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BIRDS BUDDY: THE SHELTER TO BIRDS

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Abstract - The present project relates to a Birds shelter and method. This smart shelter aims to support local bird populations, particularly in urban areas where natural water sources may be scarce and no developing places for birds. By integrating technology with wildlife conservation, the BIRDS BUDDY shelter fosters coexistence between humans and nature, encouraging biodiversity and environmental awareness. The design is simple, scalable, and can be customized to include features like temperature sensors, automated feeders, and cleaning mechanism, water level detector, making it a versatile tool for bird enthusiasts and conservationists alike. Overall, the BIRDS BUDDY project highlights the potential of affordable electronics in wildlife preservation, demonstrating how small innovations can make a meaningful impact on sustaining local ecosystems and protecting avian species for future generations.

Keywords: Methods of bird shelter, Raspberry pi-4 and sensors.

Introduction

Different methods of bird's shelter.

1. Natural Shelter
2. Artificial Birdhouses / Nest Boxes
3. Bird Shelters for Harsh Weather
4. Feeding-Based Shelters
5. Plant-Based Artificial Habitats
6. Temporary Emergency Shelters
7. Modern / Innovative Methods

Bird shelters can be created in many different ways, using both natural and artificial methods. Natural shelters include dense shrubs, thick bushes, tree cavities, climbing plants, and brush piles, which offer birds protection from predators and weather without the need for construction. Artificial shelters involve man-made structures such as wooden, clay, or gourd birdhouses, each designed to suit different bird species. For harsh weather, roosting boxes and windbreak shelters help birds stay warm and safe during cold or stormy conditions.

Some shelters are built around feeding areas, such as covered feeders or platform shelters, providing both food and protection. Landscaping with native plants, bamboo, or willow structures also creates long-lasting habitats that birds can use for nesting and hiding. Additionally, temporary shelters like ventilated cardboard or wooden boxes are used for injured birds or emergencies. Modern methods include green roofs, artificial nesting walls, and even 3D-printed nest boxes, which offer eco-friendly and species-specific shelter options, especially in urban areas.

Our paper is based on the bird shelter and feeder project were founded with a mission to provide a safe and nourishing environment for local and migrating bird populations. As natural habitats continue to shrink due to urbanization, deforestation, and climate change, many bird species struggle to find safe spaces to rest, forage, and nest. Recognizing this pressing issue, the shelter and feeder initiative was created to offer these vital resources in an accessible, sustainable, and bird-friendly way. Many people love songbirds and want to attract them to their homes. It's widely understood that a birdhouse should be designed with the right size and entrance for a specific species. However, it can be disappointing to buy a house tailored for a particular bird type only to find that no birds move in, leaving the house unused. If a birdhouse has a small entrance that needs enlarging, it's difficult to do so permanently, and if the entrance is made too large, it may allow fewer desirable birds to invade, which is also hard to correct. However, the size of the entrance is crucial in determining which birds will use it. While some smaller birds may nest in houses with larger openings, they typically prefer an entrance that keeps out predatory birds, more dominant birds, and animals like squirrels and rats. When homeowners are successful in attracting birds to a house on their property, they typically stay year-round as long as adequate, proper food is provided. Smart shelters and feeders not only provide birds with a secure habitat but also contribute significantly to maintaining ecological balance. By supporting avian species in urban landscapes, such systems help promote pollination, seed dispersal, and insect control—functions crucial for a healthy urban ecosystem. Therefore, integrating smart technology with traditional bird conservation practices is becoming increasingly essential. Traditional birdhouses, while simple and widely used, often fail to address factors such as varying bird sizes, entrance hole dimensions, predator risks, and weather conditions. Moreover, they offer no method for real-time monitoring, making it difficult for users to track bird activity, nesting patterns, or threats. These shortcomings highlight the need for a more intelligent, customizable, and data-driven sheltering solution.

a. EASE OF USE

The proposed bird shelter monitoring system is designed to be simple, efficient, and user-friendly. The use of a Raspberry Pi as the central controller allows easy integration of sensors such as the water level sensor, weight sensor, and smoke detector without the need for complex circuitry. The system's plug-and-play architecture enables quick setup and maintenance. Sensor data can be easily monitored through a web interface or mobile application, providing real-time updates on the shelter's condition. Additionally, open- source Python libraries simplify coding and customization, making it suitable for beginners and researchers alike. Overall, the system's modular design and automation ensure minimal manual intervention, improving reliability and accessibility for users with varying technical skills. The interface uses visual indicators such as graphs, alerts, and color-coded warnings to help users quickly identify abnormal conditions without needing technical expertise. The configuration process is also simplified through pre-installed scripts and automated setup procedures. Users only need to input basic information such as Wi-Fi credentials or threshold values for sensors, significantly reducing the time required for system initialization. To enhance accessibility, the system supports remote access through secure cloud integration. This allows users to monitor bird activity and shelter conditions from any location, increasing convenience for wildlife caretakers and researchers who may not always be physically present. Additionally, the system supports modular upgrades, allowing users to add or replace sensors without modifying the core hardware. This modularity ensures that even users with limited engineering knowledge can expand the system as needed. Error detection and troubleshooting features are also built into the system. Automatic error logs, diagnostic messages, and guided prompts assist users in resolving issues quickly, minimizing downtime and maintenance complexity. Energy-efficiency features such as automatic sleep modes and optimized sensor polling further reduce manual oversight. Users do not need to frequently check or adjust system settings, which improves long- term usability.

