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SMART RELIEF DISTRIBUTION PLATFORM

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Abstract:
In the aftermath of disasters, the timely distribution of relief kits to affected populations often faced significant challenges, including logistical inefficiencies, delays, and a lack of transparency. To address these issues, this study introduced a Smart Relief Distribution Platform designed to streamline the allocation, delivery, and tracking of emergency supplies. The proposed system ensured equitable and efficient distribution by integrating advanced user registration, real-time tracking, and delivery management mechanisms. The system began with user registration through government-issued IDs, which captured personal, family, and live location details to prioritize aid distribution. A unique token ID was generated for each user, enabling secure, transparent delivery while preventing misuse. The architecture empowered administrators to oversee critical processes, such as allocating delivery personnel and managing relief kit inventory. Delivery personnel were verified using their government IDs and assigned unique delivery IDs, enhancing accountability during distribution.A key component of the architecture was live delivery tracking, which leveraged geolocation to monitor delivery progress in real time. This ensured that kits were delivered directly to recipients' locations, minimizing delays and reducing operational inefficiencies. Additionally, the system provided a feedback loop for delivery personnel and administrators to further optimize logistics. By addressing challenges in traditional disaster relief operations, such as mismanagement and delays, this system offered a robust framework that enhanced reliability and fostered trust among affected communities. The integration of real-time tracking, tokenization, and user-friendly interfaces made it a scalable and efficient solution for disaster management worldwide.

Keywords: Tokenization, Relief Kit, Delivery Tracking.

I. INTRODUCTION:

In the wake of disasters, ensuring the prompt and efficient distribution of relief supplies was critical to supporting affected communities. However,

traditional relief distribution systems often faced challenges such as logistical inefficiencies, delays, and a lack of transparency, which hindered the effectiveness of aid efforts. The development of intelligent seismic safeguard systems became a focal area in disaster management research. Real-time seismic monitoring and automated response systems proved to be critical in minimizing casualties during earthquakes. Studies demonstrated the effectiveness of integrating environmental sensors with microcontroller-based systems like Arduino, which offered cost-effective and versatile solutions for disaster preparedness.Arduino-based systems were widely adopted for their ability to process data from environmental sensors, trigger emergency mechanisms, and support compact designs. GPS integration also played a transformative role in emergency response by enabling real-time location tracking. Research highlighted how GPS systems improved rescue operations by providing precise location data to emergency teams. Additionally, innovations in power management significantly extended the operational efficiency of portable devices, a crucial factor during

prolonged emergencies. Compact and tamper-proof designs for life-saving devices further enhanced their reliability during seismic events, preventing accidental malfunctions caused by tremors.Despite advancements, challenges such as improving durability, enhancing user-friendly designs, and ensuring cost-effectiveness remained underexplored. The proposed intelligent seismic safeguard system addressed these issues by combining a compact, tamper-proof life-saving box, GPS-enabled tracking, and optimized power management, offering a robust and reliable framework for earthquake disaster preparedness [1].

The study investigated fire disaster management challenges and introduced an intelligent support pathway for improving emergency response. By integrating case-based reasoning with matter-element graphs, the approach facilitated more effective decision-making. A comprehensive database of 128 fire cases was developed, and the methodology was validated using the Beijing Changfeng Hospital fire as a case study. This innovative framework enhanced the quality and efficiency of emergency decision-making, offering valuable theoretical insights and practical tools for advancing fire disaster management strategies [2].

The remainder of this paper was organized as follows: Section 2 provided a literature review of existing disaster management systems, focusing on GPS tracking and relief kit management strategies. Section 3 explained the existing system in detail. Section 4 outlined the methodology, including a comprehensive description of the intelligent kit distribution system. Section 5 presented the experimental findings, demonstrating the effectiveness of the proposed system. Finally, Section 6 discussed disaster management, potential challenges, and avenues for future research.

