Using VEX Brain Programming and Visual Sensors to Create Animal-Specific Traps with Eradication Units to Reduce the Impacts of Invasive Species. *Rhinella marina* as a Model Species.

Noah Cartwright

PROBLEM

- A huge problem in Southwestern Florida is invasive species, more specifically, cane toads (Rhinella marina). These toads pose such a huge problem that people are legally allowed and recommended to kill them. The poison from these toads can kill domestic animals in as little as 15 minutes, and they commonly kill animals that are native to Florida. The toads run rampant mainly during early spring and the rainy season. However, they can often be found along canals, rivers, and ponds throughout the year. The average size of an adult ranges from six to nine inches, which is larger than other native frogs and toads. This study aims to create a trap that will help in lowering the population of these harmful, invasive toads.

GOALS

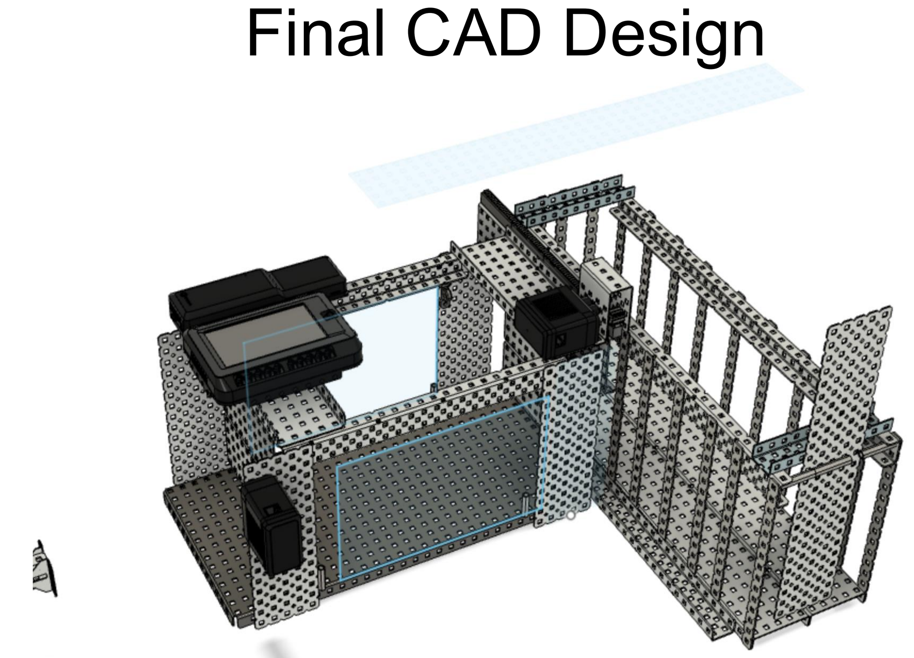
- Trap that can detect when a cane toad has entered it
- Trap should be able to move the toad to a removable storage area
- Trap can reset back to step one
- Function during day and night
- All parts function as intended to

ABSTRACT

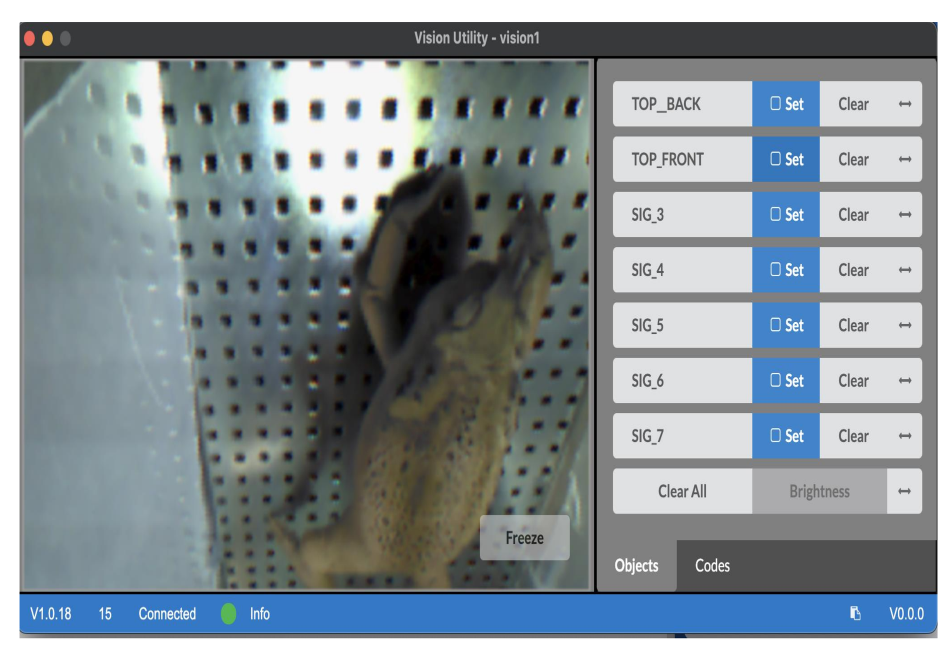
- A huge problem in Southwestern Florida is invasive species, more specifically, cane toads (Rhinella Marina). The poison from these toads can kill domestic animals in as little as 15 minutes, and they commonly kill animals that are native to Florida. The average size of an adult ranges from six to nine inches. Therefore, the goal of this engineering project was to design a trap that could detect when a cane toad has entered it, move the toad to a removable storage area in the trap, and have the trap reset back to step one. Also, the trap should only activate when a cane toad enters it. The trap was designed on paper, then online, and then constructed in real life. The trap uses VEX parts including a vision sensor and reasonable amounts of code. The trap could not be tested on live toads, so a stuffed animal imitating a cane toad acted as a replacement for the live toad. The trap was tested during the day and simulated nighttime (a dark room). In all 10 of these tests, the toad was detected, moved to the removable storage area, and the trap reset itself back to step one. 10/10 test successes for both day and night (20 total tests). Therefore, all the set goals were complete with a 0% error.

