Thermal Vision

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Introduction

Thermal imaging technology has become a vital tool across industries—from electrical inspections to medical diagnostics—but its accessibility remains limited to specialized hardware and desktop software. This project bridges that gap by developing a mobile thermal image analysis application that empowers users to capture, analyze, and interpret thermal data directly on Android devices. The app transforms smartphones into portable thermal diagnostic tools, enabling professionals and enthusiasts alike to perform temperature-based inspections with ease.

Objective

This project aims to develop an Android application that utilizes digital image processing techniques to analyze thermal images and detect temperature variations. The app enhances thermal image data using preprocessing methods and identifies hotspots based on temperature intensity. It is designed for real-time usage, enabling efficient monitoring and diagnosis in industrial or photovoltaic (PV) systems.

Objective 01

To process thermal images using digital image enhancement and segmentation techniques

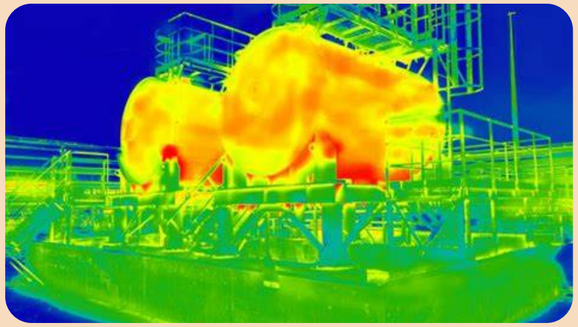
Objective 02

To detect and annotate hotspot regions by mapping pixel values to temperature data.

Objective 03

To build a user-friendly Android application that supports image upload, processing, and result display.

Key Features

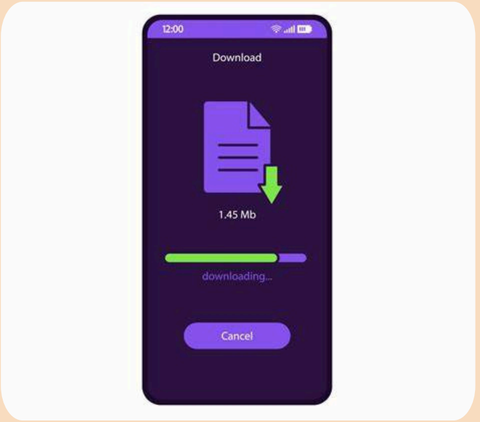


Mobile Thermal Data Processing

- Enable acquisition of thermal images via device / thermal cameras or gallery uploads
- Decode 16-bit thermal data (e.g., TIFF files) for precise temperature mapping

Interactive Analysis Toolkit

- Implement touch-based temperature detection
- Provide real-time visualization tools (heatmaps, gradient overlays)



Data Storage & Organization

- Chronological list of all temperature readings are saved .
- Store metadata such as:

Date and time of reading, Specific points or areas measured, Temperature values detected

Development Environment

It is a complete setup of tools, software, and configurations that a developer uses to build, test, and debug an application. It includes everything required to write code, compile it, run it, and see how it behaves—whether on a real device or simulator.

