SENTRY

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CC: ECET Capstone Faculty, Camosun College

From: Amaziah Kinavuidi, Mark Gladkevitch

Date: September 8, 2025

Subject: Sentry project proposal

Summary

Wildlife intrusions have caused lots of damage to residential and commercial areas, and it's no easy task to deal with [5]. This proposal will outline our solution, the SENTRY system. It is a sentry turret system equipped with camera tracking and multiple deterrence options to prevent intrusions before they occur. This product is projected to be done by December 12th and by the re-use of certain expensive components we have managed to lower the cost down to around $200, this has not only helped us reduce costs but also saves time for system improvements. Our team requests approval for the research and development for this project. Projected to be in effect from September 3rd to December 12th during the capstone symposium.

Introduction

Wildlife intrusions on people's properties have always been an issue. Often animals like deer damage people's orchards and gardens. Other culprits are raccoons that raid trash cans or endanger pets [4]. Unfortunately, it isn't easy to deter intruders such as deer, it takes time and energy to do so, and often its all-out dangerous [2]. Some actions are being taken to help reduce the population of animals like deer [3], but it will take a long time to feel the impact, and by then, much more harm can be done before the issue is solved.

Figure 1, deer breaches into house bedroom [14]

Our Solution

Our project, the sentry turret, is built to combat this very issue. The sentry turret is a standing camera tracking platform that can be equipped in many ways to deter our uninvited visitors. We will leverage simple tools like bright lights, ultrasonic speakers built to scare away animals, and lasers for target tracking. When these tools are paired together, they can act as a powerful deterrent for our intruders.

This proposal aims to explain the inner workings of the SENTRY turret system, how it will function, and what further features it will have. We will also be discussing project management along with the cost analysis.

Technical Overview

If this project had to be summarized in a few words, it would be to detect and deter deer. This is the foundation our creation will be built upon, and from there we have endless ways to scale or modify it.

For its operation, the wide-angle camera scans any target indefinitely. When a target appears, it is recognized by the algorithm and the software along with our laser begins to track the target, next depending on the mode, deterrence options can be activated either manually by the owner or automatically by the software. During this entire process, the user can view the live video footage at any time and make decisions based on that. The deterrence can then be deactivated manually by the operator or automatically after the target is no longer detectable by the camera. *Refer to the block diagram [15] in the appendix for a visual representation.*

Modes

The sentry turret will have two modes, an autonomous mode, and a manual mode. In autonomous mode, the machine will make the decisions itself, it controls what kind of deterrence will be used at what time, and it will instantly activate as soon as a target is detected.
Manual mode gives control to the owner. The video from the turret camera will be streamed to the owner’s device where they will be able to choose when and what to deter with. There will be a user-friendly interface with all options for system settings and deterrence options.

Hardware

Microcontroller [5]

For the microcontroller we intend to use a raspberry pi module due to its computational power which is needed for fast video processing and the ability to run heavyweight algorithms for target tracking.

Figure 2, Raspberry pi microcontroller [5]

Motors [6]

Because the sentry requires smooth and precise movement for good accuracy, we will use stepper motors. They are very precise and high speed, but they lack torque, although this issue can be mitigated with the use of gears to increase torque. Also, they are cheaper than other options, which makes it worth the tradeoff.

Figure 3, NEMA 17 stepper motors [6]

Bearings [7], [8]

This build will use two different types of bearings, the lazy Susan bearing is a four-inch-wide ball bearing, we will be using it as our base for horizontal rotation due to its wide diameter and its ability to support heavy loads. Next, we will use two radial bearings which are used for skateboards, these will give us vertical rotation at the top of our turret base for an affordable price.

Figure 5, Lazy Susan bearing [7]

Figure 4, 22mm Radial bearings [8]

Lazer [9]

We will use a 5-miliwatt green laser which is the highest power rating allowed for lasers, yet it is too weak to cause any damage to the eye, so it is safe. Green is chosen because it is more visible during day and night compared to other common colors.

