

Computer Aided Medical Bed

Hema Shubraja J

Assistant Professor, Department of Electronics & Communication Engineering,
Sri Sairam college of Engineering, Anekal, Bengaluru, India

hemashubrajaj.ece@sairamce.edu.in

Sandeep D Pagade, S Mithun, Prajwal A

Student, Department of Electronics & Communication Engineering,
Sri Sairam college of Engineering, Anekal, Bengaluru, India

sce19ec033@sairamtap.edu.in, sce19ec044@sairamtap.edu.in

sce19ec047@sairamtap.edu.in



Publication History

Manuscript Reference No: IJIRAE/RS/Vol.10/Issue06/JNAE10088

Research Article | Open Access | Double-Blind Peer-Reviewed | Article ID: IJIRAE/RS/Vol.10/Issue06/JNAE10088

Received: 02, June 2023 | Revised: 18, June 2023 | Accepted: 20, June 2023 | Published Online: 23, June 2023 | Volume 2023

<https://www.ijirae.com/volumes/Vol10/iss-06/09.JNAE10088.pdf>

Article Citation: Hema, Sandeep, Mithun, Prajwal (2023). Computer Aided Medical Bed. IJIRAE:: International Journal of Innovative Research in Advanced Engineering, Volume 10, Issue 06 of 2023 pages 294-299

<https://doi.org/10.26562/ijirae.2023.v1006.09>

BibTeX Hema2023Computer



Copyright: ©2023 This is an open access article distributed under the terms of the Creative Commons Attribution License; Which Permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract: Background and goal: Being bedridden long-term can motivate deterioration in sufferers' physiological feature and overall performance, restricting each day sports and growing the prevalence of falls and different unintentional injuries. Little research has been carried out in designing effective detecting systems to screen the posture and status of bedridden sufferers and to provide correct real-time comments on posture. The functions of these studies were to develop a laptop-aided gadget for actual-time detection of bodily sports in bed and to validate the system's validity and check-retest reliability in determining 8 postures: movement leftward/rightward, turning over leftward/rightward, getting up leftward/rightward, and getting out of bed leftward/rightward. Strategies: The in-bed physical interest detecting system consists specifically of a clinical sickbed, signal amplifier, a records acquisition (DAQ) machine, and working software program for computing and figuring out postural modifications related to four load cellular sensing components. Thirty healthy subjects (15 males and 15 ladies, suggest age = 27.8 ± 5.3 years) participated within the look at. All topics were asked to execute eight in-bed sports in a random order and to take part in an evaluation of the take a look at-retest reliability of the outcomes 14 days later. Spearman's rank correlation coefficient was used to examine the gadget's determinations of postural states with researchers' recordings of postural modifications. The test-retest reliability of the gadget's potential to decide postures was analyzed the use of the interclass correlation coefficient ICC(three,1). Consequences: The machine was determined to show off excessive validity and accuracy ($r = \text{zero}.928$, $p < \text{zero}.001$; accuracy rate: 87.nine %) in determining in-bed displacement, turning over, and sitting up, and getting out of bed. The machine become mainly correct in detecting motion rightward (ninety %), turning over leftward (83%), sitting up leftward or rightward (87–93%), and getting out of bed (100%). The test-retest reliability ICC (three,1) fee was 0.968 ($p < \text{zero}.001$).

