AUTOMATED TREATMENT DEVICE FOR VARICOSE VEIN PATIENTS

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Abstract: Varicose veins are twisted, enlarged veins. Any superficial vein may become varicose, but the veins most commonly affected are those in your legs. That's because standing and walking upright increases the pressure in the veins of your lower body. For many people, varicose veins and spider veins, a common, mild variation of varicose veins, are simply a cosmetic concern. For other people, varicose veins can cause aching pain and discomfort. Sometimes varicose veins lead to more- serious problems. Treatment may involve self-care measures or procedures by your doctor to close or remove veins. Approximately 23% of US adults have varicose veins. If spider telangiectasias and reticular veins are also considered, the prevalence increases to 80% of men and 85% of women. Generally, more common in women and older adults, varicose veins affect 22 million women and 11 million men between the ages of 40 to 80 years. In this paper, we propose an inexpensive, lightweight, and wearable device for the early detection and prevention of varicose veins using non-invasive methods. The method includes continuous monitoring of the temperature of the affected area and when the temperature of the affected area becomes more than the normal body temperature, improper blood flow is detected and vibrations are applied automatically to make the blood flow proper.

Index Terms - Knee exercise, Gyroscope sensor, non-invasive treatment, temperature monitoring

I.INTRODUCTION

Varicose veins, also known as varicosities, are a medical condition in which superficial veins become enlarged and twisted. These veins typically develop in the legs, just under the skin. Varicose veins usually cause few symptoms. However, some individuals may experience fatigue or pain in the area. Complications can include bleeding or superficial thrombophlebitis. Varices in the scrotum are known as varicocele, while those around the anus are known as hemorrhoids. Due to the various physical, social, and psychological effects of varicose veins, they can negatively affect one's quality of life.

Varicose veins have no specific cause. Risk factors include obesity, lack of exercise, leg trauma, and family history of the condition. They also develop more commonly during pregnancy. Occasionally they result from chronic venous insufficiency. Underlying causes include weak or damaged valves in the veins. They are typically diagnosed by examination, including observation by ultrasound. Varicose veins are very common, affecting about 30% of people at some time in their lives. They become more common with age. Women develop varicose veins about twice as often as men. Varicose veins have been described throughout history and have been treated with surgery since at least A.D. 400.

1.1 METHODOLOGY

1. Text Encoding
2. Image Generation
3. Contrastive Learning
4. Training Data
5. Fine Tuning

1.1.1   ESP8266

ESP8266 offers a complete and self-contained Wi-Fi networkingsolution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor.ESP8266 has been designed for mobile, wearable electronics, and Internet of Things applications with the aim of achieving the lowest power consumption witha combination of several proprietary techniques.

1.1.2   RA-02LORA

It can be used for ultra-long distance spread spectrum communication, and compatible FSK remote modulation and demodulation quickly, to solve the traditional wireless design cannot take into account the distance, anti-interference, and power consumption.Ra-02 can be widely used in a variety of networking occasions, for automatic meter reading, home building automation, security systems,remote irrigation systems, and is the ideal solution for things networking applications.

1.1.3   DS12B20 TEMPERATURE SENSOR

The temperature sensor used in our project is used to detect the body temperature ofthe patient in various areas.

1.1.4   VIBRATON MOTOR

When the temperature and force are created in the varicose vein patient, the vibrationmotor automatically starts to vibrate to reduce the inflammation of the vein and thepain caused due to the varicose vein.

1.1.5   LCD

LCDs are used as an indicator. In the transmitter block, it simply glows to indicate that the transmitter block is working and transmits the signal to the receiver block. The receiver block, shows the values of the patient's hand temperature, the difference between temperatures, and the average temperature of the varicose vein affected area.

1.1.6   POWERSUPPLY

Though ESP8266 supplies power to the other parts, it is not enough for all components. So, the additional power supply is given to the temperature sensor and force sensor

1.2 OBJECTIVE OF THE STUDY

The objective of this project is to design and develop a system that can monitor and treat varicose veins automatically, without the need for constant manual intervention from medical personnel. The project aims to create a solution that incorporates non-invasive diagnostic methods such as ultrasound and infrared imaging to accurately diagnose varicose veins. An automated compression therapy device will be designed to apply pressure to the affected area at regular intervals, based on the severity of the condition and the patient's individual needs. The software will analyze the data collected by the sensors and adjust the treatment plan accordingly. The effectiveness of the system in treating varicose veins will be evaluated through tests, and the results will be compared with traditional treatment methods. Overall, the main objective of this project is to develop an innovative, effective, convenient, safe, and cost-effective solution for treating varicose veins for patients.

