

## Chapter 6

# Thermal Imaging in Smart Applications

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### ABSTRACT

*Temperature measurement is an essential requirement for a large number of smart applications in medicine, agriculture, environment, and security domains, to name but a few. Conventionally, temperature measurements are mostly performed using thermometers, thermocouples, thermistors, and resistance temperature detectors. Most of these instruments require physical contact with the object to measure temperature at specific points. Infrared thermography has revolutionized the concept of temperature measurement. Infrared thermal imaging (IRTI) can provide the temperature mapping without a physical contact with the object of interest from a reasonable distance. A typical IRTI system comprises of a thermal camera equipped with infrared detector, a signal processing unit and an image acquisition system, usually in the form of an embedded system. Such cameras are utilized for applications like fault detection, irrigation management, motion detection, etc. This chapter briefly introduces use of thermal imaging in medicine, agriculture, environment, smart home/cities and security applications.*

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## BACKGROUND

### Infrared Technology

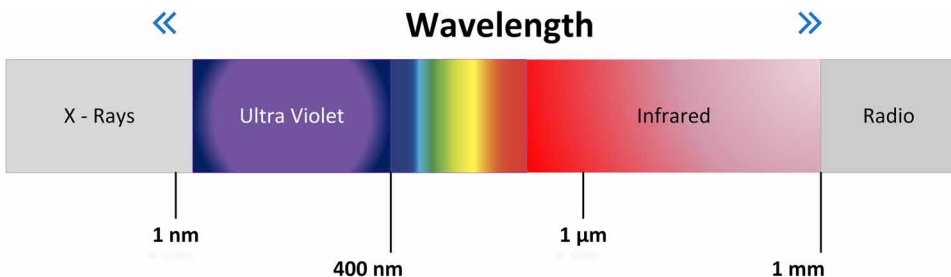
By means of our eyes, we perceive the ecosphere in visible light. However visible light seals simply a minor fragment of the radiation spectrum, the invisible light shelters most of the remaining spectral kind. The radiation of invisible light conveys greatly further material.

Just for a swift review from history, probing for different photosensitive substances, in 1800 William Herschel accidentally discovered radiation of a different wavelength which is now known as infrared radiation. He initially darkened the top of a very sensitive mercury based thermometer. In William Herschel's thermometer, a glass prism was added to direct the sun rays on his working table where he completed his preparation for measurement. With this setup, he long-established the temperature ranges of different colors of the visible electromagnetic spectrum. Gently stirring the mercury bulb of the darkened thermometer over the various colors of the spectrum, he surprisingly observed that the temperature is rising from violet towards red. He observed that the temperature kept rising more rapidly in the area after the red band of the spectrum. After multiple attempts, he concluded that the maximum temperature is after the red band of visible spectrum. These days maximum temperature area after red band is named as "Infrared Area" (GmbH).

### The Electromagnetic Radiation Band

A band in the technical term is the concentration of a combination of electromagnetic waves as the function of the wavelength or band. The electromagnetic radiation band encompasses wavelength's area of about  $10^{23}$  and differs from region to region in origin in establishment and area of usage for that specific radiated wavelength. The complete categories of electromagnetic radiation tail the same physics' laws

Figure 1. A glance of electromagnetic spectrum (GmbH)



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