Semester Project

Project Title: AI Based Wildlife Conservation System

Section: I

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AI-Based Wildlife Conservation System

Requirement Document:

1. Project Overview:
Develop an AI-based wildlife conservation system that utilizes drone technologies and artificial intelligence models to identify endangered species and implement protective measures against hunting and environmental hazards.

2. Drone Technology Integration:
Integrate state-of-the-art drone technologies capable of conducting aerial surveys and monitoring wildlife habitats. Ensure drones are equipped with high-resolution cameras and sensors for efficient data collection.

3. AI Species Identification:
Implement advanced AI models for species identification using image recognition. Train the models to recognize endangered species based on distinctive features and behaviors.

4. Threat Detection:
Develop AI algorithms to detect potential threats such as poaching activities, habitat destruction, or other environmental hazards. Implement real-time threat alerts for immediate intervention.

5. Geo-spatial Mapping:
Utilize Geo-spatial mapping technologies to track the movement of endangered species and identify critical habitats. Integrate GPS data with drone imagery for accurate mapping and monitoring.

6. Environmental Monitoring:
Incorporate environmental sensors on drones to monitor factors such as temperature, humidity, and pollution levels. Analyze this data to assess the impact of environmental changes on wildlife.

7. Data Storage and Management:
Establish a secure and scalable data storage system to store drone imagery, AI model outputs, and environmental data. Implement data management protocols to ensure data integrity and accessibility.

8. Communication Infrastructure:
Develop a robust communication infrastructure for real-time data transmission between drones and the central monitoring system. Ensure communication reliability in remote wildlife habitats.

9. Integration with Conservation Databases:
Integrate the system with existing wildlife conservation databases to enhance the knowledge base and facilitate collaboration with conservation organizations.

10. Wildlife Habitat Protection:
Implement automated protective measures based on identified threats. This may include activating deterrents, notifying local authorities, or deploying on-site conservation teams.

11. User Interface for Conservation Teams:
Develop a user-friendly interface for conservation teams to access real-time data, receive alerts, and coordinate response efforts. Ensure compatibility with various devices, including tablets and smartphones.

12. Machine Learning Model Training:
Continuously train and update AI models using new data to improve species identification accuracy. Implement a feedback loop for conservation experts to provide input for model refinement.

13. Legal and Ethical Considerations:
Ensure compliance with local and international laws related to wildlife protection. Implement ethical guidelines for data collection and use, respecting privacy and cultural considerations.

14. Public Awareness Campaigns:
Develop strategies for public awareness and engagement to promote wildlife conservation efforts. Implement educational programs to inform local communities about the importance of protecting endangered species.

15. System Scalability:
Design the system to be scale able to accommodate an increasing number of monitored
habitats and species. Consider future advancements in drone and AI technologies for seamless integration.

16. Monitoring and Evaluation:
Establish a monitoring and evaluation framework to assess the effectiveness of the system in protecting endangered species. Regularly review performance metrics and make necessary improvements.

17. Budget and Resource Planning:
Develop a comprehensive budget outlining costs for technology acquisition, development, training, and ongoing maintenance. Plan for human resources and expertise required for successful implementation.

18. Collaboration with Conservation Agencies:
Collaborate with wildlife conservation agencies, NGOs, and governmental bodies to share data, resources, and expertise. Foster partnerships to maximize the impact of conservation efforts.

19. System Security:
Implement robust security measures to protect the system from cyber threats. Encrypt

sensitive data, establish access controls, and regularly audit the system for vulnerabilities.

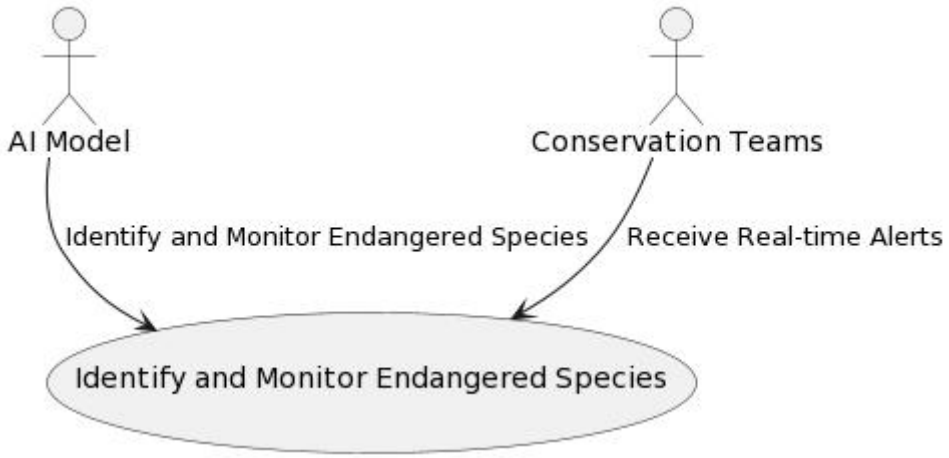
20. Public and Stakeholder Engagement:

