



EPICS^{IN}IEEE

User Customizable Multifunctional Wheelchair for Disabled

EPICS in IEEE - 2024 Proposals

IEEE Madras 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.

User Customizable Multifunctional Wheelchair for Disabled

IEEE Member Number*

If you are not a current member, please put N/A.

100227792

IEEE Region (select one)*

Region 10 - Asia & Pacific

IEEE Section (if known)

IEEE Madras Section

Entity Type*

What IEEE entity is leading this project?

Section

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

SRMIST Student Branch

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.

Dr. J. Anand Pushparaj - Assistant professor/ECE,

Non-Profit Organization/Non-Governmental Organization Name*

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

The Spastics Society Of Tiruchirappalli

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?*

6

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

4

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

50

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

100

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

3

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.

\$1,577.00

Project Category*

Please select one or more categories.

Access & Abilities

Project Location (Select one country only)*

India

EPICS in IEEE Partners

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

Industry Applications Society (IAS)

Partner Member Name and Number

If you select one of our partners from the door down 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.

Bharath M L, 100227792

Project Details

Problem Statement*

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

Manual wheelchairs require physical effort, using hand rims on large rear wheels for movement, which can be challenging for those with limited strength or dexterity. Electric wheelchairs, powered by a motor and battery system, offer better mobility and are controlled by a joystick or other methods, aiding those with reduced physical abilities. In response to the needs of students at the Spastic Society, we developed a wheelchair system with three modes: Joystick Mode, Touch Recognition Mode, and Voice Recognition Mode. These modes address different user needs, enhancing accessibility and independence. Joystick Mode works for users with moderate arm control, allowing manual adjustments. Touch Recognition Mode is ideal for users with limited dexterity, offering navigation through touch sensors. Voice Recognition Mode enables voice commands, benefiting those who can't use their hands effectively. By combining these modes, we aim to improve mobility and inclusivity for students and staff.

Project Description*

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

moveOur collaborative project with the Spastics Society of Tiruchirappalli endeavors to revolutionize mobility solutions for individuals with physical disabilities. Recognizing the unique challenges faced by this community, we have developed an innovative wheelchair system equipped with three distinct modes of operation: Joystick Mode, Touch Sensing Mode, and Voice Recognition Mode. Case 1: Voice Recognition Control, we address the needs of individuals who are unable to use their hands for physical control. Through advanced voice recognition technology integrated into the wheelchair system, users can operate the device entirely hands-free. Simple voice commands such as "move forward" or "turn left" enable users to navigate their environment with autonomy and ease, empowering those with minimal motor function to move independently. Case 2: Touch Sensing Control caters to individuals who have limited dexterity in at least one finger. The wheelchair incorporates touch-sensitive controls that respond to minimal touch, such as a single finger tap or swipe. This intuitive control system allows users to change direction or adjust speed effortlessly, providing a versatile alternative to traditional joystick controls. By accommodating varying levels of finger mobility, we ensure that individuals with diverse physical abilities can navigate their surroundings comfortably and efficiently. Case 3: Joystick Control for Limited Hand Function, we address the needs of individuals with functional hands but are unable to use their fingers effectively. Our specially designed joystick requires minimal fine motor skills, enabling users to operate the wheelchair using alternative hand movements such as palm or wrist control. This ergonomic joystick design enhances accessibility for users who cannot operate standard joysticks, ensuring that they can maneuver the wheelchair with precision and ease. By integrating these three modes of operation into our wheelchair system, we aim to enhance accessibility and independence for students and staff within the Spastics Society of Tiruchirappalli. Our innovative approach breaks down barriers to mobility, fostering a more inclusive environment where individuals with varying degrees of physical disabilities can participate fully and confidently in daily activities. Through collaboration and innovation, we aspire to empower individuals with physical disabilities to lead fulfilling and independent lives, with unrestricted access to mobility and freedom of movement.

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?

Project Inputs*

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

Many individuals with severe physical disabilities encounter significant challenges with traditional wheelchair designs, which often fail to adequately address their specific needs. Particularly, individuals with limited dexterity or strength may struggle to operate standard wheelchairs effectively, resulting in restricted mobility and diminished independence. Recognizing this critical gap in accessibility and inclusivity, our project endeavors to develop a revolutionary wheelchair system tailored to the distinct requirements of users associated with the Spastics Society of Tiruchirappalli.

The project will focus on three primary modes of operation, each designed to cater to the diverse needs of individuals with physical disabilities:

Joystick Control: Designed for individuals with moderate control over their arm movements. Allows manual control over the wheelchair's direction and speed through a traditional joystick interface.

