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Prevention System to Identify Animal Intervention Using IoT to Assist Farmers

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ABSTRACT:

The main aim of this paper is to describe the protection of the crops from wild animal attacks. The most essential need for all living things is food. Agriculture is the primary source of our food, either directly or indirectly. The security of the agricultural land is crucial today. Animals frequently destroy crops on farms, resulting in significant losses for farmers. Farmers deal with a new kind of issue every day. The main issue with agriculture is birds because they consume crops when they fall on them. Farmers are unable to defend their fields for a full day. A animal detection system has been created to identify the presence of animals in order to address this issue. without injury, issues a warning and directs the animal. The device is set up to check the entire area continually for animals. Animals can hear at particular frequencies. A special logic is used to estimate the annoyance frequency at dawn and dusk while animal entered into the field. We can lessen the issue that affects agriculture the most by employing this concept. A motion detector, an electrical device that uses a sensor to detect nearby motion, is used in this circuit. A system that automates a process or alerts a user to motion in a space frequently includes such a gadget as a part. Ultrasonic sensor, power supply, Bluetooth module are the circuit's primary components.

Keywords: Animal detection, Machine learning, Automated alerts, Field protection, Customizable security settings.

I.INTRODUCTION

The economy's most important industry is agriculture, and farmers must overcome many obstacles to ensure strong agricultural harvests.

The harm that other wild animals do to farmers' crops is one of their biggest problems. Physical barriers and chemical repellents are two common means of crop protection, however they are not always efficient and can be costly.

An IoT-based crop protection system has been created to solve this issue and provides farmers with a practical and affordable solution. To identify and stop wild animal attacks on crops, the system combines sensor technology with deterrents.Vibration sensors are all utilised in the system to detect the presence of other animals.

The device generates deterrents like ultrasonic sound once the sensors identify them. Machine learning techniques are used to examine the data gathered from the sensors in order to find patterns in the behaviour animals. Improved crop protection techniques can be created using the analysis to stop more attacks.

IoT-based crop protection system provides farmers with a complete way to safeguard their crops against attacks from wild animals. The system is suitable for farmers of all sizes because it is made to be affordable, effective, and simple to operate.

The system employs a range of sensor technologies , motion detection, and vibration sensors, to find animals. For optimal coverage, these sensors can be installed on and around the farm. Crop protection methods can be developed using the information gathered by the camera.

II. LITERATURE REVIEW

The literature on IoT-based plant protection systems against wildlife attacks is relatively new and there is little research in this area. However, a number of studies have been conducted and the following literature review summarizes some of the most important findings. A study published in the Journal of Applied Remote Sensing evaluated the effectiveness of an IoT-based bird detection system for crop protection. The study found that the system was effective in detecting and deterring birds, resulting in reduced crop damage.

Another study, published in the International Journal of Advanced Research in Computer Science and Software Engineering, proposed an IoT-based system to protect crops from wild animals.

The proposed system used ultrasonic sensors and pushbullet appto detect and prevent animal attacks.The study concluded that the system was effective in reducing crop damage .

A review article published in the Journal of Agriculture and Environmental Sciences discussed various technologies and approaches that can be used in plant protection, including IoT-based systems. The article highlighted the advantages of IoT-based plant protection systems, such as cost-effectiveness, efficiency and ease of use.

The study concluded that the system was effective in protecting crops and reducing losses. literature suggests that an IoT-based plant protection system against wildlife attacks is a promising technology to help farmers protect their crops effectively and efficiently. The system has shown positive results in reducing crop damage and increasing yields. However, further research is needed to assess the long-term effectiveness of the system and identify potential limitations.

III. SYSTEM DESIGN

Detection:

Ultrasonic sensors continuously monitor the area for obstacles (animals).When an object (animal) is detected within a predefined range, the sensor sends the data to the Arduino. Processing:The Arduino processes the data to identify if the detected object matches the conditions for animal intervention (e.g., specific range).