Develop a strategy for engaging the public and stakeholders in the conservation process.
Solicit feedback, address concerns, and involve local communities in the sustainable management of wildlife habitats.

Use Cases

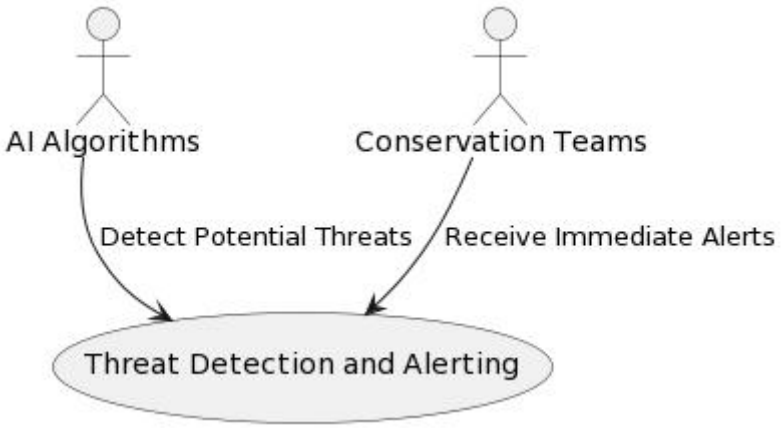
1. Species Identification and Monitoring:

● **Actor:** AI Model, Conservation Teams
● **Description**:The AI model identifies and monitors endangered species through drone aerial surveys. Conservation teams receive real-time alerts based on accurate species recognition.



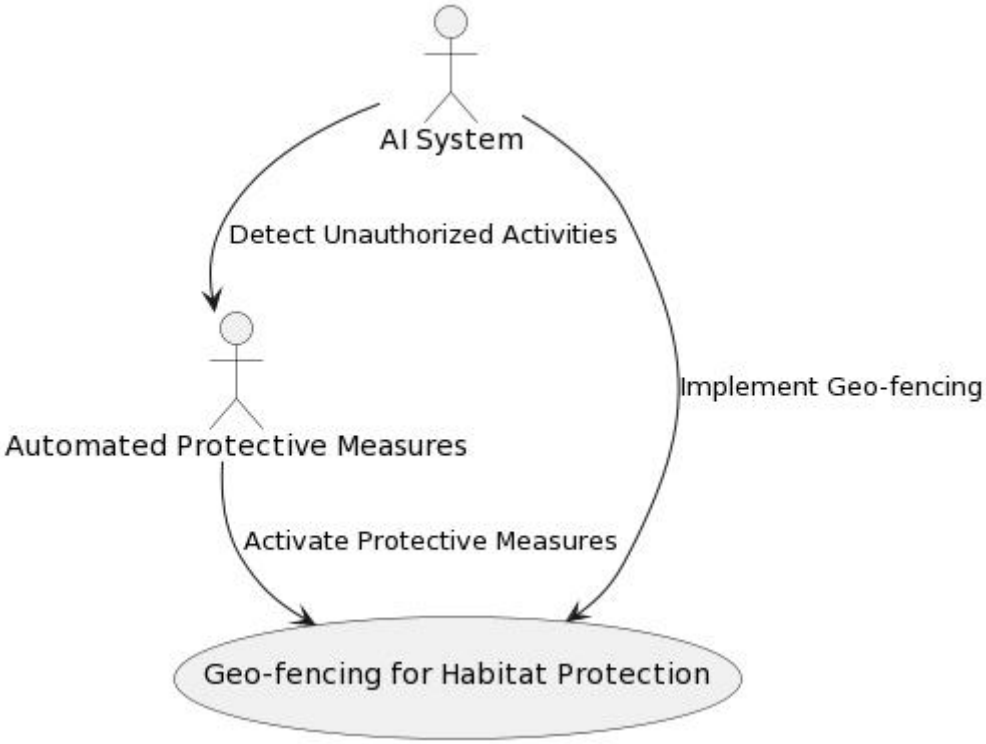
2. Threat Detection and Alerting:

