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EMKEN: A MEDICAL WEB APPLICATION FOR INTEGRATED EMERGENCY AND TRAUMA RESPONSE

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Abstract— **The Emken web application was created to address prolonged delays in accessing essential healthcare and guidance during emergencies, difficulties in connecting with healthcare practitioners, and the lack of information about nearby hospitals during medical crises. The React framework was selected for the front-end to provide a modern, responsive user interface. Firebase was chosen as the back-end platform for its real-time database, user authentication, and hosting services. Development followed secure, scalable, and maintainable software engineering standards, supported by continuous integration and systematic testing. Integration testing was conducted to ensure that both frontend and backend components function seamlessly together, while automated and manual unit testing were employed to identify and rectify bugs and issues. Version control was managed through Git and GitHub, ensuring effective collaboration, traceability, and structured code maintenance. This web application provides users with comprehensive information on the steps to take in any medical emergency, regardless of location, via wireless communication. It also features a map showing all nearby medical hospitals. Additionally, users can chat with an experienced doctor at any time of day regarding any medical emergencies or traumas they may be facing. With Emken's precise and comprehensive emergency instructions, users can respond promptly and effectively to critical situations. This feature could save lives by guiding individuals through essential steps before professional assistance arrives.**

Keywords— **Emergency Response, Medical Web Application, Patient Tracking, Resource Allocation, Telemedicine, and Trauma Care.**

I. INTRODUCTION

Advances in the internet and technology have significantly transformed people's lifestyles, particularly in today's world. In the medical and healthcare sectors, innovations such as web and mobile applications have brought notable benefits, greatly enhancing patient care. These technologies have made it much easier for patients to connect with healthcare providers from anywhere in the world. Technology, primarily through web and mobile applications, has revolutionized global healthcare, a trend that is likely to continue in the coming years. The growing demand for fast and efficient healthcare services is driving the development of medical emergency applications. With rapid advancements in smartphones and other mobile devices, eHealth services have become central to our daily lives, potentially transforming how we access and receive medical care. The use of technology in healthcare has increased markedly in recent years, particularly regarding medical emergencies. The surge in smartphone usage has led to the development of applications that provide quick, easy access to medical information and resources during emergencies. Key factors that determine the overall effectiveness of the healthcare system include the quality of patient care, the efficiency of medical professionals, and the accessibility of eHealth services. Therefore, the advancement and adoption of eHealth technologies are crucial for ensuring widespread access to medical services [1]. For instance, remote patient monitoring via applications enables early disease detection and timely notifications to relevant medical specialists. However, implementing these remote services requires effective computing solutions and substantial computational power to meet quality standards for diverse services reliant on multimodal data, such as video and audio streaming. Research has shown that using handheld devices, such as smartphones with embedded applications, can save time and speed up decision-making and treatment [2]. These applications can greatly benefit individuals with chronic medical conditions needing quick access to their health information, as well as anyone who is far from a hospital or doctor during a sudden health crisis. Essentially, medical emergency applications aim to provide individuals with rapid access to vital medical information and resources during emergencies. Typical features of these apps include symptom checkers, first-aid guides, emergency contact information, and the ability to call for ambulance services or locate the nearest hospital. Medical emergencies and trauma response are critical areas of healthcare that require prompt, effective intervention to save lives and prevent long-term complications [3].

Several studies have demonstrated that early recognition and management of medical emergencies can significantly reduce morbidity and mortality rates. For instance, a survey found

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that timely interventions by emergency medical services (EMS) decreased mortality among patients. Similarly, a review highlighted the importance of early recognition and treatment of sepsis for improving patient outcomes [4]. Effective trauma response is another vital aspect of emergency care. The Advanced Trauma Life Support (ATLS) guidelines are widely used in trauma centres to ensure the prompt and efficient management of trauma patients. A study found that adherence to ATLS guidelines was associated with lower mortality rates among trauma patients [5]. Further studies on eHealth service applications indicate that they are effective in helping individuals manage their health conditions, access medical information, and locate resources when needed. Disaster management and response are achieved through the coordinated efforts of multiple agencies, including EMS, hospitals, law enforcement, search and rescue, public health, and public utilities [6]. The EMS system and its providers have evolved beyond traditional roles into specialized, highly trained positions in leadership, education, and response. Emergency Medical Services (EMS) providers and medical directors play a crucial role in disaster preparedness and response.

