A REPORT
ON

Non-Contact Estimation of Thermal Properties of Engineering Structures

Submitted by,

Mr. Avyukth Potnuru - 20211CAI0123

Under the guidance of,

Mr. Likhith S R

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

At

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

BENGALURU

MAY 2025

PRESIDENCY UNIVERSITY

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the Internship/Project report **"Non-Contact Estimation of Thermal Properties of Engineering Structures"** being submitted by Avyukth Potnuru bearing roll number "20211CAI0123" in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering is a bonafide work carried out under my supervision.

16/5/25

Mr. LIKHITH S R
Assistant Professor
PSCS
Presidency University

Dr. ZAFAR ALI KHAN N
Associate Professor & HoD
PSCS
Presidency University

Dr. MYDHILI K NAIR
Associate Dean
PSCS
Presidency University

Dr. Md. SAMEERUDDIN KHAN
Pro-Vice Chancellor - Engineering
Dean –PSCS / PSIS
Presidency University

PRESIDENCY UNIVERSITY

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

DECLARATION

I hereby declare that the work, which is being presented in the report entitled **"Non-Contact Estimation of Thermal Properties of Engineering Structures"** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Computer Science and Engineering (AI & ML)**, is a record of my own investigations carried under the guidance of **Mr. Likhith S R, Assistant Professor, Presidency School of Computer Science and Engineering, Presidency University, Bengaluru.**

I have not submitted the matter presented in this report anywhere for the award of any other Degree.

Avyuktha.P

Avyukth Potnuru(20211CAI0123)

INTERNSHIP COMPLETION CERTIFICATE

Department of Mechanical Engineering
Indian Institute of Technology Kanpur
211 Northern Laboratories I
Kanpur, UP, India 208016

C. Chandraprakash, Ph.D.
Phone: 91-(512) 259-6743
Fax: 91-(512) 259-7408
Email: chindamc@iitk.ac.in

To Whom It May Concern

This is to certify that Avyukth Potnuru (enrolled in a B. Tech program in Computer Science and Engineering (AI & ML) at Presidency University) has completed his internship in my lab at Mechanical Engineering, Indian Institute of Technology Kanpur, from 27/01/2025 to 05/05/2025. He explored the application of "Deep Learning for Non-Contact Estimation of Thermal Properties of Engineering Structures". He had (i) conducted a detailed literature survey on AI models and (ii) adopted, validated, and implemented various AI models. This internship exposed him to engineering applications of his coursework and provided him with first-hand experience in scientific research. His performance in this internship has been good, with an equivalent rating of over 9/10.

Thank you,

C. Chandraprakash
Associate Professor

ABSTRACT

This project proposes a novel deep learning-based framework for the non-contact estimation of thermal properties namely thermal conductivity, density, and specific heat capacity of engineering structures. Traditional methods often require physical contact or destructive testing, which limits real-time and safe evaluations. In contrast, this approach leverages pulsed thermography and infrared (IR) image sequences to infer thermal diffusivity through a 3D Convolutional Neural Network (3D CNN). Synthetic and simulated data are generated via COMSOL Multiphysics simulations and controlled thermographic imaging, then preprocessed for model training. The model learns spatio-temporal heat diffusion patterns to accurately predict thermal characteristics. This contactless technique offers a scalable, cost-effective, and reliable alternative suitable for structural health monitoring, especially in inaccessible or sensitive environments, while preserving material integrity.

ACKNOWLEDGEMENTS

First of all, we indebted to the **GOD ALMIGHTY** for giving me an opportunity to excel in our efforts to complete this project on time.

We express our sincere thanks to our respected dean **Dr. Md. Sameeruddin Khan**, Pro-VC - Engineering and Dean, Presidency School of Computer Science and Engineering & Presidency School of Information Science, Presidency University for getting us permission to undergo the project.

We express our heartfelt gratitude to our beloved Associate Dean **Dr. Mydhili K Nair,** Presidency School of Computer Science and Engineering, Presidency University, and Dr. Zafar Ali Khan N, Head of the Department, Presidency School of Computer Science and Engineering, Presidency University, for rendering timely help in completing this project successfully.

We are greatly indebted to our guide **Mr. Likhith S R, Assistant Professor** and Reviewer **Mr. Santhosh Kumar K L, Assistant Professor**, Presidency School of Computer Science and Engineering, Presidency University for his inspirational guidance, and valuable suggestions and for providing us a chance to express our technical capabilities in every respect for the completion of the internship work.

We would like to convey our gratitude and heartfelt thanks to the CSE7301 Internship/University Project Coordinator **Mr. Md Ziaur Rahman and Dr. Sampath A K,** department Project Coordinators **Dr. Afroz Pasha, Assistant Professor** and Git hub coordinator **Mr. Muthuraj.**

We thank our family and friends for the strong support and inspiration they have provided us in bringing out this project.

Avyukth Potnuru