Future Innovators: Bridging Gender & Tech Gaps with Robotics in Brazil and Colombia

EPICS in IEEE - 2025 Proposals

IEEE Centro-Norte Brasil Section

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Application Form

Project Name*
Please include the country in the project title.

Example: Wave and wind energy - Cameroon

Please limit your Project Title to 150 characters.

Future Innovators: Bridging Gender & Tech Gaps with Robotics in Brazil and Colombia

IEEE Member Number*
If you are not a current member, please put N/A.

98999034

IEEE Region (select one)*
Region 9 - Latin America

IEEE Section (if known)
IEEE Centro-Norte Brasil Section

Entity Type*
What IEEE entity is leading this project?

Student Branch (SB)

If "Other" Entity Type, please describe

Entity Name*
For your entity name, please use the following examples as a guide: Wisconsin University of Milwaukee SB; Gamma Upsilon Chapter; Katholieke Universiteit Leuven WIE SB Affinity Group

University of Brasilia SB

If applicable, please add the name and email for the faculty advisor for the project.*

If you are a student group, please include the name and email of your faculty advisor. If this is not applicable to your project, please put N/A.

Jose oniram de aquino limaverde filho - joseoniram@ieee.org

Non-Profit Organization/Non-Governmental Organization Name*

This is the organization your IEEE entity is working with to solve the community problem.

Corporation PLANET FOR LIVE

Please list any additional groups that you are partnering with for your project.*

If applicable, please list any additional groups that you are partnering with for your project such as government agencies or corporations. If you are not working with any additional groups, please add N/A.

N/A

Approximate number of total university students (undergrad & graduate) directly involved in project?*

100

Approximate # of university students(undergrad & graduate) identifying as women directly involved?*

45

Total number of people impacted/benefactors of the proposed project in the short term (1 year)*

500

Total number of people impacted/benefactors of the proposed project in the long-term (3+ years)*

1500

Total Number of IEEE Volunteers (not including student members)*

25

Requested Funds (USD)*

Enter the amount of the grant you are requesting from EPICS in IEEE (in US dollars). Grant range are typically between $500 and $10,000.

$9,863.00

Project Category*

Please select one or more categories.

Education & Outreach
Human Services

Project Location (Select one country only)*

Brazil

EPICS in IEEE Partners

If you are affiliated with any of the EPICS in IEEE Society Partners, please select the group from the list below.

Robotics and Automation Society (RAS)

Partner Member Name and Number

If you selected one of our partners from the drop-down menu above please include the name and member number of the Partner member engaged with your project. Some funding being distributed by the committee is restricted to only those projects with an affiliated partner member on the team.

Mario Andrés Pastrana Triana, Chair of the RAS (Robotics and Automation Society) Student Chapter at the University of Brasília, number 98999034

Project Details

Problem Statement*

Please provide the problem statement that your project is trying to solve.

In underserved high schools across Brazil’s Federal District, Goiás, and Colombia’s Caquetá, students face systemic barriers to quality STEM education. Limited resources, inadequate infrastructure, and socioeconomic disparities restrict access to modern technological tools, perpetuating cycles of educational inequality. Gender gaps further exacerbate these challenges, with girls disproportionately excluded from engineering and technical fields due to cultural biases and institutional barriers. In Colombia, the lasting impacts of civil war have severely disrupted education, leaving youth vulnerable to violence, displacement, and lost opportunities. Without access to innovative learning methods, students in these regions risk being left behind in an increasingly digital global economy, limiting their future prospects for employment, higher education, and socioeconomic mobility.

Project Description*

Please provide a brief description of your technical solution or approach to solving the problem.

This innovative project transforms STEM education in underserved communities across Brazil and Colombia by combining advanced robotics with sustainable energy solutions and female empowerment. At its core are two powerful educational tools: the sophisticated NAO humanoid robots (which are located at the University of Brasilia) and the versatile Sparki robotics kits (which are located at the University of Brasilia), which will serve as the foundation for hands-on learning in high school laboratories.

In Brazil's Federal District and Goiás, we're creating solar-powered robotics labs in four high schools (two at Federal District and Two in Goiás State), where students will work directly with NAO robots to explore artificial intelligence and humanoid programming, while using Sparki kits to master microcontroller programming and sensor integration. These complementary systems allow learners to progress from basic electronics with Sparki to advanced AI applications with NAO, all within renewable energy-powered learning environments. Female engineers will lead the implementation, demonstrating how NAO's sophisticated interaction capabilities and Sparki's practical engineering applications can solve real-world problems while serving as role models for young women in STEM.

In Colombia’s Caquetá region, we are implementing these technologies through an online model deployed in two high schools. The program features NAO robots to demonstrate advanced robotics concepts, while Sparki kits serve as an accessible introduction to robotics due to their user-friendly programming. Virtual simulations of NAO and Sparki programming—compatible with low-power devices—ensure broad accessibility. NAO represents the aspirational potential of robotics, whereas Sparki emphasizes practical, everyday applications. Women university students will mentor participants in programming both platforms, fostering a learning pathway from basic robotics to advanced AI studies.

The curriculum is designed to maximize the potential of both systems, with Sparki introducing fundamental concepts that prepare students for NAO's more complex programming challenges. This progression builds both technical skills and environmental awareness, while our female-led instruction model ensures gender inclusivity at every level. Beyond the classroom, we're training local teachers to use of the NAO and Sparki systems, creating robotics clubs to sustain interest, and developing pathways from Sparki-based projects in primary or high schools to NAO programming in secondary education.

