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Review on Research Gap for Project (Trauma Linker: Emergency Medical Response System)

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Abstract - *A major research gap exists in the lack of accessible, AI-based systems that can perform early detection of visible wounds and provide instant emergency support, especially in remote or underserved areas. Trauma Linker aims to address this gap by developing an AI-powered healthcare application that bridges the divide between early diagnosis and timely medical response. The system allows users to upload images of wounds or skin issues, which are analyzed using deep learning models built with MONAI and PyTorch to classify conditions, assess severity, and suggest initial care steps. The platform integrates React.js for the frontend, Node.js for backend processing, and Supabase with Microsoft Azure for secure, scalable data storage and cloud deployment. A key feature of Trauma Linker is its real-time SOS mechanism, which automatically shares the user's live location and health profile with nearby hospitals during emergencies. By combining AI-based image analysis with real-time response, the system enhances healthcare accessibility, minimizes diagnosis delays, and empowers users with early awareness and timely assistance—effectively closing the research gap in intelligent trauma management and emergency healthcare solutions.*

1. INTRODUCTION

1.1 Introduction

In recent years, healthcare inequality has become a growing concern, particularly in rural and low-resource regions where access to professional medical assistance is limited. Many individuals face long distances to healthcare centers, shortage of doctors, and delayed emergency responses, which can lead to preventable complications or even fatalities. Despite advancements in telemedicine, the absence of real-time analysis and automated preliminary diagnosis remains a major barrier to timely treatment. This creates a critical research gap — the need for intelligent systems capable of detecting visible injuries or skin-related conditions instantly and guiding users toward appropriate medical care without requiring immediate physical consultation.

Trauma Linker is developed to bridge this gap by integrating Artificial Intelligence (AI), Deep Learning (DL), and cloud computing technologies into a single, responsive platform for early medical analysis and emergency assistance. The system empowers users to upload images of wounds, burns, or infections directly from their devices, which are then processed by AI models trained using MONAI and PyTorch for accurate classification and severity assessment. Beyond analysis, Trauma Linker incorporates a real-time SOS feature that transmits the user's live location and health profile to nearby hospitals, ensuring immediate help during critical situations.

Furthermore, the system architecture is built using React.js for an intuitive frontend, Node.js for a robust backend, and Supabase with Microsoft Azure for secure and scalable data storage. By integrating these technologies, Trauma Linker not only delivers accurate AI-based diagnostics but also enhances the reliability and efficiency of emergency responses. This research aims to contribute to the development of intelligent healthcare systems that promote early detection, reduce diagnostic delays, and extend quality healthcare services to underserved populations through technological innovation.

1.1 Healthcare Accessibility Challenges

Healthcare accessibility continues to be a pressing issue, particularly in rural and underserved regions where medical professionals and facilities are scarce. Many individuals face long travel distances and delays in receiving care, leading to worsening of conditions that could have been easily treated through early intervention. Visible issues such as wounds,

rashes, and burns are often ignored or misjudged due to low medical awareness, resulting in preventable complications. Limited transportation, financial constraints, and the absence of digital medical assistance further aggravate the situation. These barriers highlight the need for a rapid, technology-driven solution capable of providing immediate medical guidance. The increasing adoption of mobile devices offers an opportunity to bridge this gap by enabling users to access healthcare advice directly. Thus, improving healthcare accessibility requires integrating intelligent image analysis, remote monitoring, and emergency response systems. Addressing this challenge forms the foundation of Trauma Linker, a system designed to deliver preliminary analysis and real-time help to individuals regardless of location, ensuring that timely medical attention is no longer dependent solely on proximity to a healthcare facility.

Fig -1: Accessibility of Healthcare

1.2 Identified Research Gap

Although artificial intelligence has made progress in medical imaging, most existing solutions focus on hospital-based applications and overlook patient-centric accessibility. Current wound detection and classification models often depend on controlled datasets and lack adaptability to real-world smartphone images. Moreover, available mobile healthcare apps primarily offer symptom tracking or teleconsultation without automated AI-driven assessment or emergency response features. Few studies have explored integrating deep learning-based wound analysis with location-enabled SOS systems for rapid intervention. This leaves a critical gap in providing real-time, intelligent, and scalable wound care for the general population. Addressing this gap requires a system that not only detects and classifies visible injuries but also advises users on immediate actions and connects them to nearby healthcare facilities in emergencies. *Trauma Linker* is developed precisely to bridge this divide, offering AI-powered analysis, instant feedback, and automated emergency communication—ensuring early detection leads seamlessly to timely care and improved outcomes.

