



Detering Unwanted Visitors in Urban Gardens

Finin Quincey

Supervisor: Dr Steve Cayzer

A Quick Introduction...



Grew up in Devon, SW England



MEng Integrated Design
Engineering
1st Class Honours
University of Bath
(graduated 2021)



Mechanical Engineer
Crux Product Design, Bristol



Some Statistics...

78% of urban residents have experienced problems with nuisance animals

Only **36%** said existing measures were effective or very effective



Nuisance Animals Survey

A short survey about garden wildlife and home animal deterrents

* Required

Welcome

Thank you for taking the time to complete this survey!

This survey has 4 parts and should take 10-15 minutes to complete. Most of the questions are multiple choice.

Before you begin, please read the following carefully and then indicate your consent to complete this survey:

(this survey is to inform...

The Brief

Design a **device or system**, aimed at **residents in urban areas**, that is capable of **reducing** or **eliminating** the presence of **unwanted animals** in a garden, courtyard or other **private outdoor space**



Research Focus

The Problem

Information required to make the solution **work**, for example:

- Which animals to target
- Relevant animal behaviours
- The urban garden environment
- Legal and ethical issues

The Market

Information required to make the solution **profitable**, for example:

- Users' opinions towards particular animals
- User preferences and priorities
- Strengths and weaknesses of existing products

Key Innovations

Selectivity

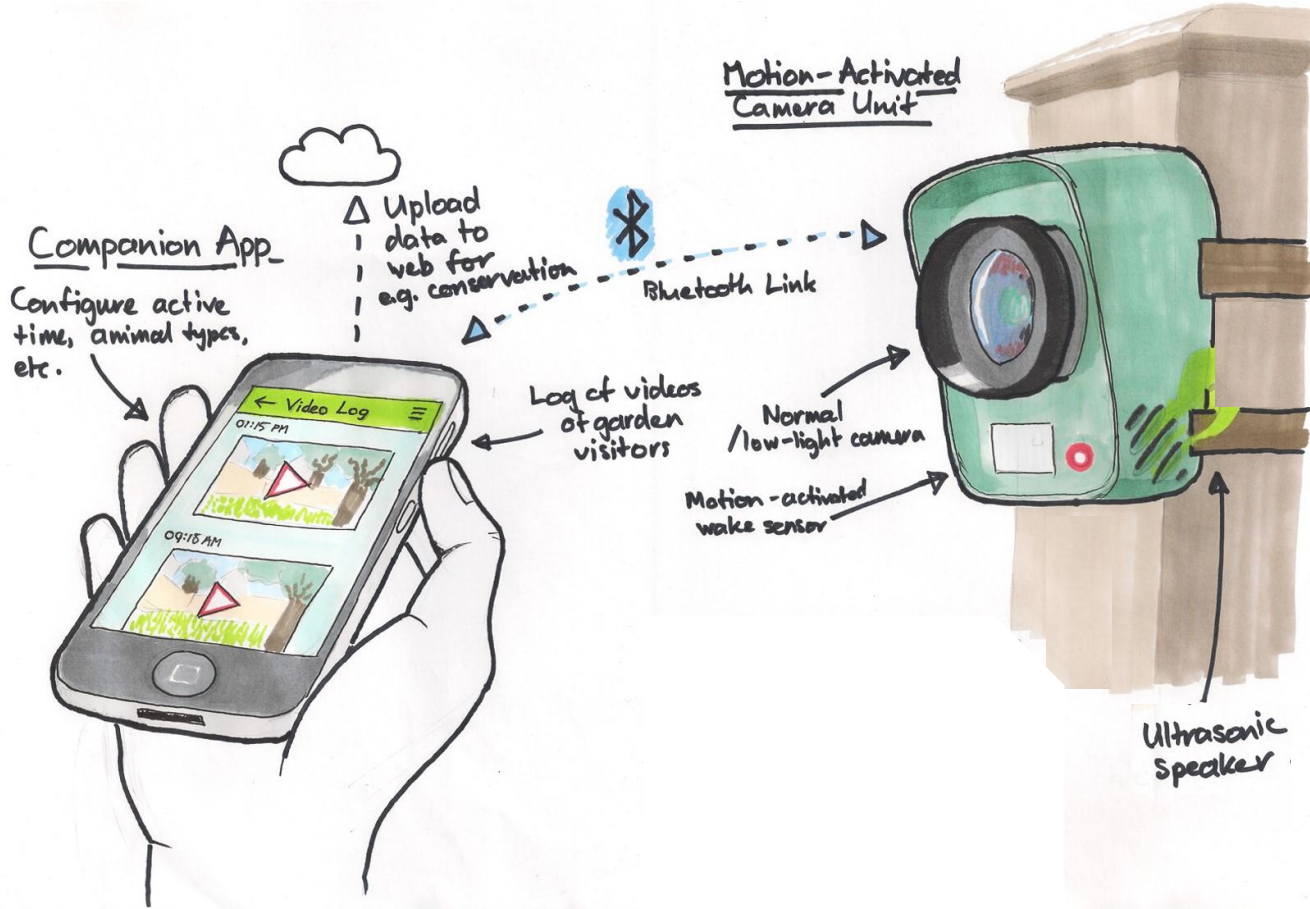
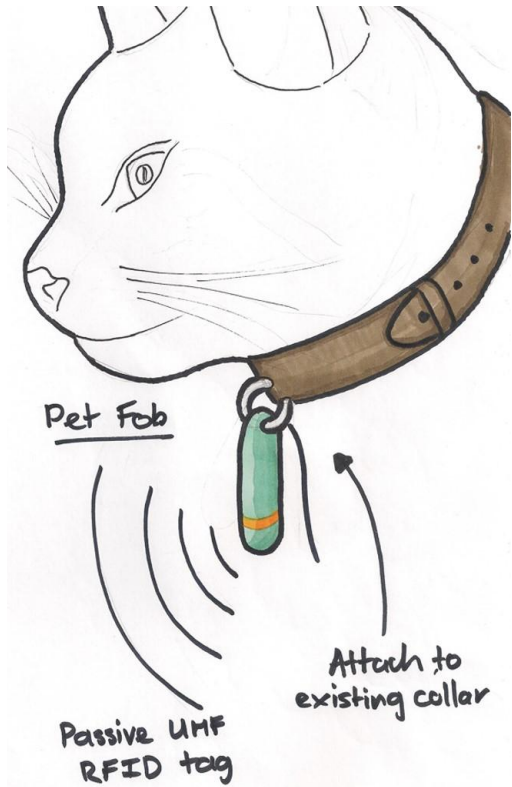
The ability to deter some animals
and not others

