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Research Paper

Development of bracelet type for vessel navigator using near-infrared ray

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Abstract

Background/Objectives: Bruises on skin or bent in blood vessel and needle stick might occur when a newly graduated nursewho is a poorly trained stuck the needle into wrong spot instead of blood vessel due to poor visibility of fat patients as well as young children
Methods/Statistical analysisDevelopment of product design for vein finder with a bracelet form using near-infrared ray and securement of not only certificate authority for the device through the possible application of test progress in actual environment but product test specification.
Findings: This study is a vessel finding device through near-infrared ray technology. Technology development for various kind of applied products which is able to give first aid to a first-aid patient will be able to be expected. Having technology in convergence field of industry in case of upgrade development of beam projection method which is directly project the back of the hand will be considered to occupy an advantageous position.
Improvements/Applications: It is expected the device to be a good opportunity to invigorate related research and development for optimizing performance in medical device industry even though poor R&D domestic environment

Keywords: *Near- Infrared Ray; Blood Vessel; Syringe; Health Care; Image Diagnosis*

1. Introduction

Death rate has been increased by chronic illnesses due to aging, changing eating habits and decreased physical activity while diagnostic imaging instruments and measuring devices are in increasing demand due to an environment for the importance of preventive medicine in treatment. Diagnostic imaging instruments and measuring devices are a convergence technology which utilizes a various field of knowledge such as IT, BT, and NT [1], [2]. The convergence technology has not only an epidemic on other industry but high added value for next generation medical instrument to be expected the continual increases in demand in the future. But various types of problems has occurred annually in health and medical treatment environment [3], [4]. A novice nurse tends to make black a skin due to being got pierced by syringe because fat people and pediatrics whose vessel is so difficult to find that giving an injection on the vessel is occurred wrong spot instead of a blood vessel [5], [6]. If doctor or medics will examine a patient in a disaster site patients have to move outside or use light to be examined. Bracelet type vessel navigator using near-infrared ray developed in this study makes it possible to take action within golden time without difficulty [7], [8]. The vessel navigator which is used near-infrared ray not only differ from an existing big sized instrument which needs two persons together to operate but doesn't need for patient to move toward instrument to be examined. The application of result in this study will be expected to be good opportunity to boost related research and development for optimizing performance in the medical instrument industry. Near-infrared ray penetrates human skin and then transmitter module which is sending reflection data to display screen and design of outward appearance are developed [9], [10].

2. Status of related technology

2.1. Status of domestic technology

Technology of domestic vein finder is to establish the concept and its products are just releasing. The specification of existing product is same as vein viewer that is used in America. But this device must be moved towards the patient to have a checkup due to its structural design of fixed hardware. So there is weakness in the condition that nurses work in teams of two. An essential element of bracelet type of vein finder is to find out location of blood for digital shooting.

2.2. Status of foreign technology

Paradigm is changing from curing diseases to preventing them as diagnosis of a disease has increased rapidly the demand. The world market size on diagnostic imaging equipment and measuring device industry is $8,500,300,000 in 2014 and it is expected to form $ 10.5 billion of the market in 2018 with average annual growth rate of 5.59% from 2013.

3. Results and discussion

3.1. Development of vein finder device with a form of bracelet based on near-infrared ray

The system is a display device that contrast information which is projected to hemoglobin in blood vessel using near-infrared ray is

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collected. The major functions are blood vessel detection, golden time keeper at the disaster, angiopressure, easy to see blood vessel, how to operate the camera, and expression of contrast in location of blood vessel.
PCB output of the device is shown in Figure 1.

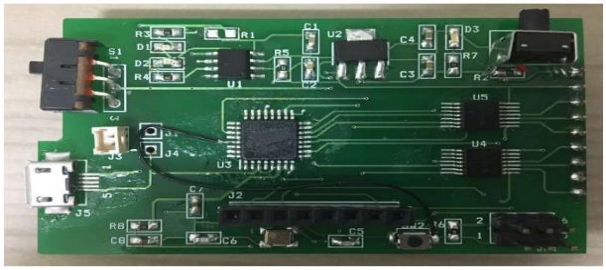


Fig. 1: PCB Product.