II. LITERATURE REVIEW

In[1] "Real-Time Epidemiology of Varicose Veins and Chronic Venous Disease Prediction Using Decision Tree Algorithm"[TURKISH JOURNAL OF COMPUTER AND MATHEMATICS EDUCATION, 2021] by R.Panneer Selvi,R.Sasikumar, S.Deva Priya, and C.Jeganathan.

In[2] " Rehabilitation Exercise Monitoring Device for Knee Osteoarthritis Patients"[INTERNATIONAL CONFERENCE ON CONTROL, ELECTRONICS, RENEWABLE ENERGY AND COMMUNICATIONS (ICCEREC), 2017] byNur Amirah Ishak, Mitra Mohd Addi.

In[3] "Patient-Provider Interaction System for Efficient Home-based Cardiac Rehabilitation Exercise "[IEEE, 2018] by H. Chung, H. Lee, C. Kim, S. Hong, andJ. Lee1.

In[4] " Developing a wearable ankle rehabilitation robotic device for in-bed acute stroke rehabilitation "[IEEE TRANS NEURO SYSTEM REHABILITATIONENGINEERING, 2016] by Yupeng Ren, Yi-Ning Wu, Chung-Yong Yang, Tao Xu, Richard L. Harvey, and Li-Qun Zhang.

In[5] "Real-Time Monitoring System for Upper Arms Rehabilitation Exercise " [IEEE 3rd INTERNATIONAL CONFERENCE ON SMART INSTRUMENTATION, MEASUREMENT AND APPLICATIONS, 2015] by Kushsairy A. K, A. MalikM. Ali, Zulkhairi M.Y, Haidawati Nasir, Sheroz Khan.

III. ANALYSIS

3.1 EXISTING SYSTEM

In the existing system, separate people check the patient and give the treatment. Whenever the patient needs treatment, they need a medical assistant's help. The invasive treatments include laser therapy, sclerotherapy, radiofrequency ablation, and ambulatory phlebectomy. The existing non-invasive treatments are whole-body vibration, using compression stockings, and doing exercises. One of the greatest challenges faced by the medical industry is the early detection and prevention of varicose veins. When varicose veins go undetected, it gets aggravated and causes a lot of pain to the affected person as well as makes them resort to surgical methods as a cure.