II.LITERATURE SURVEY

Table 1 Comparison of literature reviewed

SI NO	Author name	year	Proposed
[1]	Ooko, S.O. Ndashimye, E. Twahirwa, E. Busogi, M	2025	IoT and Machine Learning for Smart Bird Monitoring and Repellence: Techniques, Challenges and Opportunities
[2]	Rahman, M., & Rahman, S	2024	Development of IoT-Based Real-Time Fire Detection System Using Raspberry Pi and Fisheye Camera.
[3]	Sharma, R., Gupta, P., & Verma, S.	2023	Smart bird shelter using Arduino and iot for resource management.
[4]	Barron, A	2023	Design of a smart birdhouse incorporating environmental sensors.
[5]	Murugan, S., & Kumar, L.T.S	2022	Iot water level monitoring system
[6]	Ait Abdelouahid, R. Debauche, O. Mahmoudi, S. Marzak, A. Manneback, P. Lebeau, F.	2022	Smart Nest Box: IoT Based Nest Monitoring in Artificial Cavities.
[7]	Karle, S., Bansode, V., Tambe, P., Bhambare, R	2021	IoT Based Greenhouse Monitoring System Using Raspberry Pi
[8]	Arowolo, M.O.Adekunle, A. Ade-Omowaye, J.	2020	A Real Time Image Processing Bird Repellent System Using Raspberry Pi.
[9]	Youngblood, M	2020	A Raspberry Pi-based, RFID-equipped birdfeeder for the remote monitoring of wild bird populations.

Ooko, S.O., Ndashimye, E., Twahirwa, E., and Busogi, M. in 2025. The proposed work focuses on the application of IoT and Machine Learning for smart bird monitoring and bird repellence. It highlights various techniques used, as well as the challenges and opportunities associated with implementing such intelligent systems[1].

Rahman, M., and Rahman, S., published in 2024. The study presents the development of an IoT-based real-time fire detection system, which uses a Raspberry Pi and a fisheye camera. While not specifically limited to birds, the system contributes to environmental safety and monitoring systems that may be integrated with wildlife shelter[2].

Sharma, R., Gupta, P., and Verma, S. from 2023, proposing a smart bird shelter using Arduino and IoT. This design focuses on effective resource management, likely involving automated feeding, temperature control, or environmental monitoring[3].

Barron, A. from 2023. It describes a smart birdhouse equipped with environmental sensors. This system integrates monitoring of conditions such as temperature, humidity, or movement, enhancing the sustainability and safety of bird habitats[4].

Murugan, S., and Kumar, L.T.S. published in 2022. Their work demonstrates an IoT-based water level monitoring system, which can be useful in bird shelters for ensuring consistent water availability[5].

Ait Abdelouahid, R., Debauche, O., Mahmoudi, S., Marzak, A., Manneback, P., and Lebeau, F. from 2022. Their proposed system, called Smart Nest Box, focuses on IoT-based nest monitoring in artificial cavities, enabling detailed observation of bird behavior and habitat conditions[6].

Karle, S.J., Bansode, V., Tambe, P., and Bhambare, R.. This work involves an IoT-based greenhouse monitoring system using Raspberry Pi, which though designed for greenhouse environments, utilizes similar sensor and data- collection technologies applicable to bird shelters[7].

Arowolo, M.O., Adekunle, A., Ade-Omowaye, J. Their study focuses on real-time image processing for bird repellent systems, using Raspberry Pi to detect and deter birds using automated techniques[8].

Youngblood, M. from 2020, describing a Raspberry Pi-based, RFID-equipped bird feeder. This system is designed for remote monitoring of wild bird populations, using RFID tags to identify individual birds and track their feeding behavior[9].

II. BLOCK DIAGRAM.

This figure refers to the block diagram of bird's buddy shelter system that processes various inputs to generate specific outputs, functioning as an automated monitoring and control system. On the input side, the system receives signals related to water, cleaning, and food. These inputs could come from sensors — for instance, a water level sensor to monitor water availability, a cleaning sensor or manual trigger to start the cleaning process, and a volume level sensor to check for adequate food supply.

