

Edu-Act Peru

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August 17, 2022

1 Introduction

1.1 Background

Throughout Peru, access to healthcare is a struggle. In particular, the delivery of healthcare is difficult due to decentralization, maldistribution and a lack of infrastructure, which creates underserved populations [1]. Nearly all facets of healthcare are disrupted by these issues, including pharmaceutical and surgical services [2, 3]. Existing solutions do not take into account geographic disparities (as pictured in Figure ??), such as pueblos jóvenes and barriadas [4, 5, 6]. These impoverished districts of Lima possess poor social determinants of health, meaning that Limeños living in Pueblos Jóvenes are often homeless and lack access to clean water or appropriate medical care. As a whole newly industrialized nations tend to have less access to health services than highly-developed nations [7], but even recognizing that, disparities within Peru are exacerbated in districts such as Comas, Los Olivos and Villa El Salvador.

1.2 Scope and Motivation

The scope of the proposal was limited to the city of Lima, Peru, although the solution discussed herein is expandable to cities throughout Peru. Specifically, focus was placed on the Pueblos Jóvenes surrounding Lima, as pictured in Figure ?. The solution does not attempt to address housing, political turmoil or weather problem areas, and as such supplemental solutions are required to develop a full solution.

The solution was motivated by the key issues throughout Peruvian healthcare. Current solutions take central geographic approaches to solving healthcare, meaning poor and fringe communities are left without aid. The solution proposed herein aims to address the systematic component of Peru’s health needs by distributing health education, preventative care and bringing critical supplies like water and food to otherwise isolated communities. Additionally, the solution herein addresses acute care via the transport of patients to clinics or treatment centres. The preventative and educational aspects provide a long-term solution, while acute care provides short-term relief.

2 Solution

2.1 The HealthDeck

The HealthDeck is a mobile, off-road, autonomous, six-tread stretcher and supply transport unit (sketched in Figure ?? and modelled in Figure 2). HealthDecks are primarily aimed to carry and transport patients from congested or remote locations particularly, from the Pueblos Jóvenes around

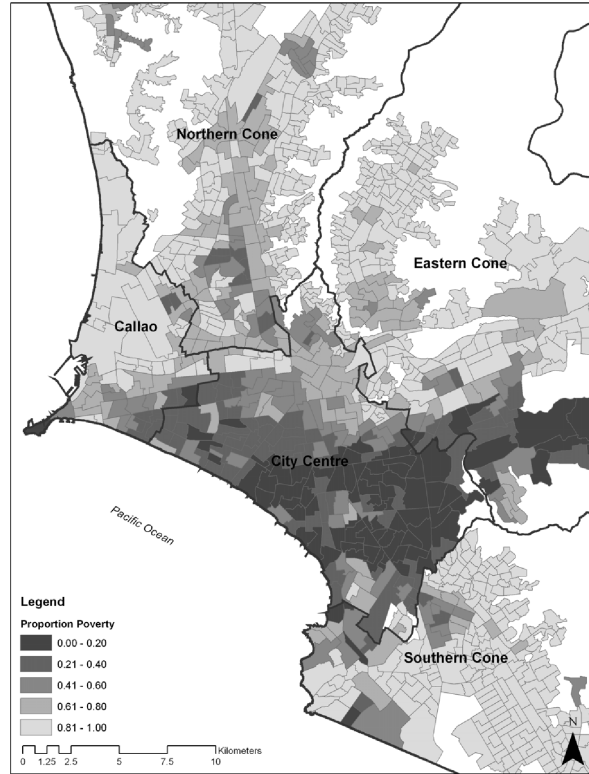


Figure 1: Percentage of households by socioeconomic status in metropolitan Lima[8]

cities without transport infrastructure, to health clinics. Apart from acute medical transportation it can serve as an amalgamated medical subsistence setup transporting supplies and clean water to the communities it services. The HealthDeck is equipped with foldable chairs, meaning it can carry several people with more minor injuries or switch to a stretcher for a prone patient. Each chair would be supplied with a vital signs monitor to measure the fundamental parameters of health. In addition, the HealthDeck would carry first aid and oxygen kits in case of emergency.

2.2 HealthBeacons

The complimented to the HealthDeck is the HealthBeacon (modelled in Figure 3), a prebuilt solar-powered alert system and educational tool for economically disadvantaged Peruvians. Solar power is viable in Peru as demonstrated in the following figure: (see Figure ??) and provides our system with sustainable power off the grid [9]. Effectively a light post with an attached tablet, a HealthBeacon is built to alert individuals to its location and dispense to them the preventive healthcare advice they need or, for acute medical emergencies, summon a HealthDeck to extract the patient. This provides a means of communication and education distribution to communities that would otherwise lack medical infrastructure altogether. A HealthBeacon interaction is diagrammed in a UML State Diagram, pictured in Figure 4.

