

Averting of Pressure Ulcer for Patients

M. Gokilavani,

Electronics and communication Engineering,
Angel College of Engineering and Technology,
Tirupur, Tamil Nadu, India,

P. Dinesh,

Electronics and communication Engineering,
Angel College of Engineering and Technology,
Tirupur, Tamil Nadu, India,

V. Jayashree,

Electronics and communication Engineering,
Angel College of Engineering and Technology,
Tirupur, Tamil Nadu, India,

N. Nalini,

Electronics and communication Engineering,
Angel College of Engineering and Technology,
Tirupur, Tamil Nadu, India,

Abstract: Pressure ulcer, also known as pressure sores are localized damage to the skin and/or underlying tissue that usually occur over a bony prominence as a result of pressure, or pressure in combination with shear and/or friction. These ulcers often occur when patients have limited mobility and cannot change positions in bed on their own. Traditionally it is minimized by turning the patient every 2 hours to alternating lateral and spine position and by redistributing mattresses. A novel method to address the need for improved pressure ulcer prevention is presented. The proposed method consists of a wearable device which continuously monitors the patient's position and communicates wirelessly with a tab or a system which enables alerts to be sent to the caregiver when a patient turn is due in accordance with the protocol adopted by the hospital. The patient's position is continuously monitored and the turning procedure carried out is logged and updated on the hospital's cloud system, thereby enabling centralized monitoring. Under a controlled setting, system was able to continuously monitor patient's position and can accurately detect standard patient positions.

Keywords- Pressure ulcer, position, change

I. INTRODUCTION

Pressure ulcers are associated with ill health and poor mobility and are defined as 'localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear'. Pressure ulcers, also known as pressure sores, pressure injuries, bedsores, and decubitus ulcers, are localized damage to the skin and/or underlying tissue that usually occur over a bony prominence as a result of pressure, or pressure in combination with shear and/or friction. The most common sites are the skin overlying the sacrum, coccyx, heels or the hips, but other sites such as the elbows, knees, ankles, back of shoulders, or the back of the cranium can be affected.

Pressure ulcer occurred due to pressure applied to the soft tissue. Pressure ulcer mostly occurs in bedridden or confined to wheelchair. Pressure ulcer is very difficult to prevent in critically ill people, frail people and individuals with impaired mobility. Primary prevention is to redistribute pressure by regularly turning the person. The benefit of turning to avoid further sores is well documented since at least the 19th century. In addition to turning and

re-positioning the person in the bed or wheelchair, eating a balanced diet with adequate protein is very important. Pressure ulcer has four stages. Stage 1 is the mildest stage. These pressure sores only affect the upper layer of your skin. Pain, burning, or itching are common symptoms. Stage 2 happens when the sore digs deeper below the surface of your skin. Skin is broken, leaves an open wound, or looks like a pus-filled blister are the symptoms of this stage. In Stage 3 the sores have gone through the second layer of skin into the fat tissue. The sore looks like a crater and may have a bad odor. In Stage 4 sores are the most serious. Some may even affect your muscles and ligaments. Skin has turned black and shows signs of infection. The rate of pressure ulcers in hospital settings is high; the prevalence in European hospitals ranges from 8.3% to 23% and 26% in Canadian healthcare settings. In 2013, there were 29,000 documented deaths globally, up from 14,000 deaths in 1990. This paper describes how to prevent pressure ulcer automatically.

II. EXISTING SYSTEM

High and moderate risk patients are provided care to prevent the occurrence of pressure ulcer by following the hospital's turn protocol. The patient's position is changed every 2 hours to alternating lateral and supine positions by the caregiver and a manual log of the changed position is recorded.

DRAWBACKS

- In ICUs and hospital wards such a turning procedure is not always followed strictly because of a low caregiver compliance to turning protocols.
- 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 pressure ulcer.

III. PROPOSED SYSTEM

A novel method is presented in this paper to address the need for improved pressure ulcer prevention with appropriate 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 various subsystems in the proposed method and the functionality of each of these subsystems is detailed in the following sections.

1. BRADEN SCALE

The Braden scale is a tool for predicting pressure ulcer. The purpose of the scale is to help health professionals, especially nurses, assess a patient's risk of developing pressure ulcer. The braden scale assesses a patient's risk of developing a pressure ulcer by examining six criteria.