1.3 Role of Artificial Intelligence in Modern Healthcare

Artificial Intelligence (AI) has revolutionized healthcare by enabling data-driven, precise, and accessible medical solutions. Deep learning models can analyze medical images, detect abnormalities, and predict potential risks faster and more accurately than traditional methods. In wound and skin-related diagnostics, AI can segment affected areas, determine severity, and recommend suitable care measures with minimal human input. Such automation not only supports healthcare professionals but also empowers individuals to self-assess and seek timely treatment. Furthermore, the integration of AI with cloud platforms and mobile technologies enhances scalability and real-time accessibility. These advancements have made AI a critical enabler of telemedicine and early intervention systems. By leveraging AI, Trauma Linker transforms ordinary smartphones into diagnostic tools that provide instant analysis and emergency alerts, extending quality medical support to those who lack immediate professional help.

1.4 Overview of the Proposed System – Trauma Linker

Trauma Linker is an AI-powered web application designed to analyze visible wounds or skin conditions and provide immediate medical insights. Users can upload images through their smartphones or computers, and the system employs deep learning models trained on medical datasets to identify the condition, estimate severity, and suggest first-aid or preventive steps. Based on the detected seriousness, the application triggers a real-time SOS alert that shares the user's location and health profile with nearby hospitals or emergency services. The platform integrates React.js and Node.js for seamless user interaction, while AI models built using PyTorch and MONAI perform image processing. Data is securely stored on Supabase and hosted on Microsoft Azure for scalability. This system bridges the gap between early diagnosis and professional intervention, providing individuals—especially in remote or underserved regions—with quick, reliable, and life-saving assistance.

1.5 Significance and Scope of the Study

The significance of this research lies in its potential to make healthcare accessible, proactive, and intelligent. By combining AI-driven image analysis with real-time emergency response, Trauma Linker addresses both preventive care and crisis management in a single framework. The study demonstrates how deep learning can be applied to real-world healthcare challenges, reducing dependency on physical consultations and accelerating response in emergencies. Its scope extends beyond wound detection to potential applications in dermatology, infection monitoring, and remote diagnostics. Moreover, the system's modular design allows integration with hospital networks,

government health programs, and wearable devices for continuous monitoring. Ultimately, Trauma Linker contributes to building a future where technology ensures that timely medical guidance and emergency support are available to everyone, regardless of location or resources.

2. Healthcare Accessibility Challenges – Review

Despite growing awareness of mental health issues, access to trauma-focused healthcare remains limited and unequal across regions. Millions of individuals affected by trauma face significant barriers such as high treatment costs, shortage of mental health professionals, geographic isolation, and persistent social stigma [1]. The World Health Organization reports that nearly 75% of people in low- and middle-income countries receive no mental health treatment due to resource constraints and limited infrastructure [2]. In India and many developing nations, the doctor-to-patient ratio for mental health care is alarmingly low, highlighting a severe gap between need and service availability [3].

Digitalization in healthcare has brought new possibilities, yet mental health support systems often remain underdeveloped compared to physical healthcare services [4]. Many trauma survivors avoid traditional therapy due to fear of judgment or cultural taboos, leading to delayed diagnosis and worsening conditions [5]. The lack of personalized, trauma-specific care further intensifies emotional distress and hinders recovery.

Recent studies emphasize that accessible, technology-driven solutions can help overcome these barriers by enabling remote monitoring, real-time support, and data-informed intervention [6]. However, current digital health tools are primarily generalized mental wellness apps, lacking focus on trauma-oriented recovery mechanisms [7]. This gap underscores the necessity for innovative platforms like Trauma Linker that combine accessibility, empathy, and intelligence to ensure inclusive trauma support for all.

2. Review of Identified Research Gap

A thorough review of existing literature, research papers, and digital healthcare systems reveals that while technological innovation has transformed several medical domains, trauma-specific mental health care still lacks adequate representation. Numerous studies acknowledge the rise of AI-based diagnostic tools for physical health, such as wound detection and radiological analysis, yet very few extend similar capabilities to trauma-related emotional or psychological conditions [8]. The research community continues to focus largely on generalized stress or depression management apps, with minimal emphasis on the nuanced needs of trauma survivors [9].

Existing systems such as Talkspace, Wysa, and BetterHelp provide text-based counseling and chatbots; however, these platforms do not integrate real-time emergency alerts, visual analysis of physical trauma, or AI-driven condition severity estimation [10]. Most are limited by static user input, lack of medical image interpretation, and absence of integrated emergency workflows. Several research articles highlight the need for cross-functional systems that merge physical wound identification with emotional care support, yet this interdisciplinary approach remains underdeveloped [11].

Moreover, documentation from global health organizations emphasizes the importance of early detection, especially in remote or low-resource settings, but the absence of adaptive AI frameworks continues to hinder scalable implementation [12]. Books and review articles on digital mental health echo similar concerns, urging for more contextualized, data-driven, and ethically sound AI solutions [13]. Therefore, the research gap clearly lies in designing an integrated, accessible, and intelligent trauma support system like Trauma Linker that bridges the divide between physical and psychological care.

