Final Year Project Showcase Batch 2020
Year 2024

	Department: Electronic Engineering Programme: Bachelor of Electronic Engineering
1	**Project Title** Smart Inclined Mobility: Empowering Disabled Individuals with IoT Wheelchair Lifters for Stairs
2	**Project Idea** The project focuses on developing an inclined wheelchair lifter to address the significant accessibility challenges faced by individuals with mobility impairments. The device enhances mobility by providing a safe, cost-effective, and versatile solution for overcoming stair-related obstacles, especially in environments where elevators are not feasible. The lifter is adaptable for various settings like buildings, homes, hospitals, and public spaces, promoting inclusivity and independence for wheelchair users.
3	**Process** **Component Selection and Research** • **Identify Components:** Leverage affordable and accessible components such as Arduino Mega, stepper motors, and DC motors. • **Literature Review:** Conduct a comprehensive literature review to understand the functionalities of each component and existing solutions related to wheelchair mobility. **Design and Integration** • **System Design:** Integrate Bluetooth modules for user control, ensuring seamless communication between the device and users. • **Safety Features:** Incorporate critical safety features, including load cells to monitor weight, emergency stop buttons, and limit switches, to enhance user safety during operation. • **Mobile App Development:** We developed a companion mobile application using MIT App Inventor to enhance the functionality of our inclined wheelchair lifter project, allowing caregivers or users to remotely trigger emergency notifications **User Interface Development** • **LCD Interface:** Design and implement an LCD interface to facilitate user-friendly operation, making it easy for users of all ages to control the device. • **Customization Options:** Ensure the design allows for future enhancements, such as smartphone app integration for remote control. **Prototype Assembly** • **Lifter System:** Assemble all components into a lifter system, ensuring proper alignment and functionality. **Testing and Evaluation** • **Functionality Testing:** Test the complete system to ensure that all components work together effectively and that safety features function as intended
4	**Outcome** The project successfully delivers a low-cost, easy-to-use wheelchair lifter that allows users to navigate stairs independently. The device can be deployed in both public and private spaces,

	ensuring that mobility-impaired individuals can safely and easily overcome obstacles like stairs, promoting greater independence and quality of life.
5	**Evidence (Theoretical Basis)** The goal of our FYP is to design and implement an **Intelligent Stair Lifter System** that enhances mobility for individuals with disabilities or elderly people facing difficulty with stairs. This system integrates safety features, weight sensors, and smart control mechanisms, ensuring efficient and secure operations. Our approach combines **IoT technologies** with a **microcontroller-based system** to manage and process sensor data, providing real-time alerts and automatic emergency responses, such as shutdowns during malfunctions. **Key Features** 1. **Weight Sensors**: The system enforces weight limits to prevent overloading and ensure safety. 2. **Microcontroller**: An Arduino serves as the central control unit, processing data from sensors and controlling operations. 3. **Safety Mechanisms**: Emergency stop buttons, automatic shutdown during malfunctions, and overload protection are integrated to enhance user safety. 4. **Real-Time Alerts**: Notifications inform users or caregivers of critical events, such as low battery levels or required maintenance. 5. **Power Backup**: The system includes a reliable power supply with backup options to ensure functionality during outages. 6. **Security**: Measures are in place to prevent unauthorized access and ensure data privacy. **Literature Review** Our research highlights the critical need for advanced mobility solutions, particularly for **6.1 million** people in the US who rely on mobility aids and **11.5 million** elderly individuals facing difficulties with stairs. While current solutions offer basic assistance, they often lack affordability, ease of use, and versatility. Modern stair lifts have evolved to be safer and more user-friendly, but there is still a gap for an **affordable, comprehensive solution** that integrates smart technology for indoor and outdoor environments. Our intelligent stair lifter aims to bridge this gap by incorporating advanced safety, usability, and accessibility features. **Design and Components** 1. **Mechanical Design**: The system includes upper and lower call stations, a moving platform, safety locks, limit switches, and a rack and pinion drive system for precise control and movement. 2. **Dimensions**: The platform and rails are optimized to accommodate various user needs, with specific height, width, and clearance measurements to ensure functionality and comfort.

	3. **Drive System**: A **rack and pinion mechanism**, powered by a DC motor, provides smooth vertical movement, while a **stepper motor** manages the safety belt. 4. **Control System**: Users can control the lift using a keypad or a Bluetooth module for wireless operation. An LCD provides real-time feedback on system status and errors. 5. **Safety Features**: The system includes limit switches to prevent mechanical overrun, an emergency stop button for immediate shutdown, and overload protection via load cell sensors. 6. **Mobile App Development:** We developed a companion mobile application using MIT App Inventor to enhance the functionality of our inclined wheelchair lifter project, allowing caregivers or users to remotely trigger emergency notifications.
6	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** By improving accessibility and inclusivity, the wheelchair lifter contributes to the United Nations Sustainable Development Goal (SDG) 11: Sustainable Cities and Communities. The project encourages equitable access to urban infrastructure, fostering a more inclusive society by enabling wheelchair users to move independently in spaces that were previously inaccessible.
7	**Competitive Advantage or Unique Selling Proposition** The **Inclined Wheelchair Lifter** offers a unique selling proposition by providing a cost-effective, innovative solution to mobility challenges, particularly for elderly and disabled individuals. By utilizing affordable components like Arduino Mega, stepper motors, and DC motors, our product significantly reduces production costs compared to traditional elevator systems, making it an attractive option for budget-conscious markets. Additionally, it enhances process efficiency by offering a space-saving, easy-to-use system that is both reliable and safe, improving the overall mobility experience for users. This project also contributes to the attainment of several Sustainable Development Goals (SDGs), including SDG (Good Health and Well-Being), SDG (Reduced Inequalities), and SDG (Industry, Innovation, and Infrastructure), by promoting accessible, sustainable infrastructure solutions. Together, these factors create a compelling case for industry investment and adoption, with the potential to capture new market segments and increase market share.
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region) • **Good Health and Well-Being:** The project enhances the quality of life by providing independence and reducing injury risks for wheelchair users while navigating stairs. • **Decent Work and Economic Growth:** The product enables greater mobility, fostering opportunities for wheelchair users in social and economic activities. • **Industry, Innovation, and Infrastructure:** The design integrates modern technology to offer an innovative mobility solution that can be adapted to existing infrastructure. • **Life on Land:** By promoting independence, the project contributes to healthier, more inclusive communities.
b	**Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.)

	The device uses energy-efficient motors, minimizing environmental impact while providing a cost-effective mobility solution.	
c	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests) Unlike conventional electric wheelchairs that struggle with stairs, this device provides a versatile, mechanical solution that enhances safety and efficiency in various environments. It offers improvements in safety, ease of use, and flexibility compared to existing solutions.	
d	**Expanding of Market share** (e.g. how it expand and what is the problem with the current market The wheelchair lifter opens up opportunities in markets such as hospitals, hotels, homes, and public spaces where inclusive design is increasingly in demand.	
e	**Capture New Market** (e.g. Niche market or unaddressed segment) This product addresses a niche market—wheelchair users in urban environments where staircases are a common obstacle—offering a unique solution not widely available.	
8	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service • Individuals with mobility impairments • Elderly wheelchair users • Hospitals, nursing homes, and healthcare institutions • Public facilities such as hotels, airports, and transportation hubs □ Caregivers looking for reliable and safe mobility solutions	
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11	**Video (If any)**	https://www.instagram.com/reel/C_uPfpoI_1b/?igsh=aWJzbjdiazIwdDBy