Group 7: Active Bird Deterrent

Project Closeout

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Kathleen Xiong (xiongk@oregonstate.edu)
Victoria Vasquez (vasquevi@oregonstate.edu)
XiYuan Huang (huanxiyu@oregonstate.edu)

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1.0 Design Impact Statement

The Design Impact Assessment provides a brief overview of our project's greater impacts in the areas of public health, social, environmental, and economic areas.

1.1 Public Health, Safety, and Welfare Impacts – Dead birds are known to pose a health risk to humans. Birds carry diseases such as Salmonella, Trichomoniasis, Aspergillosis, Avian pox, [1] and more. Coming into contact with a dead bird may put that person into contact with the bird's feces or saliva, which may contain pathogens that can cause illnesses in humans [2]. By decreasing frequency of avian deaths from window collisions, this project may reduce the contact humans have with dead birds and reduce the transmission of disease-causing pathogens. The project may also positively impact the public's mental and emotional health by decreasing the public's exposure to dead wild birds. Some people report sadness and brief moments of grief at finding a dead wild animal such as a bird or squirrel [3]. However, the project may have a negative impact on public health and safety by the pollution associated with mass producing this system if it were to enter the market.

1.2 Cultural and Social Impacts – Some large cities like Toronto, New York, San Francisco, and others have initiated light-off plans to persuade building owners to turn off the lights from dusk to dawn during bird migration seasons [4]. The active bird deterrent project may also serve the purpose of raising people's awareness to protect wild birds, and also has the potential to have significant impact on groups like the Audubon Society that are concerned with environment and wildlife conservation. The Audubon Society in Pennsylvania and Portland, for example, promote multiple solutions to reduce bird-window collisions [5], [6].

1.3 Environmental Impacts – Birds fill key roles in ecological systems that are vital to the health of the environment and perform irreplaceable natural services that humans benefit from [7]. Therefore, this project may potentially impact the environment by saving birds' lives so that they can continue to thrive and contribute to their ecological service roles. This project may also have a detrimental effect on the environment due to electronic waste from the batteries, sensors, and OpenMv microcontroller. Electronic equipment contains toxic heavy metals, such as lead and mercury, which may harm human health and the environment [8].

1.4 Economic Impacts – Humans receive a non-trivial economic benefit from the ecological services that wild birds contribute to the natural environment. It is estimated that the full value of the world's ecosystem services are worth 44 trillion U.S. Dollars [9]; therefore, healthy ecosystems are an economic capital worthy of investing in. Our project aims to protect wild birds which is an investment in the natural environment and the economic benefit humans receive from healthy ecosystems.

1.5 Conclusion – The Active Bird Deterrent project has the potential to have a large impact beyond its immediate use, which is especially true if it were to be released into the market.

2.0 Project Timeline

TASK NUMBER	TASK TITLE	TASK OWNER	Week of the Term										
			Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Finals
1	**Fall Term**												
1.1	Engineering Requirements	Team											
1.2	Block Diagram	Team											
1.3	Project Charter	Team											
1.4	Meeting with project partner	Team		10/23/20		10/9/20		11/6/20					
2	**Winter Term**												
2.1	Block check offs #1	Team											
2.1.1	Solar Panel	Victoria											
2.1.2	LED Light Control	Kathleen											
2.1.3	PIR sensor	XiYuan											
2.2	Block check offs #2	Team											
2.2.1	Lithium ion Battery	Victoria											
2.2.2	Ultrasonic Sensor	XiYuan											
2.2.3	Strobe Light	Kathleen											
2.3	Block check offs #3	Team											
2.3.1	Charge controller Module	Victoria											
2.3.2	OpenMV microcontroller	XiYuan											
2.3.3	Code	Kathleen											
2.4	Meeting with	Team				1/29/2				2/26/2			

	project partner					1				1			
3	**Spring Term**												
3.1	First iteration of System Integration	Team											
3.2	Second iteration of system integration	Team											
3.3	Project closeout and showcase	Team											
3.4	Meeting with project partner	Team								5/21/21			

