

Suggestion on Distribution of Enhanced Blood Bank Services

Vineeta Garwal¹, Neha Shekhawat¹, Ravi sharma¹, Ajay Kumar^{2,*}

¹Department of Computer science and Engineering, JECRC University, Jaipur, Rajasthan, 303905, India
Corresponding author: vineeta8440@gmail.com

Article Info

ABSTRACT

Keywords:

Blood bank
Blood storage
Blood transportation
Blood tracking and tracing
Donor recruitment
Blood testing
Blood donation camps
Patient history
Blood wastage management
Blood banking system
Blood transfusion

The Blood Bank Management System (BBMS) plays a pivotal role in ensuring the efficient and effective management of blood donation, storage, and distribution processes in India. With a vast and diverse population, India faces constant challenges in meeting the demand for safe and compatible blood units. This abstract outlines the essential features and significance of the BBMS, which serves as a crucial component in the healthcare infrastructure of the country. The BBMS in India operates as a centralized network, encompassing both government-run and private blood banks, fostering collaboration and ensuring a steady supply of blood units to hospitals and medical facilities nationwide. The system incorporates modern technologies, including cloud-based data management, mobile applications, and real-time tracking, to streamline the entire blood donation cycle. The implementation of the BBMS in India has led to significant improvements in the blood transfusion process, reducing critical shortages, and enhancing the overall healthcare system's resilience. The system's technological advancements have empowered healthcare professionals with the necessary tools to respond promptly to emergencies and manage the diverse demands for blood products in the country.

However, ongoing challenges, such as reaching remote and marginalized communities and sustaining a consistent supply of voluntary donors, remain. Thus, future research and investment in improving the BBMS are essential to further enhance its capabilities and ultimately save more lives.

Date of Submission: 02-09-2023

Date of acceptance: 14-09-2023

I. INTRODUCTION

In recent times, India has seen a tremendous improvement in collection of blood. Despite such growth, we face a shortage of nearly 1.95 million units. We aim to create an efficient database system to curb the existing gaps in the Blood banking systems and ensure minimal wastage of blood units. Blunders at the hour of organization of blood or blood parts have resulted in severe casualties. We have created a system that mitigates such disparities. Rajya Sabha was informed by the Union government of India that 63 districts did not have blood banks. Arunachal Pradesh, Assam, Manipur,

Bihar, Meghalaya and Nagaland are the states that face such issues.

Blood bank management in India is a crucial aspect of the healthcare system, as blood transfusions are often necessary in emergency situations and for individuals undergoing medical treatment. Here are some key points about blood bank management in India In this narrative review, we outline the complex process of blood transfusion and draw attention to the unique challenges to this process in the world's poorest settings. We then highlight some approaches to improve blood bank management system. A blood bank management

system is a software application that is designed to manage the various aspects of a blood bank, including blood donor registration, blood donation, blood testing, blood storage, and blood transfusion. The system is designed to improve the efficiency of blood bank operations, enhance the quality of blood products, and ensure patient safety. Here is a brief review of the literature on blood bank management systems. "Design and Implementation of a Blood Bank Management System" by Mohammed Abdul raheem and Abdul lhakim Aljohani (2018) This study presents the design and implementation of a blood bank management system that utilizes a database management system to store and manage information about donors, blood units, and transfusion requests. The system also includes a blood inventory management module that tracks the quantity and expiry dates of blood products in the blood bank. "Blood Bank Management System: A Comprehensive Review" by Shyamala Gowri, Sharmila Devi, and Shree Lakshmi (2018) This review article provides a comprehensive overview of blood bank management systems, including their features, functions, and benefits. The authors highlight the importance of such systems in ensuring the availability of safe and high-quality blood products, and they also discuss the various challenges associated with implementing and maintaining these systems. "Development of a Blood Bank Management System" by Anil Kumar Yadav, Nidhi Gupta, and Alok Kumar (2017) This study presents the development of a blood bank management system that includes modules for donor registration, blood donation, blood testing, blood storage, and blood transfusion. The system is designed to be user-friendly and customizable, and it also includes a reporting module that generates various types of reports, such as donor reports and inventory reports.

"A Study on Blood Bank Management System" by S. S. Subramanian, K. Prakash, and R. Soundararajan (2015) This study evaluates the effectiveness of a blood bank management system in a hospital setting. The authors find that the system improves the efficiency of blood bank operations, reduces errors and delays, and enhances the safety and quality of blood products. "Design and Implementation of Blood Bank Management System with Mobile Interface" by Sunil Kumar and Rakesh K umar (2014) This study presents the design and implementation of a blood bank management system that includes a mobile interface for donors and staff. The mobile interface allows donors to register, schedule appointments, and receive alerts about blood drives, while staff can use the interface to manage donor information and blood inventory.

Overall, the literature suggests that blood bank management systems are effective in improving the efficiency, safety, and quality of blood bank operations. These systems are also customizable and adaptable to the specific needs of different organizations. However, there are also challenges associated with implementing and maintaining these systems, such as staff training, data security, and system integration.

1.2. Contributions

Government Initiatives: The Indian government has played a crucial role in establishing and promoting the BBMS across the country. Various health departments, such as the National Blood Transfusion Council (NBTC), State Blood Transfusion Councils (SBTCs), and the National AIDS Control Organization (NACO), have collaborated to formulate policies, guidelines, and regulatory frameworks to ensure the efficient functioning of blood banks and the BBMS.

Blood Banks and Healthcare Institutions: Both government-run and private blood banks have actively participated in the implementation of the BBMS. They have adopted technology solutions, such as information management systems, barcoding, and quality control measures, to streamline blood donation, testing, storage, and distribution processes.

Technological Innovations: IT companies and technology experts have developed specialized software applications and platforms to facilitate donor registration, inventory management, real-time tracking, and compatibility matching. These innovations have significantly improved the overall efficiency and transparency of the BBMS.

Voluntary Blood Donors: The backbone of the BBMS is the contribution of voluntary blood donors. Numerous non-governmental organizations (NGOs) and social groups have organized blood donation camps and awareness campaigns to promote voluntary blood donation, which is vital for maintaining an adequate and safe blood supply.

Medical Professionals: Healthcare professionals, including doctors, nurses, and lab technicians, have been actively involved in the BBMS implementation. Their expertise ensures proper donor screening, blood testing, and transfusion procedures, thereby enhancing patient safety.

Research and Development: Ongoing research in blood transfusion medicine and technology has resulted in improved screening methods, better storage techniques, and advancements in blood component separation. These advancements have contributed to the overall efficacy of the BBMS in India.

