Detection and Prevention for Varicose Vein Using Hydrotheraphy Massager in Healthcare

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ABSTRACT

This Methodology proposes a novel approach for the detection and prevention of varicose veins utilizing an ESP8266 microcontroller as the central processing unit. Varicose veins are a prevalent vascular condition whose early detection is crucial forpreventing severe health complications. The system employs DS18B20 temperature sensors to monitor body temperature changes and force sensors to detect bulging orpressure indicative of varicose veins. Continuous monitoring of temperature and force readings enables the system to initiate preventive measures upon detecting significant increases in temperature and pressure associated with varicose veins. Preventive measures include activating a vibration mechanism to stimulate blood flow and heating a water bag to apply hydrotherapy, effectively preventing the exacerbation of varicose veins. To facilitate seamless communication and data transfer between upper and lower body areas, wireless sensor network (WSN) technology is integrated, enabling efficient differentiation of temperature patterns. The proposed system leverages ESP8266 microcontroller technology, temperature sensors, force sensors, and WSN technology to enable real-time monitoring and preventive interventions for varicose veins. This innovative approach holds promise for enhancing the effectiveness of varicose vein detection and prevention, ultimately improving patient outcomes and quality of life.

Key Words: Varicose veins, sclerotherapy, Hydrotherapy Massager, endovenous interventions and surgery.

INTRODUCTION

The study reveals that hot/cold water therapy significantly reduces both varicose vein symptoms and pain levels in patients. The positive correlation betweenpost-treatment readings underscores the sustained benefits of the therapy [1]. These findings support the integration of hot/cold water therapy into the care protocols forvaricose vein patients. Varicose veins are a very common condition, especially in the legs. They are caused by malfunctioning valves in the veins that allow blood to flow backwards and pool [2]. This can cause a number of symptoms, including pain, achiness, throbbing, itching, and burning. Varicose veins can also lead to more serious complications, such as ulcers and blood clots. There are a number of treatment options available for varicose veins, including conservative management, external laser treatment, injection sclerotherapy, endovenous interventions, and surgery. Conservative treatment options include avoiding prolonged standing or sitting, elevating the affected leg, regular exercise, and wearing compression stockings [4]. These measures can help to improve blood flow and reduce symptoms. Other treatment options include laser treatment, sclerotherapy, endovenous interventions, and surgery. These procedures can be used to close off the varicose veins and improve blood flow.

Varicose Veins are subcutaneous twisted superficially dilated veins, often inblue or dark purple colour for at least larger than 3mm in size most located on lowerextremity. Especially for females due to overweight, prolong period of standing or sitting, age etc [5]. Regular exercise will stimulate blood circulation, improve muscle strength, and help to prevent a varicose vein. The purpose of the study is to investigate effect of Aerobic Exercise and

