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The Management System for the Healthcare Resources: A review

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ABSTRACT
Recently, healthcare resources and services can be effectively provided to patients anytime and anywhere using healthcare management systems. Healthcare systems are developed through many mechanisms and applications that improve the management of healthcare-related resources by aggregating data with mechanisms such as the Internet of Things (IoT) that include sensors and mobile phones, as well as using unified databases for such resources so that they are arranged and managed in light of what is available and what is required and determine the required delivery to the requesting party as soon as possible. Healthcare and services are indicating many things related to health such as kidney donors, surgeries, advice from doctors, etc. Here in our study, we will use the blood banks as the sample of the services that the management system can provide. Today, the application of modern technologies such as cloud programming and real-time algorithms has helped solve many problems associated with traditional systems.
Real-time algorithms are concerned with producing logically accurate results and answers in a timely manner without human intervention. Telehealth is an important purpose of the healthcare system where device interoperability and data normalization are challenging task that requires research attention. Several solutions have been proposed in the literature based on manual interpretation through explicit programming. However, programmatic implementation of the interpretation of data sender and receiver in a healthcare system for data transmission is counterproductive as modification is required for each new device added to the system. In this paper, some research works on managing the healthcare system and facilitating their work using modern technology have been studied and analyzed.

KEYWORDS: Smart blood management, Blood units' management, COVID-19 vaccine centers Allocating, Real-Time Systems, Blood Units Allocating..

1. Introduction

Blood seems to be the only source of life for every species that exists on our planet, and it is provided only by the generosity of those who give blood on a limited basis. Donors are used to treating trauma victims - such as those injured in accidents or burned - as well as for heart surgery, organ transplantation, mothers who have experienced complications during childbirth, newborns and premature babies, and patients undergoing treatment for leukemia, cancer, or thalassemia, among other things. Maintaining the blood supply chain is critical, and the blood bank plays an important part in this. Their main role is to give blood to hospitals in order to fulfil the increasing demand for blood from patients. As a result of the numerous paperwork involved in the blood banking system, it is hard for blood banks to keep good accuracy and stability. As a result, the need for automating the blood storage and management system arises in order to smoothly deal with an actual emergency if the blood stores are depleted or hard to find[1]. Blood accessibility is critical in any emergency circumstance. To enhance the functionality of the present structure, which is usually stored, collect, and analyze data administrative and inventory management within a blood bank, we intend to automate the blood management system within the blood bank, which will be advantageous in the interest of safety. Additionally, an automated blood control system aims to improve communication between needed patients and nearby blood banks, ensuring a hassle-free experience for patients. The internet of things is a component of this emerging and burgeoning notion[2]. It discusses how devices are linked and communicate with someone without human help. The characteristics of the Internet of things (IoT) are critical for establishing the route; they enable better and quicker planning; they enable people; they address safety; a new generation of sensors will be introduced, and cloud computing and big data will play a significant role. Additionally, this article plays a critical function in the IoT which requires devices to communicate with one another. In health care systems, resource management must be precise and right, as resources are frequently rare and have a limited lifespan while distributing these resources on time has a major and direct impact on human life. Traditional health care systems frequently rely on traditional supply chain algorithms and theories, which allocate resources based on the recipient's priority, the demand's deadline, and the resource's secure storage[3]. Blood and its products, such as COVID-19 convalescent plasma (CCP), are an example of these resources, and their management is the responsibility of blood unit management systems (blood banks Blood units and blood products are among the most valuable resources in the healthcare system under normal circumstances, and controlling blood units is among the most significant and tough tasks in medical systems.[4]. The research indicates that broad usage of intelligent technologies and other newest technologies can alleviate physician stress, lower health care expenses, and expedite patient treatment and quick access to patient medical information. By giving information more easily, this usage of smart gadgets will not eliminate the need for health care personnel, but rather assist them in providing enhanced health care. Additionally, researchers are examining the impact of the growing usage of technology sensors smart gadgets and contemporary medical equipment, with the effects of cloud computing and internet of things (IoT) technologies. While this helps programmers to leverage these novel methodologies in order to create true illness management and early detection application. The scientists' goal is to identify opportunities for convergence in the healthcare field via the use of intelligent devices, which have been provided by newer technological developments in medical equipment and the use of cloud-based approaches[5]. The remainder of the article is as below. Section 2 scientific and social contribution; Section 3 is healthcare system Model; Section 4 is related works; and finally, Section 5 is conclusion and discussion.