I. INTRODUCTION

Many frail inpatients have the concomitant hassle of low mobility, which could result in the morbid phenomenon of being bedridden for long intervals of time. This phenomenon happens for approximately one-third of all inpatients, of whom about 23%–33% are seniors. Whether for frail bedridden seniors or young inpatients, being bedridden for long intervals of time can severely impact the capability for bodily sports, and this effect turns into progressively exacerbated as the wide variety of days in the sanatorium increases. In addition to such factors as a affected person's age or disorder, different individuals to a patient's purposeful decline in daily lifestyles might also include being required to lie in mattress after unique medical treatment. For example, a affected person's motion may be restrained or the affected person may be handled with a fixation device to save you injury after an operation. research have proven that even when sufferers have their ailment under manage and have resumed some activities, even demonstrating the potential to stroll, the duration of confinement to bed nevertheless money owed for greater than 60% of the typical period of hospitalization. Early-stage research has shown that being bedridden for lengthy intervals of time can't best lead to deterioration in sufferers' physiological capabilities however additionally affect functional performance in day by day life, even increasing the quantity of days inside the health facility or in lengthy-time period care establishments, and elevating the danger of loss of life and the prevalence of relevant headaches and unintended injuries. Moreover, bedridden sufferers are at risk of cognitive disorders, dizziness, and bodily weakness, amongst other consequences on their physiological capabilities, due to drug facet outcomes, ensuing in inadequate blood supply to the pinnacle following speedy postural changes or dizziness resulting from stability dysfunction of the inner ear.

Those results may additionally bring about unintentional accidents if the affected person falls from the mattress to the ground. An inpatient is most likely to fall and emerge as injured on the bedside, especially due to the volatile position of the body's middle of gravity when the inpatient tries to rise from the mattress and walk or hold close the brink of the bed to stand up. Among about thirteen and 20% of inpatients suffer as a minimum one fall. Studies imply that such falls bring about loss of life in thirteen% of patients and physical injuries, including fractures, joint dislocations, lacerations, and bruising, in 25% of patients. Falls can also reason mental trepidation and effect functionality in each day existence; for this reason, sufferers may reduce their participation in every day socializing sports for fear of falls, growing the weight on circle of relatives, medical employees, and the medical care provider gadget, as well as raising medical costs. Therefore, many scientific establishments have equipped their sickbeds with defensive handrails or hand grips to prevent sufferers from by accident injuring themselves because of falling from the bedside. But, research has shown that even equipment with bedside handrails stays incapable of appreciably reducing the incidence of falls. For that reason, scientific caregivers need to develop strategies to screen adjustments in sufferers' in-bed sports and save you bedside fall injuries.

PROBLEM TO CONSIDER

The problem statement for a computer-aided medical bed could be to design and develop a bed that integrates advanced automation technology with medical devices to create a smart hospital bed. The bed should be capable of measuring and tracking vital signs in real-time and automatically adjust the patient's position based on their medical condition. The bed should also be easy to operate, with a user-friendly interface that allows medical professionals to easily access and analyze patient data. Other potential problems to consider when designing a computer-aided medical bed include ensuring patient safety, minimizing the risk of infection, and developing a cost-effective solution that can be widely adopted in hospitals and healthcare facilities.

AIM OF THE PAPER

- To find the patients position of the bed.
- Weight of the patient on the bed.
- Pulse of the patient on bed.
- Railing sensor (this is to protect patient from falling off the bed by sensing pressure on the railing when patient puts pressure on the railing).

II. COMPONENTS SPECIFICATION

A software requirements specification (SRS) is a thorough statement of the functional and non-functional requirements for a software system that needs to be produced. Based on the agreement between the customer and the contractors, the SRS is developed. It offers use cases for the various ways in which users will engage with the product. The software requirement specification document contains all the specifications needed to carry out the project.

Software:

1. Arduino IDE.
2. Embedded C.
3. Thing Speak app

Hardware:

1. Node MCU.
2. Pulse sensor.
3. HX711
3. Pressure sensor.
4. Buzzer.
5. LCD display.
6. Power supply.

III. METHODS

To put into effect the hardware and software additives for similarly processing of the load and role statistics from load cells connected to the mattress, observe those steps:

1. Hardware setup:

- a. Connect the load cells to the 4 corners of the bed securely, making sure proper alignment and balance.
- b. Connect the load cells to the hx711 load cell amplifiers.
- c. Join the hx711 amplifiers to the arduino board using the unique statistics (dout) and clock (clk) pins.

