



**NAME: SWAFIYAH GICHUKI**

**ID. NO.: 665725**

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**REFINED PROJECT CONCEPT**

# 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**

This project addresses the persistent public health challenge of maternal and neonatal mortality in Kenya. According to a 2025 report by UNFPA Kenya, the maternal mortality ratio (MMR) is approximately 355 deaths per 100,000 live births, while the neonatal mortality rate (NMR) stood at around 21 deaths per 1,000 live births in 2022. These figures are demonstrably high, exceeding Sustainable Development Goal targets and falling below global averages. This project is designed to mitigate a primary contributing factor to these deaths: the "second delay," which is the logistical challenge of transporting expectant mothers to a health facility.

The SMERS platform is conceived as a technological intervention to bridge this critical gap. The proposed system will leverage widely accessible mobile technologies, specifically USSD and WhatsApp, and a community-based transport network to provide a cost-effective, 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 principal objective of this project is to develop and evaluate a functional prototype of the SMERS platform to validate its technical feasibility and potential impact. This will be accomplished by pursuing the following specific objectives:

1. To architect and implement a dual-channel mobile interface utilizing USSD and WhatsApp protocols to facilitate the initiation of emergency requests by patients or their caregivers.
2. To design and integrate a localized network of community responders for immediate emergency transport.
3. To develop a centralized, hospital-facing dashboard capable of receiving real-time emergency notifications and patient data.
4. To implement a rule-based AI triage algorithm for the prioritization of high-risk cases and optimal allocation of the nearest available responder.
5. To conduct a simulation-based evaluation to measure the system's effectiveness in reducing emergency response times and to document its technical feasibility.

## **Project Scope**

This project is delimited as a Minimum Viable Product (MVP) to be developed and evaluated within a single, representative urban informal settlement. The scope will focus on the healthcare sector and will not encompass a full-scale, real-world deployment. A primary delimitation is the use of simulated GPS and movement data rather than real-time location tracking. This methodology allows for the validation of the system's core logic and its potential impact within a controlled environment, which mitigates the logistical and financial complexities associated with a live deployment. (Rescue.co, 2025).

## Proposed Methodology

The project will follow an Agile development methodology over a condensed 9-week timeline. This approach facilitates iterative development and continuous integration, which is essential for a short-term project. The methodology will prioritize the development of a functional MVP that can be rigorously tested and evaluated within the given timeframe.

- 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. 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.). This design choice is a mitigation strategy for inconsistent connectivity in urban informal settlements.
- 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 (Council of Europe, n.d.; World Scientific, 2024). This is crucial for addressing concerns about algorithmic accountability in a healthcare context .

## Expected Outcomes/Deliverables

The project will result in a functional software prototype of the SMERS platform. The deliverables will be adjusted to align with the compressed schedule while maintaining academic rigor.

- a) **Software Prototype:** A demonstrable MVP of the SMERS platform with core functionalities, including a dual-channel mobile interface and a hospital-facing dashboard.
- b) **Technical Documentation:** Comprehensive documentation detailing the system's design specifications, architecture, and a user guide for the prototype.
- c) **Project Report:** A final report that summarizes the research, methodology, development process, and the outcomes of the simulation-based evaluation.

- d) **GitHub Repository:** A fully documented repository containing the complete source code, demonstrating a functional and reproducible prototype.

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 9-week period, with the phases adjusted to a more aggressive schedule.

- a) **Phase 1 (Weeks 1-3): Research, Design, and Architecture.** This phase will involve a focused sprint on finalizing the system's architecture, defining the core functionalities, and establishing the database schemas.
- b) **Phase 2 (Weeks 4-7): Development and Integration.** This is the core development period, where the front-end, back-end, and the Twilio API integration will be built. The rule-based AI triage algorithm will also be implemented during this phase.
- c) **Phase 3 (Weeks 8-9): Simulation, Testing, and Final Reporting.** The final two weeks will be dedicated to conducting a simulation-based evaluation to measure the system's effectiveness and to prepare all final deliverables, including the project report and technical documentation.

## 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.

## 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

<https://github.com/Swaph/smers>

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