**Literature Review**

**Introduction**  
Disaster response in Liberia needs faster alerts and better monitoring. Floods and bushfires affect lives and infrastructure. Our research is important because it links citizen reports with AI-based satellite monitoring. A review of existing work is necessary to see what has been done, what works, and where the gaps are.

**Organization**  
Citizen-centered crisis reporting and coordination  
Satellite-based hazard monitoring and mapping  
AI models for disaster detection and response

**Summary and Synthesis**  
Copernicus Emergency Management Service  
• Methodology: Sentinel data used for flood and fire hazard mapping  
• Findings: Satellite analysis reduced response times across Europe  
• Contribution: Proves feasibility of rapid hazard mapping with satellite data

**Ushahidi Crisis Mapping, Kenya**  
• Methodology: Collected citizen reports by SMS and web, mapped them with geospatial tools  
• Findings: Enabled coordination in low-bandwidth settings  
• Contribution: Validates value of community input, similar to the ResQNet+ approach

**MODIS and VIIRS Fire Detection Studies**• Methodology: Thermal hotspots tracked with satellite sensors  
• Findings: Reliable for bushfire activity at continental scale  
• Contribution: Informs ResQNet+ fire monitoring in Liberia

**Comparison**  
Copernicus is institutional, with advanced mapping for governments. Ushahidi is grassroots, with citizen-driven data. MODIS and VIIRS add large-scale fire detection. ResQNet+ combines these elements into one system for Liberia.

**Conclusion:**   
Existing studies show the value of both institutional satellite data and citizen-driven reporting. The gap is local, real-time monitoring for resource-limited countries. ResQNet+ addresses this by merging mobile alerts with AI-based satellite analysis.

**Data Research**

**Introduction**  
Reliable data is central to hazard monitoring. Your project depends on satellite data, population exposure data, and citizen reports. A thorough exploration of data sources shows how they support your project goals.

**Organization**

1. Satellite-based data
2. Ancillary data
3. Crowd-sourced data

**Data Description**Satellite Data  
• Sentinel-1 SAR, GeoTIFF, used for radar-based flood mapping  
• Sentinel-2 optical, GeoTIFF, used for NDWI and NDVI vegetation and water analysis  
• MODIS and VIIRS, CSV or GeoJSON, used for fire hotspot detection

**Ancillary Data**  
• WorldPop and LISGIS for population distribution  
• OSM for roads and health facilities  
• CHIRPS rainfall data for flood and drought analysis

**Crowd-sourced Data**  
• ResQNet in-app reports in JSON or CSV  
• SMS or USSD for low-bandwidth users

**Preprocessing**  
• Calibration and filtering of Sentinel-1  
• Cloud masking and mosaicking of Sentinel-2  
• Index calculation and alignment  
• Ground truth from NDMA, LISGIS, and Red Cross

**Data Analysis and Insights**  
• Sentinel-1 is strong for flood detection under cloud cover  
• Sentinel-2 adds vegetation and water index analysis  
• MODIS and VIIRS detect fire hotspots, but at lower resolution  
• Citizen reports fill data gaps in time and space

**Conclusion:**   
The data mix provides both environmental and social context. Combining satellite and community input ensures stronger analysis and validation. This supports real-time monitoring and targeted alerts in Liberia.

**Technology Review**

**Introduction**  
Technology choices shape the success of ResQNet+. You need tools for geospatial processing, AI analysis, and mobile communication. Reviewing available options shows their strengths and weaknesses.

**Technology Overview**  
• Google Earth Engine for large-scale satellite analysis  
• U-Net and DeepLab for flood and fire image segmentation  
• Gradient Boosting and Isolation Forest for anomaly detection in time-series  
• Android app for citizen alerts and first-aid training  
• SMS and USSD integration for inclusion in low-connectivity areas

**Relevance to Project**  
Google Earth Engine handles large datasets with low infrastructure cost. AI models improve precision of hazard maps. Mobile apps provide access in cities. SMS and USSD keep rural populations engaged.

**Comparison and Evaluation**  
• Google Earth Engine reduces costs but requires internet. Local processing avoids this but is slower  
• U-Net is more accurate than simple thresholding but needs training data  
• SMS and USSD are less rich than apps but reach more users

**Use Cases and Examples**  
• Copernicus EMS uses Sentinel data for rapid hazard mapping  
• Red Cross Missing Maps project links OSM and community mapping  
• Ushahidi uses SMS and web inputs for real-time crisis coordination

**Gaps and Research Opportunities**  
• Limited Liberia-specific training data calls for partnerships with local agencies  
• Dependence on internet services requires fallback systems for offline use

**Conclusion:**   
The selected technologies match the project goals. They balance accuracy, cost, and accessibility. ResQNet+ uses proven platforms and adapts them to Liberia’s emergency needs.