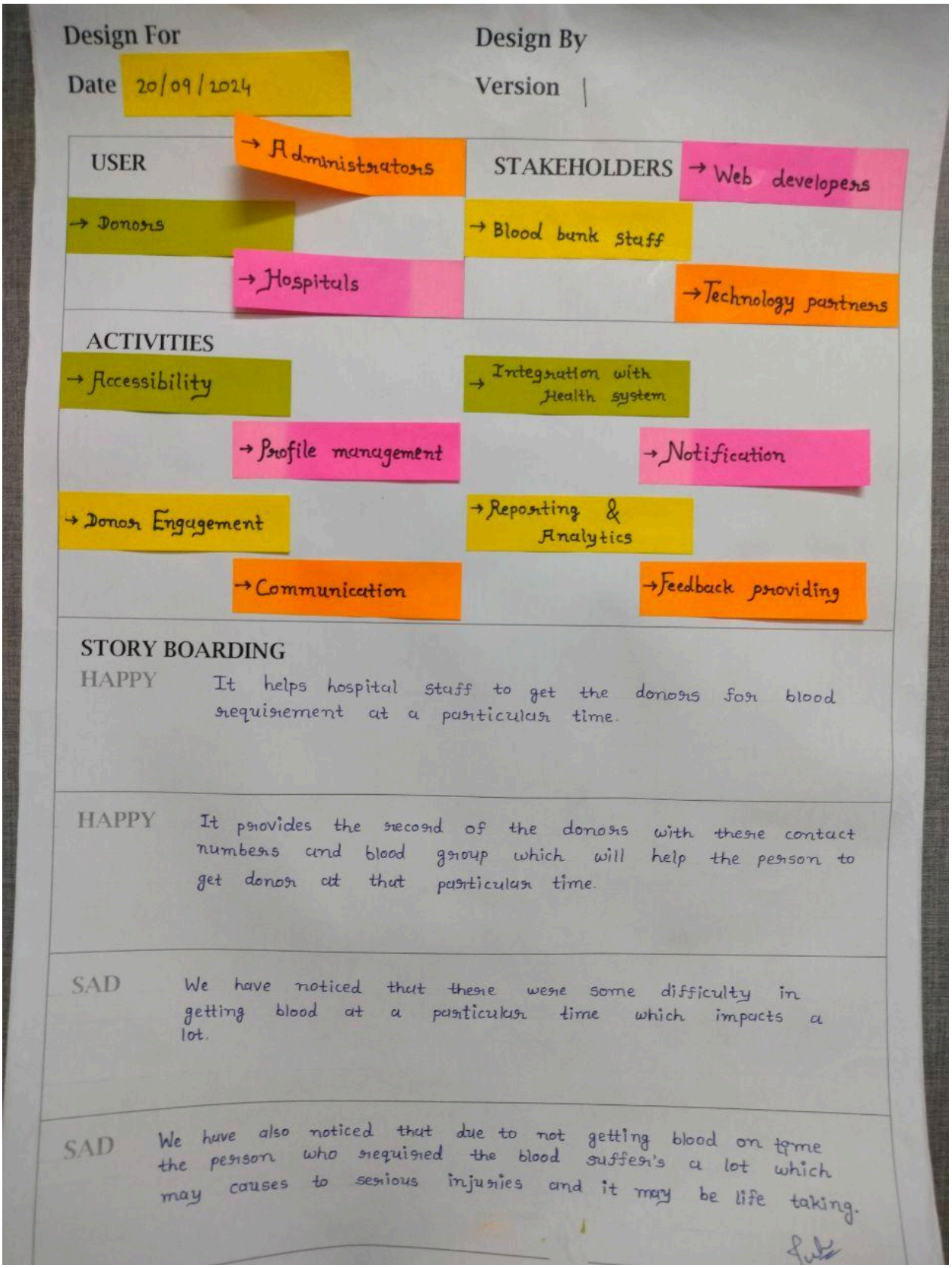

Figure 2.2.1 Empathy Canvas

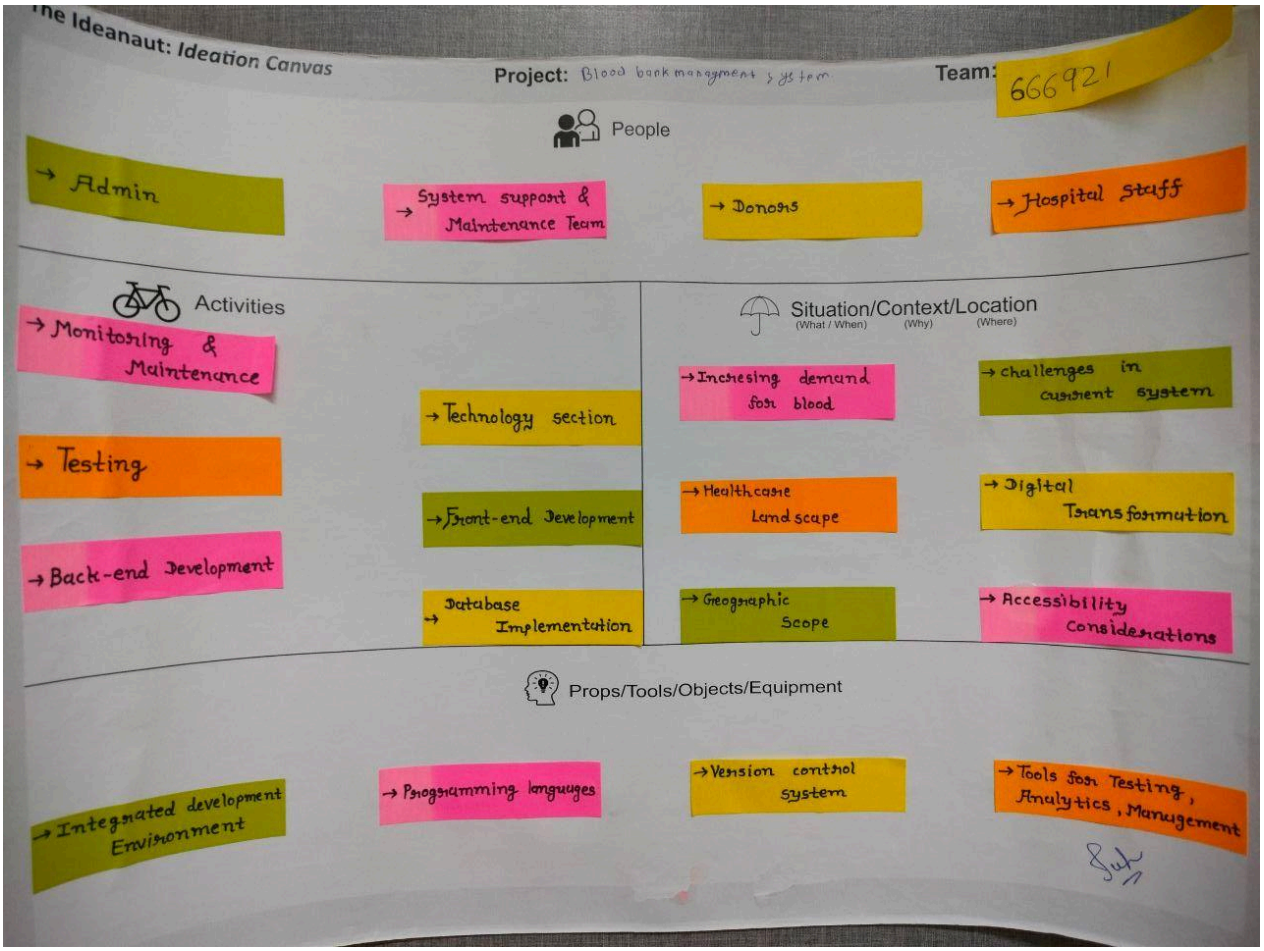

Figure 2.3.1 Ideation Canvas

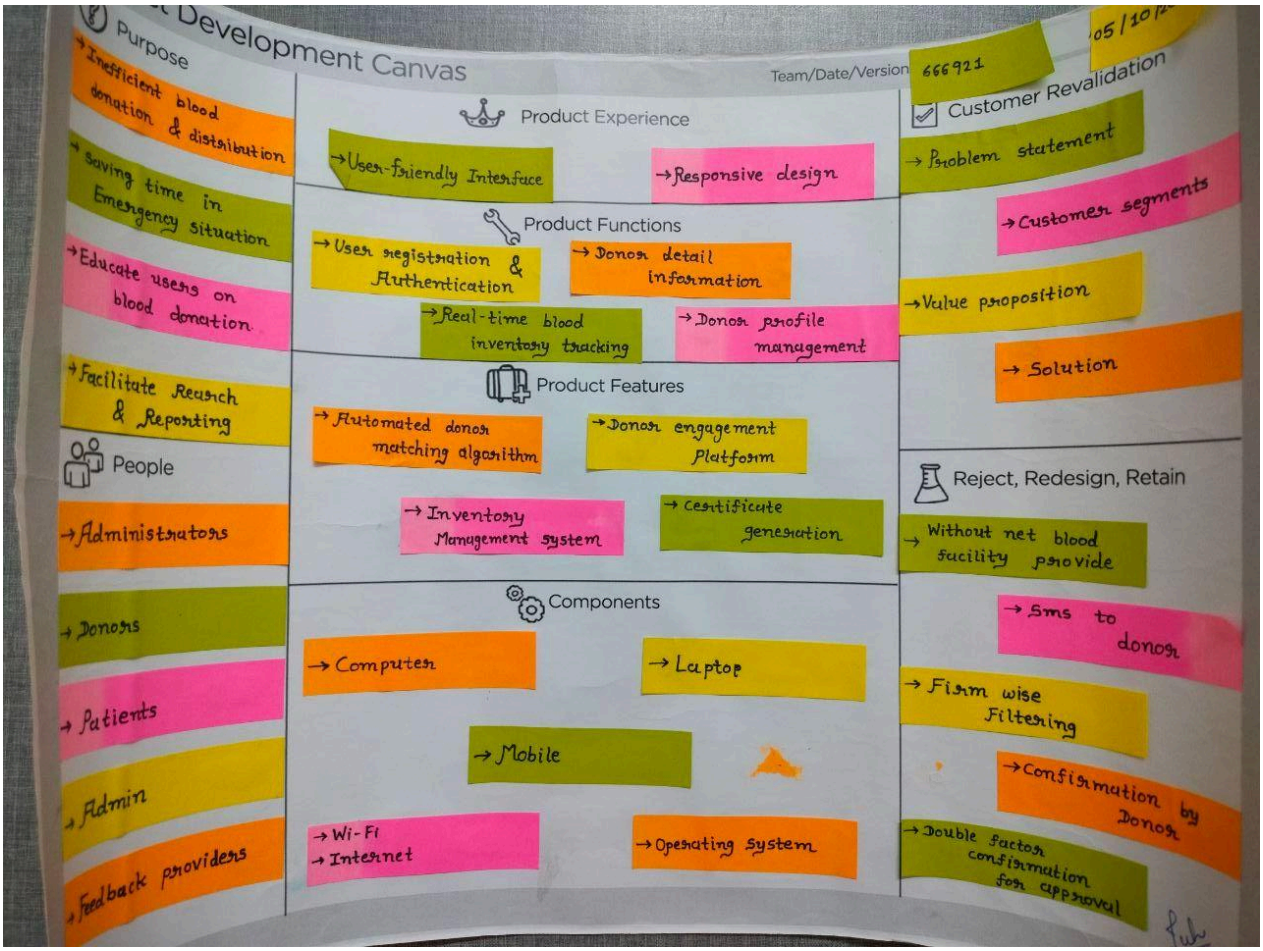

Figure 2.4.1 Product Development Canvas

CHAPTER – 3
SYSTEM REQUIREMENTS STUDY

3.1 Existing System / Scenario

The existing systems for blood bank management are often manual or use outdated software, leading to inefficiencies in donor registration, inventory tracking, and request handling. These systems may lack real-time data access, making it difficult to match donors with recipients promptly and accurately. Additionally, they may not offer adequate security measures for sensitive information, resulting in potential data breaches. Overall, these limitations hinder effective communication and resource management within blood banks and healthcare facilities.

3.2 Proposed System

The proposed Blood Bank Management System aims to automate and enhance the efficiency of blood donation and distribution processes. It will feature a user-friendly interface for donors, healthcare providers, and administrators, enabling easy registration, real-time inventory tracking, and compatibility-based matching for blood requests. The system will incorporate secure data storage and encryption to protect sensitive information and ensure compliance with regulatory standards. Additionally, it will facilitate communication through automated alerts and notifications, streamlining operations and improving response times in emergency situations. Overall, the proposed system will significantly enhance the management of blood resources, ensuring a timely and safe supply for patients in need.

3.2.1 Modules & Features in the New System

1. **Donor Management**: Allows donors to register, update their information, and track their donation history, ensuring accurate records and easy communication.

