

Smart Pressure Ulcer Avoidance System Based on Braden Scale

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ABSTRACT: Hospital acquired pressure ulcers (HAPUs) are bruise caused to skin and its underlying tissue which occurs due to prolonged pressure on the skin. Skin covering bony prominences such as the heels, ankles, hip and tailbone are the major areas that are affected by HAPUs. Under the influence of pressure, shear, and friction or any combination there will be stoppage of blood flow or supply of blood is disrupted. This leads to detrimental effects on skin and its underlying tissue which further breakdown due to insufficient blood circulation. The proposed method consists of a support system which continuously monitors the patient's position and communicates wirelessly. This notifies alerts to the caregiver when a patient turn is due in accordance with the protocol adopted by the hospital. After monitoring the patient's position, turning procedure carried out is logged and results are intimated on the hospital's cloud system, thereby enabling centralized monitoring. The presence of the controlled environment makes the system continuously monitor patient's position accurately.

KEYWORDS: Hapu, pressure ulcer, support system

I. INTRODUCTION

Generally pressure ulcers known as Bedsores, decubiti are the localised damage to the skin and on the underlying tissue. Those who are on the chronic bedrest or consistently using wheelchair are the individuals mostly affected by this pressure ulcers. Pressure ulcers further causes other complications such as sepsis, cellulitis, bone and joint infections. A largely accepted tool is the Braden scale. Braden scale consists of number of parameters namely sensory perception, moisture, physical activity, mobility, nutrition and friction & shear. Based on the guidelines prescribed in the Braden scale caregiver score each of these parameters by assigning values ranges from 0 to 25.

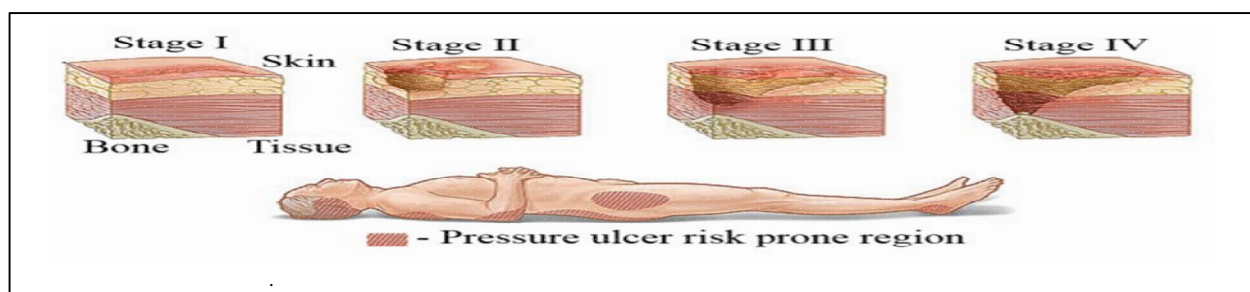


Fig 1: Stages of pressure ulcer and risk prone region

The effect each score looks like, in **fig1**. All those values obtained from braden scale of individual parameters are added up to give the cumulative Braden scale score, which gives a numerical estimate for the possibility of occurrence of pressure ulcers. A least level of score indicates high threat to patient developing pressure ulcer. High and moderate risk

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are taken special care to prevent the occurrence of HAPU by following the hospital’s turn protocol. The position of the patient is changed once in every 2 hours to alternating lateral and supine positions by the caregiver and a manually changed position is recorded in the log. The turning procedure is not always followed strictly because of the low possibility of presence of caregiver compliance to turning protocols at hospitals. Difficulty in continuously monitoring patient position, lack of a system which can provide turn reminders/alerts and suboptimal caregiver staffing ratio increases the occurrence of HAPUs. A novel method is presented in this paper to address the need for improved pressure ulcer prevention. The aim of this method is to assist the caregiver in implementing an effective pressure ulcer prevention procedure

II.EXISTING SYSTEM

In existing method patients are monitored by the manual caretaker and all the data of the patients turning are recorded. The general steps is as follows

- High and moderate risk level of patients are taken care and by providing necessary measures the occurrence of HAPU can be prevented by following the hospital’s turn protocol. This protocols implements the changes in position of patients in every 2 hours to its alternating lateral and supine positions by the caregiver and a manual log of the changed position is recorded.
- The Institution of Healthcare Improvement (IHI, 2014) developed a visual tool used to improve HAPU rates. The tool has proved successful in hospitals by decreasing their HAPU rates. The tool is a constant staff reminder of current HAPUs and PUs rates.

The Wound, Ostomy, and Continence Nurses Society recommends the use of appropriate skin care products to reduce HAPUs.

III.PROPOSED SYSTEM

A unique automated method is proposed in this paper which enhances improved pressure ulcer prevention with appropriate usage of sensors of lower cost and more accuracy. The aim of this method is to assist the caregiver in implementing an effective pressure ulcer prevention procedure. The improvement in HAPUs is done by prevention, working in collaboration with intensivists. The system developed can be seamlessly and flawlessly integrated into the caregiver's working environment and is capable of guiding the personnel through the steps required for implementing the hospital turn protocol.