The work presented in [7] involved the development of a smartphone and server application to collect structured patient data and point-of-care photographs. However, challenges and limitations, such as integrating the application at the point of care and assessing its clinical impact before deployment, have hindered its intended purpose of facilitating remote consultations for burn injuries. Therefore, this study seeks to incorporate this solution into routine acute clinical care, promoting equity in emergency treatment for injuries that have become increasingly significant public health concerns.

The proposed application, Emken, aims to enhance wireless communication channels between patients and healthcare professionals, enabling individuals to easily locate medical experts for consultations or assistance during emergencies. Emken provides users with essential guidance on responding to various medical emergencies, including information on nearby hospitals, their locations, and directions, thereby reducing both healthcare costs and the time spent seeking assistance. Additionally, it aims to alleviate the financial burden on patients by offering free guidance on emergency procedures, eliminating the need for consultation fees.

The rest of the paper is organized as follows. The subsequent sections of this paper will detail the methodology, the implementation of the proposed application, the results, the discussion, and the conclusions.

II. METHODOLOGY

To actualize this project, we begin by defining the application requirements, features, and functionalities. This initial phase involves creating a high-level architectural design for the web application.

The block diagram of the proposed web application, Emken, is shown in Figure 1.

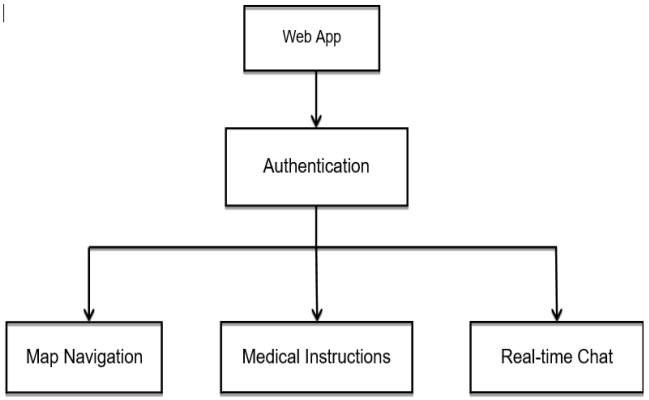

Fig. 1. Emken Architectural Workflow of the Web Application: From User Authentication to Service Modules (Map Navigation, Medical Instructions, and Real-Time Chat)

This diagram depicts the core components of the Emken system as distinct blocks, with lines indicating their interconnections. Upon opening the web app, users are taken to the authentication page, where they can explore the map, access medical instructions, and chat with a medical doctor.

We utilize the React framework for the front end, providing a modern, responsive user interface. React is an open-source JavaScript library developed by Facebook, widely used for building user interfaces (UIs) for web applications. Since its introduction in May 2013, it has become one of the most popular front-end libraries for web development [8]. ReactJS is a component-based library that allows developers to create reusable UI components. We leverage the React framework by adopting the virtual Document Object Model (DOM) approach, which efficiently updates and renders the UI, thereby improving performance. Following the front-end implementation, we focus on the backend. We use Firebase as our backend platform due to its real-time database, user authentication, and hosting capabilities. Firebase is a comprehensive mobile and web development platform provided by Google. It offers a wide range of services and tools that help developers build high-quality applications quickly and efficiently. Firebase serves as a toolset for creating, improving, and growing applications. The tools it provides cover many services that developers would typically need to build themselves, allowing them to focus on enhancing the app experience. These services include analytics, authentication, databases, configuration, file storage, push messaging, and more.