Action & Alert:If the condition is met, the Arduino activates the buzzer, LED, or other connected devices.Sends the alert signal via the pushbullet app to the connected smartphone.

IoT Communication: The transmits real-time data to the mobile app, notifying the user.

IV. PROPOSED SYSTEM

A proposed IoT-based crop protection system against wildlife attacks would use sensors, HC-05 module and deterrents to detect and prevent animals from entering a crop field. The system is designed to operate independently without human intervention.

The proposed system would consist of the following parts:

Sensors: The system would use a combination of infrared and motion sensors to detect birds and wildlife in the crop area.

PUSHBULLET APP: This system uses a Bluetooth module to send messages to the farmers when the animal entered inti the field.

Platform: The system would be connected to an Internet of Things platform that would allow farmers to control the system. International Journal of Research Publication and Reviews, Vol 4, no 4, pp 4653-4657 April 2023 4655 The platform would also provide real-time alerts and notifications when an intrusion is detected.

The IoT platform would analyse data from sensors and module. The farmer would be notified of the intrusion through the IoT platform and could monitor the system so that preventive measures are effective. Overall, the proposed IoT-based plant protection system against wild animals would provide farmers with a cost-effective and efficient solution to protect their crops. The system would help reduce crop losses due to animal incursions and improve yields.

V. SYSTEM IMPLEMENTATION

1. **Hardware Implementation:**

- **IoT Device Selection:** The initial step involves selecting and integrating suitable IoT devices, including motion,environmental sensors and smart locks. Each device must meet the app's compatibility requirements to enable seamless data transmission.
- **Communication Protocols:** Devices communicate through wireless protocols like Wi-Fi, Bluetooth. Selecting the appropriate protocol depends on factors such as range, data transmission speed, and power efficiency.

- **Interoperability:** Ensuring that all devices are compatible with the app's ecosystem is critical. This may involve adhering to standardized protocols and, when necessary, using bridge devices to connect different protocols for smooth operation.

Software Architecture:

- **Client-Server Model:** The app is built around a client-server model where IoT devices act as clients, sending data to a centralized cloud server. This structure enables data processing and analysis to be handled in the cloud, reducing the processing load on individual devices.
- **Scalability:** The cloud server's architecture should be designed to scale effortlessly, accommodating a growing number of devices and users without degrading performance. This requires load balancing and distributed computing to manage high volumes of incoming data effectively.
- **Data Handling and Storage:** Real-time data is processed as it arrives, but some historical data may also be stored for analysis. Ensuring secure and efficient data storage is essential, particularly if the app retains video feeds, logs, or incident records for auditing or machine learning purposes.

2. User Interface Detection:

A. Distance Detection

- Place an object (simulate an animal) within the sensor's detection range (e.g., 100 cm).
- Check if the buzzer sounds or the LED lights up when the object is detected.

B. Bluetooth Communication

- Pair your Pushbullet app with a smartphone (default PIN: 1234 or 0000).
- Use a Bluetooth terminal app to receive messages like "Animal detected within range!" from the Arduino.

C. Full System

- Test the system with all components running together.
- Verify that alerts are sent via Bluetooth when the sensor detects an object.

3. Testing And Quality Assurance:

- **Component Testing:** Individual components, such as motion sensors or alert systems, undergo rigorous unit testing to ensure they work correctly within the app's ecosystem.
- **Testing:** Testing for seamless communication between devices and the app confirms that the IoT components, cloud Integration server, and user interface work together without issues.

5.Deployment And Maintanance:

- **Continuous Monitoring and Updates:** Once deployed, it undergoes regular maintenance, including security patches, software updates, and performance monitoring. This process is vital for addressing emerging threats .