3.2 PROPOSED SYSTEM

In the proposed system, we have used an ESP8266 microcontroller which acts as the brain of our system; hence the entire system program is stored in it. The system consists of a temperature sensor used to know the body temperature. It is fixed on the patient body in two different places. So, one is fixed in the hand and another one is fixed in the leg position. The RA-02 LORA MODULE works as a communication device. If one of the temperature sensors detects any abnormality in the leg positionthe RA-02 Lora transmits the data to the receiver. And whenever The RA-02 Lora receives the data from the transmitter the vibration motor will run and give the message to the patients. LCD is used to display all the Information.
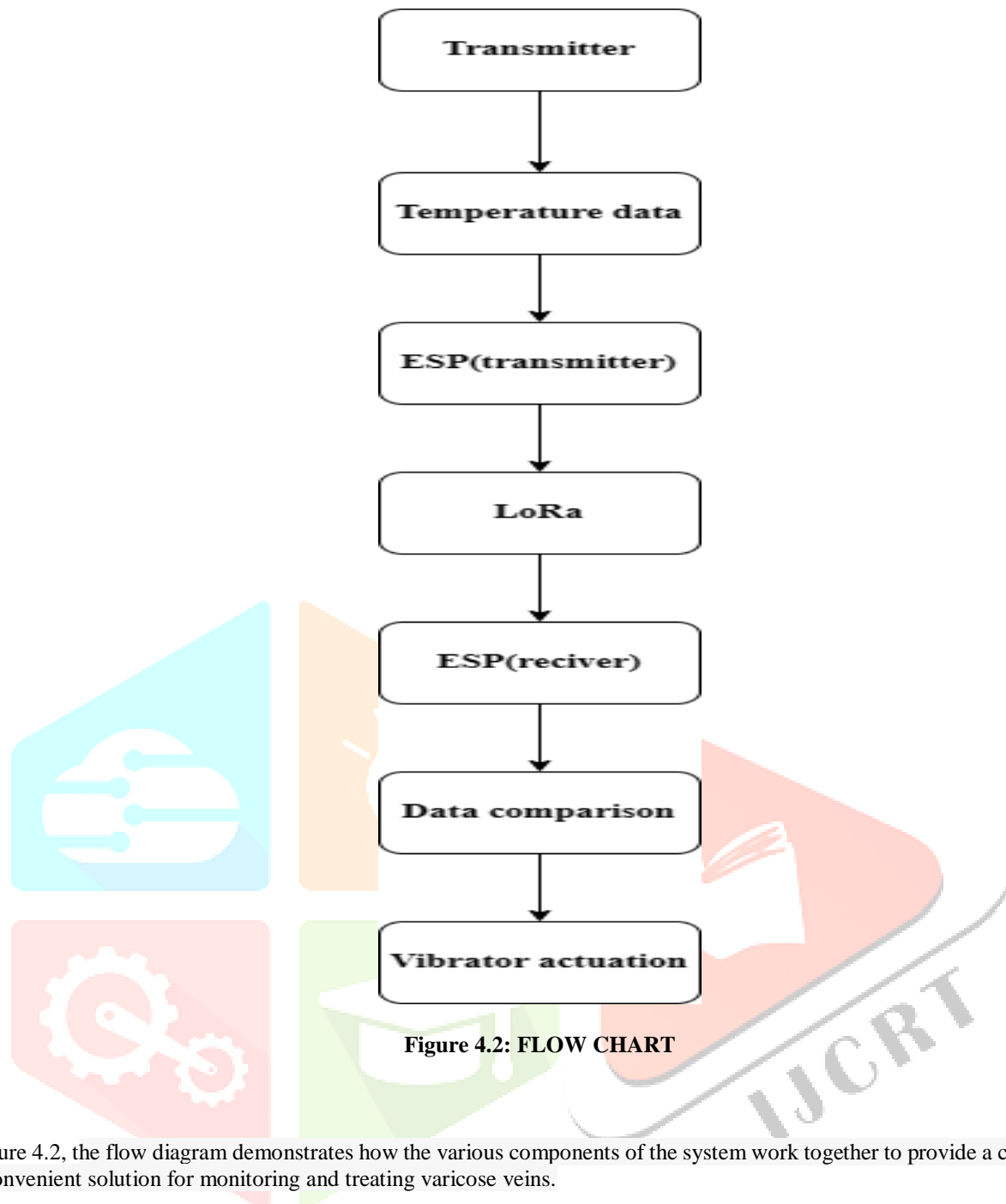
IV. ARCHITECTURE