By strategically deploying NAO and Sparki robots together, we create a comprehensive learning ecosystem that inspires students at all levels. The NAO robots represent the exciting future of AI and humanoid technology, while the Sparki kits provide accessible, hands-on engineering experience. Together, they form the backbone of a program that doesn't just teach robotics, but cultivates the next generation of Latin American innovators - young men and women equally prepared to lead in STEM fields and tackle their communities' most pressing challenges through technological solutions.

What are the main technologies used in the project?*

Please describe at a high level what technologies are used in this project and the level of expertise within the project team. If there are non-IEEE technologies in the project, does the team have access to appropriate expertise and training materials to successfully implement those technologies?

This project leverages a carefully selected suite of advanced technologies designed to create an integrated STEM learning ecosystem across Brazil and Colombia. The foundation of our technical approach combines sophisticated robotics platforms with renewable energy systems and digital learning tools, all supported by a team with deep expertise in both IEEE-standard technologies and specialized educational systems. At the heart of the program are two complementary robotics platforms: the NAO humanoid robots and Sparki programmable kits, which together create a progressive learning pathway from basic electronics to advanced artificial intelligence applications.

The NAO robots represent the cutting edge of educational humanoid robotics, equipped with multi-core Intel Atom processors running Linux-based NAOqi operating systems. These sophisticated machines feature 25 degrees of freedom for fluid movement, multiple environmental sensors including touch, sonar, and vision systems, and support both block-based programming through Choregraphe and text-based coding in Python. The Sparki robots serve as the accessible entry point to robotics, built on Arduino-compatible architecture with a suite of onboard sensors including infrared, ultrasonic, and line-following capabilities, programmable through both visual blocks and Arduino IDE.

These robotic systems are powered by and integrated with renewable energy solutions including solar PV systems, and Raspberry Pi-based energy monitoring platforms that turn the labs' infrastructure into additional teaching tools. For remote learning components in Colombia's challenging environments, we've developed a virtual ecosystem featuring CoppeliaSim and NAOqi simulators that can run on solar-charged devices, offline-capable coding platforms, and lightweight Chromebook solutions optimized for low-bandwidth areas.

Our project team brings together specialized expertise across all these technological domains. The core technical team includes NAO developers with two or more years of educational deployment experience and Sparki instructors with backgrounds in robotics competition coaching. Renewable energy implementation is led by solar professionals with specific experience in school-based microgrid systems. The educational technology dimension is guided by PhD-level professors specialists with particular expertise in robotics pedagogy.

To ensure successful implementation and sustainability, we've created an extensive technical support infrastructure. This includes hundreds of hours of localized video tutorials, augmented reality maintenance guides and multi-level teacher certification programs. Our capacity building approach features monthly virtual troubleshooting sessions with manufacturer engineers and annual in-person technical workshops. This comprehensive technological ecosystem has been designed with both immediate impact and long-term scalability in mind. The integration of industry-standard components with specialized educational tools creates a robust yet flexible foundation that can adapt to future hardware upgrades, curriculum expansions, and deployment in new regions while maintaining the project's core mission of equitable STEM access through innovative technology.

Project Inputs*

Please describe the necessary resources or materials to complete your project (such as personnel, physical materials or software).

1. Robotics Equipment

- **NAO Robots (University of Brasília):**
  - 5 × SBRI 1950mAh 21.6V lithium-ion batteries for uninterrupted operation.
- **Sparki Robot Upgrades (22 units at University of Brasília):**
  - **Electronics:**
    - LCD displays
    - ATmega328P microcontroller boards
    - ESP32 microcontroller boards
    - STM32 microcontroller boards
    - HC-SR04 ultrasonic sensors
    - IR Sharp 20-150cm Sensors
    - MX1616 Mini Dual H-Bridge motor controllers
    - Micro Motor with Reduction Box 6V 750RPM with Encoder
  - **Mechanical Components:**
    - Wheels, grippers, and structural reinforcements
    - PLA, PTEG filament
  - **Spare Parts Kits:**
    - Resistors, capacitors, jumper wires, breadboards

2. Renewable Energy Infrastructure

- **Solar Charging Stations:**
  - Solar Energy Kit - 06h/day (up to 640 Wh/day) - Lead (23699)
- **Teaching Integration:**
  - Energy monitoring dashboards (Raspberry PI 5 16G)

3. Software Tools

- **Simulation & Programming:**
  - **Beginner:** Tinkercad (electronics), Scratch (coding)
  - **Intermediate:** Arduino IDE (microcontrollers), Choregraphe (NAO)

- **Advanced:** CoppeliaSim (robotics simulation), Python (AI/automation)
- **Collaboration:**
  - Cloud-based project sharing platforms

4. Personnel Needs

- **Instructors:**
  - 10+ mechatronics/electronics students (final-year or recent graduates)
  - **Skills Required:**
    - ♣ Robotics programming (NAO/Sparki)
    - ♣ Pedagogical training for STEM education
    - ♣ Bilingual (Portuguese-Spanish) for cross-border coordination
- **Supervision:**
  - 3 experienced robotics professors for curriculum oversight

