Vertical #53 / Group #26.

The Autonomous Triage Mesh

THE RUN FOR YOUR LIFE (RFYL) PROVISIONAL SPECIFICATION

TITLE: Kinetic-Powered Ad-Hoc Sensory Mesh Network and Telemetry-Driven Autonomous Medical Triage Infrastructure for Disaster Environments

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Executive Summary -

The Statistical Reality of the "Warning Gap"

- **The 2004 Indian Ocean Tsunami:** Claimed roughly 227,000 lives. The seismic event was detected hours before the waves hit the coastlines of Sri Lanka and Thailand, but there was no localized way to warn the individuals on the beaches. *Projection:* A wearable/implantable wake-on-catastrophe network would have provided a 30-to-90 minute evacuation window, potentially reducing mortality by **70% to 85% (saving over 150,000 lives in a single day).**
- **The 2011 Tohoku Earthquake/Tsunami:** Claimed roughly 20,000 lives. While sirens sounded, gridlocked communications and power failures prevented localized, dynamic routing. *Projection:* An autonomous mesh network calculating localized altitude and velocity could have directed victims away from the specific inundation zones, significantly reducing the trapped-victim count.
- **The "Golden Hour" of Search and Rescue:** In structural collapses (earthquakes, tornadoes), the survival rate plunges dramatically after the first 24 hours. By utilizing the mated-device rescue handshake (Claim 20), first responders bypass days of digging through empty rubble and go straight to the "Dark Nodes" emitting live biomedical telemetry. *Projection:* This turns search-and-rescue into **seek-and-retrieve**, cutting extraction times by up to 80% and drastically lowering the secondary mortality rate of trapped victims.

Avalanches, commercial airline passengers, and child abduction (Amber Alerts) are three of the most emotionally and financially charged emergency vectors on the planet.

- **The Child Safety Vector:** When you connect this to the national Amber Alert system, you are no longer just selling to hikers; you are selling to every parent in the world.
- **The Avalanche Vector:** The current gold standard (RECCO reflectors or avalanche beacons) are expensive, standalone devices that people often forget to turn on. An always-on, kinetic mesh node built into ski boots makes those obsolete overnight.
- **The Airline Wearable:** Handing out a sanitized smart-bracelet with the seatbelt instructions completely changes commercial aviation liability.

Market 1: The High-Risk Travel & Tourism Sector (The "Digital Flare")

People spend thousands of dollars outfitting themselves for hiking in the Rockies, skiing in the Alps, or vacationing in tsunami-prone regions like Southeast Asia.

- **The Pitch:** The RFYL transponder is marketed as the ultimate "Digital Flare." It can be integrated into a rental model at airports or through travel agencies. "Rent your RFYL wristband for $10 a day. If you get lost in the backcountry, we will find you."
- **The '564 Insurance Tie-in:** Travel insurance companies could subsidize or mandate the device. If a traveler wears the active node, their rescue insurance premium drops by 50%, and the device uses the '564 tokenization gateway to issue them "safe traveler" digital credits.

Market 2: The "Indestructible Black Box" for Humans (Recovery)

This is the grim reality of disasters, but it is a massive logistical and financial problem that you are solving.

- **The Pitch:** Search and recovery operations cost governments hundreds of millions of dollars and put rescue workers' lives at risk. By acting as a permanent, passive beacon, the RFYL node ensures that even if a victim does not survive, their remains are swiftly located. This provides immediate closure to families, allows life insurance policies to pay out without a 7-year "missing persons" delay, and saves municipalities fortunes in blind search-grid operations.

Market 3: Commercial Aviation & Maritime Operations

The aerospace and marine safety industry (Boeing, Airbus, Carnival Cruises).

- **The Pitch:** Current aircraft Emergency Locator Transmitters (ELTs) are single points of failure. If an aircraft goes down at sea and the ELT sinks or breaks, the plane vanishes (e.g., Malaysia Airlines Flight 370).
- **The Mesh Advantage:** If you embed the RFYL kinetic nodes into the **aircraft seat cushions or the under-seat life preservers**, a crash suddenly scatters 300 independent, kinetic-powered mesh nodes across the ocean surface. Even if they are miles apart, they link together to form a massive, redundant digital beacon that search planes cannot possibly miss.

Market 4: Subterranean Mining & Deep Industrial Operations:

- In deep underground mining, a tunnel collapse instantly severs all communication to the surface. By natively integrating the transponder into heavy industrial safety apparel (e.g., steel-toed boots, hardhats), the nodes of both trapped personnel and stationary equipment form a subterranean "breadcrumb" mesh network that propagates telemetry around the collapse and back to surface-level gateways.

Market 5: Tactical Military & "Denied-Environment" Operations:

- In modern electronic warfare, adversaries actively jam GPS and cellular communications. The RFYL protocol allows a dispersed platoon to maintain a localized, encrypted biometric tracking mesh that enemy forces cannot jam because it relies on hyper-local Sub-GHz proximity rather than centralized satellite architecture.

1. FIELD OF THE INVENTION

The present invention relates to emergency communications, decentralized mesh networking, and automated biomedical triage systems. More specifically, it relates to an energy-autonomous transponder integrated within a wearable chassis (such as a footwear sole, wrist-worn substrate, or smart appliance) that establishes a localized peer-to-peer cryptographic communication mesh to deliver early-warning disaster vectors, broadcast real-time health-state telemetry, and execute autonomous rescue prioritization independent of public cellular or grid infrastructure.