TRANSMITTER BLOCK   RECEIVER BLOCK
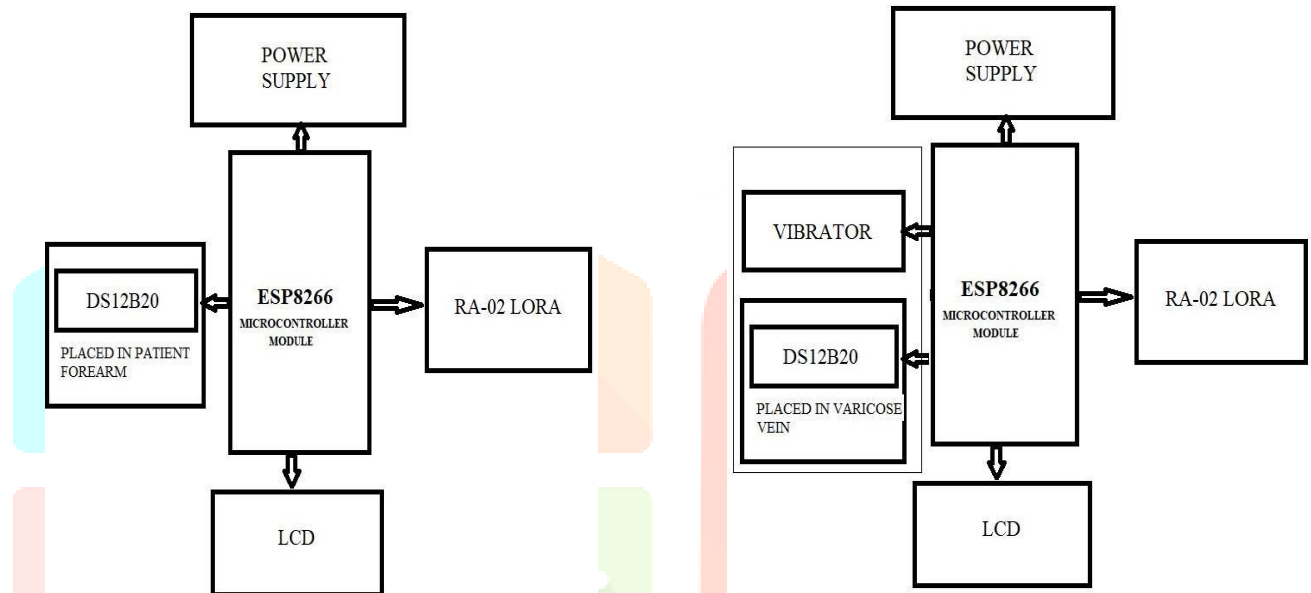
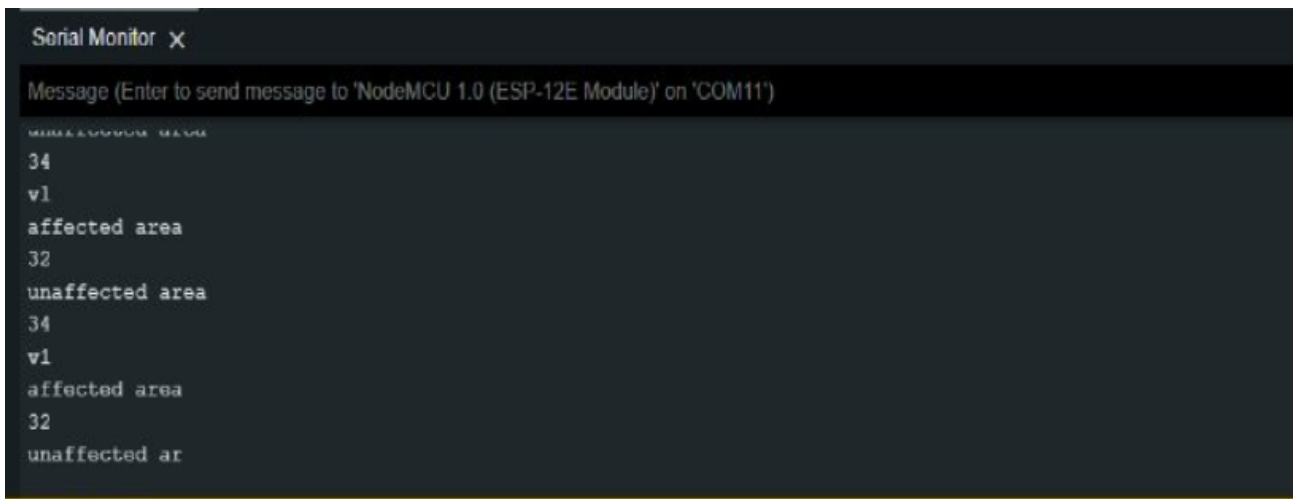**Figure 4.1 ARCHITECTURE DIAGRAM**

In Figure 4.1 The temperature data is transmitted wirelessly to a receiver module using LoRa technology, which compares the actual environmental temperature with the extracted data and actuates a motor based on the design specifications. The system provides a convenient and effective way of monitoring and treating varicose veins remotely, using a combination of temperature sensing and wireless communication.

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┌─────────────────────┐
│     Transmitter      │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│   Temperature data   │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│  ESP(transmitter)    │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│        LoRa          │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│    ESP(reciver)      │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│   Data comparison    │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│  Vibrator actuation  │
└─────────────────────┘
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Figure 4.2: FLOW CHART

In Figure 4.2, the flow diagram demonstrates how the various components of the system work together to provide a comprehensive and convenient solution for monitoring and treating varicose veins.

4.1 RESULTS AND DISCUSSION

Figure 4.1.1   Normal person temperature

Figure 4.1.2   Affected person temperature

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V. CONCLUSION AND FUTURE ENHANCEMENT

The project offers a new approach to identifying varicose veins early and providing preventive treatment. To detect the disease, the temperature and force of the affected area are continuously monitored. When both values surpass a certain threshold, vibrator modules attached to the compression stockings are activated. The modules work together to boost blood circulation and prevent blood accumulation in the affected region.

To further enhance this project, future work includes improving the accuracy of varicose vein detection by measuring blood flow. Another improvement would be reducing the delay time from 5 seconds to 2 seconds for quicker response. Additionally, the prototype model could be integrated into wearable compression stockings for practical use.

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