Public Awareness Campaigns: Various government and non-government organizations have conducted public awareness campaigns to educate the population about the importance of blood donation, dispel myths, and address misconceptions associated with blood transfusions.

Quality Control and Accreditation Agencies: Accreditation bodies like the National Accreditation Board for Hospitals and Healthcare Providers (NABH) and the National Accreditation Board for Testing and Calibration Laboratories (NABL) have played a critical role in ensuring the quality and safety standards of blood banks and the BBMS.

Centralized Blood Donation Helplines: Many states and regions in India have established centralized helplines to coordinate blood donation requests and ensure timely supply of blood units to hospitals in emergencies.

These collective efforts and contributions have significantly improved the functioning of the BBMS in India, helping to address the constant challenges of blood shortages and enhancing the quality of healthcare services related to blood transfusion. However, ongoing efforts are required to sustain and further strengthen the BBMS to meet the evolving healthcare needs of India's diverse population.

1.3. Paper Organization

This paper organized as follows: In the first section introduction is presented and a brief contribution and previous researches are pointed out in brief. The next section is suggestion on blood bank services and its management, then goes with result, and finally conclusion is presented.

II. RESEARCH METHOD

Research on blood bank management systems in India can be conducted using various research methods, depending on the specific research objectives and available resources. Here are some potential research methods that can be applied:

Quantitative Surveys: Conducting structured surveys among blood bank administrators, staff, and donors to gather quantitative data on the efficiency, challenges, and user satisfaction with the blood bank management system. Questions could cover topics such as donor registration, inventory management, logistics, and overall system effectiveness.

Qualitative Interviews: Conducting in-depth interviews with key stakeholders, such as blood bank managers, healthcare professionals, and government officials, to gain insights into their experiences, perceptions, and suggestions for improving the blood bank management system.

Case Studies: Conducting detailed case studies of selected blood banks in different regions of India to understand the unique challenges they face and the strategies they adopt to manage their blood inventories and operations.

Observations and Process Mapping: Observing the workflow and processes within blood banks to identify bottlenecks, inefficiencies, and areas for improvement. Process mapping can help visualize the steps involved in blood donation, testing, storage, and distribution.

Data Analysis: Analyzing existing data from blood bank records and management systems to identify trends in blood donation patterns, blood utilization rates, and seasonal variations in demand.

CHALLENGES IN BLOOD BANK SYSTEM OF INDIA

There are several challenges in the blood bank system in India. Some of the main challenges include:

Shortage of Blood Supply: There is a constant shortage of blood supply in India, particularly in rural areas. The demand for blood is high, but the supply is low, resulting in a significant gap. Hundreds of millions of people experience traumatic injury, obstetric bleeding, and pediatric anemias each year and require immediate access to blood transfusion (Vos, 2016, Roth et al., 2017).^{1,2}

Shortages of blood supply can lead to delayed or canceled surgeries, as doctors may not be able to perform surgeries safely without the necessary blood products. Reduced availability of blood products: Shortages of blood supply can limit the availability of blood products, particularly for rare blood types or during times of high demand. **Reduced quality of care:** If hospitals are unable to provide necessary blood products to patients, it can result in reduced quality of care and poorer health outcomes for patients. **Increased healthcare costs:** Blood shortages can lead to increased healthcare costs, as hospitals may need to purchase blood products at higher prices from other sources or may need to delay procedures, leading to longer hospital stays and increased costs. **Increased risk of transfusion reactions:** Blood shortages can increase the risk of transfusion reactions, as hospitals may be forced to use blood products that are not a perfect match for the patient due to limited availability. [25] [Sultan S., Altayar O 2019]

Inadequate Infrastructure: Many blood banks in India lack adequate infrastructure and resources to maintain an effective blood supply. This includes inadequate equipment for blood storage, transportation, and testing.

Lack of proper storage facilities: Blood and blood products must be stored under specific

conditions to maintain their quality and safety. Inadequate infrastructure may result in insufficient refrigeration or cooling systems, which can compromise the integrity of the blood and increase the risk of spoilage. Inefficient inventory management: Inadequate infrastructure can lead to poor tracking and management of inventory, resulting in inaccurate records of blood types and quantities available. This can lead to delays in processing and distribution, as well as shortages of certain blood types. Limited processing capabilities: Blood banks must have appropriate equipment and facilities to process blood and blood products safely and efficiently. Inadequate infrastructure may result in limited processing capabilities, which can lead to delays in preparing blood products for transfusion and increase the risk of contamination. Poor transportation and distribution systems: Blood and blood products must be transported and distributed quickly and safely to ensure their quality and effectiveness. Inadequate infrastructure may result in insufficient transportation and distribution systems, which can lead to delays and increase the risk of contamination.

Lack of Voluntary Donors: The majority of blood donors in India are family members or friends of the patient. There is a lack of awareness among the public about the importance of voluntary blood donation, which is a key factor in ensuring a consistent supply of safe blood. The World Health Organization (WHO) suggests blood donors should have a minimum hemoglobin of 13 g/dL in men and 12 g/dL in women.(WHO, 2012)¹¹ Unfortunately, over 40% of all individuals in low- and middle-income countries are estimated to be anemic, with a staggering predominance in the lower socioeconomic groups.(Balarajan, 2011)¹⁶ High rates of TTIs such as HBV, HCV, and HIV in many LMICs further erode an already diminished donor pool(*Global health, 2016*).¹⁸ Distrust of the blood collection system among potential blood donors further lowers collections. While the ideal blood donor is an adult acting voluntarily and without financial motivation, as the size of the eligible donor pool narrows, blood banks in LMICs frequently depend on paid or replacement donations, or particular donor populations. Paid donors are monetarily compensated for donation, while replacement donors are typically family members or friends who donate in order to “replace” blood units to a blood bank that has provided blood to the patient. This presents unique logistical and ethical challenges, as oftentimes the patient is denied transfusion until a family member has donated blood, and family members are also often anemic and unfit for blood donation (Bates, 2007).²⁸ Paid

donation has been associated with safety risks from over-donation under expanded criteria.

Quality of Blood Testing: Blood banks are required to test donated blood for infectious diseases before it can be used. However, the quality of testing is often poor due to inadequate infrastructure and lack of trained staff.