Figure 7, 5mW green laser [9]

Camera [10]

Our camera will have a wide-angle lens for maximal area coverage for target detection, good framerate so that the microprocessor can have constant and smooth target tracking updates, and a good resolution for clear imagery and easier target recognition.

Figure 7, 160-degree wide camera module [10]

Mechanical gears [11]

Mechanical gears will be used to help increase torque for our weak motors; we will be using a 10:1 gear ratio which will sacrifice motor speed for torque so that we are able to move heavier objects mounted to our turret when needed. These gears will be 3d printed, which will also help us reduce our costs.

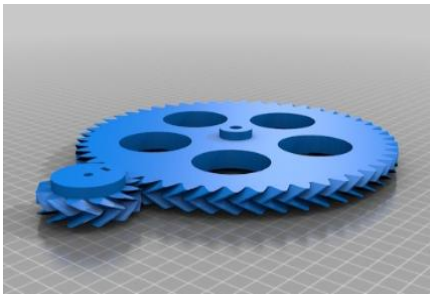

Figure 8, 10:1 ratio 3d print gear model [11]

Printed circuit board [12]

The circuit board will function as electrical hub where all our parts meet and communicate. Through it our microprocessor will connect and control all our electrical parts, it will connect to the motors, the laser, the camera, and any other deterrent that will be mounted. We will be designing it ourselves and getting it built through a PCB manufacturer.

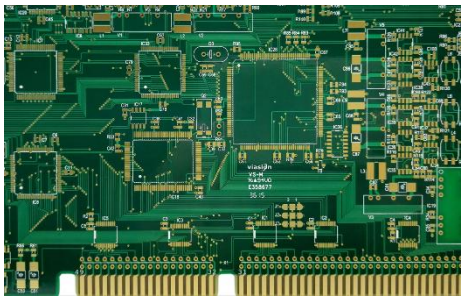

Figure 9, PCB example picture [12]

Frame/hull [13]

The frame is what will hold everything together, it is what will make the turret look and work like an actual turret. It is responsible for holding everything upright and how our project will look. We will be 3d-printing it due to cost effectiveness and the ability to modify our frame on demand.

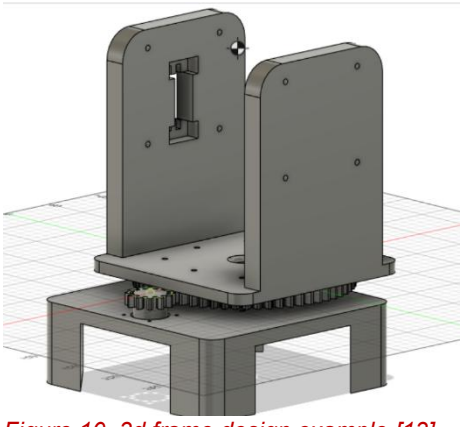

Figure 10, 3d frame design example [13]

Benefits

Our sentry project will address a real problem that a lot of people face today. It would stop deer and other kinds of animals from invading people's property and doing damage to their crops, gardens and plants. This device will be engineered to be safe for its users. It will be designed to recognize and differentiate between people and animals, so it ensures all its users are safe.

Another benefit of the sentry device is that people can use it for various security purposes. It can be a typical security system that alerts its users when there are animals or even people trespassing on their property and even provides actual footage. This would especially be very beneficial to farmers for the protection of their agriculture. This can help users save time and money in the long run.

Limitations

The device will not cover long distances or a very wider range, but it will take a more targeted approach. It will perform best in open areas with little obstruction for maximal potential by the wide-angle lens. The device will not be fully waterproof, so it would be ideal when placed under weatherproof conditions.

Management

All tasks and responsibilities are equally divided between all members of the group, and every group member has equal say. All implementation of major changes must be agreed upon by the whole team.

