



INSPIRATIONAL CASES



FINALIST 2024



PERU

#JUSTSOCIETY

Students create smart stick for people with visual impairments

Born from a robotics activity, this student-led project helps avoid obstacles and facilitates mobility, promoting the inclusion of people with disabilities.

TEACHER

Kervin Calle

COMMUNITY/CITY

Callao

STEM AREAS

Technology and Engineering

STUDENTS

Ayala Muchotrigo Axel
Tello Rapray M. Melania
Ramirez Salinas Anghely

SCHOOL

I.E. N° 5143, Escuela de Talentos

PROJECT NAME

Pusaqkuna

OTHER AREAS OF KNOWLEDGE

Art and Social Sciences
or Sociology

Faced with the daily challenges people with visual impairments encounter, a group of Peruvian students decided to use their creativity and knowledge to promote inclusion. The team created “Pusaqkuna”, a smart stick equipped with sensors, vibration, and GPS, which enhances autonomy and safety in urban mobility. The initiative was a finalist in [Solve for Tomorrow Peru](#) 2024.

The project was developed by three 16-year-old students in the fifth and final year of secondary education. The idea emerged during a robotics class. Surrounded by daily reality — their school is located next to two hospitals — the students often saw people with visual impairments heading to medical appointments and struggling to navigate independently. “In Peru, urban design is generally not friendly to people with disabilities — whether visual, physical, auditory, or others. The students noticed this and began thinking about how robotics could provide a solution,” says Kervin Calle, art teacher and the group’s [mediator](#).

Among the obstacles observed were poor signage, environmental noise, and a general lack of social awareness. Through a [brainstorming](#) session, they decided to create a device to help users follow a safe path. The name “Pusaqkuna” was chosen because it means “the good guide” in quechua, a language spoken in the central Andes before the Inca Empire, and still the most spoken native language in South America.

Before Solve for Tomorrow, the team had already participated in a national competition, where they performed well and were motivated to continue. “After that first experience, the main improvements were made to the [prototype](#)’s ergonomics and weight. It was too uncomfortable,” explains the teacher. At that stage, “Pusaqkuna” was a stick made of heavy metal that emitted sound alerts to signal obstacles.



Eureka moment!

One major change introduced in “Pusaqkuna” during Solve for Tomorrow, was the addition of sensors with vibration feedback, in addition to the sound alerts. This came after they discovered that some people with visual impairments also have mild hearing loss. “The first prototype used different sounds through a buzzer to indicate obstacles on the left or right, but for those with hearing loss, it was difficult,” the teacher explains. They weren’t sure how to improve the [user experience](#) until one of the students, while playing video games, noticed the controller’s vibration system and thought it could be an effective alert mechanism.

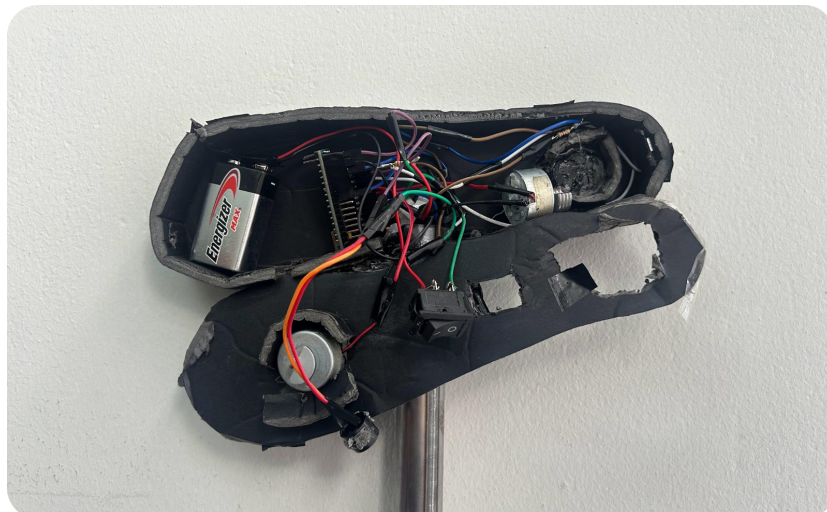


“I was amazed by robotics and how students begin assembling parts and programming to bring solutions to society”,

says Calle.

Even though Calle is not a Robotics or Mechatronics teacher, the students already had some knowledge in those areas, and other teachers supported them throughout each stage. This way, they were able to refine the final prototype. Now, when an obstacle is detected, the sensor triggers vibration in the corresponding part of the stick. For example, if there is something ahead, the front part of the stick vibrates.

The team also added LED lights to make users visible at night to other pedestrians and vehicles, increasing safety. A buzzer provides a second layer of sound alert, and their goal is to implement a GPS module that, in the future, could allow users to report dangerous obstacles — similar to navigation apps. Part of the materials was funded by the school, and the rest was covered by the students themselves. The final cost of the prototype with 3D printing was 120 soles (about 32 USD).