Testing methods: Different testing methods may have varying levels of accuracy and sensitivity. Blood banks should use validated testing methods that have been shown to be effective in detecting potential infectious agents. **Equipment and reagents:** Blood testing requires specialized equipment and reagents that must be of high quality and regularly maintained. If equipment is outdated or poorly maintained, it can result in inaccurate test results. **Training and expertise:** Staff performing blood tests must be appropriately trained and have the necessary expertise to perform testing accurately and interpret results correctly. Inadequate training can result in errors and inaccurate test results. **Quality control and assurance:** Blood banks should have robust quality control and assurance programs in place to monitor testing processes and ensure that testing meets established standards. **Timeliness of testing:** Blood testing should be performed in a timely manner to minimize the risk of transmission of infectious agents. Delays in testing can result in increased risk to patients and reduced efficacy of blood products.

Inefficient Blood Collection and Distribution: The collection and distribution of blood in India are often inefficient due to poor logistics and transportation infrastructure, leading to delays and wastage of blood products.

Blood shortages: Inefficient collection and distribution can lead to shortages of blood products, particularly for rare blood types or during times of high demand. This can result in delays in transfusions or even the inability to provide necessary blood products to patients in need. **Wastage of blood products:** Inefficient distribution can result in the wastage of blood products due to expiration or spoilage. This can be a significant waste of resources and can limit the availability of blood products for patients who need them. **Inaccurate tracking and inventory management:** Inefficient collection and distribution can lead to inaccurate tracking of blood products and inventory management. This can result in delays in identifying and locating specific blood types or in overstocking of certain blood types, leading to wastage and shortages. **Increased risk of contamination:** Inefficient collection and distribution can increase the risk of contamination of blood products, which can have serious health consequences for patients.

This can occur due to inadequate testing, storage, and handling of blood products. Lack of standardization: Inefficient collection and distribution can result in a lack of standardization in blood collection and transfusion practices, which can lead to variations in the quality of care provided to patients. [26] [Cohn C.S., Pagano M.B., Allen E.S]

Cultural Barriers: Cultural and religious beliefs can also pose a challenge to the blood bank system in India. Some people may not donate or receive blood due to religious or cultural reasons, leading to a shortage of blood supply. Additionally, people who believe behavioural traits can be transferred through blood prefer to receive blood from a known person or family member.

For limited-resource settings, lack of blood products is a symptom of a greater problem requiring novel, setting-specific solutions. Cultural barriers impact supply. Lacking infrastructure allows waste and inappropriate practices, indications for blood transfusion are population-specific, questioning the use of component therapy, and patients are subject to delays in accessing and receiving care. Rural blood donors are often inaccessible due to poor transportation infrastructure, a situation worsened during rainy seasons when insect-borne illnesses leave donors febrile or anemic. Malaria becomes an indication for transfusion and contraindication for donation. Summer finds farmers in the fields, leaving behind pregnant or breastfeeding women and the elderly less able to donate. Donation campaigns through schools recruit valuable student donors that vanish when schools are no longer in session Areas with “witchcraft” and traditional beliefs resist modern medicine. [6]. Some believe blood is sold for money or used for spiritual rituals creating additional distrust.

For the creation of effective donation campaigns, cultural misconceptions must be addressed. Traditional healers must be engaged for sustainable solutions. Lack of available studies specifically examining cultural misconceptions related to blood donation and blood transfusion limits our understanding of communities hesitant to donate blood 2004 [21].

Lack of Proper Record Keeping: Accurate record keeping is crucial for ensuring the safety and quality of blood products. However, many blood banks in India do not maintain proper records of blood donors, testing results, and blood distribution, making it difficult to trace the source of any problems that may arise.

There are several reasons why blood bank systems may have a lack of proper record keeping. Some of these reasons include:

Insufficient resources: Blood bank systems may not have adequate resources, such as staff, funding, or technology, to maintain accurate and up-to-date records. This can lead to errors, omissions, or incomplete records.

Manual processes: Blood bank systems may still rely on manual processes, such as paper-based record keeping, which can be time-consuming and prone to errors. This can lead to difficulties in retrieving information when it is needed.

Lack of training: Blood bank staff may not receive adequate training on record keeping practices, which can lead to inconsistent or incorrect documentation.

Lack of Standardization: There is a lack of standardization in data formats, communication protocols, and procedures across different blood banks. This makes it difficult to develop a common platform for interoperability.

Lack of standardization in the blood bank system in India can be attributed to several factors. The following are some of the reasons why standardization is lacking in the blood bank system:

"Quality Assessment of Blood Component Preparation in Blood Bank of a Tertiary Care Hospital in Delhi" (Agarwal et al., 2018): This study found that there was significant variation in the quality of blood component preparation across different blood banks in India. The study recommended that standardization of blood component preparation practices be implemented across all blood banks in the country.

"Standardization of blood transfusion practices in a tertiary care hospital in India" (Anand et al., 2013): This study examined the challenges associated with implementing standardized blood transfusion practices in a tertiary care hospital in India. The study found that a lack of awareness of the importance of standardization among healthcare workers, inadequate training, and limited resources were significant barriers to implementing standardized practices.

"Quality Control Practices in Blood Transfusion Services in India: A Systematic Review" (Marwaha et al., 2014): This study reviewed the existing literature on quality control practices in blood transfusion services in India. The study found that there was significant variation in the quality control practices across different blood banks in the country, and recommended that the government take steps to standardize these practices.

Overall, addressing these issues will require a concerted effort from the government,

healthcare professionals, and blood bank staff to improve the regulatory framework, increase resources, raise awareness of the importance of standardization, and promote better communication among different blood banks and healthcare facilities.[27] [Gomez AT, Quinn JG, Doiron DJ,2015]

Limited Adoption: Although many blood banks have implemented online systems, the adoption of interoperable systems is still limited. Some blood banks still rely on manual processes or use proprietary software, which cannot be easily integrated with other systems. The e-Rakt Kosh is a government initiative for centralized blood bank management system launched in April 2016 with objectives directed toward better blood bank functionality. The seven key barriers to effective online participation under e-Rakt Kosh portal were found that directly or indirectly affected the performance and adherence. Main problems arose from lack of appropriate staff for the work. Single time training of a single staff was another problem. Besides it regular training in the initial year of the implementation was found missing. On the program front, lack of option for simultaneous collaborative online work was limiting factor. Backlog from inadequate entries due to manpower deficit was later recognized as important barrier in the long run. Lack of any knowledge about toll free troubleshooting number is also problematic.

Privacy and Security Concerns: The sensitive nature of blood donor information and medical records requires that online systems maintain strict privacy and security protocols. There is a need for robust data protection measures to prevent unauthorized access, data breaches, and cyber attacks.

