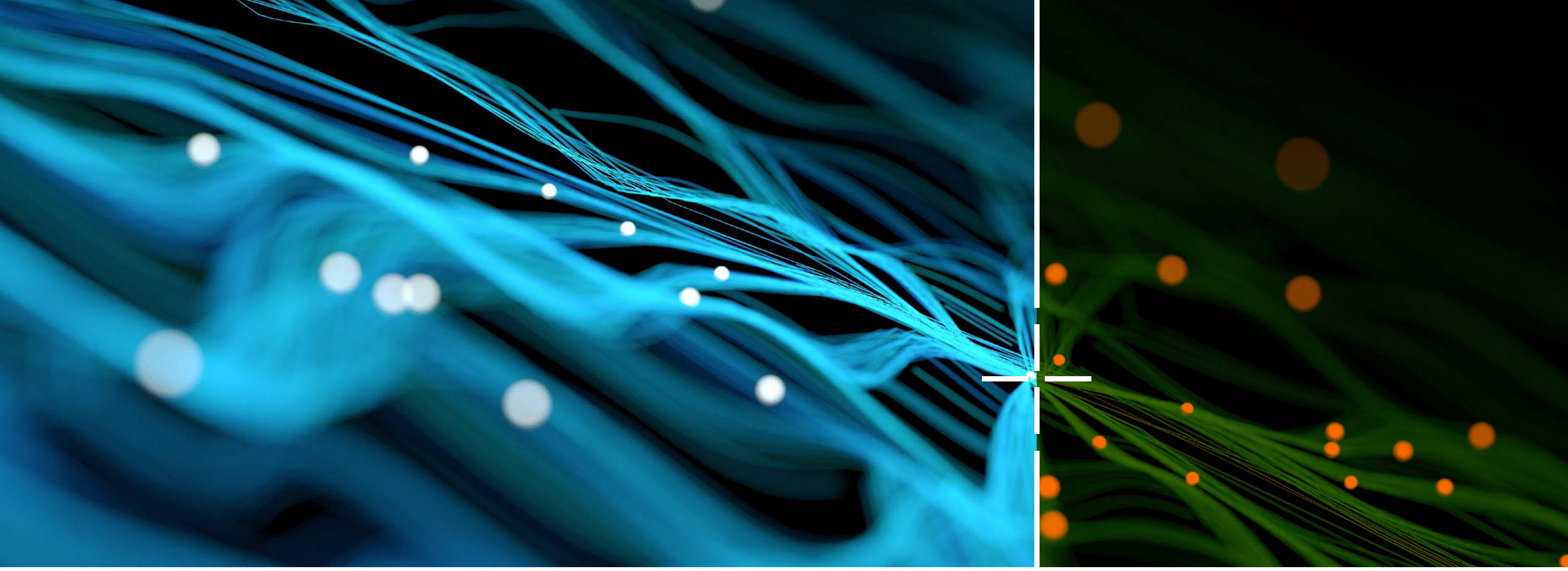

CASE STUDY

A Family Trip, Endangered Species Sparks Innovative Arm-based Solution

- Grovety
- Software Development
- <25 employees
- Delaware, USA
- Founded 1993

OVERVIEW

Around the world, wildlife officials are harnessing the power of digital technologies to safeguard endangered species and combat threats from poachers, and battery-powered cameras have emerged as a revolutionary tool. However, the demands of monitoring vast and diverse ecosystems are substantial. Many cameras have no wireless connectivity, which means manual intervention from wildlife officials who need to hike miles to retrieve them. Additionally, cameras often capture every movement that triggers their sensors, which quickly runs down battery-powered devices.

Introduction

A family outing to a national park may change the course of animal conservation. Grovety CEO Antony Vasiliev had recently moved to Armenia when he took his family to a national park to see the wildlife. There, he and his 11-year-old son were awe-struck when they spotted the endangered snow leopards. It was a rare sight indeed: According to the International Union for Conservation of Nature (IUCN) Red List, there are only about 1,000 such animals remaining worldwide and perhaps no more than 10 in Armenia.