2. Software setup:

- a. Deploy the arduino ide for your laptop if you have not already.
- b. Open the arduino ide and create a brand new sketch.
- c. Replica and paste the supplied arduino code into the caricature.
- d. Keep the caricature with the proper name.

3. Load mobile calibration:

- Calibrate each load mobile individually to make certain correct weight measurements. Seek advice from the load cellular manufacturer's documentation or calibration manual for precise commands.
- Alter the calibration elements within the arduino code for each load cell primarily based at the calibration procedure.

4. Upload the code:

- Join the arduino board to your computer the use of ausb cable.
- Pick the correct board and port from the equipment menu inside the arduino ide.
- Click on the "add" button to add the code to the arduino board.

5. Take a look at and verify:

- Open the serial reveal in the arduino ide.
- Make sure that the baud charge is about to 9600 (identical as detailed inside the code).
- Confirm that the burden and role values are displayed correctly within the serial monitor.
- Vicinity unique weights at the mattress and look at the corresponding modifications in the weight and position readings.

6. Similarly processing:

- As soon as the load and function records are efficiently received, you can further technique it in line with your specific requirements.
- Put in force algorithms or common sense to research the facts, locate patterns, or cause actions primarily based on precise weight or role thresholds.
- Integrate the records with different structures or gadgets for tracking, notifications, or automation purposes, if preferred.
- Save the records in a database or transmit it to a far off server for long-time period garage or evaluation. To put into effect the hardware and software additives for similarly processing of the load and role statistics from load cells connected to the mattress, observe those steps:

Node MCU ESP8266:

It's perfect for IoT projects, especially other Wireless connectivity projects as Arduino does not work wirelessly. We either need to connect it to a Bluetooth or nRF module this chip has a great deal in common with the Arduino they're both microcontroller-equipped prototyping boards that can be programmed using the Arduino IDE. The ESP8266 is more updated and younger than Arduino, and therefore the ESP has stronger specifications than Arduino.



Specifications & Construction

- Operating Voltage: 2.5 to 3.3V
- Operating current: 800 mA
- 3.3V 600mA on-board voltage regulation
- ESP8266 comes up with 2 switches one is reset and another one is flash button, Reset button is used to reset Node MCU and flash button is used to download and is used while upgrading the firmware. The board has build in LED indicator which is connected to D0 pin.
- The Node MCU board also contains a CP2102 USB to UART module to convert the data from USB to serial so that it can be controlled and programmed via computer.
- The esp8266 has 4 power pins: One VIN pin for input power supply and three 3.3V pins for output power supply. Even if 5V regulated supply is given through VIN, the voltage regulator will decrease it to 3.3v during output.
- The esp8266 has 3 GND pins which indicate ground supply. Generally, the negative terminals are connected to these pins.
- Esp8266 board additionally has I2C pins which may be used both as I2C master and I2C Slave. those pins are used to attach numerous I2C sensors and peripherals to your challenge. I2C interface capability may be managed via programming, and the clock frequency is one hundred kHz at a most.
- Esp8266 Node MCU has 17 GPIO pins which may be assigned to diverse capabilities including UART, PWM, I2C,IR and Button thru programming. While configured as an input pin, the GPIO pins can also be set to area-cause or level-cause to generate CPU interrupts.
- ESP8266 Node MCU has 2 UART interfaces, i.e. UART0 and UART1, which provide asynchronous verbal exchange, and might speak at up to 4.five Mbps. TXD0, RXD0, RST0 & CTS0 pins can be used for conversation. It supports fluid control. However, TXD1 pin functions most effective records transmit signal so, it is generally used for printing log.