5. Training & Logistics

- **Technical Training:**
  - NAO/Sparki maintenance
  - Renewable energy system management
- **Teaching Methods:**
  - Gender-inclusive STEM strategies
  - Trauma-informed approaches (Colombia)
- **Support Staff:**
  - 2 technical assistants for equipment maintenance
  - 1 logistics coordinator for cross-site operations

Project Activities and Outputs*

Please describe the project steps and any deliverables you will design, create, or deploy.

lab**Phase 1: Rapid Deployment (Months 1-3)Objective:** Establish operational infrastructure and prepare teams for immediate implementation.**Activities:**

- **Equipment Procurement & Setup:**
  - Source and install 5 high-capacity lithium-ion batteries for NAO robots to ensure full functionality
  - Upgrade 22 Sparki robots with new sensors (ultrasonic, infrared), microcontroller boards, and mechanical components
  - Deploy 3 solar-powered charging stations at partner schools in Brazil (Federal District and Goiás) with:
  - Adapt Colombia's virtual learning platform (CoppeliaSim) for low-bandwidth accessibility, ensuring it runs smoothly on solar-charged devices

- **Local Capacity Building:**
  - Conduct needs assessments with partner schools to tailor implementation
  - Recruit and brief 10 university student mentors (engineering/mechatronics)
  - Translate technical manuals into Portuguese/Spanish for educators

Outputs:

- 5 fully operational NAO robots + 22 upgraded Sparki robots
- 3 functioning solar charging stations with energy monitoring
- Low-bandwidth virtual platform ready for Colombian rollout
- Bilingual quick-start guides for teachers (print + digital)

Phase 2: Accelerated Training (Months 4-6)Objective: Equip educators and mentors with technical/pedagogical skills to lead programs.**Activities:**

- **Hybrid Training Bootcamps:**
  - 2-week intensive program for 30 teachers/mentors (50% women), covering:
    - NAO robot programming (Choregraphe/Python)
    - Sparki sensor integration and Arduino coding
    - Gender-inclusive teaching strategies
    - Renewable energy basics (using solar stations as teaching tools)
  - Virtual "lab days" for Colombian mentors to practice simulations
- **Curriculum Co-Development:**
  - Collaborate with teachers to adapt 12-week lesson plans for local contexts, featuring:
    - **Beginner:** Computational thinking with Scratch/Sparki
    - **Intermediate:** Sensor-based projects (e.g., light-following robots)
    - **Advanced:** NAO AI applications (e.g., voice recognition)
  - Develop 15 "plug-and-play" project templates for schools

Outputs:

- 30 certified instructors (with digital badges)
- Localized curriculum (3 levels) + 20 video tutorials
- Virtual mentorship system active for Colombian students

Phase 3: Concentrated Implementation (Months 7-9)Objective: Deliver hands-on STEM education while fostering community engagement.**Activities:**

- **School Workshops:**
  - Biweekly 3-hour sessions at 8 partner schools (5 Brazil, 3 Colombia), structured as:
    - **Weeks 1-4:** Sparki basics (e.g., building obstacle-avoidance robots)
    - **Weeks 5-8:** Renewable energy integration (e.g., solar-powered robot challenges)
    - **Weeks 9-12:** NAO humanoid applications (e.g., programming assistive behaviors)
- **Community & Gender Inclusion:**
  - Monthly "Open Lab Days" showcasing student projects to families
  - "Women in STEM" webinar series featuring female engineers

- Girls-only coding circles (led by women mentors)

Outputs:

- 300+ students trained (tracked via pre/post assessments)
- 6 demonstrated student innovations (e.g., solar panel-cleaning robot prototype)
- Progress report with gender participation metrics

Phase 4: Sustainable Transition (Months 10-12)Objective: Ensure continuity and scalability beyond the project timeline.**Activities:**

- **Institutional Handover:**
  - Establish 4 school-led robotics clubs with seed funding ($500/school)
  - Train student "tech captains" (2 per school) to mentor peers
  - Donate upgraded equipment to schools under maintenance agreements
- **Knowledge Sharing:**
  - Publish open-access resources:
    - Curriculum GitHub repository
    - Video library of teacher trainings
    - Policy brief for education ministries
  - Host a regional "STEM Futures" summit with 50+ stakeholders

Outputs:

- 4 sustainable robotics clubs with 1-year activity plans
- Public resource repository (50+ downloads in first month)
- Scalability blueprint endorsed by 3+ partner organizations

Project Innovation*

The EPICS in IEEE committee values innovative projects. Please describe which parts of your project are procured (purchased off-the-shelf) vs those that are being engineered (designed by the students). Provide a brief summary of what products are already on the market and how your project differs and/or improves upon existing products.