II. LITERATURE SURVEY:

[3] Disasters amplified due to the vulnerabilities created by human settlements. In response, mobile apps played a crucial role in enhancing disaster preparedness, communication, and response efforts. These apps provided real-time alerts and hazard maps, keeping users informed of potential threats. They also offered guides on assembling emergency kits and securing homes. Additionally, mobile apps bridged information gaps, ensuring that individuals and communities were equipped with the knowledge needed to take coordinated actions during crises.

[4] Explored real-time human detection and tracking, addressing challenges such as crowded environments and occlusions. By combining YOLONAS (You Only Look Once with Neural Architecture Search) and Deep SORT (Deep SORT), the system enhanced performance. It achieved more than 90% detection accuracy across multiple datasets. Experiments were conducted on the Jetson Nano Developer Kit, and the proposed approach outperformed existing state-of-the-art techniques in terms of accuracy.

[5] Introduced a platform for disaster management that connected organizations for more efficient disaster response. Its goal was to reduce chaos and minimize communication loss during crises. The platform leveraged advanced technologies such as Blockchain, Cloud, and IoT to improve coordination. By enhancing disaster relief efforts, it aimed to save more lives in critical situations.

[6] Explored battery electricity storage systems (BESS) in Germany, focusing on developing an optimization model to minimize economic costs. Input data was generated using an agent-based simulation model, and ten scenarios were analyzed to assess uncertainties in market development. The findings indicated that while large-scale BESS reduced economic costs, the benefits exhibited diminishing returns. The economic advantages were influenced by storage configuration and costs, raising questions about the economic suitability of large-scale BESS.

[7] Focused on modular UAV sensor systems designed for rescue missions. These systems were equipped with multi-channel remote biophysical monitoring equipment, high-resolution video and thermal imaging cameras, audio recorders, and subsurface radar. They also supported telemedicine and first aid operations, enabling efficient and effective responses in emergency scenarios.

[8] Designed a LoRa-based disaster management system to enhance search and rescue efforts in disaster zones. The system addressed communication challenges in severely damaged areas and provided coordination, communication, and navigation support for SAR robots. Its effectiveness was demonstrated through successful field tests in real-world scenarios.

[9] Presented a proposed Product-Service System aimed at delivering emergency kits to families, particularly migrant workers at the Bottom of the Pyramid, who were severely affected by the COVID-19 pandemic. These

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kits were designed to meet the hygiene, nutritional, and psychological needs of children and mothers. The distribution model leveraged an online service platform powered by ICT infrastructure, making the system applicable to India and other developing countries, offering essential support during emergencies.

[10] Explored synchronized multicast reception in networks with a focus on Service Function Chaining (SFC) for multicast traffic. It introduced TopoSync-SFC, a system that leveraged Software-Defined Networking (SDN) and Network Function Virtualization (NFV) to achieve synchronization. The approach involved the creation of application-specific multicast distribution trees aimed atminimizing reception variance across multicast nodes. Evaluation of the proposed method demonstrated a significant improvement in synchronized reception, particularly for push-to-talk services, highlighting its effectiveness in real-time communication scenarios.

III. EXISTING SYSTEM:

The existing system for relief kit distribution during disasters was heavily dependent on manual processes, leading to significant inefficiencies. Distribution was often uncoordinated, lacking real-time monitoring and proper tracking mechanisms. As a result, kits were sometimes over-distributed in certain areas while other regions remained underserved. This centralized approach to relief efforts created delays, especially in reaching remote or heavily affected areas.Moreover, the absence of tracking mechanisms led to misuse or unauthorized hoarding of kits, reducing the overall effectiveness of aid efforts. The system also heavily relied on pre-assigned personnel, which created bottlenecks when staff was insufficient during large-scale disasters. Resource allocation did not leverage technology, resulting in unequal distribution based on outdated or inaccurate data. Furthermore, time-consuming, paper-based documentation added to the delays, while a lack of transparency reduced trust in the fair allocation of resources.

