SMART HOSPITAL BED: AUTOMATED BED CONTROL WITH HEALTH TRACKER*

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Abstract— Automation is an integral part of our everyday life. Hand gesture recognition is one of the main implementations in the automation field. This project survey focuses on the aspects of adjusting the position of the bed with the help of hand gestures. Implementing this research in a real-time system requires the integration of mutually interactive applications for hand gesture recognition. In this real-time setup, webcams play a crucial role in enabling hand gestures for effective human-computer interaction. It is proposed to demonstrate a real-time system to change the position of the bed by recognizing hand gesture signs using webcams and other simple hardware components. In this society, the number of disabled patients is high and there is absence of guardianship for them. A patient requires a caretaker to continuously monitor which is not always possible due to social or financial circumstances. So, to minimize the caretaker's requirement and to increase the comfort level of the patients here, we have proposed an automatic bed position controlling system for disabled patients. This bed positioning is controlled by different hand gestures. The system also contains a seamless patient monitoring system that monitors various parameters such as temperature and pulse rate. If any of these parameters cross the safe minimal level, this unit sends an alert signal to the doctor by sending an SMS.

Keywords – Automated bed movement, hand gestures, health monitoring, pill dispensary, alert system

I. INTRODUCTION

In recent years, society is facing many sociological and financial challenges, due to which there is constrained time and focus on the elderly community. There has been a significant rise in the number of individuals who are incapable of independently managing their well-being and require assistance for the entire day. Continuous monitoring of these patients may require a fulltime caregiver, which is not always possible due to social or financial constraints. The current electronic bed systems in hospitals are limited to only two bed movements, namely upward and downward adjustments. So, to minimize caretaker's requirements and increase the comfort level of these patients, we have developed a bed motion system that utilizes distinct hand gestures, offering a novel approach compared to existing electronic bed systems.

A bed system used in various cases such as for disabled persons, paralyzed patients, patients affected by accident and old age people is also developed. The aim of this bed is to minimize the requirement of caretakers by providing two movements such as up and down movements thereby increasing the patient comfort level.

The bed is structured to automatically adjust its position according to the patients' needs through the utilization of hand gesture recognition. A DC motor, assisted by a dedicated DC motor driver, is employed for the management of the bed.

A continuous patient scrutinizing system that contains the sensor nodes such as heart rate sensor and temperature sensor, these are incorporated with the ability of sensing the analog biomedical signal . The Arduino board is employed to process these signals.

There is an alert system that comes into action if any abnormal condition is found in patients' health. This is performed by sending a stored message to the respective doctors of particular patient using Nodemcu module. This contributes to enhanced efficiency and services within the medical sector.

Furthermore, the bed system incorporates an automated pill dispensary box. This component serves a crucial role in enhancing patient care by issuing timely reminders to individuals for the scheduled intake of prescribed medications. The alerts are specifically configured as per the recommended timing established by the respective healthcare providers overseeing the patient's treatment plan. This integration not only guarantees medication adherence but also promotes a proactive approach to healthcare management, aligning with the broader objectives of our study focused on optimizing patient well-being and treatment outcomes.

II. LITERATURE SURVEY

The analysis conducted for this study is summarized in a tabular format, providing a comprehensive overview of relevant research works. The table encompasses crucial details such as the title of the published paper, author(s), publication year, research objectives, and key advantages and disadvantages identified in each work.

Title	Authors	Year	Objectives	Advantages	Disadvantages
Smart Mattress Based on Multipoint Fiber Bragg Gratings for Respiratory Rate Monitoring.	Francesca De Tommasi, et.al	2023	1.The focus is on utilizing advanced optical sensing techniques to accurately measure respiratory rates and body temperature. 2.Assess the accuracy, reliability, and feasibility of the developed smart mattress system in comparison to standard methods for respiratory rate monitoring.	1.A non-intrusive and real-time respiratory rate and body temperature monitoring system. 2.The presence of multipoint Fiber Bragg Gratings in the smart mattress enables non-intrusive respiratory rate monitoring, ensuring patient comfort without the need for uncomfortable sensors or attachments. This feature promotes better adherence to monitoring protocols, especially for extended periods.	1.Need for specialized equipment and sometimes may generate nonfactual values. 2.The cost factor could potentially limit the widespread adoption of the system in healthcare settings, particularly in resource-constrained environments.
MediaPipe to Recognize the Hand Gestures .	Anil Kumar C et.al	2022	1.Provides detailed description about how the hand recognition works using the MediaPipe algorithm . 2. Integrate the MediaPipe-based hand gesture recognition system with a user interface, aiming to enhance user experience and facilitate seamless interaction with digital devices through recognized gestures.	1.Accurate recognition of the fingertips using coordinates. 2. The recognition system incorporated with MediaPipe is versatile and applicable across a wide range of applications, from virtual reality to human-computer interfaces.	1.The accuracy of recognition may not correct everytime. 2. Achieving optimal gesture recognition accuracy may require complex calibration processes. Users may find it challenging to calibrate the system for their specific hand movements accurately, potentially impacting the system's usability and hindering widespread adoption.
A robotized hospital bed for COVID-19 patients in intensive care treatments.	Marco Ceccarelli, et.al	2021	Designing a hospital bed to enhance the safety by integrating automation, mobility and remote monitoring.	Provides optimal care to patients, emphasizing infection control, usability, and scalability to positively impact public health.	Challenges include high implementation costs, specialized maintenance needs.
Internet of Things (IoT) Based Smart Health Care Medical Box for Elderly People .	Obaidulla-Al-Mahmud, et.al	2020	Provides the patient with medication reminder alerts to avoid fluctuations in their health .	This system helps the patient to take their medicines at the right time.	The updated intervals of the medication may not be accurate at all times.

