Thermal Imaging Mobile Module

Allie Walters, Chloe Tutunick, Robert Wilson, Janae Maxwell, Charles Gardner, and John Copsey

Florida State University Panama City

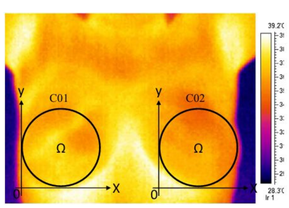
Abstract

This project focuses on designing and developing a viable prototype of a portable module equipped to capture thermal images for medical screenings. The system will include a user-friendly mechanical interface, allowing patients to adjust the camera for optimal imaging. Emphasizing patient privacy, accessibility, and comfort, the module will be housed in a secure, climate-controlled room to ensure effective imaging and a positive user experience. The system will be designed to deliver accurate results while maintaining ease of use for both patients and healthcare providers. The primary market includes individuals at risk for illnesses detectable through infrared imaging, such as breast cancer, and healthcare providers who will utilize the technology for diagnostic purposes. Florida State University Panama City and Tallahassee, and the Federal University of Paraná, have agreed to collaborate to bring this innovative concept to life.

Introduction

1 IN 8 WOMEN WILL DEVELOP BREAST CANCER

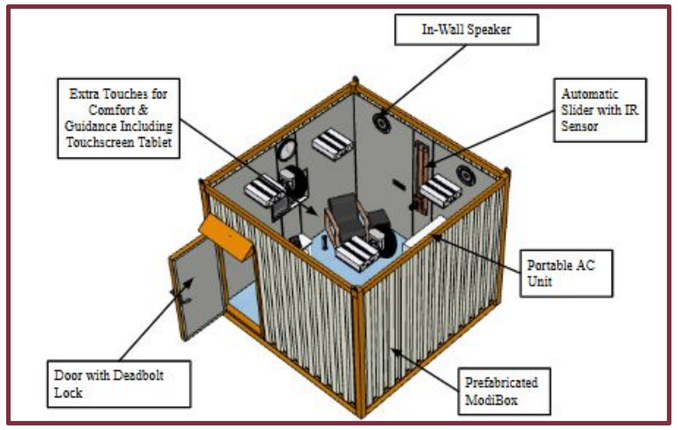
1 in 8 women will develop breast cancer, a disease where early recognition and treatment is crucial. Unfortunately, modern examination methods, such as mammograms, are uncomfortable both physically and emotionally. A new method is currently being developed and examined to provide a quick and private exam. This method involves using thermal imaging and asymmetry to detect breast cancer.



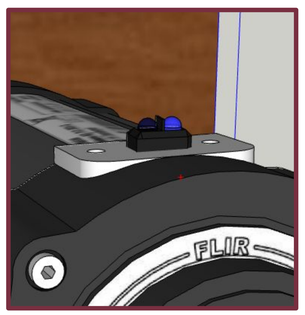
The methodology of infrared biomonitoring of breast illness includes defining an area of interest (indicated with circles) and determining a mean dimensionless temperature difference.

This value incorporates the body, room, and breast temperatures. If the mean dimensionless temperature difference is below the normality range of $\lambda<0.03$, there is a detected abnormality that should be further examined.

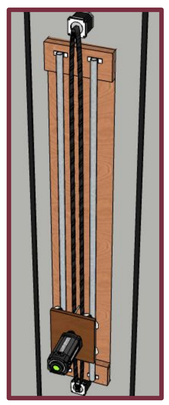
Concept Selection

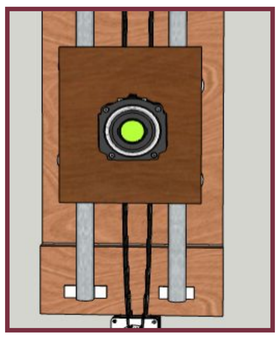


The Thermal Imaging Mobile Module (TIMM) features a prefabricated Modi-Box with an automatic camera adjustment system for precise thermal imaging. The controlled environment includes dual fans, a portable AC, and in-wall speakers. Pre-installed power and lighting ensure quick assembly, while a deadbolt lock enhances security.



Camera with Infrared Sensor





Autonomous Camera Rail System

Detailed Views of Camera Adjustment System

The figures above provide a detailed schematic of the camera adjustment system. To ensure accurate positioning, an IR sensor will be mounted above the camera. To move the camera, two motors will drive a timing belt, allowing for vertical translation. Both of these mechanisms will work together to adjust to the patient's height and create a reliable setup for breast imaging to take place.

Next Steps

The next phase of the project involves finalizing the bill of materials (BOM) and the corresponding budget, ensuring all components are within financial constraints. Additionally, the team will secure a suitable location for constructing the prototype and begin assembly. Extensive testing will be conducted to ensure accurate camera positioning, thermal stability, structural integrity, and portability. The team will present the final design in our Phase II Design Review presentation in late July.

Please feel free to scan the QR code to further explore our senior design project.

References

Dalmaso Neto, C., Buabssi, Y. P., Vargas, J. V. C., Balmant, W., & Mariano, A. B. (2021). A simplified mathematical model to predict the human breast thermal response. 26th International Congress of Mechanical Engineering (COBEM 2021), Virtual Event. ABCM.

Morais, K., Vargas, J., Reisemberger, G., Freitas, F., Oliari, S., Brioschi, M., Louveira, M., Spautz, C., Dias, F., Gasperin, P., Budel, V., Cordeiro, R., Schittini, A., & Neto, C. (2016). An Infrared Image Based Methodology For Breast Lesions Screening. Infrared Physics & Technology, 76, 710–721. Https://Doi.org/10.1016/J.infrared.2016.04.036

Vargas, J. V. C., Mariano, A. B., & Brioschi, M. L. (2019).Cabin telemedicine system for infrared disease screening and biomonitoring (BR Patent No. 102018009083-6 A2).National Institute of Industrial Property.