These limitations underscored the need for a more efficient, technology-driven system to address these challenges effectively.

IV. PROPOSED ARCHITECTURE:

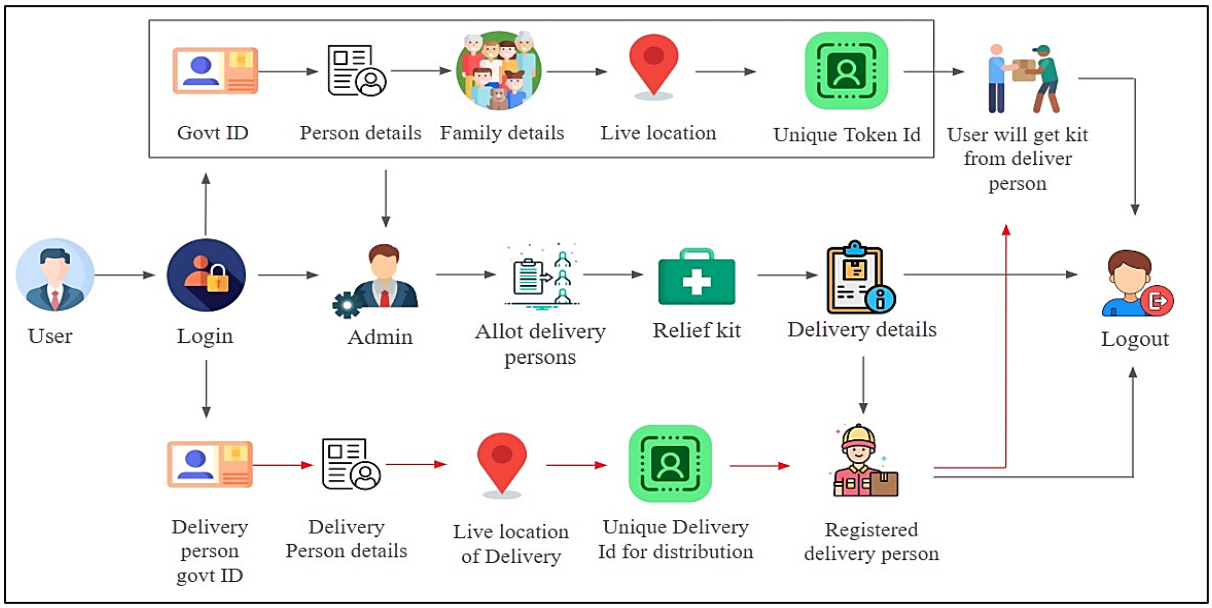

FIGURE 1. Smart Relief Distribution Platform architecture

The proposed system was a digital framework for efficient and transparent relief kit distribution. Users (beneficiaries) began by logging in and providing their government ID, family details, and live location. The system generated a unique token ID for each user, ensuring identification and tracking. Admins managed the process by verifying user details, assigning delivery personnel, and preparing relief kits for distribution.

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Delivery personnel, whose details and live locations were tracked, received a unique delivery ID for each distribution.They then delivered the kits to the specified locations, where users verified and collected them. Real-time monitoring enabled administrators to track the progress of deliveries and address any delays or discrepancies immediately. The system also incorporated automated notifications to inform users about the status of their relief kits, enhancing transparency. Feedback mechanisms were made available for both users and delivery personnel to report issues, ensuring continuous improvement. By maintaining comprehensive digital records, the system provided a scalable solution for disaster management that minimized errors and built trust among stakeholders.