Pet-friendliness

The ability to disable the deterrent
when the user's pets are present

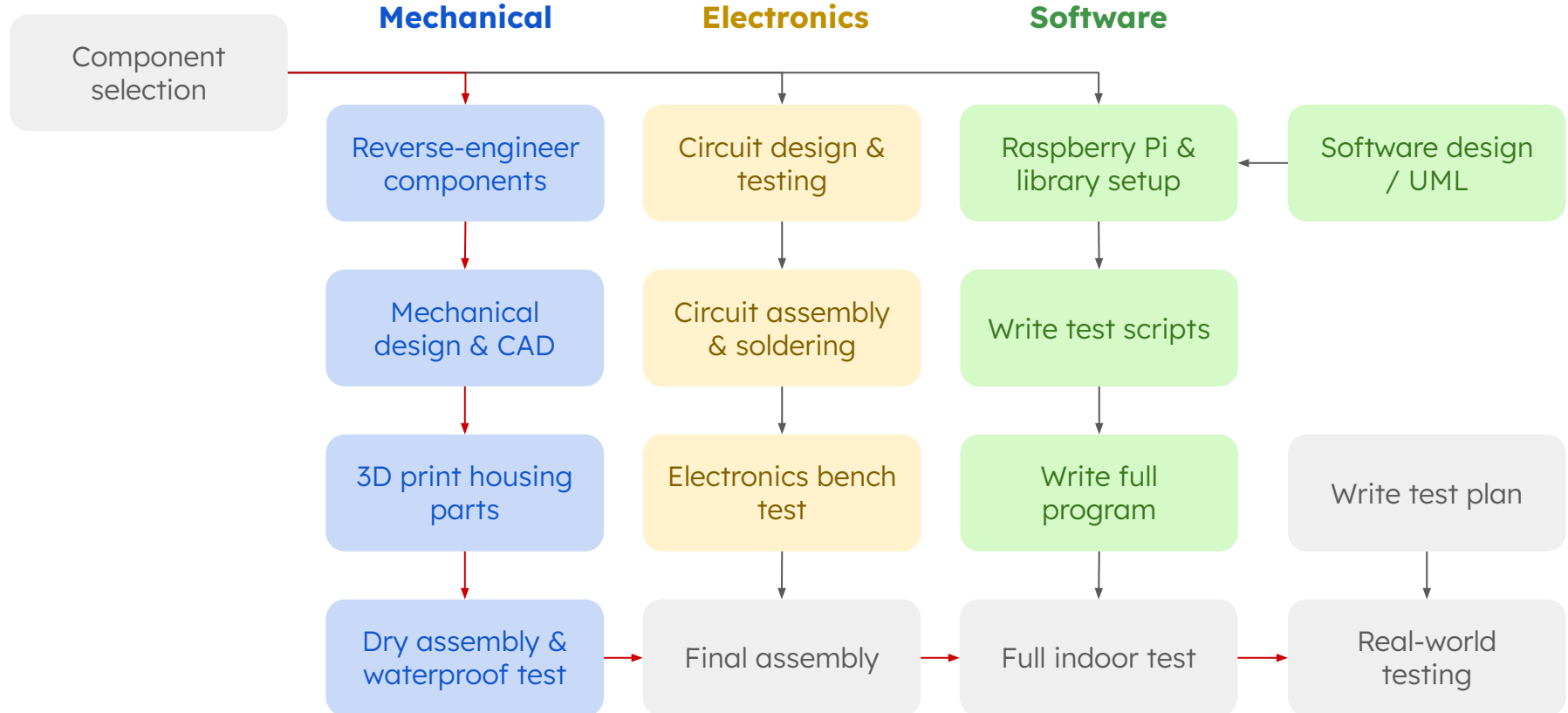


Design Concept



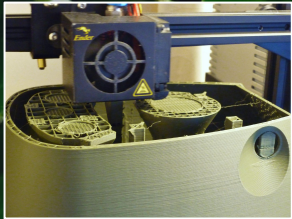
→ Critical path

Prototyping Process



Prototype

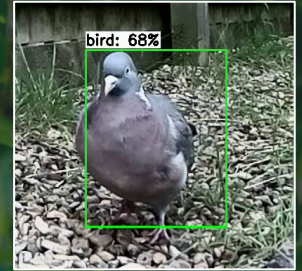
Swappable
20,000mAh
battery pack
lasts around 30
hours per charge



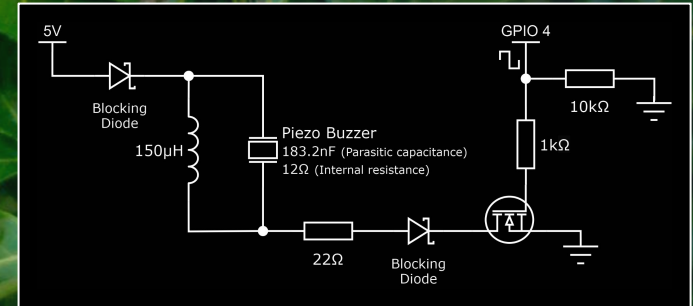
Waterproof housing
3D printed using a
custom support
structure



TensorFlow object recognition
with Python and Raspberry Pi 3B



Night-vision using
MOSFET-controlled IR LEDs and
real-time image filtering



30kHz resonant piezo buzzer
driver for increased volume

person: 69%

What Did I Learn?

- LC oscillator circuit design
- Limitations of MOSFETs
- Concurrent programming and thread-safety
- Design for additive manufacture (DfAM)
- How to be resourceful during a national lockdown!



Question Time!



