INFRARED BIRD REPELLENT SENSOR

Muhammad Hafiz Kamarudin[1*], Mohd Suri Saringat[2] and Hairman Omar[3]

[1] Department of Mechanical Engineering,
Politeknik Melaka, No 2, Jalan PPM 10, Plaza Pandan Malim, 75250 Melaka,
Melaka, Malaysia.

[2]Department of Petrochemical Engineering,
Politeknik Tun Syed Nasir Syed Ismail, Hab Pendidikan Tinggi Pagoh, KM 1,
Jalan Panchor, 84600 Pagoh,
Johor, Malaysia.

*Corresponding Author's Email: vilgrim82@gmail.com

Article History: Received xxxxx; Revised xxxx; Accepted xxxx

ABSTRACT: The bird repellent project aims to integrate innovative technology to create an effective and humane solution for deterring birds from settling in unwanted areas. By utilizing sound and light sensors, the system will detect the presence of birds and activate deterrent mechanisms accordingly. The sound sensors will capture birds' movement nearby, triggering ultrasonic emitters that produce high-frequency sounds unpleasant to birds. Simultaneously, light sensors will detect changes in ambient light caused by bird movements, activating flashing lights or laser patterns to scare them away. This dual-sensor approach ensures that the repellents are only activated when necessary, minimizing energy consumption and reducing the impact on non-target species. The project's design emphasizes safety and environmental considerations, ensuring that the methods used are both effective and humane, making it a sustainable solution for bird control in various settings. The results conclusively showed no new bird droppings accumulated on the floor throughout the experiment. The floor area remained as clean as it was initially prepared, affirming that the bird repellent device operated with 100% effectiveness in deterring birds. This outcome indirectly guarantees a disturbance-free environment from bird noises and ensures the cleanliness of the floor, free from bird droppings.

KEYWORDS: *Bird repellent, infrared sensor, bird droppings, noise pollution, health risks, bird roosting, architectural designs.*

1.0 INTRODUCTION

Birds in Malaysia represent a diverse and integral component of the country's natural ecosystems, with over 700 species contributing to biodiversity across various habitats, from rainforests to coastal areas. They play vital roles such as seed dispersal, insect control, and pollination, thereby supporting ecosystem health and resilience.

However, the presence of birds, particularly in urban settings, can lead to challenges related to bird droppings and sound disturbances. Bird droppings, a natural byproduct of bird activity, can accumulate on buildings, sidewalks, and vehicles, posing sanitation issues and potential health risks due to bacterial and fungal spores they may carry. In urban areas, where birds adapt to human environments for food and shelter, the concentration of droppings can become a nuisance and require regular cleaning and maintenance efforts.

Sound disturbances caused by bird vocalizations also affect human communities. Common urban birds like crows, pigeons, and mynas can produce calls and vocalizations that, when amplified by urban environments, contribute to noise pollution. This noise pollution can disrupt daily activities, disturb sleep patterns, and impact overall quality of life for residents.

Managing bird-related challenges in urban areas involves a combination of strategies. These include architectural designs that discourage bird roosting and nesting, implementing humane deterrents to modify bird behavior away from sensitive locations, and fostering public awareness and education on coexistence practices. Additionally, urban planning efforts that consider both human needs and wildlife conservation are essential for creating sustainable and harmonious urban environments where both people and birds can thrive.

0.1 Problem Statement and Research Focus

Most buildings, particularly in the shop lot area, have become nesting sites for birds such as pigeons, sparrows, and swallows. This disrupts the environment and poses health risks. The birds produce loud noises that distract people and interfere with their concentration. Additionally, bird droppings scattered across floors create unsanitary conditions and health hazards, including asthma, histoplasmosis, cryptococcosis, and bird flu. Consequently, the floors become dirty, and an unpleasant odor permeates the area, affecting everyone.

1.2 Project Significant

The "Infrared Bird Repellent Sensor" project addresses the challenges posed by bird disturbances and droppings in buildings. It saves cleaning time by minimizing the need to clean floors covered in hard-to-remove bird droppings, maintains cleaner floors to prevent dirt spread, reduces bird-related noise disruptions, and fosters a better learning and working environment. Moreover, it enhances overall health and safety by shielding individuals from bird filth exposure. Ultimately, by effectively repelling birds, this project greatly enhances cleanliness, hygiene, and tranquility in its environment.

2.0 LITERATURE REVIEW

A review of projects addressing bird-related challenges in urban environments reveals several key strategies and considerations. These projects typically focus on managing issues such as bird droppings, noise disturbances, and potential health risks associated with bird presence.

Architectural designs are pivotal in addressing the persistent issue of buildings affected by bird droppings. Research underscores the effectiveness of structures like angled surfaces, bird spikes, and netting, which deter birds from roosting and nesting in problematic areas. Integrating these designs into building planning is crucial to reduce maintenance costs and health hazards associated with accumulated droppings. This issue poses a substantial concern across urban and rural environments alike.