Infrastructure and Connectivity: There is no alternative to human blood, reliable, safe and uncontaminated blood is still inaccessible to many. Limited resources and lack of access to efficient blood storage and management measures are the major challenges that threaten blood safety. To bridge these challenges, innovative and specialized equipment to safely store and transport blood products at its intended temperature, is the need of the hour. Online blood bank management requires robust IT infrastructure and reliable connectivity, which may not be available in all areas of India. Limited internet connectivity and power outages can affect the performance of online systems, making them less reliable.

Cost and Resource Constraints: Blood banks may face budgetary constraints, limiting their ability to invest in interoperable online systems. Additionally, the lack of skilled personnel to

manage and maintain online systems can be a significant barrier to adoption.

Lack of Automation while collecting and testing Blood: The manual handling of blood samples increases the likelihood of human error, which can lead to inaccurate or unreliable test results. Automation can reduce the potential for human error by standardizing and automating the collection and testing process. **Time-consuming and inefficient processes:** Manual blood collection and testing can be time-consuming and labor-intensive, leading to inefficiencies in the process. Automated processes can help reduce the time required to collect and test blood samples, improving efficiency and allowing blood banks to process more samples in less time. **Inconsistent test results:** Manual testing methods can result in inconsistent test results due to differences in the techniques used by different technicians. Automation can help standardize the testing process, ensuring consistent and reliable results. **Increased risk of contamination:** Manual blood collection and testing can increase the risk of contamination, which can result in the transmission of infectious diseases. Automated processes can reduce the potential for contamination by reducing human contact with the blood samples.

Lack of Communication among Blood Banks: At the blood collection stage, the absence of coordination between blood banking organizations can lead to aggressive competition for the same pool of donors—multiple organizations attempting to collect from the same local college, for example—instead of a systematic effort to expand the donor pool. In the testing and delivery phases, absence of harmonization promotes inconsistent refrigeration and challenges with blood storage, difficulties in processing and transportation to and from remote blood centers, data entry errors, and high rates of expiration and wastage (Moore,2001, Butler, 2015, Javadzadeh, 2017).³⁹⁻⁴¹ In addition to poor adherence to guidelines driving inappropriate transfusion, clinician tactics to circumvent chronic shortages such as ordering blood in greater quantities than necessary for fear of it running out, also contributes to wastage (Sood, 2019).⁴³

Wastage of Blood: Blood banks have a major responsibility to ensure a regular supply of blood, but donor dearth and concomitant wastage are major issues in blood availability. According to WHO data, the blood wastage is accredited to poor inventory management, deprived manufacturing practices, inadequate storage, and shipment. Dropping the rate of blood wastage through proper stock management and optimal blood utilization practice may overcome the impact of low blood donations. Millions of lives are saved every year in

regular and urgent situations for medical and surgical indications by the accessibility of safe blood transfusion services (Lakum,2016) [1]. Wastage of all blood components, including RBCs, platelets (PLT), and plasma, is an important issue for hospitals worldwide. The College of American Pathologists (CAP) recommends monitoring the wastage of unexpired blood as it represents a financial loss to the health care system, and more importantly, systemic wastage of blood may reflect a care environment that is out of control, and unsafe for the patient (Bobde, 2015) [6]. A study from Western India reported 0.05% of blood units being discarded due to non utilisation after issue (Kanani, 2017) [3]. An insufficient or unsafe blood supply for transfusion has a negative impact on the effectiveness of key health services. Despite maintaining the sufficient stock at blood bank, careful management of inventories to minimise wastage is crucial. In a study done by Roberts N et al., estimated that India is in need of 52.5 million units of blood components with deficiency of 40.9 million (Roberts, 2019) [10].

In a study done by Tahmasebi A et al., most of the blood components (55%) were wasted by the Department of Surgery followed by the Department of Orthopaedics and EMD (Tahmasebi, 2020) [5]. In another study done by Javadzadeh SH et al., maximum blood and blood components were wasted by burns (40%), cardiology (30%) and surgery (29%) wards (Javadzadeh Shahshahani, 2016) [9]. Blood inventory management is both demanding and critical; to ensure enough timely availability of each product at the same time to diminish its wastage. In our blood bank, we maintained our inventory depending upon our outcome/ demand. Taking into account our main limitation is lacking online blood bank software. The online blood bank management software systems are specially designed for the process, storage, analysis, and retrieval of information related to blood inventory and administration. The main reason for the discard of blood units in our study was seropositivity for transfusion-transmitted infections. When compared this finding with the studies from India and Nigeria outcome was similar (Morish, Mohammed, et al, 2012 and Atinuke, 2015) [11,17]. This higher prevalence in donors is alarming and is likely to adversely affect the donation pool in long term. Stringent donor

selection and deferral criteria, promoting voluntary donation and cautious donor screening are suggested to ensure maximum blood safety.

To deal with the necessity and supply of blood and blood components, more strict measures should be accessible and pursued for the right utilization of this insufficient reserve (Sharma, 2004) [2]. Along with this, a protocol for minimizing the discard of blood should be formed to save energy and human and financial resources in the developing countries. Excessive and inappropriate use of blood products poses a burden on transfusion services. Similarly, with a proper coordination between clinicians and blood bank staff, wastage owing to expiry of blood can be minimized (Far RM, 2014) [3].

Unavailability of safe transportation services: After successful collection and testing of blood, administration of blood to the recipient depends on adequate human resources powered by appropriate infrastructure and organized logistics. National and regional governmental policies can promote organization by coordinating testing strategies and adherence, centralizing resources, and developing mechanisms for donor tracking, engagement, and infection follow-up. Blood bags could be leaked and ruptured during transportation or processing owing to mishandling of blood bags during collection or manufacturing errors (Stainsby, 1998, Mahapatra, 2017 and Mukherjee, 2018) [18-20]. It is noted that the quality of the blood bags is an extremely important factor that contributes to preventing leakage (Cobain, 2012) [12].

Online blood bank management interoperability in India faces several challenges, including:

Addressing these challenges will require a collaborative effort between blood banks, government agencies, and IT service providers to develop common standards, enhance infrastructure, and provide adequate training and resources to support interoperable online blood bank management in India.

After collecting all the data from the projects I personally created a survey to analyze whether the blood bank management system is there in hospitals or not. So here the survey report which I have collected from blood bank centers.

