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Original Article

Design and Development of Wheelchair cum Stretcher with IoT

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ABSTRACT: *The wheelchair-cum-stretcher is an innovative, multifunctional medical device designed to enhance patient mobility and healthcare efficiency. It integrates the functionalities of both a wheelchair and a stretcher, allowing seamless transformation between the two modes. This dual-purpose design minimizes the need for multiple transfers, reducing patient discomfort and the risk of injury. The device is particularly beneficial in emergency settings, hospitals, and elderly care facilities, where quick and safe patient movement is crucial. Features such as an adjustable frame, foldable components, and ergonomic support ensure ease of use for both patients and caregivers. This study explores the design, materials, and engineering considerations behind the wheelchair-cum-stretcher, focusing on durability, maneuverability, and patient comfort. Various prototypes were analyzed to optimize weight distribution, stability, and ease of operation. The research also highlights the potential impact of this device on healthcare efficiency, particularly in reducing response time and labor costs. The findings suggest that a well- designed wheelchair-stretcher hybrid can significantly improve patient care, making it a valuable addition to modern medical equipment.*

KEYWORDS: *Iot, Heart Rate, Temperature Level.*

1. INTRODUCTION

Wheelchair-cum-stretcher is a multifunctional medical device designed to serve as both a wheelchair and a stretcher, providing flexibility in patient transport across various healthcare settings. It is commonly used in hospitals, ambulances, and emergency situations, allowing caregivers to easily switch between sitting and lying positions based on the patient's condition.

These devices typically feature an adjustable backrest, lockable wheels, and safety measures such as seat belts and side railings to ensure patient security. Made from lightweight yet durable materials like aluminum or steel, they offer ease of handling and portability. The wheelchair-cum- stretcher is particularly beneficial for individuals with limited mobility, enhancing comfort and efficiency in patient care. Its versatility makes it an essential tool in medical facilities, home care, and public spaces where quick and safe patient movement is required.

2. COMPONENTS

The proposed system is composed of the following primary components:

FIGURE 1 Temperature Sensor

- Heart Rate Sensor: A photoplethysmography (PPG) sensor is used to measure the patient's heart rate. It detects blood volume changes in the capillaries of the skin by emitting light and measuring the light reflected back.
- Temperature Sensor: A thermistor -based or infrared sensor is used to monitor the patient's body temperature. This data helps identify fever, which could indicate infection or complications.

2.1. PROBLEM STATEMENT:

Patient transportation in hospitals, ambulances, and emergency situations often requires switching between a wheelchair and a stretcher, leading to delays, discomfort, and increased workload for healthcare providers. Traditional wheelchairs and stretchers are separate units, making patient transfers challenging, especially for individuals with mobility issues or in critical conditions.

This can result in strain on caregivers, potential risks of injury to patients, and inefficiencies in emergency medical response. There is a need for a versatile, easy-to-use, and safe solution that combines both wheelchair and stretcher functionalities to enhance patient comfort, improve workflow, and ensure smooth transitions in various healthcare settings.

FIGURE 2 Heartrate Sensors

3. OBJECTIVE OF THE PROJECT:

- Dual-Functionality: Develop a wheelchair- cum-stretcher that seamlessly converts between both modes.
- Ease of Use: Ensure a simple mechanism for quick and effortless transformation.
- Safety & Stability: Incorporate features like lockable wheels, seat belts, and side railings for patient security.
- Lightweight & Durable Design: Use strong yet lightweight materials for easy handling and longevity.
- Comfort & Ergonomics: Provide adjustable support and cushioning for patient well-being.

3.1. EXISTING SYSTEM:

The existing system for patient transportation primarily relies on separate wheelchairs and stretchers, requiring manual transfers between them. This process can be time-consuming, physically demanding for caregivers, and uncomfortable for patients, especially those with mobility issues or critical conditions. Traditional stretchers provide support for lying patients but lack independent mobility, while wheelchairs are designed for seated transport and do not accommodate patients who need to be in a lying position. Some wheelchairs offer reclining features, but they do not fully function as stretchers.

Additionally, the design prioritizes comfort and ergonomics, incorporating an adjustable backrest, leg support, and cushioning. By reducing manual lifting, improving efficiency, and saving space in healthcare environments, this is practical and innovative solution for hospitals, ambulances, and home care.

