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SYSTEMIC REVIEW ON VOICE ACTUATED SMART HOPITAL BED

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ABSTRACT
During the 20th century, medical beds underwent technological advancements, especially making them smarter in patient care. The past fifteen years have brought various changes in the concept of smart bed technology, but no definitive evidence of the project's existence has been presented. These and previous systems typically use at least one push button or pressure-sensitive type switch to implement various control and articulation capabilities. Smart beds are designed to assist patients with mobility issue as it will allow them to control bed movement by themself and help them return to normal movement more quickly, with the presence of a monitoring system that alerts nursing staff when patients move and leave the bed with side rails. This type of high-end bed contributes greatly to the recovery of the patient's physical condition, health and activity because it is the main factor in achieving this goal, according to studies that have confirmed that the patient's movement during hospital stay as contributed to his quick recovery and early discharge from the hospital.
Key Words-- Smart bed, Monitoring, Alert, Recovery

1.INTRODUCTION

The hospital bed is where most patients spend most of their time. Moments that require a solid awareness of helping the patient stay safe while flexibility helps flight attendants investigate data and improve patient care. A definitive goal is given as a result, patients have specific, empowering autonomy perform some essential activities when the nurse or caregiver is late or inaccessible. Therefore, such solutions help most patients with their condition is inevitable and requires sudden changes in their movements. Access to good medical support in hospital becomes an important question. Two basic goals Behind this is the increasing cost of treatment review and reduce the number of tutors, (For example: healthcare provider). It turned out such a problem increasingly serious if the patient shows signs of locking disorder. Caring for these patients is demanding effort and worry. In this way, it is essential to provide special response to support the guardians of these patients for patients who are completely immobile, patients feel the harmful effects of long-term safety disorders coma, quadriplegia, clinical death, etc. These patients need special consideration because they cannot travel any imagination. Alternatively, by rotating each one a few now implies that from time to time someone shoul can exercise responsibility; included at hour of night. The scope of the project is to build a smart and intelligent system read in such a way that it responds quickly to user requests. Instructions for using voice commands to achieve desired results and mainly focused on a small-scale prototype can be expanded to a larger proportion if it proves effective. The main goal of the project is streamlining how to manage an immobile patient and stay in bed forever.

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2.RELATED WORKS

2.1 SMART BED

Smart medical bed capable of controlling its motion conditions through voice commands, encourage local production and reduce costs, and it is possible used in homes, hospitals or health care and support centre worldwide expanding and exporting it around the world, significantly reducing price and providing health care services to the majority of the patient population (Amer R. Zerek. et.al,2022).

The eye tracking system that uses an innovative digital-to-analog converter module to control the positioning bed through a new graphical user interface. They also tested the system's ergonomics and usability by performing a series of fixed positioning tasks in which the footrest and headrest were raised and lowered repeatedly. Fifteen women and eleven men aged 42.7 ± 15.9 years in the control group and nine women and eight men aged 60.3 ± 9.14 years in the patient group participated their experiments. The level of disability, according to the Expanded Disability Status Scale (EDSS), ranged from 7 to 9.5 points in the patients. They evaluated the speed and effectiveness of hospital bed control and improvement during the trial. In a questionnaire, they rated satisfaction with system (Martin Kopecek .et .al, 2023).

In this proposed paper, they attempted to create a first viable prototype that validates the basic functions of a voice-controlled surgical bed. Hence a complex mechanism of surgical bed movements are not reflected in this prototype. This development is mainly related to the electrical System design and software implementation of voice control system. Emphasis is placed on configuring voice commands and connectivity between microcontrollers (Jeong Hun Kim.et.al, 2020).

The article proposes to develop a smart bed that operates by voice command and is capable of moving the bed into a motion that meets the user's needs. Also bed was able to incline and recline at certain angles. The methods and methodologies of each process performed during bed construction have been discussed. Using stress and load analysis, components, the requirements were clearly understood, although revisions to the conceptualization were made (Shaik Junaid.et.al,2019).

In this research they tried to design a smart bed system using speech recognition to control and model a bed with height in accordance with the voice commands given by the user. Recognized voice commands make Arduino change the relay and change the direction of the motor because which jack lifts the bed or brings the bed back to a lower altitude angle. The bed can be adjusted to fit three positions, tidur position, istirahat position, and bangun position. Tidur position is a position where the bed height is at 180 degrees to the ground. The person can tidur comfortably in this position. In istirahat bed height is at 145 degrees to the ground . In the bangun position, the height of the bed is almost equal to 110 degrees (Nurul Fadillah.et.al,2020).