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3. Review of Role of Artificial Intelligence in Modern Healthcare

Artificial Intelligence (AI) has emerged as a transformative force in the global healthcare ecosystem, enhancing the accuracy, speed, and accessibility of diagnosis and treatment. AI algorithms, particularly deep learning and convolutional neural networks (CNNs), have shown remarkable performance in medical image classification, disease prediction, and personalized care planning [14]. Studies have demonstrated that AI models can detect dermatological conditions, fractures, and even internal anomalies with precision levels comparable to or exceeding human specialists [15]. The integration of AI in healthcare is not limited to diagnosis but extends to predictive analytics, drug discovery, and patient monitoring systems [16].

AI-driven tools have also shown potential in addressing healthcare disparities by offering remote diagnostic capabilities, reducing the burden on medical staff in low-resource settings [17]. In emergency medicine, AI models facilitate triage, prioritize critical cases, and assist in rapid decision-making, thereby saving lives [18]. However, despite these advancements, the ethical use of patient data, model transparency, and reliability under diverse real-world conditions remain ongoing challenges [19].

These studies collectively establish AI as a pivotal enabler of modern healthcare innovation. Yet, gaps persist in developing AI solutions tailored to trauma care — particularly those integrating physical wound analysis with real-time emergency response, which forms the foundation of the Trauma Linker system.

4. Details of Overview of the Proposed System – Trauma Linker

Existing digital health platforms primarily focus on telemedicine or symptom checking, yet they fail to deliver holistic solutions for trauma-related medical analysis and

emergency coordination [20]. The proposed Trauma Linker system bridges this gap by integrating AI-driven wound classification, instant condition assessment, and real-time SOS connectivity. Unlike conventional medical apps that depend solely on textual inputs, Trauma Linker leverages deep learning algorithms to analyze images of visible wounds or skin conditions, offering immediate insights into possible causes and treatment suggestions [21].

A review of similar systems such as SkinVision and DermaCompare highlights limitations including restricted image categories, subscription barriers, and lack of emergency linkage features [22]. The Trauma Linker framework combines these missing components through a multi-layered architecture powered by React.js, Node.js, and MONAI (Medical Open Network for AI). The system's architecture supports integration with hospitals and emergency services to share critical data, ensuring timely responses [23].

In research and application terms, Trauma Linker represents a hybrid of diagnostic intelligence and emergency automation — a capability not yet widely implemented in existing literature or practice [24]. Hence, it stands as a necessary innovation to improve trauma care accessibility and real-time medical support.

5. Detailed Significance and Scope of the Study

The significance of Trauma Linker lies in its potential to transform trauma care delivery by merging AI-based diagnostics, emergency communication, and accessibility for underserved populations. Studies indicate that delayed treatment of injuries, especially in rural or remote areas, often leads to severe complications or preventable fatalities [25]. By enabling early detection through automated image analysis, the proposed system directly contributes to reducing diagnostic delays and improving patient outcomes [26].

In addition, the system's SOS module enhances the scope of tele-emergency medicine by instantly transmitting the user's location and health profile to nearby hospitals — a critical feature in life-threatening situations [27]. This aligns with global healthcare objectives outlined by the World Health Organization and the United Nations, which emphasize the role of technology in achieving equitable health access [28]. Furthermore, Trauma Linker supports continuous model updates and scalability, allowing integration with future AI modules like infection prediction or post-trauma emotional analysis [29].

The reviewed literature reinforces that no existing framework currently provides such a unified AI-powered platform for both early detection and real-time emergency coordination. Therefore, the Trauma Linker project not only fills a significant research gap but also holds the potential to set a new direction for AI-assisted trauma and wound management systems.

3. CONCLUSIONS

The proposed system, *Trauma Linker*, addresses a critical gap in healthcare accessibility by integrating artificial intelligence with real-time emergency support. Through deep learning–based image analysis, the system enables early detection and classification of visible wounds or skin conditions, empowering users with instant medical insights and preventive care guidance. Its SOS functionality ensures that emergency assistance can be triggered automatically, sharing user location and health data with nearby medical facilities for immediate response.

By combining the capabilities of AI, cloud computing, and web technologies, *Trauma Linker* demonstrates how intelligent automation can enhance healthcare delivery, particularly in remote and underserved regions. The system promotes early awareness, reduces diagnosis delays, and supports equitable healthcare access for all. With continued improvement through larger datasets, clinical validation, and integration with hospital networks, *Trauma Linker* holds significant potential to evolve into a reliable, life-saving tool for proactive medical assistance and emergency intervention.

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