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Onshore exercise on severity of pain andquality of life in woman with Varicose Veins. The study was concluded that there isan improvement in both groups but when groups compare to mean value of group B(onshore exercise) is more effective than group A [6]. Varicose veins are one of the most significant venous disorders all over the world. It can be associated with heavy, aching, and restless legs, swelling and nightcramps, and burning and tingling sensations Thus, the present study was conductedto evaluate the add effect of hydrotherapy on varicose veins patient's pain. Quasi experimental research design was utilized. Forty adult patients were studied for 1 year from Abu-Qir Specialized Hospital, Gamal Abdel Nasser Hospital and the MainUniversity Hospital using two tools. Results revealed that the most common complaints of studied patients were disfigurement, edema, and dilatation of the subcutaneous veins, discomfort easy leg fatigability, and pain [7]. A significant decreasein disfigurement, subcutaneous vein dilatation, leg edema, and tenderness was observed after hydrotherapy sessions. In relation to standing, walking, and climbingstairs, rest, and lying positions more than one third of the patients in the study grouphad no pain. The add effect of hydrotherapy-in general- was effective, quick, and prolonged in most of the patients. The use of hydrotherapy demonstrated a notable reduction in common complaints such as disfigurement, vein dilatation, leg edema,and tenderness among patients. Importantly, the positive impact extended to various daily activities, with over one-third experiencing pain relief in standing, walking, climbing stairs, and during rest or lying positions [9]. The doctor determines whether there are lesions in the human body through the diagnosis of medical images and classifies and identifies the lesions. Therefore, the automatic classification and recognition of medical images has received extensive attention. Since the inflammatory phenomenon of vascular endothelial cells is closely related to the varicose veins of the lower extremities, to realize the automatic classification and recognition of varicose veins of the lower extremities, this paper proposes a varicose vein recognition algorithm based on vascular endothelial cell inflammation images and multi-scale deep learning, called MSDCNN [10]. First, we obtained images of vascular endothelial cells in patients with varicose veins of the lower extremities and normal subjects. Second, multiple convolutional layers extract multi-scale features of vascular endothelial cell images.Then, the MFM activation function is used instead of the ReLU activation functionto introduce a competitive mechanism that extracts more features that are compact and reduces network layer parameters. Finally, the network uses a 3×3 convolutionkernel to improve the network feature extraction capability and use the 1×1 convolution kernel for dimensionality reduction to further streamline network parameters [11].

During the last decade less invasive endovenous methods of treatment of lower limb varicose veins (LLVV) have obtained widespread appreciation. Nevertheless, the problem of improving their long-term results is still actual. The aim of this study is investigation of the bio thermomechanical response of the venouswall to the low-frequency ultrasound exposure, which is an advanced method in thetreatment of LLVV. The model designed to analyse frequency range of the ultrasound instrument and the different values of its pullback velocity. According to the simulation results, the frequency range, in which necrotic changes of the venous wallcan be caused was determined. The dependencies of the venous wall collagen denaturation time on the temperature and pullback velocity of the ultrasound instrument were obtained. After the developed model is supplemented with temperature dependencies of the physical properties of the venous wall, these resultscan be used to form requirements for ultrasound treatment modes for lower limb varicose veins.

PROPOSED METHODOLOGY

This methodology proposes a wearable system for the early detection and prevention of varicose veins in the legs. The system uses an ESP8266 microcontroller as the central processing unit to monitor body temperature and pressure and trigger preventive measures when needed.

Here we use ESP8266 Microcontroller is the brain of the system, responsible for collecting sensor data, processing it, and activating preventive measures, DS18B20 Temperature Sensors is Attached to the legs, these sensors continuously monitor body temperature changes, Force Sensors is used to Detect pressure or bulging in the legs, potentially indicative of varicose veins. Vibration Mechanism, activates upon detection of concerning temperature or pressure changes, promotingblood flow through vibration massage. Heated Water Bag provides heat therapy whenneeded, further aiding in preventing varicose vein exacerbation. Wireless Sensor Network (WSN) Technology enables communication between sensors on the legs and the central microcontroller, facilitating data transfer and analysis.

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The system continuously monitors leg temperature and pressure readings. If significant increases in temperature or pressure are detected, exceeding pre-defined thresholds, the system initiates preventive measures. The vibration mechanism activates, providing localized massage to stimulate blood flow. The heated water baginflates and warms the affected area, applying heat therapy.

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Transmitter:

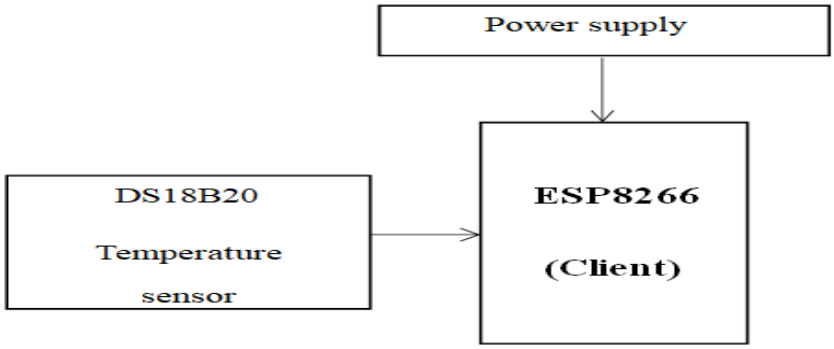

Fig 2.1 proposed Block diagram for transmitter (Client)