2. Scientific and Social Contribution

Blood resource management is one of the most challenging responsibilities in healthcare. Each regional blood bank is responsible for the management of blood units within a zone defined by one or more hospitals and donation facilities, as illustrated in Figure 1. The Main Blood Bank monitors these local banks' storage levels on a regular basis and supplies safe reserves.[6][7].

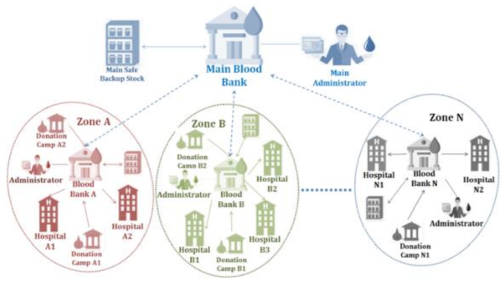

Fig.1. Blood Management System in Traditional healthcare systems

The old technique of blood unit management is highly reliant on human intervention. To assist in the management of blood units, new electronic systems have been developed. They facilitate access to donor databases, blood units that are available for allocation, allocation requests, and beneficiaries. Additionally, some of these technologies make it easier for those who need donating units to connect with donors[8].

At the moment, blood banks are run manually, with designated medical workers handling the blood bags. Given the issue at hand, which can be roughly defined as a lack of knowledge and a scarcity of blood administration, which includes internet and telecommunications connection across multiple blood banks, the Intelligent Blood Management System is an effective platform for tackling this issue. To allow communication across different blood banks, this system makes use of a single database that enables global monitoring of different aspects such as blood unit movement and volunteer blood donor information. It performs real-time assessments and sends immediate alerts to the blood bank regarding the availability of blood units.[9]. Machine learning algorithms assist in making an informed decision regarding the blood unit requirement for a certain area. Prior to the occurrence of an emergency, blood units might be circulated from one blood bank to another that may require more than the others. Additionally, the platform makes a concerted effort to raise awareness by displaying various information pop-ups and insights about the importance of voluntary blood donation. Additionally, blood banks can request requested units online from other blood banks that are capable of donating. This decision is also automated. There is contact between blood banks, but there is also communication between hospitals that may require blood for important surgeries. This is mostly for hospitals without their own blood bank. Additionally, the platform connects standard users to the IBMS's advanced features. If the user wishes to donate blood, he or she will be directed as to where to go and who to contact.[10].

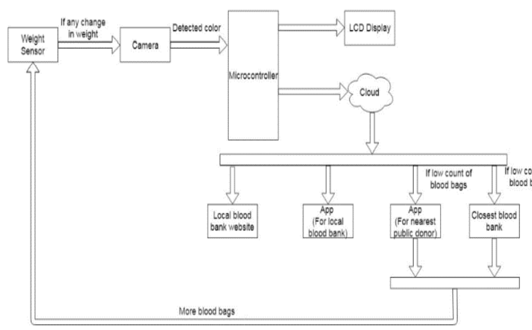

Fig. 2. Blood Management System Block Diagram[5]

3. Healthcare System Model

The healthcare system's architecture is divided into three distinct models, as seen in Figure 3.

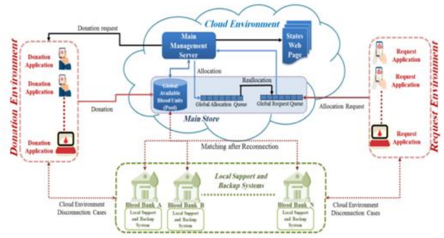

Fig. 3.Healthcare system models[11]

3.1 Cloud Environments

This component contains both the central administration server and the central data store. The system's heart and most crucial component is the primary administration server, and it is what distinguishes the system from prior systems. It features real-time methods for assigning, managing, and distributing blood units based on the priority of incoming requests and the availability of resources locally or throughout the system. The server is solely responsible for user authentication. The primary data store enables the system's other models to quickly and concurrently access and changes the database. Additionally, the cloud environment includes authentication activities that restrict access to the system to registered users. Additionally, the cloud environment will house the status web page, which will provide general information to the public and affected users about the level of storage and blood unit requirements[12]. Additionally, it is the most compatible and closest solution to currently-used systems and apps, with the most popular choice among users.

