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# Infrared system's early warning for diseased livestock

Like humans, animals are threatened by deadly pandemics that spread quickly and, in the case of commercial livestock, decimate herds and flocks. But an inexpensive early warning diagnostic tool developed by the University of Cape Town's (UCT) Professor Amit Mishra and start-up company 3DIMO holds hope for small- and medium-scale livestock farmers, many of whom are black women.

The Thola infrared imaging tool is being developed by local black economic empowerment start-up company 3DIMO. It is in the final stages of phase one of a pilot project involving several emerging farmers in Thaba Nchu in the Free State.

A basic infrared camera (around one third of the size of a smartphone) can be mounted on a smartphone or, for larger areas and numbers, the images can be taken using bigger infrared cameras mounted on drones.

The infrared camera measures the heat signature of each point of the animal in the field of view. This provides useful information; for example, a higher temperature on a foreleg could signal inflammation or some other malaise.

Said Mishra: "Different diseases have different signatures. Not all diseases are detectable, but the temperature of the hoofs, and some other parts of the animals, for example, has been shown to be very useful in detecting common diseases like foot-and-mouth disease."

This data is fed into the Thola platform, where the artificial intelligence (AI) algorithms are designed to look for abnormalities. A network of monitoring devices can be built, integrating information across critical livestock areas. The archive of data is also searchable.

Tags are used to identify individual animals in a herd or flock. The team, which includes a UCT electrical engineering postgraduate, is also working on image-based identification using machine learning and AI.

"As the image platform – the phone or the drone – can also take optical images, we would be using both the optical image and the infrared image," said Mishra. This part of the development has been one of their biggest challenges.

The data can be used for vital stock monitoring and management. In 2019 South Africa was the continent's largest beef and dairy producer, said Mishra. "With the growth in meat consumption at an all-time high, the demand for meat and dairy products has ignited growth in new farmers and increased herd sizes."

The flip side is that larger herds mean that viral infection can go undetected in the early stages, spreading rapidly. In the past five years, unprecedented livestock deaths have created a decline of 15-26% in revenue generated from the country's livestock production and export.

In 2013 the porcine epidemic diarrhoea virus (a coronavirus that infects the cells lining the small intestine of a pig) killed almost eight million pigs in the United States. Last year, an outbreak of foot-and-mouth disease on South African cattle farms severely dented exports in one of the country's biggest economic sectors.

"One in five farm animals is being lost to disease, and this reverberates far beyond the animal," said 3DIMO's chief executive officer, Nneile Nkholise. It affects almost one billion people worldwide who rely on meat, milk and egg production.

The cost can be staggering, Nkholise added. In the past 20 years, six international outbreaks of disease caused billions of economic losses. And for every 20 farm animals lost, one job is at risk.

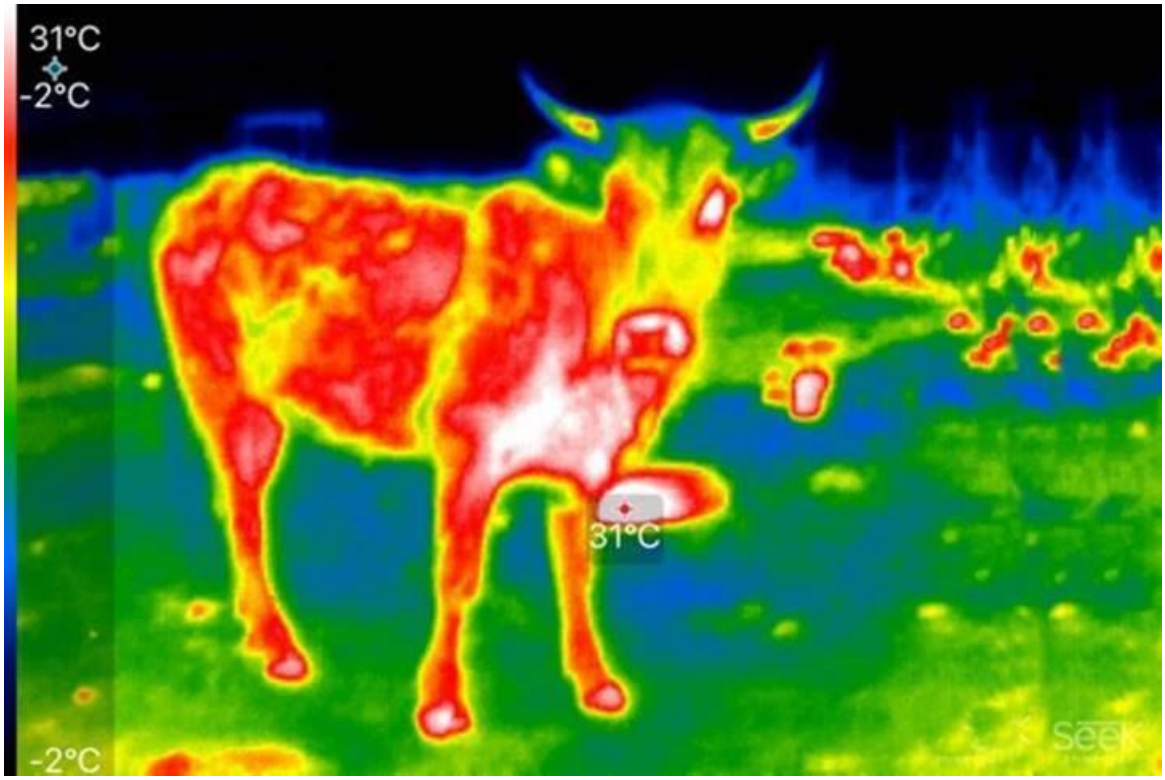
"Addressing biosecurity and food security in South Africa and the continent has critical and lasting social and economic benefits," said Nkholise. "But long-term solutions can't lie solely with government. We need an innovative, accessible and affordable lasting approach to protect farm animal welfare."

Mishra said that they started with the idea of the early warning of viruses in farm animals to help prevent future pandemics. However, very soon they realised that there's an acute shortage of diagnostic tools for most small- and medium-scale farmers. "We also found that many of the small-scale farmers are black women. Serendipitously, we may have found a niche with major scope to create an impact."

Mishra hopes that this will help refine their system, prove commercial viability and related socio-economic impact. The plan is to develop two models using off-the-shelf infrared cameras and drones – one for commercial farms and another for smallholder farmers.

The benefits include the monthly scanning of farm animals, detailed reports that can be accessed on a user dashboard, training and access to partner animal health specialists.

They are also working towards a third option: a business in a box for use on smallholdings. "This can be used according to an Uber-like model, where owners of the business in a box can be outsourced to collect data at different farms and get paid for it. So, there's a job creation element too," said Mishra.



An infrared image reveals a hot spot on a member of a herd.

Image: Amit Mishra.

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