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REVIEW on MULTIFUNCTIONAL ROBOT for SPECIALLY ABLED PEOPLE

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Abstract: Patients have never been easy to transport, though several methods have been used to address this issue, from basic stretchers to advanced wheeled equipment. Even with advancements in medicine, moving patients between beds, stretchers, and wheelchairs is still challenging for caretakers. A wheelchair that can be transformed into a stretcher is suggested as a solution, with the goal of making use easier and enhancing patient comfort. Many disabled persons today rely on wheelchairs to help them move about. With robots, sensors, and artificial intelligence (AI), smart wheelchairs provide improved features to boost productivity and freedom. This evaluation delves into the state-of-the-art smart wheelchair technologies and recommends avenues for future investigation. Additionally, a multipurpose wheelchair with increased patient lifting capabilities, powered mobility, and features including object recognition, vertical movement, black line detection, and an integrated buzzer are being developed. This cutting-edge tool attempts to empower wheelchair users and reduce caregiver workloads. This abstract analyzes smart wheelchair technology, addresses historical mobility issues, suggests improvements in mobility aids, and introduces the multifunctional wheelchair with its cutting-edge features for better healthcare mobility solutions. Wheelchairs, stretchers, mobility aids, smart wheelchairs, multifunctional wheelchairs, healthcare, artificial intelligence, robotics, sensors, vertical movement, black line detection, and integrated buzzers are among the terms that are used.

Keywords: Artificial Intelligence, Robotics, Sensors, Smart wheelchair.

I. INTRODUCTION

A wheelchair is a specific type of mobility aid that is used to facilitate the movement of individuals with disabilities around on their own. It is only a chair with wheels attached. Although powered and manual wheelchairs have advanced, they continue to unable to fully meet the diverse needs of users. The requirements of users of wheelchairs must be deeply understood by designers to be able to genuinely enhance freedom as well as living quality. The idea of a wheelchair that doubles as a stretcher is examined in this discussion. By looking at the conception and creation of this adaptable device, the aim is to more effectively address the mobility problems that individuals with disabilities encounter. The goal is to provide a versatile system that enhances mobility and enables seamless transitions between everyday use and medical emergencies or transfers.

II. OBJECTIVE

The creation of a state-of-the-art mobility solution that enhances the independence, mobility, safety, accessibility, and convenience of individuals with disabilities is the aim of the smart wheelchair initiative. This wheelchair has advanced technology, such as sensors for obstacle detection, AI-based navigation algorithms, and user-friendly interfaces. These features enable users to explore complex environments with comfort and effectiveness. The wheelchair is equipped with real-time environmental monitoring and user health metrics tracking because safety is the primary concern. This allows for early warning of potential threats. Accessibility improvements include adjustable chairs, strong, lightweight materials, and seamless assistive technology integration.

III. PRIOR: THE POWER WALKER

The first prosthetic limb (PW) was created by mechanical engineer George Klein of the National Research Council of Canada for paraplegic World War II veterans [22]. That kind of impairment means that the person is doomed to bed and cannot get out of bed without the help of others or medical technology. But we also want to communicate to those who are just starting out in life about the origins of disability that an individual with quadriplegia may still live a very full life and contribute significantly to society if they are provided with the appropriate technology and human resources. Although individuals that have limited movement are the main target audience for PWs, those with wearisome or painful

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situations can also profit from them. The American Wheelchair Company and Everest & Jennings started manufacturing PWs for retail sales in 1956 [23].

The following are a PW's fundamental elements:

- The driving system, or chassis, which may front-wheel drive, rear-wheel drive, center-wheel drive, or all-wheel drive. The chassis features four wheels for all-terrain driving, tank tracks that are all-terrain, stairs, and standing. It may also be folded [24].
- Alkaline batteries: Two 24V batteries with wet cells were used to power the original PWs. However, before leaving the wheelchair, these batteries must be taken out. Dry cell batteries eventually took their place.
- The controller makes it simpler for both humans and robots enabling them to able to communicate effectively. In addition to hand joysticks, commercial controllers also come with head, chin, and sip-n-puff joysticks.