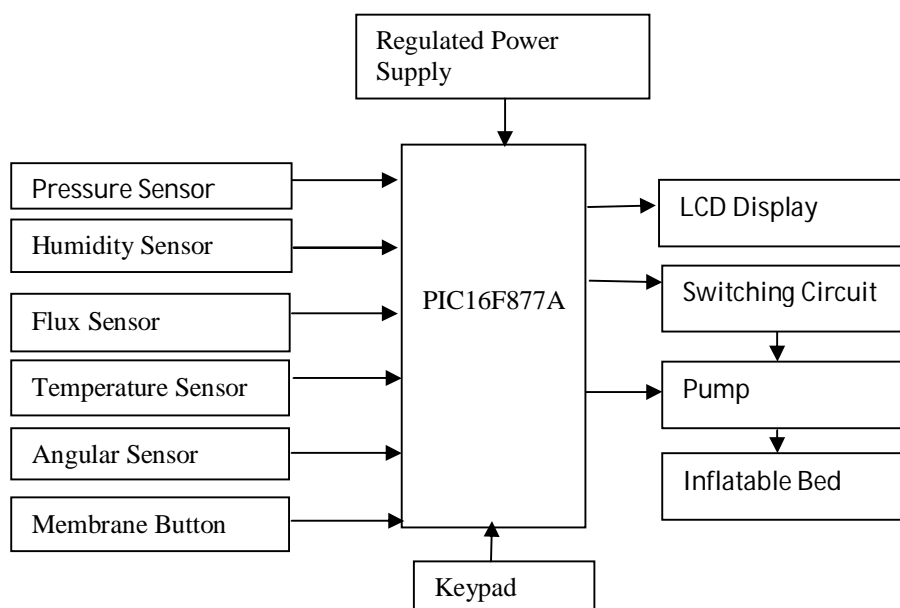


Fig 2: Block diagram of proposed system

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The results obtained shows that the device can continuously monitor the patient's position and identify the various standard positions. The standard positions here tells about the support system position. The positions can be divided in four dimensions that is viewed to be from diagonal edges. A largescale clinical validation to assess the efficiency of the proposed method in an ICU setting is being planned. Our proposed system basically works by taking input such as nutritionand activities of patients from the caretaker through the keypad. On the other hand all the sensor such as angular sensor, moisture sensor, temperature sensor, pressure sensor that acts as a catalyst for our system gives the condition of the patients. All these information are processed by the microcontroller. Braden system accepts the processed output from the microcontroller and does the necessary calculation and then the output is measured using braden scale to know the condition of the patients. This braden scale measurement output is displayed in LCD. According to the output we obtained in ranges the pumping source will pump the airto inflate or deflate the pressure of the patient. The resting patient’s bed is divided into 4 positions that can be viewed as the diagonal edges.

IV.RESULTS AND DISCUSSION

The figure value represents the braden scale ourput and stage which represents the stage of ulcer and the rate of infalction and defalation of air bed .The automatic switching depending upon the sensor which reperesents the critical values of position ,pressure,temperature moisture motion and angular values .The change in presseure values of bed helps in regulating blood flow over the body which regulates and decreases the effect of prolonged effects of hospital acquired bed ulcers.



Fig 3: Input value

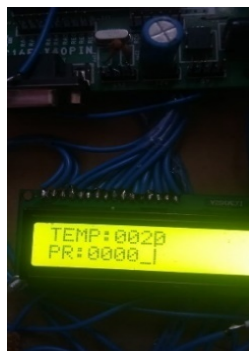


Fig 4: Sensor value

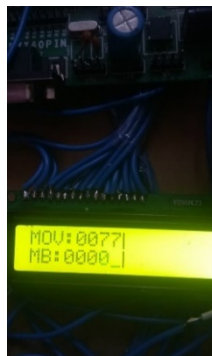


Fig 5: Sensor value

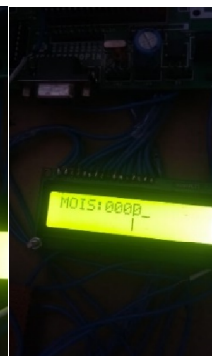


Fig 6: Sensor value

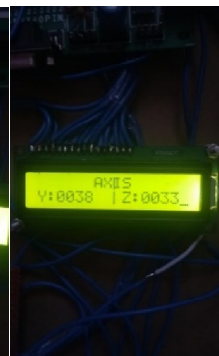


Fig 7: Sensor value



Fig 8: Braden scale output displayed in LCD

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Fig 9: Experimental Setup

V. CONCLUSION

Every project attains its success only if it is scalable & sustainable. Our project results best automatic way to provide solutions to pressure ulcers. The strategic interpretations as indicated above have not only helped in identifying the causes of HAPU but also suggest a method to prevent upto 96.98% patients from acquiring HAPU with Braden scores less than 15. Evidences proved that the most effective appeal includes keeping the wound moist, appropriate repositioning, using support surfaces, and proper nutrition. These evidences provide us each that approaches has been tested and their cause and effects are identified, shared. As a result it provides improvement on the care of patients within the hospitals. Since the introduction of this approach, incidence of grade 3 and 4 pressure ulcers has been consistently made zero & there has been 89% reduction in incidence of occurrence of HAPU. Patients experience and earlier studies improves through reduction of pressure ulcers by our automatic approach. Success in this process seems to be related to the data-driven Lean Sigma approach & evidence based Nursing care.

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