Amaziah Kinavuidi

By growing up in a home with various electronics, Amaziah developed a love for it and became the tech guy in his home. After graduating from high school, he pursued Electronics and computer engineering at Camosun, where he had the opportunity to create various electronics and programs. Amaziah is looking to develop his programming skills while completing this project.

Mark Gladkevitch

With a passion for entrepreneurship, music and engineering, Mark has had a background in computers, electronics and engineering since age 13. He built artificial intelligence, microprocessor boards, and other practical gadgets. Mark is devoted to helping make the world a safer place.

Contract

To ensure the completion of the SENTRY project, our team has signed a group contract that defines our roles, work expectations, policy, and discipline.

Timeline

The project began on September 2nd, 2025, and is expected to be completed during the last week of the semester around December 8th to 12th 2025, before the Capstone Symposium.

Finance

As a group, we've discussed and decided on the different parts and materials that will be needed to accomplish this project. We have a budget of $ 500 and in table 1 you can see a breakdown in the expenses. Each member of the group will contribute 50% of the funds needed to cover the costs. Since we all have different parts and materials from previous semesters, that will allow us to save a good sum of money and be ready to cover unforeseen costs.

Table 1. A breakdown of the costs to produce the sentry device.

EXPENSES	ESTIMATED COST	ACTUAL COST	BUDGET
Core Hardware (Raspberry pi, radar sensor, relay module, buzzer/speaker, power supply etc..	$ 325	$ 125	$ 250
Optional Upgrades (Infrared sensors, small solar panel, rechargeable batteries)	$ 150	$ 0	$ 100
Software	$ 45	$ 0	$ 50
Other costs (shipping)	$ 75	$ 50	$ 100
TOTAL:	**$ 595**	**$175**	**$ 500**

Note: There is a total budget of $500 and the best estimate of the costs of the parts is $595, but we have decided to use as many parts as we already have and buy cheap but good quality materials to save money. Therefore, the actual cost of the remaining parts we'll need is $150.

Conclusion

The sentry project is a step forward to providing innovative solutions for the people of Victoria. It is a device that is going to use a camera as the main detection unit with an AI algorithm that is going to keep track of animals trespassing on to people's properties and have multi-level deterrence options. We are certain that we can complete the project a week before the Capstone symposium, which is on Dec 15. Being a group of 2, we're going to have to put all our effort into this project to complete it successfully and on time.

We seek your approval to go ahead with this project and start as soon as we can. Please feel free to reach out to anyone of us, using any contact method, if you have any questions or concerns. We'll be happy to provide more information.

Contact info

Contact	Email		Phone
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Mark Gladkevitch		C0534836@online.camosun.ca	360-355-0808

References

[1] "Gladiator II Paintball Sentry Gun," YouTube, https://youtu.be/nTs7VRFV36c?si=1g7FL6BK4bVJNuaA (accessed Sep. 12, 2025).

[2] CBC, "Police issue warning after deer kills pet dog in Oak Bay, B.C.," CBC, Nov. 02, 2024. https://www.cbc.ca/news/canada/british-columbia/oak-bay-deer-death-1.7372083

[3] District of Oak Bay, "Urban Deer - District of Oak Bay," District of Oak Bay, Jul. 04, 2025. http://oakbay.ca/community-culture/pets-wildlife/urban-deer/

[4] BC SPCA, "Raccoons in B.C.," BC SPCA, Oct. 30, 2024. https://spca.bc.ca/ways-to-help/take-action/urban-wildlife/raccoons/

[5] BC SPCA, "Deer in B.C.," BC SPCA, May 01, 2024. https://spca.bc.ca/ways-to-help/take-action/urban-wildlife/deer/

Part links:

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[7] "Nema17 Stepper Motor," Amazon, https://www.amazon.com/Nema17-Stepper-4-Lead-42BYGH-17HS4401S/dp/B0D1QFFHDK (accessed Sep. 17, 2025).

[8] "Metal square bearing," Amazon, https://www.amazon.ca/Square-Bearing-Rotating-Turntable-Display/dp/B0F2FQCC4M (accessed Sep. 17, 2025).