- ESP8266 has two SPI in slave and master modes. Those SPIs additionally support the following popular functions: four timing modes of the SPI format switch. Up to sixty four-byte FIFO buffer.
- Esp8266 has a comfy virtual I/O interface which is used immediately manage the SD cards.
- Esp8266 has four channels of Pulse width modulation (PWM). The output can be controlled thru programming and is regularly used for driving vehicles and LEDs. The frequency stages from 100Hz to 1KHz.
- There are 3 manipulate pins at the esp8266: The permit pin (EN), the reset pin (RST) and the wake pin.
- The esp8266 chip works whilst the enable pin is high. When the permit pin is low, the chip works on minimal energy.
- The reset pin is used to reset the esp8266 chip.

The wake pin is used to wake up the chip from deep sleep mode

Load Cell: A load cellular is an electro-mechanical sensor used to measure pressure or weight. It has a easy yet powerful layout which is predicated upon the transference among an implemented pressure, material deformation and the flow of electricity. they are highly flexible devices that provide correct and robust overall performance across a diverse variety of packages. It's no wonder that they have come to be crucial to many commercial and business tactics, from automating vehicle production to weighing you're shopping at the checkout. As generation explodes forward, many new and thrilling applications are emerging that still stand to advantage from using load cells. New advances in robotics, haptics and medical prostheses, to name a few, all need effective methods to degree forces and weights. New kinds of load cells are constantly being designed to satisfy the wishes of this ever-changing market.



Load Cell

Methodology:

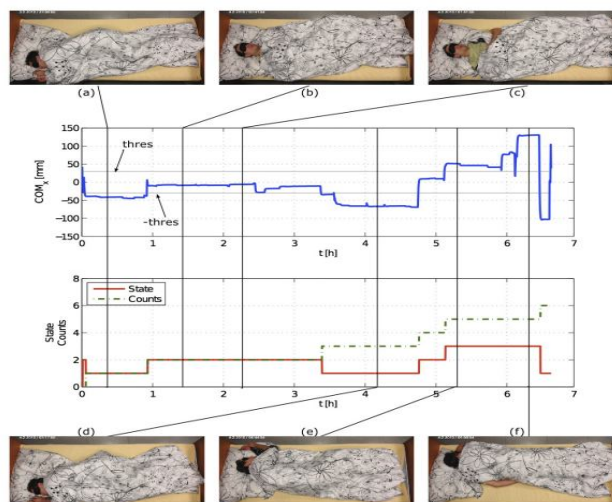
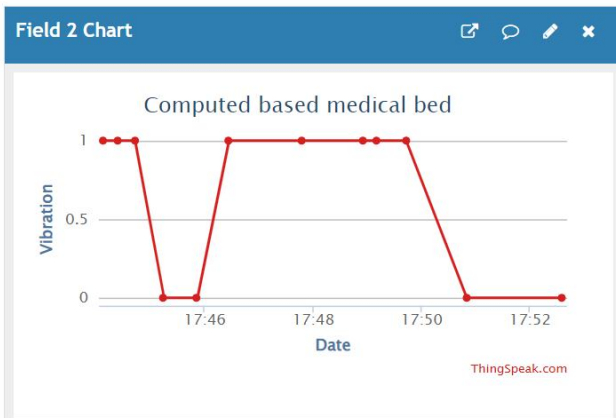
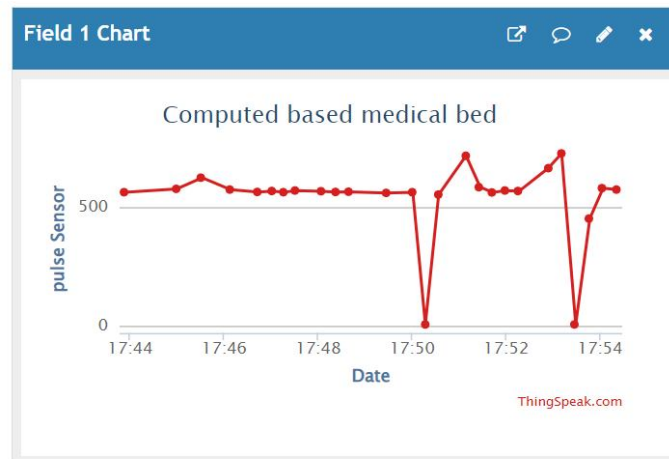
The task employs a Node MCU microcontroller and module for seamless connectivity. All the components, consisting of the heart beat sensor for coronary heart fee measurement and the pressure sensor for fall detection, are interfaced with the Node MCU. Whilst a fall is detected, the buzzer is precipitated to alert nearby individuals. Load cells, related to the Node MCU and connected to the bed, permit the willpower of the character's sleeping role primarily based on weight distribution. The load statistics is displayed on a liquid crystal display display screen, supplying real-time facts. Moreover, the accrued information is securely stored in the cloud the use of the module, making sure lengthy-time period accessibility and analysis. This opens up opportunities for remote monitoring, statistics visualization, and integration with other systems. by leveraging the mixed functionalities of the Node MCU, load cells, sensors, and module, this challenge helps improved safety, healthcare monitoring, and capability automation in a person-pleasant and Wi-Fi green manner.