Title	Authors	Year	Objectives	Advantages	Disadvantages
Design and development Intelligent Medical Care Bed Using Voice Recognition	Moeid M Elsokah	2022	Design and implement features within the intelligent medical care bed that leverage voice recognition technology to enhance the overall user experience and accessibility for patients. The objective is to provide a more user-friendly interface that accommodates individuals with varying physical abilities and promotes efficient communication with the bed's control system.	The intelligent medical care bed with voice recognition empowers patients to control bed functions independently, fostering a sense of autonomy and preserving the dignity of individuals in healthcare settings. Patients can articulate their needs verbally, reducing reliance on caregivers for routine tasks and enhancing their overall experience.	Implementing voice recognition in an intelligent medical care bed is the potential misinterpretation of patient commands. The system may struggle to accurately recognize specific voice instructions, leading to unintended adjustments or actions.
Next Generation of Medical Care Bed with Internet of Things Solutions	Amer R. Zerek	2019	Focus on optimizing the bed's features to prioritize patient-centric care. This includes leveraging IoT solutions to enhance patient comfort through features such as automated adjustments, remote-monitoring,and integration with healthcare systems.	This facilitates proactive healthcare management by providing healthcare professionals with immediate access to patient data, enabling early detection of issues and timely interventions.	The integration of Internet of Things (IoT) solutions in medical care beds raises concerns about the security and privacy of patient data.
Development of an IoT-Based Health Monitoring System for e-Health	Md Julhas Hossain	2022	Develop a comprehensive framework for integrating various health sensors into the IoT infrastructure, ensuring seamless communication and accurate data gaining for real time monitoring.	The implementation of an IoT-based health monitoring system allows for remote and continuous monitoring of individuals' health parameters.	Implementing a robust IoT-based health monitoring system involves dealing with various technical challenges, including sensor calibration, connectivity issues, and system interoperability.
Novel Model for Hospitalization Tracking based on Smart Contracts and IoT	HristoValchanov et.al	2022	The objective is to create a comprehensive system that utilizes blockchain-based smart contracts and IoT devices to monitor and track patient hospitalization data in real-time.	This ensures that accurate and up-to-date information about patients' admission, treatment, and discharge is securely recorded on the blockchain through smart contracts, providing healthcare professionals with a comprehensive and trustworthy overview of patient status.	The adoption of a novel model incorporating smart contracts and Internet of Things (IoT) technologies in hospitalization tracking may introduce complexity in implementation and entail significant initial costs. The integration of these advanced technologies requires specialized expertise, and hospitals may face challenges in terms of both financial investment and technical skill acquisition, potentially hindering widespread adoption.

III. METHODOLOGY

This section provides a comprehensive overview of the methodologies and strategies employed in designing and the implementation of hand gesture recognition for altering the positions of the hospital bed .

1. Hardware Setup: Assemble the physical components including Arduino, LCD, heartbeat sensor, temperature sensor, DC motor, emergency switch, and Nodemcu. Connect the components in accordance to the specifications provided by the manufacturers.

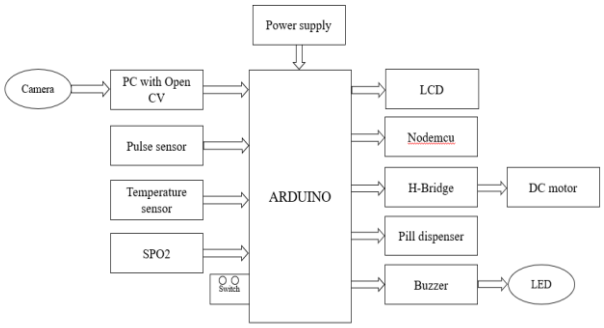
2. Arduino Programming: Write code for Arduino to initialize and read data from sensors (heartbeat and temperature). Implement logic for controlling the DC motor based on user input or sensor data. Code emergency switch functionality to disable motorized functions in case of an emergency.

3. LCD Display Integration: Write code to display relevant information on the LCD screen. Display real-time data such as heartbeat, temperature, and bed position. Ensure the LCD interface is user-friendly and informative.

4. Nodemcu Setup for Message Intimation: Integrate Nodemcu into the system for wireless communication. Program Nodemcu to send messages or alerts in case of abnormal conditions. Configure Nodemcu to connect to a Wi-Fi network for internet access.

5. Machine Learning Integration (Gesture Recognition): Choose and set up a machine learning library, such as Mediapipe, for gesture recognition. Collect a dataset for training the machine learning model. This dataset should include examples of different hand gestures for bed control. Train the machine learning model using the collected dataset. Integrate the trained model into the Python code for gesture recognition.

6. Python Programming for Gesture-Based Bed Control: Write Python code to interface with the Arduino and interpret sensor data. Implement logic for translating recognized hand gestures into specific commands for bed control. Ensure seamless communication between the Python script and Arduino for effective control.



IV. CONCLUSION

The proposed Gesture Controlled Bed movement is simple to use, and it is an inexpensive one. It is possible to provide a man-machine interaction system, which can be able to manage the movements of the bed position through the recognition of hand gestures. The Media pipe algorithm is used to recognise image coordinates and hand landmarks in the image. The svm algorithm is used to recognise the hand gesture. This project also helps the patients itself to adjust the bed on their comfort. The wireless smart health monitoring system is created to enhance healthcare services. This system is really assisting them in not spending much time with each of the patients for monitoring.

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