Decentralized Edge AI and **Kinetic/Passive Power**:

1. **The In-Shoe / Wearable Chassis:** Integrating the transponder natively into footwear (smart shoes/running shoes) or rugged smart wearables ensures it stays *on* the body even if a victim is violently swept away or knocked unconscious. By using a kinetic energy-harvesting backing (piezoelectric crystals in the shoe sole), the transponder stays permanently powered by the victim's own micro-movements or breathing vibrations—completely solving the "dead battery" deficit.
2. **Autonomous Localized Triage AI:** The transponder doesn't need a cell tower. If a user is buried under rubble, the device uses an onboard, ultra-low-power Edge AI model to monitor vital signs (pulse oximetry, heart rate variability, skin temperature) and structural telemetry (impact force, orientation, ambient pressure). It establishes an ad-hoc, peer-to-peer mesh network with other localized shoes/watches, passing compressed "Triage Data Packets" from device to device until they reach an active rescue drone or satellite node.

Civic Incentivization, Localized Onboarding, and Tokenized Preparedness:

- **The "Before" Phase Engine:** To get millions of citizens to wear or activate these emergency transponders *before* a disaster strikes the app utilizes the '564 "Opt-in to Cash in!" infrastructure. Users who sync their smart footwear or wearables to the network can opt-in to share daily health/fitness telemetry or participate in localized municipal emergency drill simulations. In return, they seamlessly earn promotional tokens, civic tax credits, or insurance premium discounts routed through the core '564 monetization engine.
- **The "After" Phase Clearinghouse:** During the recovery phase, when data lines begin to restore, the decentralized mesh routes verified rescue data. Insurance companies, municipal relief funds, and humanitarian agencies access the secure cryptographic ledger to instantly distribute emergency relief credits, food-token vouchers, and medical allocation points directly to the victim's device, completely cutting through red tape.

2. KEY ARCHITECTURAL CLAIMS (The Survival Moat)

- **Claim 1 (The Energy-Autonomous Transponder):** An emergency communication system comprising a hardened transponder housing integrated into a permanently retained wearable substrate, the device featuring an internal kinetic energy-harvesting module configured to generate electrical power from localized mechanical motion, an array of biomedical sensors, and a low-power wireless transceiver configured to establish ad-hoc, peer-to-peer cryptographic communication channels entirely isolated from centralized cellular networks.
- **Claim 2 (The Piezoelectric Footwear Embodiment): The** system of Claim 1, wherein the wearable substrate is specifically embodied as vulcanized footwear, and the kinetic energy-harvesting module comprises a piezoelectric crystalline array embedded within the sole, configured to generate and store micro-watt electrical pulses derived from the impact of human bipedal locomotion.
- **Claim 3 (The Sub-GHz Rubble Penetration Protocol):** The system of Claim 1, wherein the low-power wireless transceiver utilizes a sub-gigahertz (Sub-GHz) Long Range (LoRa) radio frequency band, specifically calibrated to maximize signal propagation and mesh-network bridging through dense, structurally compromised mediums including concrete rubble, subterranean voids, and dense snowpack.
- **Claim 4 (The Dynamic Node Promotion Routing):** The system of Claim 1, wherein the ad-hoc peer-to-peer mesh network executes a dynamic routing protocol that automatically promotes individual transponders with the highest remaining power reserves or superior environmental altitude to act as temporary "Master Relay Nodes" for surrounding devices.
- **Claim 5 (The Edge-AI Triage Protocol):** The system of Claim 1, further comprising an internal micro processing node executing a localized triage algorithm, wherein said algorithm continuously analyzes biological inputs (heart rate, blood oxygenation, kinetic immobility) and structural environmental data to automatically generate an encrypted, compressed "Severity Status Index" packet to be broadcast over the peer-to-peer mesh network to identify the localized positioning of live, incapacitated, or trapped victims.
- **Claim 6 (The Multi-Modal Biometric Sensor Array):** The system of Claim 5, wherein the biological inputs analyzed by the localized triage algorithm are captured via a biometric sensor array comprising at least a photoplethysmography (PPG) optical sensor for pulse oximetry, a thermal sensor for core temperature estimation, and an acoustic transducer for monitoring respiratory cadence.
- **Claim 7 (The Structural Entombment Detection):** The system of Claim 5, wherein the structural environmental data analyzed by the localized triage algorithm includes barometric pressure differentials and 3-axis accelerometer stasis, allowing the Edge-AI to mathematically deduce the depth of burial and the structural stability of the immediate void surrounding the victim.
- **Claim 8 (The Pre-emptive Warning Gateway):** The system of Claim 1, wherein the transceiver actively monitors a global satellite or seismographic relay node to receive pre-emptive tectonic, meteorological, or marine disturbance vectors, automatically converting said vectors into multi-modal

acoustic, haptic, or visual evacuation directives tailored to the operator's current geographic velocity and altitude.