01 **IDE : Android Studio**

02 **Programming Language : Kotlin**

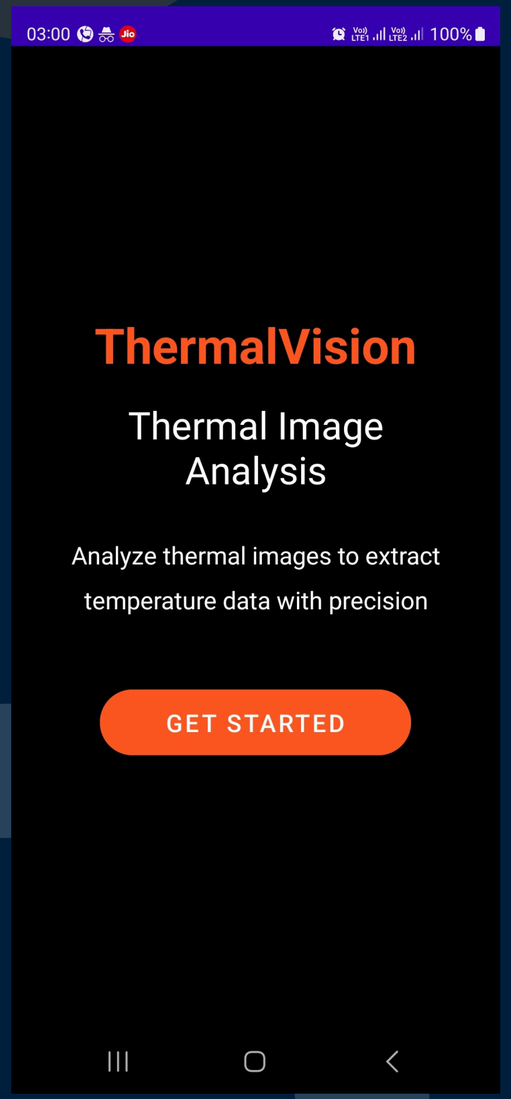
03 **Build System : Gradle**

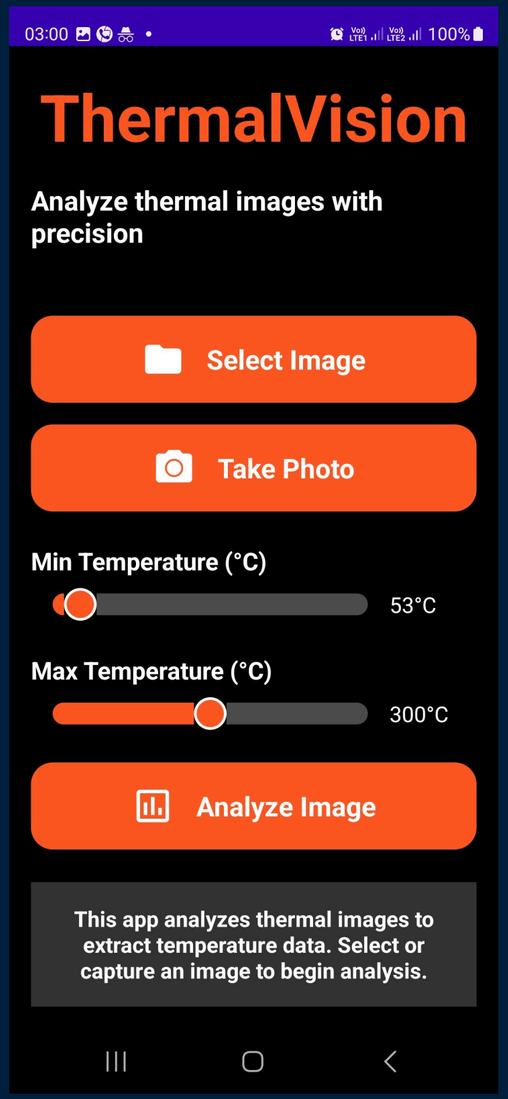
04 **Minimum SDK Version :**
API Level 33 or Android 13 and above