Hands on! The students were in charge of the project, from the design to the assembly of the internal system and the prototype testing.

Working together to promote inclusion for people with disabilities

[Creativity](#) was essential for building the stick's structure. They recycled an aluminum shower curtain rod and cut it to reduce weight. For the base, they first used cardboard and tape, and in the final version, they 3D-printed a new model that integrated an [open-source](#) Arduino Nano board, compact and ideal for portable projects.

The teacher believes that the greatest challenge wasn't technical, but convincing the students that they had the power to solve real problems. At first, they lacked confidence, but as they completed each step, they became more motivated and excited. "They are very smart and resourceful, and they weren't top students. This experience showed them they can make a difference — and it boosted their self-esteem," Calle emphasizes.

Their dedication was clear: "No exaggeration, I saw the students assemble and disassemble the wiring at least 15 times. They were so committed and it was a rich and really fun learning process," he adds.

Bringing a solution to the world

After the testing in the workshop, it was time to try it with real users — in one of the nearby hospitals and with the Union of the Blind. The main positive surprise was that this prototype didn't cause wrist pain, unlike many devices already on the market.

From understanding how sensors work to designing the stick's ergonomic structure, every step involved trial, error, and dedication. They conducted two [feedback](#) sessions — one at the hospital and other at the National Union of the Blind in Peru. "Some members of that organization tested the prototype and really liked it. They even asked where they could buy one. They were surprised by how light and comfortable it was," Calle recalls.

Concerns were also raised about battery life and portability. Thanks to the Solve for Tomorrow mentorship, the team envisioned future improvements: wireless charging, mobile device integration, and making the stick foldable and even lighter.

The team is now seeking partnerships with NGOs and public institutions to scale the project, make it accessible to more people, and ensure sustainability. They are also working on new versions of the stick, integrating more features without losing sight of its core purpose: fostering autonomy and inclusion for people with disabilities.



Explaining!

Kervin Calle is an Arts and Culture teacher but has always had an interest in technology. “I believe art is another kind of science. I’m very interested in creating those connections. When we talk about color, sculpture, or painting, we’re dealing with chemical or physical processes. That’s how I teach,” he explains. His example shows that there is room for promoting STEM (Science, Technology, Engineering, and Mathematics) projects in any subject!



Focus on practice!

Check out at the teacher’s guide on how to combine robotics and social inclusion through a STEM project:



Empathy

✱ The “Pusaqkuna” project was born from direct observation of a daily issue in the students’ school environment. Being near two hospitals, they frequently noticed people with visual impairments struggling to move safely through the city. These observations, along with a robotics activity, motivated the group to focus on urban accessibility challenges. Through constant interaction with their surroundings, they identified physical barriers, lack of proper signage, ambient noise, and limited public awareness as factors restricting autonomy.



Definition

Based on this initial understanding, the group defined the problem: improving urban mobility for people with visual impairments through technology. The goal was to develop a device that increased users' independence, adapted to local conditions, and considered varying levels of impairment. They established key criteria such as ergonomics, lightness, and effective obstacle detection. The project name — “Pusaqkuna,” meaning “the good guide” in Quechua — was chosen to reflect the stick's central purpose and incorporate local cultural elements.



Ideation

During the ideation phase, the group held brainstorming sessions and assessed several tech alternatives to address the limitations they identified. At first, they designed a stick with sound alerts that emitted different tones depending on obstacle location. But after interacting with real users, they discovered that some also had hearing difficulties. This led to the addition of vibration alerts, inspired by video game controllers. They decided to add sensors that triggered vibrations in different parts of the stick based on the obstacle's direction, and complemented the system with LED lights to improve nighttime visibility.



Prototype

To bring their idea to life, the students worked with available resources — including recycled aluminum tubing and household materials for early versions. Later, they created a 3D-printed casing, optimizing the design and reducing weight. They integrated an Arduino Nano board, ultrasonic sensors, vibrators, a buzzer, and LED lights. The prototype's technical development required multiple adjustments to wiring, component layout, and software configuration. Support from teachers in various fields — since the main mentor wasn't a robotics specialist — was essential to making significant technical progress in the final model.



Testing

 The team conducted user testing at a nearby hospital and at the National Union of the Blind of Peru. These sessions validated the stick's comfort, functionality, and lightness. Feedback highlighted the ergonomic design and the usefulness of the vibration alerts. Based on this input, they considered improvements like wireless charging, mobile device integration, and a foldable design for easier transport. They also explored partnerships with social organizations and public institutions to scale the project and ensure accessibility. The "Pusaqkuna" stick thus became a tool for promoting inclusion and autonomy in urban settings.