IJIRAE:: International Journal of Innovative Research in Advanced Engineering ISSN:2349-2163
Volume 13, Issue 03, March 2026 https://www.ijirae.com/archives
https://doi.org/10.26562/ijirae.2026.v1303.67

Remote Assistive Patient Transfer Device for Hospital

Dr.R.Satish Kumar
Principal & Professor
Sengunthar Engineering College (Autonomous), Tiruchengode, India
principal@scteng.co.in, harsiga@gmail.com
https://ocrid.org/0000-0003-2756-487X
Shri Sabari Nivash S, Vasanth A, Vijayasarthi S
UG Scholar, Department of Medical Electronics
Sengunthar Engineering College (Autonomous), Tiruchengode, India
sabarinivash50@gmail.com, vasanth32143@gmail.com, vijayasarathivj@gmail.com

Publication History
Manuscript Reference No: IJIRAE/RS/Vol.13/Issue03/AEMR26.MRAE10148
Research Article | Open Access | Double-Blind Peer-Reviewed |Article ID:IJIRAE/RS/Vol.13/Issue03/AEMR26.MRAE10148
Received:22,February 2026, Revised: 01, March 2026, Accepted: 16,March 2026,Published Online: 25, March 2026.
https://www.ijirae.com/volumes/Vol13/iss-03/67.AEMR26.MRAE10148.pdf
Article Citation: Dr.Satish Kumar,Shri,Vasanth,Vijayasarthi(2026), Remote Assistive Patient Transfer Device for Hospital ,IJIRAE: International Journal of Innovative Research in Advanced Engineering, Volume 13, Issue 03 of 2026 pages 521-525 **Doi:>** https://doi.org/10.26562/ijirae.2026.v1303.67
BibTeX Key: Dr.Satish@Remote
IJIRAE papers should be cited as IJIRAE (International Journal of Innovative Research in Advanced Engineering, AM Publications, India 2025, ISSN 2349-2163, https://doi.org/10.26562/ijirae.2026.v1303.67 The journal's official abbreviation is IJIRAE. Orcid: https://orcid.org/0009-0004-9398-7488

Abstract: A Remote Assistive Patient Transfer Device for Hospital Beds is a smart system designed to assist caregivers in moving hospital beds safely and efficiently within healthcare environments. Patient transportation in hospitals often requires significant physical effort from nurses and medical staff, which can lead to fatigue, stress, and potential safety risks. The proposed system aims to reduce manual workload and improve the efficiency of patient movement by enabling controlled and automated bed mobility. The system operates using a three-stage control process consisting of operator detection, desired velocity generation, and low-level motor control. For operator detection, two techniques Gaussian Distribution Method (GDM) and Artificial Neural Network (ANN) are evaluated. The ANN model trained using the Levenberg Marquardt algorithm demonstrates higher accuracy and better performance in identifying the operator's position. To achieve smooth and stable movement, two motion control methods, Optimal Multivariable PID (OMPID) and Optimal Multivariable Neural Network (OMNN) controllers, are implemented and analyzed, where the OMNN controller provides improved tracking accuracy and system stability. The hardware system includes Bluetooth communication for wireless operation, relay-based motor control, and DC motors powered by a12V power supply. These components enable the care giver to control the movement of the hospital bed conveniently and safely. Experimental results show that the system improves the efficiency, safety, and stability of patient transportation in hospitals. The proposed device provides a practical and cost-effective solution for modern healthcare environments, although improvements in load balancing and continuous power supply can further enhance its performance.
Keyword: Bluetooth-Based Control, Motorized Patient Transportation, DC Motor Drive System, Arduino Control System, Healthcare Automation, Workload Reduction

I. INTRODUCTION

Hospital beds are important medical equipment that helps improve patient comfort and assist healthcare workers in providing proper care. Over time, hospital beds have evolved from simple manually operated beds to advanced systems with features such as motorized wheels, adjustable height, and intelligent steering. These improvements make patient transportation within hospitals easier and safer. However, transferring patients between beds, stretchers, and hospital departments still creates challenges, especially for obese or critically ill patients. Frequent manual handling can also cause physical strain and injuries for nurses and caregivers. To overcome these problems, a Remote Assistive Patient Transfer Device for Hospital has been proposed. This system uses motorized movement, remote control, and intelligent navigation to assist caregivers in transporting patients safely. An operator-following mechanism allows the bed to automatically follow the care giver while maintaining proper direction and distance. The system also includes control algorithms and a low-level controller to stabilize movement and ensure accurate operation. Overall, this technology reduces the physical burden on healthcare staff and improves the safety and efficiency of patient transportation in Hospital

II. LITEARATURE REVIEW

[1] Early hospital beds were mainly mechanical structures designed to provide basic comfort and support for patients during treatment. These beds used manual mechanisms such as crank handles and mechanical linkages to adjust the headrest and leg rest positions.

