Keeping the spread of viral infections under control

Infrared thermography helps to detect and contain the spreading of bird flu and other viral diseases.

Growing international exchange, travel, and economic migration require a consistent, prompt, effective and international viral disease prevention policy. Elevated human body temperature, or fever, is a convincing and reliable indicator of most human viral infections. Since the outbreak of SARS, public health authorities around the world have been looking for a fast, easy, contactless and reliable method to detect elevated human body temperature differences. Thermography is such a method. It has become vital to control body temperature of risk groups such as travellers and proven itself as a monitoring tool that has substantially contributed to reduce the spreading of SARS virus in many countries and regions.

But viral contagious diseases unfortunately do not end with SARS. While the latter has taken lives of some 10% of the infected people, the H5N1 strain of avian influenza, in its current early stage in Asia and Europe, has a death rate of over 50%. So far, the spread of H5N1 virus from person to person has been very rare and has not continued beyond one person. Nonetheless, because all influenza viruses have the ability to change, scientists are concerned that H5N1 virus one day could be able to infect humans and spread easily from one person to another.

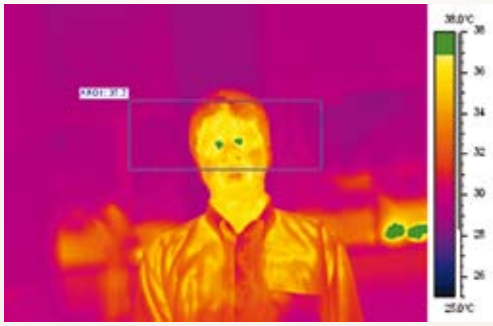
INFRARED THERMOGRAPHY : AN EFFECTIVE TOOL TO DETECT ELEVATED BODY TEMPERATURES

An infrared camera is a very effective tool to detect people infected with a viral disease at a very early stage. It produces thermal images or heat pictures which allow to display even the smallest temperature differences.

Human body temperature is a complex phenomenon. Humans are homeothermic, they radiate heat, which must be lost to the environment. The interface between that heat production and the environment is the skin. This dynamic organ is constantly adjusting the optimum balance between the physiologic demands of the body and external environmental conditions.

Infrared thermography provides a visual map of skin temperatures in real time. In addition, infrared cameras are very sensitive devices. FLIR cameras can measure temperature differences as small as 0.08 °C.

The infrared camera automatically detects the hottest temperature within an area, set by the operator. A color alarm makes it easy to decide whether a person needs further examination or not.



The symptoms of most infectious diseases are similar – malaise, sore throat, cough and of course fever. Consequently, it is extremely easy to detect whether a person carries the risk of having an infectious disease or not. All that needs to be done is make an infrared image of the subject and measure if his/her body temperature exceeds a certain value.

Thanks to the infrared camera's built-in functions like colour and sound alarms that can be set to go off when a certain temperature threshold is being exceeded, the operator can instantly decide whether the subject needs to be referred for medical examination or not. As the infrared camera produces images in real-time, the total evaluation process takes less than a second.

This makes infrared technology very useful for rapidly screening large numbers of people. However, a few things need to be taken into account.

THE APPLICATION: MEASURING THE TEMPERATURE OF THE HUMAN BODY

A person's general skin temperature is not equal to the person's core temperature. The most practical spot on the body giving the most reliable result (where the skin temperature approaches the core temperature of the human body) is in the corner of the eyes where the lachrymal duct comes to the surface.
It is therefore recommended to take subjects in front of the camera at a marked distance, in general at 1 to 1.6 meters away from the camera lens, so that the face fills the entire image.

The subject only needs to look into the camera for less than a second. As the highest temperature will be measured in the corner of the eyes, people can continue to wear a mouth mask or their headwear without influencing the measurement. Glass and plastic do not transmit infrared radiation, so people need to remove their glasses in order to be examined.

It would be advisable to set up the infrared camera at places with long queues such as passport or customs control points as persons should be screened on an individual basis. It is also recommended, though not mandatory, to install the camera on a tripod and connect it to a video screen, to facilitate the working conditions of the camera operator.