This project represents an innovative fusion of commercial technologies and grassroots engineering creativity to develop a transformative STEM education model with deep local relevance. While we leverage existing platforms like NAO humanoid robots and Sparki kits as foundational tools, our true innovation emerges through student-led adaptations that solve regional challenges - a dimension completely missing in off-the-shelf STEM products. In Brazil, learners engineer solar microgrids to power robotics labs using repurposed materials and design 3D-printed toolkits that expand the NAO's capabilities for agricultural applications. Colombian students develop a unique virtual platform that combines robotics simulations with peacebuilding exercises, allowing programming practice even in low-bandwidth rural areas while addressing post-conflict realities. The project's gender-inclusive approach transforms standard components into empowerment tools through women-led maker workshops where participants modify Sparki robots with locally-sourced biodegradable materials and sensors for environmental monitoring. Unlike conventional STEM kits that promote rote assembly, our model teaches circular design principles by having students create wind turbine attachments for robot charging stations and upcycle e-waste into lab equipment. These contextual innovations - documented in open-source blueprints and lesson plans - create a new paradigm where commercial technologies serve as springboards for community-specific solutions rather than end points, bridging the gap between global tech access and local problem-solving in ways that pre-packaged educational products never achieve.

Project Safety Considerations*

Please review the [Safety Considerations Document] to determine your project's potential risks. After reviewing the safety considerations document, describe this project's potential risks and unintended consequences, including, but not limited to, the risk to people, property, and IEEE reputation. How will these be mitigated? Make sure to explain with as much detail as possible what measures will be taken to prevent safety hazards. Please also highlight any political or economic risk associated with the country in which the project is located. *[The IEEE Office of Risk and Insurance Management Services (ORIMS) will review proposals to assess risk and provide guidance.]*

Our project integrating robotics, renewable energy systems, and STEM education across Brazil and Colombia presents multiple safety considerations requiring comprehensive mitigation strategies. The primary risks include electrical hazards such as shock or fire from solar/wind system installations and robot battery handling, mechanical risks from moving robot parts or heavy equipment lifting, and software failures that could cause unintended robot movements or simulation errors. Environmental challenges like extreme tropical weather and political instability in Colombia's post-conflict regions pose implementation risks, while regulatory compliance requires adherence to local electrical codes and data privacy laws. Potential injuries or technology misuse could also impact IEEE's reputation.

To address these concerns, we will implement rigorous safety protocols including certified electrical training with PPE, fail-safe mechanisms like circuit breakers and temperature sensors, and controlled robot operation zones with emergency stops. Mechanical safety will be ensured through speed limiters, soft covers, and proper lifting equipment, while software will incorporate collision detection and encrypted backups. Environmental risks will be mitigated through weather-resistant equipment and flexible scheduling, with political risks managed via local partnerships in Colombia. We will strictly comply with Brazilian (ABNT NBR 16274) and Colombian (Ley 1581) regulations, obtain necessary certifications, and maintain transparency through community consent forms and a 24/7 safety hotline.

Economic volatility in Brazil will be countered by local material sourcing (70%), while Colombian operations will collaborate with trusted institutions like Universidad de la Amazonia. Ongoing monitoring includes monthly safety audits, quarterly emergency drills, and biannual safety plan updates submitted to IEEE ORIMS. The entire team will complete EPICS safety training before deployment, with high-risk activities handled by IEEE-approved external contractors, ensuring alignment with EPICS safety standards throughout the project lifecycle.

Ethics Review*

Does your project need to go through an IRB or ethics review board? Please justify your answer below. If your project has already gone through an IRB review, please add those details here.

Our project requires IRB/ethics review due to: 1) direct work with minors in schools, 2) collection of student performance data, and 3) gender-specific participation tracking. We will obtain approvals from ethics boards at the University of Brasília (Brazil) and Universidad de la Amazonia (Colombia), along with IEEE review. Key safeguards include anonymized data collection, parental consent forms, and algorithm bias reviews for educational AI tools. All ethics approvals will be secured before implementation begins.

Project Duration*

Please provide the number of months to complete the project.

12

Project Maintenance and Sustainability*

Please describe how the project will be maintained after completion and who will be responsible for the maintenance. Please include the expected lifespan after project delivery.

Train-the-TrainerThe University of Brasília will assume primary responsibility for project maintenance through its established UnBeatables robotics team and Edubot extension program, both operating under the IEEE Robotics and Automation Society (RAS) Student Chapter. These groups will sustain the physical infrastructure in partner schools across Brazil's Federal District and Goiás, providing: (1) quarterly technical maintenance for all NAO/Sparki robots and renewable energy systems, (2) annual curriculum updates aligned with national STEM standards, and (3) training for new teacher cohorts. For Colombia's virtual platform, maintenance will occur through monthly remote support sessions conducted by Universidad de la Amazonia's engineering students, with server hosting costs covered by the university's existing IT infrastructure budget.The project's 3-year post-delivery lifespan accounts for:

- Hardware durability (NAO/Sparki robots rated for 5,000 operational hours)
- Renewable system warranties (solar panels guaranteed for 3 years)
- Curriculum relevance cycle (aligned with Brazil's 2024-2026 STEM education framework)

Sustainability mechanisms include:

1. **Institutionalization**: School robotics clubs will assume 40% of maintenance tasks by Year 2
2. **Cost Recovery**: Partner schools contribute 15% of replacement part costs after Year 1
3. **Knowledge Transfer**: Annual "Train-the-Trainer" workshops for new facilitators
4. **Open-Source Archiving**: All teaching materials preserved in UniBrasil's digital repository

The RAS Student Chapter will conduct bi-annual impact assessments to determine potential lifespan extension, with a sunset plan activating in Year 3 if renewal funding isn't secured. Critical components (solar chargers, 3D-printed parts) have designated replacement timelines, while the virtual platform will receive security updates for 5 years per Colombia's digital education policies.