Replica Cane Toad

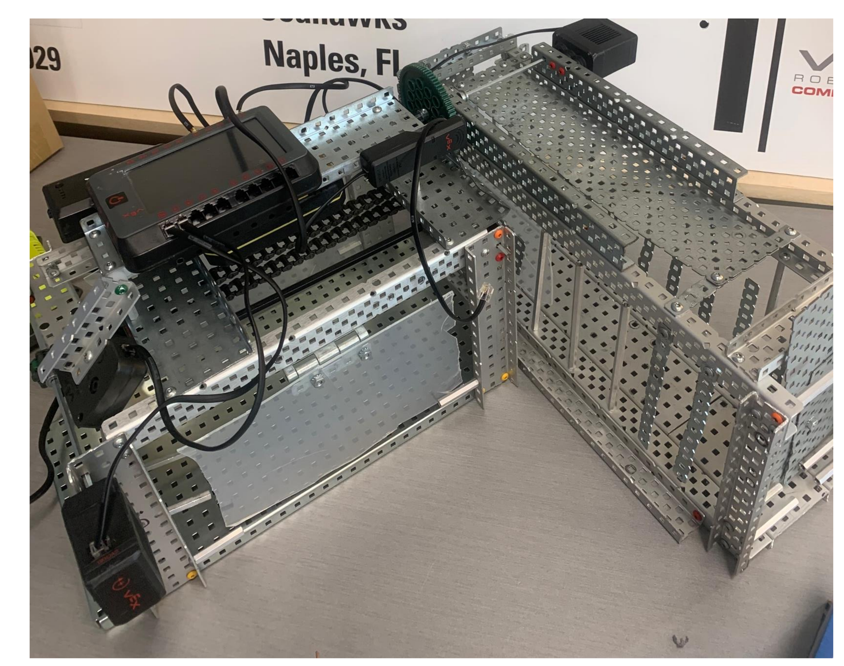
Final CAD Design



What Vision Sensor Sees



Completed Trap



TESTS

SUCCESSFUL TEST CRITERIA

- Vision sensor detects the toad
- Toad is pushed into the storage area
- All parts function as they were intended to (one-way doors only open one way)
- Trap resets back to how it began

PERCENT ERROR – 0%

COST ANALYSIS

Components	Price (USD)
Magnetic LED	19.99
V5 VEX Bundle (includes brain, motors, wiring, chargers, and battery)	777.65
Vision Sensor	92.27
2 sheets of 16" x 20" plastic	3.98
Structure Booster Kit	217.73
15x30 Base Plate	37.84
Aluminum Kit	31.1
Stuffed Animal Toad	22.95
	$1,203.51

TOTAL – $1,203.51

DAYTIME

Test Number	Vision Sensor Detection	Trap Functioning	Toad Moved to Storage
1	y	y	y
2	y	y	y
3	y	y	y
4	y	y	y
5	y	y	y
6	y	y	y
7	y	y	y
8	y	y	y
9	y	y	y
10	y	y	y

SIMULATED NIGHT

Test Number	Vision Sensor Detection	Trap Functioning	Toad Moved to Storage
1	y	y	y
2	y	y	y
3	y	y	y
4	y	y	y
5	y	y	y
6	y	y	y
7	y	y	y
8	y	y	y
9	y	y	y
10	y	y	y

PROCEDURE

- After brainstorming three different trap ideas, the one shown in the photos was selected due to it being theoretically more efficient. This trap was then designed in CAD and then physically. Once the trap was constructed, the trap needed to be coded. Specifically, the motors and vision sensor needed code. The simplified code functions like so: the vision sensor detects the toad, the gate to storage opens, the toad pusher pushes the toad into storage, the gate to storage closes, and the toad pusher goes back to its starting position. Ten tests were run during the day and simulated at night, which is a dark room, so twenty tests were run in total.

ANALYSIS

- All tests were successful as in each test the vision sensor detected the toad, pushed it into the storage area, the trap resets back to step one, and all mechanisms function as intended.

CONCLUSION

- The trap functioned excellently with a replica of a Cane Toad, but this isn't a real toad. Therefore, it's difficult to determine whether or not it would function on a real toad. However, the trap was constructed with the intention of a real toad entering it. This means that certain parts of the trap were added, which the replica can't test. For example, the one-way door, walls, and the removable gate. The price of $1,203.51 is so high because most of the pieces used were convenient to build with but pricey. The price could be drastically decreased by replacing the walls with materials like a piece of a chain link fence. Nonetheless, the trap could detect a cane toad, and move the toad to a removable storage area. The results from this study imply that other species-specific traps using vision sensors could be constructed.

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