The following are a PW's fundamental elements:

How individuals are seated: Seat cushions are usually improved with foam, gel, or air to lessen pressure sores; For a cozier recline, footrests might be retractable or motorized. Backrests can be tilted and reclined and are frequently padded with foam. The provision of using lateral supports, the person is kept from falling. PWs are restricted by Medicare prescription rules to people who are incapable of pushing a wheelchair manually.

Nevertheless, many individuals may benefit from a PW and often resort to less expensive, generic substitutes that often do not meet the necessary standards. Many quadriplegics end up customizing their wheelchairs with additional safety features like rearview cameras, lighting or reflectors, and assistive technology for input computing.

Co-author Dr. Jesse Leaman began improving the PW user experience in 1998 while interning for the summer at NASA's Marshall Space Flight Centre. His invention, the information technology upgrade package for PWs, also referred to as "Gryphon Shield," was recognized as one of the top 25 inventions of 2007 by the History Channel and the National Inventors Hall of Fame [25]. But by 2010, the wheelchair foundation was no longer strong enough to sustain the weight and size of the system, and maintenance was getting harder. An improvement over "Gryphon Shield," the I Chair was introduced in [26], [27]. It uses a Mount-n-Mover [29] and a head tracking mouse [28]. All things considered, previous research has had positive results in presenting the first technology breakthroughs that help PW users inside their day-to-day work.

IV. OPERATING MODES

Based on the work and the user's level of skill, operating modes can be fully or partially autonomous. An inventory of subtopics and illustrative references pertaining to studies on SW operating modes may be found. An autonomous system can be most useful to those who are unable to organize or execute a route toward a goal, but only in the event that they most of their time spent in the same regulated environment. It is ideal for the design to consider each user's unique talents and preferences, providing them with as much autonomy and help as needed.

A. *Machine learning*

In addition to being pile of parts, wheelchairs are now outfitted with sophisticated codes which offer the artificial intelligence required to make snap decisions about the wheelchair's orientation and potential risks. Machine learning is applied in SWs through a number of techniques, such as using neural networks for obstacle identification , replicating pre-taught routes, combining sonar sensors data with user input via joystick, using obstacle density histograms, and using approaches that are based on rules.

The not real impedance concept is used in the control architecture of the LIASD SW. The required activities are executed smoothly since this method considers actual impedance concept qualities like stiffness, viscosity, and inertia. There were many number of companion SW creations, as demonstrated. Utilizing the range of the lazer sensors, it can follow the companion's body location and orientation by utilizing data association estimations of the guide's footprint and Kalman filter estimates. A spline of cube is used to calculate the wheelchair's desired path relying on the data of the position from the footprint.

The walker is positioned such that it maintains a consistent distance from the guide while following their footprint. Another example is a recently discovered method that enables wheelchairs to travel with their companions despite the wheelchair not knowing the companion's destination ahead of time. The companion's destination is estimated by the wheelchair using data from observations of people's everyday actions.

Multi-wheelchair development controls was created to aid multiple disabled individuals simultaneously and facilitate companion communication. Planning a location (p) as indicated from trajectory of model later computing a path (p1, p2) for every walker a minimal displacement from p allows wheelchairs to be managed while keeping formation.

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B. *Localization and mapping*

Creating a solid, trustworthy localized and navigated operation for indoor as well as outdoor settings takes so much work. Ever after the SW must safely navigate roads and sidewalks, the localization precision must be within some centimeter. The inaccuracy and robustness of global positioning systems (GPS) are the primary obstacles to outdoor localization, particularly in areas of maximum concentration of trees. For the betterment of localization accuracy, the GPS readings are combined with attitude data from the onboard inertial measurement unit (IMU). Furthermore, the navigation system's architecture integrates GPS/IMU readings with wheel odometry data using an extended Kalman filter (EKF) architecture. The fusion of odometry-enhanced will allow the SW to locate itself exceedingly precisely even in scenarios where GPS is not available.