Find out more about this project on GitHub

<https://github.com/Finin-Quincey/Lookout-Garden-Monitor>

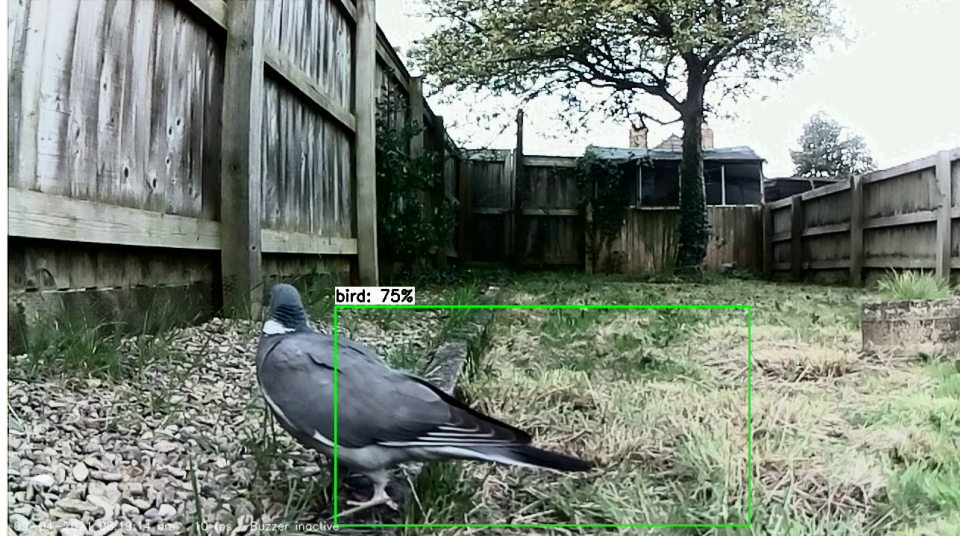


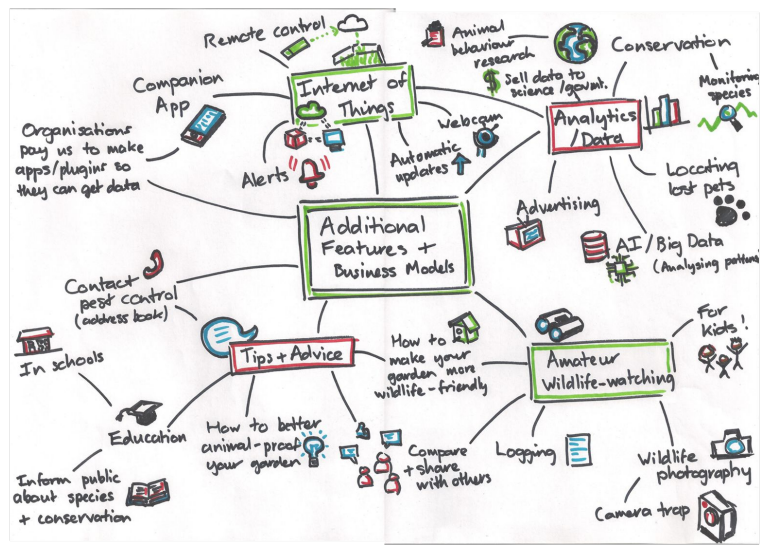
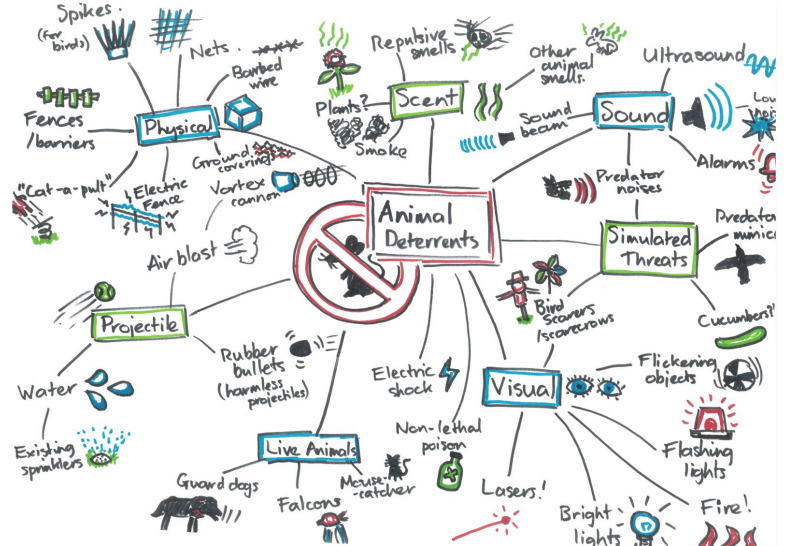
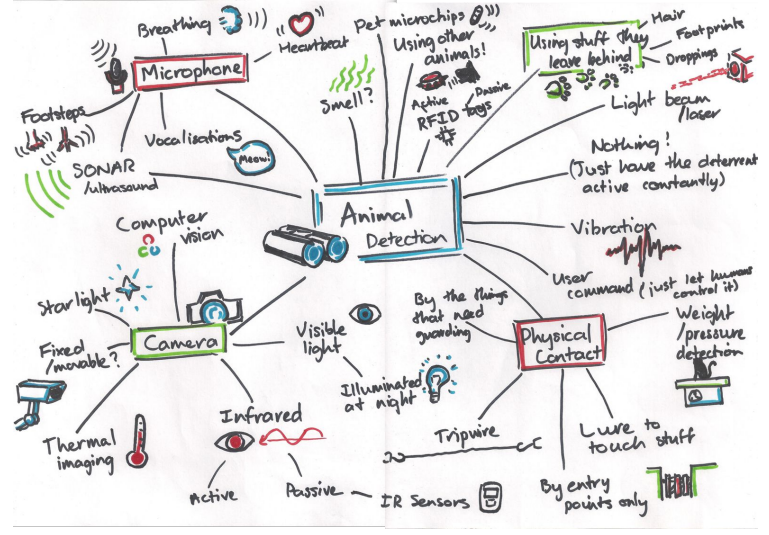
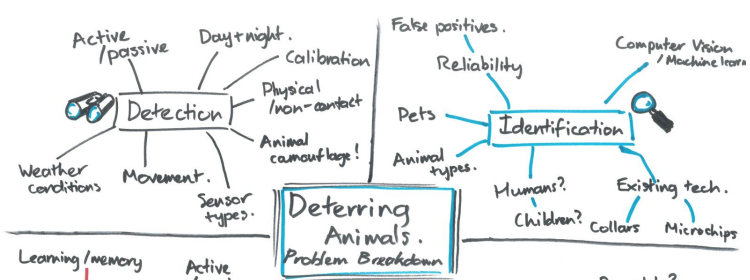
Find out more about me on LinkedIn

