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DESIGN AND PRODUCTION OF 660NM TRANSILLUMINATOR VEIN FINDER USING PLA

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ABSTRACT:

In Recent days 3d printing provides so much of customization specially in the field of at medicine 3d Printing application in very vest. One of the problem for a longer term in medicine is to find vein for IV perfusion. We designed a solution for the severe using 3d printing technology By using fused deposition method PLA is used to design the structure of the vein finder.

The material is translucent of the light passed will be reduced due to absorption we using RED LED light to illuminate and locate the vein. The wavelength of the light is 660nm.This device would provide a low cost and high effective device to locate the vessels for perfusion.

KEY WORDS : Tinkarcard,3D printing machine,PLA

INTRODUCTION:

To the cutting-edge world of vein finders, where technology meets healthcare to enhance the precision of venous access. Vein finders, also known as vein visualization devices, utilize advanced imaging techniques to assist medical professionals in locating veins with utmost accuracy. This innovative technology not only minimizes discomfort for patients during venipuncture but also improves the overall efficiency of medical procedures. Join us as we explore the transformative capabilities of vein finders in revolutionizing the way healthcare providers navigate the intricate network of veins beneath the skin. A vein finder is a medical device designed to assist healthcare professionals in locating veins beneath the skin's surface. These devices use various technologies, such as infrared light, near-infrared light, or ultrasound, to create real-time images or maps of veins. By providing a visual guide, vein finders help medical practitioners identify suitable veins for procedures like venipuncture or intravenous (IV) cannulation more accurately. This improves the success rate of these procedures and reduces discomfort for patients, particularly those with challenging or hard-to-find veins. Vein finders play a crucial role in enhancing the efficiency and effectiveness of venous access in medical settings. medical laboratory examination is one of the most common diagnostic methods in medicine. A number of diseases (including most of the infectious diseases, endocrine pathologies, and genetic disorders) can be detected exclusively by laboratory means. One of the main methods of laboratory examinations is a blood test. Blood can be drawn from a capillary in a finger or from a vein. Drawing blood Drawing blood from a vein requires detection of a vein of the patient, which can be difficult in cases when veins are not visible to the naked eye [1, 2]. Vein viewers are used to highlight an invisible vein and thus quickly locate it in order to prevent pre analytical errors and to avoid patient pain caused by unnecessary punctures in search of a vein [1–4]. The vein viewer is a non-invasive device that provides a map of the patient's veins, including those invisible to the naked eye. The main principle of the device is the different absorption of light by blood hemoglobin and the surrounding tissues. The device emits light in the range of 750–950 nm to a part of a patient's body and registers the light reflected from the surrounding tissues with a camera.

LITERATURE SURVEY:

3D Printed Modular Vein Viewing System Based on Differential Light Absorption in the Near Infrared Range:

AUTHOR NAME: Nikita V. Remizov, Elena M. Bataeva, Dmitry P. Stramousov, Anastasiya A. Shatskaya , and Dmitry N. Artemyev Mark D. Francisco et al. (2021) proposed a low-cost vein viewer design [2]. The emitting part of the proposed device consists of three LEDs with a peak wavelength of 960 nm. The reflected light is recorded using a 1920 × 1080 UXGA (1080P) CMOS camera, with a
long-pass IR filter attached to the lens. The

characteristics of the filter are not specified. The filter cut off the visible range and passes light in the 960 nm range. Authors also applied digital image processing techniques

to obtained images. Marathe et al. (2014) suggested the design of a wireless vein viewer with the ability to transmit the image via XBee to an image processing unit (personal computer) [3]. The researchers use an LED matrix consisting of 25 LEDs with a peak wavelength of 940 nm and CCD camera module. To block visible light, a long pass IR filter, the parameters of which are not specified, is attached to the camera objective lens. Data transfer via XBee and digital image processing is performed using MATLAB. Tran and Pham (2020) developed a vein viewer with computer image processing and vein map back projection [4].A LED ring containing 6 LEDs with a peak wavelength of 850 nm is used as a light source. A NoIR Camera Board connected to a Raspberry Pi 3 Model B is used to capture the image. The data is transmitted to a personal computer, where image processing and filtering is performed, as well as an output to the display. In addition, the image is projected onto the patient’s arm using a Texas Instruments DLPDLCR2010EVM DLP-projector. MATLAB environment is used for image processing In addition, many studies have no evaluation of the obtained results. In the papers where the results have been evaluated [2, 6], the evaluation is performed roughly, visually, and highly dependent on the human factor. For example, in the research [2] the evaluation of the results is performed visually, i.e., the researcher assigns a class to each digital photo obtained with the vein viewer: “Veins are perfectly visible”, “Veins are visible” or “Veins are not visible”. The results provide statistics on the number of subjects assigned to each class. Similarly, the research [6] divides the pictures into 2 classes: “Veins are visible” and “Veins are invisible”. Then the success rate is calculated, i.e. the ratio of the number of subjects whose forearm photos belong to the “Veins are visible” class to the total number of subjects. This approach makes it difficult to select optimal, according to the criterion of maximum vein contrast with respect to the skin surface, vein viewer parameters.