2. **Inventory Management**: Monitors blood types and quantities in real-time, enabling efficient stock management and alerts for low inventory levels.

3. **Request Management**: Facilitates blood requests from healthcare facilities, automatically matching donors based on blood type compatibility for timely fulfillment.

4. **Reporting and Analytics**: Generates reports on donation trends, inventory usage, and donor activity, providing insights for strategic planning and resource allocation.

5. **User Authentication**: Ensures secure access for different user roles (admin, donor, hospital staff) with role-based permissions to protect sensitive data.

3.2.2 User Characteristics

- **Donor**: Individuals who register to donate blood, providing personal information and tracking their donation history and upcoming drives.

- **Admin**: Manages the overall system, including user accounts, inventory levels, and donor management, ensuring smooth operations within the blood bank.

- **Hospital Staff**: Healthcare professionals who request blood for patients, accessing the system to find compatible blood types and manage emergency needs.

- **System Administrator**: Responsible for maintaining the system's technical aspects, including server management, database integrity, and user support, ensuring optimal performance and security.

3.2.3 Hardware & Software Requirements

Hardware Requirements:

- **Processor**: Minimum dual-core processor (Intel i3 or equivalent) for efficient processing.

- **Memory (RAM)**: At least 8GB for smooth multitasking and operation.

- **Storage**: 500GB HDD or SSD for adequate data storage and quick access.

- **Server**: Dedicated or cloud server to host the application and database.

- **Network**: Reliable internet connection for online access and data synchronization.

Software Requirements:

- **Operating System**: Windows Server or Linux for hosting the application.

- **Web Server**: Apache or Nginx for handling web requests.

- **Database Management System**: MySQL or PostgreSQL for data storage and management.
- **Backend Language**: PHP or Python for server-side development.
- **Frontend Technologies**: HTML, CSS, and JavaScript for user interface design.
- **Frameworks**: Laravel (PHP) or Django (Python) for efficient development.

3.2.4 Assumptions and Dependencies

- Users will have basic computer and internet skills.
- The system will be deployed on a stable network infrastructure.
- Necessary hardware and software resources will be available.
- Regular training and support will be provided to users for effective system utilization.

3.3 DATA FLOW DIAGRAM:

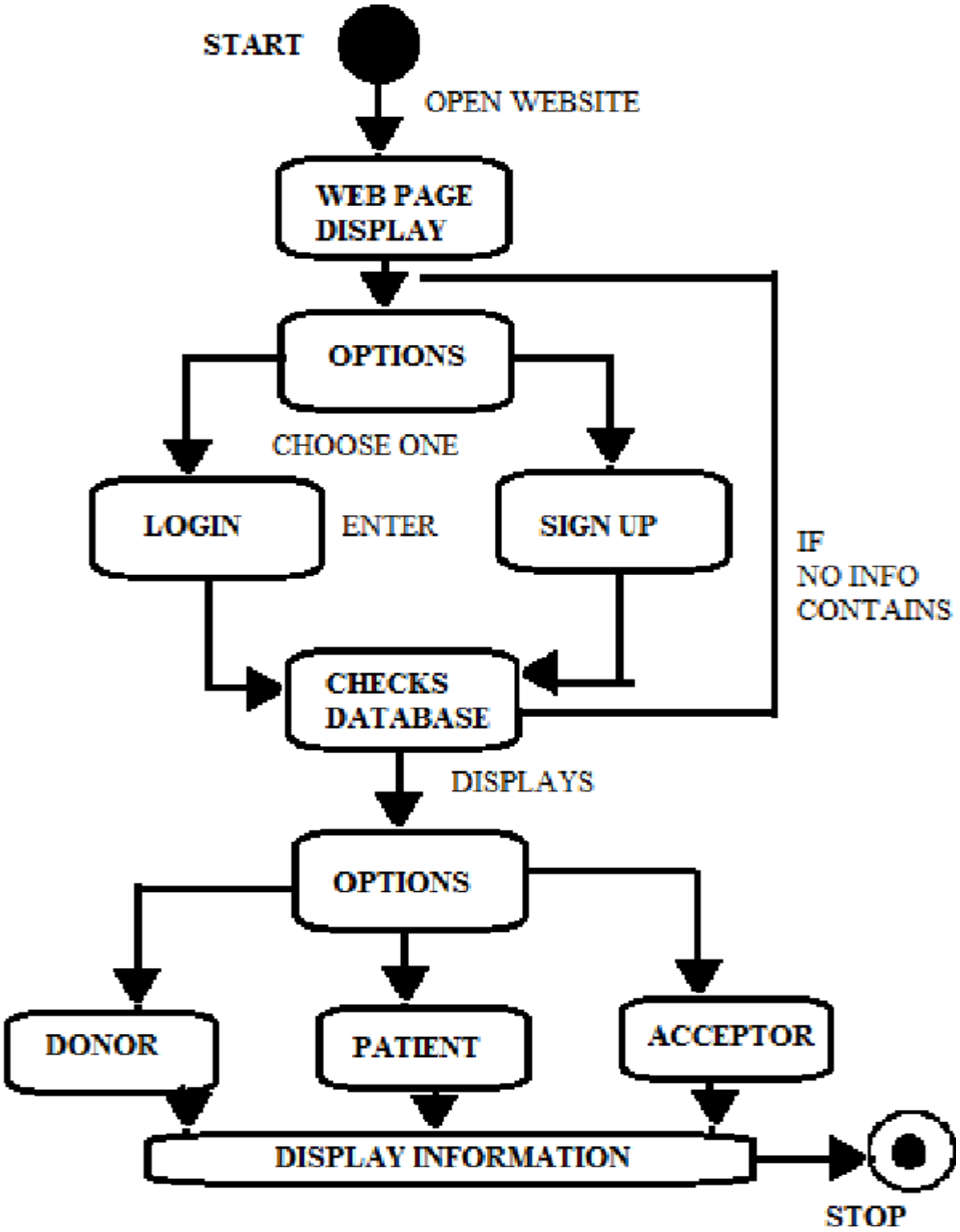

Figure 3.1.1 Data Flow Diagram

CHAPTER – 4
SYSTEM ANALYSIS

4.1 Feasibility Study

A feasibility study assesses the practicality of the proposed gesture recognition system. This includes evaluating technical, economic, operational, and legal aspects.

- **Technical Feasibility**:

  - **Technology Availability**: The system can be developed using widely available web technologies like PHP, Python, MySQL, and front-end languages (HTML, CSS, JavaScript), making it feasible and accessible.