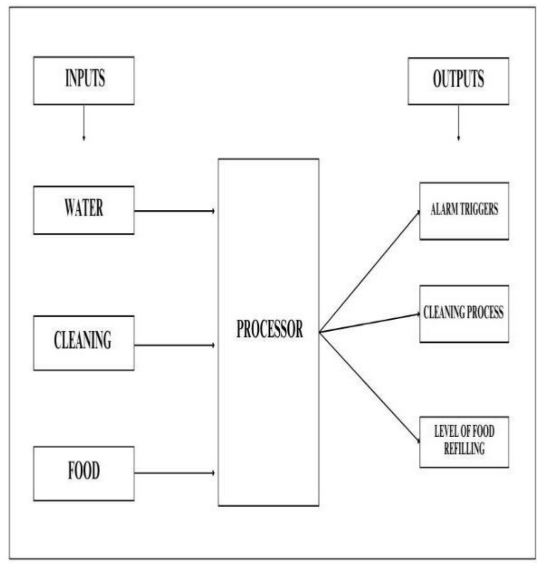

Fig.1-propoesd block diagram

The processor acts as the core of the system, collecting and analyzing data from these inputs to make decisions. Based on the information it receives; the processor can generate multiple outputs to maintain the system's functionality. For example, if the water level drops below a certain threshold or the food container is running empty, the system can activate an alarm to notify the user. If the cleaning input is triggered, the processor initiates the cleaning process automatically. Similarly, when food levels get low, the processor can either send an alert for manual refilling or, in an advanced setup, control a motorized dispenser to refill the food automatically.

a. METHODOLOGY

This figure refers to the Architecture of the bird's buddy shelter. The system begins with signals collected from sensors, which detect various environmental parameters or events. These signals are sent to a processor, which serves as the core decision-making unit of the system. The processor interprets the sensor data and determines the appropriate response.

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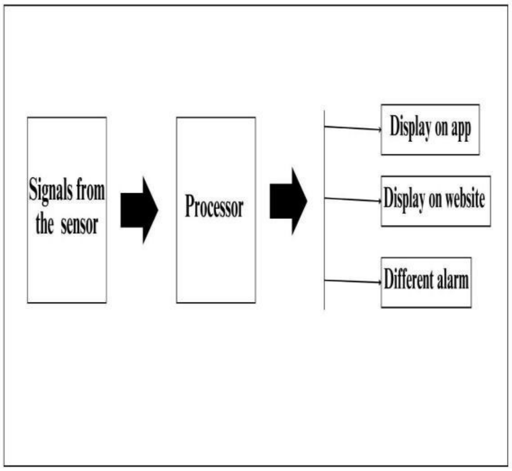

Fig.2-flow chart of the system

The processed information can then be displayed through multiple channels for user awareness and interaction. Specifically, the data can be showcased on a mobile application, allowing users to monitor conditions in real time. Additionally, the information can be accessed via a website for remote observation and analysis. In cases where immediate action is required, the system can trigger different types of alarms, alerting users to critical changes or anomalies. This setup illustrates a smart, connected solution where sensor-driven insights are made accessible across various platforms, enhancing responsiveness and control.

b. FLOW CHART

This figure refers to the flow chart of bird's buddy monitoring system that checks water and food levels will triggers alarms when these resources run low.

System Initialization:

The process begins with the system starting up.

It gathers input from two sensors: a water level sensor and a food sensor.

Data Collection and Processing:

The sensors send data to the processor.

The processor acts as the decision-making unit of the system.

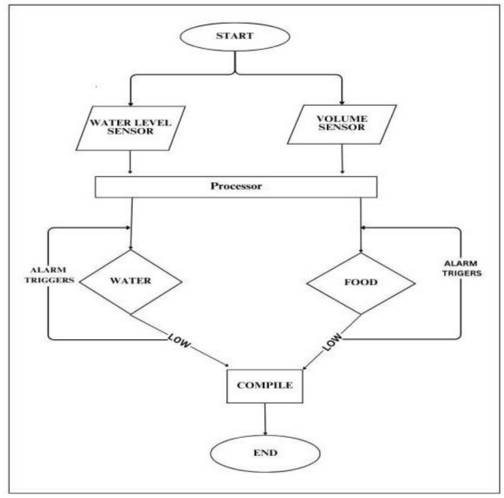

Fig.3-flow chart

Water Level Monitoring:

The processor checks the water level.

If the water level is low, the system triggers an alarm to notify the user.

Food Level Monitoring:

The processor checks the food level.

If the food level is low, another alarm is triggered to alert the user.