[2] The mechanical hospital bed developed by Audrey(2016) is an example of this design, consisting of a metal frame, adjustable sections, side rails, and lockable wheels. The bed operates through a hand-crank mechanism that converts rotational motion into linear motion to change the position of the bed. Although this design is simple, durable, and cost-effective, it requires significant manual effort from caregivers.[2] To reduce the physical workload of caregivers, semi-electric hospital beds were introduced. The semi-electric bed developed by Drive Medical (2015) combines manual and electric mechanisms. In this system, electric motors adjust the head and foot sections using a handheld remote control, while the bed height is adjusted manually using a crank. This design improves patient comfort and reduces caregiver effort compared to fully mechanical beds. However, the manual height adjustment still limits the overall automation of the system.

[3] With advancements in healthcare technology, fully electric hospital beds were developed to provide better patient care and operational efficiency. The electric hospital bed developed by Stryker(2013) uses multiple electric motors and actuators to control movements such as height adjustment, backrest positioning, and leg support. The bed is operated through a control panel or handheld remote, allowing caregivers to quickly adjust the patient's position. While this system significantly reduces manual labor and improves patient comfort, it requires a continuous power supply and involves higher cost and maintenance.

[4] Modern hospitals require efficient patient transportation systems to reduce the physical strain on healthcare staff. The Intelli Drive Powered Transport System developed by Hill-Rom (2014) was introduced to assist caregivers in moving hospital beds safely. This system integrates an electric motor, battery, sensors, and a control handle to provide powered assistance while transporting patients. The technology improves manoeuvrability and reduces the risk of caregiver injuries during patient transfer. However, it increases system complexity and requires regular maintenance and battery charging.

[5] The Zoom Motorized Drive System developed by Stryker (2013) is another powered transport technology designed to assist in moving hospital beds within healthcare facilities. This system uses a motorized drive wheel, rechargeable battery, and electronic control unit to provide motorized assistance for pushing and steering the bed. It significantly reduces physical strain for caregivers and improves safety during patient transportation. However, it depends on electrical power and increases the cost of hospital equipment.

[6] The Drive Power™ System developed by Linet (2013) also provides powered assistance for hospital bed movement. It integrates an electric motor, rechargeable battery, drive wheel, and control handle to assist care givers in transporting patients more easily. The system improves manoeuvrability in hospital corridors and reduces the physical workload of healthcare staff. Despite its advantages, the system requires regular charging and maintenance due to its reliance on battery power.

[7] Innovative healthcare technologies have also explored multifunctional patient mobility systems. The bed–wheelchair system developed by Panasonic (2009) combines the functions of a hospital bed and a wheelchair in a single device. Using electric actuators and an adjustable frame mechanism, the bed can transform into a wheel chair, allowing patients to move from alying position to a seated position without manual lifting by caregivers. This system improves patient in dependence and reduces care giver work load, but the design is complex and expensive.

[8] Recent developments in healthcare technology emphasize the importance of reducing caregiver workload and improving patient mobility through automation. Many modern hospital beds now include motorized adjustments, electronic control systems, and smart mobility features to enhance patient safety and comfort. These systems aim to reduce manual handling tasks and prevent injuries among healthcare workers.

[9] Research studies also highlight the need for improved patient transportation solutions in hospitals. Traditional patient transfer methods often require manual pushing of heavy beds, which can lead to physical fatigue and musculoskeletal injuries among nurses and caregivers. As a result, powered and automated bed movement systems are increasingly being developed to address these challenges.

[10] Several advanced hospital bed systems integrate electronic controls, sensors, and motorized wheels to improve manoeuvrability and patient safety. These systems allow caregivers to transport patients smoothly through hospital corridors with minimal effort. However, the high cost and complexity of such technologies limit their adoption in smaller healthcare facilities.

III. METHODOLOGY

The methodology of the proposed Remote Assistive Patient Transfer Device for Hospital focuses on developing a motorized and wireless system to assist caregivers in transporting patients within hospital environments. The system integrates a microcontroller-based control unit, Bluetooth communication, relay modules, and DC motors to enable remote control of the hospital bed using a mobile application. The methodology includes system design, hardware integration, software development, wireless communication, and system testing.

A. System Design and Architecture

The proposed system is designed to assist care givers by reducing the manual effort required to move hospital beds. The architecture of the system consists of three main modules: control module, communication module, and motion module. The control module is based on the Arduino UNO microcontroller, which acts as the central unit of the system. It processes commands received from the mobile application and controls the movement of the motors accordingly. The communication module uses a Blue tooth module (HC-05) to establish wireless communication between the caregiver's smart phone and the hospital bed system. The mobile application sends directional commands such as forward, backward, left, and right to the microcontroller through Bluetooth.