Touch Recognition Mode: Incorporates advanced touch sensing technology to provide alternative control methods. Ideal for users with limited dexterity or strength, enabling navigation through simple touch gestures.

Voice Recognition Mode: Utilizes cutting-edge voice recognition systems for hands-free wheelchair control. Suited for users with minimal or no use of their hands, allowing them to navigate the wheelchair using voice commands.

Project Activities and Outputs*

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

Project Activities and Outputs:

- 1. Hardware Development:** - Design and fabrication of the wheelchair system prototype incorporating joystick, touch sensing, and voice recognition control mechanisms. - Integration of necessary hardware components, including sensors, actuators, and microcontrollers, to enable seamless operation of the control systems. - Iterative refinement of the hardware design based on feedback from user testing and evaluation.
- 2. Software Development:** - Development of firmware and software algorithms to support the functionality of each control mode (joystick, touch sensing, voice recognition). - Implementation of user-friendly interfaces for configuring control preferences and adjusting sensitivity settings. - Testing and optimization of the software to ensure reliability, responsiveness, and compatibility with the hardware components.
- 3. Training Phase:** - Creation of instructional materials, including user manuals and video tutorials, to guide users and caregivers in operating and maintaining the wheelchair system. - Conducting training sessions with individuals with physical disabilities and staff members at the Spastics Society of Tiruchirappalli to familiarize them with the different control modes and their functionalities. - Providing ongoing support and assistance to users during the training phase to address any questions or concerns they may have.
- 4. Testing Phase:** - Comprehensive testing of the wheelchair system in real-world scenarios to evaluate its performance, usability, and durability. - Conducting user trials and feedback sessions to gather insights on user experiences and preferences with each control mode. - Identifying and addressing any technical issues or usability challenges encountered during testing through iterative refinement of the hardware and software.

Project Outputs:- Fully functional wheelchair system prototype with three distinct control modes: Joystick Mode, Touch Sensing Mode, and Voice Recognition Mode.- User manuals and instructional materials providing guidance on operating and maintaining the wheelchair system.- Training sessions conducted with individuals with physical disabilities and staff members at the Spastics Society of Tiruchirappalli, facilitating their adoption and integration of the new technology.- Comprehensive testing reports documenting the performance, usability, and user feedback gathered during the testing phase.- Finalized hardware and software designs ready for potential further development and commercialization, aimed at improving accessibility and independence for individuals with physical disabilities globally.

Project Duration*

Please provide the number of months to complete the project.

6

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.

Our concept offers a multipurpose wheel chair is a way to help people with impairments, especially those who struggle with different kind of disabilities. Our wheelchair guarantees adaptability and user-friendliness by including the three modes of Operation, joystick control mode, touch pad control mode and Voice recognition control mode . Our design, which prioritises sustainability, is intended to last three years, guaranteeing extended dependability and performance. Furthermore, our institution has reaffirmed its dedication to this cause by entering into an MOU with The Spastics Society of Tiruchirappalli, which ensures prompt upkeep and assistance throughout the wheelchair's whole life. With this collaboration, you can be confident that our committed staff of associated members will take care of any problems or maintenance needs right away.

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.

The success of the project will be assessed based on several criteria. Firstly, we'll evaluate the functionality and reliability of the traditional wheel chairs. Secondly, In addition to joysticks in the normal wheel chairs we are using touch pads and voice recognition modes. Thirdly, who are facing the problems in the traditional wheel chair, they can asses the user customizable multipurpose wheel chair. The project aims to benefit students with disabilities in the Spastics Society of Tiruchirapalli, specifically those facing difficulties with stair navigation. Approximately 150 students aged 10–25 are expected to benefit from this innovative solution, improving their mobility and independence.

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.

Problem Identification and Analysis: Students will be able to recognize and evaluate accessibility obstacles, in using the traditional wheelchairs, that people with disabilities must overcome and create a concise problem statement that addresses these concerns.

Innovative Design and Technology Integration: To enhance wheelchair mobility in a variety of settings, students will gain competence in designing novel solutions.

Materials Selection and Construction Skills: Students will learn how to choose suitable materials, such as steel and aluminum, and use exact manufacturing methods to build a working wheelchair prototype that is customized to meet certain accessibility requirements.

Prototype Development and Testing: Students will have practical experience in wheelchair design iteration, testing, and prototyping to guarantee wheelchair functionality, safety, and user satisfaction. The project will conclude with the delivery of a working prototype and thorough testing results.