In this transmitting module, the ESP8266 microcontroller serves as the centralprocessing unit, acting as the brain of our system. The module incorporates a DS18B20 temperature sensor dedicated to detecting upper body temperature. This sensor captures temperature variations, providing crucial data for analysis. Subsequently, the ESP8266 microcontroller processes this information, extracting relevant temperature values. Utilizing Wireless Sensor Network (WSN) technology,the module then transmits these temperature values to the receiver section. Throughseamless communication facilitated by WSN, the data is efficiently relayed to the receiver, ensuring timely and accurate transmission.

Receiver:

In the receiving module, the ESP8266 microcontroller functions as the centralprocessing unit, serving as the core component of our system. This module is responsible for receiving data transmitted from the transmitting module via WirelessSensor Network (WSN) technology. Upon reception of the data, the ESP8266 microcontroller initiates processing and analysis procedures. Within the receiving module, temperature sensors are utilized to detect lower body temperature. These sensors provide crucial input for monitoring temperature variations in the lower body region. Additionally, force sensors are employed to detect the force exerted onthe veins. This allows for the identification of pressure points and potential varicosevein development. In this module, the ESP8266 microcontroller serves as the centralprocessing unit, orchestrating the treatment process for varicose veins. Within this module, the treatment procedure involves the utilization of a vibration motor and a water heater bag. The vibration motor is employed to administer stimulation to the affected area, facilitating blood flow and circulation. This proactive measure aims toalleviate discomfort and promote vein health. Additionally, force sensors are employed to detect the force exerted on the veins. This allows for the identificationof pressure points and potential varicose vein development. In this module, the ESP8266 microcontroller serves as the central processing unit, orchestrating the treatment process for varicose veins.

Simultaneously, a water heater bag is utilized to apply heat therapy to the affected region. Heat therapy is known to aid in dilating blood vessels, improving circulation, and reducing inflammation, thus contributing to the treatment of varicose veins.

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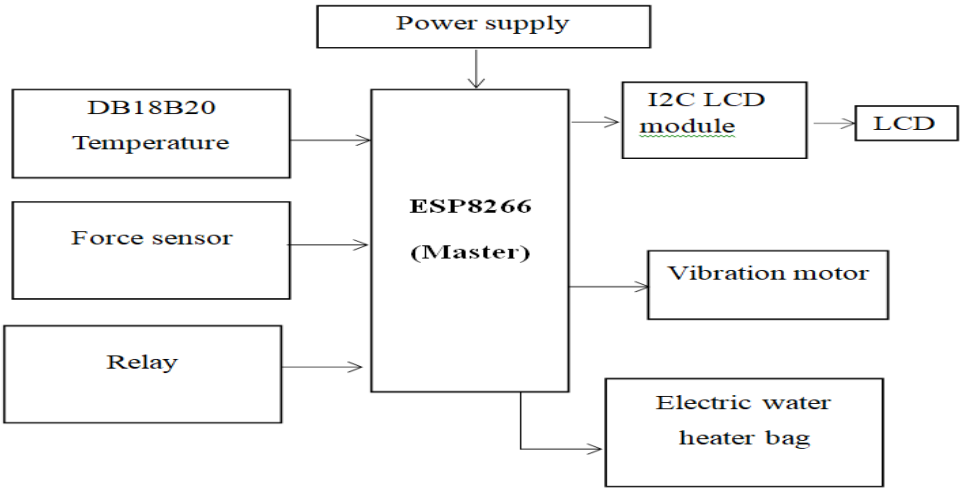