The motion module consists of relay circuits and DC motors connected to the wheels of the hospital bed. These motors enable the bed to move in different directions based on the commands received from the control module. The system operates in real-time where commands from the mobile application are transmitted via Bluetooth, processed by the Arduino controller, and then executed through the motor control system. This architecture ensures smooth, reliable, and efficient movement of the hospital bed while minimizing physical strain on caregivers.

Fig1.1 Block Diagram

A. Hardware Components

The hardware components used in the proposed system include the Arduino UNO microcontroller, Bluetooth module (HC-05), relay module or motor driver circuit, DC motors, power supply unit, and mechanical frame with wheels. These components work together to enable wireless control and movement of the hospital bed. The Arduino UNO acts as the central control unit of the system. It receives commands from the Bluetooth module and processes them to control the motor operation. The Bluetooth module (HC-05) provides wireless communication between the caregiver's smart phone and the system, allowing remote control through a mobile application. The relay module or motor driver circuit is used to control the direction and operation of the DC motors. The DC motors are connected to the wheels of the hospital bed and provide the mechanical movement required for patient transportation. A regulated power supply provides electrical energy to all electronic components and motors. All the hardware components are integrated with the hospital bed frame and wheel mechanism. The design ensures stability, smooth movement, and ease of operation for caregivers while transporting patients within hospital environments.

B. Data Acquisition and Processing

The system continuously receives control commands from the caregiver through the Bluetooth-based mobile application. These commands include movement instructions such as forward, backward, left, and right, up, down. The Bluetooth module receives the wireless signal and transmits the data to the Arduino microcontroller. The microcontroller processes the received command and determines the required motor action. Based on the command, the system activates the relay module to control the rotation direction of the DC motors. Signal processing within the microcontroller ensures that the commands are interpreted accurately and executed without delay. This process allows the system to respond quickly to user instructions and ensures smooth operation of the hospital bed.

C. Bluetooth-Based Control System

The Bluetooth-based control system enables wireless communication between the caregiver's smartphone and the hospital bed system. A mobile application installed on the smartphone sends control commands through the Bluetooth interface. The HC-05 Bluetooth module establishes a wireless connection with the smartphone. When the caregiver presses a control button on the mobile application, the command is transmitted to the Bluetooth module and then forwarded to the Arduino microcontroller.

The microcontroller interprets the command and sends appropriate signals to the relay module to drive the motors. This wireless control mechanism eliminates the need for manual pushing of the hospital bed and allows caregivers to operate the system conveniently.

D. Motor Control Mechanism

The motor control mechanism is responsible for converting electrical signals from the microcontroller into mechanical movement of the hospital bed. The system uses DC motors connected to the wheels of the bed frame to achieve movement. The relay module controls the direction of motor rotation. When the caregiver sends a forward command, both motors rotate in the same direction, moving the bed forward. For backward movement, the motors rotate in the opposite direction. For turning movements, the system controls the motors independently. To turn left, the right motor continues rotating while the left motor slows down or stops. To turn right, the left motor rotates while the right motor slows down or stops. This control method allows smooth steering and manoeuvrability of the hospital bed.

E. System Operation and Testing

The system operation begins when the caregiver opens the mobile application and connects it to the Bluetooth module. After the connection is established, movement commands can be sent to control the hospital bed. The Arduino microcontroller receives the commands, processes them, and activates the relay module to operate the DC motors accordingly. The hospital bed then moves in the selected direction based on the command received. System testing is conducted to verify the functionality and reliability of the device. Different movement commands such as forward, backward, left, and right are tested to ensure accurate motor response. The wireless communication between the smart phone and the system is also evaluated to confirm stable connectivity. The testing results demonstrate that the system responds correctly to Bluetooth commands and provides smooth motorized movement of the hospital bed, there by reducing the physical effort required from caregivers during patient transportation.

F. User Control Interface

The system communicates with the care giver through a mobile application and Bluetooth communication interface. The mobile application provides control buttons that allow the caregiver to move the hospital bed indifferent directions such as forward, backward, left, and right. When a control button is pressed, the command is transmitted through the Bluetooth module to the Arduino microcontroller. The microcontroller processes the command and controls the motor operation accordingly. This wireless control interface eliminates the need for manual pushing and allows caregivers to operate the hospital bed conveniently. The interface is designed to be simple and easy to use so that caregivers can quickly control the bed movement without difficulty. This improves efficiency in patient transportation within hospital environments.

