Continuing the development of AI-driven automated pest animal baiting system

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Acknowledgements

- Initial project to develop pioneer development of next generation automation technologies for pest animal control.
- A collaborative projects with computer science and engineering staff at the University of New England with practical staff from the NSW Department of Primary Industries (DPI).
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Background

- Vertebrate pests (e.g. feral cats, foxes, feral pigs and wild dogs) cause major negative impacts to both agriculture and the environment.
- Controlling of pests has traditionally mostly involved aerial and ground baiting or trapping.
- Currently used population reduction methods are not able to be specific to the target species and operationally time consuming.

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Wild Dog Alert

- This project was a continuation of work from the Wild Dog Alert project, specifically the Wild Dog Alert Node (pictured on the right).
- Experimental deployments outlined the need for edge-based image recognition models to be used for operating actuators due to limitations in cellular and satellite.

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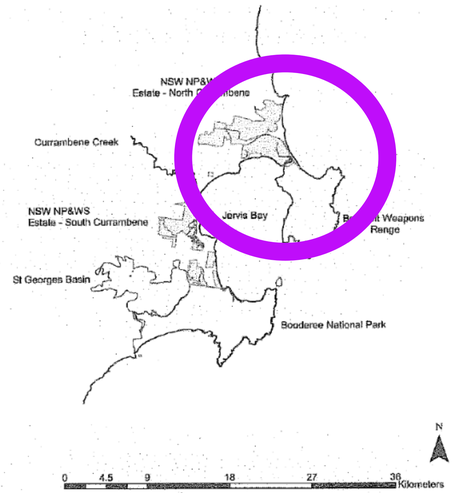
Conceptualisation of the Project

- The conceptualisation of the system was based on research investigating the effectiveness of controlling re-invasion of a peninsula by foxes (Dexter et al. 2007).
- This study highlighted challenges with maintaining predators at a low level.
- The concept of the SBS aimed to address maximising the availability of baits whilst reducing the burden on operational resources to frequently replenish baits



Dexter et al. 2007

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The Aims

- Develop and test an automated, intelligent, and semi-permanent, multi-bait dispenser.
- Detects target species (dogs and foxes) and automatically deliver bait.
- Provides another bait when a target animal or species revisits the site.

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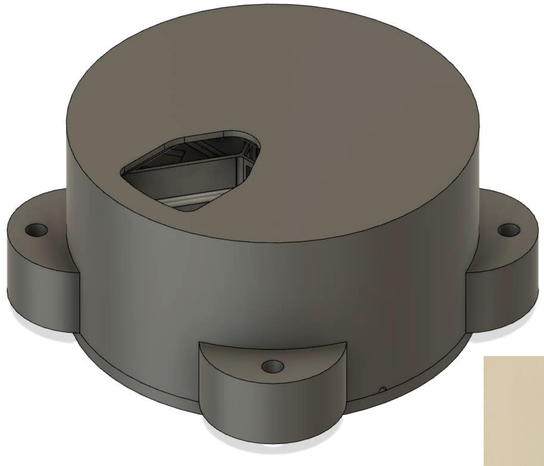
The Solution

- Customised Camera Trap with edge-based AI computing capability.
- Automated bait dispenser able to dispense up to 5 baits.
- Wireless communication between camera and dispenser.
- Tested with both simulations (pre collected images) and in the field as part of normal DPI operations.