3.2 Smart Devices Application

By using these elements, the user will be able to access the database in a rapid and simple manner. In our system, we have two types of applications: the donation environment, which acts as an interface for blood donation centers, allowing them to input donor information, donation location information, and the kind of blood units provided into the system; and the second type of application, which provides the donor environment. Also included is the ability to receive messages from the server, which provide information on the blood units that will be necessary to satisfy the demands of those who are served. It is the second program that offers the requests environment, which enables authorized health workers to generate requests for blood units using an interface that allows them to input the needed blood unit information, the patient's condition, with the location of the case in question. Following the allocation of a blood unit, the applicant gets an allocation notification from the server via the same application through which the application was submitted[6].

3.3 Support and backup systems

Due to the sensitivity of the healthcare system and its direct impact on the lives of patients, each local blood bank will have its own data storage and management server. The local data store will act as a secure backup for the data in the primary data store. The local server will provide a user interface via which the accountable employee may monitor and record unit-related actions such as contributions, allocation requests, and delivery requests. Along with the ability to manage registered users' information and authentication, the system shows the assigned reports for the specified local area. Under abnormal situations, such as when the cloud environment is disconnected or an emergency arises, the local management services will provide the same capabilities as the main server within the local region. All knowledge about local operations is kept in the local data store until connectivity to cloud environments is restored, at which point all information about local operations is imported into the central data store. This component may be implemented in a number of ways depending on the system architecture, for example, by using a personal computer as a local management server in combination with a local data storage device integrated into the same device. Due to the fact that the local backup and storage system will be unable to provide services for smart device applications in this scenario, all modification and contribution requests will be handled manually[11].

4. RELATED WORK

In this section, we will focus on approaches proposed in the literature that has focused on healthcare resources and services. Where, it focused in its entirety on the use of modern technologies, to improve the methods currently used in terms of raising the level of performance and reducing costs, and facilitating communication, access, and use.

Lalmohan Dutta, Giridhar Maji, Partha Ghosh and Soumya Sen[13], developed an integrated framework for managing the blood management process from start to finish, identifying essential modules, use cases, and comprehensive user process flows. A special emphasis has been placed on administering the local blood donation campaign, with events scheduled according to the donor's preferred time, location, and date. The data produced by this technology can be saved in a data warehouse for analysis and then used to plan future camps based on the study of prior data.

Prinolan G. & Absalom E. E. [14], used a novel approach to establish a unique percentage bound for each month. The boundaries are based on information from South African social behavior, with the goal of simulating the monthly demand and supply of blood units in real life. Additionally, this work employs a hybrid metaheuristic algorithm that combines a search algorithm for symbiotic organisms with a blood assignment policy in connection to South African blood banks in order to effectively reduce the operational expenses of blood transfusion centers.

Babajide A. et al. [15], addressed the issue of blood availability during emergencies by developing a system that assists users in locating nearby blood banks and donors, which is a critical component of life. Without a doubt, this procedure is faster than manually travelling from hospital to hospital in search of a specific blood type, hence lowering the number of deaths caused by blood shortages during emergencies. While this topic addresses difficulties related to blood bank access, it is not intended to provide blood to the user.

Binbin Y. et al. [16], developed a revolutionary intelligent system for vaccination supply chain surveillance. Smart contracts were used to facilitate the querying of personal vaccination information and vaccine distribution. Additionally, they developed smart contracts to identify expired vaccines, and alerts about expired vaccines can be issued to regulators automatically.

A. Abdul and A. Fahad [17], developed a cloud application, often known as a web application, for Android mobile devices. The project's overall objective is to create a computer program that will connect all donors. Their system will assist control in developing a database and blood transfusion service that will save information on blood stocks located wherever at any time. They will be able to register as donors and will thus receive an SMS from their local area clients in need of blood. They will donate blood in such instances where it is required.

