# Sensor & Instrumentation

Unit-2

## Thermal Imaging

**by**

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# Concept of Thermal Imaging

# Introduction

- Thermal imaging is the technique of using the heat given off by an object to produce an image of it or to locate it.
- First developed for military purposes in the late 1950s and 1960s by Texas Instruments, Hughes Aircraft and Honeywell.
- In recent times it is being used in firefighting, law enforcement, industrial applications, security, transportation, medical and many other industries.

# Thermal Imaging

•It is the technique of using the heat given off by an object to produce an image of it .
• Works in environments without any ambient light and can penetrate obscurants such as smoke, fog and haze.
• Normally grey scale in nature: black objects are cold, white objects are hot and the depth of grey indicates variations between the two.

• Some thermal cameras, however, add color to images to help users identify objects at different temperatures.

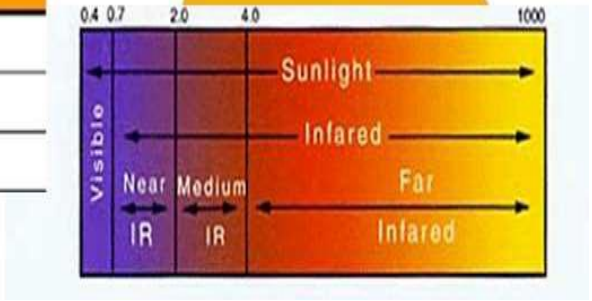
# Cont……

An image generated from a Thermal Imaging Camera. Note the persons skin (as a heat source) is shown as ‘white hot’ whilst the background (which is cold) is shown as black.

# Thermal Imaging Camera

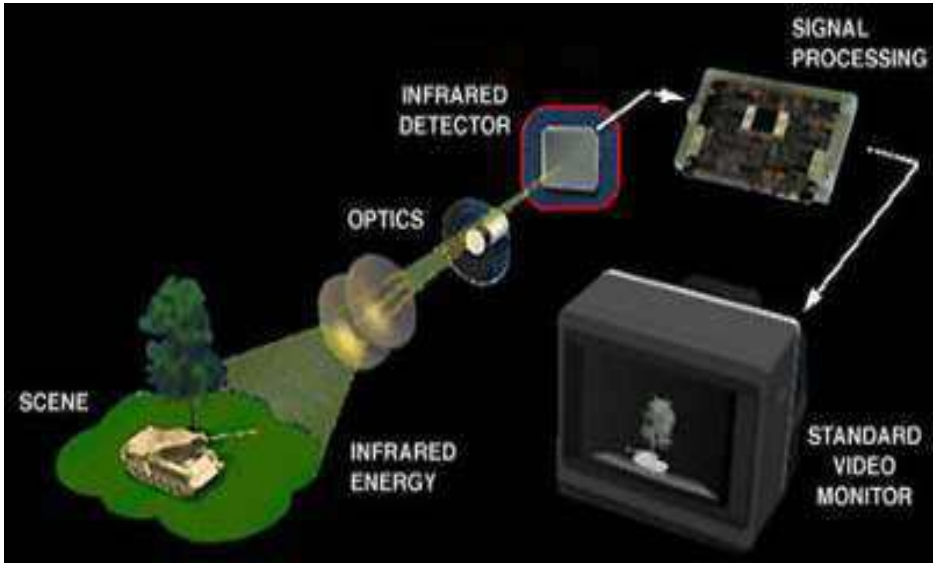
A thermal imaging camera records the intensity of radiation in the infrared part of the electromagnetic spectrum and converts it to a visible image.


| IR Band | Wavelength Range |
|---|---|
| IR-A | 700nm - 1400nm |
| IR-B | 1400nm - 3000nm |
| IR-C | 3000nm - 1 mm |



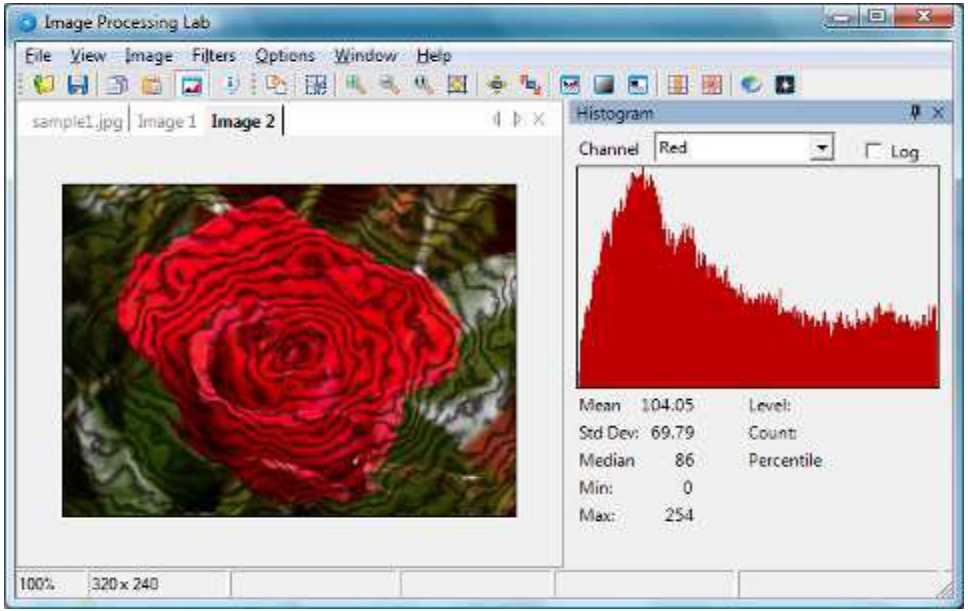
# Working of Thermal Imaging Camera

A thermal imaging camera consists of five components: an optic system, detector, amplifier, signal processing and display



# Image Processing

Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame and the output may be either an image or a set of characteristics or parameters related to the image.



# Types of Thermal Imaging Cameras

**COOLED THERMAL IMAGER**

- Cooled detectors are typically contained in a vacuum-sealed case and cryogenically cooled
- Cooling is necessary for the operation of the semiconductor materials used else they would be blinded by their own radiation

**UNCOOLED THERMAL IMAGER**

- Un-cooled detectors use a sensor operating at ambient temperature or a sensor stabilized at room temperature using control elements
- Resolution and image quality tend to be lower than cooled detectors

# Cont……

- Cooled infrared cameras provide superior image quality
- Bulky and expensive to produce and run
- Cooling is power-hungry and time consuming hence the camera needs time to cool down before it can begin working again

- Smaller and less costly to produce and run
- Fast operation and consumes less power

# Components of Thermal Imaging Camera

- An optic system
  - Lens
- Detector
  - Cooled Detector
  - Uncooled Detector
- Amplifier
- Signal processor
- Display
  - Standard Video Monitor

# Thermal Imaging Applications

- Industrial Applications
- Medicine Applications
- Security Applications
- Building Constructions
- Night Vision

# References :-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