Humane deterrents also feature prominently in literature on bird management projects. Techniques such as sound emitters, visual deterrents like reflective materials or predator decoys, and non-toxic chemical repellents are employed to modify bird behaviour without harming them. Research underscores the need for evidence-based approaches to ensure the efficacy and ethicality of these methods.

2.1 Roosting and Nesting Sites

Birds often choose buildings for roosting and nesting due to their sheltered spaces and ledges. These areas provide protection from predators and the elements, making them attractive locations for birds to settle.

2.2 Food Sources

Buildings near food sources, such as restaurants or food markets, may attract birds looking for easy access to food waste. The presence of food further encourages birds to frequent these areas, increasing the likelihood of droppings accumulating.

2.3 Perching Habits

As illustrated in figure 1 certain bird species have specific perching habits, favoring ledges, rooftops, and other elevated surfaces for resting between foraging or during migration. These habits lead to concentrated areas where droppings accumulate over time.

Figure 1: Birds Perching Area in Various Building

2.4 Health and Sanitation Concerns

Accumulated bird droppings, as depicted in figure 2, pose sanitation risks due to the presence of bacteria, fungi, and parasites that can potentially cause health issues for humans. Additionally, the acidity of bird droppings can corrode building materials over time, leading to maintenance challenges and costs.

Figure 2: Bird Droppings Area in Various Sidewalk

3.0 METHODOLOGY

Creating a bird repellent sensor involves a systematic methodology that integrates various processes to ensure functionality and reliability. Considerations throughout the process include safety measures when handling tools and electrical components, the effectiveness of the electrical components chosen, and ensuring weatherproofing for outdoor durability. This structured approach ensures the bird repellent sensor is not only effective in its function but also durable and suitable for outdoor applications.

3.1 Cutting PVC Pipe

The process begins with cutting a PVC pipe to the desired length, ensuring clean and precise cuts to serve as the main body of the sensor. Once cut, the PVC pipe is prepared by spraying it with a bird repellent substance, applied evenly to deter birds effectively.

Figure 3: Cutting and Spraying PVC Pipe

3.2 Wiring Process

Next, the wiring process commences, where electrical components such as motion sensors, wires, and batteries are assembled and connected. This step includes securely mounting the motion sensor onto the PVC pipe and wiring it to a power source, along with any additional circuitry required for operational features like LED indicators and siren alarms.

Figure 4: Wiring Installation Process

3.3 Install On/Off Button

Integration of an ON/OFF button provides manual control over the sensor's activation, strategically installed and wired to the sensor circuitry.

Figure 5: Install On/Off Button

3.4 Finish Model

Finally, the assembly undergoes a thorough check to ensure all components are securely attached and properly connected. Testing follows to validate the sensor's functionality in detecting motion and activating the repellent system as intended.

Figure 6: Infrared Bird Repellent Sensor

4.0 RESEARCH FINDINGS

To validate the effectiveness of the completed bird repellent project, an experiment was conducted in two locations known for its bird droppings, as depicted in figure 7 and figure 8. Prior to the experiment, the floor was cleaned to remove all existing droppings. The primary objective was to assess whether the bird repellent device could prevent new droppings from accumulating once deployed. This served as an indirect test of the device's capability and efficacy. The bird repellent device was strategically positioned on the fifth floor and clearly marked with warning signs to avoid interference from the public. It operated continuously in standby mode for two weeks, during which its sensor system, including a sound siren and LED lights capable of detecting bird movements within a 2-meter range, was activated by pressing the on button. Whenever the sensor system detected birds in proximity, the device emitted sound and illuminated the LED lights to deter them.

Figure 7: Before and After Installing Infrared Bird Repellent Sensor on the Sidewalk A

Figure 8: Before and After Installing Infrared Bird Repellent Sensor on the Sidewalk B

The results conclusively showed no new bird droppings accumulated on the floor throughout the experiment. The floor area remained as clean as it was initially prepared, affirming that the bird repellent device operated with 100% effectiveness in deterring birds. This outcome indirectly guarantees a disturbance-free environment from bird noises and ensures the cleanliness of the floor, free from bird droppings.

5.0 CONCLUSIONS

Central to the project's success was the innovative approach taken to design an effective infrared bird repellent sensor. Understanding the operational mechanics of the sensor was crucial in refining its functionality for practical application. By exploring these principles and optimizing the repellent's design, the project aimed to enhance its usability and affordability.

In conclusion, the successful integration of design analysis, comparative evaluation, and innovative thinking has positioned the project at the forefront of improving bird repellent technology. By offering a streamlined yet efficient solution, the project endeavors to facilitate more accessible and efficient bird deterrence methods across various environments.

ACKNOWLEDGMENTS

The authors would like to thank the Director of Politeknik Melaka and the Department of Mechanical Engineering, as well as the Director of Politeknik Tun Syed Nasir Syed Ismail and the Department of Petrochemical Engineering for their constant encouragement of this research project.