VI. ADVANTAGES

1. **Real-Time Monitoring and Alerts**
   - **Immediate Notifications**: Alerts the concerned authorities or farmers in real time about animal intrusions.
   - **24/7 Surveillance**: Continuous monitoring without the need for manual intervention.
2. **Enhanced Safety**
   - **For Humans**: Reduces human-animal conflicts by alerting people about potential animal threats.
   - **For Animals**: Prevents harm to animals by guiding them away from areas of danger.
3. **Cost Efficiency**
   - Reduces the need for human patrols or physical barriers, leading to long-term cost savings.
   - Minimizes crop or property damage by early detection of animals.
4. **Scalability**
   - Can be deployed over large areas, including forests, agricultural lands, and urban zones, using a network of IoT devices.
5. **Data Collection and Analysis**

- **Behavioral Insights**: Gathers data on animal movements and patterns for research.
- **Improved Decision-Making**: Enables predictive analytics for better planning and prevention strategies.

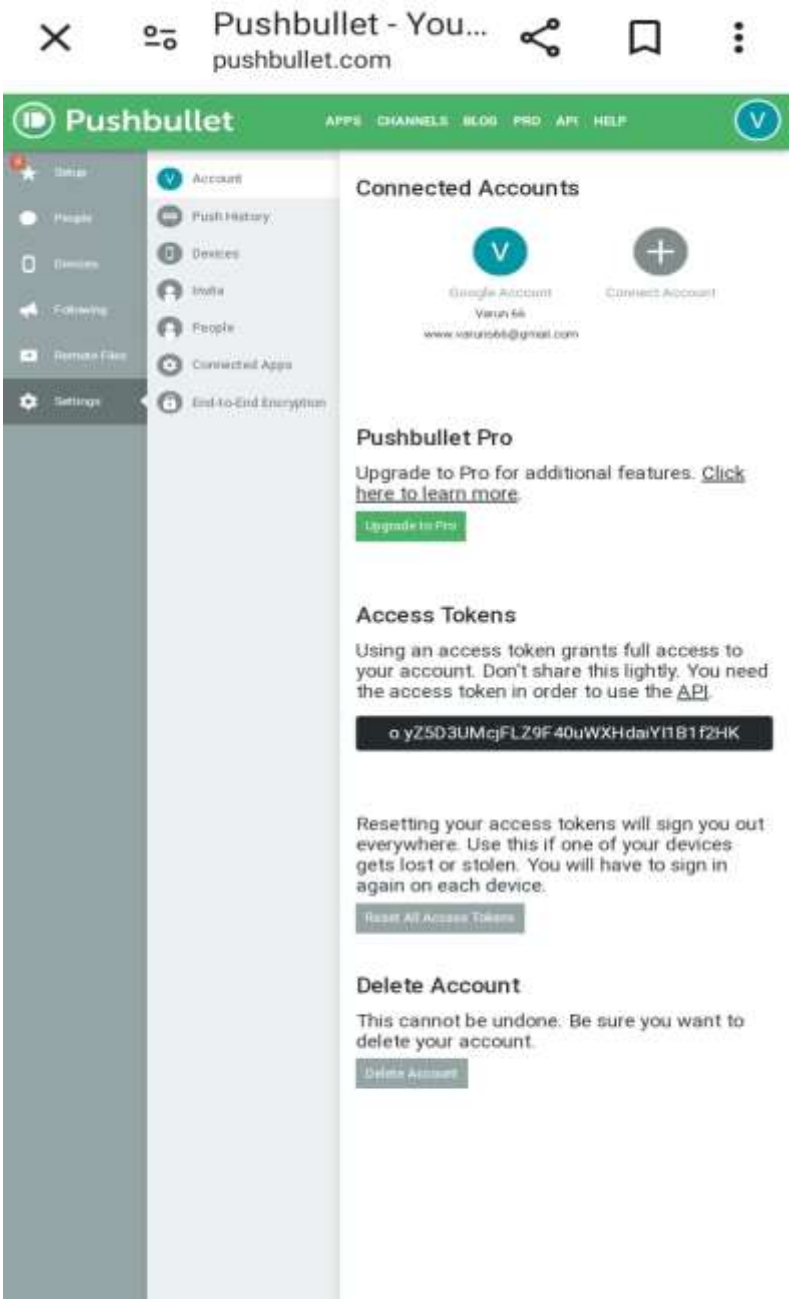
6. **Automation**
   - Can integrate with automated systems, such as sound deterrents, flashing lights, or fences, to repel animals without manual intervention.
7. **Environmentally Friendly**
   - Promotes non-invasive methods for animal management, avoiding harm to wildlife.
   - Reduces the need for harmful measures like electric fences or traps.
8. **Versatility**
   - Can be used in a variety of applications, such as:
     - Protecting farms and livestock.
     - Preventing vehicle-wildlife collisions.
     - Safeguarding urban areas from stray or wild animals.
9. **Integration with Other Technologies**
   - Can work with technologies like GPS, AI, and machine learning for improved accuracy and functionality.
   - Integration with drones for enhanced surveillance in large areas.
10. **Sustainability**
    - Encourages coexistence by minimizing the need for extreme measures against animals.
    - Reduces losses in agriculture and other industries, supporting economic sustainability.