Timestamp	Email Address	Blood bank name	Contact number	Blood bank address	City	Email Id	Are you currently using any software to manage your blood bank operations and inventory?	Untitled Question	Are you satisfied with the efficiency and accuracy of your current Blood bank management system?	Does your software system currently support and manage the inventory and distribution of blood products in your Blood bank?	Does your software ensure compliance with regulatory requirement and standards for blood bank operations?	Do you prefer blood bank solutions with ABDM compliant?	Would like to have an electronic system for managing your blood bank operations and inventory?	What features or capabilities would you like to see in a blood bank software solution?	Would you like to schedule a demo or consultation to learn more about our blood bank software solution?	Do you need blood logistics support to transport the blood to hospitals and remote locations?
5/12/2023 15:13:20	dmehta2@rediffmail.com	EHC Blood Centre	759544588	EHC Hospital, 34 Jagatpura road, near jawahar	Jajpur	dmehta2@rediffmail.com	Yes		Yes	Yes	Yes	No	No	Bio waste manager	No	No
5/14/2023 12:34:17	modisharma808@gmail.com	Ajij blood centre	6375136024	51 besment shilpa path mansarovar	Jajpur	Ajijbloodcentre@gmail.com	Yes	Option 1	Yes	Yes	Yes	Yes	Yes	Blood Donation	Yes	No
5/15/2023 13:00:36	angesh1994@gmail.com	Tuls Blood Centre	7230012902	78 A raghuath puri sec 3 Pratap Nagar Tonk road	Jajpur	Tulsbloodcentre@gmail.com	Yes	Option 1	Yes	Yes	Yes	No	Yes	Registration	No	No
5/15/2023 15:01:01	Zprashantchoudhary@gmail.com	RDP Blood bank	6376917074	RDP mlap nager tonk road	Jajpur	Zprashantchoudhary@gmail.c	Yes		Yes	Yes	Yes	Yes	Yes	Blood Donation	Yes	Yes
5/15/2023 15:19:46	anandsvesthya1@gmail.com	Swasthya Kayen Blood Bank	9982211000	125, Milap Nagar Tonk Road	Jajpur	anandsvesthya1@gmail.com	Yes		Yes	Yes	Yes	No	No	Blood Donation	No	No
6/8/2023 17:13:13	isamta123@gmail.com	Mis taraa blood centre	8652016063	NH 52 radhaswami bagh chomu	Jajpur	Ksamta123@gmail.com	Yes		Maybe	Yes	Yes	Maybe	No	Blood Logset	No	Yes
6/8/2023 19:45:22	revitidewal10@gmail.com	Gurukul blood bank	6276268407	Bani park	Jajpur	Gurukulbloodbank@gmail.com	Yes		Yes	Yes	Yes	Maybe	No	No need	No	Yes
6/8/2023 20:02:42	gareadsanj4@gmail.com	Jan Kayen blood bank	9785132222	Guronanek pura raje park	Jajpur	Jkbloodcentre@gmail.com	No	Option 1	Yes	No	No	No	No	Blood Donation	No	No
6/9/2023 12:56:26	vineeta444@gmail.com	S.K. Soni Hospital	9678989874	Rmabagh	Jajpur	sksonihospital56@gmail.com	No		No	Yes	No	No	No	Blood Donation	Maybe	No
6/10/2023 19:20:45	phulerabloodcentre@gmail.com	Phulera blood centre	7230012904	Plot no 05, first floor, new colony, near nagar palli	Jajpur	phulerabloodcentre@gmail.co	Yes		Yes	Yes	Yes	Maybe	Yes	Bio waste manager	Maybe	No
6/10/2023 19:37:52	vikasraba@gmail.com	Shanti blood bank	8895168016	Sirsi road bindayeka	Jajpur	Shantibloodbank@gmail.com	No		Yes	Yes	Yes	Yes	Yes	Blood Donation	Yes	Yes
6/11/2023 7:46:36	sharmagajan311@gmail.com	Narayana Blood Centre	8065650762	Kumbha marg sec. 28 priyapa nager	Jajpur	Sharmagajan311@gmail.co	Yes		Yes	Yes	Yes	Yes	Yes	Blood Donation	No	Yes
6/11/2023 11:44:02	pankajhotagarwal6369@gmail.com	Swastik blood centre	9829032521	B.23 delight tower govind marg	Jajpur	swastik4bloodcentre@gmail.c	No		Yes	Yes	Yes	No	Yes	Blood Donation	Yes	Yes
6/11/2023 12:00:10	sanjaypanchoi4@gmail.com	Pushpa devi memorial blood centre	8849230772	52,53 Ashok vihar ambabari jotwara road	Jajpur	sanjaypanchoi4@gmail.com	No		Yes	No	No	No	No	Blood Donation	No	Yes
6/11/2023 12:04:11	sanjaypanchoi54@gmail.com	Pushpa devi memorial blood centre	8849230772	52,53 Ashok vihar ambabari jotwara road	Jajpur	sanjaypanchoi54@gmail.com	No		Yes	No	No	No	No	Blood Donation	Yes	Yes
6/11/2023 13:43:51	phul4738@gmail.com	Agrasen blood center	9982211000	Vidhya dhar nager	Jajpur	anandsvesthya1@gmail.com	Yes		Yes	Yes	Yes	Maybe	Yes	Blood Logset	No	Yes
6/11/2023 13:52:35	krishnagarwal29@gmail.com	Bansal blood center	962002949	Basement 252 Sinhu nager Maripura	Jajpur	bansalbloodcenter@gmail.com	Yes		No	No	No	No	No	Dashboard	No	No
6/11/2023 14:02:13	disha.sunary22@gmail.com	Chirayu Blood center	6377652576	Hathoi Kalwar road	Jajpur	chirayuhospitalbloodcenter@	No		Yes	No	No	No	No	Blood Donation	No	No
6/15/2023 18:41:02	navetkim6@gmail.com	B.D. Memorial Blood centre	9887316880	Neelkanth colony ajmer road	Jajpur	bdmemorialbloodbank@gmail	Yes		No	No	No	No	No	Blood Logset	No	No
6/15/2023 18:51:05	love.kumar2229@gmail.com	Dusad Blood centre	9620630067	Krishna Vihar colony Chomu road	Jajpur	dusadbloodbank@gmail.com	Yes		No	No	No	No	No	Blood Logset	No	No
6/20/2023 12:43:59	vineeta444@gmail.com	Dr Rampal Blood center	9782462408	Heerapura Chitraloot	Jajpur	bloodbankdrampal@gmail.co	No		No	No	No	No	No	Blood Logset	No	No
6/20/2023 12:47:59	vineeta444@gmail.com	Govt Bdm Sai Hosp topulli	9116534500	Milap nager	Jajpur	bloodbankgovtsai@gmail.com	No		No	No	No	No	No	Dashboard	No	No
6/20/2023 12:50:10	vineeta444@gmail.com	Hantakish Kantawale Hospital	8619103876	Shashin nager	Jajpur	bloodbankkantarwale@gmail.c	No		No	No	No	No	No	Dashboard	Yes	Yes
6/20/2023 12:52:20	vineeta444@gmail.com	Mamta Blood centre	9620913910	Chomu road	Jajpur	mamtabloodbank@gmail.com	Yes		Yes	Yes	Yes	No	No	Dashboard	No	No
6/20/2023 12:54:54	vineeta444@gmail.com	Pratishtha Blood Center	8387930007	Jangpath road Lakothi	Jajpur	pratishthabloodcenter@gmail	No		No	No	No	No	No	Dashboard	No	No
6/20/2023 12:58:19	vineeta444@gmail.com	Shubham blood center	9672169667	Old chungi Anra road	Jajpur	shubhambloodbank2010@gmail	No		No	No	No	Maybe	Maybe	Inventory managem	Maybe	No

About the project

There are mainly 3 modules in this project.