Fig 2.2 Proposed Block diagram for receiver (Master)

RESULT AND DISCUSSIONS

In this methodology, we used ESP8266 microcontroller for wireless sensornetwork, DB18B20 (Dallas temperature sensor) and force sensor for obtaining real time temperature and force produced. This technology shows that the ESP8266 microcontroller with temperature is usedto obtain real time value of upper body temperature. And a resistor of 4.7Kohms isused because the value is given to the digital side of the microcontroller. The ESP8266 works as a master where it receives data from upper body (transmitter) in a Wireless Sensor Network (WSN) and comparesit with lower body (receiver)value obtained. The receiver end contains ESP8266, relay, I2C Liquid Crystal Display (LCD), Force sensor and a power supply board.

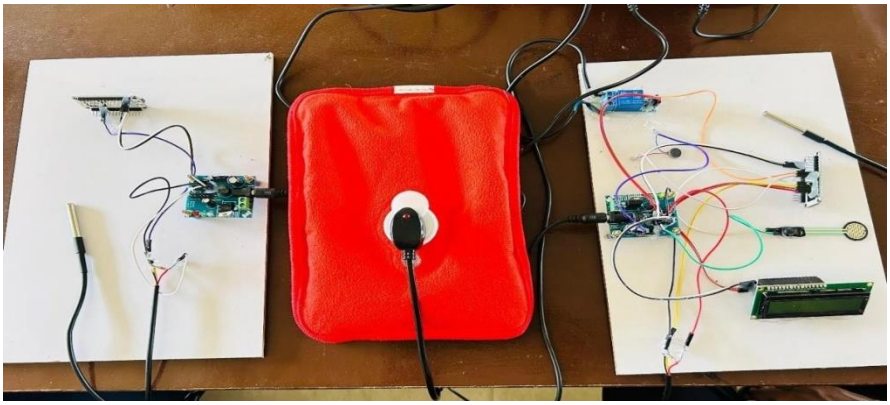

Fig 3.1 Prototype for varicose vein massager in Real time

The above figure shows that the circuit connections for the massager. Also, the hot water bag is connected in the circuit with other sensors like DB18B20 & force sensor.

Fig 3.2 Working of varicose vein massager

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In the figure.3.2 it explains that the temperature difference in the upper andlower body is displayed in the LCD when the Dallas temperature sensors are mounted on the upper and lower parts of the body respectively. Also, it depicts theforce is given in the force sensor and vibration of the coin vibrator.

CONCLUSION

In this methodology deals with people who have varicose vein symptoms by alleviating the pain using the massager. Using Dallas temperature sensors, we continuously monitor the upper and lower body temperature difference and whenthe lower body temperature exceeds the upper body temperature by 3oF the massager begins in the sense the hot waterbag starts to heat and the coin vibratorbegins vibrating, giving a soothing effect in the muscles. Force sensor is used tofind the increased pressure in the varicose vein then starting the massager and when the pressure decreases, the massager stops. The use of ESP8266 microcontroller acts as a brain and transfers information about upper body(client) and lower body(master) temperature, back and forth for the real time temperature monitoring.

Future Enhancement

For the future enhancement of this system, we can monitor the user withthe help of AI and can make use of IOT for monitoring through smartphones. Incorporating machine learning algorithms can enhance the system's ability to detect varicose veins by analyzing patterns in temperature and pressuredata. By training the system with a large dataset of varicose vein cases, it can improve its accuracy in identifying early signs of the condition.