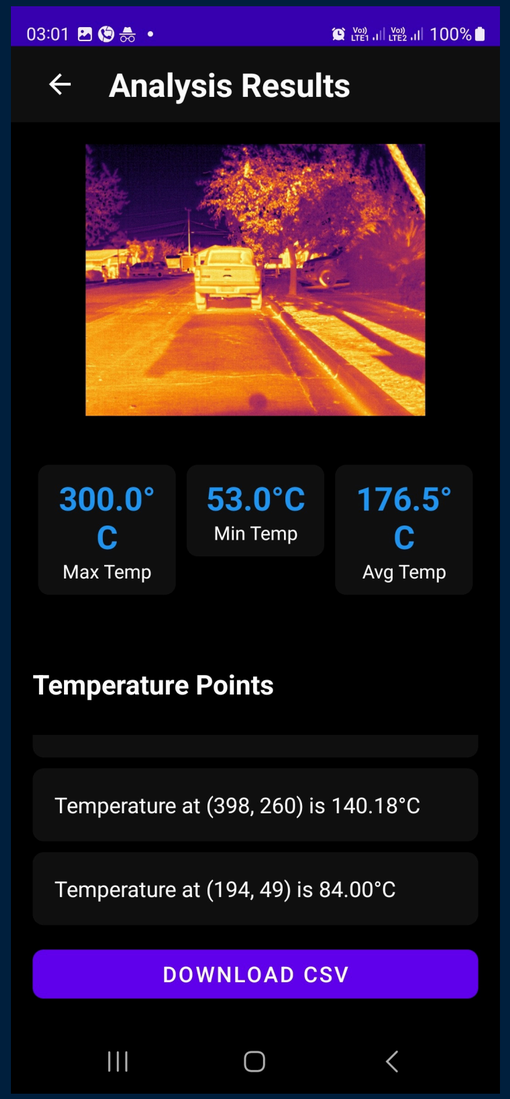
05 **Version Control System : Git**

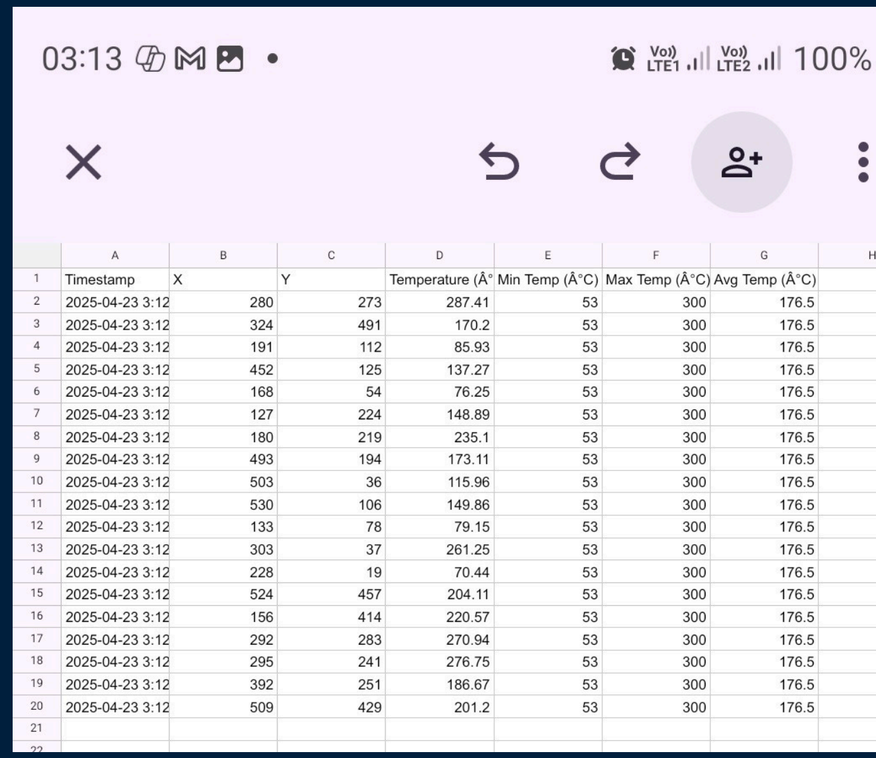
Project Demonstration

ThermalApp









	A	B	C	D	E	F	G
1	Timestamp	X	Y	Temperature (Â°	Min Temp (Â°C)	Max Temp (Â°C)	Avg Temp (Â°C)
2	2025-04-23 3:12	280	273	287.41	53	300	176.5
3	2025-04-23 3:12	324	491	170.2	53	300	176.5
4	2025-04-23 3:12	191	112	85.93	53	300	176.5
5	2025-04-23 3:12	452	125	137.27	53	300	176.5
6	2025-04-23 3:12	168	54	76.25	53	300	176.5
7	2025-04-23 3:12	127	224	148.89	53	300	176.5
8	2025-04-23 3:12	180	219	235.1	53	300	176.5
9	2025-04-23 3:12	493	194	173.11	53	300	176.5
10	2025-04-23 3:12	503	36	115.96	53	300	176.5
11	2025-04-23 3:12	530	106	149.86	53	300	176.5
12	2025-04-23 3:12	133	78	79.15	53	300	176.5
13	2025-04-23 3:12	303	37	261.25	53	300	176.5
14	2025-04-23 3:12	228	19	70.44	53	300	176.5
15	2025-04-23 3:12	524	457	204.11	53	300	176.5
16	2025-04-23 3:12	156	414	220.57	53	300	176.5
17	2025-04-23 3:12	292	283	270.94	53	300	176.5
18	2025-04-23 3:12	295	241	276.75	53	300	176.5
19	2025-04-23 3:12	392	251	186.67	53	300	176.5
20	2025-04-23 3:12	509	429	201.2	53	300	176.5
21							

Future Scope

Cross Platform Integration

Goal: Extend beyond Android to create a unified thermal diagnostics suite.

Key Expansions:

- iOS Version: Leverage SwiftUI and Core ML for Apple devices.
- Web Dashboard: Sync mobile data to cloud for team collaboration.

Real-Time Thermal Camera Integration

Goal: Enable real-time thermal data streaming

- Integrate directly with external thermal cameras (e.g., FLIR via USB or Wi-Fi).
- Enable real-time streaming and instant hotspot detection without manual image upload.

AI-Powered Predictive Analysis

Goal: Transform raw thermal data into actionable insights using machine learning.

- Anomaly Detection: Train models to flag abnormal temperature patterns
- Automated Reporting: Generate AI-driven diagnostic summaries
- Integration: TensorFlow Lite models for on-device inference.

Conclusion

This project successfully demonstrates the application of digital image processing techniques for analyzing thermal images and detecting temperature-based anomalies. The app enhances image quality for accurate temperature mapping. This feature enables efficient identification of critical thermal regions, making it useful for real-world applications such as photovoltaic module inspection, industrial safety, and diagnostics.

References

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[4]. Cardinale-Villalobos L., Meza C., Méndez-Porras A., Murillo-Soto L.D., “Quantitative Comparison of Infrared Thermography, Visual Inspection, and Electrical Analysis Techniques on Photovoltaic Modules: A Case Study.”

THANK YOU!