G. Testing and Evaluation

The developed system is tested to evaluate its performance and reliability. Different movement commands such as forward, backward, left, and right, up, down are tested to verify the proper functioning of the motors and relay control circuit. The Bluetooth communication between the smart phone and the hospital bed system is also tested to ensure stable and continuous connectivity. Response time is observed to confirm that the system executes commands quickly and accurately. Multiple test trials are conducted to verify smooth movement, directional control, and system stability. The testing results confirm that the system successfully performs wireless control and motorized movement of the hospital bed.

H. Expected Outcome

The proposed methodology aims to develop a simple, efficient, and cost-effective remote assistive patient transfer system for hospitals. By integrating Arduino-based control, Bluetooth communication, and motorized movement, the system helps caregivers transport patients more easily. The developed system reduces the physical effort required from healthcare staff and improves the efficiency of patient movement within hospital environments. The project demonstrates the feasibility of implementing an affordable and reliable wireless patient transfer system that enhances patient care and caregiver convenience.

G. Result

The proposed Remote Assistive Patient Transfer Device for Hospital was developed and tested to evaluate its performance in assisting caregivers during patient transportation within hospital environments. The system wastested under different operating conditions to analyse movement accuracy, response time, and wireless communication reliability. Experimental results show that the system effectively controls the movement of the hospital bed using the integrated Arduino microcontroller, Bluetooth module, relay module, and DC motors. During testing, the Bluetooth communication between the caregiver's smart phone and the system was stable and reliable. Commands such as forward, backward, left, and right, up, down were successfully transmitted through the mobile application and accurately executed by the microcontroller. The relay module activated the DC motors according to the received commands, enabling smooth and controlled movement of the hospital bed. The response time of the system from command transmission to motor activation was observed to be less than one second, ensuring quick and efficient operation. The motorized movement allowed caregivers to transport patients without manually pushing the hospital bed, thereby reducing physical strain and improving operational efficiency. The experimental results confirmed that the system operates effectively and provides reliable wireless control for patient transportation. Overall, the developed system demonstrates improved mobility assistance, reduced caregiver workload, and a practical solution for motorized hospital bed movement in healthcare environments.

Fig1.2 Remote Assistive Patient Transfer Device for Hospital

CONCLUSION & FUTURE SCOPE

The Remote Assistive Patient Transfer Device was successfully developed to assist caregivers in transporting patients with in hospitals. The system uses components such as an Arduino UNO, Bluetooth module, relay module, and DC motors to provide wireless control of hospital bed movement through a mobile application. The testing results show that the system responds accurately to control commands and allows smooth bed movement, which helps reduce care giver effort and improves patient safety. The system also offers a simple and cost-effective solution for patient transportation in hospital environments. In the future, the system can be improved by integrating Internet of Things (IoT) technology to enable remote monitoring and control through hospital management systems. Additional sensors such as ultrasonic or LiDAR can be used to develop autonomous navigation for automatic movement and obstacle detection. Further improvements may include a lighter mechanical structure, better battery capacity, and advanced safety features such as automatic braking and emergency stop mechanisms. These developments can transform the system into a smart hospital bed transportation and monitoring system, enhancing patient care and reducing the work load of health care staff.

REFERENCES

1. A.Audrey, “Mechanical Hospital Bed Design for Patient Care,” International Journal of Healthcare Equipment, vol. 5, no. 2, pp. 45–50, 2016.
2. Drive Medical, “Semi-Electric Hospital Bed User Manual and Product Specifications,” Drive Medical Design & Manufacturing, 2015.
3. Stryker Corporation, “Electric Hospital Bed System and Patient Positioning Technology,” Stryker Medical Equipment Documentation, 2013.
4. Hill-Rom Holdings,“Intelli Drive Powered Transport System for Hospital Beds,”Hill-Rom Product Technical Report, 2014.
5. Stryker Corporation, “Zoom Motorized Drive System for Hospital Bed Transportation,” Stryker Healthcare Technology Report, 2013.
6. Linet Group, “Drive Power™ System for Powered Hospital Bed Transport,” Linet Medical Equipment Technical Documentation, 2013.
7. Panasonic Corporation, “Bed-to-Wheelchair Mobility System for Patient Transfer,” Panasonic Healthcare Innovation Report, 2009.
8. World Health Organization (WHO), “Assistive Technology for Improving Patient Mobility in Healthcare Facilities,” WHO Technical Report, 2018.
9. J.Smith and R.Brown, “Patient Handling and Transportation Systems in Hospitals,” Journal of Medical Engineering & Technology, vol. 40, no. 3, pp. 120–128, 2016.
10. K.Patel and S.Mehta, “Design and Development of Motorized Patient Transport Systems,” International JournalofBiomedicalEngineering,vol.7,no.1,pp.32– 38, 2017.