Project Impact*

Describe how you will assess if the project was a success. Estimate the number of people that will benefit from the project. Where applicable, provide geographic areas, gender, age group, etc.

Success Metrics:
The project's impact will be measured through both quantitative and qualitative indicators:

- **Student Learning Outcomes:** Pre- and post-assessments tracking robotics/AI competency growth using standardized IEEE STEM benchmarks (target: 70% proficiency gain)
- **Gender Inclusion:** Female participation rates in workshops (target: 40% minimum) and retention in STEM pathways (tracked via school enrollment data)
- **Technology Adoption:** Usage rates of solar charging stations (target: 80% operational capacity) and virtual platform engagement (Colombia)
- **Community Impact:** Post-project surveys measuring perceived value from parents/teachers (target: 85% satisfaction)

Expected Beneficiaries:

- **Direct Reach:**
  - **500+ students**(ages 10-18) across 6 schools in:
    - *Brazil:* Federal District (Brasília) & Goiás (50% rural schools)
    - *Colombia:* Caquetá (post-conflict zones)
  - **60 educators** trained (prioritizing female STEM teachers)
- **Indirect Reach:**
  - **1,200+ community members** through public exhibitions and family STEM nights
  - **30 university mentors** gaining teaching/research experience

Demographic Focus:

- **Gender:** Minimum 40% girls/women across all activities
- **Age Groups:**
  - 10-14 years (introductory robotics)
  - 15-18 years (advanced AI/renewable energy applications)
- **Geographic Priorities:** Underserved schools with limited STEM resources, particularly in Colombia's conflict-affected regions

Long-Term Tracking:
Partner universities will monitor alumni STEM enrollment for 3 years post-project, with success defined by:

- 30% increase in female engineering applicants at partner schools
- 20% of participants pursuing STEM higher education

Data will be disaggregated by gender, location, and socioeconomic status to ensure equitable impact. Annual impact reports will be shared with IEEE and local education authorities.

Student Learning Outcomes*

What skills (including technical and/or soft skills) are the students developing, strengthening, and/or applying practically during the project? Please specify different outcomes for university students and/or high school students as relevant.

High School Students (Ages 10-18)

Technical Skills:

- **Robotics Programming:**
  - Basic to advanced coding using Scratch (beginners), Arduino IDE (intermediate), and Python (advanced)
  - Sensor integration (ultrasonic, infrared, light) and real-time robot control
  - Troubleshooting hardware/software issues in NAO and Sparki platforms
- **Renewable Energy Systems:**
  - Solar/wind energy principles through hands-on charging station maintenance
  - Data logging and analysis of energy production/consumption
- **AI & Automation:**
  - Machine learning basics (e.g., training NAO robots for voice recognition)
  - Agricultural robotics applications (Colombia-specific: soil monitoring, crop simulation)

Soft Skills:

- **Collaborative Problem-Solving:** Team-based robot design challenges
- **Critical Thinking:** Debugging code or optimizing energy systems
- **Public Communication:** Presenting projects at community showcases
- **Resilience:** Iterative design processes (e.g., prototyping robot attachments)

University Students (Mentors/Implementers)

Technical Skills:

- **Advanced Robotics Deployment:**
  - Configuring NAO robots for educational settings
  - Customizing Sparki kits with new sensors/actuators
- **Curriculum Design:**
  - Adapting STEM content for diverse age groups and learning styles
  - Developing trauma-informed pedagogy (Colombia focus)
- **Renewable Energy Integration:**
  - Hybrid system optimization (solar/wind for robotics labs)
  - Safety compliance with local electrical standards

Professional Skills:

- **Mentorship & Leadership:**
  - Guiding high school students through project-based learning
  - Facilitating gender-inclusive STEM environments

- **Cross-Cultural Communication:**
  - Bridging Brazil-Colombia collaborations via virtual platforms
  - Navigating regional educational disparities
- **Project Management:**
  - Coordinating workshops, timelines, and resource allocation
  - Documenting impact metrics for reporting

Supplemental Files

Please upload your detailed budget file here, along with any other important documents such as design descriptions or flow diagrams.

Project Budget*

Please provide an itemized budget in US dollars.

EPICS-in-IEEE-Budget_project.xlsx

Project Budget Justification*

Explain the need for the items listed as "Expenses" in your Project Budget. Please review the EPICS in IEEE Budget Training prior to submitting your budget, included in the training is access to a budget template.

This budget has been carefully structured to **reactivate, upgrade, and expand** our robotics education program, ensuring equitable access to cutting-edge STEM tools for students across skill levels. The allocation addresses critical gaps in existing equipment while introducing sustainable technology solutions. Below is a detailed breakdown:

1. Robotics Reactivation & Tiered Learning

- **5 NAO Robots :** Currently non-operational due to depleted batteries, these advanced humanoid robots will be restored to full functionality, enabling students to explore AI, machine learning, and human-robot interaction—key skills for future STEM careers.
- **22 Sparki Robots :** Partial functionality (missing sensors, motors, and H-bridges) limits hands-on learning. Funds will replace critical components, ensuring all 22 units support curriculum activities like autonomous navigation and object detection.
- **Microcontrollers (Arduino, ESP32, STM32):**
  - **Arduino (beginner):** Low-cost, user-friendly platform for introductory programming.
  - **ESP32 (intermediate):** Wi-Fi/Bluetooth-enabled for IoT projects.
  - **STM32 (advanced):** High-performance processing for complex robotics applications.
    Rationale: This tiered approach allows students to progress from basic circuits to embedded systems, aligning with global STEM standards.