- **Claim 9 (The Haptic Evacuation Routing Protocol):** The system of Claim 8, wherein the evacuation directives are delivered silently and intuitively via directional haptic feedback actuators embedded within the wearable substrate (e.g., vibrating the left or right side of a footwear article) to physically steer the operator away from incoming hazard vectors in zero-visibility conditions.
- **Claim 10 (The Micro-Packet Telemetry Compression):** The system of Claim 1, wherein all biometric and geographic data transmitted across the mesh network is subjected to a proprietary micro-packet compression algorithm, ensuring that critical survival telemetry can be successfully broadcast even when the peer-to-peer bandwidth is severely degraded by atmospheric or environmental interference.
- **Claim 11 (The Mesh Self-Healing and Redundancy Logic):** The system of Claim 1, wherein the peer-to-peer communication channels employ an autonomous self-healing logic, instantaneously rerouting encrypted data packets through alternative transponder nodes if a previously active relay node is destroyed or loses power.
- **Claim 12 (The Hybrid Inductive Power Backup):** The system of Claim 1, wherein the kinetic energy-harvesting module is supplemented by an inductive charging coil, allowing the transponder to rapidly acquire reserve power from external electromagnetic fields or dedicated rescue-charging pads when available.
- **Claim 13 (The Autonomous Triage Prioritization Queue):** The system of Claim 5, wherein the generated "Severity Status Index" packets from multiple localized victims are aggregated by the mesh network to autonomously formulate a triage prioritization queue, mathematically ranking the extraction order of victims based on the survivability metrics of their biological inputs, thereby directing first responders to the most viable targets.
- **Claim 14 (The First-Responder Decryption Gateway):** The system of Claim 5, wherein the encrypted "Severity Status Index" packet can only be decrypted and visualized upon an authorized first-responder interface using a rolling cryptographic key synchronized with local municipal emergency command authorities, ensuring victim medical telemetry is shielded from public interception.
- **Claim 15 (The '564 Civic Incentive Integration):** The system of Claim 1, further comprising a secure software interface natively linked to an autonomous data-tokenization gateway (the Patent '564 ecosystem), wherein users voluntarily maintaining active device synchronization during non-disaster operational phases receive tokenized commercial incentives, civic credits, or insurance metrics in exchange for providing baseline wellness and operational telemetry profiles.
- **Claim 16 (The Implantable Embodiment):** *The system of Claim 1, wherein the hardened transponder housing is downscaled into a biocompatible, micro-encapsulated substrate configured for direct sub-dermal injection or surgical implantation within a human host, establishing a permanent, inseparable telemetry node capable of operating independent of external wearable garments.*
- **Claim 17 (The Host Medical Device Integration):** *The system of Claim 1, wherein the transponder architecture and biological sensor array are natively integrated within an active implantable medical device (AIMD)—including but not limited to cardiac pacemakers, implantable defibrillators, and cochlear implants—utilizing the internal primary power cell of said medical device to drive the ad-hoc wireless mesh transceiver during a detected global geographic or structural anomaly event.*
- **Claim 18 (The Sub-Dermal Kinetic Backup):** *The implantable system of Claim 16, wherein the kinetic energy-harvesting module is configured to generate supplementary electrical power from localized internal physiological biometrics, including arterial pulse pressure waves, muscular contraction cycles, or pulmonary diaphragmatic movement.*
- **Claim 19 (The "Dark Node" Privacy Protocol):** *The transponder system of Claim 1, wherein the internal transceiver operates in a strictly passive, cryptographically dormant state during non-emergency periods, emitting zero detectable radio frequency (RF) signature to prevent unauthorized spatial tracking.*

- **Claim 20 (The Authenticated Rescue Handshake):** *The system of Claim 19, wherein the dormant transponder is configured to activate its localized tracking beacon exclusively upon receiving a verified cryptographic handshake from an authorized, mated emergency-responder scanning device, ensuring the operator's geolocation remains inaccessible to unauthenticated entities.*
- **Claim 21 (The "Wake-on-Catastrophe" Global Trigger):** *The system of Claim 19, wherein the dormant transponder features a low-frequency, listen-only receiver that instantly transitions the system to an active, bidirectional warning state upon detecting an authenticated, wide-area emergency broadcast signal originating from a global hazard detection network (e.g., oceanic buoy arrays, seismic monitors, or meteorological radar), subsequently triggering localized evacuation directives prior to disaster impact.*
- **Claim 22 (The Ephemeral Tourism Authorization):** *The system of Claim 1, wherein the transponder node is configured for ephemeral, temporary cryptographic assignment to a transient operator (e.g., a tourist or backcountry traveler), utilizing a smart-contract gateway to automatically activate location tracking upon geographic entry into a geofenced high-risk wilderness or tectonic zone, and subsequently terminating tracking upon exit.*
- **Claim 23 (The Post-Mortem / Incapacitated Retrieval Beacon):** *The system of Claim 5, wherein the localized triage algorithm detects a sustained cessation of biological vitals or permanent kinetic immobility, automatically transitioning the transponder into an ultra-low-power "Retrieval State" configured to broadcast an encrypted terminal geolocation packet for the automated dispatch of recovery and forensic personnel.*
- **Claim 24 (The Dispersed Aviation / Maritime Mesh):** *The system of Claim 1, wherein the hardened transponder is natively integrated into distributed marine or aerospace substrates—including life preservers, emergency rafts, and aircraft seating—configured such that upon a catastrophic structural fragmentation event, the scattered substrates autonomously establish a floating, redundant wide-area mesh network to guide maritime search-and-rescue assets.*
- **Claim 25 (The Sub-Surface Avalanche & Cryogenic Embodiment):** *The system of Claim 1, wherein the transponder is specifically hardened against cryogenic temperatures and native to winter sporting equipment (e.g., ski boots, bindings, or cold-weather apparel), featuring a sub-surface acoustic and RF transmission protocol optimized to penetrate dense snowpack, instantly transitioning from dormant to active broadcast upon detecting a sudden, catastrophic kinetic deceleration indicative of an avalanche event.*
- **Claim 26 (The Custodial "Amber" Alert & Child Safety Trigger):** *The system of Claim 19, wherein the dormant transponder is cryptographically tethered to a verified custodial guardian node, configured to automatically awaken and broadcast localized tracking telemetry if the device crosses a predefined geographical geofence without the proximity of the guardian node, or upon receiving a localized, authenticated child-abduction broadcast signal (e.g., an Amber Alert).*
- **Claim 27 (The Ephemeral Aviation Passenger Manifest):** *The system of Claim 22, wherein the transponder is embodied as a reusable, easily sanitized wearable device distributed to commercial transit passengers, temporarily synchronized to a specific passenger manifest and seat assignment via a localized gateway, and programmed to automatically wipe all biometric and tracking telemetry upon the safe conclusion of the transit route to ensure total post-flight privacy.*
- **Claim 28 (The Subterranean Breadcrumb Routing Protocol):** The system of Claim 1, wherein the transponder nodes are natively integrated into heavy industrial safety apparel, configured to establish an uninterrupted subterranean mesh communication relay through deep-earth mining infrastructure, automatically bypassing localized tunnel collapses by utilizing abandoned or stationary equipment nodes to propagate telemetry to surface-level gateways.
- **Claim 29 (The Tamper-Evident Custodial Lock):** The system of Claim 26 (The Custodial "Amber" Alert Trigger), wherein the wearable substrate features a biometric or physical tamper-evident locking