REFERENCES

[1] Ahmad, Muhammad Baballe, Abubakar Sadiq Muhammad, Abdullahi Abba Abdullahi, Abdulrazak Tijjani, Auwal Sani Iliyasu, Ibrahim Mahdi Muhammad, Isa Ibrahim et al. "Need for security alarm system installation and their challenges faced", *International Journal of New Computer Architectures and their Applications (IJNCAA)*, vol. 9, no. 3, pp. 68-76, 2019.

[2] Ahmad, Muhammad Baballe, Abdullahi Abba Abdullahi, Abubakar Sadiq Muhammad, Yusuf Bello Saleh, and Usman Bukar Usman. "The Various Types of sensors used in the Security Alarm system", *International Journal of New Computer Architectures and their Applications (IJNCAA)*, vol. 9, no. 2, pp. 50-59, 2019.

[3] Aldar, Supriya, and Ganesh Deshmukh. "Mosquito Repellent, Prevention is better than cure", *Asian Journal of Research in Pharmaceutical Science*, vol. 9, no. 3, pp. 193-198, 2019.

[4] Al-Mamun, GM Sharif Ullah, and Abdullah Omar Faruk. "Analysis Of Sensors Used to Make Smart Homes", *LC International Journal of STEM*, vol. 2, no. 4, pp. 1-6, 2021.

[5] Bakar, W. A. W. A., M. Man, L. C. Hwa, and L. Y. Wang. "iAMR: intelligent auto-dispenser mosquito repellent system", *IOP Conference Series: Materials Science and Engineering*, vol. 1173, no. 1, pp. 012038, 2021.

[6] Cantarini, Michela, Leonardo Gabrielli, and Stefano Squartini. "Few-shot emergency siren detection", *Sensors*, vol. 22, no. 12, pp. 4338, 2022.

[7] Clapperton, B. Kay, Dai KJ Morgan, Tim D. Day, Kerry E. Oates, Alison M. Beath, Neil R. Cox, and Lindsay R. Matthews. "Efficacy of bird repellents at deterring North Island robins (Petroica australis longipes) and tomtits (P. macrocephala toitoi) from baits", *New Zealand Journal of Ecology*, pp. 116-123, 2014.

[8] Clapperton, B. K., T. D. Day, D. K. J. Morgan, Frances Huddart, Neil Cox, and L. R. Matthews. "Palatability and efficacy to possums and rats of pest control baits containing bird repellents", *New Zealand Journal of Zoology*, vol. 42, no. 2, pp. 104-118, 2015.

[9] Crowell, Michelle, Lynn Booth, Phil Cowan, Alastair Fairweather, and Ian Westbrooke. "Stability of bird repellents used to protect kea (Nestor notabilis) during aerial 1080 cereal operations", *New Zealand Journal of Ecology*, vol. 40, no. 1, pp. 42-48, 2016.

[10] DeLiberto, Shelagh T., and Scott J. Werner. "Applications of chemical bird repellents for crop and resource protection: a review and synthesis", *Wildlife Research*, vol. 51, no. 2, 2024.

[11] Esther, Alexandra, Ralf Tilcher, and Jens Jacob. "Assessing the effects of three potential chemical repellents to prevent bird damage to corn seeds and seedlings", *Pest Management Science,* vol. 69, no. 3, pp. 425-430, 2013.

[12] Kumar, Dharmendra, Ankit Verma, Mukesh Kumar, Vipin Maurya, and Ashutosh Mishra. "Utilizing machine learning for the assessment of mosquito repellent effectiveness and decision support in product selection", *International Journal of Sustainable Building Technology and Urban Development,* vol. 14, no. 4, pp. 519-533, 2023.

[13] Laursen, Willem J., Gonzalo Budelli, Ruocong Tang, Elaine C. Chang, Rachel Busby, Shruti Shankar, Rachel Gerber, Chloe Greppi, Rebecca Albuquerque, and Paul A. Garrity. "Humidity sensors that alert mosquitoes to nearby hosts and egg-laying sites", *Neuron,* vol. 111, no. 6, pp. 874-887, 2023.

[14] Meucci, Filippo, Laura Pierucci, Enrico Del Re, L. Lastrucci, and P. Desii. "A real-time siren detector to improve safety of guide in traffic environment", *16th European Signal Processing Conference,* pp. 1-5, 2008.

[15] Muhumuza, Naboth. "An electronic mosquito repellent system to avoid mosquito bites using ultrasound sound sensor", 2023.

[16] Orr-Walker, Tamsin, Nigel J. Adams, Lorne G. Roberts, Joshua R. Kemp, and Eric B. Spurr. "Effectiveness of the bird repellents anthraquinone and d-pulegone on an endemic New Zealand parrot, the kea (Nestor notabilis)", *Applied Animal Behaviour Science,* vol. 137, no. 1-2 pp. 80-85, 2012.