Mitesh Sarode, Ayush Ghanekar, Sahil Krishnadas, Yash Patil and Manish Parmar [5], By assisting blood banks and hospitals in automating the blood management process, the intelligent blood management system may prove to be a blessing. The technology delivers real-time analytics on blood pouch donations and requests. The color-coding system used to identify blood pouches according to blood group is unique and simplifies pouch handling by eliminating the need for pouches to be separated according to blood group.

Moh. Nabil , R. Ihab , H. El Masr , S. Said and S. Youssef [18], presented a web-based blood donation and medical monitoring system based on cloud and mobile platforms in their article. Their suggested system streamlines communication among patients, blood donors, medical professionals, and blood banks. The developed system was hosted in the cloud, taking advantage of numerous cloud hosting advantages such as high availability, scalability, and data protection. It merges electronic medical data and blood information from many blood banks in order to improve the quality of blood donation services.

Ahmed Mousa et al.[19], suggested a system utilizes both mobile and online applications to collect and distribute blood bags between blood banks and hospitals. When a family member faces a severe situation, the created method enables family members to assist one another. Once family members provide a critical notification, they automatically share their blood points and learn about neighboring donation programs.

S. Sil and S. Roy [20], described a scientific blood management system that enables persons in need of blood and blood banks to search for, request, and obtain blood more efficiently and effectively, with to avoid loss of blood, money, and time. Their system (website) is separated into and maintained as a collection of numerous subsystems. All of these subsystems work in concert to improve the current healthcare system, specifically the blood management system.

O.S. Albahri [21], proposes an intelligent rescue strategy based on biological criteria for the transfusion of suitably tested CPs to the most severe COVID-19 sufferers. Their framework will be adopted and evaluated in order to assist and assist the healthcare sector in combating the SARS-CoV-2 virus by enhancing the immune system of affected patients. Their proposed framework can be employed with any future generation of coronaviruses or other novel viruses to rescue newly infected individuals using the framework's designed strategies. This approach can be implemented in two distinct architectures: centralized telematics using data centers and decentralized telemedicine using blockchain technology.

Fawaz A. [22], Due to the critical nature of blood donation, it is necessary to design effective and efficient mechanisms for the donation process.

Currently, donors must wait an extended period of time to donate blood, which can diminish their enthusiasm to donate again. The technology has the potential to significantly cut the time necessary for blood donation and increase efficiency in a variety of ways.

Benjamin J J [23], Uganda's National Institute of Information and Access to Vaccines (NITAG) and the Ministry of Health are piloting a web-based decision-support tool for vaccine prioritization (MOH). With an easy-to-use interface and shareable results, SMART Vaccines 2.0 facilitated transparent, reproducible, and evidence-informed priority setting. The tool emphasized the importance of attention to the inherent biases of various stakeholders in the prioritization process and enabled evaluation of the implications of data ambiguity.

Ivan V. and Gleb R. [24], described a blockchain-based system for transparent tracking of COVID-19 vaccine registration, storage, and distribution, as well as self-reporting of side effects, in their work. Decentralized smart contracts are used to track and monitor vaccination delivery against producer-defined rules for safe manipulation. Additionally, a blockchain system for vaccination administration and transparent and tamper-proof self-reporting of side effects, individual identity, and vaccine association is offered. The results for an Ethereum-based implementation demonstrate the practicality of their suggested solution in terms of transaction throughput and cost, using our country's immunization program as a reference scenario.

Ivan Volkov and Gleb Radchenko[25], described a blockchain-based system for tracking the registration, storage, and distribution of COVID-19 vaccines, with self-reporting of side effects. The immutability, transparency, and accuracy of vaccination beneficiary registration are ensured through the use of blockchain technology, thereby avoiding identity theft and impersonation. Additionally, a blockchain-based vaccination administration system is supplied, with transparent and tamper-proof, personal identity, and vaccine connection. The results for an Ethereum-based implementation indicate the feasibility of their proposed solution in terms of transaction throughput and cost per unit of gas spent.

Thura J. M. et al. [26], proposes a unique architecture for intelligent CP transfusion-rescue interoperability across centralized/decentralized telemedicine institutions. It prioritizes patients and donors using the same DM. However, a patient/donor priority list may be advantageous if decision-makers keep in mind how to determine the significance of clinical perspective studies' criteria.

