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AI-Enabled Support for Thalassemia Patients: A MERN Stack System for Donor Prediction, Alerts, and Assistance

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Abstract: *Thalassemia, a congenital blood disorder, requires lifelong management through blood transfusions to maintain stable hemoglobin levels. This creates ongoing challenges for affected individuals and their families. Timely access to compatible blood donors is critical for survival, particularly in severe cases that require frequent transfusions. Securing a suitable donor often becomes a major concern. In many cases, the process of arranging blood transfusions is stressful and slow, especially during emergencies. Conventional methods such as phone calls and social media appeals are unreliable and can result in harmful delays, negatively affecting patient health and increasing anxiety for both patients and caregivers. To address these issues, this paper presents a web-based support system designed to assist thalassemia patients by improving the coordination of blood donors. The system aims to reduce common problems in current transfusion practices, such as fragmented information, delayed responses, and lack of structured assistance. The proposed system provides donor management, blood request handling, and prediction of donor availability. It also integrates alert notifications and a chatbot to support patients and donors through a unified portal. Developed using the MERN stack (MongoDB, Express.js, React.js, and Node.js), the platform is designed for practical deployment and modular growth. Machine learning techniques are used to analyze donor history and behavioral patterns in order to estimate donor availability during urgent situations. This helps patients gain timely access to compatible blood. The system can send automated messages using services like Twilio and can integrate with healthcare platforms such as e-RaktKosh to discover additional donors and improve reliability. In addition, the platform includes an assistance component that offers information on transfusion schedules, donation guidelines, eligibility requirements, and navigation instructions. This is intended to make the system easier to use and to encourage user participation. Security is treated as a primary concern, with JWT-based authentication and role-based access control used to safeguard sensitive data and limit access based on user roles. Initial trials indicate that the system performs effectively in terms of task completion, coordination, and transparency. These findings suggest that the system can serve as a foundation for transfusion support, helping to improve access to care and quality of life for thalassemia patients.*

Keywords: Thalassemia, Predictive Donor Availability, MERN Stack, Artificial Intelligence, Smart Alerts, Healthcare Information Systems

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