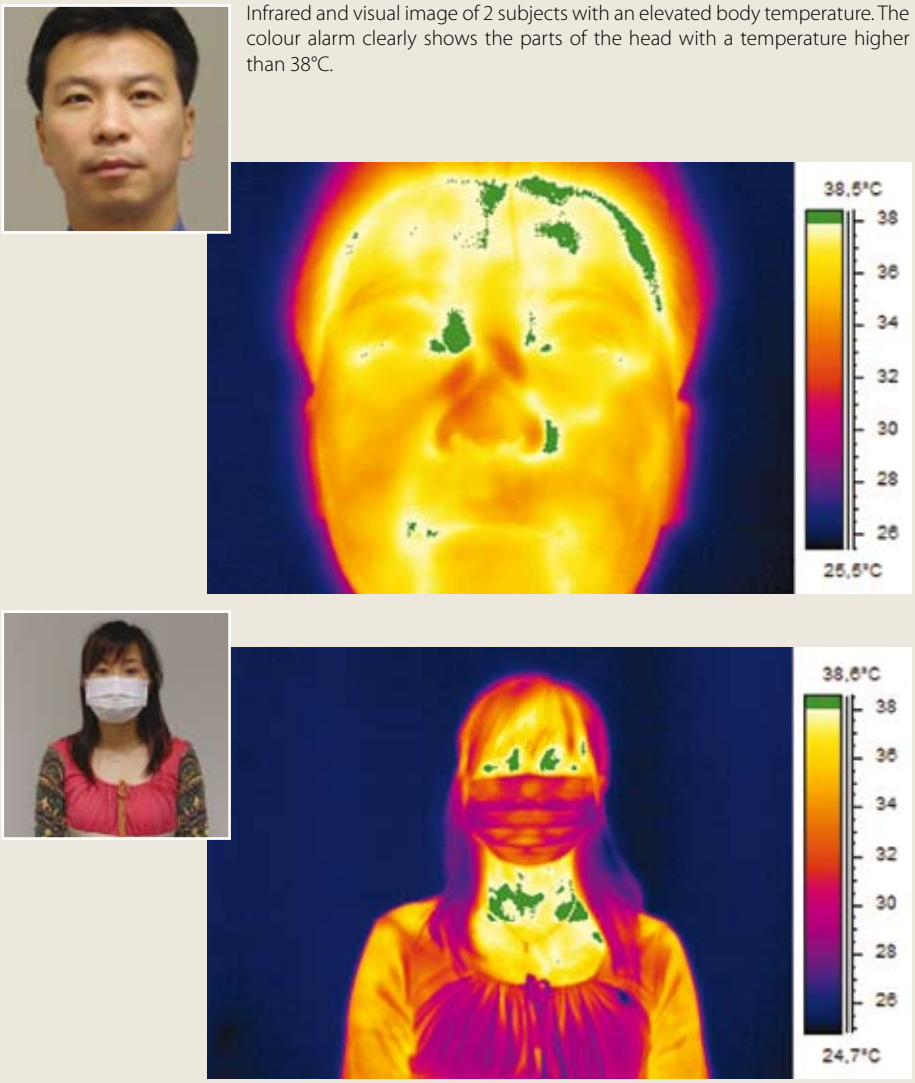
PROOF THAT INFRARED WORKS

It is not necessary to measure absolute temperatures to determine whether a person has an elevated temperature or not. The following procedure has been initially followed to determine if infrared measurement works: after measuring the true body temperature of approx. 10 to 25 healthy people with a medical ear thermometer and the face temperature of these same people with a FLIR infrared camera, the average temperature difference is calculated: true body temperature minus face temperature.

Experience has shown that this average temperature difference is fairly constant and varies between 0.8 and 1.2°C depending on the environmental conditions of the test area, such as ambient temperature, air conditioning, wind, weather conditions etc. This corresponds to the principle that the body temperature of a feverish person is about 1°C higher compared to a healthy person. Whether that average temperature turns out to be 32, 34, or 36°C is not relevant. It should be correlated to the core temperature and remain stable.

In practice, the camera is installed and can be used immediately: the infrared camera automatically calculates the average temperature of the first 10 scanned people and then defines their average. Then, an alarm should be set to go off when the measured temperature reaches an average plus 1°C.

The purpose is to differentiate the people who are well from those that have fever and not to measure absolute body temperatures. The absolute error measured on both the threshold values and the subjects tested will be the same, as long as the camera is stable.



Infrared and visual image of 2 subjects with an elevated body temperature. The colour alarm clearly shows the parts of the head with a temperature higher than 38°C.

A UNIQUE FLIR FEATURE: THE AUTOMATIC TEMPERATURE COMPENSATOR (ATC)

FLIR has equipped its infrared cameras with an Automatic Temperature Compensator (ATC) to avoid generating false alarm. The ATC constantly calculates a moving average of the body temperatures from the last 10 scanned people. The two highest and the two lowest values are not taken into account when making this calculation. Based on the outcome of this calculation the ATC automatically adjusts the generation of visible and audible alarms, greatly improving the reliability of the screening.

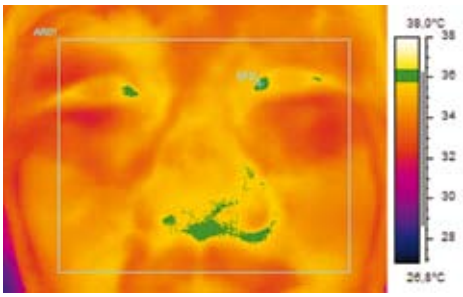
QUICKLY SCANNING A LARGE NUMBER OF PEOPLE BY USING INFRARED CAMERAS WITH COLOUR AND SOUND ALARMS

Temperatures are measured by full radiometric infrared cameras, not by infrared imagers. These systems can be battery-operated for over 2 hours or continuously connected to main power. Adhering to the IP 54 standard, they can be used either indoor or outdoor.