● **Actor:**AI Algorithms, Conservation Teams
● **Description:**The system's AI algorithms detect potential threats such as poaching activities or habitat destruction in real-time. Conservation teams receive immediate alerts for swift response.



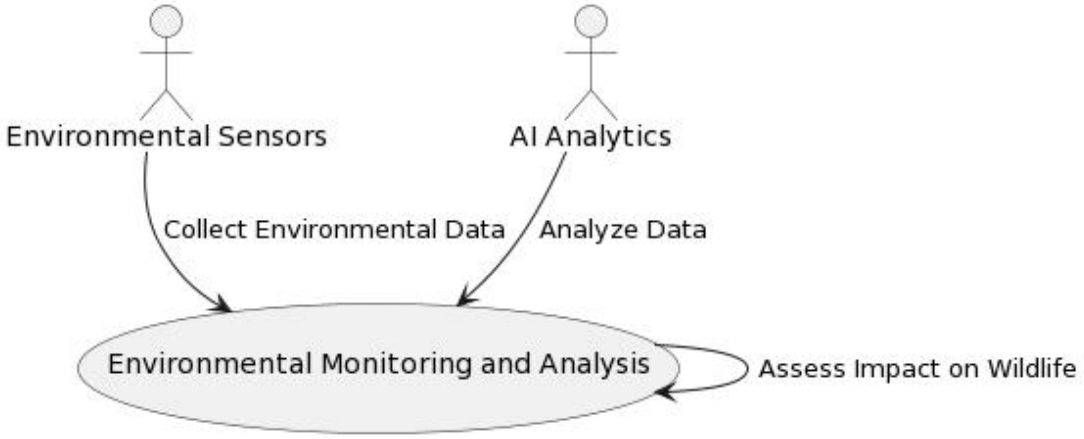
3. Geo-fencing for Habitat Protection:

● **Actor:** AI System, Automated Protective Measures
● **Description:** The system implements geo-fencing around critical wildlife habitats. When unauthorized activities are detected, automated protective measures are activated.



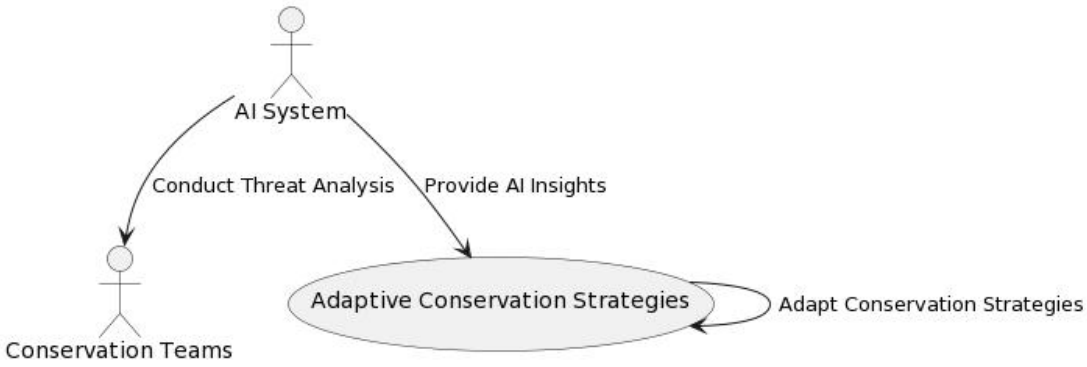
4. Environmental Monitoring and Analysis:

● **Actor:** Environmental Sensors, AI Analytic
● **Description:**Drones equipped with environmental sensors collect data on temperature, humidity, and pollution levels. The system analyzes this data to assess the impact of environmental changes on wildlife.