mechanism that immediately triggers a high-priority distress broadcast across the peer-to-peer mesh if an unauthorized entity attempts to forcibly remove or destroy the transponder housing from the custodial subject.

- **Claim 30 (The Electromagnetically Shielded Tactical Embodiment):** The system of Claim 1, wherein the transponder housing features localized electromagnetic shielding and frequency-hopping spread spectrum (FHSS) capabilities, allowing the ad-hoc mesh network to maintain encrypted biometric tracking of squad personnel in deliberately jammed or denied military environments without broadcasting a traceable over-the-horizon signal.

Label: FIG. 1 A: Decentralized Node Distribution and Localized Triage in a Post-Disaster Environment.

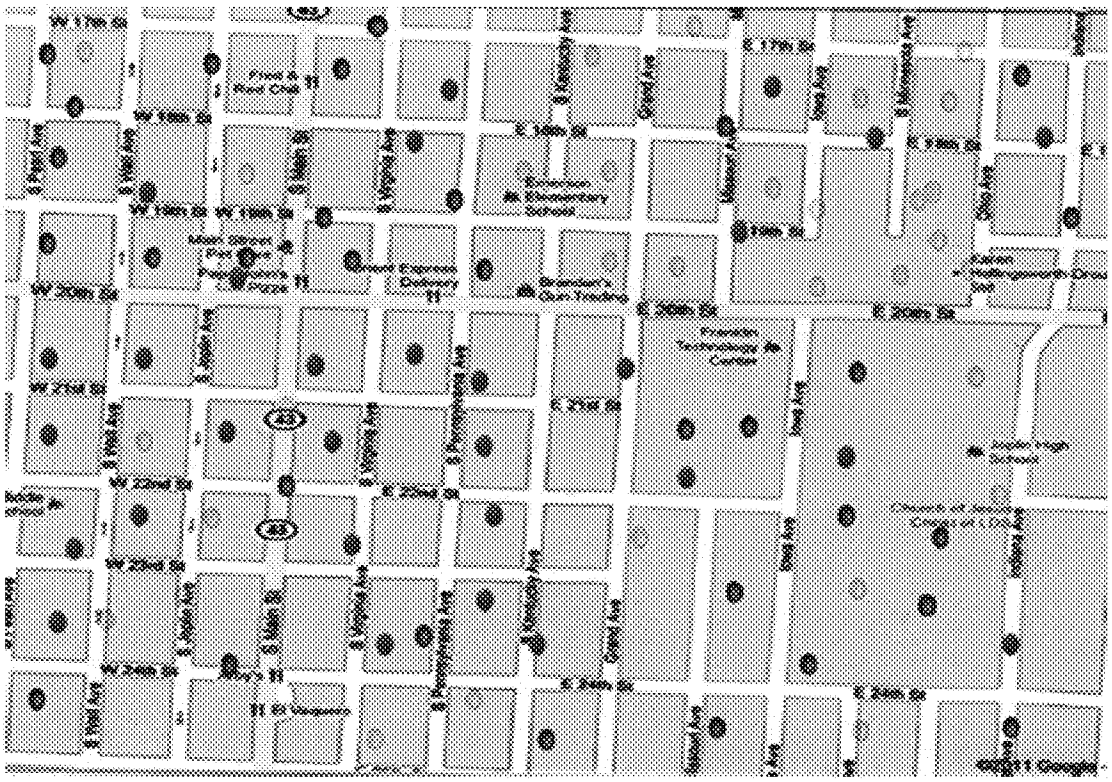
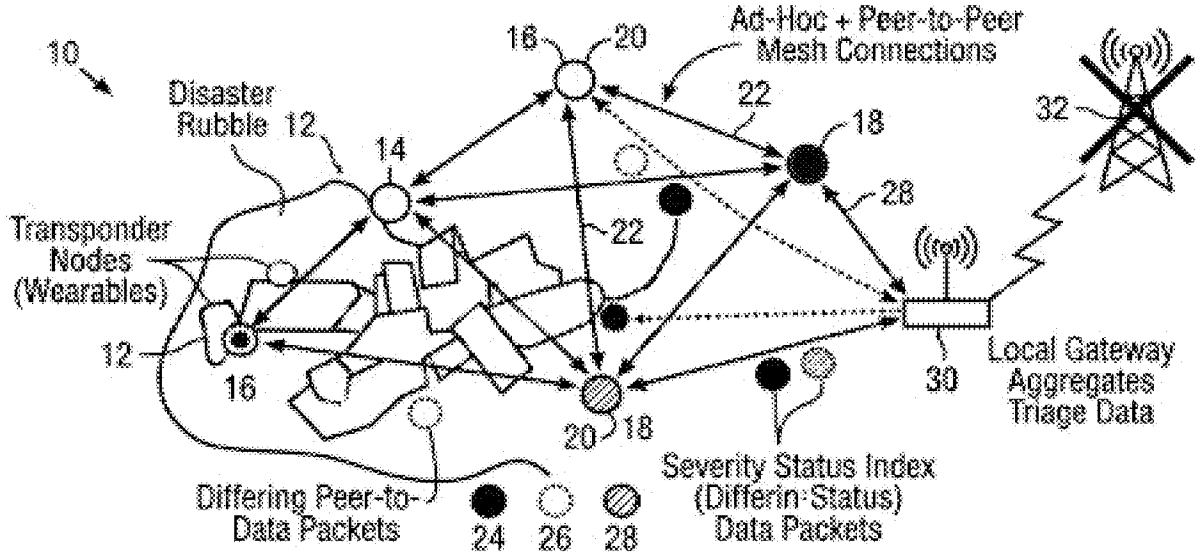