Documentation and Reporting: Students will become proficient in communicating project results and suggestions to stakeholders as well as in documenting project activities, such as design schematics, testing protocols, and effectiveness reports.

Project Duration Management: By sticking to a six-month timeframe from concept creation to prototype deployment and placing a premium on quality, safety, and performance, students will get valuable experience managing project deadlines.

Sustainability and Maintenance Planning: Through proactive maintenance techniques and institutional partnerships, students will gain an understanding of the significance of sustainability in design and maintenance planning, guaranteeing the wheelchair solution's dependability and longevity over a three-year period.

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.

The project's novelty is in its novel approach to resolving accessibility issues that people with impairments, Wheelchair riders may now enjoy greater mobility and independence thanks to a novel solution that they can use the wheelchair based on their disabilities.

1. Customizable system: This innovative design is for user can use the wheelchair based on the disabilities, they can change the modes accordingly.

2. 3 Modes of Operations : There are three modes in our wheel chair, joystick control mode, touch pads control mode, voice recognition control mode. In addition to joystick here we are using touch pads control mode and voice recognition control modes

3. Materials and Construction: The proposal guarantees the lifespan and performance of the solution by placing a high priority on the choice of materials and the quality of construction

4. Collaborative strategy: The project's collaborative strategy promotes interdisciplinary cooperation and

knowledge integration by bringing together technicians, mechanical engineers, and accessibility experts. By combining different viewpoints and skill sets, this cooperative effort improves the project's inventiveness

5. Sustainability and Maintenance: The project is dedicated to sustainability in a way that goes beyond architectural considerations to include institutional relationships and maintenance planning. The initiative guarantees continuous maintenance and assistance by entering into an MOU with The Spastics Society of Tiruchirappalli, which secures the wheelchair solution's long-term sustainability.

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.

USER_CUSTOMIZABLE_MULTIPURPOSE WHEELCHAIR.docx

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.

The allocated budget for the User Customizable Multipurpose Wheelchair for disabled is carefully justified to ensure the creation of a reliable and effective solution for individuals with different disabilities. It encompasses essential expenditures such as materials for durability and strength, specialized machinery and tools for precise construction, advanced sensors and software for multipurpose functionality, and funding for research and development to drive innovation and refinement. Each component of the budget is integral to the creation of a high-quality, accessible, and user-friendly wheelchair, reflecting our commitment to providing individuals with disabilities the opportunity to navigate their environments with dignity and independence.

Additional File 1 (Optional)

Examples:

Supporting documents

Preliminary technical documentation

Additional File 2 (Optional)

Examples:

Supporting documents

Preliminary technical documentation

Collaborators

NPO/NGO Name*

The spastics society of Tiruchirappalli

NPO/NGO Full Address*

No. 5, Revival Nagar, Ramalinga Nagar South Extension, Vayalur Road, Tiruchirappalli, Tamil Nadu 62001

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.

spasticsocietyoftiruchirappalli@gmail.com

NPO/NGO Point of Contact Name*

The spastics society of Tiruchirappalli

NPO/NGO Point of Contact Email*

spasticsocietyoftiruchirappalli@gmail.com

NPO/NGO Point of Contact Telephone (Optional)

0431 2772001

Mission*

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

Our focus is to provide an accessible, affordable, and appropriate range of high-quality habilitation

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services for children with cerebral palsy.

Our aim is to provide self-development opportunities to the disabled in order to enable them to live with dignity and be considered equal citizens of India.

Our commitment is to change for the better the lives of the disabled.

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.

NGO_letter.pdf

Are you working with a high school?*

No

Project Team

Project Leader: First Name*

Sindhuja

Project Leader: Last Name*

GS

Project Leader: Email Address*

sindhujags03@gmail.com

Project Leader: Telephone Number*

9791286213

Is the Project Leader a member of IEEE?*

No

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.

Second Team Member: First Name*

Gopikka Nair

Second Team Member: Last Name*

A

Second Team Member: Email Address*

agopikaanair@gmail.com

Second Team Member: Telephone Number*

9514341727

Is the Second Team Member a Student?

No

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Is the Second Team Member a member of IEEE?*

Yes

Is there a third member of the team?*

Yes

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.

Third Team Member: First Name*

Bharath Kumar

Third Team Member: Last Name*

ML

Third Team Member: Email Address*

m.l.bharathmurugan@gmail.com

Third Team Member: Telephone Number*

9487490768

Is the Third Team Member a member of IEEE?*

Yes

Is the Third Team Member a Student?

Yes

Is there a fourth 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.

