A WEARABLE ELECTRONIC MONITORING DEVICE FOR LOW PRESSURE GARMENT APPLICATIONS AND TEMPERATURE ANALYSIS FOR PREVENTION OF ULCERATION AND INFECTION

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ABSTRACT

The healing process of several medical conditions related to venous insufficiency and burn scar management can be improved by the proper application of pressure. Current practices for applying pressure to an extremity do not guarantee the consensus ideal interface pressures for such medical conditions. Applying a low pressure range (within 15 – 40 mm Hg) is challenging due to many factors, but especially because the actual pressure applied by a compression garment used on a patient is unknown. The proposed device, used to sense and display low pressure values, is described in detail throughout the chapters of this thesis.

An electronic device was designed, fabricated, assembled, calibrated, and tested in order to deliver a small wearable electronic system which can measure and provide low pressure values inside the range of interest. The sensing unit is intended to be placed underneath the compression garment against the arm or leg of the subject and take force (which is then converted to pressure) and temperature readings. These readings are analyzed by the microcontroller and sent via Bluetooth to the smart phone application where they can be reviewed by the user to make appropriate adjustments to the applied pressure, if necessary. The purpose of the thermal sensor is to sample the skin temperature over a period of time and use the collected data to determine the potential presence of skin infections. The four major elements that complete this system are the sensor unit, the controlling unit, the Bluetooth module, and the smart phone application, which can be powered by a single 3.7V rechargeable battery lasting tens of hours without replacement. The system can be adapted to run for several days if timers are implemented. The test results conducted to the wearable gadget show exceptional linearity and accuracy within 1N range (75 mm Hg), providing a promising solution for sensing low pressure values.

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