Humane Animal Repellent V1 (HARV1)
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Project Background

- HARV1: a consumer product meant to prevent squirrels from damaging your garden
  - Scans for squirrels.
    - If squirrel is detected, robot will shoot squirrel with an automated water gun (humanely).
  - Portable and low maintenance.
    - Only need power outlet and garden hose.
    - No user input required

Design Objectives

- Autonomous squirrel detection and repelling:
  - Shoot squirrels before any damage is done.
  - Only shoot squirrels.

- Small and portable form factor:
  - Can be placed in various areas around a yard
  - Easily movable

- Low maintenance for user:
  - Minimal involvement from use after initial setup.

Design Challenges

- Structural Challenges:
  - Ensure adaptability to different environments.
  - Effectively shoot water at least 20 ft.

- Computer Vision Challenges:
  - Efficiently identify squirrels.
    - Identify target
    - Communicate with electronics.

- Electronic challenges:
  - Shoot target before it causes damage.
    - Rotate motors and open solenoid valve quickly.
    - Must do so in less than 5 seconds

Principles of Operation

- Camera
- Raspberry-Pi
- Caffe Model
- Results
- Raspberry-Pi
- Stepper motors
- Solenoid Valve

- Takes picture
- Passes current frame through Caffe objection recognition model (0.25 seconds)
- Analyzes video to determine if there is a squirrel (1 second)
- If squirrel is detected location is determined (0.25 seconds)
- If no squirrel is detected, loop starts over (0.25 seconds)
- Turns motors to position sent from computer (~0.5 seconds)
- Valve is actuated to shoot water (~1 second)
- Once squirrel has been sprayed, loop starts over (0.25 seconds)

Future Direction

- HARV1 is specifically designed to recognize and spray squirrels.
  - Computer program code can be altered for different animals, such as deer and rabbits.
  - Can also be altered for use in security industry.

Results

- Raspberry-Pi
- Camera
- Steps 1
- Raspberry-Pi
- Camera
- Steps 2
- Raspberry-Pi
- Camera
- Steps 3
- Raspberry-Pi
- Camera
- Steps 4a
- Raspberry-Pi
- Camera
- Steps 4b
- Raspberry-Pi
- Camera
- Steps 5
- Raspberry-Pi
- Camera
- Steps 6
- Raspberry-Pi
- Camera
- Steps 7

Timeline:

- September 2017: Research existing products and draft preliminary designs
- October 2017: Initiated squirrel detection program code, CAD model, and circuit diagram
- November 2017: Create parts list and refine CAD model
- January 2018: Create prototype, integrate electronics, and test valve.
- March 2018: Testing and troubleshooting of all integrated subsystems