Fourth Team Member: First Name*

Vasath Kumar

Fourth Team Member: Last Name*

T

Fourth Team Member: Email Address*

tandyalavasanth@gmail.com

Fourth Team Member: Telephone Number*

8374914961

Is the Fourth Team Member a Student?

No

Is the Fourth Team Member a member of IEEE?*

No

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/>

Where did you hear about EPICS in IEEE?*

I have a thorough grasp of IEEE's EPICS program, which I was introduced to throughout my undergraduate years with the help of instructors. I was able to have direct experience with applying engineering concepts to community needs—a fundamental idea of EPICS—through their guidance. This experience gave me a strong sense of social duty in addition to improving my technical abilities. I'm excited to keep contributing to worthwhile initiatives that improve society by using this expertise.

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

- USER_CUSTOMIZABLE_MULTIPURPOSE WHEELCHAIR.docx
- NGO_letter.pdf

Components and Costs for Voice and Joystick-Controlled Wheelchair Project is \$1577(1,30,000)

Microcontroller Board

Arduino Mega 2560 Rev3: \$30(2500rs)

Voice Recognition Module

EasyVR 3 Voice Recognition Module: \$78(6500rs)

Joystick Module

Logitech Extreme 3D Pro Joystick: \$42(3500rs)

Motor Drivers

Cytron 10A DC Motor Driver (2 pieces): \$36(3000rs)

Pololu Dual G2 High-Power Motor Driver 24v21 (2 pieces): \$145(12,000rs)

Power Supply

24V 20Ah Lithium-Ion Battery Pack: \$217(18,000rs)

DC-DC Buck Converter (24V to 5V): \$12(1,000rs)

Display

Waveshare 7-inch HDMI LCD (H) Touch Screen: \$96(8,000)

Wiring, Connectors, and Enclosures

Jumper Wires (assorted): \$12(1,000rs)

Connectors and Crimping Tools: \$30(2,500rs)

Waterproof Enclosure Box: \$48(4,000rs)

Programming and Integration

No additional cost (assuming you have the necessary programming skills)

Testing and Debugging Tools

Multimeter: \$18(1,500rs)

Mechanical Components and Fabrication

Aluminum Extrusions and Brackets: \$120(10,000rs)

Fasteners and Hardware: \$30(2,500rs)

Fabrication and Assembly: \$241(20,000rs)

Wheelchair

Basic Wheelchair Model: \$181(15,000rs)

Miscellaneous and Contingency

\$241 (20,000rs)

Total Approximate Cost

\$1577(1,30,000)



THE SPASTICS SOCIETY OF TIRUCHIRAPALLI (SPASTI)

Registered under the Tamil Nadu Societies Registration Act, 1975 R. No. 239 / 1992.

Registered with the Government of India under FCR Act, 1976, R. No. 076040061

Registered under the Rights of Person with Disabilities Act, 2016

Donations are exempted under Sec. 80G of the Income Tax Act; 1961.

Patron
District Collector, Tiruchirapalli

President
P. M. Shafi

Secretary
M. Subramanian

To,

The Committee Members

EPICS in IEEE

IEEE, USA

Sub: Acceptance to support the project '**User Customisable Multifunctional Wheelchair for disabled**' proposed by SRM Institute of Science and Technology (SRMIST), Tiruchirappalli, India.

Dear Sir/Madam,

The Spastics Society Of Tiruchirappalli, Tamil Nadu, India is a recognised institution by the State Commissioner for the Welfare of the Differently Abled, Government of Tamil Nadu, India. This organisation is a non-profitable organization which rehabilitates and provides education for children with Cerebral Palsy and other Neuro Developmental Disabilities. Our school is willing to be the collaborator for the "**User Customisable Multifunctional Wheelchair**" project proposed and submitted for EPICSS in (EEE funding by SRM Institute of Science and Technology, Tiruchirappalli, India. The Spastics Society Of Tiruchirappalli, will support the project by allowing for the development of client centric mobility device for the seamless transition to enhance social participation.

Yours sincerely,

C. Shanthakumar
Director

Director
THE SPASTICS SOCIETY OF
TIRUCHIRAPALLI

Director : C. Shanthakumar

Service Centre for Cerebral Palsied Children

No.5, Revival Nagar, Ramalinga Nagar South Extension, Vayalur Road, Tiruchirapalli - 620 017, Tamilnadu.
e-mail : spasticsocietyoftiruchirapalli@gmail.com / website : www.spasticstrichy.co.in / Phone : 0431 - 2772001.

Branches at : Musiri, Lalgudi, Thuraiyur, Manaparai