Cacophony Project Artificial Intelligence triggered trap: Final Report for Predator Free 2050

Executive Summary

- The Cacophony Project has developed a proof of concept device that can use AI to trigger traps. The AI is able to identify predators and thus ensure safe activation of the trap

- The AI thermal camera is connected to a device with 3 outputs and 3 inputs that can trigger a range of sensors (e.g. motion sensors) and activation units (e.g. servos and linear actuators, speakers etc.)

- An AI algorithm has been run on the camera in real time and shows that it has the capability to contribute to the decision to trigger a trap

- The cameras and trap have an integrated portable power supply (trap powered by same rechargeable battery as camera)

- The trap set up and testing is done via an Android device.

- The trap's software settings can be adjusted remotely via the cloud to allow for a wide range of trap configurations

- Modelling by The Cacophony Project has confirmed that the interaction rate with current traps is very low. This increases the importance of devices that are more open (removing barriers to interaction) and that can be triggered by AI

- Field testing of the AI triggered trap has been limited due to budget constraints. Insufficient funding was available to develop a robust open trap suitable for extensive field testing.

- The limited testing showed that one ground based trap could catch rats, possums, feral cats, and hedgehogs (no mustelids showed up during testing). This with a much higher interaction rate than typical traps.

Agreed Milestones

Milestone No.	Milestone Description	Milestone Due Date
Milestones are to be written as activities conducted rather than outcomes achieved. Critical achievements that are essential for Project progression will be included as Decision Points in the section below.		
Project Aim 1: Develop hardware to support AI trap triggering		
Milestone 1.1	Development of robust, input/output device that can receive inputs from various sensors (e.g. motion sensors) and output to a variety of other devices (e.g. food dispensers, linear actuators and servos). This device will communicate to the AI thermal camera using a standard industrial interface such as RS-485.	March 2020
Milestone 1.2	Support for high operating current for driving linear actuators etc. so it does not require a separate power source	May 2020
Project Aim 2: Develop software to support AI triggered trap		
Milestone 2.1	Embedded firmware for the input/output device. The simplest version of this is a device that activates the trap if AI senses a predator or it could be more sophisticated with additional requirements	March 2020
Milestone 2.2	Control software to run on the predator monitor hardware	May 2020
Milestone 2.3	Updated AI predator detection models that are optimised for activating traps.	July 2020
Milestone 2.4	Update the existing Sidekick mobile app interface to support field configuration and testing of input/output device and attached hardware	July 2020

Project Aim 1: Develop hardware to support AI trap triggering

Milestone 1.1: Robust, input/output device that can receive inputs from various sensors (e.g. motion sensors) and output to a variety of other devices (e.g. food dispensers, linear actuators and servos). This device will communicate to the AI thermal camera using a standard industrial interface such as RS-485. Verbal report to PF 2050 Ltd

Below is a photo of the trap electronics device that includes 3 sensor inputs and 3 servo outputs along with a linear actuator activator.

This device is connected to the computer in the thermal camera box and can be controlled remotely.

The AI is run on the computer in the thermal camera box and can be used to decide whether to activate the trap.

Verbal report to Dan Tomkins in March

Milestone 1.2: Support for high operating current for driving linear actuators etc so it does not require a separate power source

A version of the trap that was self resetting was tested that used a linear actuator drawing significant power. This was able to be drawn from the Thermal Camera although an improved power system may be required for some trap set-ups.

Project Aim 2: Develop software to support AI triggered trap

Milestone 2.1: Embedded firmware for the input/output device. The simplest version of this is a device that activates the trap if AI senses a predator, or it could be more sophisticated with additional requirements. Verbal report to PF2050.

The simplest version of this would be an on off switch for an existing trap so that it excluded non-targets. It has become clear from testing over many years that pretty much all traps and poison dispensing devices have a very low interaction rate – most predators just walk past them. This means a much more open trap is required and we have therefore developed a flexible Input Output device that could be used for a large range of new types of trap. The version we tested had 3 input devices (motion sensors) and 4 output devices, (3 servos and one linear actuator).

Verbal report to Dan Tomkins in March

Milestone 2.2: Control software to run on the predator monitor hardware

An early version of the AI trap tool has the software for controlling the trap on a separate electronics box and the AI camera just sent a message to the trap that a predator was there. Every time the trap parameters needed to be changed, a trip back to the workshop was required for reprogramming. Given there is a computer in the Thermal Camera electronics we now use that to determine the logic of the trap e.g. what happens when certain sensors are triggered etc. This allows very flexible types of traps to be developed and tested very rapidly. It also allows for more sophisticated lure strategies that can adapt to what the camera sees.

Milestone 2.3: Updated AI predator detection models that are optimised for activating traps.

Initial tests of the AI model running on the camera in real time were of the predator classification model that can tell the difference between rats, stoats, possums, birds, and cats. While this model did run it was decided that a simpler and more appropriate model is one that is “birds” and “not birds”. This way the device will trigger for anything but birds which is appropriate for the first version of the trap that is live capture and designed to catch all predator types.

Milestone 2.4: Update the existing Sidekick mobile app interface to support field configuration and testing of input/output device and attached hardware

The android device essentially acts as a control interface (screen) for the trap. This makes testing and configuration of the trap very easy compared to previous methods that required the device to be returned to the workshop. This app shows the status of the sensors (e.g. triggered or waiting) and the outputs like servos (eg waiting). The trap can be reset and debugged via this screen.

Conclusion and next steps

This flexible hardware and software platform could be used to trigger any trap so that they can be a lot more open and still not have unintended catches. The most promising types of traps that could now be developed using this tool are:

- Paint-ball targeting device
- Much more open ground based live capture trap
- Cognified feeding/poisoning devices
- Traps with adaptive lures matched to the predators present
- Traps that sequence predators (e.g. possums first then rats)
- Traps with live local lures
- Multiple predator kill trap (a killing device attached to the high catch rate live capture trap

As our modelling shows, the most common predator behaviour is to walk straight past existing devices. This behaviour seems to be driven by the presence of a physical barrier to the predator engaging with them. We are very excited about the large range of possibilities to have a digital trigger allowing much more open trap devices and thus removing those barriers making it possible to catch the last hard to catch predators.