V. METHODOLOGY:

Our proposed system was very useful during disaster times for providing relief kit distribution across affected areas. This system helped connect affected users to ensure they received their relief kits on time. Here, we broke down each step of the methodology:

1. User Registration and Verification:

The system successfully ensured that relief kits reached the intended recipients by integrating multiple ID verification options during user registration, including Aadhaar Card, Ration Card, and PAN Card. This flexible approach reduced the chances of misuse and duplication by allowing individuals to use the most accessible form of identification. By collecting personal and family details alongside live location data, the system facilitated precise delivery and efficient planning. The generation of Unique Token IDs for each user enhanced the tracking of applications and ensured accountability throughout the distribution process. This streamlined system also supported delivery personnel in verifying recipients before distributing the kits, ensuring a secure and transparent operation.Additionally, automated notifications were sent to users, keeping them informed of their kit status and estimated delivery time.

2. Relief Kit Allocation by Admin:

The admin played a pivotal role in managing the distribution of relief kits. After logging into the system, the admin accessed the database containing registered user details, including their location and unique token ID. Based on this information, the admin allocated delivery personnel to specific users and organized the relief kits for dispatch. All delivery details, such as the assigned delivery person and the recipient's information, were documented within the system. This centralized management ensured efficient coordination and equitable distribution of resources. The admin was responsible for allocating the relief kits to the delivery persons who were available in their area. In addition, the admin needed to share the count of affected people who had received the relief kits from the delivery persons, and this system helped achieve that. In this system, the delivery person needed to upload the details of the person who received their relief kit after delivery.

3. Delivery Personnel Management:

Delivery personnel were an essential component of the system. Each delivery person had to register by submitting their Government ID for verification. The system collected their personal details and live location, which were used to assign delivery tasks effectively. A Unique Delivery ID was generated to track their activities and ensure accountability in the distribution process. By organizing and registering delivery personnel, the system ensured that relief kits were delivered promptly and accurately to the intended recipients.

4. Relief Kit Delivery:

The delivery process ensured that relief kits reached the registered users seamlessly. Guided by live location data and user details, the delivery personnel located the recipients and verified their identity using the Unique Token ID. This verification step eliminated unauthorized access and guaranteed that the resources reached legitimate beneficiaries. Upon confirmation, the delivery personnel handed over the relief kit to the user, completing the transaction. This structured approach facilitated secure and transparent delivery operations.

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VI. RESULT AND DISCUSSION:

1. User Registration and Verification:

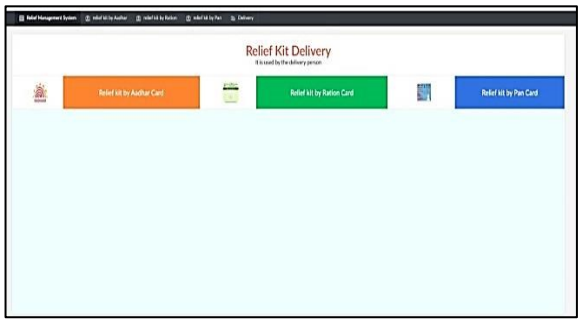

Figure 2.User registration page.

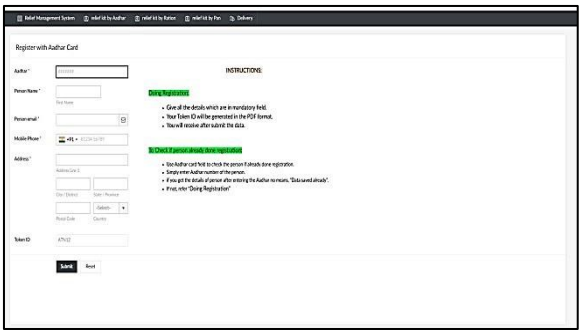

Figure 3.User registration form.

The system ensured that relief kits were distributed efficiently and securely by incorporating mandatory Government ID verification (e.g., Aadhar) during the registration process. This helped minimize misuse and duplication of aid. Users were required to provide personal and contact details, including their address and live location, enabling precise planning and delivery. Each registration generated a unique Token ID in PDF format, allowing easy tracking and ensuring accountability for both the recipients and the administrators. The system also included a check to verify if a person had already registered, preventing redundancy in registrations.