[9] "Yamaso 20 pcs 608 2rs ball bearings," Amazon, https://www.amazon.com/YAMASO-Pcs-608-Ball-Bearings/dp/B0CYYYZRV9 (accessed Sep. 17, 2025).

[10] "Green Laser Diode," Amazon, https://www.amazon.com/green-laser-diode/s?k=green+laser+diode (accessed Sep. 17, 2025).

[11] "Aideepen OV5640 Camera module," Amazon, https://www.amazon.ca/dp/B0BVHTFKQG?ref= (accessed Sep. 17, 2025).

[12] "10 to 1 ratio big gear thin by Stevereg59," Thingiverse, https://www.thingiverse.com/thing:747508 (accessed Sep. 17, 2025).

[13] R. Feng, "Key components of a PCB: Layers, traces, and pads explained," Viasion, https://www.viasion.com/blog/pcb-layers-traces-and-pads-explained/ (accessed Sep. 17, 2025).

[14] "Automated nerf gun turret," Raytran, https://raytran.net/projects/nerf-turret (accessed Sep. 17, 2025).

Appendix A:

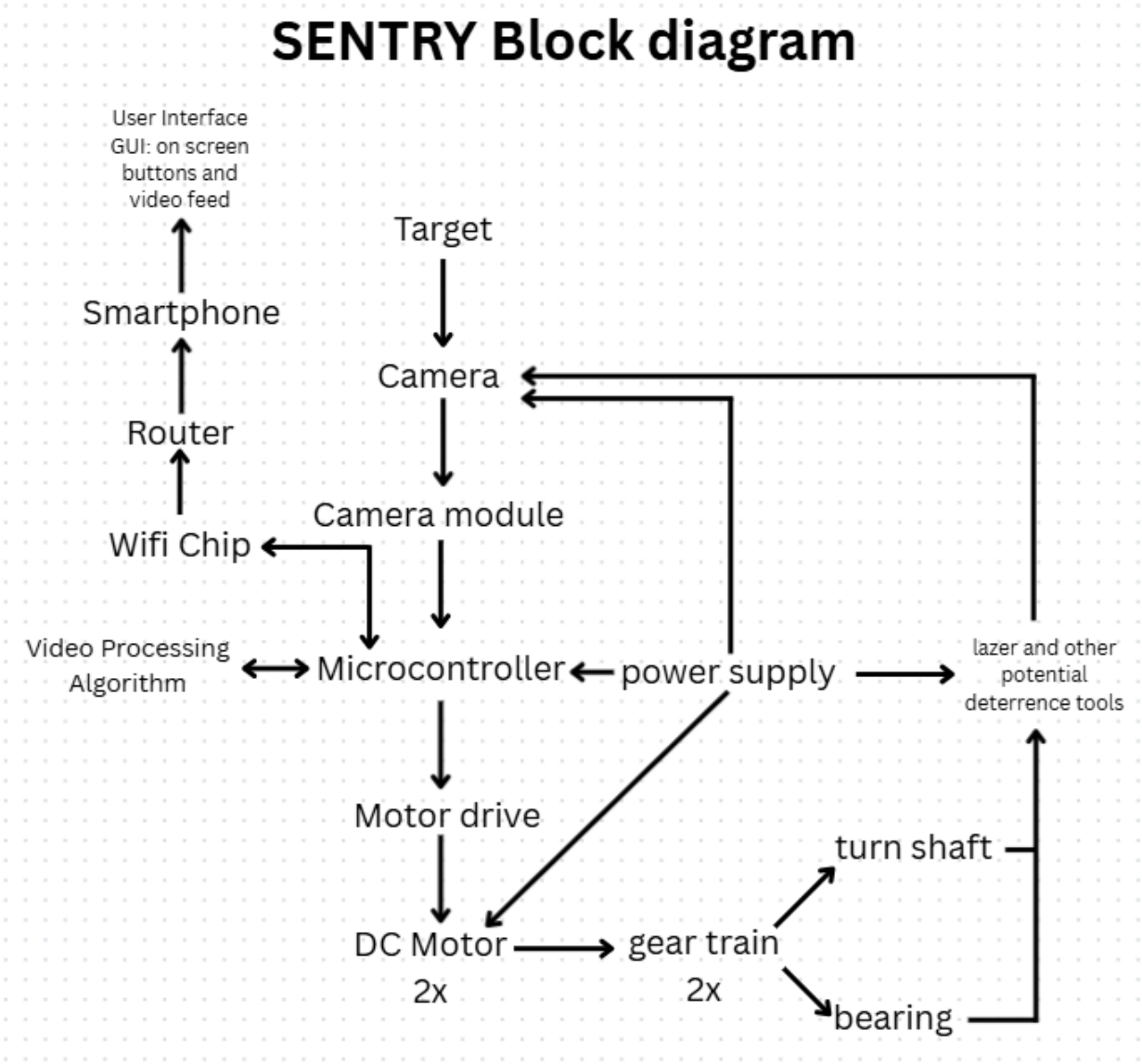

Figure 11, Sentry system block diagram [15]

Appendix B: Schedule

Key	Summary	Status
STY-2	proposal doc	IN PROGRESS
STY-1	Finish scope doc	DONE
STY-3	Contract	DONE
STY-12	Sign funding document	DONE
STY-4	Week 1-2: Project Planning and Research	DONE
STY-5	Week 3-4: Hardware Test & initial setup	IN PROGRESS
STY-6	Week 5-6: Prototype Development	TO DO
STY-7	Week 7-8: Integration & Control Modes	TO DO
STY-8	Week 9-10: Optional Features/Enhancements	TO DO
STY-9	Week 11-12: System Testing and Iteration	TO DO
STY-10	Week 13: Documentation & Presentation Prep	TO DO
STY-11	Week 14: Final Review and Demo	TO DO
STY-14	Requirements doc	DONE

Figure 12. This is a schedule that shows the list of things we'll be working on every week. It is marked by Done, in progress and to do. [16]

Appendix C: Project Requirements

Table 2. A table that lists the requirements and tests that will be conducted to ensure the requirements are met. [17]

Requirements	Test	Pass/Fail Criteria
System can run autonomously without external technology or supervision	We will let the system become standalone with no laptop connected or person controlling it and we will observe if the system operates as expected.	If the system stays ON and operates according to group expectations then it's a pass, anything else is a fail.