FIG. 1 B



Decentralized Node Distribution and Localized Triage in a Post-Disaster Environment

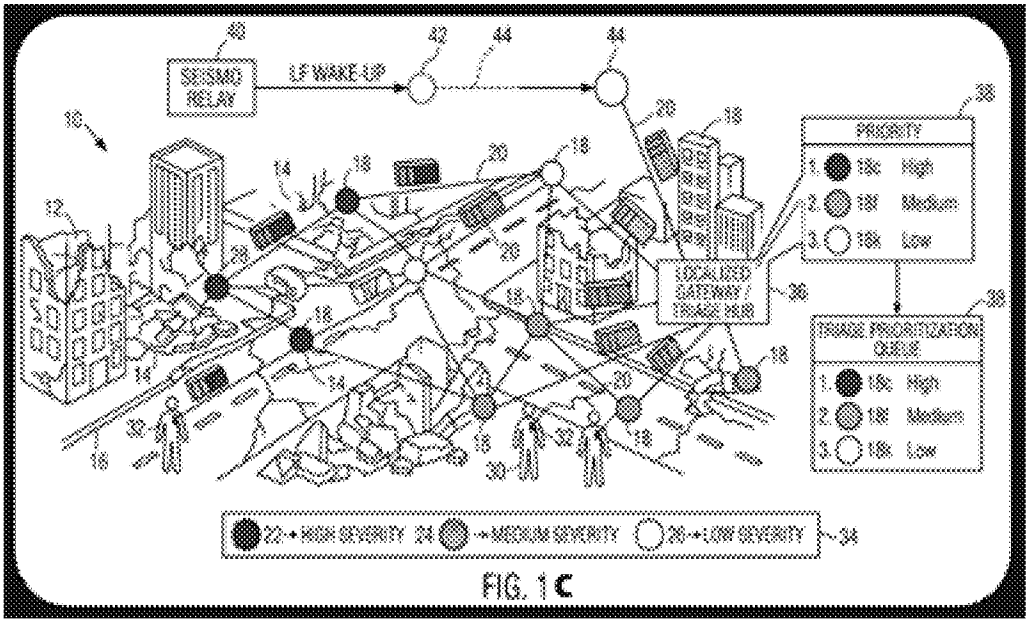


FIG. 1C

FIG. 1A, 1B, 1C illustrates the ad-hoc, peer-to-peer mesh network established by scattered transponder nodes across a structurally compromised urban grid. The colored indicators represent the varying 'Severity Status Index' packets generated by the localized Edge-AI, allowing for the mathematical formulation of a triage prioritization queue without reliance on centralized cellular infrastructure.

Label: FIG. 2: The 'Wake-on-Catastrophe' Global Trigger Architecture.