3.2. THE PROPOSED SYSTEM:

Wheelchair-cum-stretcher system is designed to address the inefficiencies of traditional patient transportation by integrating the functions of both a wheelchair and a stretcher into a single, convertible device. This system allows seamless transformation between sitting and lying positions, eliminating the need for manual patient transfers and The main structural framework is made from lightweight yet strong materials such as aluminum or stainless steel, providing stability while keeping the device portable.

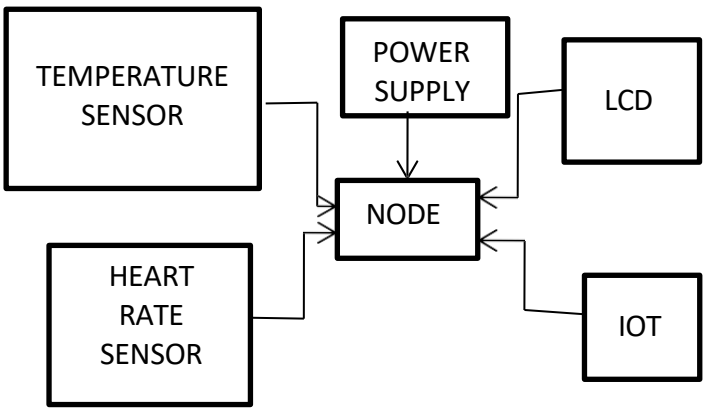

FIGURE 3 Block Diagram

3.3. HARDWARE DESCRIPTION:

FIGURE 4 Wheelchair cum Stretcher

The wheelchair-cum-stretcher consists of several key hardware components designed to ensure durability, safety, and ease of use. The seating and lying surface are made of high- density foam padding covered with a waterproof, easy-to-clean material for patient comfort and hygiene.

- The system includes a foldable and adjustable mechanism that allows smooth transformation between wheelchair and stretcher modes.
- Lockable caster wheels are incorporated to provide both mobility and stability, ensuring safe patient transport.
- A braking system enhances security by preventing unintended movement. Side railings and seat belts add an extra layer of safety, securing the patient during transport.
- The backrest and leg support are adjustable, allowing for customizable positioning based on the patient's needs.

3.4. FUTURE SCOPE:

- Integration of Automation and Smart Features: Future developments could include motorized mechanisms for effortless conversion between wheelchair and stretcher modes, as well as the addition of IoT sensors to monitor patient health during transport, providing real-time data to healthcare providers.
- Material and Ergonomic Improvements: The use of lightweight, durable materials like carbon fiber, along with enhanced shock absorption and modular designs, could make the device more portable, comfortable, and customizable for various healthcare applications.

3.5. FUTURE IMPROVEMENT:

- Automation and Motorization: Future improvements could involve the integration of motorized systems to automate the conversion between wheelchair and stretcher modes, reducing manual effort and improving efficiency in patient transport.
- Enhanced Comfort and Durability: The use of advanced materials like carbon fiber and improved shock-absorbing features would further reduce the device's weight while enhancing durability and more comfortable experience for patients during transport.

3.6. APPLICATION:

The wheelchair-cum-stretcher has a wide range of applications across various healthcare and public sectors. In hospitals and healthcare facilities, it is used for efficient patient transport between departments, examination rooms, and operating theaters, ensuring both comfort and safety during transitions. In ambulances and emergency medical services, the device provides a versatile solution for transporting patients in critical conditions, allowing easy conversion between sitting and lying positions for better stability and faster response times. For home care, it offers an ideal solution for individuals with limited mobility, helping caregivers move patients safely within the home.

The device also proves valuable in public spaces like airports and malls, where it facilitates the movement of individuals with mobility challenges. Additionally, it is an essential tool in elderly and disability care, enhancing daily mobility and improving quality of life for individuals who need assistance with movement.

4. CONCLUSION

The wheelchair-cum-stretcher offers a practical and innovative solution to improve patient transport across various healthcare settings. By combining the functions of a wheelchair and a stretcher into one device, it enhances both efficiency and patient comfort while reducing the risk of injury public spaces, where smooth and safe patient movement is critical. As the technology advances, incorporating features such as automation, smart sensors, and lightweight materials will further enhance its functionality and make it an indispensable part of modern healthcare. Ultimately, the wheelchair-cum-stretcher aims to improve overall patient care and streamline medical transport.

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