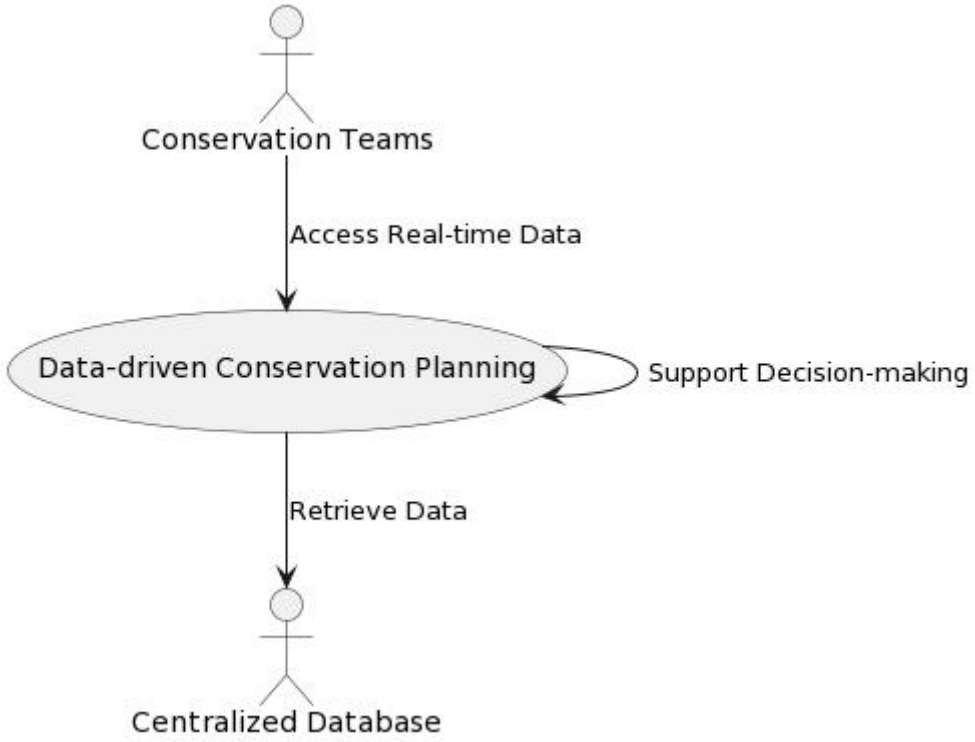
5. Adaptive Conservation Strategies:

● **Actor:**AI System, Conservation Teams
● **Description:** Based on AI insights and threat analysis, the system adapts conservation strategies in real-time. This may involve adjusting patrol routes, modifying protective measures, or collaborating with local authorities.



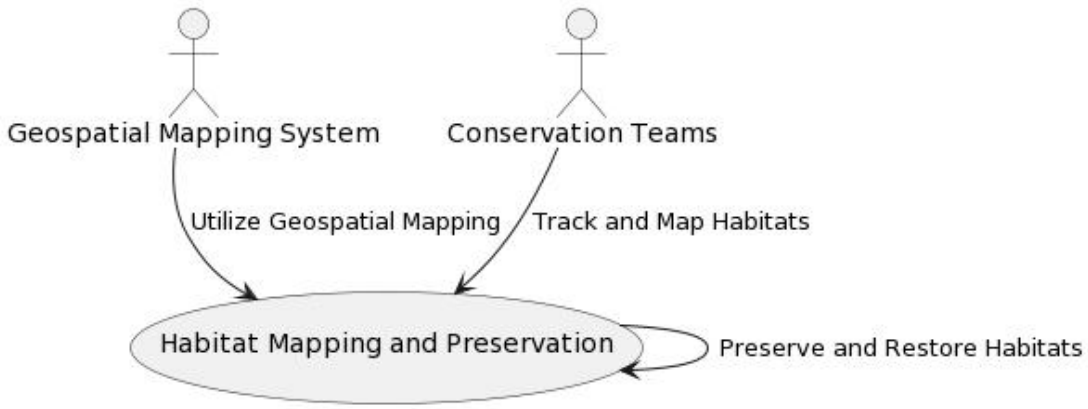
6. Data-driven Conservation Planning:

● **Actor:**Conservation Teams, Centralized Database
● **Description:**Conservation teams access a centralized database with real-time data on species, threats, and habitat conditions. The system supports data-driven decision-making for long-term conservation planning.