Camera can recognise the set targets	Check the video feed from the camera if it is recording and observe if the software will recognise its target.	The camera must be able to tell between targets and non-targets.
Camera can track its target	Observe if the software will track the target while its stationary or when it moves at different speeds.	The software must follow its target with precision, and with low latency.
The motors can move the laser to track its target in accordance with the camera	Power on the system and test if the motors move the laser pointer in accordance with software.	If the motor guided laser is aligned with the software's targeting, then it’s a pass.
The system should have a kill switch that works	Test the kill switch if it works	We must be able to turn the system ON and OFF
It must be safe for consumer use	Test the product ourselves to see if it's safe	If the system isn't lethal and doesn't harm anyone, then it should be a pass
The system must have an automatic and manual deterrence mode	Turn on the system and see if it automatically sets the deterrence mode and test if it can be switched to manual mode	The system must fend for itself without external influence in auto mode, and if can be fully controlled by an operator in manual mode.
The aiming system is accurate	Turn on the system and observe where the software is aiming in comparison to the physical laser	If the laser pointer is aligned with the software targeting and it is guided with low latency, low jitter, and high precision of about 10 MOA then it’s a pass

The final cost should be less than $ 150 CAD	Go back and check the total cost of the parts	If the total cost of the parts isn't more than $150, then it's a pass
Must be able to stream the camera video feed to another device.	Check on our cellphones if we're receiving live video feed	Live video feed with decent resolution and low latency