  - **Security Measures**: Secure technologies, such as data encryption and role-based access control, can be implemented to safeguard sensitive information, ensuring compliance with health regulations.

  - **User Accessibility**: The system can be accessed through standard devices like desktops and mobile devices, supporting user convenience and ease of use across various platforms.

- **Economic Feasibility**:

  - **Cost Efficiency**: The system can reduce operational costs by automating manual tasks, such as donor registration, inventory tracking, and blood request

management, leading to long-term savings.

- **Maintenance and Scalability Costs**: Future maintenance costs are manageable with scalable architecture, and incremental updates can keep the system relevant and functional without substantial reinvestments.

- **Operational Feasibility**:

- **User Training and Adaptability**: The system is designed with a user-friendly interface, making it easy for staff, donors, and hospital personnel to learn and adapt with minimal training.

- **Stakeholder Satisfaction**: The system's efficiency and ease of use can improve satisfaction for all stakeholders, from staff and administrators to donors and healthcare providers, leading to greater engagement and operational success.

- **Legal Feasibility**:

- **Data Privacy Compliance**: The system must adhere to data protection laws, such as GDPR or HIPAA (in applicable regions), to safeguard sensitive donor and patient information. Ensuring compliance through secure data handling, encryption, and access controls is essential to avoid legal issues and protect user privacy.

4.2 System Activity Diagram

The activity diagram illustrates the flow of activities within the system, from hand detection to gesture recognition and cursor control.

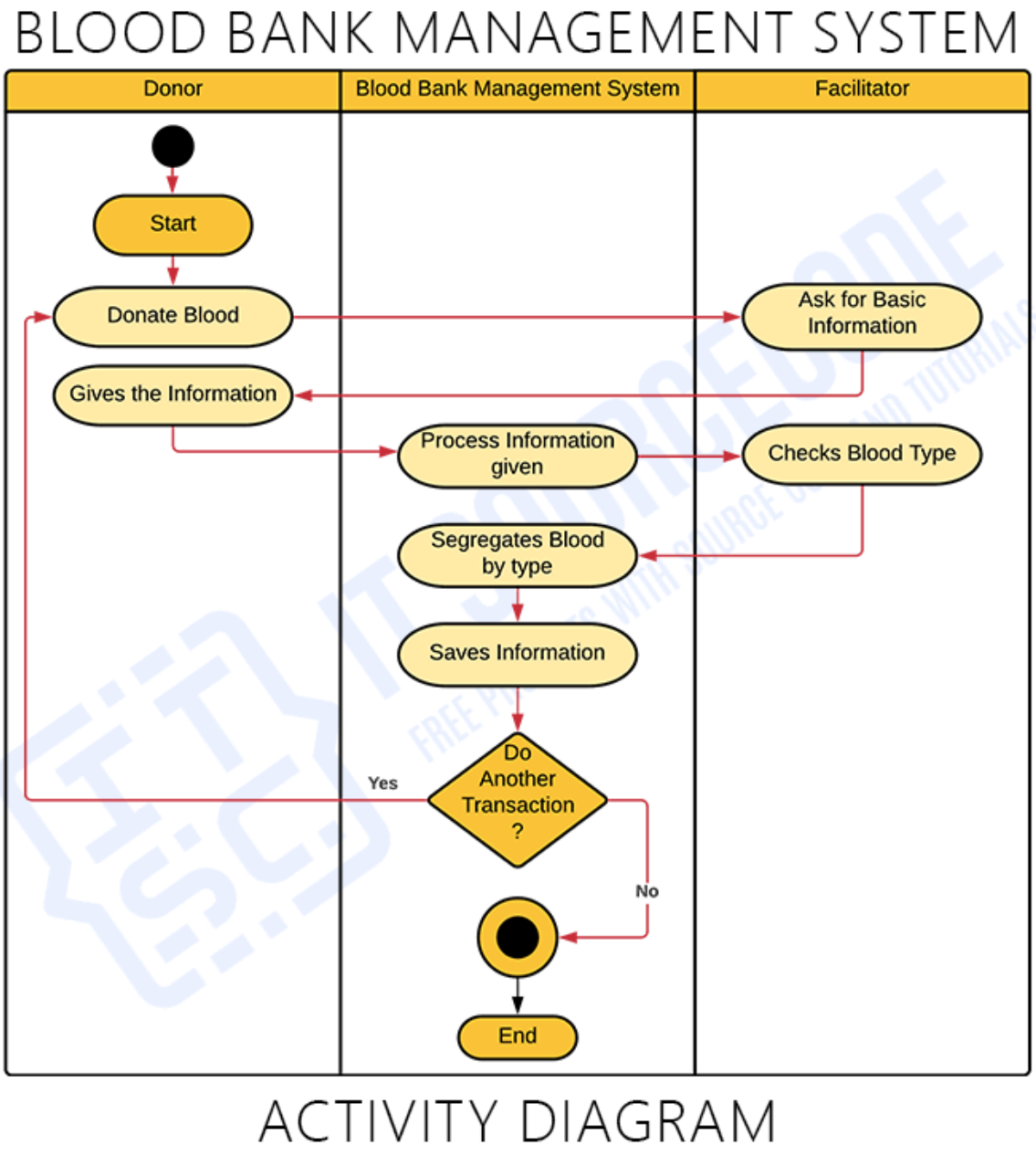

Figure 4.1.3 System Activity Diagram

4.3 Use Case Diagram

The use case diagram represents the interactions between the user and the gesture recognition system, outlining key functionalities.

