CAPSTONE Group 062
Bird Impact Detection System
Requirements Document

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1 Background and Context

The UBC Social Ecological Environment Development Studies (SEEDS) program is internationally renowned for valuable contributions to UBC's sustainability and environmental goals(1). The program views UBC campus as a living laboratory, creating and implementing solutions to various sustainability issues that may be scaled up later for use on a larger city scale.

The Green Building Manager at UBC, Penny Martyn, is a certified architect with over 12 years of experience in the field of innovative green building design - and the primary client for the project. The Green Building Manager has previously done research through SEEDS on the number of bird impacts on the buildings of UBC campus due to birds being unable to distinguish reflective or transparent windows as glass. Current research at UBC has shown that potentially upwards of 20 birds collide with any given window on UBC campus every year, as shown in Appendix A. This research has been sufficient for the Green Building Manager to identify bird collisions on campus as a challenge in green building design.

The Green Building Manager has done many projects with SEEDS, including multiple reports related to birds and the ecosystem at UBC. As a primary author of UBC's green building policies and procedures, the Green Building Manager is invested in the preservation of the natural ecosystem on UBC campus. It is imperative to the Green Building Manager that the research regarding bird impacts on campus is thorough and accurate, as it will guide future bird protection policies that are created. For further research purposes, the Green Building Manager requires a method to increase accuracy and make the collection of bird impact data more convenient for researchers. The goal of this project is ensuring that the collection of data is accurate,

and making that collection easier to perform.

The current method of quantifying bird impacts on windows on UBC campus is manual, relying on employees or volunteers surveying buildings for evidence of bird impacts. This is considered inadequate for long-term research purposes due to the high inherent error and significant time necessary to manually identify impacts. Manual identification of bird impacts is known to have significant error for multiple reasons, including other animals scavenging bird carcasses and birds moving away from the window before succumbing to injuries.

2 Domain

The project is a sensing system that fills a niche for identifying bird impacts on windows. It is a noncommercial prototype that could be scaled up to identify sustainability issues of buildings regarding bird impacts. The prototype would be employed on UBC campus initially, with potential for the project to be used in other environments in the future where bird impacts are a concern.

Several studies on similar topics have been previously conducted for commercial and non-commercial purposes(2)(3)(4). These studies focus on the use of sensor systems to quantify the number of bird impacts on wind turbines in marine and terrestrial environments. All of the previous studies focus on the narrow sector of bird impact detection on wind turbines, indicating that the domain for this project is unique in non-commercial terms. To the best of the knowledge of Capstone Group 62, no commercial bird impact detection technology exists with a focus on windows.

Currently, the only method the client has to collect data in the domain

of bird impacts upon windows is manual detection via surveying (5). This method serves as the requirements baseline for the project. The client estimates that the manual method has an approximate error rate of 25%. This project automates the identification of bird impacts, using sensors to monitor surfaces where impacts might occur rather than physical evidence.

3 Significance to Client

This project will provide the following benefits to the Green Building Manager at UBC:

- Supports the Green Building Manager in designing future iterations of the UBC Green Buildings Action Plan, Bird Friendly Design section(6).
- Facilitates future research regarding the effect of bird impacts on the campus ecosystem.
- Provides a basis for future projects in the domain of bird impact detection.

4 Functional Requirements

This list consists of the functional specifications of the system:

FR1: The system must be able to detect bird impacts. More specifically, it must be able to acknowledge bird impacts involving a variety of bird species, and discern between bird collisions and other disturbances against window panes.

FR2: The system must record bird impact events. Upon detection of a bird impact as defined in Functional Specification 1, that event must be recorded in a database.

FR3: Recorded bird impact events must be continuously accessible. A user must be able to obtain data from the system at any time.

5 Non-Functional Requirements

This list consists of the non-functional specifications of the system:

NFR1: Maximum bird strike detection error rate of at most 5% from any single source. The sources considered for this error rate are:

- False Negatives
- False Positives

False negatives indicate a strike occurred but was not recorded, and false positives indicate a strike was recorded but did not occur.