3 Discussion

3.1 Implementation, Feasibility and Cost

When considering the implementation of the Edu-Act System across Peru, we propose utilizing a modular rollout, allowing for scalability as the project's scope expands. The mobile HealthDecks are larger and more cost-intensive than the smaller Beacon component of our design; as such, rolling out Beacons first to ensure that citizens around Lima have immediate access to preventive healthcare information will allow the system to begin having an immediate impact [10]. A timeline of development is pictured in Figure 5. We propose that over 4-6 months, Beacons are implemented throughout the

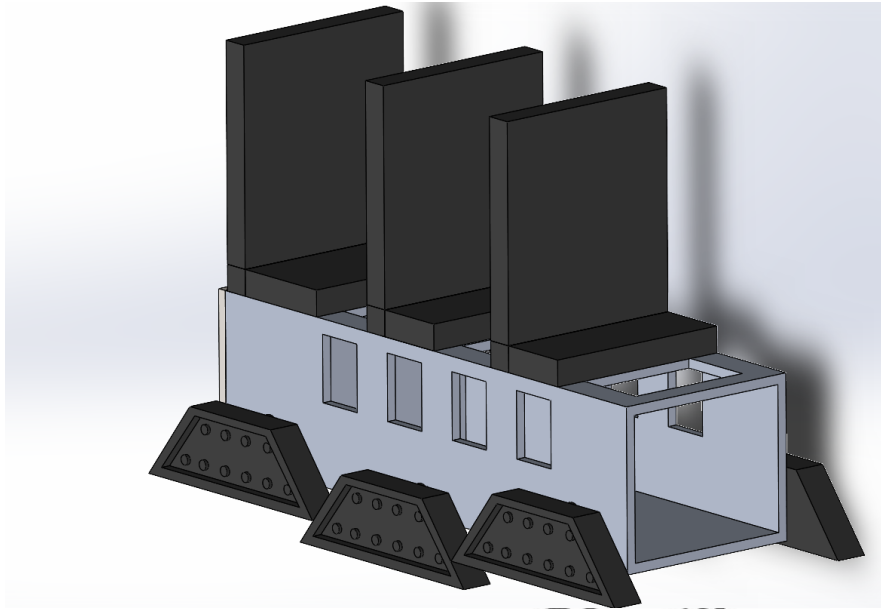


Figure 2: A 3D model of the HealthDeck.

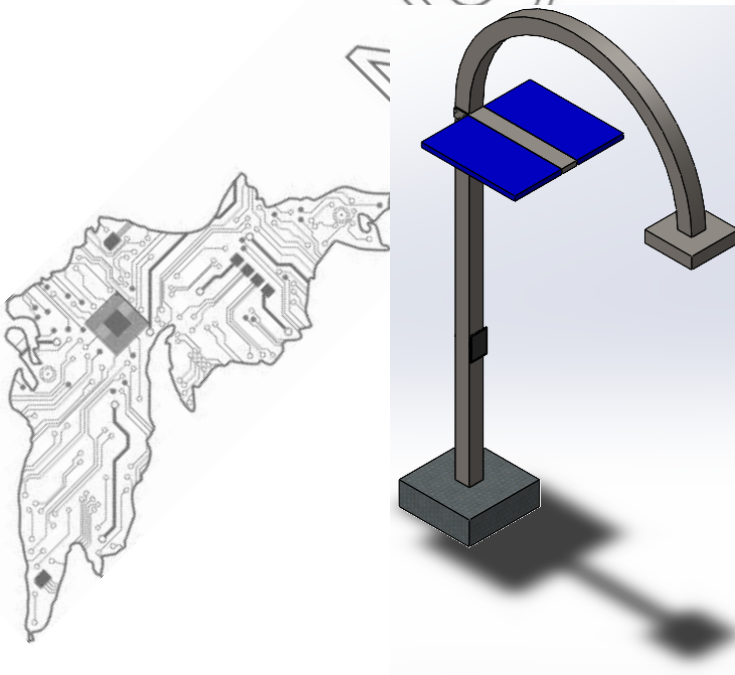


Figure 3: A 3D model of the HealthBeacon.