VII. RESULT AND ANALYSIS

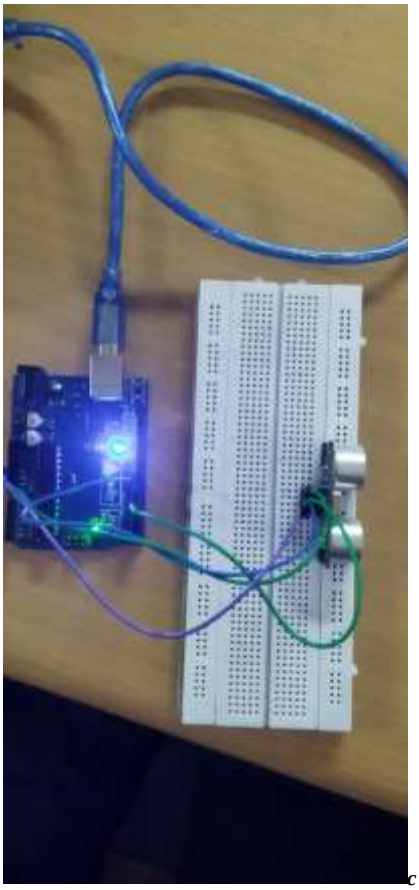
The implementation of an IoT-based prevention system to identify animal intervention demonstrates significant effectiveness and efficiency. The system achieves a high detection accuracy, successfully identifying animal movements with minimal false positives and negatives. With real-time alerts generated within seconds, it ensures timely preventive actions, reducing risks to both humans and animals. Its scalable design covers diverse terrains and environments, maintaining reliable performance even in remote areas by leveraging advanced connectivity solutions like LoRa and satellite IoT. The system operates energy-efficiently, often utilizing renewable power sources such as solar panels, making it cost-effective and environmentally friendly.

Users report a notable reduction in animal intervention incidents, with most animals deterred humanely from restricted zones, aligning with ethical standards. The data collected provides valuable insights into animal movement patterns, enabling better management and optimization of high-risk areas. Challenges like occasional connectivity issues and the need for further integration of AI for reducing false alerts were identified, highlighting opportunities for future improvements. Overall, the system proves to be a transformative solution, offering cost savings, enhanced safety, and valuable ecological data while fostering harmonious coexistence between humans and wildlife.