All services are hosted in the cloud and scale effortlessly, requiring minimal effort from developers [9]. Next, we adopt an iterative and flexible approach known as Agile for the software development process. Agile emphasizes collaboration, adaptability, and customer value. As a project management approach, it advocates for constant collaboration

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and iterative work, assuming that a project can continually improve throughout its life cycle, with changes implemented quickly and responsively [10]. The Agile model combines iterative and incremental process models, with each iteration functioning as a self-contained mini-project. Activities within each iteration range from system requirements gathering to system review and feedback, all within the software development life cycle (SDLC) model adopted in this project, as illustrated in Figure 2.

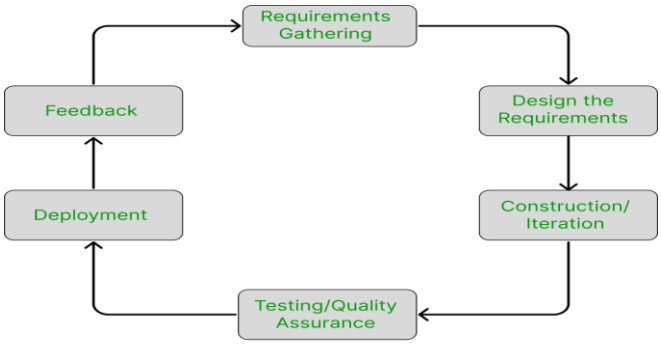

Fig. 2. Agile Software Development Life Cycle (SDLC) Flowchart [11]

The adoption of the Agile methodology enables us to effectively manage the Software Development Life Cycle, encompassing phases such as requirements gathering, design, development, testing, and feedback implementation [11, 12]. Throughout the development process, we emphasise continuous integration and testing while incorporating best practices to create secure, scalable, and maintainable applications. Integration testing ensures seamless operation between frontend and backend components, while both automated and manual unit testing facilitate the identification and resolution of bugs and issues.

We utilize GitHub as our web-based medical application designed for an integrated emergency and trauma response system. It is a source control tool to manage the application's codebase. In the Emken web app, users navigate a defined journey that starts with the input specification, which serves as the authentication form where they enter their details to access the app's features. The software's input specifications outline the parameters and data that users provide to interact effectively with the system. These specifications dictate how users enter information and interact with the software's features. Conversely, the output specification details how the system presents information, results, and responses to users, defining the format, content, and delivery of the software's outputs. An example of the output specification in the Emken web app is shown in the visual map navigation view in Figure 8, which displays directions to medical emergency locations.

III. EXPERIMENT AND RESULT

Emken runs on a web browser, enabling seamless access across various screen sizes, including laptops, tablets, and mobile phones. The flowchart in Figure 3 illustrates the step-by-step process for using the Emken medical web app.