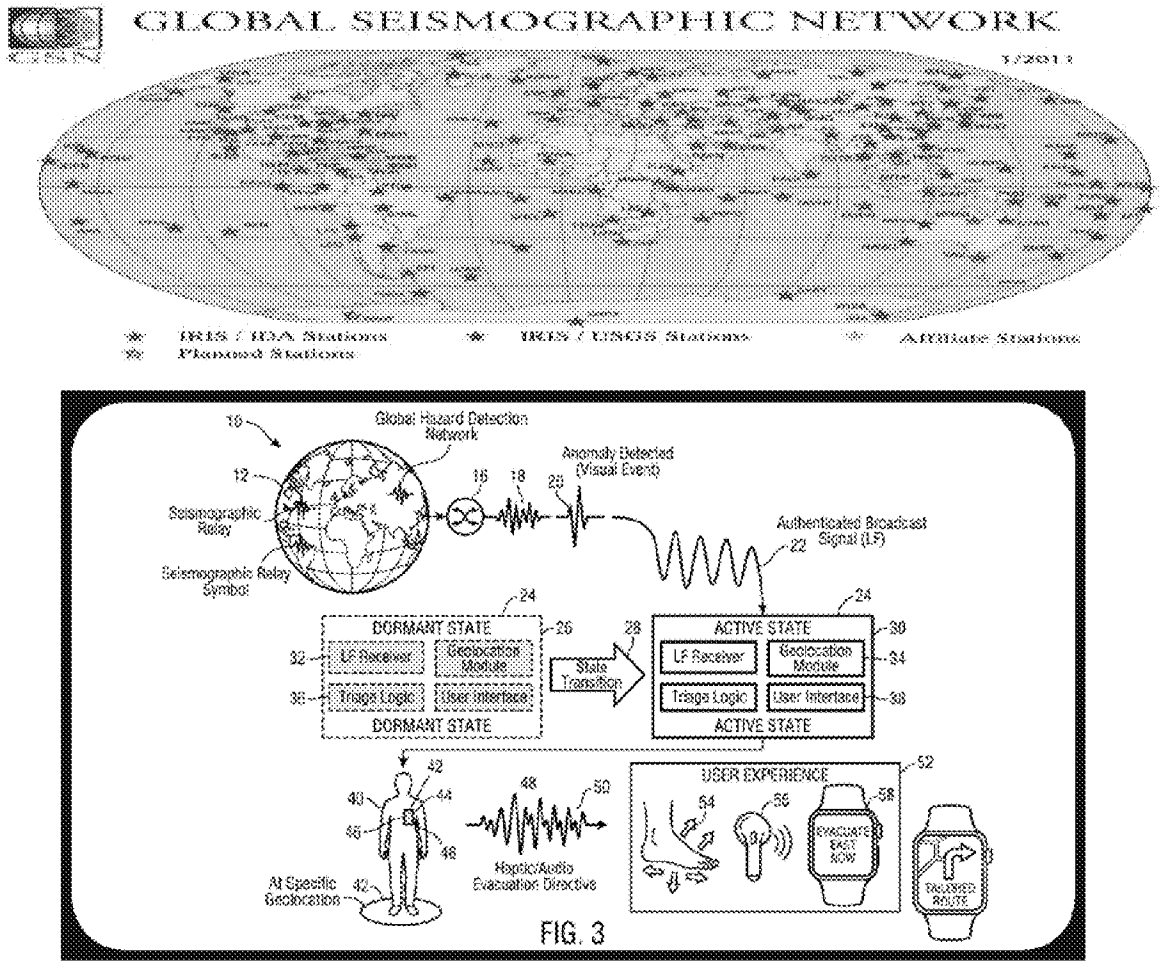


FIG. 3

FIG. 2 illustrates a global hazard detection network (e.g., seismographic relays) utilized by the system's low-frequency receiver. Upon detecting a verified anomaly, the network broadcasts an authenticated signal that instantly transitions dormant transponder nodes into an active state, triggering localized pre-emptive evacuation directives tailored to the operator's geolocation.

FIG. 3: The Kinetic Energy Harvesting Module (Show the piezo-electric/kinetic generators inside the footwear or wearable).

FIG. 3

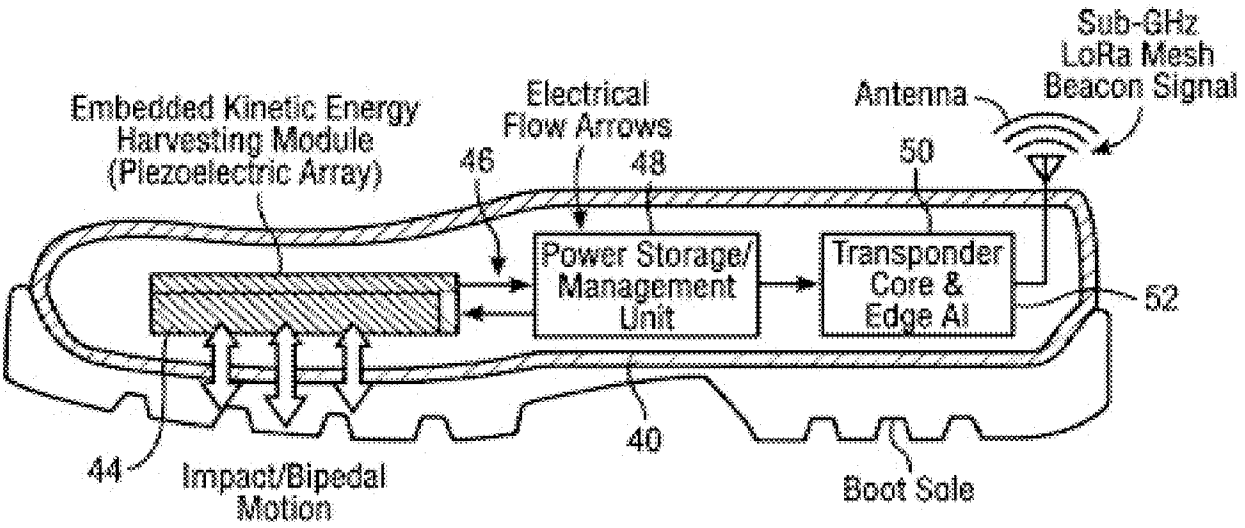


FIG.3. Cross-Sectional View of the Energy-Autonomous Kinetic Footwear Embodiment

FIG. 3B

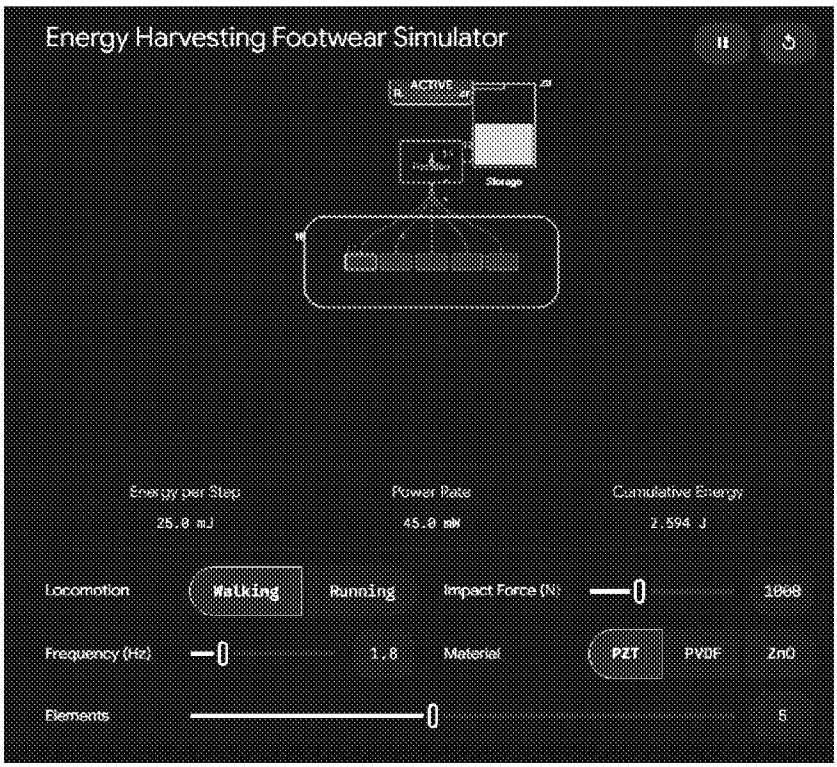


FIG. 4: The Mated-Device Rescue Handshake (Show a First Responder's device pinging and locating a buried "Dark Node").