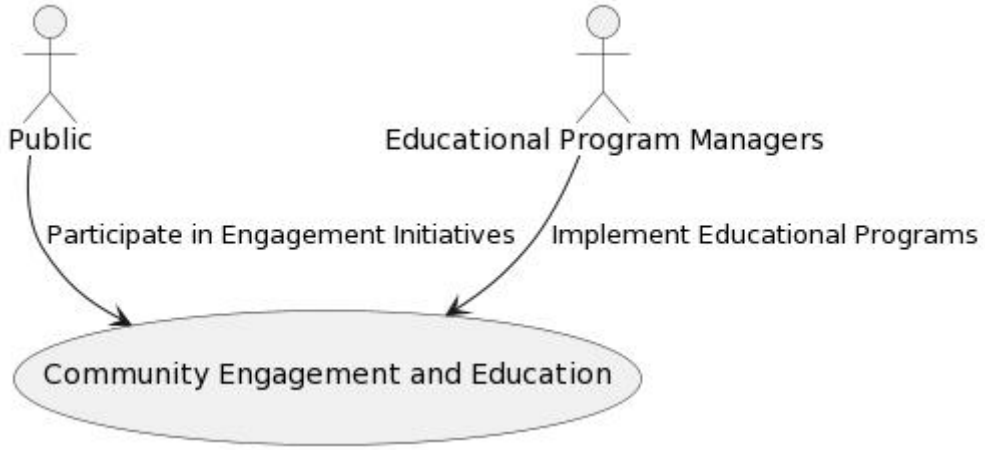
7. Habitat Mapping and Preservation:

● **Actor:Geo-spatial** Mapping System, Conservation Teams
● **Description:**The system utilizes spatial mapping to track and map wildlife habitats. Conservation efforts are directed towards preserving and restoring these critical habitats.



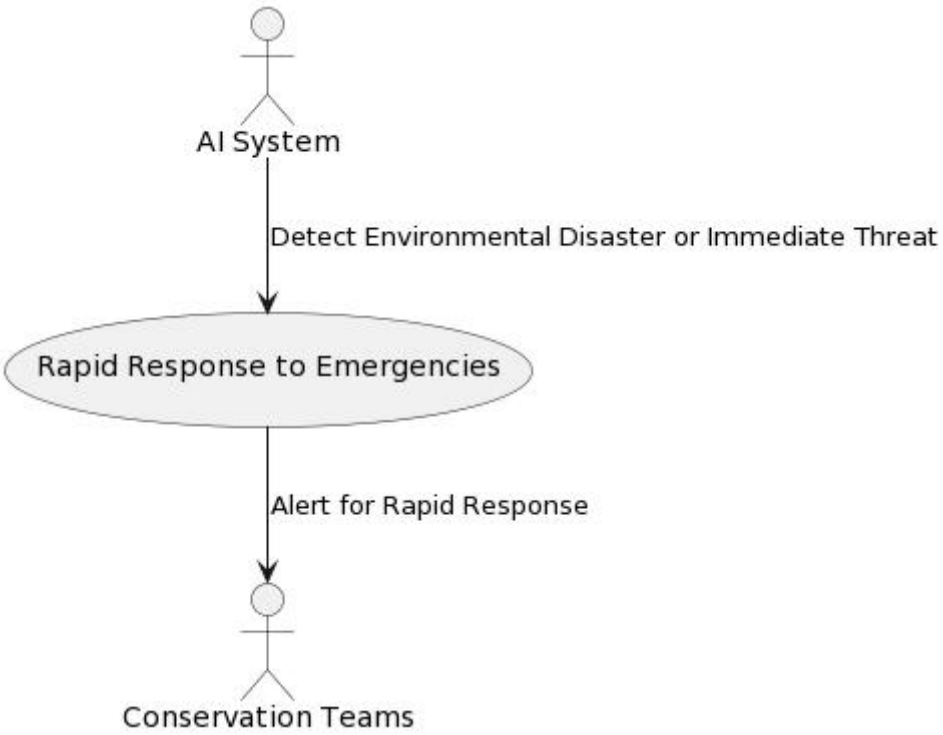
8. Community Engagement and Education:

● **Actor:** Public, Educational Program Managers
● **Description:**The system supports community engagement initiatives to raise awareness about wildlife conservation. Educational programs are implemented to inform local communities about the importance of protecting endangered species.