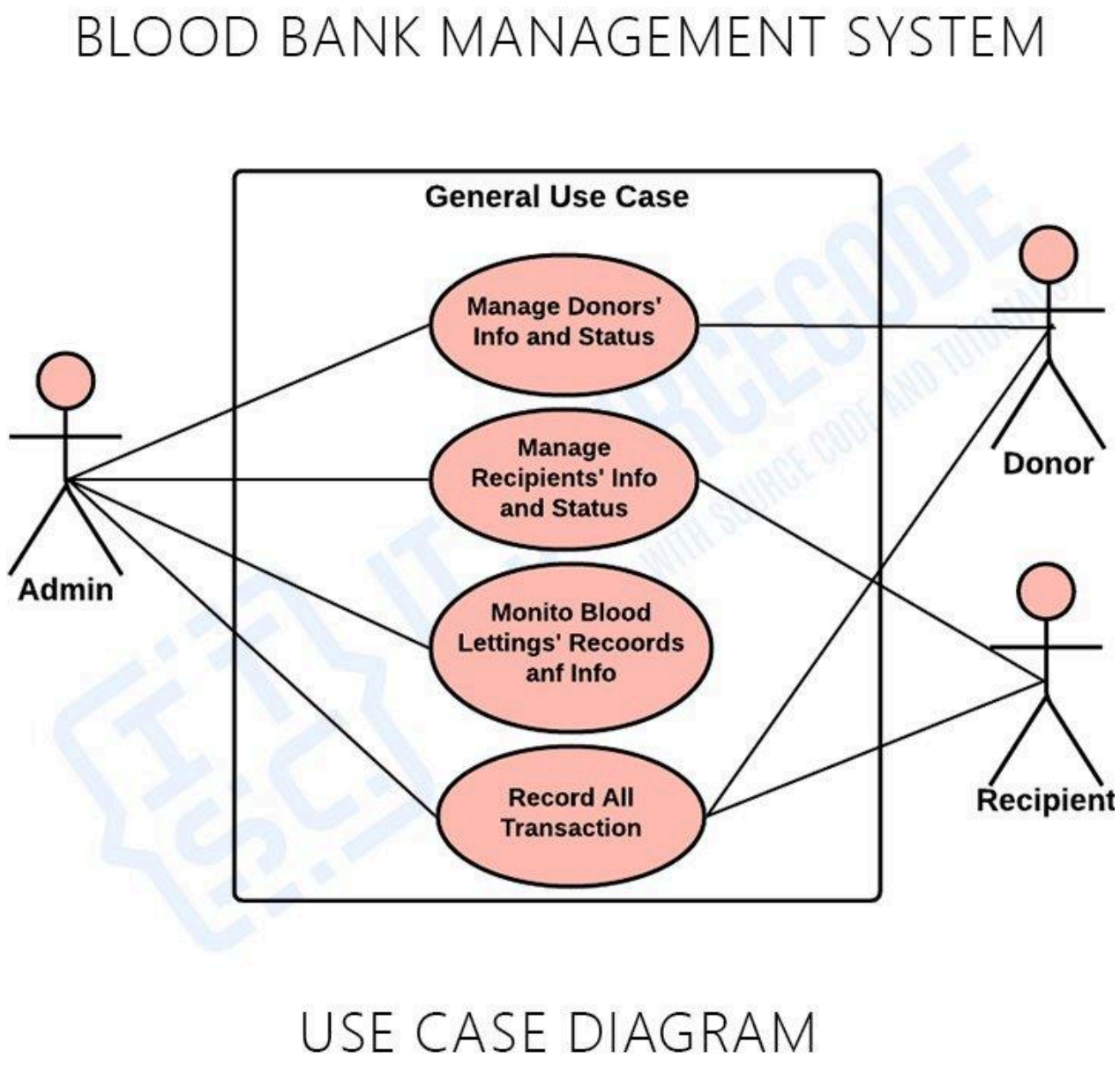

Figure 4.1.1 Use Case Diagram

4.4 Sequence Diagram

The sequence diagram illustrates the interaction between the user, gesture recognition system, and components for a typical gesture action (e.g., moving the cursor).

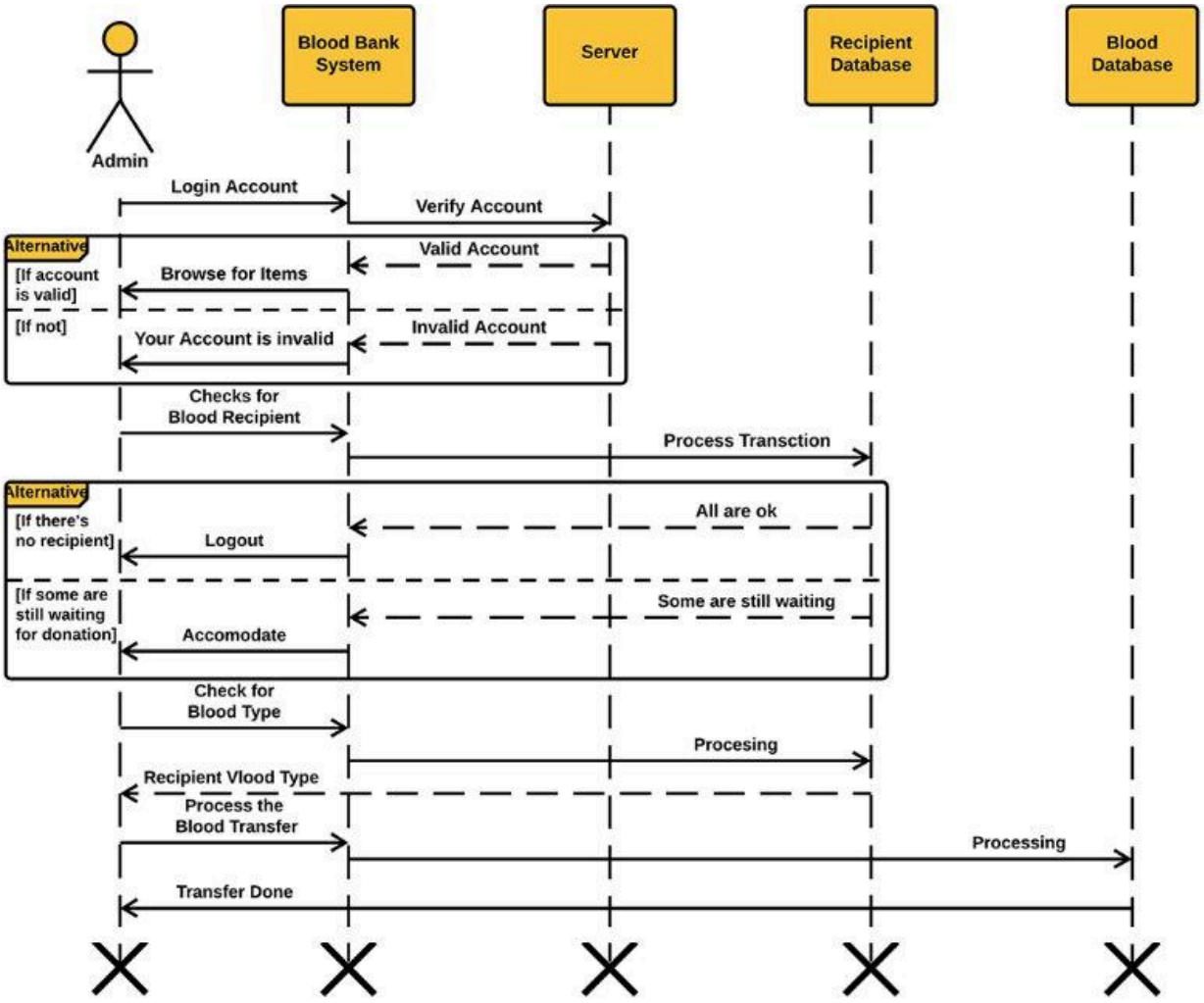

Figure 5.1.1 Sequence Diagram

CHAPTER-5
SYSTEM DESIGN

5.1 ER DIAGRAM

An Entity-Relationship (ER) diagram visually represents the database structure. The entities and their attributes for a gesture recognition system might look like this