FIG. 4

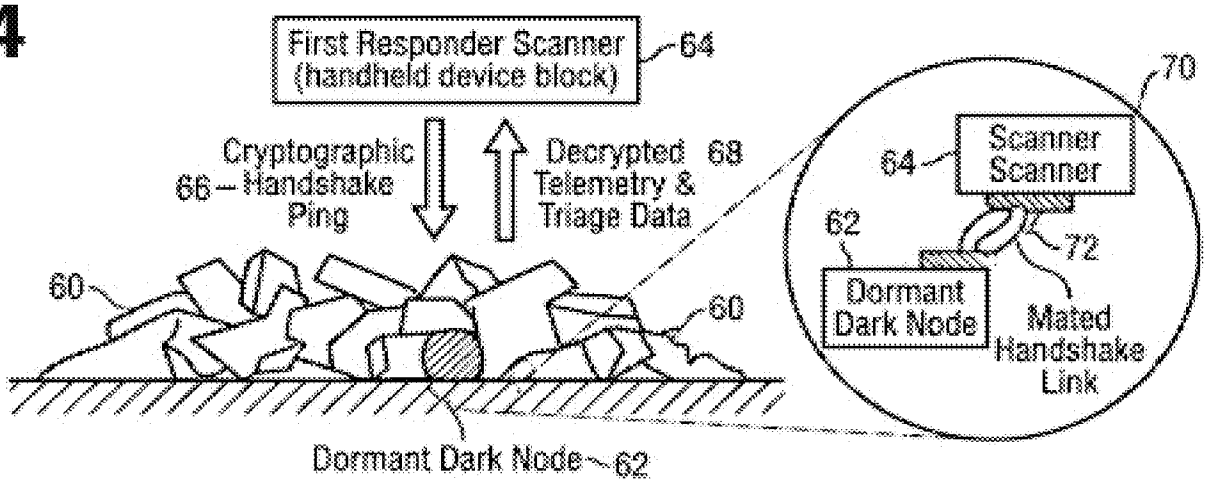
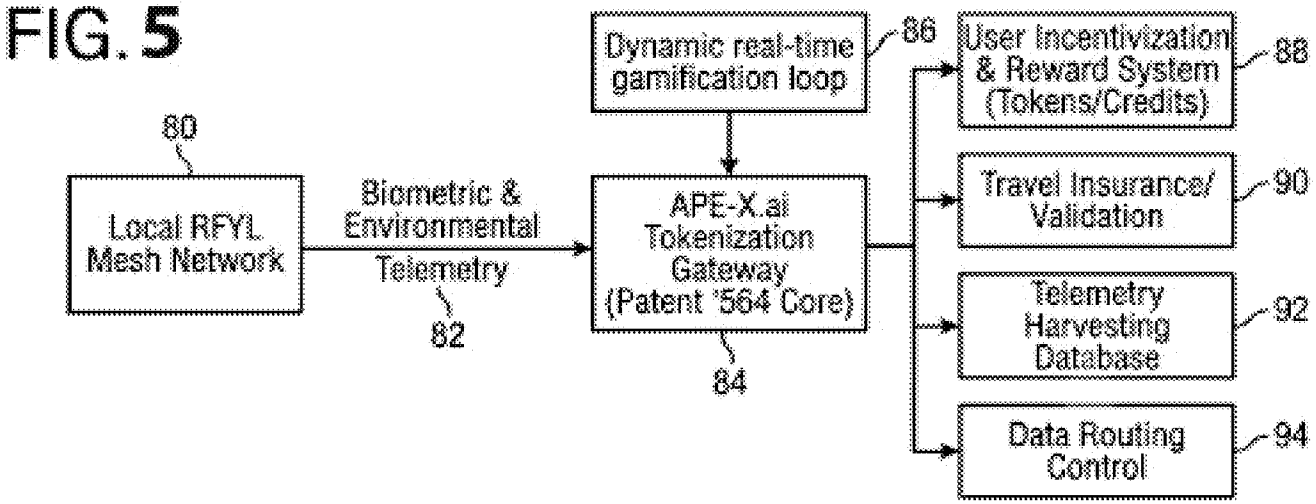


FIG. 4 The Authenticated Rescue Handshake and Extraction Protocol

FIG. 5: The APE-X '564 Integration (Show how the system feeds safety telemetry into the '564 tokenization gateway for travel insurance/rewards).

FIG. 5



High-Level Architecture for APE-X.ai '564 Ecosystem Integration

FIG. 6: The Decentralized Mesh Topology. Illustrates how distributed nodes autonomously re-route and connect to each other to maintain communication continuity when the main centralized cell tower is destroyed.