Admin

Donors

Patients

Admin:

Admin is the main role in the system, admin can manage all the activities like managing donor, patients and blood stock etc.

Admin can perform –

Check the available stock of the blood

Manage donors

Manage patients

Manage blood donations

Manage blood requests

Logout

Admin can manage donations like he can accept or reject the donations request based on the donor details. He can accept or reject blood requests based on the blood stock available. Admin can manage all the donor and patient. He can edit the details of donors or patients. He can delete any donor or patients.

Donor:

Donor is also an important role in the system. If any person or donor want to donate the blood, he or she has to register himself first. Once he or she

register he/she can login to the system where he can manage or execute donor's activities like –

Donate blood

Manage donation history

Check the status of donation requests

Logout

Once donor make a request to donate blood, admin has to take action on that request based on the donor details. Once admin accept or reject that donation request, it will be automatically update to the donor dashboard. Donor can check the status of his request. Once his donation request is accepted, he or she will be called to donate blood at the specified donation camp.

Patient:

Patient is the one who is suffering from any disease and he need blood. He can go to the system and register himself as a patient. Once he registers, he/she can login to the system and access patient dashboard.

Patient can perform some activities like –

Make blood request

Check the status of his request

Logout

Once the patient makes a request for blood, he has to provide the basic details like the no of blood units required, blood group, disease etc.

Once he makes a request, it will be reflected in the admin dashboard. Now admin has to take action on that request. Admin can accept or reject that

request based on the patient details or blood stock available in the system.
 Languages used
 HTML
 CSS

JavaScript
 jQuery
 PHP
 MySQL

Schema used

Admins

id(int)	name(varchar)	email(varchar)	password(varchar)	mobile(bigint)
---------	---------------	----------------	-------------------	----------------

Donors

id(int)	name(varchar)	email(varchar)	password(varchar)	mobile(bigint)
---------	---------------	----------------	-------------------	----------------

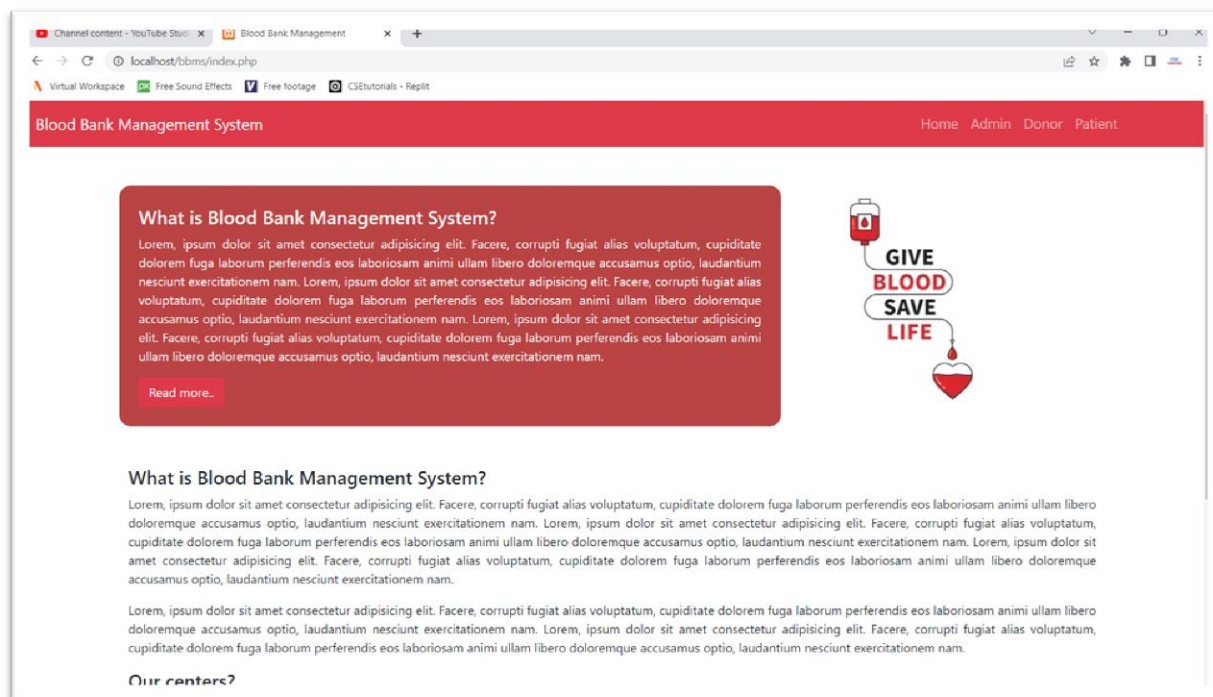
Patients

id(int)	name(varchar)	email(varchar)	password(varchar)	mobile(bigint)
---------	---------------	----------------	-------------------	----------------