1. a. MOBILITY

Mobility looks at the capability of a patient to adjust their body position independently. This assesses the physical competency to move and can involve the client's willingness to move.

1. b. ACTIVITY

Activity looks at a patient's level of physical activity since very little or no activity can encourage atrophy of muscles and breakdown of tissue.

1. c. NUTRITION

The assessment of a client's nutritional status looks at their normal patterns of daily nutrition. Eating only portions of meals or having imbalanced nutrition can indicate a high risk in this category.

1. d. SENSORY PERCEPTION

This parameter measures a patient's ability to detect and respond to discomfort or pain that is related to pressure on parts of their body. The ability to sense pain itself plays into this category, as does the level of consciousness of a patient and therefore their ability to cognitively react to pressure related discomfort.

1. e. FRICTION AND SHEAR

Friction and shear looks at the amount of assistance a client needs to move and the degree of sliding on beds or chairs that they experience.

1. f. MOISTURE

Excessive and continuous skin moisture can pose a risk to compromise the integrity of the skin by causing the skin tissue to become macerated and therefore be at a risk for epidermal erosion. So this category assesses the degree of moisture the skin is exposed to.

SCORING WITH BARDEN VALUE

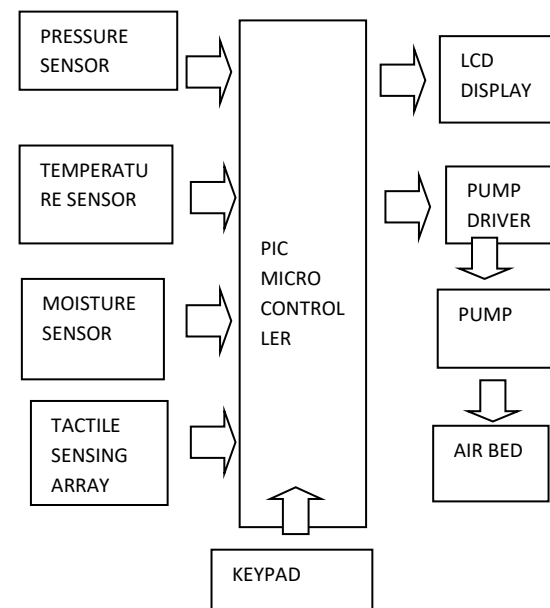
Each category is rated on a scale of 1 to 4 excluding the friction and shear category which is rated on a 1-3 Scale. This combines for a possible total of 23 points, with higher

score meaning a lower risk of developing a pressure ulcer and vice versa. A score of 23 means there is no risk for developing a pressure ulcer while the lower possible score of 6 points represents the severest risk for developing a pressure ulcer.

The braden scale assessment score scale:

- Very high risk: Total score 9 or less
- High risk: Total score 10-12
- Moderate risk: Total score 13-14
- Mild risk: Total score 15-18
- No risk : Total score 19-23

2. BLOCK DIAGRAM



2. a. PIC MICROCONTROLLER

PIC Microcontroller initially referred to Peripheral Interface Controller. PIC microchip are designed with Harvard architecture, and are offered in various device families. PIC had read only memory (ROM) or field programmable EEPROM for program storage, some with provision for erasing memory.

2. b. PRESSURE SENSOR

Pressure sensors are used for control and monitoring in thousands of everyday application. Pressure sensor can alternatively be called Pressure transducer, pressure transmitter among other names. These types of electronic pressure sensor generally use a force collector (such as a diaphragm, piston, bourdon tube) to measure deflection due to applied force over an area.

2. c. TEMPERATURE SENSOR

The temperature sensor is a device, typically, a thermocouple or RTD, that provides for temperature measurement through an electrical signal. A thermocouple

made from two dissimilar metal that generate electrical voltage in direct proportion to change in temperature in a precise, repeatable and linear.

2. d. MOISTURE SENSOR

The moisture level of human skin is a crucial parameter for several application in medical field. The human skin is the covering of human body. It has several functions, such as protection against pathogens, insulation, temperature regulation and tactile sensation.

2. e. TACTILE SENSOR

Tactile sensor is a device that measures information arising from physical interaction with its environment. Tactile sensor are generally modeled after the biological sense of cutaneous touch which is capable of detecting stimuli resulting from mechanical stimulation, temperature, and pain. A common application of tactile sensor is in touchscreen devices on mobile phones and computing.

