

Faculty Sponsored Design Project Proposal

Project Name: Doggy Doo Detection Device

Advisor name and contact information:

Andrew Lamperski
Electrical and Computer Engineering
5-155 Keller Hall; 200 Union St SE; Minneapolis, MN 55455
Email: alampers@umn.edu
Phone: 626-625-7381

Project motivation and background:

Dogs are great. Stepping in their poop is not. If a dog goes outside on their own, it can be hard to know where their poop is. It can hide in the grass, blend in with leaves, and get covered in snow. So, the poop can sneak up on you, even when you're on the look-out.

Dog poop has some key characteristics that makes it possible to detect with modern technology:

- It comes out of a dog.
- A healthy dog has a body temperature between 38.3 and 39.2 degrees Celsius.
- It doesn't move on its own (hopefully).
- It starts out near the temperature of the dog, and then converges to the outside temperature based on the laws of thermodynamics.

Project goal/objective:

The goal is to develop a prototype dog poo detection system using an infrared camera and image processing. It should create an image that marks the poo locations.

Challenges and opportunities:

Likely the biggest challenge is getting image processing to work reliably enough to detect a poo with confidence. We don't want a lot of false positives or false negatives. (False negatives are worse than false positives here, though. Think about it.)

Another challenge would be to get an imaging system with sufficient resolution to give sharp thermal images over a wide area, such as a yard. Most likely, with the budget given, only a small prototype area can be covered.

So, there will be room to grow here.

Project specifications:

- Hardware:
 - Should utilize thermal imaging (unless there is a good argument that another sensing modality would be more reliable.)
 - The main computations should be able to run on either a small computer, like a Raspberry Pi, or a smartphone/table.
- Computations:

- Should use image processing and physics principles to locate poos
 - Should be able to store multiple poo locations
- User Interface:
 - Should display an image with poo locations marked
 - User should have the ability to clear poo locations from image
 - Ideally, this would be able to run from a smartphone, or tablet, or web app.
- Reliability Tests:
 - Must perform reliability tests using artificial “poo-like” objects (such as warm water bottles)
 - Reliability must be quantified, describing false positives, false negatives, and so on.
 - Reliability at various distances should be tested.
 - Ideally, reliability with different “poo-like” object sizes (because dogs come in lots of sizes), and different ambient temperatures (because Minnesota) should be tested. (The ambient temperature tests could be hard, so this is not a hard requirement.)

Expected deliverables/final product:

A working prototype that can reliably detect artificial “poo-like” objects over a small area. It should be possible to give a working demonstration as long as someone can supply the warm objects. (If someone brings a kettle, you can get a steady supply of warm water.)

Technical skills required:

- Microcontroller / embedded system programming for camera interface
- Image processing / signal processing for poo detection algorithms
- Web/App design for the user interface
- Statistical analysis for reliability tests

Expected budget:

Total: \$125 - \$250:

- Computer: \$50-\$100
- Infrared Camera: \$50-\$100
- Other supplies and equipment (experimental supplies, computer peripherals, etc) \$25-\$50