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DESIGN AND DEVELOPMENT OF SEMI AUTOMATIC WALKER FOR ACCIDENTAL PATIENT

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ABSTRACT

The increasing number of accidents and related injuries has resulted in a growing need for effective mobility assistance during rehabilitation. Conventional walkers often lack stability and require considerable upper-body effort, increasing the risk of fatigue and secondary injuries. To address these limitations, a cost-effective semi- automatic walker has been designed and developed to provide enhanced stability, reduced user strain, and adaptive support during ambulation. The system integrates sensors, a microcontroller, and motorized actuators to assist movement while maintaining user control. Experimental evaluations demonstrated strong load-bearing capability, improved stability, and a significant reduction in required user input force, along with high user satisfaction regarding safety and easy of use.The walker also features a stair-adjustable mechanism that enables safe ascent and descent by automatically adapting to changes in surface elevation, ensuring stability on uneven terrain. Additionally, semi-automatic movement assistance supports patients during standing and gait initiation through pressure-sensor-based motor activation and adaptive speed control. These combined features make the walker suitable for real-world rehabilitation environments, improving patient confidence, safety, and recovery outcomes while remaining economically feasible for healthcare settings, particularly in developing regions.

Keywords: Walker, Design, Load Analysis, Stair Cladding, Move Forward, Mobility.

1. INTRODUCTION

Accident injuries often limit a person's ability to walk and move independently due to pain, weakness, and poor balance. During recovery, patients usually depend on conventional walkers, which require physical effort and can feel uncomfortable or unsafe, especially after fractures, surgeries, or nerve injuries. Because of these limitations, recovery can become slow and patients remain dependent on care givers for longer periods.

To overcome these problems, semi-automatic walkers have been developed by combining mechanical support with electronic control systems. These walkers use motors and microcontrollers to assist the patient's movement based on their walking needs. By providing controlled and powered assistance, they reduce physical effort, improve balance, and increase user confidence. Compared to traditional walkers, semi-automatic walkers offer safer mobility, faster rehabilitation, and greater independence, making them a promising solution for modern rehabilitation care.

2. LITERATURE SURVEY

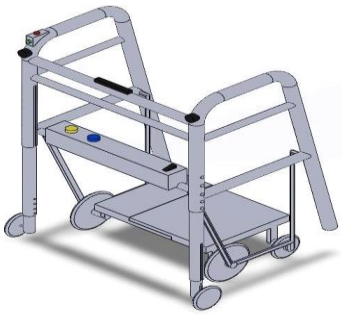
SN	Paper Title	Author	Year	Methodology/ Concept	Gap Identification
01	A Smart Robotic Walker with Intelligent close-Proximity Interaction capabilities for Elderly Mobility Safety	W. Yuan, S. Wang, et al.	2020	Developed a robotic walker with multiple interaction modes The core concept is control using machine learning to monitor and predict user movement, allowing the walker to automatically move in front direction.	Developing a low-cost, safe, and compact semi-automatic system that can help in patient movement, walking, and stair climbing, as current devices are expensive, bulky, and unsafe for home use.
02	Development of smart mobile Walker for Elderly and Disabled	M. Tanaka, K. chugo, et al.	2014	Developed a multi-functional smart walker that includes walking aid, sit-to- stand aid, and electric scooter functions.The methodology focuses on	Highlights the gap where devices lack multi-functionality and physical support beyond simple motion. Supports your aim for a holistic apparatus

