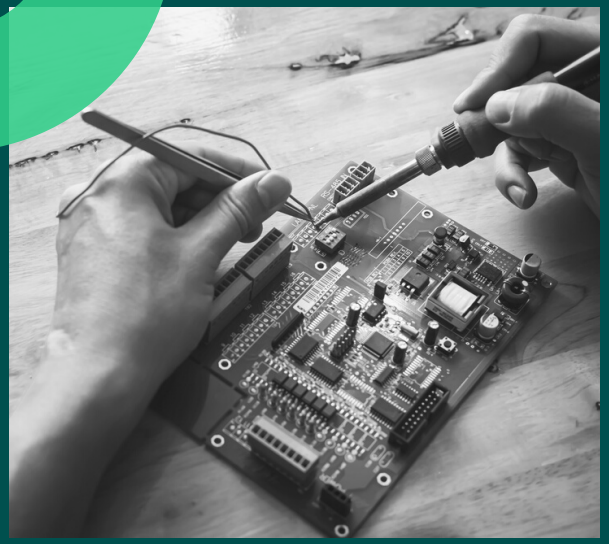


## Final Product Summary

It is often challenging to locate defects or identify faults in PCBs. Our project aims to detect 3 types of PCB defects: Surface scratches, Broken Tracks, and Broken components. 3 Different Computer Visions (CV) have been implemented to detect these respective defects.

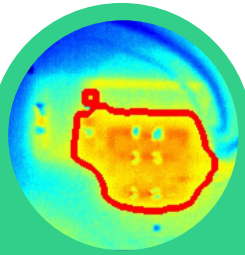
Additionally, our setup incorporates stepper motors to adjust the distance between the PCB and the camera. To find the best optical working distance, the Jetson Nano in the setup uses our Resolution detection algorithm to detect the best distance for a clear image.

If the optical image of the PCB is still unclear, there is more help to increase the resolution using our Resolution improvement CV.

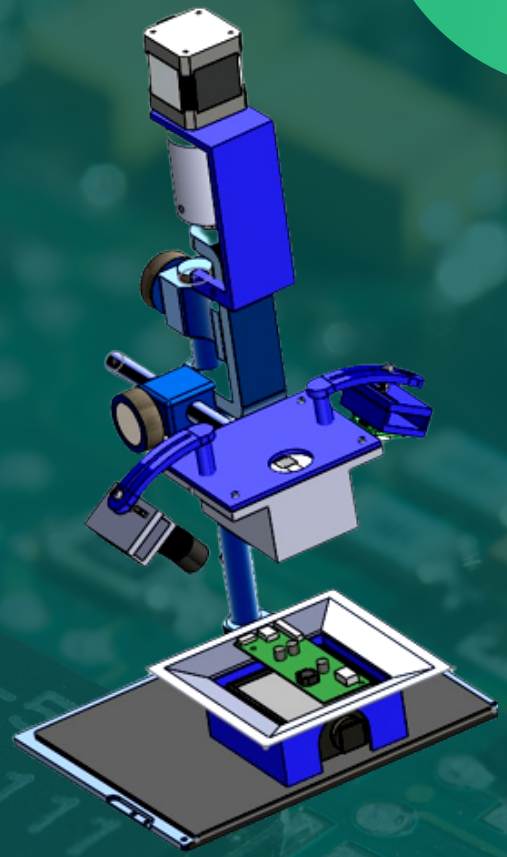
## Key features: Defects profile

With polarised light, Optical Camera captures surface defects (e..g. scratches) on the PCB.

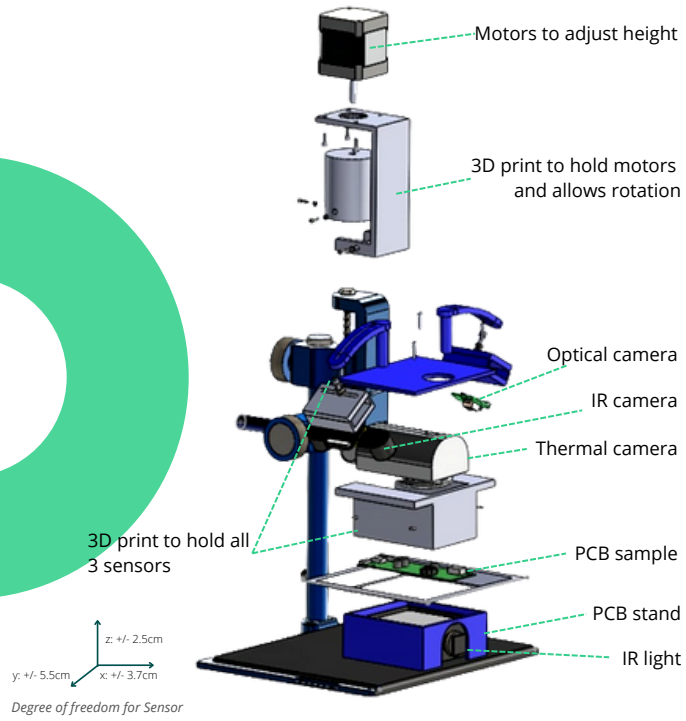
With IR light, the IR camera (i.e. Camera without IR filter) can pick up the gaps of broken tracks within the PCB.