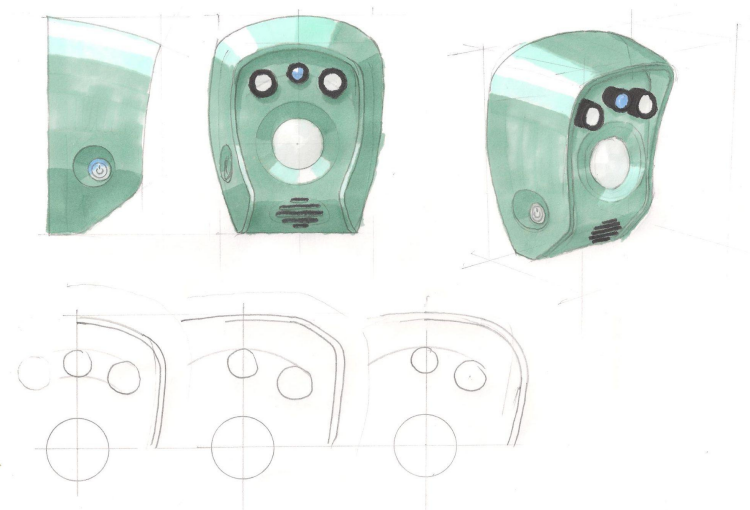
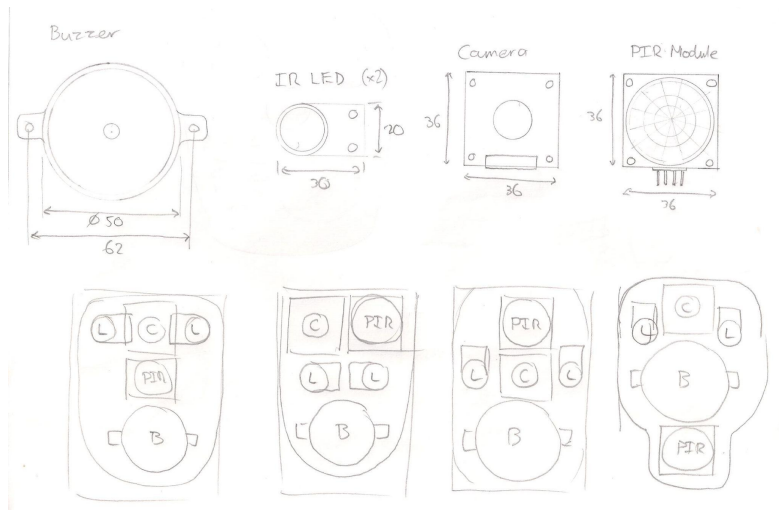
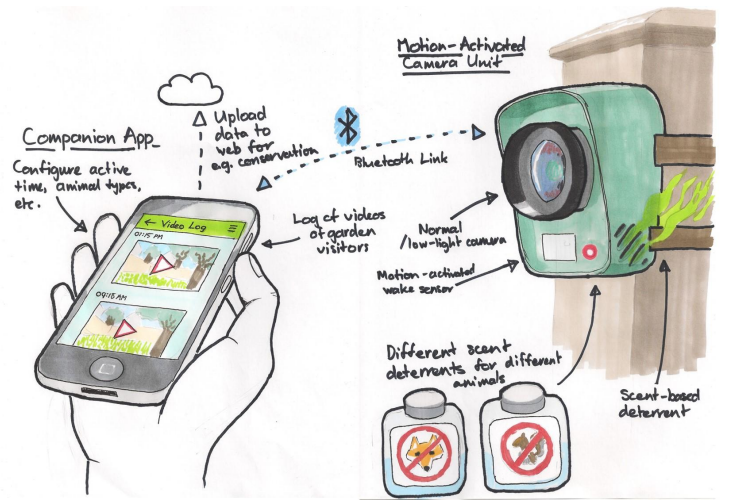
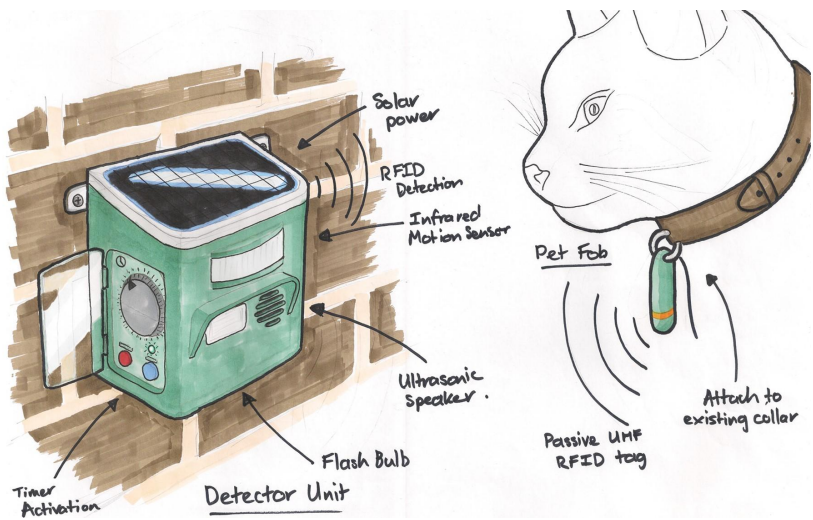
[linkedin.com/in/finin-quincey](https://www.linkedin.com/in/finin-quincey)

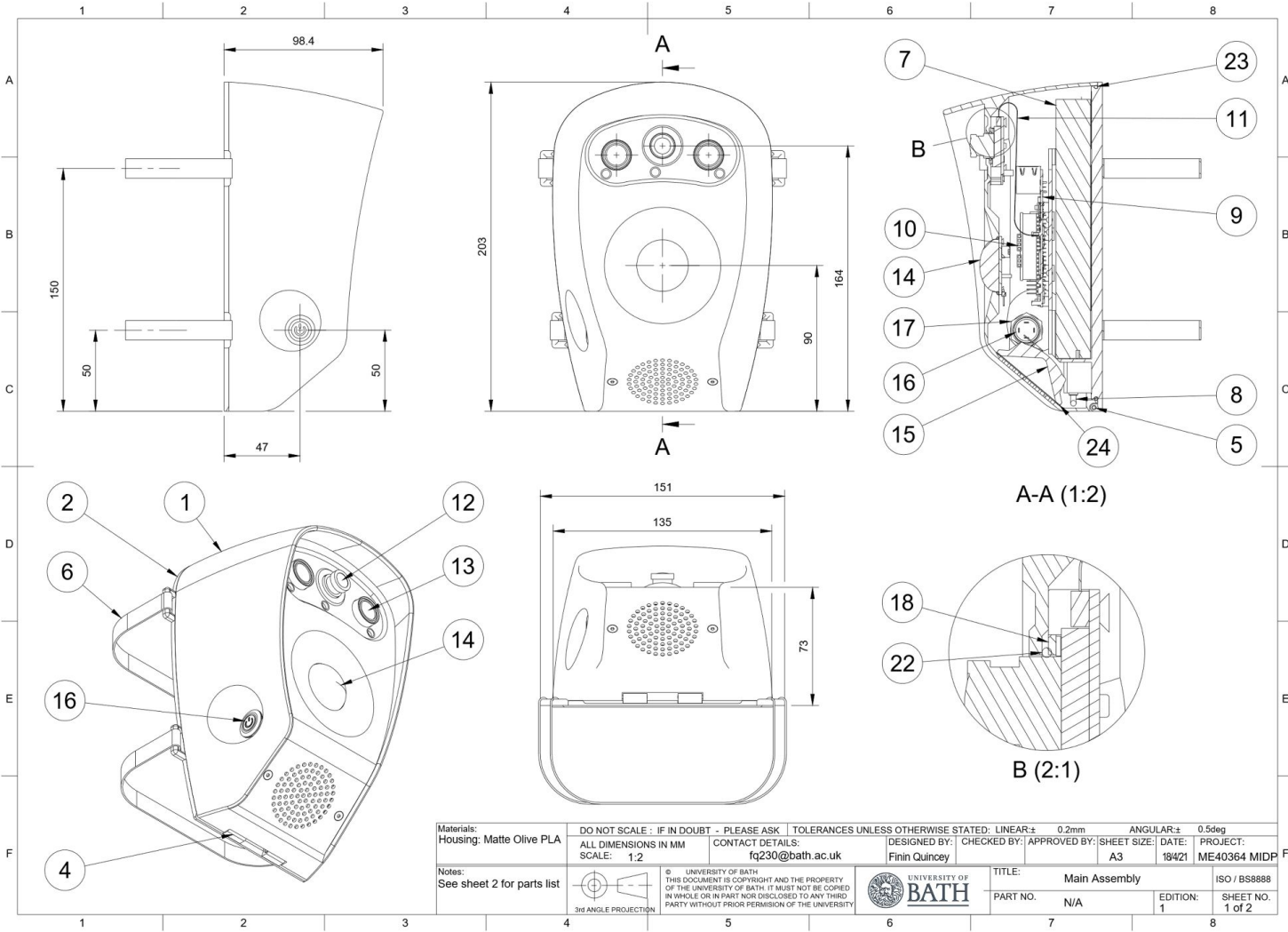


Appendix





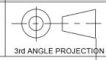




A-A (1:2)