				modular design and integrating systems to provide comprehensive physical assistance, including posture maintenance.	that provides adaptive support and stability across various patient needs.
03	Design of an Assistive Walking Device with Special Rehabilitation Capabilities	Ahmad Muammar Bin Md Yasin, Lim Wei Liong, Patrick S. K. Chua	2016	There is a growing need to develop and improve assistive devices, especially walkers, to enhance their effectiveness in rehabilitation and functional support for users. This review highlight the importance of smart walkers in maintaining mobility and explorestheir potential role in the rehabilitation process. It also summarizes researchon evaluating smart walkers, particularly their efficiency and impact on gait performance. Additionally,it discusses advanced conceptssuch as autonomous and shared-control systems, manual guidance, and the use of smart walkers as personal aids for sit-to-stand Assistance and as	Current walkers provide only basic support and lack intelligent features such as balance assistance, stair adaptability, reduced physical effort, and gait monitoring. Existing smart walkers are often costly, bulky, or limited in functionality. This creates a gap for a cost-effective, semi- automatic walker that improves safety, Stability.
				diagnostic tools for assessing patient gait during rehabilitation.	
04	A Study on the Development of an Electrically Assisted Smart Walker	Yuto mori	2025	A smart, electrically assisted walker designed to help elderly or mobility- impaired individuals walk more independently by solving common problems faced in care facilities.	Existing walkers lack motor assistance, smart features, and personalized support, making them insufficient for users who need mild walking help and want greater independence in care facilities.
05	Prototype of a Stair Climbing Walker	Mr. Bapina Kumar Kout	2020	stair climbing walker, ascending stairs, descending stairs.	The walker which is not stable in stair which is have a wheel attached in the legs of walker
06	A Smart Robotic Walker With Intelligent Close-Proximity Interaction Capabilities for Elderly Mobility Safety	Mr. Jian Huang	2020	Falling protection and Motion system (emergency brake), The smart robotic walker is designed as an advanced indoor mobility	Traditional walkers for the elderly are basic, non-intelligent, and lack interactive features for safe mobility. They cannot detect user

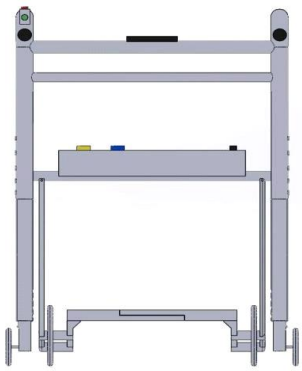
				aid for the elderly, combining a conventional rollator frame with a mobile robotic platform. It provides intelligent support through	intentions, provide emergency prediction, or support autonomous navigation. There is no system that combines robotics, gait tracking, and voice-based
				multiple interaction modes such as voice commands, gait detection, and haptic touch. The system aims to offer flexible, safe, and user-friendly assistance by tracking the user's movement, predicting emergencies like falls, and navigating autonomously using sound-source localization.	interaction in a single walker. The need for a smart, intelligent walker that enhances safety, independence, and user assistance beyond conventional designs.
07	Innovative "RK Walker": Transdisciplinary Multiphasic Observational Experimental Trial	Mr. Priyanshu Rathod and Kartik Kothari	2020	The concept is to create an innovative walker that helps patients not only walk on flat surfaces but also climb stairs safely. Traditional walkers fail to support stair egotiation, so this design introduces a mechanism that adapts to different stair heights and angles. The walker improves balance,	Traditional walkers cannot be used on stairs, causing difficulty and dependency for patients during stair climbing. They lack stability, adjustability, and safety features for stair negotiation. This gap highlights the need for a specially designed walker that supports safe and
				Reduces effort, and increases safety for people with partial or restricted weight- bearing gait. Through design, testing, and comparison with standard walkers, the new model proves more functional and user-friendly. Overall, it aims to enhance independence and improve the quality of life for individuals with locomotor disabilities	Independent stair climbing.
08	An Innovative Concept for a Walker with a Self-	Stephane lopes, Lucia Filipe	2019	To design a safe, easy-to-use two- wheeled walker	Existing walkers have heavier or inefficient locking systems,