2.2 PRESSURE ULCER

To prevent pressure sores, a device was created by classifying the human position on the bed using a pressure mat sensor. First of all, a visual representation is given by convert raw pressure data to grayscale using opacity treatment. Second, by using special data augmentation feature, it is possible to create a large data set from a small data set by creating new synthetic sleeping position. Then, two CNN models came was established to evaluate the influence of diapers on the effectiveness of bed position classification (Sheryl Robinson et .al, 2023).

The authors have researched and developed of a new mattress that meets many different aspects of clinical needs and patient requests; For example. 1) Equipped with an automatic body pressure relief function, 2) Provides comfortable sleep. Their goal is still far away but the cushioning equipment is current a self-feedback pressure dispersion system and specially developed compact double-layer air cells respond above the required level at least to an acceptable level. The mattress developed will reduce physical and psychological stress burden of care (Kyoko IMANISHI.et, al.2020).

To prevent pressure ulcers, the authors used sensor-based data, possibly combined with other internal or external information, processed by some form of intelligent algorithm, to provide Healthcare professionals' knowledge helps improve decision-making when treating patients at any time. certain

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time. risk of developing pressure sores. They identified three steps in which intelligent algorithms are used to help prevent and control pressure ulcers. These include data preprocessing to generate higher-level features, supine posture classification, and decision support for healthcare professionals. We conclude that most sensor-based methods to prevent pressure ulcers mainly involve classifying supine posture using a simulated environment (Arlindo Silva.et, al,2022).
The proposed platform collects information from multiple sensors built into the bed, analyzes the data to create a time-stamped map of whole-body pressure distribution, and commands the bed's actuators to adjust periodically adjusts its surface configuration to redistribute pressure across the entire body. These capabilities are combined to form a cognitive support system that enhances caregivers' capabilities, allowing them to provide better care to more patients in less time (R. Yousefi, et. al, 2011).
They designed dynamic models of the Smart Bed drive system, as well as descriptions of the designed individual and overall bed control systems. The control equations defined in the simulation are then simplified, allowing the microcontroller to execute them in real time. Finally, the simplified control system is tested against an initial dynamic model in simulation, and the operation of a constructed part of a multi-unit bed platform is tested with loop user input. open, confirming design options and improvements to the mechanism hardware(Zachary Brush, et, al. 2013).

2.3 IV FLUID MONITERING SYSTEM
In this proposed system, the IV solution flow rate can be automatically monitored using a microcontroller. It can send data wirelessly to the nurse or doctor's computer and display the results as saline droplet ratio, number of drops from saline bottle, saline infusion to patient in ml and remaining time to empty the saline bottle using serial port testing software. The system is reliable, cost-effective and practical for nurses (S. Sharmila, et. al, 2023).

This proposed model, they focus on manual flow control using the mobile app, monitor IV fluid levels in the bag and notify medical staff to replace the bottle. Likewise, their next stage is to regularly monitor each individual's condition. To do this, they regularly monitor the patient's heart rate, blood pressure, temperature and fluids level on the IV bottle during injection. If there are sudden changes arrives, it will alert medical staff. For warning, they use buzzer technology and warning message function. If the patient feels discomfort, he can alert the nurse by pressing the panic button (Ms. Sincy Joseph, et. al, 2019).

In this proposed system, they used HX711 module which is very useful to detect the load placed on the load cell. The IV Fluid bottle is hung from the load cell by a hook. The load cell senses the weight of the IV fluid in the bottle and display it on the LCD screen. They initially set a specific threshold in the written code. When the bottle reaches the threshold, the proposed system sends an SMS to the hospital management. This SMS sending mechanism is done through GSM connected to Arduino.In SMS sent to hospital management they can see room number and remaining level of the saline bottle (Karthik Maddala,et. al 2020).

This article proposes an automatic method to Monitor the intravenous fluids bottle and also the speed of drip rate in drip chamber uses microcontroller. The system can send data to nurses and doctor's smartphone through the application wirelessly and display the output as drip rate, intravenous fluid level in the bottle and any other action can be taken on the patient on the advice of a physician instruction. This system does not have touch sensors for droplet monitoring, easy to reuse, will recover Accurate data on drip rate (N. Y. SUMA KEERTHI, et. al, 2020).
In this proposed system, they developed a real-time monitoring device through which administrators can review, evaluate, and modify the IV infusion process. It consists of a flow sensor with a polymer hair cell built on a multilayer silicon substrate that forms a patterned gold strain gauge layer on a piezoelectric liquid crystal polymer (LCP) film. A gold strain gauge on an LCP film is used instead

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of a piezoelectric silicon film as the sensing element. The combination of a gold strain gauge and an LCP membrane provides better sensitivity than a piezoelectric silicon membrane of the same size and thickness. They also miniaturized the biocompatible sensor so that it could be installed inside IV tubing exposed to fluid, providing inline flow monitoring. The proposed LCP membrane sensor was compared with two commercially available IV sensors to validate its flow sensing capabilities. Experimental results demonstrate that the proposed sensor provides a low threshold detection limit of 5 mL/h, which improves the performance of other commercial sensors at low flow rates(Reza Hagihghi, et. al,2019).