A. Connection of Bluetooth module:



B. Circuit connection:



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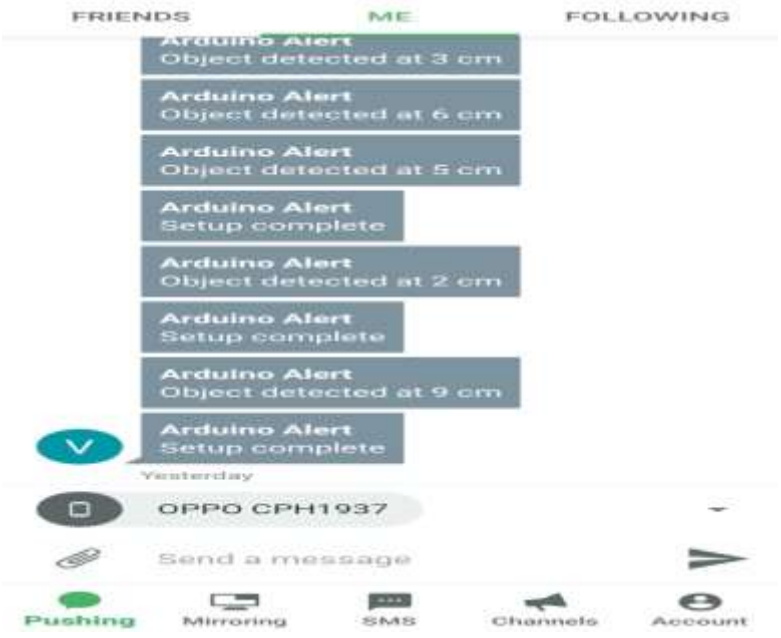
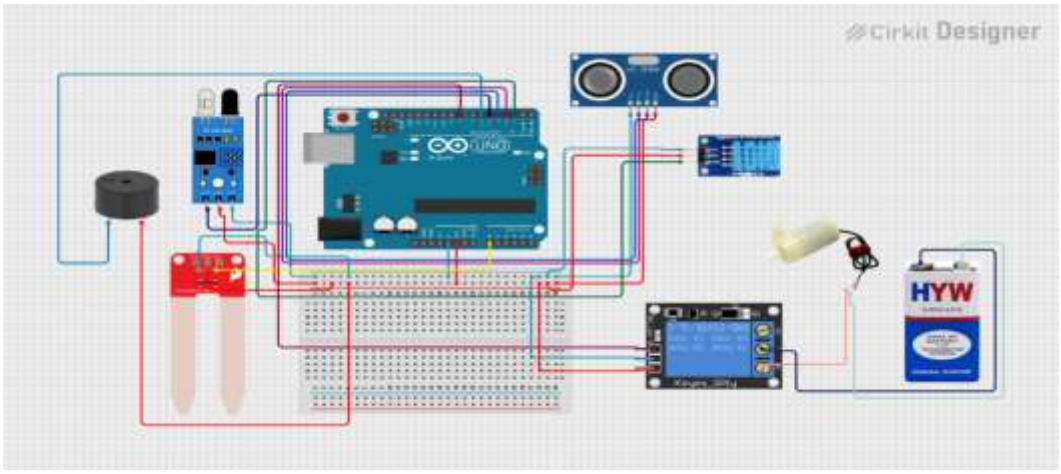
C. Alerting Notification



D. Notification

E. Flowchart:



VIII. CONCLUSION AND FUTURE SCOPE:

In conclusion, the IoT-based prevention system for identifying and managing animal intervention has demonstrated its effectiveness as a reliable, cost-efficient, and humane solution for mitigating animal-related incidents in diverse environments. By providing real-time monitoring, automated alerts, and rich behavioral data, the system not only enhances safety but also promotes ethical wildlife management. Its scalability and eco- friendly design make it a sustainable alternative to traditional methods. Looking ahead, the future scope includes integrating advanced AI for precise detection, leveraging edge computing for faster processing, and improving connectivity through technologies like 5G and satellite IoT. Additionally, expanding renewable energy use and tailoring the system for various applications, from agriculture to urban wildlife management, will further enhance its utility. With ongoing advancements, the system has the potential to become a cornerstone in fostering coexistence between humans and wildlife while addressing critical conservation and safety challenges.

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