B (2:1)

Materials: Housing: Matte Olive PLA	DO NOT SCALE : IF IN DOUBT - PLEASE ASK	TOLERANCES UNLESS OTHERWISE STATED: LINEAR:± 0.2mm	ANGULAR:± 0.5deg
	ALL DIMENSIONS IN MM	CONTACT DETAILS: fq230@bath.ac.uk	DESIGNED BY: Finin Quincey
Notes: See sheet 2 for parts list	SCALE: 1:2	CHECKED BY:	APPROVED BY:
		A3	DATE: 18421
			PROJECT: ME40364 MIDP
			EDITION: 1
			SHEET NO. 1 of 2

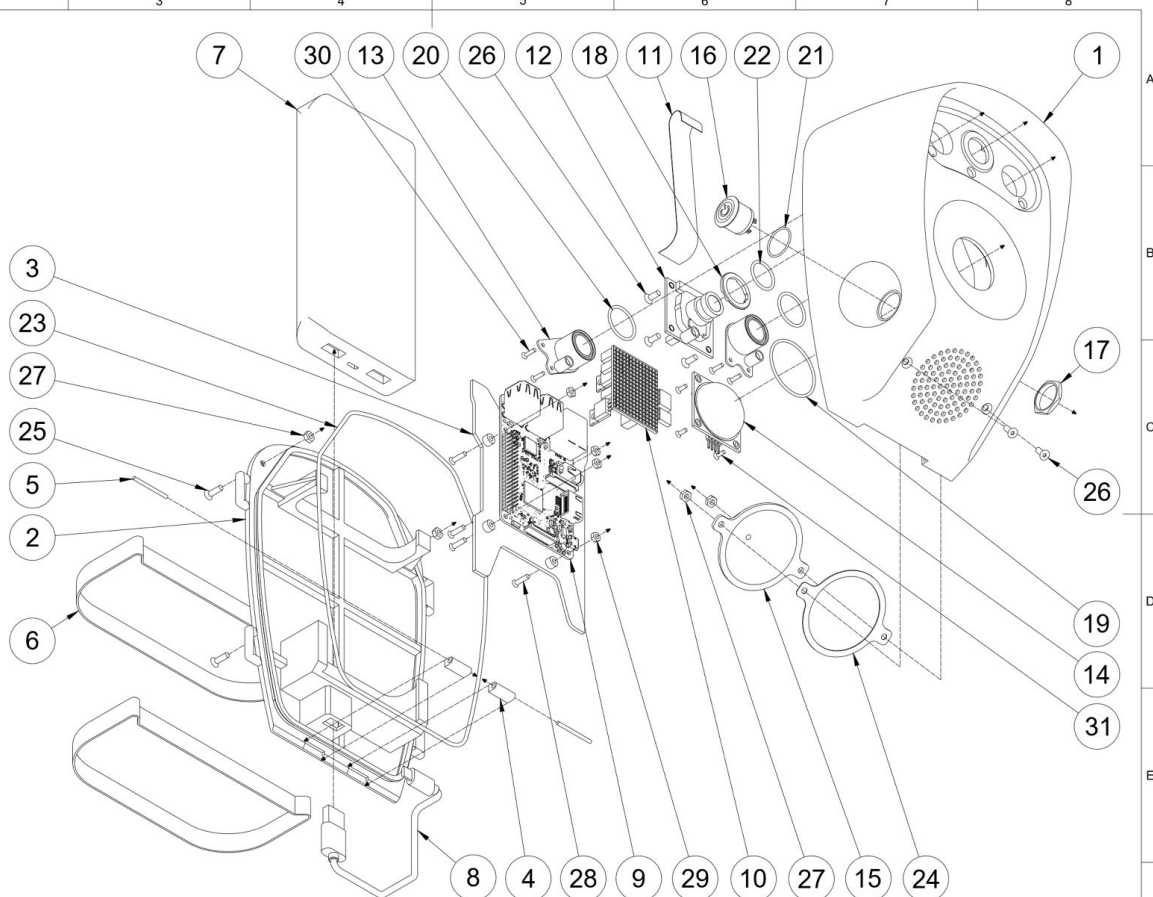


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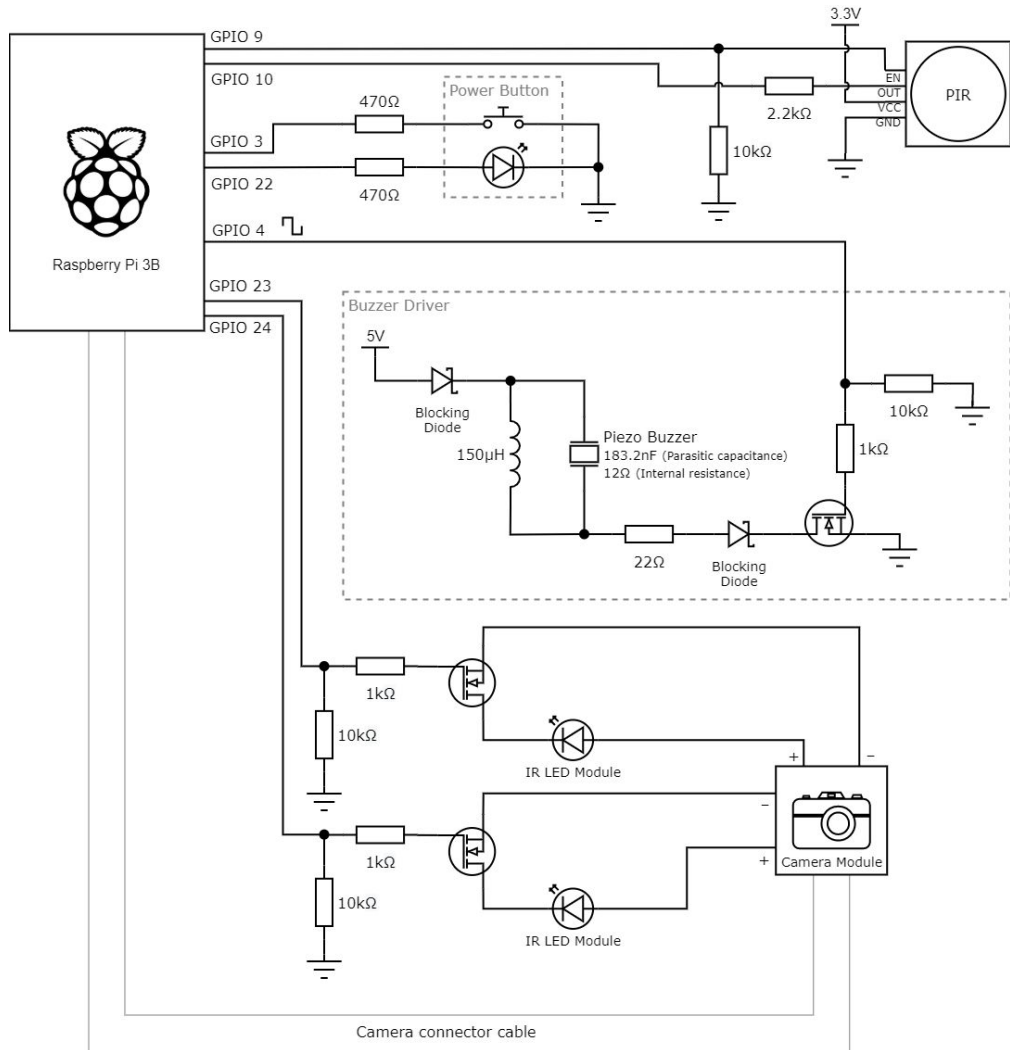