Dhuha B. Abdullah and Mohammed D. Y. [27], proposed method for allocating blood units will greatly increase the percentage of patients receiving appropriate blood units at the right time, especially for critical cases. This is instead of the traditional method that adopts isolated work for every component of blood banks, hospitals and donation camps. Their proposed system and the proposed method for allocating blood units will provide a solid base for building future systems that are broader and more comprehensive and able to deal with and contain all exceptional circumstances.

Dhuha B. A. and Mohammed D. Y. [11], The proposed system would offer unified and centralized administration of blood units throughout all blood banks and hospitals in the health system, with across the whole country. As a consequence, it removed the requirement for human participation in decision-making concerning blood unit management, resulting in enhanced performance while simultaneously lowering process mistakes and waste.

Henry E. Wang et al. [28], Amounts of donor candidates who passed the first telephone health screening, qualified for CCP donation after diagnostic testing, and completed CCP donation were calculated, and the results were published.

TABLE 1: BELOW PROVIDES A SUMMARY OF THE SELECTED RESEARCHES THAT DEALS WITH THE DESIGN AND ANALYSIS OF THE FRAMEWORK AND SYSTEMS OF MANAGING THE HEALTHCARE RESOURCES.

Ref. No	Author	Year	Study Type	Country	Research Method	Data Collection	Sample
[13]	Lalmohan Dutta et al.	2018	Case study	India	An integrated framework has been put in place to manage the blood management process and a special focus has been placed on managing a local blood donation campaign where donor preferences with respect to time, place, date, etc. will be planned	information on the number of staff, medical instruments and other infrastructure requirements	Our proposed system mainly focuses on voluntary unpaid donors
[14]	Prinolan G. & Absalom E. E.	2018	Case study	South Africa	A hybrid metaheuristic algorithm is used in this work to lower the operating expenses of transfusion facilities. The hybrid metaheuristic algorithm combines a symbiotic search algorithm with a blood allocation policy and is used in relation to blood banks.	Allocating a unique percentage associated with each month. Generate values of monthly demand & supply all blood units.	Focuses on whole blood units (WB), which relate to all components of blood. According to the ABO blood system
[15]	Babajide Ayeni et al.	2019	Case study	Nigeria	Web development techniques were used, and Google Map API was used to track, calculate and display the location of each blood bank and donor. To get blood faster instead of looking for a specific blood type during an emergency.	blood bank centers and human donors	the National Blood Transfusion Service (NBTS) units of blood
[16]	Binbin Yong et al.	2019	Case study	China	Ethereum-based smart contracts are designed to query personal vaccination records & vaccine circulation to consumers, vaccine organizations, & the government using vaccine blockchain system.	vaccine supply chain	consumers, vaccine institutions, and the government
[17]	Autho Abdul Aziz Fahad	2019	general	-	Create a database and blood transfusion service to keep data on blood stock anywhere and at any time. Also, people will be able to know which patients need blood supply through the website. They will be able to register as donors with receive SMS from their local clients and will donate blood in cases if needed.	The donor will be prompted to enter an individual's details, like name, phone number, and blood group.	receive blood from various donors.
[5]	Mitesh Sarode et al.	2019	Case study	India	Provides real-time analytics for donations and blood bag requests. The color-coding scheme for identifying blood. The use of bags based on blood groups is unique and convenient since the bags do not need to be sorted by blood type before use.	using color coding mechanism	Trauma victims - due to accidents and burns - heart surgery, organ transplants, newborns, receiving treatment for cancer.
[18]	Moh. Nabil et al.	2020	general	-	Making extensive use of cloud hosting characteristics like high availability, scalability, and data security, among other things. It merges electronic medical data with blood information that is scattered across several blood donation centers. Moreover, it concentrated on system performance metrics with the capacity of the produced system to service many users via the use of different performance measuring tools	Simple medical devices connected with medical sensors may be used to monitor the health condition of patients & to update the information contained in their electronic medical records by using the IoT cloud platform.	Patients, blood donors, medical specialists, and blood banks must all communicate with one another.
[19]	Ahmed Mousa et al.	2020	Case study	Egypt	According to the suggested method, data is analyzed & classified to forecast the most relevant locations for launching new blood drives; includes scheduling new campaigns automatically while taking into	This technology aids blood banks in a variety of ways, from collecting blood to sending to	Undergraduate students, academic researchers, engineers, designers, & instructors are the primary audience for this publication.