Vasiliev struck up a conversation with a park ranger, who explained officials have deployed remote cameras throughout the park to track the animals and collect data, with the hope of encouraging population growth. But rangers were frustrated because they had to manually review every photo they took — hundreds — and the cameras were plagued with false-positive photos, rapid battery depletion, and digital-storage constraints.

Vasiliev got an idea. He talked with his colleagues at Grovety, a software design company and Arm partner, which specializes in embedded firmware, SDKs, drivers, protocols, and low-level software.

“I discussed with my CTO whether we could help by leveraging our AI expertise,” Vasiliev said. “We knew little about camera traps initially, but we decided to create an add-on that would provide added value to the existing camera traps, rather than competing with camera trap manufacturers.”

Vasiliev outlined other challenges:

- **Lack of domain expertise in camera traps initially**: They had to do extensive research on how existing camera traps worked and what their limitations are.
- **Battery life and power consumption**: Ensuring the AI module would be power efficient and extend battery life was a major consideration.
- **False positives**: Reducing false positives from motion-triggered cameras was a primary goal to make the rangers' jobs easier and expand battery life.
- **Processing power**: Selecting a processor with sufficient computational resources and machine learning capabilities for object detection was critical.
- **Adapting models**: Fine-tuning machine learning models and adapting them to detect wildlife objects was technically challenging.
- **Data scarcity**: Limited data on rare species like snow leopards made training AI models more difficult.
- **Testing and prototyping**: Multiple experiments and iterations were needed during concept development and prototyping phases.
- **Real-world conditions**: Ensuring the solution works reliably in remote field conditions was important.

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Solution

Grovety's mission was clear: enhance the efficiency and effectiveness of wildlife camera traps by incorporating artificial intelligence (AI) to improve body detection and classification accuracy. They embarked on a multi-phase project that included concept development, proof of concept, and ML module prototyping. This endeavor required extensive research and development, involving multiple experiments and iterative processes.

For hardware, Grovety selected the Alif Semiconductor E7 processor, a member of the Ensemble family of embedded fusion processors and microcontrollers. It has high-performance, Arm-powered Cortex-A32 processors with a clock speed of up to 800MHz, along with Cortex-M55's at 400MHz and 160MHz. The E7 series is architected for power efficiency and long battery life, delivering high computation and machine learning /artificial intelligence capability, multi-layered security, computer vision, and highly interactive human-machine interface. The E7 series features a secure enclave system and firewall control security unit, as well as a dedicated Arm Ethos-U55 microNPU to run embedded machine learning.

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Leveraging Apache TVM and Collaborative Development

Grovety leveraged Apache TVM – the open-source machine learning compiler framework for CPUs, GPUs, and machine learning accelerators — for fine-tuning their ML models. They made significant contributions to TVM for Arm Ethos-U55 integration, enhancing its capabilities for floating computations to the NPU. This collaborative approach was central to their goal of creating an autonomous AI-powered device for object detection and classification, adaptable to various wildlife objects. Grovety used the open-source Vela compiler to compile a TensorFlow Lite for Microcontrollers neural network model into an optimized version that runs on the Ethos-U NPU.

Energy Efficiency and Battery Life

Grovety estimated that the power consumption of their AI module on the Alif SoC would be minimal, requiring a typical 18650 lithium-ion battery cell with 2200 milliampere-hours to power the module for just over three weeks. Their efforts aimed to significantly reduce false positives in wildlife camera traps, improving efficiency and battery life for conservationists.

Conclusion

In conclusion, Grovety's expertise in software design, AI integration, and their dedication to addressing real-world challenges in wildlife conservation, combined with Arm's advanced processors, yielded a groundbreaking prototype for wildlife camera traps. Their solution aimed to significantly reduce false positives, improve efficiency, and extend battery life, making it easier for conservationists to monitor and protect endangered species.