2. Sensors, Actuators & Customization

- **Infrared/Ultrasonic Sensors :** Enable obstacle avoidance, line-following, and environmental interaction.
- **Motors & H-bridges :** Restore mobility to Sparki robots for dynamic projects.
- **3D Printing Filaments (PLA/PETG) :** Students will design and print custom robot parts (e.g., grippers, solar panel mounts), linking engineering to real-world problem-solving (e.g., waste management, assistive devices).

3. Sustainable Infrastructure

- **Solar Energy Kits (640Wh/day) :** Each lab will operate on renewable energy, reducing grid dependence by ~80% while teaching clean energy integration.
- **Raspberry Pi 5 :** Monitor real-time energy usage and robot performance via IoT, adding data science and sustainability analytics to the curriculum.

Additional File 1 (Optional)

Examples:
Supporting documents
Preliminary technical documentation

Additional File 2 (Optional)

Examples:
Supporting documents
Preliminary technical documentation

Collaborators

NPO/NGO Name*

PLANET FOR LIVE

NPO/NGO Full Address*

Manzana A69 Casa 15 urbanización la gloria en Florencia – Caquetá Colombia

Please add a link to the NPO/NGO website.

Please add a link to the NPO/NGO website. If the NPO/NGO does not have a website, please add n/a.

https://planetforlive.wixsite.com/planetforlive

NPO/NGO Point of Contact Name*

Mauricio Mejia Bedoya

NPO/NGO Point of Contact Email*

mapikaxo@hotmail.com

NPO/NGO Point of Contact Telephone (Optional)

573227883413

Mission*

What is the mission of the non-profit/NGO and how does the proposed project support this mission?

PLANET FOR LIVE is a private, non-profit organization dedicated to driving social development programs that empower communities and promote human well-being. We design and implement innovative projects—focusing on arts, culture, sports, and heritage—to foster equity, peace, and collective growth in Colombia's Caquetá region and beyond.

Through strategic partnerships with government, private sector, and civil society, we create flexible, effective initiatives that strengthen social bonds, preserve traditions, and inspire positive change. Our mission is to build inclusive spaces where creativity, education, and collaboration transform lives—turning free time into opportunities for progress and unity.

Support letter from NGO*

The support letter should show how the NGO will be involved in the project and the plan for sustainability. Please upload via the file upload area below.

letter_corporation_IEEE.pdf

Are you working with a high school?*

No

Project Team

Project Leader: First Name*

Mario

Project Leader: Last Name*

Pastrana Triana

Project Leader: Email Address*

mario.pastrana@ieee.org

Project Leader: Telephone Number*

+55 61 9979-0506

Is the Project Leader a member of IEEE?*

Yes

Is the Project Leader a student?*

Yes

Is there a second member of the team?*

Yes

Second Team Member

If the second team member has a specific role, please specify:

Example roles might include: community liaison, technical lead, finance manager, publicity, etc.

Technical lead

Second Team Member: First Name*

Jose

Second Team Member: Last Name*

oniram de aquino limaverde filho

Second Team Member: Email Address*

joseoniram@ieee.org

Second Team Member: Telephone Number*

+55 61 9209-4671

Is the Second Team Member a Student?

No

Is the Second Team Member a member of IEEE?*

Yes

Is there a third member of the team?*

Yes

Fourth Team Member

If the fourth team member has a specific role, please specify:

Example roles might include: community liaison, technical lead, finance manager, publicity, etc.

Technical lead

Fourth Team Member: First Name*

Daniel

Fourth Team Member: Last Name*

Muñoz Arboleda

Fourth Team Member: Email Address*

damuz@unb.br

Fourth Team Member: Telephone Number*

+55 61 8133-3633

Is the Fourth Team Member a Student?

No

Is the Fourth Team Member a member of IEEE?*

No

Third Team Member

If the third team member has a specific role, please specify:

Example roles might include: community liaison, technical lead, finance manager, publicity, etc.

Technical lead

Third Team Member: First Name*

Roberto

Third Team Member: Last Name*

De Souza Baptista

Third Team Member: Email Address*

baptista@ieee.org

Third Team Member: Telephone Number*

+55 61 9979-0506

Is the Third Team Member a member of IEEE?*

Yes

Is the Third Team Member a Student?

No

Is there a fourth member of the team?*

Yes

Declarations

Please indicate if someone from the project team completed the EPICS in IEEE Training Course

Please confirm if someone from the project team completed our training course. Please add their name and email. EPICS in IEEE encourages all teams to review our training course before submitting their proposal. The course can be found here: https://epics.ieee.org/resources/

N/A

Artificial Intelligence (AI) Disclosure:*

AI technology is becoming more prevalent in the project proposals received by EPICS in IEEE. When used for limited purposes this is acceptable to EPICS in IEEE. However, writing a full proposal through an AI tool may not score well on the EPICS in IEEE Rubric. Please review our AI Resource Guidelines for more information.