The FLIR infrared cameras have built-in functions to measure the highest temperature inside a given field view area. The camera will automatically detect the hottest spot. Its value is immediately displayed on the built-in LCD of the camera or on a connected video monitor. The cameras have also been optimized for fever detection as they recalibrate themselves more frequently.

A built-in colour alarm function enables an immediate decision whether the subject requires further examination: all areas, which are hotter than a predefined temperature value, can be immediately recognized on the infrared image.

Setting up a FLIR infrared camera with Automatic Temperature Compensator (ATC) for viral disease detection.



The infrared image clearly shows the hot spots in the corner of the eyes.

In addition, FLIR cameras are equipped with a sound alarm. If the temperature exceeds a predefined value, a buzzer alarm will go off. A subject activating the alarm, can easily be taken aside for further examination on site or in a medical centre.

A SMALL INVESTMENT TO PROTECT PUBLIC HEALTH

Major airports in South-East Asia are already using FLIR cameras and have successfully applied this methodology to screen all people entering and leaving the country. It is a quick and contactless method, which is perfectly safe for both the camera operator and the screened subject. The results are extremely satisfactory.

The FLIR infrared cameras have proven themselves as tools that can be operated by non-specialists after a few hours of training. They enable a quick and accurate scan of a large number of people to trace fever, a major symptom of viral infections.

As some officials have put it, it is a very small investment to protect public health worldwide.

USING A FLIR INFRARED CAMERA FOR DETECTING POSSIBLE SARS PATIENTS:

- Assure that there are no hot objects such as lamps in the field of view of the camera. The camera should be turned on at least 30 minutes before measurement starts and carefully focused.
- Set the emissivity value to 0.98.
- Determine the average temperature of a healthy person by using an ear thermometer and an infrared camera (or utilise the built-in ATC function).
- Add 1°C to the average temperature of a healthy person to obtain the critical temperature.
- Set an area in the infrared camera.
- Set the colour and sound alarms to signal if the temperature within the area is higher than the critical temperature.
- Bring the subjects to be tested, one by one, in front of the camera. Each for about 1 second.
- If the alarms signal, detour the subject for further examination.

The average temperature of a healthy person can be determined with an ear thermometer or with the Automatic Temperature Compensator (ATC) in the FLIR infrared camera.

FLIR infrared camera's can help to prevent the spreading of viral diseases such as bird flu

With their proven track record for detecting elevated body temperatures as an indicator of infection, the FLIR infrared cameras are again being specified to counter the spread of bird flu.

Thanks to the built in functions such as colour and sound alarms the operator can instantly decide whether the subject needs to be referred for medical examination. As the camera produces images in real-time, at a rate of 50Hz, the total evaluation process takes less than a second. This makes the camera ideal for screening large numbers of people in environments such as airports, stations, department stores or building lobby's.

FLIR offers portable infrared cameras such as the FLIR T- and P-series, but also fixed mount cameras like the FLIR A-series.

FLIR infrared cameras have been used for SARS and viral infection detection in the following countries and regions : Australia, Hong Kong, Korea, Malaysia, Singapore, Taiwan.

Infrared cameras

- allow to screen large numbers of people anywhere at any time
- display and detect critical temperature elevations in real-time
- activate colour and sound alarm
- are easy to set up and use
- can be smoothly integrated in public area pedestrian traffic streams
- are able to store evidence
- protect public health

Taiwan Public Health Authorities Apply Infrared Thermography to Detect Communicable Viral Diseases

The Center of Disease Control (CDC), which is the Taiwan public health authority, is scanning travellers at the country's main entry points, the airports of Taipeh and Kaohsiung.
Before putting in place the thermographic temperature measurements, the airport authorities asked incoming country visitors to fill out a 'Communicable Disease Survey Form' on a voluntary basis. This procedure became mandatory during the SARS period. As of April 2003, the CDC has set up FLIR infrared cameras to detect elevated body temperatures of incoming travellers. Fever is one of the main symptoms of communicable diseases such as SARS, bird flu, dengue (an acute viral disease marked by fever, intense headache, nausea) malaria and many others. The consistent body temperature monitoring of travellers with a thermal camera proved to be successful in detecting disease cases in an early stadium: the CDC reported approximately 15 cases per year based on the individual Communcable Diseases Survey Form. However, after the implementation of the infrared camera scanning, 60 cases were detected between April and December 2003, 36 of which were malaria and 18 dengue fever cases. Between January and October 2004, 93 cases were reported, of which 48 dengue fever, 41 dysentery and 3 cases of malaria. Only one case of dengue was reported through the Survey Form, the other cases were found by the infrared temperature checkpoint installed at the airports.
The public health authority hence decided to cancel the 'Communicable Disease Survey Form' as of December 1, 2004 and to rely solely on infrared thermography to screen incoming travellers.

Viral diseases like bird flu must be controlled. An infrared camera can help to detect possible patients in an early stage.

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