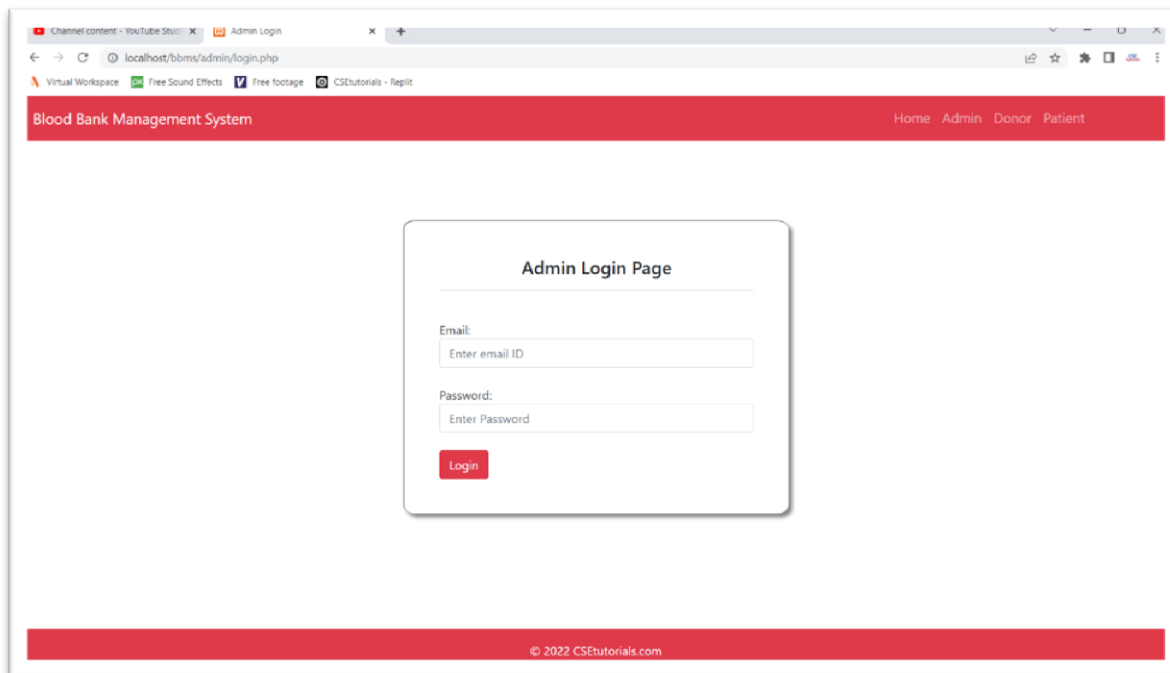
OUTPUT:

Screenshots

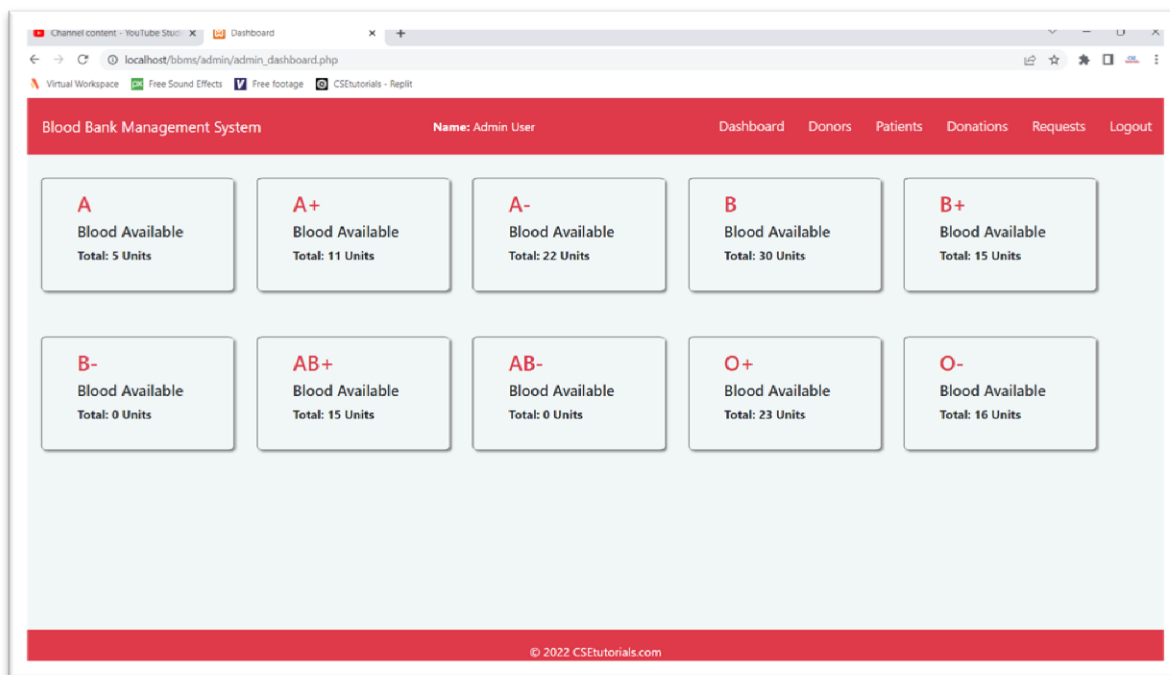
Home Page



Admin Login Page



Admin Dashboard Page



III. CONCLUSION

There have been several studies conducted on blood wastage in India, particularly in the context of blood donation and transfusion practices. Here are some key findings from the literature:

Inadequate screening of blood donors: A study conducted by Shukla et al. (2016) found that inadequate screening of blood donors was a major

cause of blood wastage in India. The study reported that around 20% of the blood units collected were discarded due to the presence of transfusion-transmissible infections.

Lack of inventory management: Another major factor contributing to blood wastage is the lack of inventory management. A study conducted by Sharma et al. (2017) reported that around 15% of

the blood units were wasted due to poor inventory management practices, such as overstocking or underutilization of blood components.

Inefficient blood collection practices: A study conducted by Singh et al. (2018) reported that inefficient blood collection practices, such as improper handling and storage, also contributed to blood wastage in India. The study reported that around 10% of the blood units were wasted due to such practices.

Lack of awareness among blood donors: Several studies have reported that a lack of awareness among blood donors regarding the importance of blood donation and transfusion practices also contributes to blood wastage in India. A study conducted by Dhiman et al. (2019) reported that around 5% of the blood units were wasted due to the presence of inadequate donors or donors who did not follow the required eligibility criteria.

Overall, the literature suggests that blood wastage in India is a complex issue that requires a multifaceted approach, including improved donor screening, better inventory management practices, efficient blood collection and storage practices, and increased awareness among blood donors.

To avoid wastage of blood components continued training of staff, involved in counseling of donor, phlebotomy and TTI testing is needed. Inventory control in blood bank regarding the stock position and requirement of different blood group is necessary. Avoid bleeding of negative blood group donor and rare blood group donor, help in prevention

of wastage due to outdated. Regular audit of transfusion of blood component by transfusion committee helps in reduction of blood wastage and also promotes its rational use. The most component wasted was platelet concentrate due to its short expiry life followed by TTI (transfusion transmitted infection) reactivity after 1st run of ELISA.

□ To avoid wastage of blood components continued training of staff, involved in counseling of donor, phlebotomy and TTI testing along with inventory control regarding the stock position and requirement of different blood group is necessary.