NFR2: The system must be able to operate for 7 days continuously without need for maintenance.

NFR3: Data stored must be accessible to a user possessing basic spreadsheet skills.

6 Constraints

The following are the constraints that have been identified for the system.

C1: The overall system must cost less than $80 per one-window detection system. This is identified by the client, to facilitate the reproduction and future iterations of the system.

C2: Data recorded and stored must contain, at minimum, the information provided in Appendix A. This is defined as acknowledgement of the

bird impact, and an identifier that identifies the building and window on which the impact occurred. This is identified by the client, who requires this data for research purposes.

C3: The system must not cover or obscure more than 10% of the window it is installed on. This is identified by the client, as the window will still be in use when the bird impact detection system is installed.

C4: The system must operate on a window with dimensions 2' by 3'. This is identified by the client, as the bird impact detection system must work on a typical window on UBC Campus.

C5: The system must operate on UBC Campus. This is identified by the client, who plans to measure bird impacts on UBC Campus.

References

1 SEEDS. About seeds. [Online]. Available: https://sustain.ubc.ca/courses-degrees/alternative-credit-options/seeds-sustainability-program/about-seeds

2 A. Pandy, J. Hermence, and R. Harness, "Development of a cost-effective system to monitor wind turbines for bird and bat collisions." [Online]. Available: https://pdfs.semanticscholar.org/a6ef/0c54709a9b54995a3d3b4d3d918ca7259a4a.pdf

3 J. Flowers, R. Albertani, T. Harrison, B. Polagye, and R. M. Suryan, "Design and initial component tests of an integrated avian and bat collision detection system for offshore wind turbines," Seattle, WA.

4 dtbird, "Bird monitoring reduction of collision risk with wind turbines." [Online]. Available: https://dtbird.com/images/Downloads/DTBird_System_Brochure_Septem_2017.pdf

5 A. Porter and A. Huang, "Bird collisions with glass: Ubc pilot project to assess bird collision rates in western north america (phase 2)." [Online]. Available: https://sustain.ubc.ca/sites/sustain.ubc.ca/files/seedslibrary/BWC%20report%20SEEDS%20May%202015.pdf

6 UBC. Bird friendly design. [Online]. Available: https://sustain.ubc.ca/campus-initiatives/green-buildings/bird-friendly-design

Appendix A: Client Sample Collected Data

facade	annual.collision		facade	annual.collision
Asian Centre 1	21		Marine drive 1	0.5
Asian Centre 2	2.5		Marine drive 10	1
Asian Centre 3	4.5		Marine drive 11	1.5
Asian Centre 4	7		Marine drive 12	2
FP 1	0		Marine drive 13	2.5
FP 2	0		Marine drive 14	0
FP 3	2.5		Marine drive 15	4
FP 4	1		Marine drive 2	2
FP 5	3.5		Marine drive 3	2.5
FP 6	0		Marine drive 4	5.5
FP 7	9		Marine drive 5	0
FP 8	0		Marine drive 6	3
International 1	16		Marine drive 7	0
International 2	0		Marine drive 8	0.5
International 3	0.5		Marine drive 9	0
International 4	0		Okanagan 1	1
Irving 1	2		Okanagan 2	6
Irving 10	19.5		Okanagan 3	0
Irving 2	2		Okanagan 4	3.5
Irving 3	0		Osborne 1	0
Irving 4	26		Osborne 2	2.5
Irving 5	1		Osborne 3	1.5
Irving 6	1.5		Osborne 4	4
Irving 7	1		Wesbrook 1	0
Irving 8	2		Wesbrook 2	0
Irving 9	1.5		Wesbrook 3	0.5
			Wesbrook 4	0
			Wesbrook 5	1.5
			Wesbrook 6	1
			Wesbrook 7	0
			Wesbrook 8	1.5
			Wesbrook 9	0.5