TITLE: Main Assembly	ISO / BS8888
PART NO. N/A	

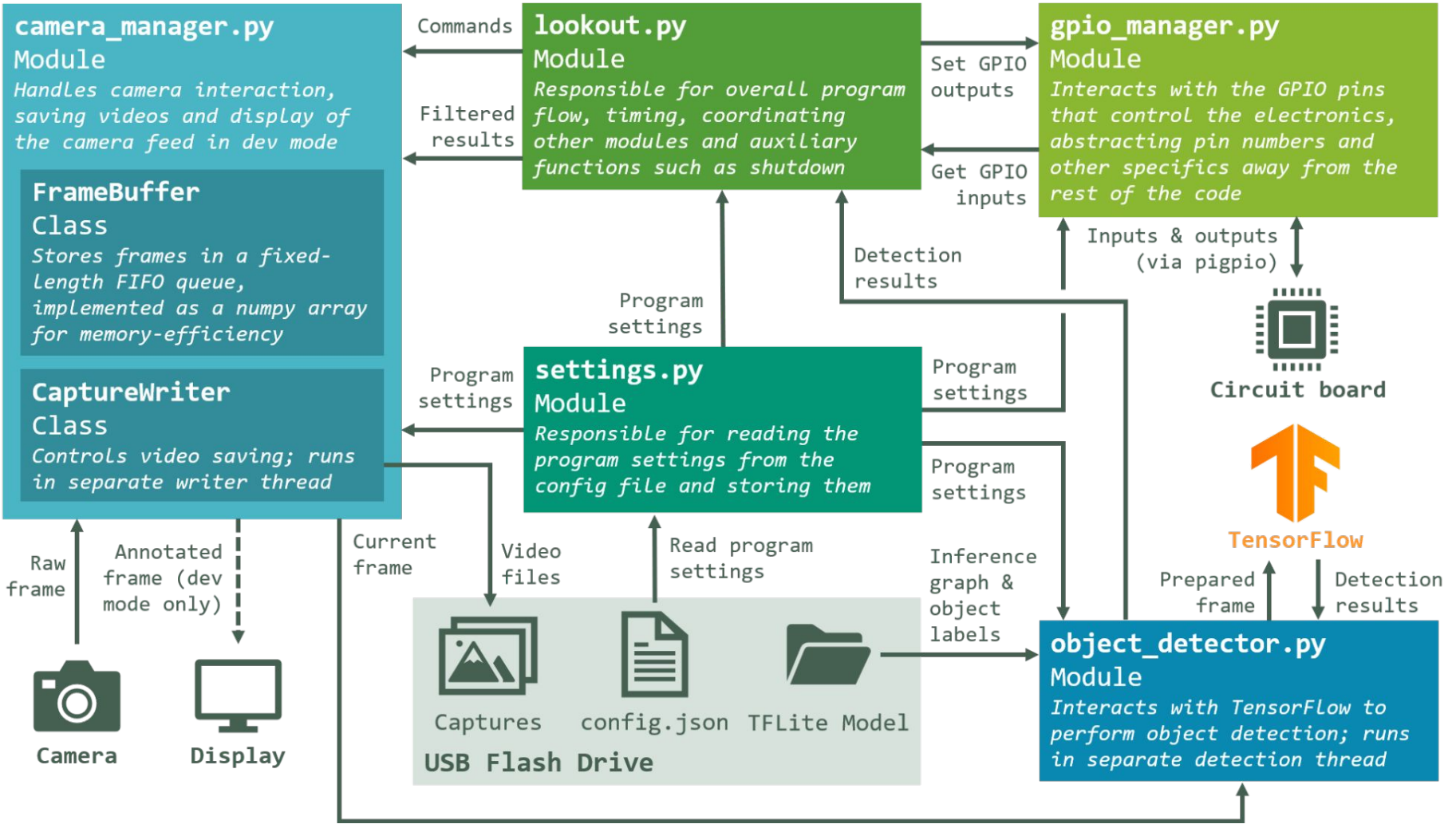
Parts List		
Item	Part Number	Qty
1	Outer Housing	1
2	Back Plate	1
3	Raspberry Pi Mount	1
4	Back Plate Hinge Lug	2
5	Hinge Pin	2
6	Velcro Mounting Strap	2
7	Ansmann Powerbank 20.8Ah 5V	1
8	USB Cable	1
9	Raspberry Pi 3B	1
10	Circuit board	1
11	Camera Cable	1
12	Arducam 5MP Motorised IR-CUT OV5647 Camera	1
13	Arducam OV5647 Camera Infrared LED Lamp	2
14	SimplyTronics ST-00081 Wide Angle PIR Sensor Rev B	1
15	RS PRO 86dB Flange Mount Piezo Buzzer	1
16	RS PRO SPST LED Pushbutton	1
17	M16x1 Nut	1
18	Camera Seal Plate	1
19	32 x 1.5mm O-ring	1
20	18 x 1.5mm O-ring	2
21	16 x 1mm O-ring	1
22	15 x 1.5mm O-ring	1
23	Housing Seal	1
24	Buzzer Gasket	1
25	M3 x 10 Countersunk Socket Screw	2
26	M3 x 8 Countersunk Socket Screw	6
27	M3 Nut	4
28	M2.5 x 10 Countersunk Socket Screw	4
29	M2.5 Nut	4
30	M2 x 8 Countersunk Socket Screw	4
31	M2 x 6 Countersunk Socket Screw	4