2. Relief Kit Allocation by Admin:

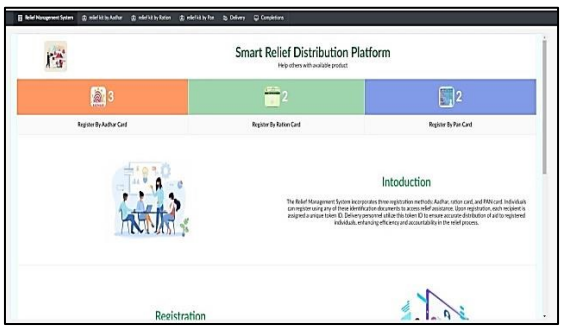

Figure 4. Smart Relief Distribution Platform – home page

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Figure 5. Details of relief kit registered people using Aadhar card.

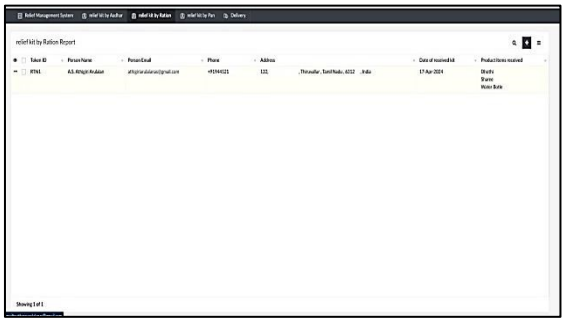

Figure 6. Details of relief kit registered people using Ration card.

Figure 7. Details of relief kit registered people using Pan card.

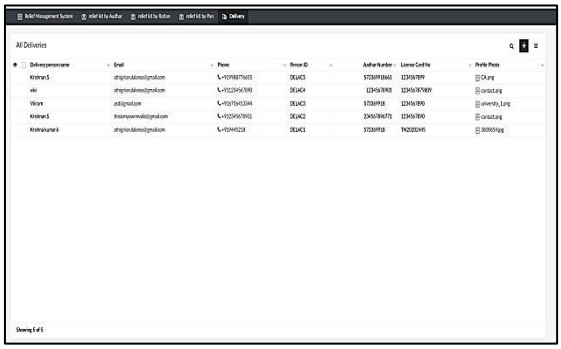

Figure 8. Details of delivery persons registered.

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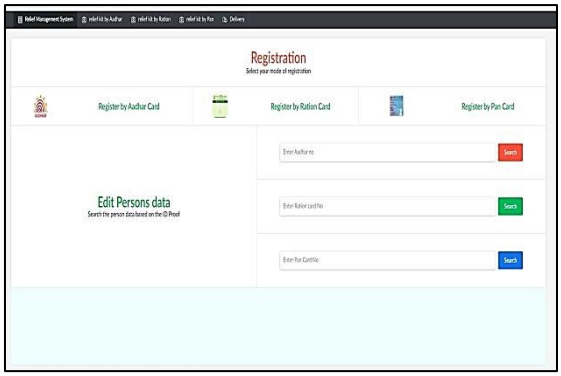

Figure 9.Admin can edit the registered user if reported as mistakes.

The Relief Management System was an advanced platform designed to streamline and optimize the distribution of relief kits during emergencies and natural disasters. It incorporated a centralized admin control, enabling administrators to oversee and manage the distribution process effectively. The system supported the allocation of resources by leveraging real-time data, ensuring that relief kits were delivered promptly and equitably to those in need. A key feature of the system was the ability to assign delivery personnel based on live user locations. This ensured that resources were allocated efficiently, minimizing delays and maximizing coverage. The system tracked deliveries in detail, recording essential recipient information such as Aadhar numbers, PAN numbers, and token IDs. This not only improved transparency and accountability but also reduced the risk of duplication or misuse of resources. Furthermore, the Relief Management System provided robust real-time tracking and reporting capabilities, enabling decision-makers to monitor progress and make informed adjustments to the distribution process as needed. The system was designed to handle large-scale operations, ensuring scalability and reliability even during peak demand periods. By integrating advanced features like geo-tagging, automated notifications, and data analytics, it empowered relief organizations to provide faster, more efficient, and targeted aid to affected individuals and communities.

