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AI-Driven, Self-Recovering Communication Network for Deep Disaster Zone

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Abstract: *Disaster zones often suffer from communication breakdowns due to damaged infrastructure, making coordination and rescue operations difficult. This paper presents an AI-driven self-recovering communication network designed for deep disaster areas where conventional systems fail. The proposed model integrates LoRa-based long-range communication, Delay-Tolerant Networking (DTN), and Artificial Intelligence (AI) to establish an autonomous and resilient communication link among distributed nodes. Each node operates on low-cost hardware consisting of an ESP32 microcontroller, LoRa transceiver, and a solar-powered battery system. Using TinyML models, nodes predict link degradation based on real-time parameters such as RSSI, SNR, and packet loss. Upon detecting potential failure, the system performs proactive recovery through dynamic rerouting, transmit power adjustment, or activation of backup nodes.The AI-assisted approach enhances network stability, reduces downtime, and maintains reliable data flow during disaster operations. Experimental evaluation demonstrates improved Packet Delivery Ratio (PDR) and reduced recovery time compared to traditional ad hoc methods. This intelligent and energy-efficient communication network can be rapidly deployed in inaccessible regions, providing continuous connectivity and supporting emergency response teams..*

Keywords: AI-driven network, self-recovering communication, LoRa, TinyML, disaster management, resilient connectivity.

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