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PROJECT CONCEPT PROPOSAL

Project Concept

Proposed Project Title/Area

A Smart Maternal Emergency Response System (SMERS) for Maternal Health in Kenya.

Previous Projects done/Languages/frameworks used

1. **Kenya Police Sentiment Analysis:** A project that utilized natural language processing (NLP) and machine learning to analyze public sentiment towards the Kenya Police Service. This involved using Python libraries such as NLTK, TextBlob, and VADER, which are known for their effectiveness in processing and analyzing sentiment in social media and other informal text.
2. **Bus Reservation System:** A full-stack application designed to manage bus routes, reservations, and ticketing. The system's architecture included a back-end that handled real-time inventory, schedules, and pricing, and a user-facing front-end with a seat mapping interface. This project provided hands-on experience in managing data integrity, integrating payment gateways, and ensuring a seamless user experience across different platforms.
3. **Copilot Project Management System:** An application that explored the use of artificial intelligence to automate and streamline project management tasks. The system was designed to leverage tools like Microsoft Copilot to automate manual steps such as generating meeting minutes from transcriptions, drafting reports and emails, and providing data-driven insights to aid in decision-making. The project demonstrated how AI can improve work efficiency by allowing project managers to focus on more strategic activities.
4. **BOLLCH AidTrack:** An aid management system designed specifically for orphanages and children's homes. The project focused on creating a platform to manage and monitor the distribution of resources, including features for inventory management, resource allocation, and tracking the welfare of the children. This provided valuable experience in building robust, database-driven systems tailored for social and humanitarian applications.
5. **Radar Activism Hub:** A platform for social and political activism. The system was designed to function as a central hub for activists, providing tools for real-time data collection, information dissemination, and community coordination. The project emphasized the use of technology to facilitate collective action and enhance the impact of social movements.

Project Background and Justification

Maternal mortality remains a significant public health challenge in Kenya. Despite a national decline in the maternal mortality ratio (MMR) to 149 deaths per 100,000 live births in 2023 (World Bank, 2023; Knoema, 2024), this figure is disproportionately high in urban informal settlements. For example, research in Nairobi slums shows an MMR of 706 deaths per 100,000 live births, a rate more than four times the national average (APHRC, n.d.). This project is designed to address a primary factor contributing to this crisis: the "second delay" in maternal healthcare, which refers to the logistical challenges of reaching a health facility (Bhattacharjee & Singh, 2023; Maternity Worldwide, n.d.).

The SMERS platform is a technological intervention aimed at bridging this critical gap. It will leverage widely accessible mobile technologies and a community-based transport model to provide a low-cost, immediate solution for expectant mothers in these vulnerable areas. This approach is informed by the success of similar digital health initiatives in Africa, such as Tanzania's m-mama program and Kenya's Flare platform, which have demonstrated the effectiveness of digital dispatch systems and community taxis in reducing emergency response times (Ndungu et al., 2024; Rescue.co, 2025).

Project Objectives

The primary objective of this project is to develop and evaluate a functional prototype of the SMERS platform.

This will be achieved through the following specific objectives:

1. To architect and implement a dual-channel mobile interface (USSD and WhatsApp) to enable the initiation of emergency requests by mothers or their caregivers.
2. To design and integrate a network of community responders (e.g., boda boda riders, tuk-tuks) for immediate, localized emergency transport.
3. To develop a centralized, hospital-facing dashboard capable of receiving real-time emergency notifications and patient information.
4. To implement a prototype rule-based AI triage algorithm for the prioritization of high-risk cases and the optimal allocation of the nearest available responder (GeeksforGeeks, n.d.; GoRules.io, n.d.).
5. To conduct a simulation-based evaluation of the system's effectiveness in reducing emergency response times and to document its technical feasibility.

Project Scope

This project is intentionally scoped as a Minimum Viable Product (MVP) to be developed and evaluated within a single, representative ward, such as Kibera or Kinamba (Paz et al., 2023; APHRC, n.d.). The project will focus on the healthcare sector and will not cover full-scale, real-world deployment. The main delimitation is the use of simulated GPS and movement data instead of real-time location tracking. This approach allows for the validation of the system's core logic and its potential impact in a controlled environment, mitigating the logistical and financial complexities of a live deployment (Rescue.co, 2025).

Proposed Methodology

The project will follow an Agile development methodology over a 12-week timeline.

a) System Architecture

A microservices-oriented architecture will be used. The front-end will be a web-based dashboard developed with React.js, while the back-end will be a RESTful API built with a Node.js/Express.js framework. PostgreSQL and MongoDB will serve as the databases for structured and unstructured data, respectively (AfricaShore, n.d.; Upwork, n.d.). The Twilio API will be integrated for the communication layer, supporting both WhatsApp and the indispensable USSD protocol, which functions without internet or a smartphone (Communications Authority of Kenya, 2024; DataReportal, 2024; Twilio, n.d.).

b) Triage Algorithm

A transparent, rule-based AI system will be implemented for the MVP. This is an ethical design choice that ensures the system's decision-making logic is explicit and auditable, addressing concerns about accountability in AI applications (Council of Europe, n.d.; World Scientific, 2024).

Expected Outcomes/Deliverables

The project will result in a functional software prototype of the SMERS platform. The deliverables will include a comprehensive project report, technical documentation (including system design specifications and a user guide), a research paper manuscript, and a fully documented GitHub repository with the complete source code. The broader goal is to demonstrate a significant reduction in simulated emergency response times, proving the system's potential to save lives by addressing the critical transport gap.

Timeline

The project will be executed over a 12-week timeline, divided into three phases:

1. **Phase 1 (Weeks 1-4):** Research, Design, and Architecture.
2. **Phase 2 (Weeks 5-10):** Development and Integration of the core system components.
3. **Phase 3 (Weeks 11-12):** Simulation, Testing, and Final Reporting.

Resources Required

1. **Personnel:** The project requires a single, proficient individual with full-stack development skills (Node.js and React.js) to perform the roles of developer, UI/UX designer, and project manager.
2. **Hardware and Software:** Access to a cloud hosting platform (e.g., AWS, GCP), a paid subscription to the Twilio API, and standard development tools such as GitHub.
3. **Cost:** The project is designed to be cost-effective, leveraging open-source technologies and a simulated environment. The estimated cost for a custom software solution of this nature in Kenya can range from KES 500,000 and upwards (Daebak.co.ke, 2025).

Potential Challenges and Mitigation

1. **Technical: Inconsistent Connectivity:** This challenge is mitigated by the dual-channel design, using USSD as a fallback for areas with poor internet access (Communications Authority of Kenya, 2024; DataReportal, 2024).
2. **Operational: The Risks of Informal Transport:** This risk will be mitigated by partnering with local boda boda associations and implementing mandatory training programs for responders (African Institute for Capacity Development, 2022; Okoth, 2025; “The Dangerous Boda Boda Transport Mode...”, n.d.).
3. **Ethical: Algorithmic Bias and Accountability:** This will be addressed by using a transparent, rule-based AI system that allows for explainable and traceable decisions (Council of Europe, n.d.; GeeksforGeeks, n.d.).
4. **Scalability and Sustainability:** The MVP approach provides a low-cost, fundable model that can be used to attract future partnerships with government bodies and NGOs for scaling (Paz et al., 2023; PATH, n.d.).

Github/Git

Repository to be made after the project concept is approved by the professor.

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