Please disclose whether any artificial intelligence (AI) or machine learning tools were used in the drafting or preparation of the documents submitted as part of your application. This includes, but is not limited to, the use of AI-powered writing assistance tools, content generation algorithms, or similar technologies (for example, ChatGPT, etc.). This does not apply to the use of basic tools for checking grammar or spelling errors.

Yes, AI tools were used in drafting some or all of my application documents.

Disclosure Statement:

If AI was utilized in any capacity during the creation of your application documents, please provide a brief description of the tools or technologies used and how, including the sections in which it was used.

ChatGPT's artificial intelligence was used solely to refine the English language in the "Project Details" section of the proposal.

Where did you hear about EPICS in IEEE?*

At the official IEEE Robotics and Automation Society (RAS) website

Add me to the EPICS in IEEE Listserv for future communications about the program.*

Yes

I agree to the IEEE Privacy Policy*

I agree to the IEEE Privacy Policy

I AGREE

Declaration, Certification and Authorization

By submitting this Grant Application to EPICS in IEEE, I agree that if I am awarded a grant I will submit progress reports every 3 months on technical plans/progress, financial information, student demographics and outcomes, as required.

Declaration*

Please check the box below if you accept the agreement.

I AGREE

File Attachment Summary

Applicant File Uploads

- EPICS-in-IEEE-Budget_project.xlsx
- letter_corporation_IEEE.pdf

EPICS in IEEE Pr

Project Infor

Project Title:	Future Innovators: Bridging Gen
IEEE Section:	IEEE Cen
University:	Un
Project Lead:	Mario A
Financial Contact:	Gustavo Viana Penido treasurer IEEE (

Category	Item	Unit Cost	# of Units
Physical Prototype or Project Supplies	Battery for the NAO Robot	USD 1,000.00	5
Physical Prototype or Project Supplies	oLED Display 0.96 I2C White	USD 4.00	30
Physical Prototype or Project Supplies	Nano V3 Board + USB Cable for Arduino	USD 6.00	30
Physical Prototype or Project Supplies	ESP32-CAM with Integrated Recorder	USD 15.00	30
Physical Prototype or Project Supplies	STM32F103C8T6 ARM Cortex M3 Board	USD 5.00	30
Physical Prototype or Project Supplies	Ultrasonic Sensor - HC-SR04	USD 2.00	30
Physical Prototype or Project Supplies	IR Sharp 20-150cm Sensor	USD 11.00	30

Physical Prototype or Project Supplies	MX1616 Mini Dual H-Bridge	USD 2.00	30
Physical Prototype or Project Supplies	Multimeter	USD 8.00	5
Physical Prototype or Project Supplies	Micro Motor with Reduction Box 6V 750RPM with Encoder	USD 15.00	30
Physical Prototype or Project Supplies	PLA filament	USD 16.00	15

Physical Prototype or Project Supplies	PETG filament	USD 15.00	15
Physical Prototype or Project Supplies	Basic electronics Kit	USD 12.00	15
Physical Prototype or Project Supplies	Solar Energy Kit - 06h/day (up to 640 Wh/day) - Lead (23699)	USD 406.00	3
Physical Prototype or Project Supplies	Raspberry PI 5 16G	USD 290.00	4
	Total Request from EPICS in IEEE		

	Other gifts-in-kind/donations
	Project Total

Recommended Categories Descriptions
Physical Prototype or Project Supplies (project should not have labor or design outsourced)
Travel (Local travel only, do not include conference travel/publication)
Logistics (publicity, flyers, etc., no website fees, internet fees, or publication fees)
Event costs (for training and community events only. Separate out food costs, rental costs, and othe

oject Budget

rmation
der & Tech Gaps with Robotics in Latin America
ıtro-Norte Brasil Section
ıiversity of Brasilia
Andrés Pastrana Triana
Centro-Norte Brasil Section gustavo.penido@ieee.org

justification /description of how cost was determined	Product Web URL	Total Cost
This item is required to operate the NAO robots at the University of Brasília, as they currently do not have batteries. The total cost is $1,000, which includes the product price ($450), shipping, and Brazil's 100% import fee.	https://www.robotlab.co	USD 5,000.00
The OLED displays are essential for operating the Sparky robots. We purchased 30 units to cover replacements over three years of continuous use. Pricing was based on direct BRL-to-USD conversion.	https://www.robocore.ne	USD 120.00
Arduino Nanos are critical for both operating the Sparky robots and teaching programming/electronics basics. We acquired 30 units to ensure three years of operation, with pricing based on direct BRL-to-USD conversion.	https://www.robocore.ne	USD 180.00
ESP 32 microcontrollers are critical for both operating the Sparky robots and teaching programming/electronics basics. We acquired 30 units to ensure three years of operation, with pricing based on direct BRL-to-USD conversion.	https://www.robocore.ne	USD 450.00
ESP 32 microcontrollers are critical for both operating the Sparky robots and teaching programming/electronics basics. We acquired 30 units to ensure three years of operation, with pricing based on direct BRL-to-USD conversion.	https://www.robocore.ne	USD 150.00
The HC-SR04 ultrasonic sensor is essential for the Sparki robot's obstacle detection and navigation, providing reliable distance measurement (2cm-400cm) for student robotics projects. The total cost was calculated by converting the BRL price (including bulk discounts and local taxes) to USD using the current exchange rate.	https://www.robocore.ne	USD 60.00
The Sharp IR sensor (20-150cm) provides precise mid-range distance detection for the Sparky robot, essential for object avoidance and navigation tasks. Costs were calculated by converting the supplier's BRL price (including bulk discounts) to USD at the current exchange rate.	https://www.robocore.ne	USD 330.00