3.0 Scope and engineering requirements summary

Engineering Requirements	Evidence Links
The system will activate 6/10 times when birds/tennis balls are thrown within 10 feet of a 5 by 3 foot area	https://drive.google.com/file/d/1FUk_sljogg7lQwA1W3-RgBdrGw0L_rHX/view?usp=sharing
The system will activate 6/10 times when birds approach/tennis balls are thrown at a window from a range of +/- 45 degrees as measured from the center of the system.	https://drive.google.com/file/d/1sfv_3i2lH1ah5HGnqgGhP0c4bUR5gNYx/view?usp=sharing
The device will use a deterrence method that will frighten away the bird 6/10 times.	https://drive.google.com/file/d/1_8-r5VoNiSLp7a4GrR5lfhAmAw5V1WhJ/view?usp=sharing
9 out of 10 people surveyed will confirm that the system is not overly distracting when it is activated 3 times in 5 minutes on a window.	https://drive.google.com/file/d/1klywi9r24OwmYoIhLj7OpbATgX1aJZ7w/view?usp=sharing
The system will operate for at least 10 hours with a new power source installed.	https://drive.google.com/file/d/1-N8sU19JN4C7VyuLRSj-8Nu1W5w73uN9/view?usp=sharing
The system will include market research where at least 50 individuals have identified a price range, interest in purchasing, and reasons why or why not the individual would likely use or not use the system.	https://drive.google.com/file/d/1S7pkyXwC4c4rH3PE9khQxpTnsCPnxTSw/view?usp=sharing
The system will remain mounted for a minimum of 8 hours on a window after the window is impacted by a tennis ball twice, thrown at a speed of at least 10 m/s.	https://drive.google.com/file/d/1rRGXmIPKUHRLrsiwzQGS696lThV7eO_A/view?usp=sharing
The system must allow no more than 1 ounce of water to penetrate the interior enclosure when sprayed with a hose of at least 1 gallon per minute from the front and top of the system.	https://drive.google.com/file/d/1YIQl1QVKDETPBxbHqhxECEVl0sw_6_VX/view?usp=sharing

4.0 Risk Register

Risk ID	Risk Description	Risk Category	Risk Probability	Risk Impact	Performance indicator	Responsible Party	Action Plan
R1	Vendor Delay/Mailing time Constraint	Timeline	50%	Med	Price or shipping change, delay in ordering parts.	Victoria Vasquez vasquevi@oregonstate.edu	Reduce
R2	Inclement Weather	Environment	65%	Med	Forecast changes to more rain and cold winters. Our system is unable to perform correctly.	Kathleen Xiong xiongk@oregonstate.edu	Avoid
R3	System Limitations	Technical	80%	High	System malfunctioning due to Code, incorrect circuitry,or team confusion on the system as a whole	XiYuan Huang huanxiyu@oregonstate.edu	Avoid
R4	COVID constraints	Illness, External constraint	75%	Med	Team is unable to meet, Team member gets sick, can't field test due the state rules	Victoria Vasquez vasquevi@oregonstate.edu	Retain
R5	Project Expenses	Budget	30%	Low	Equipment gets too expensive and we go over budget.	Kathleen Xiong xiongk@oregonstate.edu	Avoid

Figure 1: Team Risk Register

Throughout the year the team has faced many technical and non technical challenges. These challenges have all come with risks and as a team we were able to analyze the situation and make a decision with the least amount of risk. An example of this is the challenge of working as a team remotely. Being remote means there are less available

resources, lab times, and especially time to meet with one another. As a team we were able to minimize the risks that come with working remotely by meeting twice the last term, and also building two systems. By having two systems, we had less complications with who would have the system at what time. Another example of a risk we had to consider was when we were faced with the challenge of system limitations. Our project is a unique and one of a kind system, this meant that we were the first ever to create a system like this. In the real world, a product is never perfect the first time. Therefore as a team we have to minimize our risks of system limitations by analyzing the best way we can accomplish the job right now, and then jotting down improvement recommendations along the way. In conclusion, for this risk we made our technical decisions based on making sure that our system will meet the requirements, and then we will give suggestions on how to make the system better. There weren't any risks that we didn't anticipate, but there are risks that we didn't anticipate to have a higher probability than we anticipated. For example, we expected the risk of overspending on project expenses to be only 20 percent. Yet, in reality we spend double on our project in order to build two systems for testing.