3. Delivery Personnel Management:

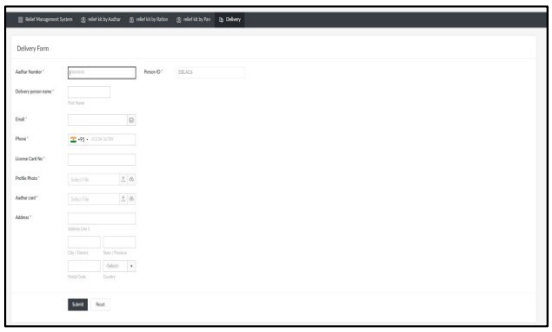

Figure 10.Registration form for delivery persons.

The registration and verification of delivery personnel using their Government IDs streamlined the distribution process. The system's live location tracking and generation of Unique Delivery IDs ensured accountability and improved task assignment. These features helped delivery personnel complete their assignments effectively, ensuring that the right resources reached the right individuals.

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4. Relief Kit Delivery:

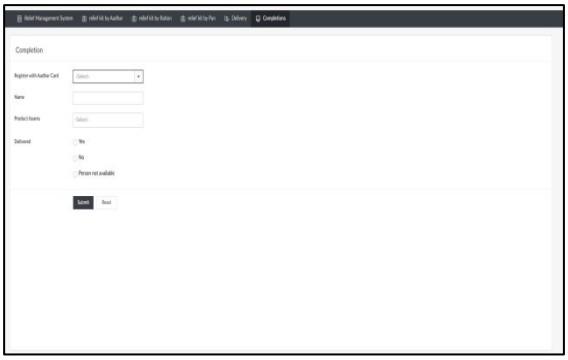

Figure 11. Delivered form for delivery persons.

The integration of live location data and Unique Token ID verification significantly enhanced the delivery process. Delivery personnel could easily locate recipients and confirm their identity before handing over the relief kits. This eliminated unauthorized claims and ensured that all transactions were accurate and transparent. Users expressed satisfaction with the timely and secure delivery of relief kits, highlighting the system's reliability in real-world scenarios.

VII. CONCLUSION:

The Smart Relief Distribution System also emphasized scalability, making it adaptable to both small and large-scale disaster events. Whether in rural areas with limited infrastructure or densely populated urban regions, the system's flexible design ensured it could cater to diverse needs and environments. Additionally, its integration with GPS tracking allowed for real-time monitoring of relief distribution, providing transparency to both aid organizations and recipients. This transparency not only fostered trust but also enabled quicker decision-making in dynamic disaster scenarios. Moreover, the system included predictive analytics, allowing for proactive measures based on demand forecasts, helping to prevent the under or over-allocation of resources. It also featured a user-friendly interface, making it accessible for all stakeholders, from government agencies to volunteers, facilitating collaboration across different levels of operation. With the added benefit of data analytics, the system generated valuable insights into disaster response patterns, which informed future planning and preparation efforts. In terms of sustainability, the system could be updated and improved through feedback loops, ensuring continuous refinement of its capabilities. The inclusion of a comprehensive reporting system enhanced accountability, ensuring that all actions and decisions were traceable. This level of transparency was essential in ensuring that relief efforts were executed ethically and efficiently. Overall, the proposed system represented a paradigm shift in disaster relief, moving away from outdated methods towards a more advanced, efficient, and community-driven approach. With its combination of real-time tracking, local involvement, and advanced resource management, it held the potential to revolutionize how relief operations were carried out globally, improving outcomes for those affected by natural disasters.
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