

Chapter 4

A Study on IoT-Enabled Smart Bed With Brain-Computer Interface for Elderly and Paralyzed Individuals

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ABSTRACT

This research tackles a major gap in healthcare for patients with severe disabilities, especially those unable to communicate or move, such as those with paralysis. Current solutions provide minimal support and lack natural, non-verbal commu-

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nication. This study introduces a smart IoT-based bed that uses advanced sensors to translate neural signals into meaningful insights. By integrating brain-computer interface (BCI) technology, the bed captures brain signals with EEG sensors, effectively translating patients' needs and emotions like discomfort or hunger. This innovation enhances communication, reducing reliance on verbal or physical cues, improving response accuracy by 40%, and increasing caregiver efficiency by 35% over conventional methods. This study highlights IoT's potential in setting a new standard for patient-centered care.

1. INTRODUCTION

The Internet of Things is an inter-networking of several physical devices embedded with sensors, electronics, and network connectivity that enable objects to collect and exchange data. The IoT has changed the manner we live and work. The development of the Internet of Things (IoT) brings several possibilities to the world. It has greatly promoted the development of smart home services, thus bringing convenience to people's lives. Nowadays healthcare technology has changed in many ways. In healthcare applications, a patient can fix the appointments without needing a call to the doctor or receptionist. A doctor can carry the patient virtually with them anywhere with the help of apps on their mobile. The patients can pay more attention to their own health. Likewise, a home monitoring system allows patients and doctors to keep in contact when a doctor is not available to prevent unnecessary costs for physicians, (Huang, 2021). In many hospitals, the IoT technologies, like smart beds which can sense occupancy and adjust according to the patient's position and pressure thus providing better support without the help of a nurse. Such can be implemented in smart homes. Hospital beds, for instance, have evolved significantly, maintaining their primary aim of enhancing patient care and aiding caregivers while introducing novel features and functions. These beds now boast adjustable heights, side rails, and an array of electronic controls not only for bed operation but also for nearby electrical devices. In essence, they represent a fusion of innovation and traditional functionality tailored to optimise the hospitalisation experience. Electric hospital beds (1940–1980) have been in the spotlight for several decades Figure 1 shows the evolution of electrical beds, (Deeba & Saravanaguru, 2018).

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