□ Regular audit of transfusion of blood component by transfusion committee helps in reduction of blood wastage and also promotes its rational use.

Blood transfusion is an essential part of patient care. Most of the common causes of blood wastage like minimal blood loss during surgery were mostly preventable. Implementation of proper blood transfusion policies in coordination with clinicians and staff nurse at ward side and operation theatres will help to minimise the preventable wastages at department side. Continuous educational programs

to improve the performance of staff will help to reduce the wastage rate and solve the shortage of these elements. Blood being an irreplaceable and important resource, needs to be properly utilized and ideally zero percent wastage should be encouraged. Common causes for discard of blood and blood components were non utilization due to Date expiry, Seropositivity for TTI and other causes like leakage, hemolysis, etc. Training programmers for doctors on usage of blood / blood components is highly recommended. Proper maintenance of records, a proper donor selection and deferral guidelines will help in better utilization of the blood bags.

TTI (Transfusion Transmitted Infections) and expired blood remain major causes of blood wastage in our hands. We recommend reviewing policies for blood management and the reduction of blood wastes. This would require technical supervision of blood product making, incorporating blood bank management software for inventory, and regular blood wastage audits for effective reduction of product wastage.

Blood being an irreplaceable resource needs to be proper utilized and to minimize wastage of blood there should be proper implementation of blood transfusion policies and coordination between hospital and blood bank staff. Suggested strategies that would maintain discard of blood as low as possible are as follows:

1. To maintain blood group-wise records of voluntary donors so that they can be contacted as and when required
2. Proper scheduling of blood donation camps should be coordinated as per the stock available in blood bank
3. Use of advance software in blood bank and hospital ward for proper coordination between clinicians and blood bank staff
4. Strict adherence to donor selection criteria, proper predonation history taking, and counseling and software to identify TTI positive donors and suspected professional donors who have been screened previously
5. There is also a need to encourage, inspire, and motivate voluntary donors to donate blood at regular intervals and become non remunerated donors. This will reduce the risk of TTI positivity
6. Increased use of apheresis technique to prevent wastage of components such as platelets whose demand cannot be predicted, should be prepared on demand and urgency
7. Proper handling of blood units and stringent storage condition to prevent hemolysis, clotting, and bacterial contamination. Education and training to technical staff for 350/450 volume collection with

the use of calibrated blood collection monitor even in camps

8. Technical expertise in phlebotomy, component preparation to prevent suboptimal volume collection of WB, RBC contamination, and precaution during storage and thawing of FFP to prevent rupture/leakage such as the use of polystyrene protective containers

9. Proper implementation of policy, preparation of aliquots as per demand, and maintaining stock inventory on regular basis

10. Continued medical education for technical staff to maintain self-audit, follow quality indicators of processing and preparation of blood components, and to monitor the rational use of blood and its components can review the blood management system.

This proposed Blood Bank Management System gives a reliable platform for both donors and acceptors. The BMMS is a web-based application that helps to minimize human errors and problems pertaining to data redundancy. It is a fast-paced and efficient way to communicate without any security threats as the data entered will be verified and frequently updated thereby increasing the probability of saving one's life. Moreover, the availability of a location-based system where the nearest blood bank can be located through Google maps makes it more accessible.

REFERENCES

- [1]. G. Muddu Krishna; S. Nagaraju(2016), "Design and implementation of short message service (SMS) based blood bank", 2016 International Conference on Inventive Computation Technologies (ICICT)
- [2]. Muhammad Arif; S. Sreevas; K. Nafseer; R. Rahul (2012) "Automated online Blood bank database", 2012 Annual IEEE India Conference (INDICON)
- [3]. "Benefit of Management Information System in Blood Bank" by 1, Vikas Kulshreshtha, 2, Dr. Sharad Maheshwari 1, Research Scholar, 2, Associate Professor 2 1, Singhania University, Jhunjhunu, Rajasthan, India 2, Government Engineering College Jhalawar, Rajasthan, India
- [4]. The Optimization of Blood Donor Information and Management System by Technopedia P. Priya¹, V. Saranya², S. Shabana³, Kavitha Subramani⁴ Department of Computer Science and Engineering, Panimalar Engineering College, Chennai, India.
- [5]. "Design and Implementation of Blood Bank Management System" by T.S. Balaji and M. Gokulraj: This research paper describes the design and implementation of a web-based blood bank management.
- [6]. "Blood Bank Management System: A Comprehensive Review" by Neeraj Kumar and Shubham Jain: This review paper provides an overview of various blood bank management systems and their features.
- [7]. "Web-based Blood Bank Management System" by M. Kamruzzaman, S. Akter and S. Sultana: This research paper presents a web-based blood bank management system that can be accessed from anywhere with an internet connection.
- [8]. "Design and Development of a Web-Based Blood Bank Management System" by S. Akter and S. Sultana: This paper describes the design and development of a web-based blood bank management system using PHP and MySQL.
- [9]. "A Web-Based Blood Bank Management System" by G. Kavitha, V. Kavitha and M. Devi: This research paper presents a web-based blood bank management system that allows users to search for blood donors and request blood online.
- [10]. Vikas Kulshreshtha, Dr. Sharad Maheshwari, "Blood Bank Management Information System in India," in International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622.
- [11]. A. Clemen Teena, K. Sankar, and S. Kannan, "A Study on Blood Bank Management," in Middle-East Journal of Scientific Research 19 (8): 1123-1126, 2014, ISSN 1990-9233
- [12]. Ravi Kumar, Shubham Singh, V Anu Ragavi, "Blood Bank Management System," IJARIE-ISSN(O)- 2395-4396, Vol-3 Issue-5 2017.
- [13]. Sibinga CT. Existing and recommended legislative framework for a national blood transfusion policy. Global Journal of Transfusion Medicine. 2017 Jul 1;2(2):89.
- [14]. Sinha S, Seth T, Colah RB, Bittles AH. Haemoglobinopathies in India: estimates of

- blood requirements and treatment costs for the decade 2017–2026. *Journal of community genetics*. 2020 Jan;11(1):39-45.
- [15]. Kulshreshtha V, Maheshwari DS. The blood donation centre Management Information System in India. *international Journal of Engineering Research & Android applications (IJERA) SSN.:2248-9622*.
- [16]. Priya P, Saranya V, Shabana S, Subramani K. The optimization of blood donor information and management system by Technopedia. *International Journal of Innovative Research in Science, Engineering and Technology*. 2014 Feb;3(1).
- [17]. Kulshreshtha V, Maheshwari S. Benefits of management information system in blood bank. *International Journal of Engineering and Science*. 2012 Dec;1(12):5-7