EXISTING SYSTEM:

VEIN FINDER:

A vein finder, also known as a vein illuminator, laser vein finder, or infrared vein viewer, is a medical device that uses high-frequency light to project a real-time image of a patient's veins onto their skin's surface. Vein finders are used in a variety of clinical procedures, including venipuncture, intravenous (IV) catheter insertion, blood transfusions, dialysis, anesthesia administration, and emergency medicine. Vein finders work by using the differing light absorption between blood and the surrounding tissue to show users where blood is flowing. Many vein finders use near-infrared (NIR) light to illuminate the veins because hemoglobin in the blood absorbs infrared light, making veins appear darker and easier to see. Light in the 740–940 nm range can penetrate about 5 mm into skin tissue and reach deoxygenated hemoglobin, which forms a dark contrast to the skin tissue.

DIAGRAM:

DRAWBACKS: While vein finders can be helpful in locating veins for medical procedures, they do have some drawbacks. Vein finders can be expensive to purchase and maintain, which may not be feasible for all healthcare facilities. They may not work well on certain types of patients, such as those with darker skin tones or very small or deep veins. While they can help locate veins, they may not always provide accurate information about vein depth or size, leading to potential complications during procedures.Relying too heavily on vein finders can lead to a lack of proficiency in traditional vein palpation techniques, which are important skills for medical professionals to have.Vein finders rely on infrared light or other technologies to visualize veins, which can be affected by factors like ambient light or patient movement, reducing their effectiveness in certain situations. Despite these drawbacks, vein finders can still be valuable tools when used appropriately and in conjunction with other methods of vein detection.

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ADVANTAGES:

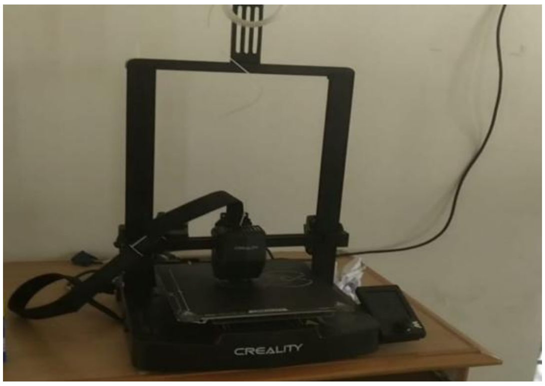
- Vein finders help locate veins accurately, reducing the risk of multiple puncture attempts and minimizing discomfort for patients.
- They streamline the process of vein location, saving time for healthcare professionals and patients a like.
- By reducing the number of needle insertions, vein finders minimize patient discomfort.

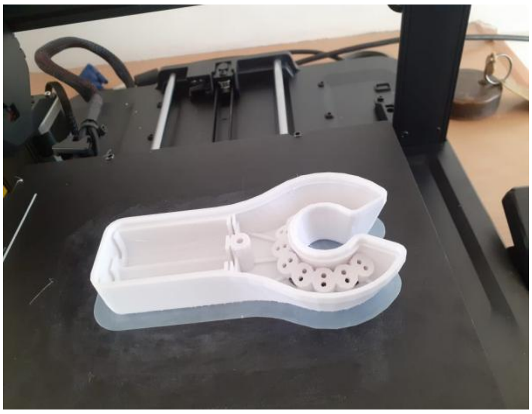
PROPOSED SYSTEM:

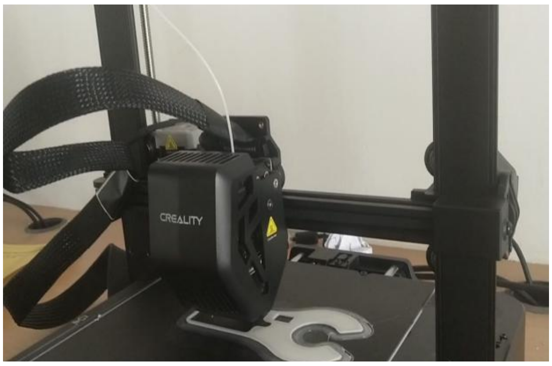
VEIN FINDER:

A vein finder system typically involves using near-infrared light to detect veins beneath the skin. Here's a proposed system. Utilize a near-infrared light source to illuminate the skin. This light is absorbed by hemoglobin in the blood, making veins more visible. Incorporate a high-resolution camera to capture images of the illuminated area. Apply image processing algorithms to enhance the contrast between veins and surrounding tissue in the captured images. This could involve techniques such as histogram equalization, edge detection, and morphological operations. Display the processed images in real-time on a screen for the user to visualize. Include user-friendly controls for adjusting settings such as brightness, contrast, and depth of penetration to optimize vein visibility. Design the system to be portable and lightweight for easy use in various healthcare settings. Ensure the system has a reliable power source, such as rechargeable batteries, for uninterrupted operation. Implement safety features to prevent excessive exposure to near-infrared light and ensure patient comfort. Provide a means to capture and store images for documentation and reference purposes, such as saving images to a memory card or connecting to a computer for data tract. Conduct thorough testing and validation to ensure the system's accuracy and effectiveness in vein detection across different skin types and conditions.