					account existing demands in blood kinds and amounts.	hospitals have shown an interest.	
[21]	O.S. Albahri et al.	2020	general	-	Their proposal included two unique and sequential phases: (i.e., testing and development). After donors are divided into four blood types, the ABO compatibility test is performed to determine their compatibility. The patient-side develop stage is characterized by the establishment of priorities based on a contracted patient decision matrix constructed from "serum/protein biomarkers and arterial blood oxygen partial pressure to fractional inspired oxygen parameters" and "Patient list constructed by the new MCDM."	It is necessary to divide donors into four blood types, namely A, B, AB, and O, in order to determine the acceptability and safety of plasma for administration to improve the CP tested list repository.	Antibodies against the coronavirus are found in the blood of people who have recently recovered from the danger of deterioration (COVID-19). As a result, the transfusion of the antibodies to patients are deteriorating might conceivably aid in stimulation of immune sys.
[22]	Fawaz Alharbi	2020	Case study	Saudi Arabia	A new central blood donation system has been implemented, in addition, the integration of multiple systems and services into a centralized and integrated system is being worked on. It has the potential to minimize the amount of time necessary to give blood while increasing efficiency. When donating blood, the repeat donors are not needed to input their information again.	Donor recruitment, donor invitation, donor selection, the contribution procedure, and donor retention are all examples of fundraising activities.	Blood donors
[24]	Ivan Volkov and Gleb R.	2021	general	-	Construct a platform that will enable medical organizations to customize the services they provide to patients. The platform should have pre-designed modules allow patients, physicians, and other services to interact with the data held inside the platform.	patient data	Bringing together people, information, and organizations that are pertinent to health care.
[25]	CLAUDIA ANTAL et al.	2021	general	-	The traceability of COVID-19 vaccine distribution, with thorough checks of storage and delivery conditions, help me to maximize the efficiency and transparency of the vaccine distribution. As part of this effort, (ii) ensuring that registration and upkeep of an immunization waiting list are accurate and transparent; build an open and public reporting mechanism for adverse effects.	A blockchain-based system for transparent tracking of COVID-19 vaccination registration, storage and distribution with self-reporting of adverse effects is being developed.	COVID-19 vaccine
[26]	Thura J. Mohammed et al.	2021	general		Using medical reference ranges, a new COVID-19 dataset is generated by experts in the field of virology; a scenario for determining patient/donor distributions across four central/decentralized telemedicine hospitals is defined as a "proof of concept"; and three stages for developing a rescue framework for blood component transfusion are defined.	blood types	COVID-19 patients/donors
[27]	Dhuha B. A. & Mohammed D. Y.	2021	Case study	Mosul city	Enhance the process of assigning blood units and reduce the possibility of human mistakes by using artificial intelligence. Also included in the planned system's geographical reach was a number of blood banks located inside the healthcare system, which was not previously included in the original proposal.	Blood units	

5. Conclusion and Discussion

On the basis of Table 1, which provides a comprehensive summary of this evaluation, it has been determined that many variables, such as research method and data collection, with samples used, all play a critical role in the development of healthcare resources management system that is effective in its operation. Taking into account all of these qualities will allow you to assess the effectiveness of the recommended approaches. According to the findings of this research, working techniques that have been developed and executed will be examined and evaluated., the following conclusions were reached in 2020, Mohammed. Nabil et al. [18], suggest an online blood donation system and a medical monitoring system that are cloud- and mobile-based. Their suggested system streamlines communication among patients, blood donors, medical professionals, and blood banks. The cloud-based system is hosted employing a variety of cloud computing capabilities, including high reliability, availability, scalability, and data security also, Ahmed Musa et al. [19], by implementing an automated system for collecting and distributing blood bags between blood banks and hospitals. With the devised method, family members can assist one another in the event of a serious problem. Once family members give a critical notification, they automatically share their blood points and learn about neighboring donation programs. Additionally, some studies suggested additional sources, such as blood banks. donation centers and vaccine centers, such as the covid-19 vaccine and etc.

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