3.2. Manufacturing module of camera part

Major function is shooting the location of blood vessel after angiopressure. It is possible to irradiate only infrared ray with removed visible light without restrictions. The device is composed of camera with 5MP image sensor OV5642, IR sensitive with proper lens combination, I2C interface for the sensor configuration, and SPI interface for camera commands and data stream.
Assembly output of camera part is shown in Figure 2.



Fig. 2: Camera Part Assembly.

3.3. Manufacturing module of LCD part

This device has a function not only to be irradiated by infrared camera module but to display transmitted data on the screen. The output of LCD display is shown in Figure 3.



Fig. 3: LCD Display Product

3.4. Manufacturing module of product mock-up

Exterior design to wrap up PCB and module and its mock-up output is shown in figure 4.

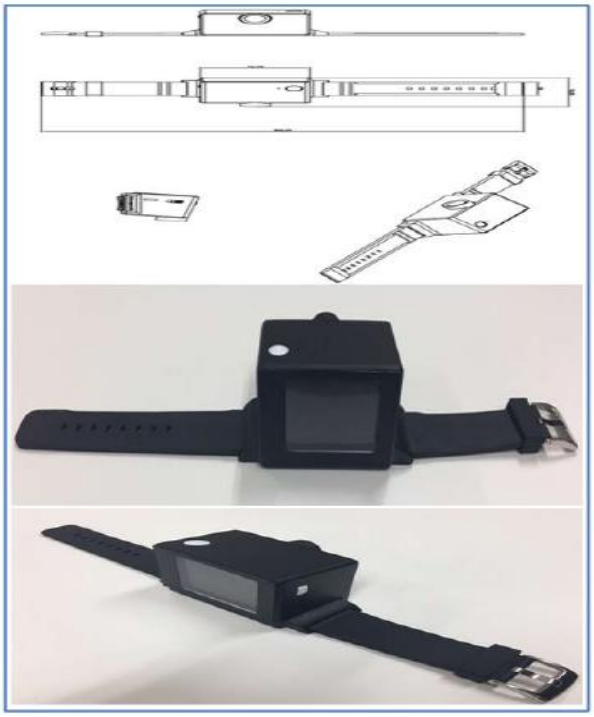


Fig. 4: Picture of Product Mock-Up

3.5. Final product

The product is composed of transmitting near-infrared ray part on the back of one's hand, receiving infrared ray part that detects reflected near-infrared ray from blood vessel inside the back of hand, image process part that generates blood vessel image of it, display part to show its generated image. Banding part that is mounting the device near wrist prevents wrist from bending in a downward direction to start finding blood vessel. Product drawing is shown in Figure 5 and final product is shown in Figure 6.

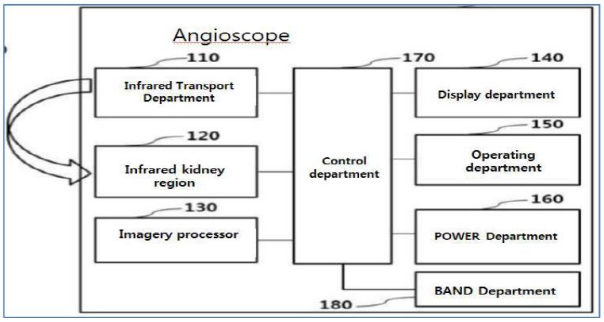


Fig. 4: Operating Concept Block Diagram.

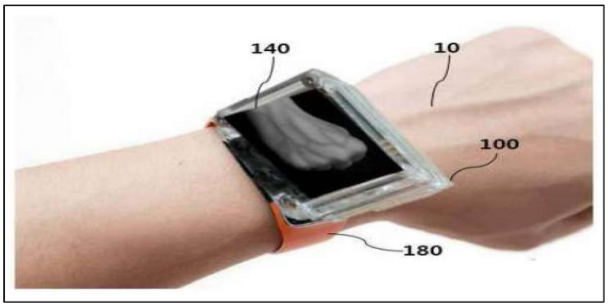


Fig. 5: Final Product.

4. Conclusion

This study is a vessel finding device through near-infrared ray technology. Technology development for various kind of applied products which is able to give first aid to a first-aid patient will be

expected. Having technology in convergence field of industry in case of upgrade development of beam projection method which is directly project the back of the hand will be considered to occupy an advantageous position. It is expected as a core technology to solve the problem of young children, fat patients, and disabled patients if an improved device using near-infrared ray is developed.

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