RESULT

The developed Raspberry Pi–based smart bird shelter successfully integrated a water-level sensor, weight sensor with HX711 amplifier, and smoke detector to create a real-time monitoring environment for birds. Experimental testing showed that the water-level sensor responded accurately to changes in water availability, with stable readings when sampled every 20 seconds. The weight sensor demonstrated high sensitivity in detecting the presence and movement of birds, capturing variations as small as a few grams, which is essential for monitoring feeding behaviour. The smoke detector operated reliably and triggered alerts within seconds of detecting abnormal air quality, thereby improving safety inside the shelter. All sensors communicated effectively with the Raspberry Pi, and data was processed smoothly using Python, confirming that the chosen components provided consistent and efficient performance. Overall, the system proved to be dependable, easy to operate, and suitable for continuous environmental monitoring in a bird shelter setup.

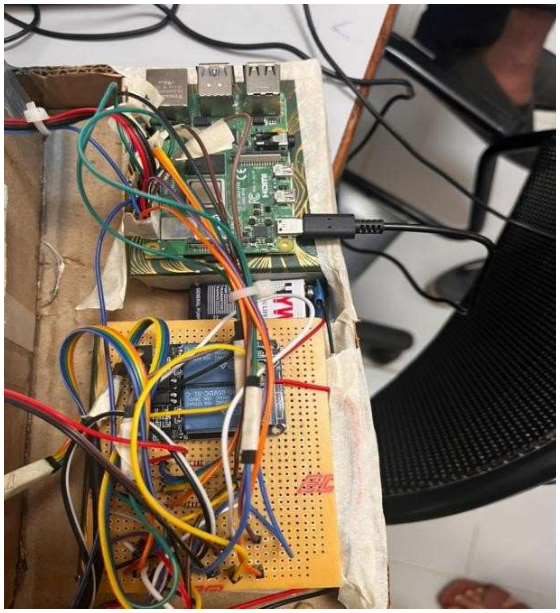

Fig.4- hardware diagram

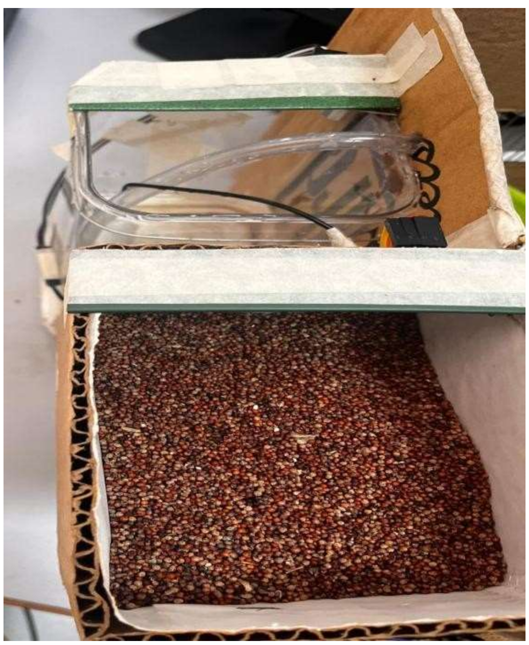

Fig.5-food grains and water

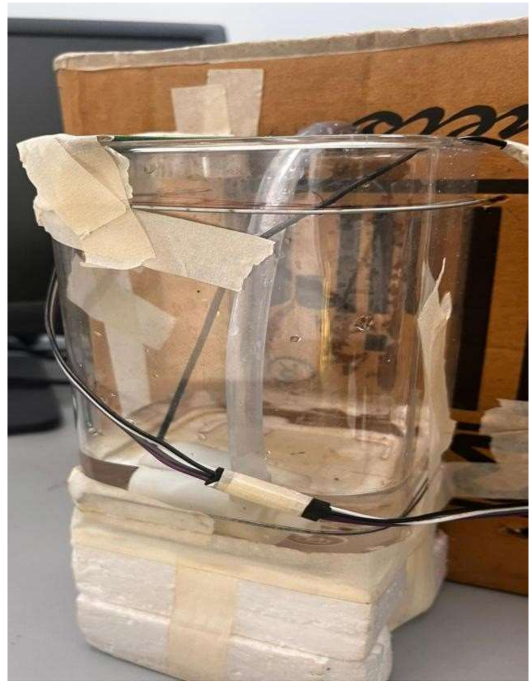

Fig.6- water

CONCLUSSION

The Birds Buddy project highlights the importance of providing safe and supportive shelters for birds, especially in areas where natural habitats are declining. By creating simple, eco-friendly, and accessible bird shelters, we can help protect bird species, support their nesting needs, and encourage biodiversity in our environment. This project shows that even small efforts—like building a shelter, offering food, or conserving green spaces—can make a meaningful difference in the lives of birds. Ultimately, Birds Buddy inspires individuals and communities to contribute to bird conservation and to build a healthier, more sustainable ecosystem for all living beings.

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