The thermal camera helps detect components or traces of PCB that emits heat.



# Group 4: PCB Defect Detection



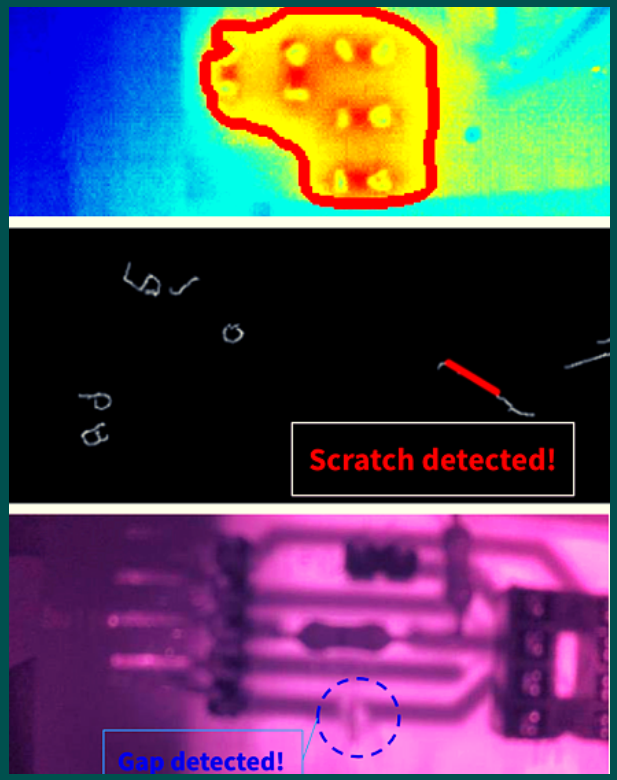

*Degree of freedom for Sensor*

## Sensor specifications

*Thermal Camera*
Resolution: 260 x 200
Refresh frame rate: 25 Hz
Focal Working Distance: 14.0 ~ 16.5cm
Temperature range: 10 ~ 120℃
Accuracy range: ±2℃
Field of View (FOV): 34.4° (H), 25.8° (V)

*Optical Camera*
Resolution: 3280 × 2464 (8 megapixels)
Focal Working Distance: 14.3 ~ 16.5cm
Image size: 342 x 541
Field of View (FOV): 75°

*IR Camera*
Resolution: 3280 × 2464 (8 megapixels)
Focal Working Distance: 15.3cm
Image size: 350 x 528
Field of View (FOV): 160°




## Computer Vision

Our final product consists of 5 Computer Visions (CV) algorithm:

- ***Thermal detection (1) :*** boundaries of heat emission is indicated when components of PCB heats up.
- ***Scratch detection (2) :*** scratches of PCB is traced out when detected.
- ***Track detection (3):*** Gaps within broken PCB tracks is circled out.
- ***Resolution improvement:*** Using Enhanced Deep Residual Neural Network (EDSR) and Bicubic Interpolation to sharpen optical images.
- ***Resolution detection:*** Detecting an improvement in Laplacian Variance provide signals for motors to stop adjusting height of set up.

## Set-up Specifications

| | |
|---|---|
| **Weight:** | **2.02 kg** |
| **Length:** | **22 cm** |
| **Width:** | **17.2 cm** |
| **Height:** | **34 cm** |
| **Sensor's Degree of Freedom:** | **x: +/- 3.7cm<br>y: +/- 5.5cm<br>z: +/- 2.5cm** |

Cost of our setup: SGD 1,126.90
Competitors price: SGD 8,599.00

Target audience:
For Engineering companies or electrical enthusiasts

## Defect Specifications

Our CV are able to pick up defects (size):

Scratches: 0.08mm

Track Gaps: 0.20mm

Traces: 0.75mm

Components: SMDs and through hole resistors