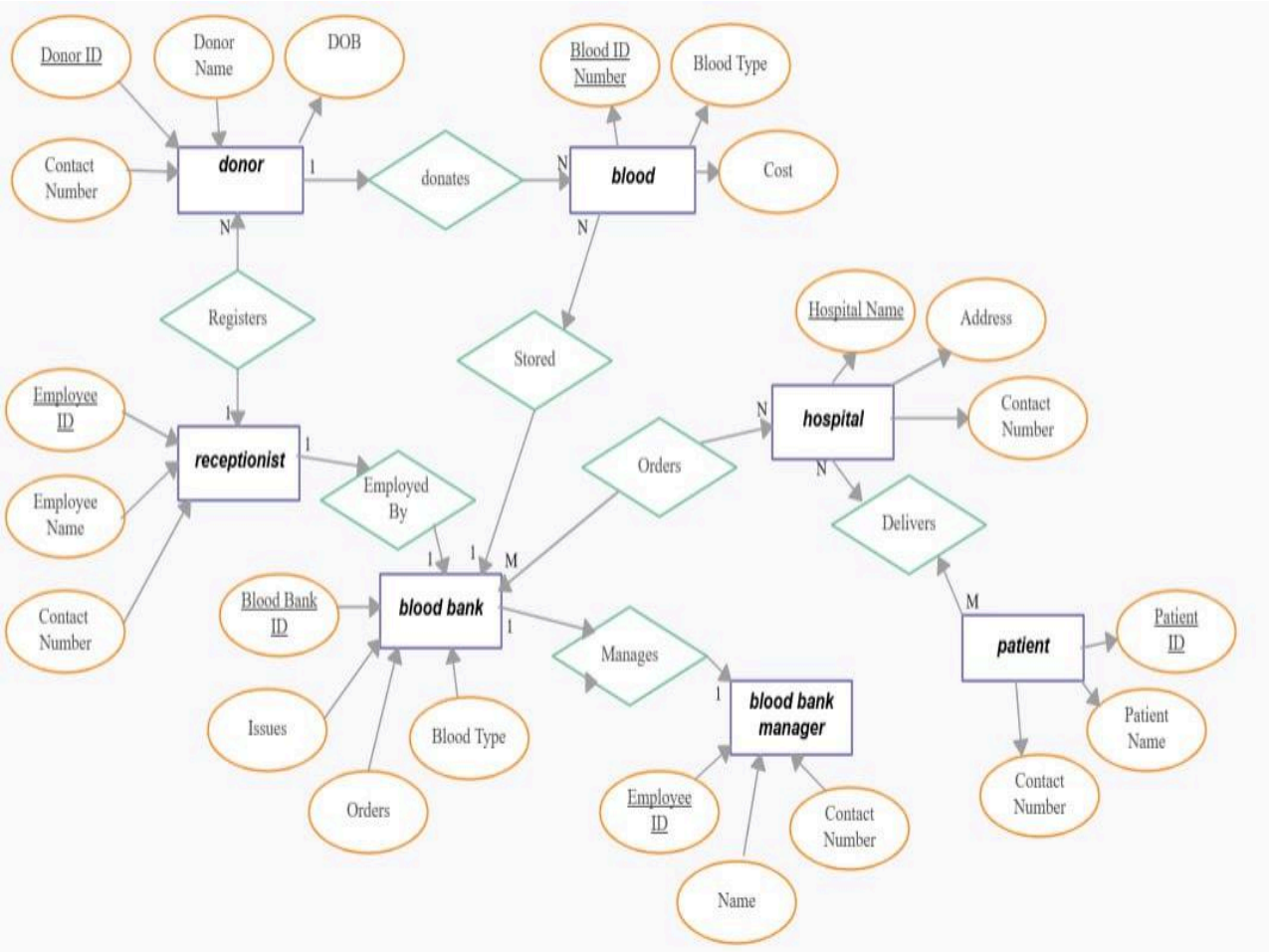

Figure 4.1.2 E-R Diagram

5.2 FLOW CHART

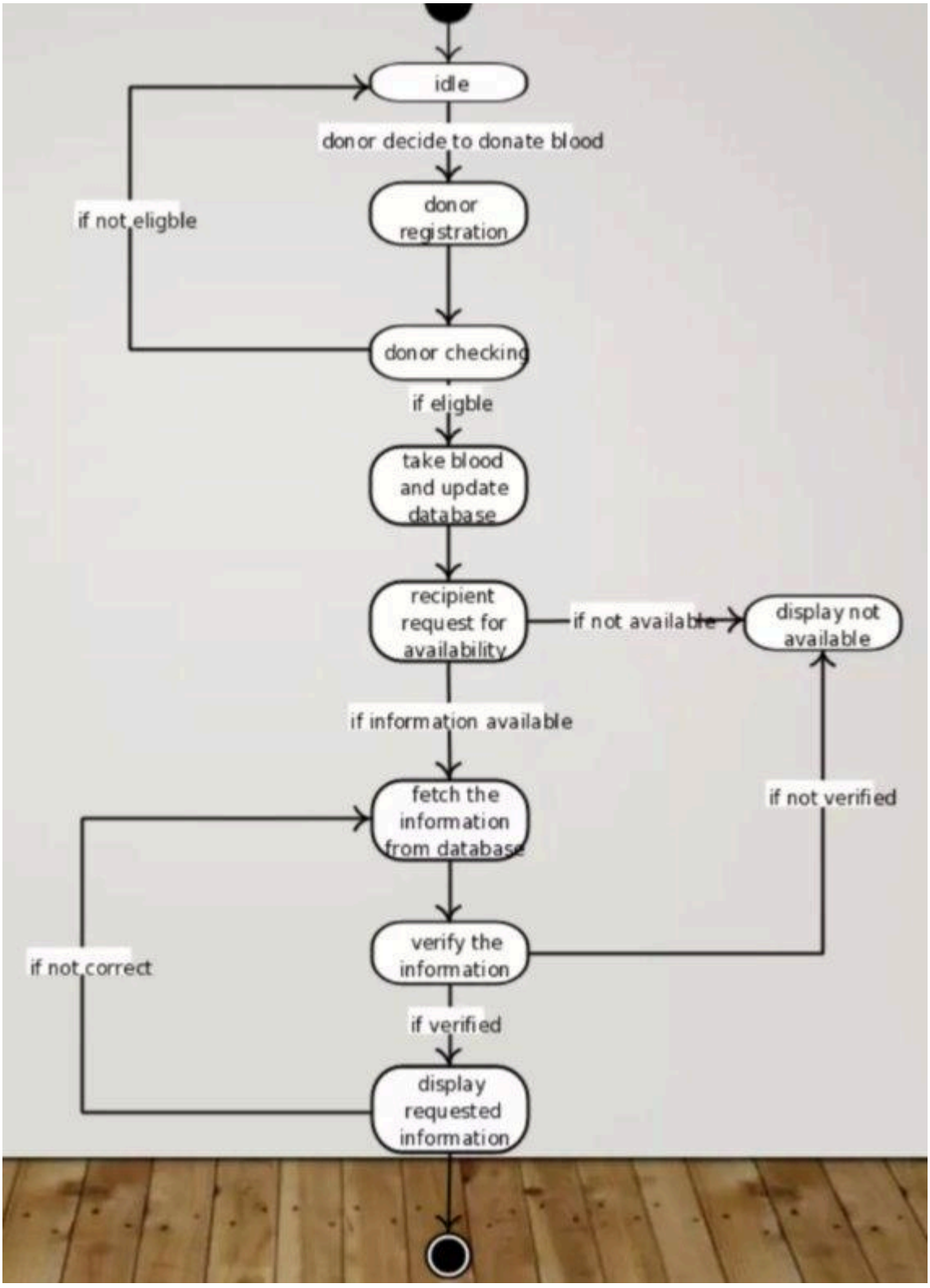

Figure 5.1.2 Flow Chart

CHAPTER – 6
IMPLEMENTATION

6.1 IMPLEMENTATION ENVIRONMENT

- Hardware Requirements:
  - **Processor**: Minimum dual-core processor (Intel i3 or equivalent) to handle application processes efficiently.
  - **Memory (RAM)**: At least 8GB of RAM to ensure smooth multitasking and operation of the system during peak usage.
  - **Storage**: 500GB HDD or SSD for data storage, allowing ample space for donor information, blood inventory records, and transaction logs.
- Software Requirements:
  - **Operating System**: Windows Server or a compatible Linux distribution to host the application and manage resources effectively.
  - **Web Server Software**: Apache or Nginx for serving web content and handling user requests efficiently.
  - **Database Management System**: MySQL or PostgreSQL for storing and managing data related to donors, inventory, transactions securely.

CHAPTER – 7
TESTING

7.1 TESTING PLAN & STRATEGY

- **Objectives**:

o Ensure efficient management and tracking of blood donations, inventory, and requests within the blood bank.

o Enhance accessibility and coordination between donors, hospitals, and blood bank administrators to improve service delivery.

7.2 FUNCTIONAL TESTING

Functional testing focuses on verifying that the system functions according to the specified requirements. This includes testing each feature of the gesture recognition model to ensure it behaves as expected.

Testing Methods:

- **Unit Testing**: Test individual components of the system (e.g., hand detection, gesture recognition, cursor control) for correct functionality.
- **Integration Testing**: Test how different modules work together, ensuring the flow of data is seamless from gesture detection to action execution.

Test Cases:

1) User Registration Test

- **Objective**: Verify that new users (donors, hospitals) can register successfully.
- **Input**: User details including name, contact information, blood type, and password.
- **Expected Output**: Successful registration confirmation with a unique user ID generated.

2) Login Authentication Test

- **Objective**: Ensure that only authorized users can access the system.
- **Input**: Valid and invalid username-password combinations.
- **Expected Output**: Access granted for valid credentials, error message for invalid credentials.

3) Blood Donation Entry Test

- **Objective**: Verify that new blood donations can be added accurately to the inventory.
- **Input**: Donor ID, blood type, and quantity donated.