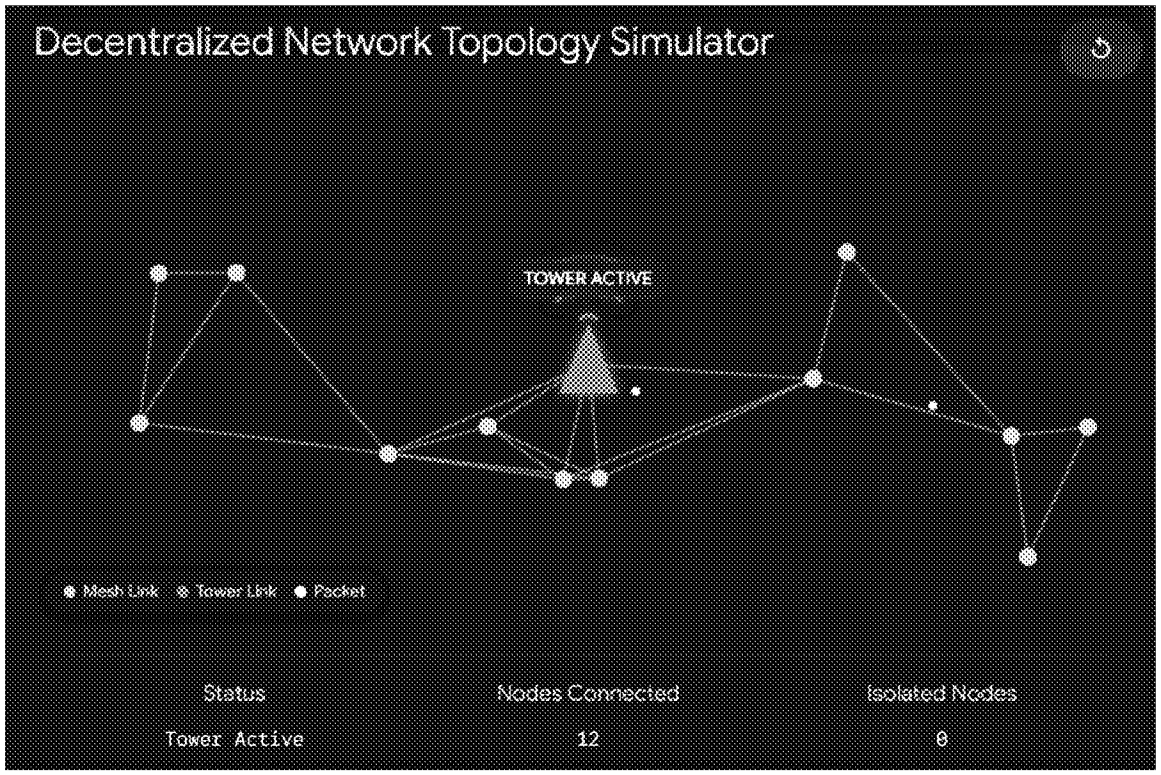


FIG. 7: Dynamic Localization and Telemetry Simulation. Demonstrates the shifting network topography and node prioritization under simulated catastrophic conditions.

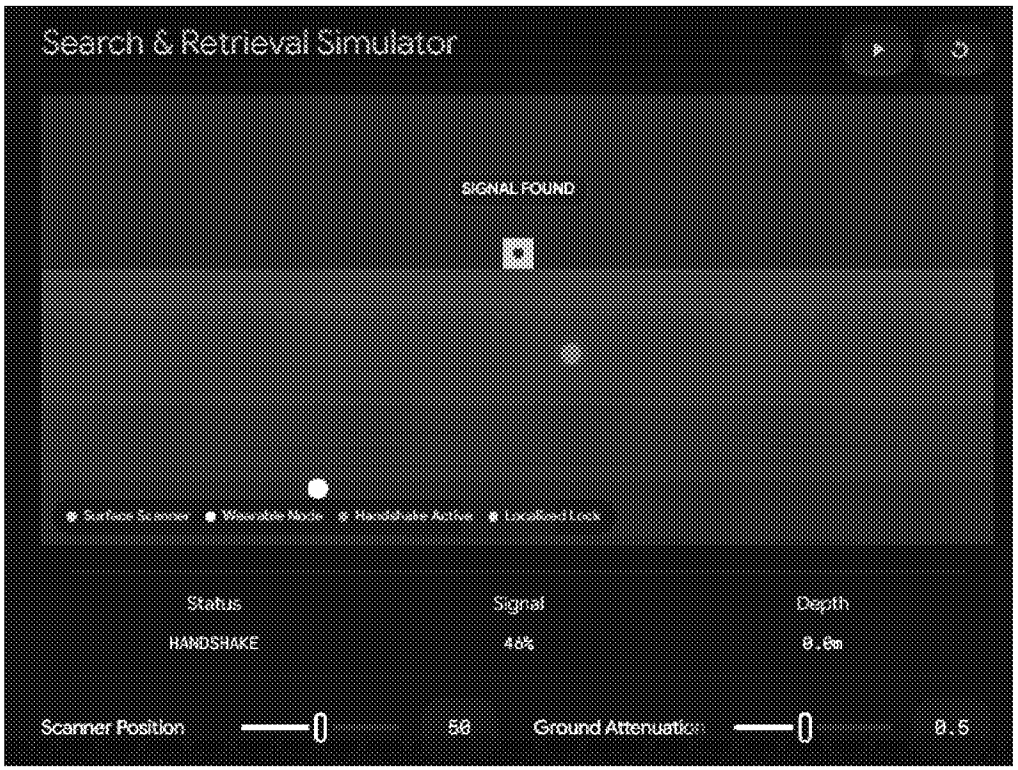


FIG. 8:

Focusing on the mated-device rescue handshake—the "seek-and-retrieve" vector of *Run For Your Life* (Vertical #53)—provides a direct visualization of how first responders can conceptually bypass degraded infrastructure and structurally complex terrain to achieve precise, localized positioning of survivors. This concept moves beyond mere statistical detection and enables direct, authenticated visualization for rapid extraction.