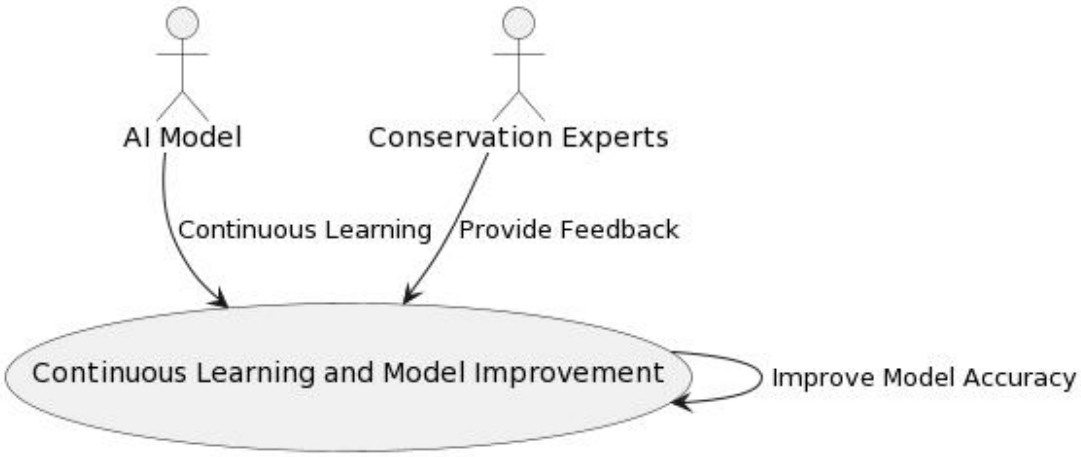
9. Rapid Response to Emergencies:

● **Actor:**AI System, Conservation Teams
● **Description:** In the event of an environmental disaster or immediate threat, the system facilitates rapid response efforts. Conservation teams are alerted to address emergencies promptly.



10. Continuous Learning and Model Improvement:

● **Actor:**AI Model, Conservation Experts
● **Description:**The AI models continuously learn and adapt based on new data. Conservation experts provide feedback on model outputs, contributing to ongoing improvements in species identification accuracy.


AI Model
Conservation Experts
Continuous Learning
Provide Feedback
Continuous Learning and Model Improvement
Improve Model Accuracy

Sequence Diagram

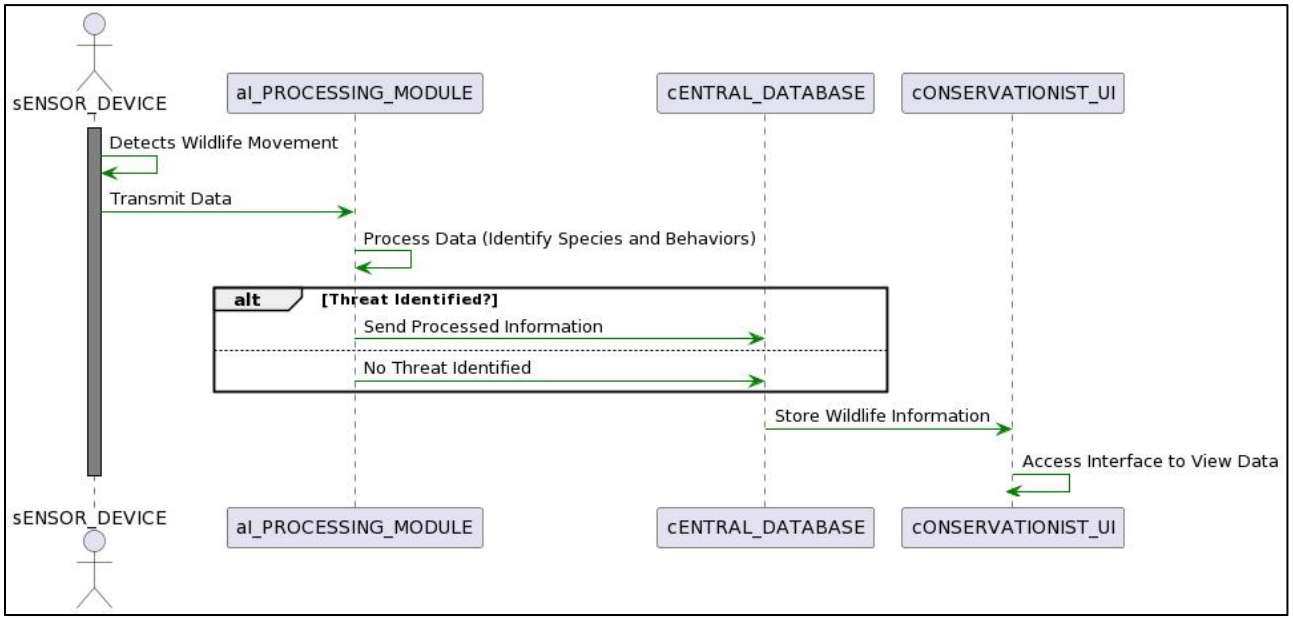
1. Wildlife monitoring Sequence:

Actor: Sensor Device
Step 1: The sensor device detects wildlife movement.
Step 2: Data is transmitted to the AI processing module.

Actor: AI Processing Module
Step 3: AI processes the data, identifying species and behaviors.
Step 4: Processed information is sent to the central database.

Actor: Central Database
Step 5: The central database stores wildlife information.

Actor: Conservationist/User Interface
Step 6: Conservationists access the interface to view wildlife data.



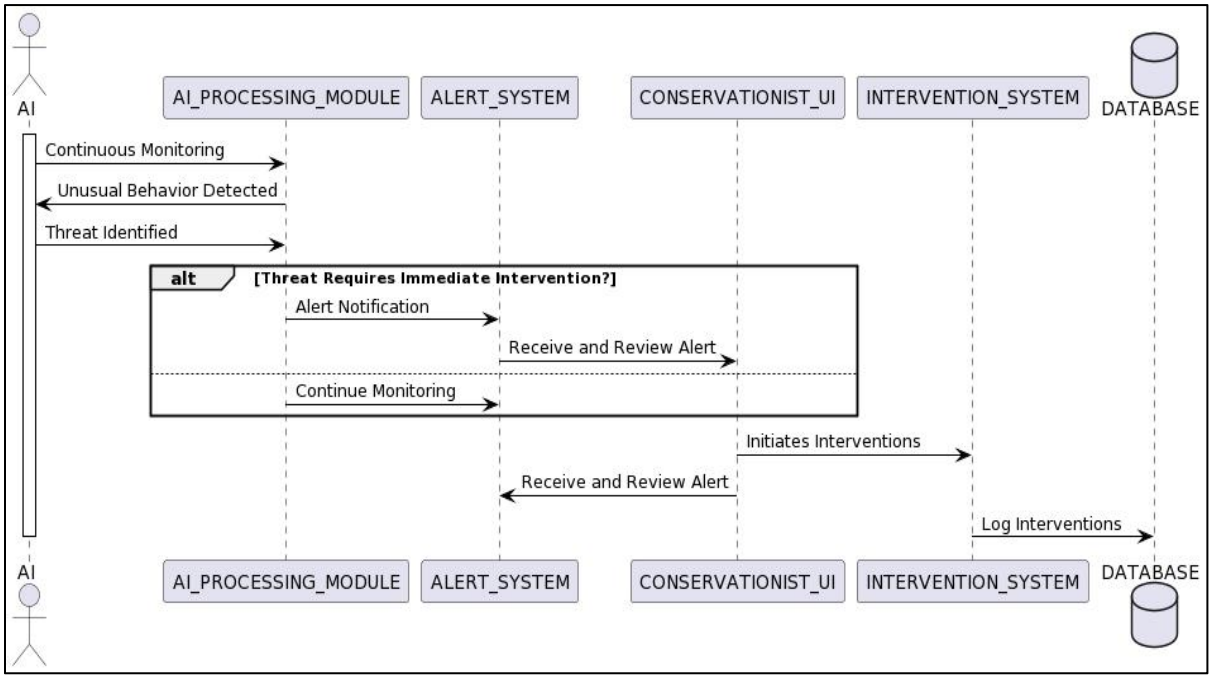
2. Intervention Alert Sequence:

Actor: AI Processing Module
Step 1: Continuous monitoring of wildlife data.
Step 2: AI detects unusual behavior or potential threats.
Step 3: If a threat is identified, an alert is triggered.