IV. EXPERIMENTAL RESULTS AND DISCUSSION

The outcomes confirmed that the physical interest detecting device verified excessive validity ($r = 0.928$, $p < 0.05$) with an accuracy accomplishing 87.9% for monitoring real people' postural adjustments in the course of 8 in-bed postures. Those consequences endorse that the system can be used to as it should be degree and determine topics' in-bed postural modifications and states inside the variety of 70–one hundred% (desk 2). The effects additionally discover that incorrect determinations can also arise during precise postural adjustments, in particular in the displacement turning over rightward of 30% (table 2 sand Fig. 3). The outcomes verified that the check–retest reliability of the bodily activity detection device in figuring out the eight in-bed postural states of wholesome topics became $ICC(\text{three}, 1) = 0.968$ ($p < \text{zero}.001$).

This depicts the COMx, the actual kingdom and the total wide variety of role changes (count) over the years. at some stage in time-duration (a), the situation lies on his right aspect on the mattress, for the duration of time period (b), the concern became onto his lower back ($COMx \approx 0$ mm) after approximately 1 hour. notice the small difference between time-duration (b) and (c) where the issue almost completely moved one foot; this small movement can be detected by using a alternate in the COMx at $t = 2$ h. all through time-duration (d), the subject lies again on his proper side. A better absolute COMx suggests that the legs are bent more as compared to time period (a). During time-duration (e), the difficulty modified the placement to the left aspect (alternate of the COMx towards wonderful values). in the end, time-length (f) indicates the situation sleeping at the belly on the outermost left side of the bed. desk 1 summarizes the consequences from the experimental measurements, where the activity count and the pastime price reflect the nightly movement interest. The interest matter (remember) is the wide variety of function changes in bed and the hobby rate is computed with the aid of the pastime counts divided by using sleep length. it is able to be found from Fig. three that the interest is quite low (2 discern four. Experimental end result: Time history of COMx, the nation (2 = center, 1 = right, three = left) and the interest counts (count) for $F_{\text{thres}} = 500\text{N}$, $\text{thres} = 30\text{mm}$, $t_{\text{min}} = 25\text{sec}$ for a high nightly hobby (table 1, #eight).

Function modifications in 4.5 hours) at some point of the primary sleep section (approx. 4.5 h) and will increase for the very last length (3 position adjustments in 2 hours). The corresponding standard nightly interest count is 6 and the activity price is zero.93 counts/h. Sleep may be 2153 legal licensed use restrained to: Sri Sairam university of Engineering. Downloaded on November 15,2022 at 07:43:49 UTC from IEEE Xplore. Regulations apply. Divided into 4 ranges. A normal sleep sample reaches several deep sleep tiers (level three & 4) during the first 4 – five hours of sleep and enters only stage 1 (REM) and degree 2 (mild sleep) afterwards. multiplied body motion seems predominantly during mild sleep (stage 2) and REM-sleep (dream-sleep) and drastically modifications with age [2], [3]. determine four depicts a dimension with a higher nightly activity, in which beginning after the first hour of sleep the character periodically adjustments its function (left - center - right). The corresponding hobby count number is 17 and the pastime price is 2. seventy four counts/h.