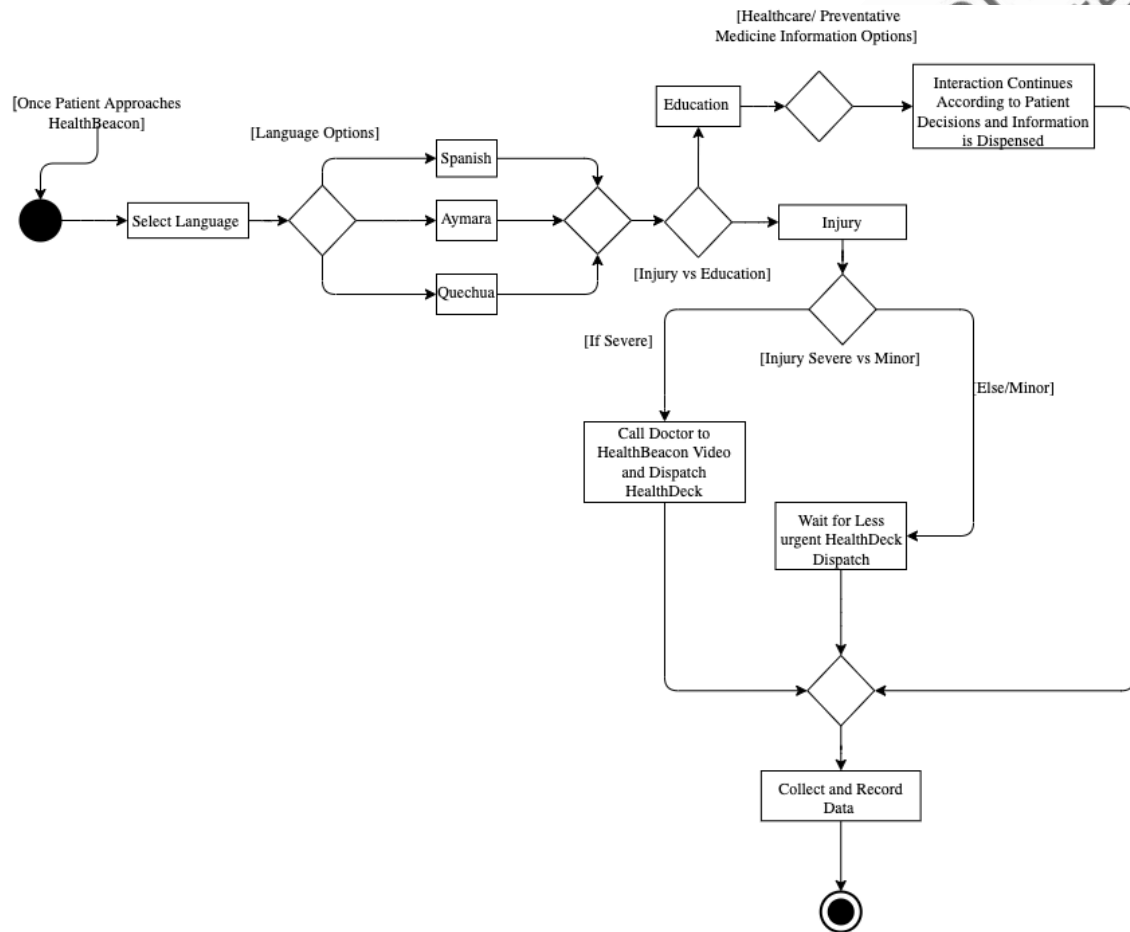


Figure 4: UML State Diagram for a typical HealthBeacon interacton.

Pueblos Jóvenes surrounding Lima and other Peruvian cities, along with temporary instructors to facilitate their introduction into the community. HealthDecks would follow as they become available and ready for deployment. The initial deployment of the Beacons allows for their use and whereabouts to become known, meaning that as HealthDecks are introduced to the system, the learning curve will be lessened. Over time the synchronized introduction of further Beacons and HealthDecks extends the reach of the Edu-Act initiative; provided that resources for production and installation remain steady a country-wide rollout could bring active healthcare, education, medical supplies, food and water to vast swaths of an underserved Peru. The simplicity of the design paired with community coordinators and a gradual implementation makes this a more than feasible solution with the appropriate funding. The implementation and design costs of the system are estimated to be relatively low, little new technology needs to be designed, and the costs mainly derive from assembly, integration and production of the system. Compared to Peru's annual healthcare expenditure, 5.22 Billion USD in 2019, the investment to get this system going would be fairly minimal [11]. Considering the known returns on healthcare investing and the potential to reach and educate the poor areas of Peru, the potential outweighs the costs [12].

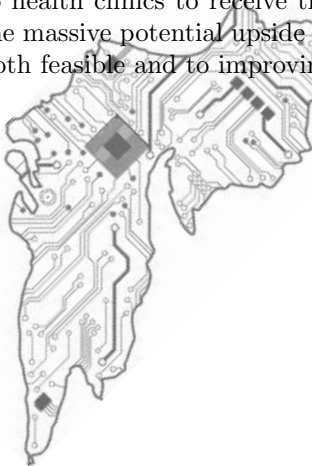
3.2 Future Areas of Research

Many future areas of research concerning the domain remain unanalyzed. These topics include, but are not limited to:

- The collection of demographic data from HealthBeacons allows for further exploratory analysis of the specific healthcare issues afflicting various Peruvian Communities [13].
- The research into wider, systemic social determinants of health, to determine a solution which would create a lasting impact and reduce stress on the Edu-Act System.
- Analysis of further viable locations across Peru and other developing nations around the world.