- **Expected Output**: Blood donation successfully recorded, and inventory updated accordingly.

4) Inventory Level Check Test

- **Objective**: Confirm that the system tracks current blood inventory levels correctly.
- **Input**: Trigger a query to view inventory by blood type.
- **Expected Output**: Display of accurate inventory levels for each blood type in stock.

5) Blood Request Test

- **Objective**: Ensure that blood requests from hospitals are processed correctly.
- **Input**: Hospital ID, requested blood type, and quantity.
- **Expected Output**: Confirmation of request placed if inventory is sufficient, or error if not available.

7.3 USABILITY TESTING

Usability testing evaluates the application's user interface and overall user experience, ensuring that users can navigate and use the system effectively.

Testing Methods:

- **Data Validation:** Ensure accurate donor and recipient information to prevent mismatches.

- **Inventory Management:** Track blood product availability and expiration dates efficiently.

Test Cases:

1. **Donor Registration**

- **Objective:** Verify that a new donor can be registered successfully.
- **Test Scenario:** Attempt to register a donor with valid information (name, age, blood type, contact details).
- **Evaluation Criteria:** Registration should succeed, and the donor's details should be saved in the database.

2. **Blood Donation Entry**

- **Objective:** Ensure that blood donation records are accurately created.
- **Test Scenario:** Record a blood donation with donor ID, donation date, and blood type.
- **Evaluation Criteria:** The donation record should be saved correctly, and the donor's donation history should reflect this entry.

3. **Reporting and Analytics**

- **Objective:** Ensure reporting functionality for tracking donations and inventory.
- **Test Scenario:** Generate reports for total donations, blood types available, and usage rates over a specified period.
- **Evaluation Criteria:** Reports should generate accurately and display the correct data based on filters applied.

4. **User Authentication**

- **Objective:** Test the security of the system through user authentication.
- **Test Scenario:** Attempt to log in with valid and invalid credentials.
- **Evaluation Criteria:** Access should be granted for valid credentials and denied for invalid ones, with appropriate error messages displayed.

CHAPTER – 8

LIMITATIONS & FUTURE ENHANCEMENTS

8.1 LIMITATIONS

1) Initial Setup Cost

- Developing and deploying the Blood Bank Management System can incur high initial costs, especially for small organizations. Expenses may include hardware, software licenses, and implementation fees.