5.0 Future Recommendations

Recommendation:	Type of Recom.	Reason for Recommendation:	Starting point for recommendation:
1. Research best Bird Deterrence and bird behaviors	Technical	Our team had a hard time scaring away birds with just the LEDs. This might have been due to the LEDs not being bright enough. However, our team still has some doubts on if LEDs can even scare birds. We recommend researching the best deterrence method, whether it be some type of motion, making noise, or brighter LEDs or infrared lights.	We recommend starting the research with theoretical research using scholarly articles to support a type of deterrence method the team should try. Then the team should also do some experimental research by testing these deterrence methods on birds before implementing it to the system.
2. System on Single Power Source	Technical	The current system has two power sources. On from the lithium ion battery and one for the LED circuit. The best thing to do would be to change the circuitry so that the whole system would be running on one power source. This is an easy fix, but due to lack of time and COVID restrictions our team had continued on the finalization process without realizing that having two power sources is inconvenient and nontraditional.	This is an easy change and we recommend that the starting point be connecting the LED circuit to an output pin from the charge controller. At the same time, it would be a good idea to look into brighter LED options if you were to change the LED circuit anyways.
3. Off/on Button on the outside of the enclosure.	Technical	One of the easiest changes that we recommend is to create an user friendly off/on switch or button on the outside of the enclosure. Externally there is no off and on switch. The final system has an off and on switch in the inside of the system for testing purposes. By the time we realized we should have placed one outside so that it is user friendly, the team had already finalized the enclosure design.	A good starting point for this is to create a schematic of how the team would wire the switch. Then the team should look into heavy duty and weatherproof switches so that it can be placed on the outside of the system for consumers to use.
4. Mounting not directly on Window	Technical	Another recommendation that we have is to create a system where the mounting is not directly on the window. One of our engineering requirements is that our system will be inconspicuous. A lot of the current bird deterrence methods cover up most of the window. Then to be completely	A good starting point for this idea is looking into stringed LEDs or creating a system that can be mounted to the side of the house. Having a string of LEDs allows the user to string the LEDs on the border of the window instead of blocking the view. Then on the other hand, if you were to have a system

		different from the rest, we would recommend trying to mount the system not on the window at all.	mounted to the side of the house not directly on the window it would allow the system to still be small and users can see through the window.
5. Change Ultrasonic Sensor	Technical	One of the biggest technical problems we had was with the ultrasonic sensor. This sensor was not fast enough to detect a bird, thus we used it to detect slow moving objects. Since it is too slow to detect a bird, then we know that whatever we did detect from the ultrasonic sensor must not be a bird, therefore we would not flash any lights. However, we still found trouble with the sensor. It didn't detect motion, and would only detect an object if it stayed right in front of it for a long time. Therefore, we would recommend changing the ultrasonic sensor all together and using something else.	A starting point would be to explore different sensors. The purpose of our Ultrasonic sensor is to detect slow moving objects and we wouldn't flash any LEDs at it. Therefore, it's best to research the best type of sensors to detect non-bird objects. A good start is to look into different proximity sensors and testing which would work best.
6. Use waterproof modules	Technical	One of the engineering requirements that we had was making sure the system was weatherproof. We accomplished this by sealing all cracks and then spraying the system with a hose. However what we did make a requirement is that the system will continue to work after the process. Therefore, we recommend that the next steps for this system is to make sure that all components are waterproof and the system will still work after testing the weatherproof requirements.	The best starting point for this recommendation is buying waterproof components. For example, the ultrasonic sensor must have an opening so that it can send ultrasonic waves to the environment. Therefore, it would be a great start to get a waterproof ultrasonic sensor. Then from there the next team can use stronger sealant other than hot glue to make sure that no water will penetrate the system.
7. Project user friendly guide	Project Manage ment	Our team recommends that there should be a project user guide. The reason for this is because in our marketing survey we got a good percent of the participants saying that they wouldn't be interested in purchasing because it looks complicated, how to keep it well maintained, etc. Therefore, if the next team were to create a user friendly guide on the system, it would erase any confusions that a consumer might	A good starting point would be to create an outline. Within this outline it must have a user operations manual, maintenance instructions, and part specifications. If the report has a user operations manual it will be easier for others to understand how to use it. If it had minatiance instructions, consumers would understand the basic protocols to make sure their system is working in the best conditions. And lastly, it's important to have a part

		have if they were to purchase the system.	specifications so that consumers know exactly what is included in their system.
8. System bird deterrence testing changes	Technical	The reason for this recommendation is because as a team, this was our hardest final system checkoff. For our bird deterrence testing, we had decided to use wild birds to react to our system. There are a number of problems with that. One problem is the unpredictability of how many birds you will get. The second problem is that we were having the birds fly to a bird feeder, and this doesn't simulate the same effect of a bird flying at full speed toward a window. And lastly another problem we had with this testing process was the birds would get used to the flash and not get scared.	The starting point we would recommend for this change would be to first research the best deterrence method for birds. (please see recommendation 1). Then once you get a great deterrence method, test the deterrence method on domestic birds. One option that we were leaning toward was using pet birds, and deterring them once or twice throughout the week. This way you have a controlled testing process and you are assured that the deterrence method will work on domestic and wild birds.

6.0 Appendix - Sources Cited

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