2.4 TEMPERATURE MONITER SYSTEM

They present a flexible, skin-mounted sensor system that continuously monitors pressure and temperature at key skin interfaces and can help guide strategies. care to reduce the risk of pressure ulcers in hospitalized patients or in those who are confined to bed. The design includes a pressure-sensitive element based on membrane deflection and a wireless, battery-free operation mode, capable of multi-site measurements at strategic locations on the body. Such devices provide continuous, simultaneous pressure and temperature measurements in a sequential fashion from a pair of main antennas mounted under the bed and connected to a wireless reader and multiplexer placed at the head of the bed. The experimental evaluation of the sensor and the complete system includes benchtop measurements and numerical simulation of key characteristics (Yong Suk Oh, et. al, 2021).

They proposed a human remote sensing parameter body including pulse and temperature. Parameters used to detect and Monitoring will send data via wireless sensor. Adding web-based observation allows you to regularly monitor the patient's condition. Detection data will be collected continuously in one database and will be used to notify patients of any undetected problems so that a diagnosis can be made.The experimental results demonstrate that the proposed system is user-friendly, reliable and cost-effective. IoT typically expected to provide advanced high-bandwidth connectivity of embedded devices, systems and services beyond the machine-to-machine (M2M) context. Progress device connectivity makes automation possible in almost any field (A. K. Vaishnave,et. al, 2019).

2.5 NURSE CALLING SYSTEM

A hospital nurse call system is a system installed around a hospital bed that allows healthcare patients to remotely call a nurse or other healthcare staff member to communicate their need for assistance. When the button is pressed, the signal notifies the nursing station staff by voice signal, and usually a nurse or nurse's assistant answers the call. The system uses IoT to allow nurses to answer every patient call without the patient or patient's family being present in the nurse's office. Hospital directors can also receive reports on the quality of nursing services, in the form of Nursing Service Quality Reports. number of calls, the nurse will take the time to answer each call and report which nurse will answer each patient call (A Rahmatulloh, et, al, 2019).

The proposed device not only enables live voice communication between patients and medical staff, but also enables real-time patient location in closed environments. For this DWM1001-DEV module development board is used for accurate positioning with real-time wireless positioning systems. The sound system consists of an SPH0645 I2S microphone for real-time audio recording, a MAX98357A I2S amplifier breakout board, and a general-purpose 8-ohm speaker. The patient interface component is a button to initiate communication. ESP32 communicates with a Python-based server over a Wi-Fi network. Communication is based on the UDP protocol. A final product based on this system is feasible and provides excellent autonomy and excellent real-time communication capabilities (Freire Venegas ,et, al, 2023).