V. CONCLUSION

The improvement of a computer-aided real-time bed sports tracking machine, incorporating stress-sensing components and programmable software, has yielded promising results in this look at. The gadget demonstrated excessive accuracy and remarkable test-retest reliability in detecting postural adjustments. As generation continues to development, it is foreseeable that those systems become even more precise and complicated in figuring out in-mattress physical activities. Furthermore, the mixing of gadget gaining knowledge of and artificial intelligence strategies holds the capacity to similarly enhance their performance.

One compelling future software for pc-aided real-time feedback structures lies in far flung patient tracking. With the increasing adoption of telemedicine, these systems ought to allow far off monitoring of patients, providing actual-time comments to healthcare providers. This would be in particular wonderful for people with chronic situations requiring frequent monitoring, allowing for proactive intervention and well timed care control. Rehabilitation is some other domain in which pc-aided actual-time comments structures will have a profound impact. As the worldwide population a while, the demand for rehabilitation services is expected to upward push. Those systems may want to facilitate personalised rehabilitation programs and monitor development in real-time, enabling healthcare specialists to tailor interventions and optimize effects. The destiny capacity for development and medical software of computer-aided actual-time feedback structures in detecting in-bed physical sports is widespread. It holds the promise of improving the high-quality of care for sufferers at the same time as concurrently lowering healthcare expenses. As research and technological improvements keep, those structures are probable to play an increasing number of essential functions in healthcare, contributing to stronger patient consequences and overall well-being.

REFERENCES

- [1]. S.K. Inouye, D.R. Wagner, D. Acampora, R.I. Horwitz, L.M. Cooney Jr., L.D. Hurst, M.E. Tinetti, A predictive index for functional decline in hospitalized elderly medical patients, *J. Gener. Internal Med.* 8 (1993) 645–652.
- [2]. B.A. Lazarus, J.B. Murphy, E.M. Coletta, W.H. McQuade, L. Culpepper, The provision of physical activity to hospitalized elderly patients, *Arch. Internal Med.* 151 (1991) 2452–2456.
- [3]. G.A. Warshaw, J.T. Moore, S.W. Friedman, C.T. Currie, D.C. Kenne, W.J. Kane, P.A. Mears, Functional disability in the hospitalized elderly, *JAMA* 248 (1982) 847–850.
- [4]. C.H. Hirsch, L. Sommers, A. Olsen, L. Mullen, C.H. Winograd, The natural history of functional morbidity in hospitalized older patients, *J. Am. Geriatrics Soc.* 38 (1990) 1296–1303.
- [5]. C.M. Harper, Y.M. Lyles, Physiology and complications of bed rest, *J. Am. Geriatrics Soc.* 36 (1988) 1047–1054.
- [6]. M.C. Creditor, Hazards of hospitalization of the elderly, *Ann. Internal Med.* 118 (1993) 219–223.
- [7]. H.M. Hoenig, L.Z. Rubenstein, Hospital-associated deconditioning and dysfunction, *J. Am. Geriatrics Soc.* 39 (1991) 220–222.
- [8]. M.R. Gillick, N.A. Serrell, L.S. Gillick, Adverse consequences of hospitalization in the elderly, *Soc. Sci. Med.* 16 (1982) 1033–1038.
- [9]. C.J. Brown, R.J. Friedkin, S.K. Inouye, Prevalence and outcomes of low mobility in hospitalized older patients, *J. Am. Geriatrics Soc.* 52 (2004) 1263–1270.
- [10]. C.J. Brown, D.T. Redden, K.L. Flood, R.M. Allman, The under recognized epidemic of low mobility during hospitalization of older adults, *J. Am. Geriatrics Soc.* 57 (2009) 1660–1665.