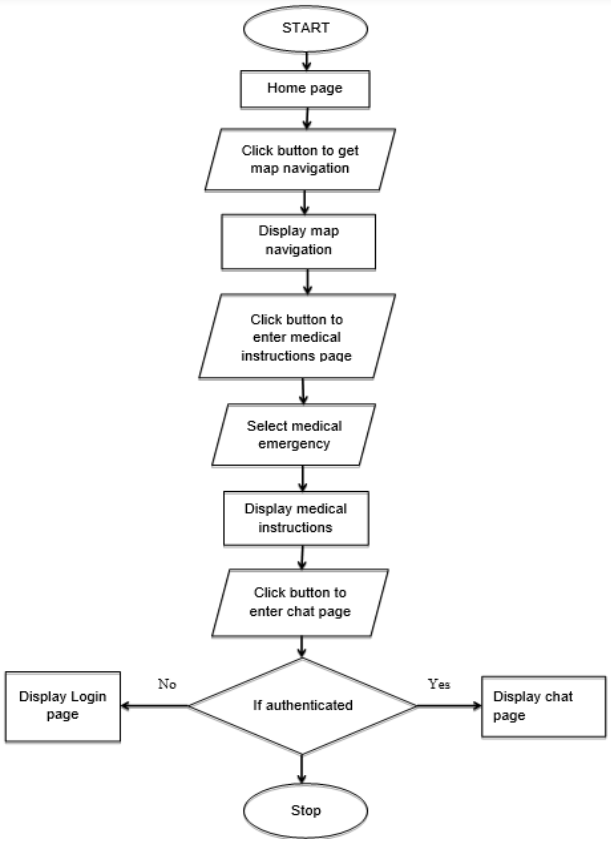

Fig. 3. The Flow Chart Illustrating the Emken System

A. Authentication Process

To access the real-time chat feature, users must first register and sign in. The registration page includes text boxes for users to enter their details. Once the user clicks the submit button, they are directed to the sign-in page, where they are prompted to provide the necessary information to complete the sign-in process. Figure 4 shows the registration page, where users can register using their username, email address, and password. Meanwhile, Figure 5 displays the sign-in page, which allows users to log in with their email and password.

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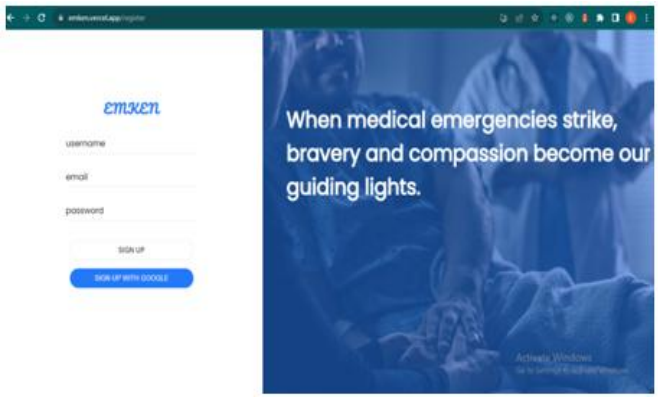

Fig. 4. The Emken User Registration Screen

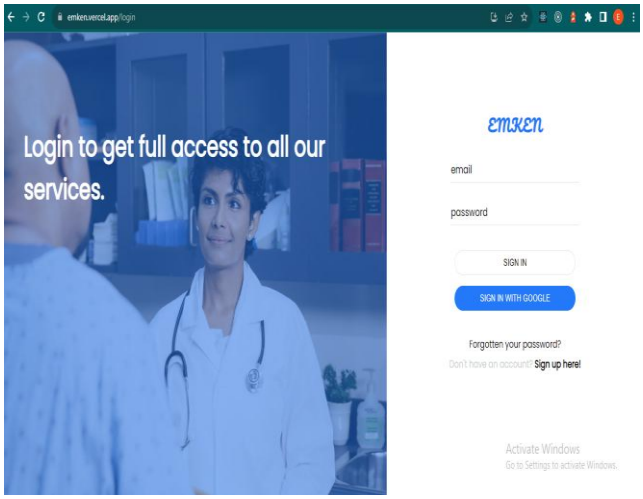

Fig. 5. The Emken User Sign-In Screen

B. The Home Screen

The home page provides details about the Emken web application, including its services, doctor information, and user testimonials, as illustrated in Figure 6.

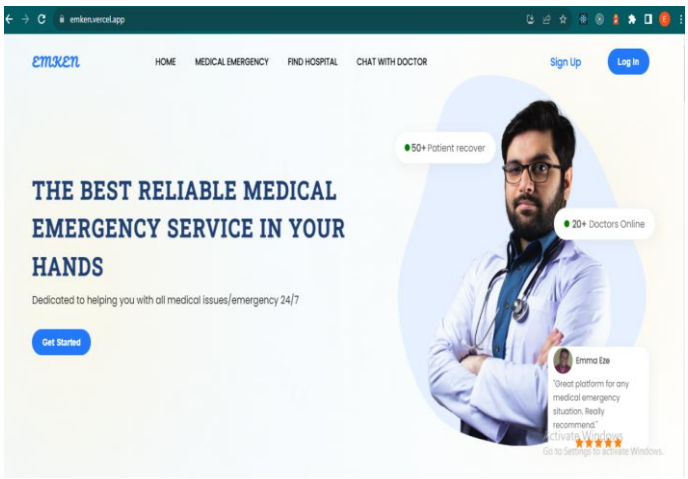

Fig. 6. The Emken Home Screen

C. The Medical Emergency Screen

Figure 7 illustrates the medical emergencies that users may encounter. When a user clicks on a specific medical emergency case, they receive detailed information about the condition and appropriate steps to take in such situations.