V. FUTURE RESEARCH

Smart wheelchairs will surely be necessary for upcoming years to increase the independence and mobility of those with disabilities. In addition to their increased capability, these state-of-the-art devices present significant opportunities for the development and integration of novel technologies such as mobile robots and sensors. The ongoing advancement including upskilling of these technologies may lead to reduced costs for intelligent walker systems, making them accessible to a larger range of users.
Sensors are crucial to the operation of smart wheelchairs because they make navigation and environmental awareness easier. sophisticated sensors enhance safety by spotting obstacles and offering guidance in difficult situations. Proximity and object detection sensors are two types of these sensors. Further research endeavors could focus on enhancing the accuracy, reliability, and responsiveness of these sensors, hence improving user experience and safety overall.
Furthermore, mobile robotics technology into intelligent wheelchairs considered to be a vital field for additional study and advancement. Robotics can help minimize dependence on outside assistance by automating tasks such as item manipulation, navigation, and even physical support. This can boost user autonomy. Research in this field of place can be used to investigate novel robotic designs, control algorithms, and human-robot interaction strategies that are particularly well-suited for smart wheelchair applications. Increasing the use and accessibility of smart wheelchairs still requires cost reduction. Future research endeavors could concentrate on developing cost-effective sensor systems, capitalizing on manufacturing economies of scale, and exploring alternative materials and components that maintain superior performance while lowering production expenses. By addressing these problems, researchers can aid for the upbringing of more affordable and accessible smart wheelchair technology for individuals worldwide.
The advancement of both hardware and software is crucial for the glory of smart wheelchairs. Improvements in hardware components, like strong but light frames, efficient battery systems, and sensitive actuators, are necessary to improve mobility and comfort. Software development is also essential for the implementation of complex algorithms for adaptive control systems, user interface customization, and navigation. Further research efforts could focus on improving hardware design and developing robust software systems that can handle a wide range of user needs and preferences.
Furthermore, making use of user reviews and comments is crucial for identifying current system issues also for generating innovative suggestions for development. User-centered design approaches have the potential to direct the innovation of intelligent wheelchairs that better accommodate the diverse needs and preferences of users. By adding new features, enhancing current ones, and incorporating user feedback into iterative design cycles, researchers and engineers can ensure that smart wheelchairs remain valuable tools for enhancing quality of life.

VI. CONCLUSION

In summary, there is so much potential and obstacles associated with the creation of smart wheelchairs and convertible stretcher-wheelchairs in the future, which call for creative research and development efforts. These findings highlight the variety of applications and future directions in assistive technology for mobility devices. First and foremost, resolving several crucial problems that manufacturers and researchers have discovered is essential to the economic viability and broad acceptance of smart wheelchairs. The balance between precision and cost-effectiveness is still important, and integrating sophisticated yet reasonably priced sensors could improve functionality without raising expenses. Comprehensive technology solutions are also required since the potential for smart wheelchairs that can monitor patient conditions independently and accommodate various kinds of limitations. Although the current models perform well in indoor environments, future research could focus on building reliable outdoor systems, especially ones for those with mental disabilities. Robotics and sensor technology developments are probably able to propel these breakthroughs ahead, opening doors to increased economic viability and increased accessibility. Second, the search on wheelchair convertible stretchers provides information on current industry trends and the variety of technologies available. The widespread use

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of electrical, hydraulic, pneumatic, and mechanism-based systems demonstrates the variety of options available to meet a range of requirements and price points. Although the additional features offered by electronic, hydraulic, and pneumatic variations are frequently prohibitively expensive as compared to simpler mechanism-based systems. This finding emphasizes how crucial it is to strike a balance between price and technical complexity so as to guarantee accessibility and diversity in healthcare settings. Subsequent advancements have to concentrate on improving current technology while investigating innovative methods that give priority to affordability and user-centred design concepts. Thirdly, utilizing the quick developments in sensors, processing power, and artificial intelligence, smart wheelchairs mark a revolutionary change comparable to the state of change from manual to powered wheelchairs.

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