4 Conclusion

The Edu-Act System presented here when paired with the MediLink software for the HealthDeck and HealthBeacons allows for the distribution of resources and knowledge to underserved communities throughout Peru. Through the interactive nature of the HealthBeacons preventative healthcare and education can be disseminated in conjunction with clean water and medical supplies from HealthDecks. Furthermore, the HealthDeck works to transport patients with both minor injuries and major injuries to health clinics to receive the treatment they need. Given the relative simplicity of the design and the massive potential upside in communities with little to no access to healthcare, the system appears both feasible and to improving Peruvians healthcare and quality of life.



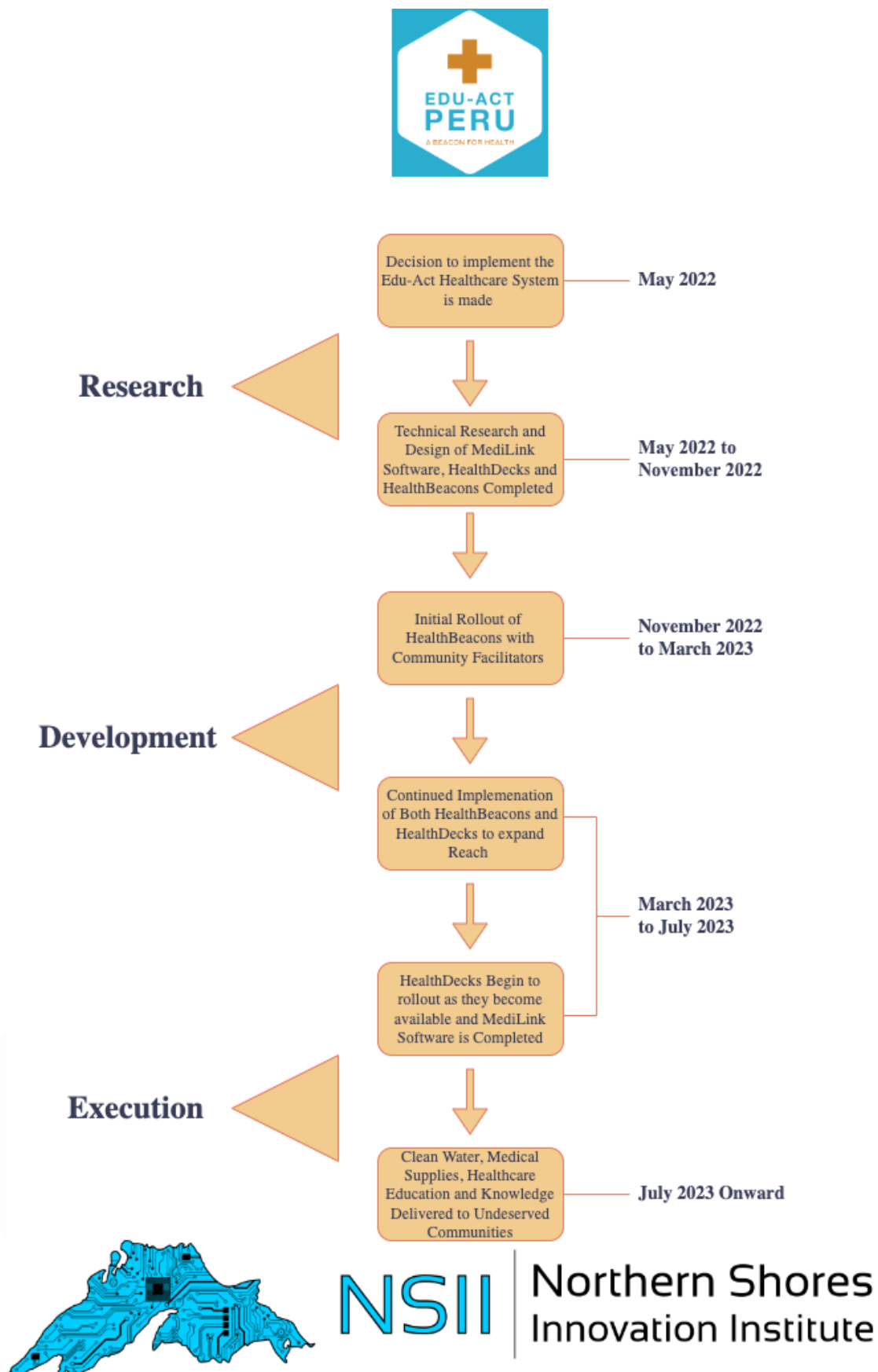


Figure 5: Timeline of development of the Edu-Act system.

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