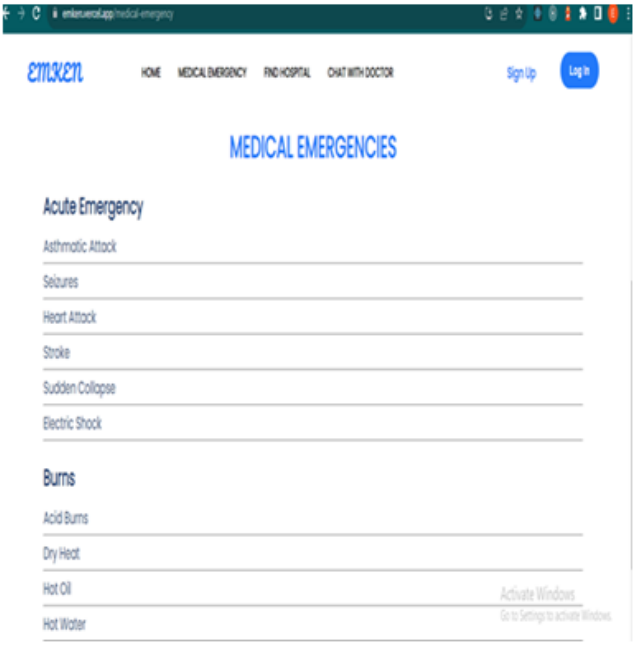

Fig. 7. The Emken Medical Emergencies Screen

D. The Real-time Chat Screen

The 'Chat with Doctor' page allows you to have real-time conversations with medical professionals in case of a medical emergency, as illustrated in Figure 8.

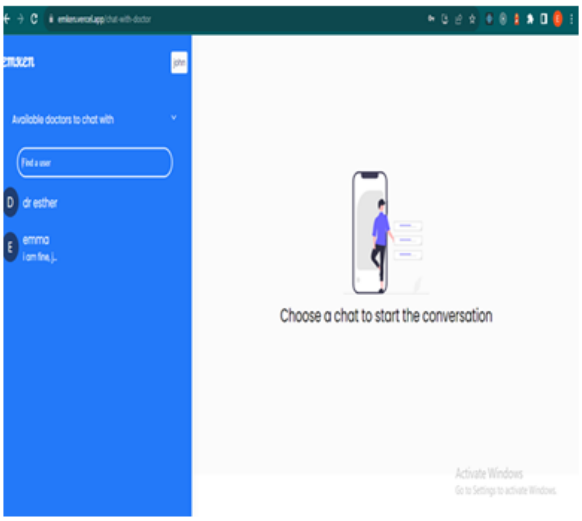

Fig. 8. The Emken Real-time Chat Screen

The testing of the medical emergency module was carried out to ensure that users can effectively locate various medical emergency conditions, select a specific case, and access relevant information and steps for that condition. This functionality was confirmed to be operational. Additionally, the system was evaluated to determine if users could exchange messages with minimal delay, typically within seconds or even milliseconds of sending and receiving.

IV. CONCLUSION

The advancement of technology has led to its increasing integration into every facet of our daily lives. The web application, Emken, provides detailed, accurate emergency instructions, enabling users to respond swiftly and effectively to critical situations. This feature has the potential to save lives by guiding users through essential steps while they await professional assistance. Including hospital location mapping enables users to quickly find nearby medical facilities, thereby facilitating a faster journey to obtain medical care. This capability addresses the urgent need for rapid response times during emergencies, enhancing the likelihood of favourable outcomes. Additionally, real-time chat with doctors empowers users to connect directly with medical professionals in emergencies, providing immediate guidance and reassurance and aiding informed health decisions during crucial moments. Emken is a web-based medical application designed to serve as an integrated emergency and trauma response system. It is compatible with all web browsers and fully responsive, ensuring accessibility across various devices while featuring an advanced user interface (UI).

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