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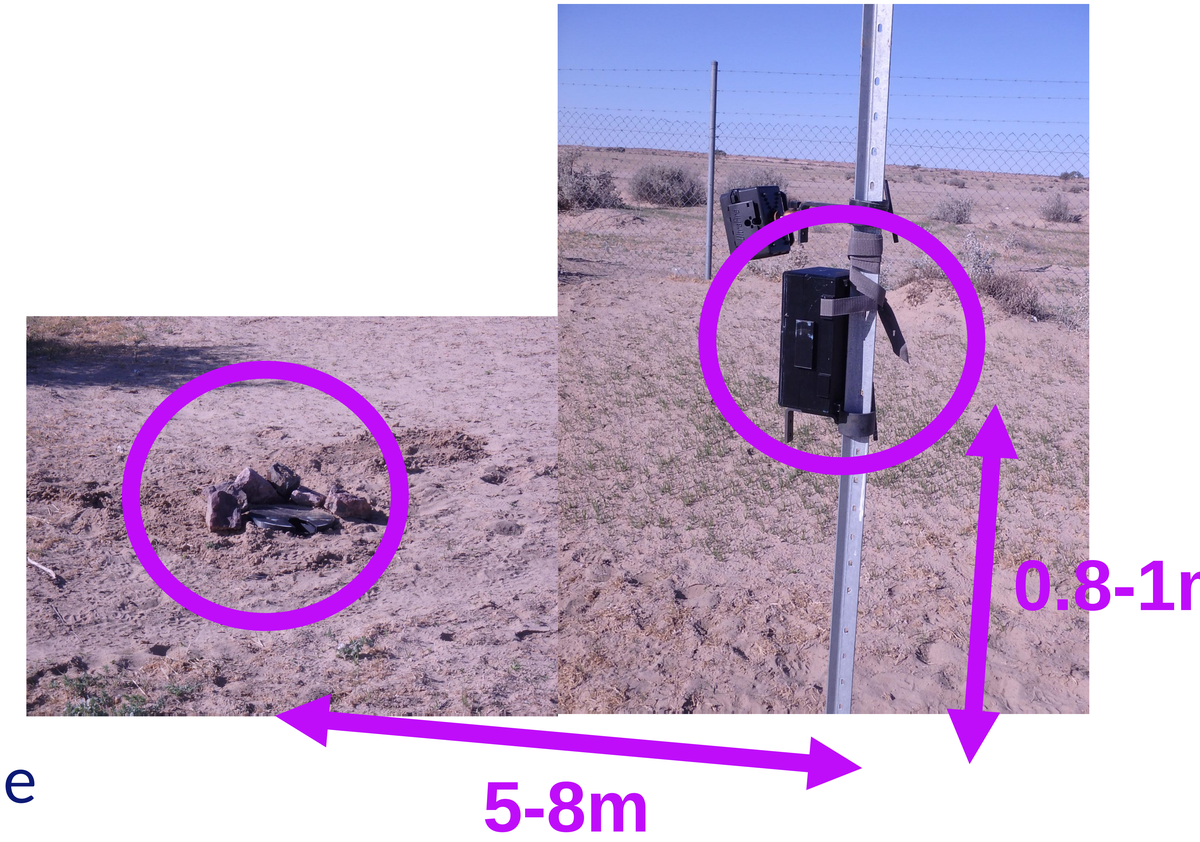
Field Testing Methodology

- Camera and Bait Dispenser were deployed for 8 days in a desert dune system.
- The site was attended daily for physical and technology review.
- Non-toxic Doggone® and equivalent sized fresh beef pieces were used in the dispenser.
- Each time an animal (or other) entered the detection zone was considered an event.



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Results

Time of day	Accuracy (ratio)	Balanced Accuracy (ratio)	Precision (ratio)	Sensitivity (ratio)	Specificity (ratio)	System Response Time (Seconds)
Day	0.96	0.85	0.71	0.71	0.98	9.5
Night	0.69	0.73	0.88	0.61	0.85	10.4
Overall	0.90	0.82	0.83	0.68	0.96	9.8

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Results

- 19 Bait offerings
- 7 baits successfully removed from the bait dispenser.
- There were 4 events where another object was falsely detected as a target.
- There were events where a target was present and a bait was not offered. (day: n = 2; night: n = 9).

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Discussion

- System designed was able to automatically deploy baits to target animals and supply baits to subsequent animals
- Further updates to the algorithm and more modern hardware could help improve the overall system performance.
- The threshold for detection confidence can be tuned towards the practical outcomes.

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Current work

- Updating to a GPU enabled hardware.
- Re-designing hardware for larger production.
- New AI models to improve results with dogs and foxes along with identifying other species
- New bait dispensers and trap actuators for other species.
- Wireless transfer of research data to continue development and enable research.
- Real-time reporting of detections, baiting/trapping event to allow for efficient operations for practical population control.

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Thank you!

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