2. f. LIQUID CRYSTAL DISPLAY

LCD is actually a combination of two state of matter the solid state and liquid state. Solid usually maintain their state unlike liquids who change their orientation and move everywhere in the particular liquid. Further study shows that liquid amount of heat can easily turn the liquid crystal into a liquids, and also it consist of thin layer.

2. g. PUMP DRIVER

Pump driver include electric motors, steam turbines, and internal combustion engines. Here three phase alternating current induction motor are the most commonly used driver for pump. Gas turbine trends towards plants with minimal operator attendance indicate that steam may become obsolete.

2. h. PUMP

A Pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pump can be classified into three major groups according to the method they use to move the fluid. It can operated by some mechanism (typically reciprocating or rotary), and consume energy to perform a mechanical work by moving the fluid.

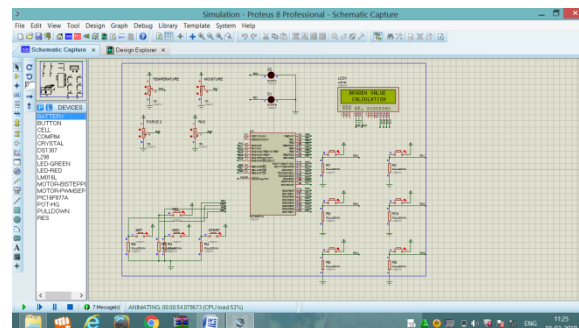
2. i. AIR BED

An air bed is an inflatable mattress, the majority of which are usually made of Polyvinyl Chloride (PVC), although recently developed textile reinforced urethane plastic or rubber version exist. The main use of air bed are camping, temporary home use, full time permanent use in hospital. The bed size for temporary air beds range from twin to king size.

2. j. KEYPAD

A keypad is a set of buttons arranged in a block or pad which bear digits, symbols or alphabetical letters. A computer keyboard has small numeric keypad.

IV. SIMULATION



VI. CONCLUSION

Most pressure ulcers can be prevented. Bedsores are easier to prevent than to treat. By using this method pressure ulcer can be predicted in early stage and necessary treatment is given to a particular patient. The patient's status is updated to a system for reference. This method is widely used for ICU patient's. It shows whether the patient has pressure ulcer or not if has then the patient's position is changed automatically for every 2 hours.

REFERENCES

- [1] B.T. Fay and D. Brienza, "What is Interface Pressure?" in Proc. Of the 22nd Annual EMBS Int. Conf., pp. 2254-2255, Jul. 2000.
- [2] P. Potter, Fundamentals of Nursing. St. Louis, MO: Mosby, 2005.
- [3] Tleyjeh I, et al. Infectious complications of pressure. <http://www.uptodate.com/home>. Accessed Nov. 13, 2013.
- [4] Braden BI, Bergstrom N., Clinical Utility of the Braden Scale for Predicting Pressure Sores, Decubitus, August 1989, 2:44 – 51.
- [5] S. O. H. Madgwick, A. J. L. Harrison, R. Vaidyanathan, "Estimation of IMU and MARG orientation using a gradient descent algorithm," ICORR, June 2011.
- [6] US National Library of medicine, initials. Braden scale source information. Available from http://www.nlm.nih.gov/research/umls/sourceReleasedocs/2009A/LNC_BRADEN.
- [7] Dheeraj Raju, Xiaogang Su, Patricia A. Patrician, Lori A. Loan, Mary S. McCarthy, Exploring factors associated with pressure ulcers: 7 August 2014.
- [8] Ceelen k.k., stekelenburg A., Loerakker s., strijkers G.J., Bader D.L., Nicolay K., Baaijens F.P.T. & Oomens C.W.J. (2008) Compression-induced damage and internal tissue strains are related. Journal of Biomechanics 41(16), 3399-3404.
- [9] kozier, Barbara, Glenora Erb, Shirlee Snyder, and Audrey berman. Fundamentals of Nursing: Concept, process, and practice. 8th ed. Upper Saddle River, NJ: Pearson Education, 2008. 905-907. print.
- [10] Cassell, Charisse. "pressure ulcer risk Assessment: The braden scale for prediction pressure sore risk." Health services advisory group of California, Inc., n.d. Web. 25 Feb 2011.