



Santa Clara University
Engineering Undergraduate Programs

**LATAM (Latin America) Intelligent Filter for Education
(LIFE)**

PROJECT DESCRIPTION:

Problem: *The World Economic Forum has ranked the region of South America as the lowest in the world for quality education, with “more than half of 15 year olds not even minimally competent in math and science” (WorldFund).* One of the obstacles preventing Latin American children from school is the lack of access to clean drinking water. Humanium, an international NGO dedicated to stopping violations of children’s rights, terms the water crisis in Latin America a ‘children’s crisis’ because *“water is a critical resource for children to be able to attend school. [...] many children help their mothers collect water, spending hours on end carrying water from streams and lakes to their homes, and thus do not attend school” (Harvard Review of Latin America).* The children of rural Latin America face water accessibility problems that, at best, hinder their ability to attend school, and at worst, render them ill to the point of death.

Goal: Engage primary and secondary school students in Latin America (LATAM) to continue into STEM higher education by providing a hands-on learning tool (an intelligent filtration system) with real world applications. Assembling and configuring the intelligent water filtration system will educate the students in elementary science, engineering, and public health and the product of the filter (clean water) will be a benefit to their community. Additionally, the scalability and sustainability of the Intelligent Filter will promote community-based learning that will proliferate clean-water practices in the future.

Project Objective: Our objective is to create a small-scale, intelligent, and interactive water-filtration system for hands-on education, designed as a kit to better accommodate shipping constraints. This filter will be accompanied by in-depth education modules that focus on the importance of water, dangers of water-borne diseases, and other STEM material, all of which

will be preloaded to a tablet. The tablet app will also contain manuals for up-scaling the filtration system in a rudimentary way, providing a tangible benefit to the community. The Intelligent Filter and accompanying tablet will be shipped to LATAM through our client, Flying Ostrich Media.

Client: Flying Ostrich Media - Our Intelligent Filter will be a part of the Providing Aid in Science for South America's General Education (PASSAGE) initiative – a non-profit project hosted by the Southern Timing Foundation and 501(c)3 organization. They will be flying the ‘Spirit of Science’ to deliver \$50,000 worth of STEM related school supplies, lab equipment, classroom essentials, and technology to Latin America's most underprivileged schools.

Constraints: Our allocated space on PASSAGE is 50 lbs split between two 10”x13”x22” boxes. Based on these limitations, we need to be innovative with how we source our materials and how we choose to construct our product. We will also need to consider the feasibility of the system and the methodology behind it as it pertains to LATAM and the resources they have access to.

Deliverables: 10 Intelligent Filter kits will be assembled, shipped, and delivered to different schools across several countries in LATAM. The Intelligent Filter package will contain both a tablet, which will contain both the educational app and the Intelligent Filter interface, and the filter system itself.

Technical Description: The Intelligent Filter will consist of a pump, sensors, and a filtration system, all scaled down to a table-top size. The students will join the subsystems of the pump, learn how to filter water (and what clean water looks like), and configure the sensors, gaining valuable insight and interest in STEM as they assemble the final product.

Intelligent Filter: Based on preliminary research into the needs of their communities, the system will incorporate four levels of filtration to account for different possible types of contaminants

most present in Latin America: sediment, viral and bacterial organisms, and chemicals such as Arsenic, Fluorine, and other anthropogenic contaminants (OECD).

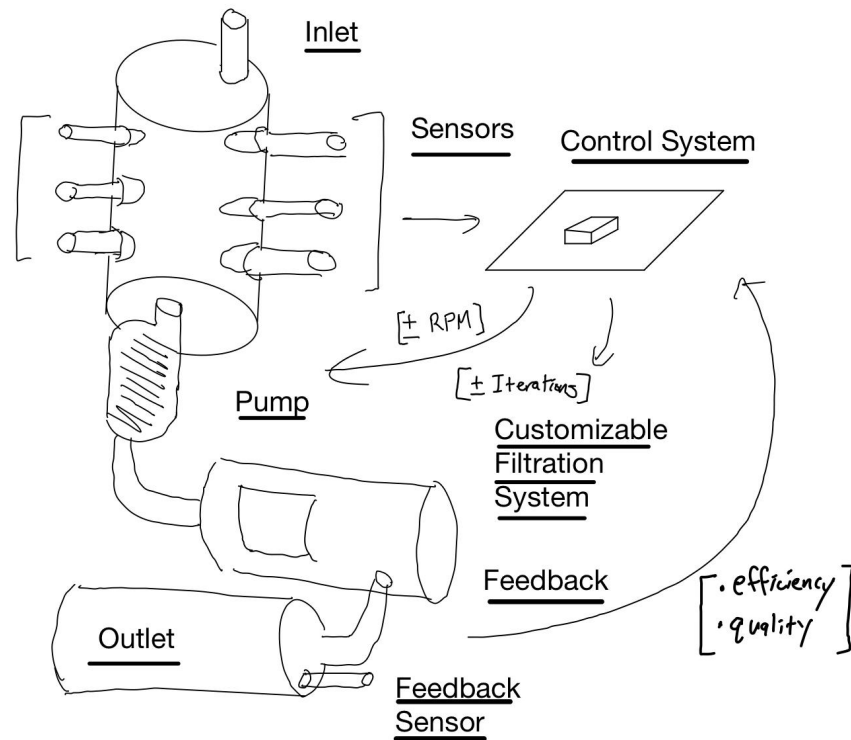


Figure 1. Potential design for the Intelligent Filter

The system will have sensors and electronic components to automate the filtration system. The sensors will allow the system to ensure the quality of the water and efficiency of the filters are optimal by manipulating the pressure and flow rate. It will accomplish this by comparing the sensor values of the input and output. The sensors will also relay information to the user, via the tablet, indicating the quality of the filtration system and identify any additional filtration systems they would need to implement, or remove. This system will ensure that the Intelligent Filter outputs the expected drinking water quality, outlined by the United States Environmental Protection Agency, while also maximising the life of the filter. To ensure the system is running efficiently, the system will indicate to the user where potential losses may be

and present a frugal method of replacing parts, addressing the issue of longevity in our device. The system will allow for students to learn and configure the individual parts, while making it obvious when the water is unsafe for consumption.

App: The app will consist of the educational modules created by the EWH team and other manuals dedicated to the set up, use, maintenance, and scalability of the filtration system. The educational content will be presented through intuitive and interactive modules guided by our virtual mascot Tita: the water droplet.



Figure 2. Potential Virtual Mascot

Tita will help personalize the learning experience and visualize the effects of water quality and sanitation on the wellbeing and health of an individual.

School Fit/Need/Justification:

We seek to promote and embody the Jesuit values of creating a ‘more humane, just, and sustainable world’ by inspiring students to better themselves and their communities. We believe the core of engineering is the application of problem solving, and by providing hands-on experiences with an intelligent water filter, we can inspire the students to pursue STEM because it allows them to investigate and solve problems.

Showing students that STEM education provides the tools to solve their own problems will not only spark interest in attending school, but also in the long term, will empower them to

contribute to their communities and collectively rise from poverty. Additionally, the useability of the public health curriculum is manifold; even after the children leave the classroom, they can share their newfound knowledge with those around them, cultivating a community of disease prevention and health awareness.

We hope our project will inspire students' interest in STEM related fields, simultaneously decreasing the dropout rate, promoting higher education, and improving job opportunities. Our goals align with many of the UN Sustainable Development Goals - 'Good health and well-being,' 'Quality Education,' and 'Decent work and economic growth.'