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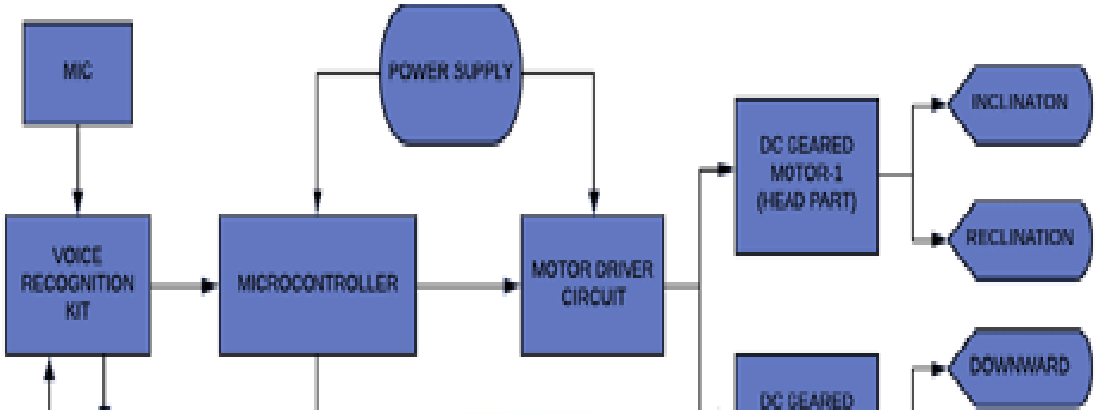
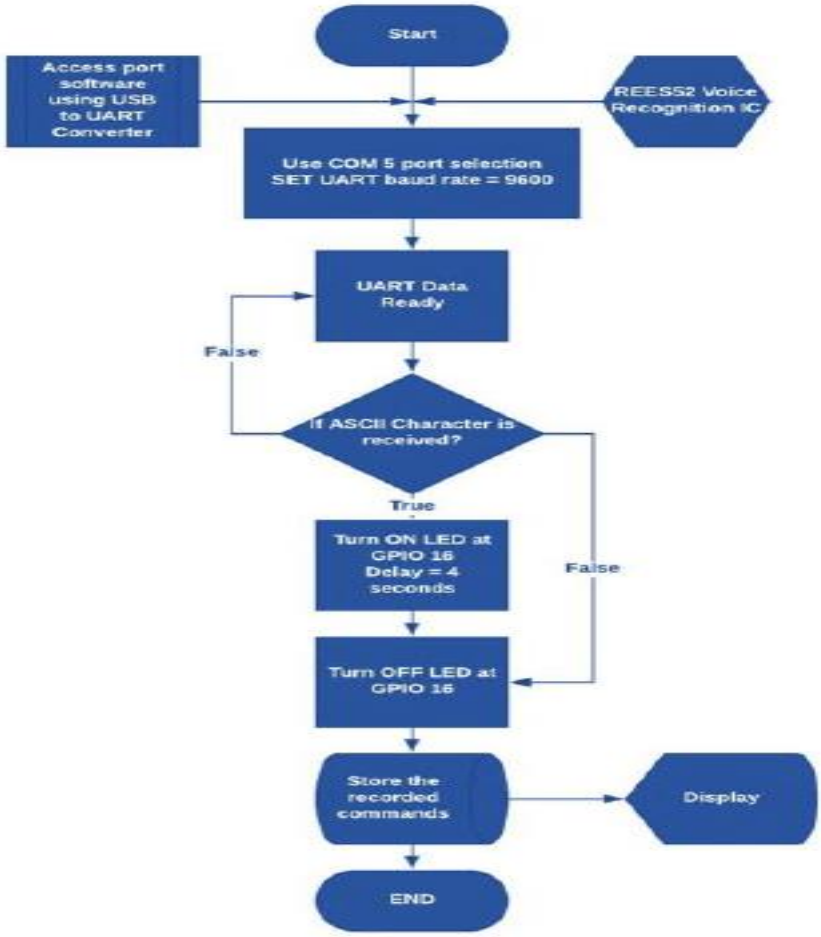
3. EXISTING WORK





Block diagram

FLOWCHART OF WORK

The voice that needs training will be received from the user through the microphone to the voice recognition chip, i.e. REES52 and this port can be accessed via a USB to UART converter by installation baud rate to 9600. Voice commands are then converted to ASCII characters. This voice recognition chip transmits data to the microcontroller enabling the motor pins of the control circuit and enter the desired mode operation of pilot circuit then motor driver. The circuit will send a signal to the motor terminal to turn it on specific direction. Voice commands are then converted to ASCII characters and if the ASCII character is stored and the LED is displayed turns on what is given in the 16th GPIO pin with a delay of 4 second. And if it doesn't get ASCII characters, i.e.no voice is been

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trained which turns OFF the LED light which is given in the 16th GPIO pin. The trained data is then stored in registers assigned to it. Voice commands are the main input to activate the motor that causes the bed to move.

4.CONCLUSION

Smart hospital beds have emerged in the past decades as one of useful solutions for patient care, it helps in providing assistance and monitoring, based on a complex multidisciplinary design process. The global market of medical beds is currently vast and competitive, and still has ability to spread. Dedicated devices for different demographics are developed, and high-end functionality under customizable solutions have become common features mainly for patient who are paralyzed, has spinal injury or severely injured in accident often find themselves bedridden and they have to lie in same position for hours, so they need someone help to change their position in bed which make them feel more dependent on others or incompetent. By using stress and load analysis, the requirements of the components were clearly understood. The ATmega328 is used to control the logic level of this system, controlling the motor control circuit for each user voice input. The entire system operates using Arduino-compatible C logic. The HM2007 chip is also compatible with Arduino, making system implementation much easier. This approach reduces project complexity, thereby reducing costs and increasing efficiency. The full potential of smart beds will not only be achieved with isolated technological or morphological advances, but when they are seamlessly integrated into the healthcare system, it is reducing work for caregivers, and more self reliant atmosphere for patients.

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