REFERENCES

1. Uhl, C. Busch, S. Marcel, and R. Veldhuis, Handbook of Vascular Biometrics. Cham, Switzerland: Springer, Jan. 2020.
2. Milton, Hitachi, Ltd. Introducing Hitachi's Newest Addition to the Digital Security Portfolio, VeinID Five. Accessed: Jul. 7, 2023. [Online]. Available: https://digitalsecurity.hitachi.eu/products/veinid-five
3. Balneotherapy for chronic venous insufficiency. Cochrane Database ofSystematic Reviews, Issue 1. Art. No.: CD013085. DOI: 10.1002/14651858.CD013085.pub3. Elamrawy S, Darwish I, Moustafa S, Elshaer N, Ahmed N. (2021).
4. Hou, H. Zhang, and R. Yan, "Finger-vein biometric recognition: A review," IEEE Trans. Instrum. Meas., vol. 71, pp. 1–26, 2022.
5. Clinical and genetic determinants of varicose veins. Circulation; 138:2869- 80.DOI PubMed PMC Guo, X., Cui, H., & Wen, X. (2019).
6. Effects of Treatment of Varicose Veins on the Occurrence ofComplications and to Improve the Quality of Life: Pilot Study.Adv J Vasc Med.;3(1): 001-005. Batten, M., Stevenson, E., Zimmermann, D., & Isaacs, C. (2017).
7. Evaluation of quality of life after minimally invasive varicose vein treatment. DOI:10.5606/tgkdc.dergisi.2019.16867TurkishJournal of Thoracic and Cardiovascular Surgery. Davies, A.H., (2019).
8. Idiap Research Institute. Biometric Vein Recognition Library. Accessed: Jul. 7,2023. [Online]. Available: https://gitlab.idiap.ch/bob/bob.bio.vein
9. Implementation of a Hydrotherapy Protocol to Improve Postpartum Pain Management. Journal of midwifery & women's health, 62(2), pp.210-214. 3 Chang,S., Hu, S., Li Huang Y., Ching Lee, M., Hung Chung, W., Yu Cheng, C., Chang Hsiao, Y., Jen Chang, C., Lee, S., Wei Chang, S., & Wen , Y., (2021).
10. J. Rice, "Apparatus for the Identification of Individuals," U.S. Patent 4 699 149,Oct. 13, 1987.
11. Marcel, M. S. Nixon, and S. Z. Li, Handbook of Biometric AntiSpoofing: Trusted Biometrics Under Spoofing Attacks. London, U.K.: Springer, 2014.
12. M. Himaga and H. Ogata, Evolution of Finger Vein Biometric Devices in Termsof Usability. Cham, Switzerland: Springer, 2020, pp. 159–177, doi: 10.1007/978-3-030-27731-4_6
13. P. K. Upputuri and M. Pramanik, "Photoacoustic imaging in the second near- infrared window: A review," J. Biomed. Opt., vol. 24, p. 40901, Apr. 2019.
14. P. Drozdowski et al., "Demographic bias: A challenge for fingervein recognitionsystems?" in Proc. 28th

Eur. Signal Process. Conf. (EUSIPCO), Jan. 2021, pp. 825–829. Batricevic G, Music, D, Maras P, Smiljanic, M, Filipovic, A. et al. (2018).

15. Pain: clinical manual for nursing practice. St Louis, MO: Mosby. Manerikar,KA., Patil, C., Bhatia, S ., Singh, G & Gawade, H. (2018).
16. The association between vegetarian diet and varicose veins might be more prominent in men than in women. Front. Nutr., 01 June 2023, Sec. Nutritional Epidemiology. Volume 10 - 2023 | https://doi.org/10.3389/fnut.2023.1046158. McCaffery M, Beebe A, et al. (1989).
17. The seriousness of chronic venous diseases: A Review of Real-World Evidence. Adv Ther. ; 36 (Suppl 1):5-12. Doi: 10.1007/s12325-019-0881-7. De Moraes Silva MA, Nakano LCU, Cisneros LL, Miranda Jr F. (2023).
18. Treatment of Varicose Veins Affects the Incidences of Venous Thromboembolism and Peripheral Artery Disease, Circulation: Cardiovascular Interventions. https://doi.org/10.1161/CIRCINTERVENTIONS. 120.0102072021;14: e010207 Çoban, P., T., & Dirimeşe, E. (2019).