

New early warning system may be the answer to prevent poaching and livestock theft

In light of the devastating game poaching statistics in South Africa, intruder detection on large game reserves and farms poses a challenge. To prevent poaching and livestock theft, intruders should be detected on the farm's perimeter and their position determined promptly and accurately.

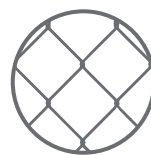
A University of Pretoria graduate, Ernst Pretorius, has developed a patented early warning system that promises to be a unique, cost-effective solution to this problem. The system, called Draadsitter (Afrikaans for "fence sitter"), warns farmers of fence tampering and pinpoints the location of triggered alarms.

Pretorius obtained his degree in electronic engineering from the University of Pretoria in 1996. For his final-year project, he developed a concept for a small ultra-high frequency (UHF) transmitter that could be used as an animal tracking device. The theory was that a transceiver attached to livestock would allow farmers to track animals' movement and learn their movement habits. Any deviation from this learnt pattern would trigger an alarm to alert the farmer that his livestock may be in danger.

Inspired by an undergraduate project

While working as a power electronics engineer, Pretorius had no idea that his final-year project would eventually inspire the revolutionary Draadsitter system and lead to a nomination for the Royal Academy of Engineering Africa Prize for Engineering Innovation. The idea for the Draadsitter system came

to him when a dairy farmer from Delmas told him about the problems he was experiencing with livestock theft. Pretorius realised that catching the intruders before they gained access to the property was crucial in the prevention of livestock theft and the resulting cruelty to the animals. Although his UHF transmitter concept showed potential, the alarm would only be triggered once the intruders had already gained access to the livestock. Livestock enclosures are often some distance from the farmhouse, and the time it takes to react may give the intruders enough time to escape.



He thought of using sound waves to develop a sensor unit that would alert the farmer of any fence tampering.

Pretorius knew that the solution to this problem lay in the wire perimeter fences, which could be excellent conductors of sound. He thought of using sound waves to develop a sensor unit that would alert the farmer of any fence tampering. Other options for intruder detection on the market exhibited some drawbacks, such as high maintenance costs and repair complexity. Pretorius was confident that he could develop a system without these drawbacks, and started developing the Draadsitter system in 2013.

How it works

The sensor unit consists of two sensors, and the unit is mounted onto the fence's wiring posts. The first sensor measures only the ambient sound. The other sensor measures both the ambient sound and additional sounds on the fence. This is transmitted through the wire via longitudinal sound waves that propagate within the wire of the fence. The difference between the two measurements is determined and an alarm is triggered when the difference between the sensor readings falls outside a pre-set range. As a result, unrelated sounds like thunder or the sound of a vehicle cannot trigger false alarms, but noises associated with fence tampering are amplified.

The system's base unit, which is typically set up in an office or a farmhouse, displays the address of the sensor that triggered the alarm. This allows farmers or landowners to react before any animals are stolen or harmed. When a fence is cut, the sensor unit can regain full functionality once the fence is repaired. This also saves costs, because repairs do not require specialists, as in the case of fibre optics or electric fencing.

The system can accommodate up to 9 999 sensor units that are linked to each other via a secure radio network. The units are mounted onto the fence's wiring posts and fence lengths of over 1 000 km can be monitored using a single system.

Turning an idea into a viable invention

The first prototype was tested on an old fence and could detect tampering up to 50 m. Although initially developed with cattle farmers in mind, the potential of the unit for protecting game reserves, and also for border fences, soon became evident. Word of the potential of the Draadsitter system spread and queries about his invention prompted Pretorius to take six months' unpaid leave from his employer at the time, Denel Dynamics, to develop it further. He registered a provisional patent, and spent all his time refining his invention. During this time, he changed the system so that it could use

AA batteries, which would keep the sensors running for more than two years at a time. This ensured constant functionality, as the system did not depend on an external power supply. He also used a cost-effective plastic casing to house the sensor unit.

During the research and development phase of his invention, the sensor unit was tested on the

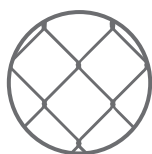
electric fence surrounding the perimeter of a game reserve. The electric field of the high voltage triggered false alarms in the sensors. Pretorius therefore encapsulated the unit in a metal box – as in a Faraday cage¹ – to shield the sensors from this electric field. He also incorporated a temperature sensor in the unit to warn users of possible fires when it senses a temperature above 65 °C. Subsequent prototypes were tested on a number of fences.

The development of the system faced a number of challenges, including financial constraints. Unlike inventors who have the support of an academic or research institution, Pretorius developed his innovation on his own, without any investors to provide seed funding or financial support for the project. However, his belief in his concept and determination to prevent unnecessary cruelty to animals spurred him on. Aside from the prize money he received as one of the four finalists for the Royal Academy of Engineering Africa Prize for Engineering Innovation Award in 2014, the project relied entirely on Pretorius's ability to finance all the development phases and patent applications himself. Draadsitter is now patented in the USA, Australia, New Zealand, Europe and 19 countries in Africa, as well as South Africa. He had to use his savings to conduct prototype demonstrations in order to commercialise his product. His perseverance paid off in the end when he was

awarded a contract to install a system comprising 340 Draadsitter units on the largest rhino farm in South Africa.

Future applications

Future applications of this technology could include early warning systems to prevent copper cable theft and systems that use drones for perimeter fence surveillance. It could prove to be effective in protecting country borders from infiltration and illegal immigrants. Another possible addition to the existing system is the use of buried Piezo wires to trigger an alarm when someone passes through a gate or other entrance.



The electric field of the high voltage triggered false alarms in the sensors.



Pretorius highlights the value of the qualification that he obtained from the University of Pretoria, and has great appreciation for the qualified academic staff and high academic standards that ensure that graduates are able to enter industry as well-rounded individuals, who can see the potential in any opportunity, and have the confidence to succeed, no matter how many hurdles they might encounter. ➔

¹ An earthed metal screen surrounding a piece of equipment to exclude electrostatic and electromagnetic influences.