2) User Adaptability and Training

- Staff and volunteers may require training to operate the system efficiently, which can lead to initial resistance and slow adoption. Frequent training sessions and support might be needed to ensure effective usage.

3) Data Security Risks

- Despite encryption and security protocols, there is always a risk of data breaches due to cyberattacks. Protecting sensitive information like donor details and health records requires continuous monitoring and updates.

4) Dependence on Stable Internet

- The system relies on a stable internet connection, which may be a limitation in areas with unreliable connectivity. Network issues could disrupt real-time data access, inventory tracking, and communication between blood banks and hospitals.

5) System Downtime and Maintenance

- Regular maintenance and occasional downtime are necessary for updates and security improvements. This may temporarily disrupt operations and require fallback procedures to ensure service continuity.

8.2 FUTURE ENHANCEMENTS

1. Adaptive Learning:

o Implement machine learning algorithms that allow the system to adapt and improve its gesture recognition capabilities based on individual user behavior and preferences over time. This could enhance accuracy and user satisfaction.

2. Expanded Gesture Library:

o Introduce a broader set of gestures to allow for more complex interactions. Incorporating customizable gestures can empower users to define their own gestures for specific actions.

3. Multimodal Interaction:

o Explore the integration of additional input methods, such as voice

commands or touch inputs, alongside gesture recognition. This could create a more versatile and user-friendly interface.

4. Enhanced Feedback Mechanisms:

- Develop more sophisticated feedback mechanisms to inform users when gestures are recognized or when errors occur. Visual cues (e.g., highlighting recognized gestures) and audio feedback can improve the user experience.

5. Robustness to Environmental Changes:

- Work on improving the system's robustness to different environmental conditions by incorporating features like automatic brightness adjustment, background subtraction, or advanced filtering techniques to enhance hand detection accuracy.

6. Cross-Platform Compatibility:

- Enhance the system's compatibility across various platforms (e.g., Windows, macOS, mobile devices) and devices (e.g., smart TVs, VR headsets), allowing for a wider range of applications and accessibility.

7. User Customization Options:

- Introduce options for users to customize settings related to gesture sensitivity, speed of cursor movement, and gesture recognition thresholds, allowing for a more personalized experience.

8. Performance Optimization:

- Continuously monitor and optimize the performance of the gesture recognition model to reduce latency and enhance processing speed, especially for real-time applications.

CHAPTER – 9
CONCLUSION

The Blood Bank Management System represents a significant advancement in the management of blood donation and distribution processes, addressing many of the challenges faced by existing systems. By automating key functionalities such as donor registration, inventory tracking, and request handling, the proposed system enhances operational efficiency and ensures timely availability of blood for patients in need. This modernization not only reduces human error but also optimizes resource allocation, ensuring that blood banks can respond swiftly to emergencies.

One of the core strengths of the proposed system is its user-friendly interface, which caters to different user roles, including donors, hospital staff, and administrators. This accessibility promotes higher engagement from donors, encouraging more frequent donations while providing healthcare providers with the tools necessary to manage their blood supply effectively. By facilitating clear communication and streamlined processes, the system fosters collaboration between blood banks and healthcare facilities.

Data security is a paramount concern in the management of sensitive health information, and the proposed system addresses this through robust security measures. Utilizing encryption and secure authentication protocols, the system safeguards donor and patient data, ensuring compliance with health regulations. This commitment to data protection builds trust among users and stakeholders, which is crucial for the success of any healthcare management system.

Furthermore, the integration of reporting and analytics features allows blood banks to gain valuable insights into donation trends and inventory usage. These analytical capabilities empower administrators to make informed decisions, plan future donation drives, and effectively manage stock levels. By leveraging data-driven strategies, blood banks can improve their operational effectiveness and better serve the community.

In conclusion, the Blood Bank Management System is a transformative solution that not only enhances the efficiency of blood management processes but also prioritizes user experience and data security. By addressing the limitations of existing systems and incorporating modern technology, the proposed system stands to significantly improve the quality of blood banking services. Its successful implementation will ultimately contribute to better healthcare outcomes by ensuring that life-saving blood is available when and where it is needed most.

CHAPTER-10
REFERENCES

10.1 Books

1) Blood Banking and Transfusion Medicine: Basic Principles and Practice

- **Authors**: Christopher D. Hillyer, et al.
- A comprehensive resource that covers the fundamentals of blood banking, including procedures and practices.

2) Transfusion Medicine: A Clinical Guide

- **Authors**: J. W. Murphy and G. S. H. F. Chan.
- This book offers insights into transfusion practices, emphasizing clinical applications and management of blood resources.

3)Fundamentals of Blood Banking

- **Authors**: David R. A. Coombs and Barbara A. T. Hill.
- A foundational text that discusses blood banking processes, ethical considerations, and operational guidelines.

4)Handbook of Blood Transfusion Medicine

- **Author**: Christopher D. Hillyer.
- A detailed reference focusing on the clinical and operational aspects of blood transfusion and management.

10.2 Research Papers

1. ***Design and Implementation of Blood Bank Management System***

Harshil Shah, Ashish N. Gohil

International Journal of Computer Applications, 2018

Description: This paper discusses the design and implementation of a web-based blood bank management system, focusing on automation of donor and blood inventory management to enhance operational efficiency.

2. ***Automated Blood Bank Management System***

S. M. H. Asadullah, S. A. Hamid

International Journal of Computer Applications, 2017

Description: The study presents an automated blood bank management system that integrates various functionalities such as donor management, inventory tracking, and reporting, aiming to streamline blood donation processes.

3. ***A Comprehensive Study on Blood Bank Management Systems***

B. K. K. Kiran, V. S. S. L. Sharma

International Journal of Advanced Research in Computer Science, 2016

Description: This research evaluates existing blood bank management systems, identifying key challenges and proposing enhancements to improve data management and operational workflows.

4. ***Blockchain Technology for Blood Donation Management***

Z. Adnan, R. A. Abas

IEEE Access, 2020

Description: This paper explores the potential of blockchain technology in enhancing the transparency and security of blood donation processes, proposing a decentralized model for better donor-recipient matching.

5. ***Development of an Electronic Blood Bank Management System***

A. R. Al-Absi, S. M. Al-Oqaili

Journal of King Saud University - Computer and Information Sciences, 2019

Description: The research details the development of an electronic system designed to improve the efficiency of blood bank operations, emphasizing user-friendly interfaces and secure data handling.