Materials: Housing: Matte Olive PLA	DO NOT SCALE : IF IN DOUBT - PLEASE ASK TOLERANCES UNLESS OTHERWISE STATED: LINEAR:± 0.2mm ANGULAR:± 0.5deg		ALL DIMENSIONS IN MM		CONTACT DETAILS:	DESIGNED BY:	CHECKED BY:	APPROVED BY:	SHEET SIZE:	DATE:	PROJECT:
	SCALE: 1:2	fq230@bath.ac.uk		Finin Quincey				A3	18421	ME40364 MDP	
Notes: Raspberry Pi mount (3) and hinge lugs (4) glued to back plate (2) with CA adhesive		© UNIVERSITY OF BATH THIS DOCUMENT IS COPYRIGHT AND THE PROPERTY OF THE UNIVERSITY OF BATH. IT MUST NOT BE COPIED IN WHOLE OR IN PART NOR DISCLOSED TO ANY THIRD PARTY WITHOUT PRIOR PERMISSION OF THE UNIVERSITY			TITLE: Main Assembly (Exploded)		ISO / BS8888				
		PART NO.	N/A		EDITION:	1		SHEET NO. 2 of 2			



Camera connector cable



UML Activity Diagram

Lookout Garden Monitor

This diagram describes the operating sequence of the onboard software. A multi-threaded approach is used to improve performance, allowing video to be captured at a reasonable framerate without the object detection or write speed impacting performance. The solid horizontal bars indicate where the concurrent processes fork off from and rejoin the main thread.

For simplicity, the startup and shutdown sequences are omitted.