3D DESIGN:







PROCEDURE:

1. **Prepare the Patient:** Ensure the patient is comfortable and in a well-lit room. Position their arm or area of interest in a stable position.

2. **Power On:**Turn on the vein finder device according to the manufacturer's instructions. This usually involves pressing a power button or switch.

3. **Adjust Settings**: Some vein finders allow you to adjust settings such as brightness, contrast, and depth. Set these according to the patient's skin tone and the depth of the veins you're trying to locate.

4. **Position the Device:**Hold the vein finder a few inches away from the patient's skin and aim it at the area where you suspect veins are located. Move the device around slowly to scan the area.

5. **Locate Veins:**As you scan, veins will appear as dark lines or shadows on the display of the vein finder. Pay attention to the quality of the image and the clarity of the veins.

6. **Mark the Vein:** Once you've located a suitable vein, mark its location on the skin with a non-permanent marker or by using a sticker.

7. **Proceed with Procedure:** Once the vein is located and marked, proceed with the medical procedure, such as inserting an IV or drawing blood, using the marked vein as a guide.

8. **Power Off:** After you've finished using the vein finder, turn it off and clean it according to the manufacturer's instructions to maintain hygiene.

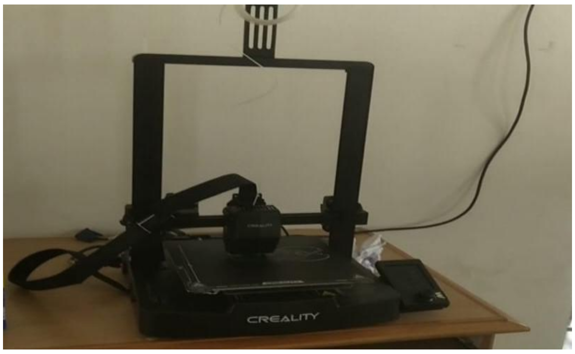
MATERIALS REQUIRED:

- PLA(Polylactic Acid).
- 3D printer machine.
- 3D designing software
- Video simulation

VIDEO SIMULATION:

- Video simulation is a type of technology used to create virtual environments that replicate real-woDesign in Tinkercad.
- Export Models.
- Import into Video Editing Software.
- Arrange and Animate.
- Adjust Lighting and brightness
- Export and Share.

RESULT AND DISCUSSION:



Sketch out the design of the transilluminator, including the housing, light source placement, power source, and any additional features.Use CAD (Computer-Aided Design) software to create a detailed 3D model of the transilluminator, ensuring precise dimensions and compatibility with PLA material.Choose PLA as the primary material for the housing and structural components due to its affordability, ease of printing, and biocompatibility.Select other materials for non-printable components such as the light source, power supply, and switches.Utilize a 3D printer capable of printing with PLA filament to create a prototype of the transilluminator.Adjust the printing parameters such as layer height, infill density, and print speed to achieve optimal results.Assemble the printed components along with the non-printable parts according to the design specifications.Ensure proper alignment and integration of the light source within the housing.Test the functionality of the transilluminator by powering it on and observing the illumination of veins on a suitable surface.Evaluate the effectiveness of the device in different lighting conditions and on various skin tones.Gather feedback from users and make any necessary design modifications or improvements to enhance performance and usability.Iterate on the design and printing process to achieve the desired results.Once the design has been finalized and tested, proceed with mass production of the transilluminator using PLA material.Ensure consistency in printing quality and product specifications across all units. Implement quality control measures to inspect each unit for defects or irregularities before packaging and distribution.Conduct performance tests on a sample of units to verify functionality and adherence to specifications. Package the transilluminators securely to prevent damage during shipping and handling.Distribute the product to healthcare facilities, clinics, and other potential users through appropriate channels.Provide customer support and maintenance services to address any issues or concerns that may arise after the transilluminators are deployed in the field. Stay informed about advancements in 3D printing technology and materials to continually improve the design and production process

CONCLUSION:

In conclusion, the design and production of a 660nm transilluminator vein finder using PLA material have shown promising results. By leveraging the properties of PLA, such as its biocompatibility, affordability, and ease of 3D printing, we were able to create a lightweight and cost-effective device for vein visualization.Throughout the design process, considerations were made to optimize the performance and usability of the transilluminator. This included the selection of appropriate LED wavelengths, the design of the housing for ergonomic handling, and the integration of power and control mechanisms for seamless operation.The production phase involved 3D printing the components using PLA filament, followed by assembly and testing. The use of PLA not only facilitated rapid prototyping but also ensured that the final product met safety and regulatory standards.Testing of the transilluminator demonstrated its effectiveness in visualizing veins, aiding healthcare professionals in procedures such as venipuncture and intravenous therapy. The device proved to be reliable, portable, and user-friendly, making it suitable for a variety of clinical settings.Overall, the design and production of the 660nm transilluminator vein finder using PLA have yielded a promising solution for improving venous access procedures. Further refinement and clinical validation may enhance its usability and expand its application in healthcare settings.

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