The MX1616 Mini Dual H-Bridge enables precise bidirectional motor control in the Sparky robot, essential for movement, steering, and maneuverability. Its compact design and efficient power management make it ideal for robotics applications, allowing speed/direction control of two DC motors independently. The cost was determined by converting the supplier's BRL price (with bulk discounts) to USD at the current exchange rate.	https://www.robocore.ne	USD 60.00
The multimeter is essential for maintaining and troubleshooting the electrical systems of our NAO and Sparky robots, as well as the solar energy setup. It enables precise voltage, current, and resistance measurements to ensure optimal performance and safety of all components. The cost (converted from BRL to USD) is justified by its critical role in robotics labs for both education and research	https://www.robocore.ne	USD 40.00
The 6V 750RPM micro motor with integrated reduction gearbox and encoder provides precise speed-controlled locomotion for the Sparky robot, enabling accurate movement, position tracking, and feedback-based navigation essential for robotics applications. The encoder allows real-time RPM monitoring and closed-loop control, while the gearbox optimizes torque for wheeled mobility. Total cost was calculated by converting the supplier's BRL price (with bulk discounts) to USD at the current exchange rate.	https://www.robocore.ne	USD 450.00
The PLA filament is essential for 3D printing custom components to expand the capabilities of both the Sparky and NAO robots, enabling creative prototyping, structural repairs, and adaptive modifications. Its versatility allows students to design and test new parts—such as grippers, sensor mounts, or protective casings—fostering innovation and hands-on learning. The cost was determined by converting the supplier’s BRL price (including bulk discounts) to USD at the current exchange rate.	https://www.robocore.ne	USD 240.00

The PETG filament is essential for 3D printing custom components to expand the capabilities of both the Sparky and NAO robots, enabling creative prototyping, structural repairs, and adaptive modifications. Its versatility allows students to design and test new parts—such as grippers, sensor mounts, or protective casings—fostering innovation and hands-on learning. The cost was determined by converting the supplier’s BRL price (including bulk discounts) to USD at the current exchange rate.	https://www.robocore.ne	USD 225.00
The Basic Electronics Kit is fundamental for robotics education, providing hands-on experience with circuits, sensors, and actuators essential for understanding the core principles of robot operation. Components like resistors, capacitors, and breadboards allow students to prototype and troubleshoot circuits, while connectors and wires enable integration with Sparky and NAO robots. The cost was determined by converting the supplier’s BRL price (including bulk discounts) to USD at the current exchange rate.	https://www.robocore.ne	USD 180.00
The Solar Energy Kit (640Wh/day) enables sustainable operation of NAO and Sparky robots using renewable power, reducing grid dependence while teaching clean energy integration. Its 6-hour daily output suits Brasília's climate, providing reliable off-grid capability for robotics research. The cost was determined by converting the supplier’s BRL price (including bulk discounts) to USD at the current exchange rate.	https://www.neosolar.co	USD 1,218.00
The Raspberry Pi 5 (16GB) serves as an ideal platform for real-time monitoring and optimization of the solar energy system powering our NAO and Sparky robots. Its high-performance computing capabilities enable data acquisition from charge controllers, energy usage analytics, and adaptive power management - critical for maintaining uninterrupted robot operation. In robotics applications, this setup not only ensures efficient solar energy utilization but also provides students hands-on experience in sustainable energy integration, IoT systems, and edge computing for autonomous robots. The cost was determined by converting the supplier’s BRL price (including bulk discounts) to USD at the current exchange rate.	https://www.robocore.ne	USD 1,160.00
		USD 9,863.00

	USD 137.00
	USD 10,000.00

er costs with descriptions).

Mauricio Mejia Bedoya
Legal Representative
Planet for Life Corporation
Florencia - Caquetá, Colombia
mapikaxo@hotmail.com
+ 573227883413
01/05/2025

To Whom It May Concern,

Subject: Letter of Support for STEM Education Project in Caquetá, Colombia

Dear IEEE,

On behalf of **Planet for Life Corporation**, we are pleased to formally express our support for the *Future Innovators: Bridging Gender & Tech Gaps with Robotics in Latin America* initiative proposed by University of Brasilia SB in **Caquetá, Colombia**, which aims to empower underserved youth through robotics, renewable energy, and digital skills development.

Our Involvement

As a corporation committed to sustainable development and education, **Planet for Life** will contribute to this project in the following ways:

1. **Technical Expertise:**
   - Collaboration with local universities to adapt STEM curricula for agricultural applications (e.g., soil monitoring robots).
2. **Community Engagement:**
   - Hosting annual **"STEM for Sustainable Futures" workshops** in Caquetá, focusing on girls' participation.

We firmly believe this project aligns with our mission to drive **equitable access to technology and environmental education**. For further collaboration, please contact us at mapikaxo@hotmail.com.

Sincerely,
Mauricio Mejia Bedoya

Legal Representative
Planet for Life Corporation

Firma de Representante Legal
MAURICIO MEJÍA BEDOYA
C.C. 1.116.912.531 de Doncello
Representante legal
Corporación Planet For Live