	Locking Mechanism Using a Single Mechanical Approach	and team		with an improved self-locking system that provides stability during gait, reduces user effort, and enhances mobility for older adults.	increase energy cost, and make users feel insecure. lightweight, reliable, and low-effort self- locking mechanism is still missing.
09	Development of A Standing	Mr. daisuke	2017	To design a low-cost robotic walker that	Current standing-Assist devices are
	Assistance Walkerb for a Patient with Low Level of Care	chugo, Atsushi kojina and team		provides partial standing assistance using minimal actuators, a gas- spring mechanism, and guided posture correction through force and voice instructions, ensuring safe and easy use for elderly users at home.	bulky, costly, and provide full lifting support that most elderly users do not require. There is a gap for a lightweight, affordable walker that offers only the necessary partial assistance while ensuring stability and safety during standing
10	Assistive Mobility Devices focusing on Smart Walkers:	M. M. Martins, Cristina P. Santos	2012	The article reviews modern robotic technologies used in mobility assistive devices, especially walkers, showing how they support elderly independence and improve daily mobility.	Current walkers still lack adaptability, intelligence, affordability, and strong safety features—highlighting the need for more advanced, user-friendly Semi automtic walker designs.

4. MODELING



Isometric view.



Front view

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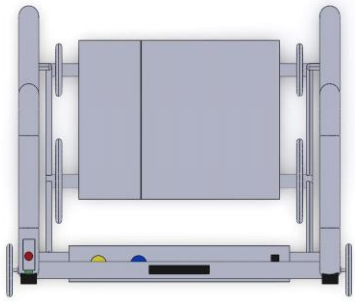
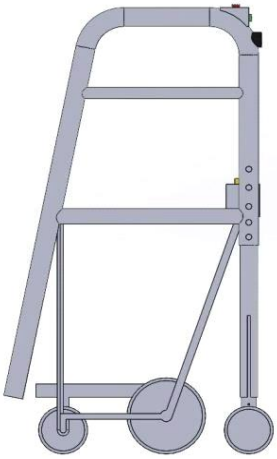


Top view



side view

5. RESULTS AND DISCUSSION

In this Section results and discussion of the study is written. It is given by its benefits and advantages.

6. ADVANTAGES

1. Improves Stability: Provides strong balance support for weak or elderly patients.
2. Reduces Fall Risk: Minimizes chances of slipping or falling while walking.
3. Easy Stair Climbing: Helps patients move safely on stairs.
4. Supports Weight Bearing: Reduces load on injured or weak legs.
5. Increases Mobility: Allows patients to move independently indoors/outdoors.
6. Enhances Safety: Gives secure grip and steady walking assistance.
7. Boosts Confidence: Encourages patients to walk without fear.
8. Requires Less Effort: Reduces physical strain due to smooth gliding/wheels.
9. Suitable for All Ages: Helpful for elderly, post-surgery, or injured patients.
10. Lightweight & Portable: Easy to carry, handle, and use anywhere.

The authors can acknowledge professor, friend or family member who help in research work in this section.

7. APPLICATIONS

1. Hospitals: Used for patient mobility during recovery.
2. Rehabilitation Centers: Essential for physiotherapy and gait training.
3. Homes: Helps elderly and disabled individuals move safely at home.
4. Orthopedic Recovery: Ideal for leg injuries, fractures, and surgeries.
5. Neurological Conditions: Assists patients with weak motor control.
6. Elder Care Centers: Widely used for daily movement support of seniors.
7. Stair Assistance: Useful for patients living in multi-storey homes.

8. Post-Operative Care: Helps patients regain walking ability after operations.

9. Balance Training: Used in therapy sessions for improving body balance.

10. Mobility Aid on Uneven Surfaces: Helps patients walk confidently on rough or uneven floors.

8. CONCLUSION

The design and development of a semi-automatic walker for accidental patients demonstrate a significant step toward improving mobility assistance and patient rehabilitation. By integrating supportive mechanical structures with semi-automated features, the device enhances stability, reduces physical strain, and promotes safer, more independent movement for individuals recovering from injuries. The project successfully addresses key challenges faced by patients with limited mobility by offering controlled movement, improved ergonomics, and enhanced usability. Overall, the semi-automatic walker has the potential to greatly improve recovery outcomes and quality of life, while also contributing to advancements in assistive healthcare tech.

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