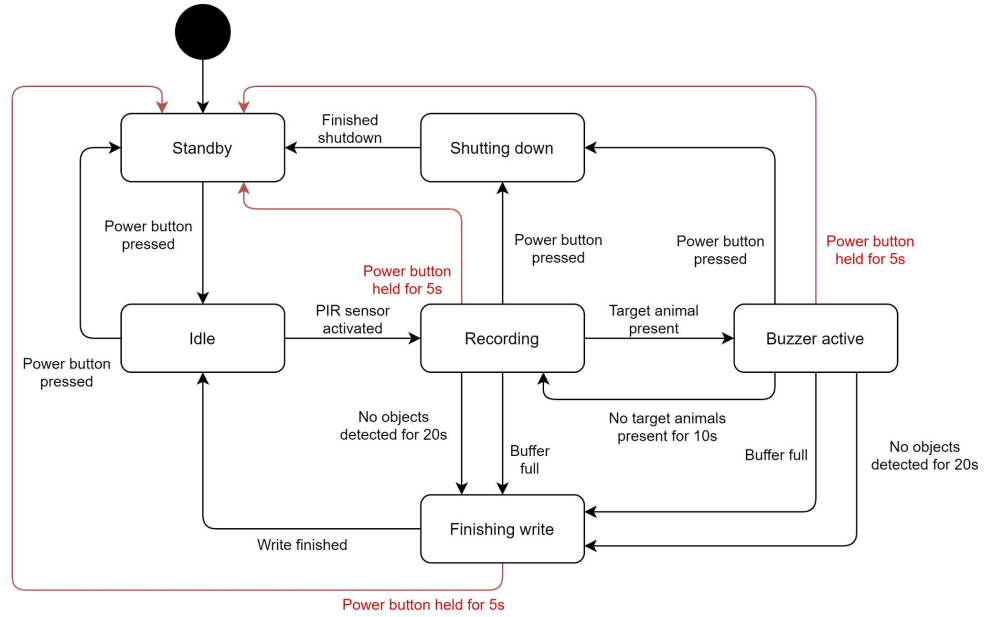
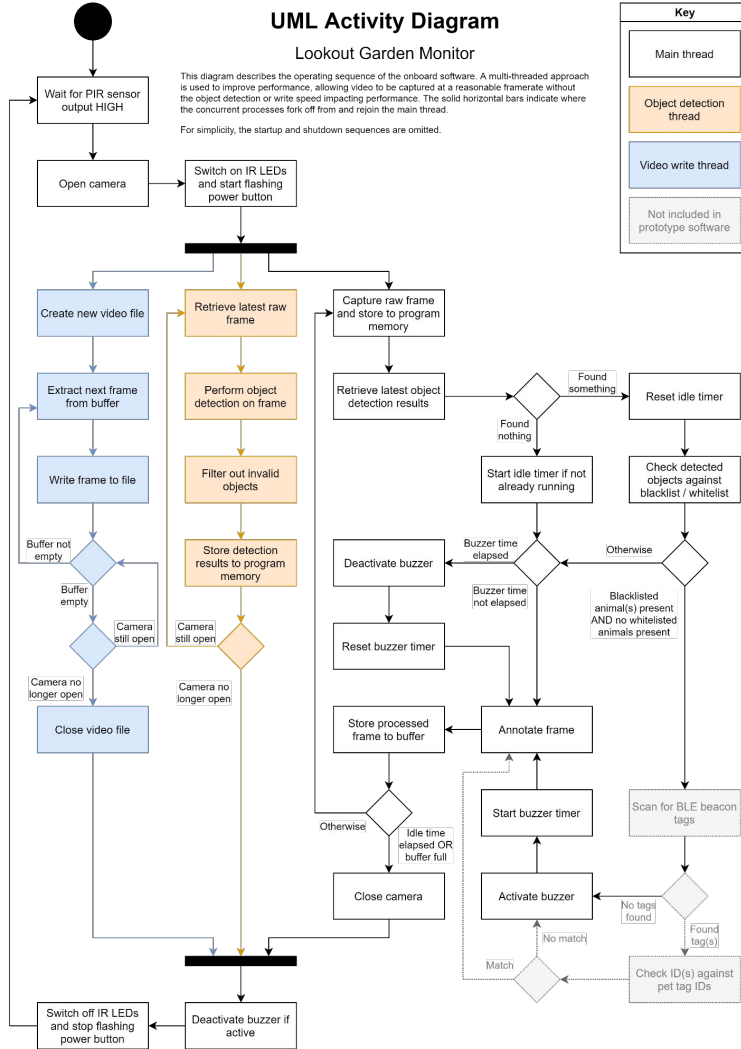
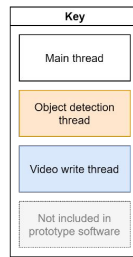
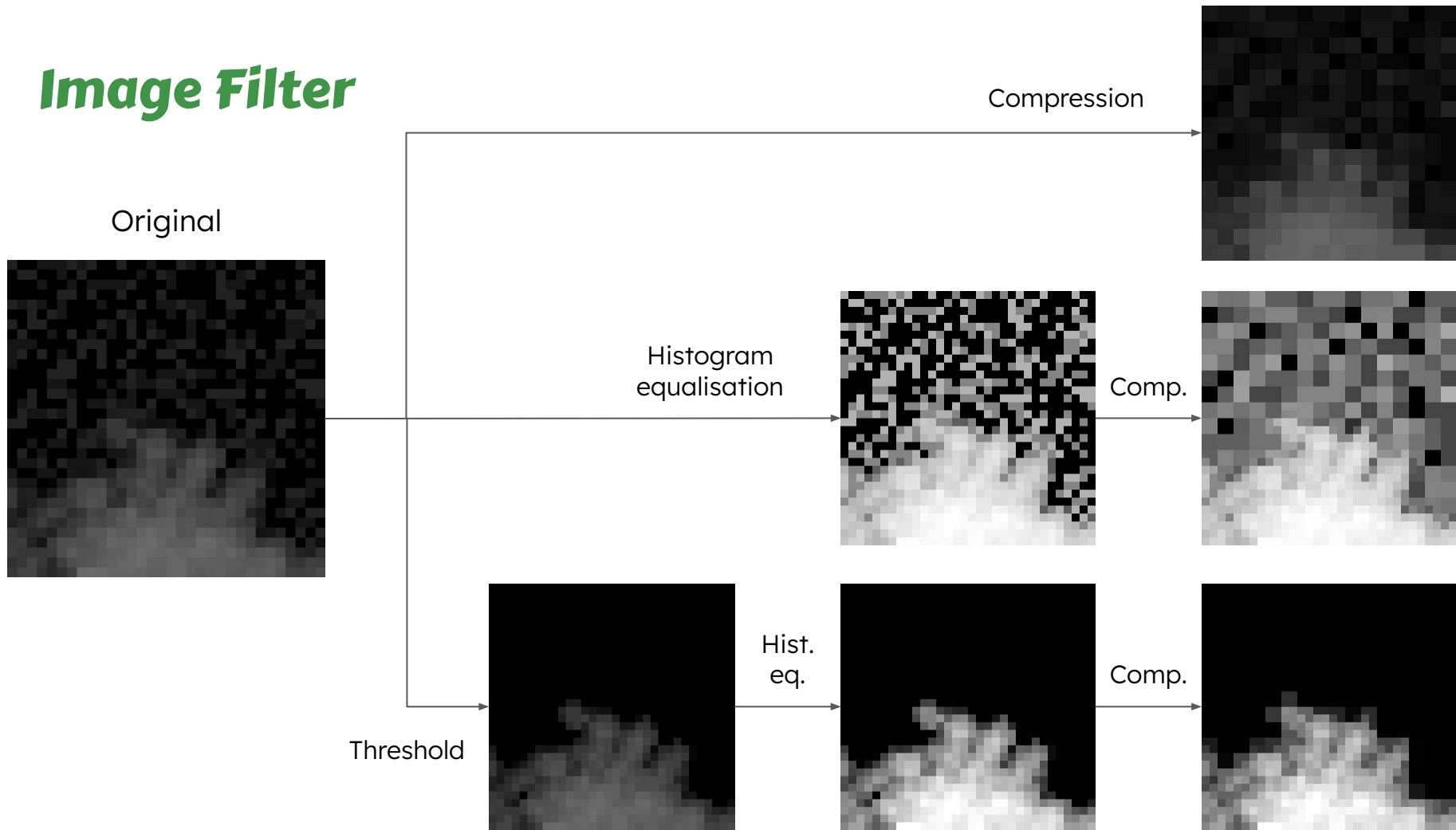
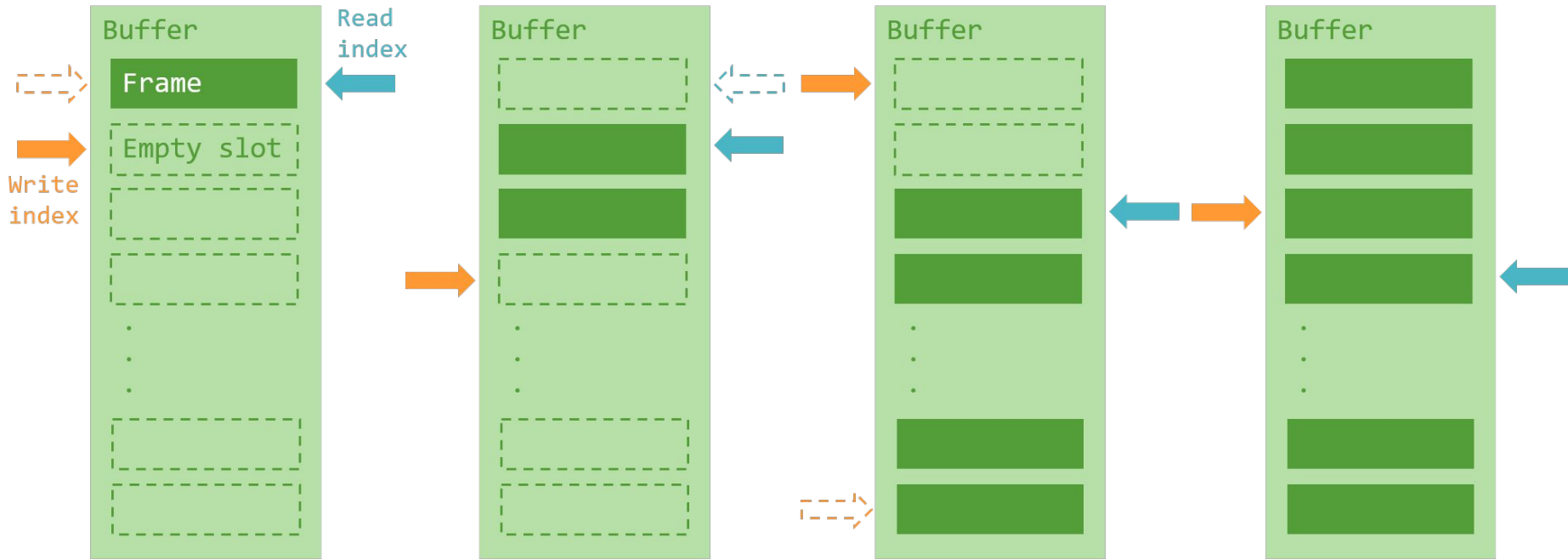


Image Filter





The buffer starts empty, with the write and read indices both at 0. The write index advances by 1 each time a frame is written.

The buffer continues to fill up with frames. Each time a frame is read, that position is cleared and the read index advances by 1.

When either index reaches the end, it loops back round to index 0 at the start of the buffer.

Eventually, the write index reaches the position directly behind the read index, meaning the buffer is full.