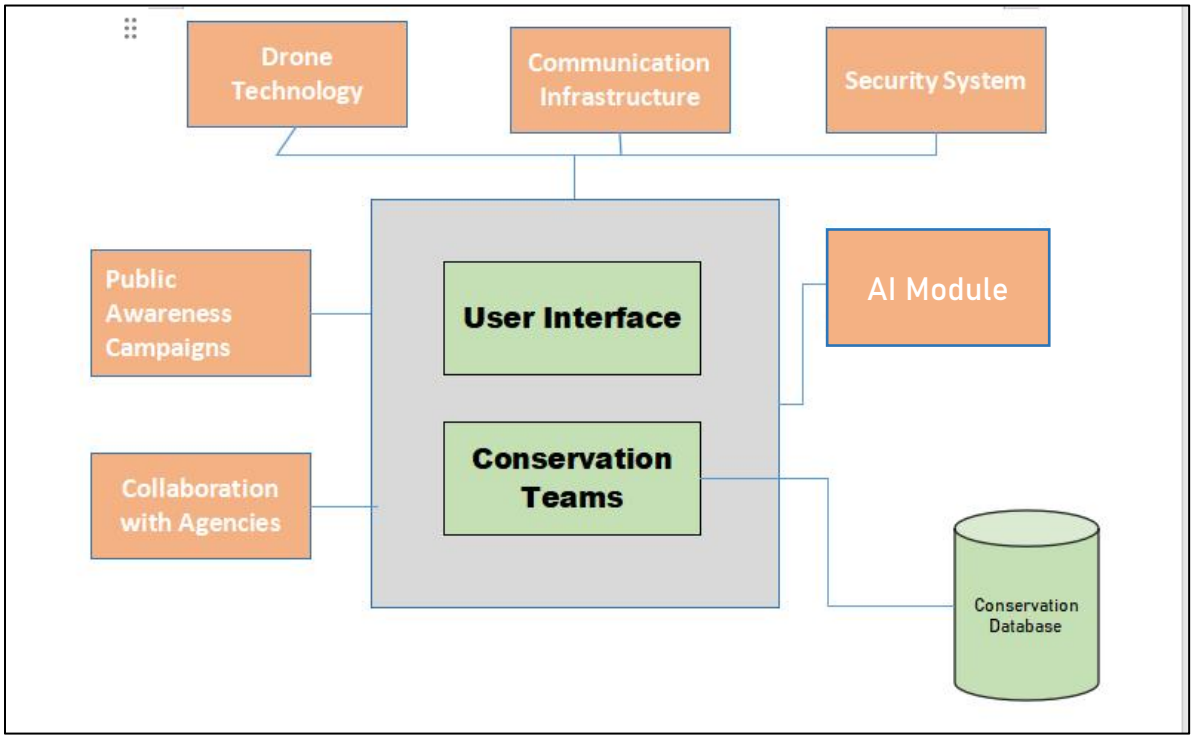
Actor: Alert System
Step 4: The alert system notifies conservationists.

Actor: Conservationist/User Interface

Step 5: Conservationists receive and review the alert.
Step 6: Based on the alert, conservationists may initiate interventions.
Actor: Intervention System
Step 7: Interventions are logged and recorded in the database.



Context Diagram



Here is the detailed description of Context Model:

1. Wildlife Conservation System:

Represents the overarching system focused on wildlife conservation.
Serves as the central hub coordinating various components to achieve conservation goals.

2. Drones:

Responsible for capturing data from the environment related to wildlife.
May include diverse sensors such as cameras, motion detectors, or environmental sensors.
Provides raw data input to the system for further analysis.

3. AI Module:

Functions as the core intelligence of the system.

Processes the data received from sensors for species identification and behavior analysis.
Utilizes advanced algorithms and machine learning models to enhance accuracy.
Plays a crucial role in identifying potential threats or unusual activities in wildlife.

4. Database:

Acts as the central repository for storing wildlife-related information.
Archives data from drones and processed information from the AI module.
Enables historical analysis, trend identification, and supports conservation planning.

5. Interface:

Represents the user interface through which conservationists interact with the system.
Provides visualization tools, dashboards, and reports for real-time monitoring of wildlife data.
Allows conservationists to review alerts, analyze trends, and initiate interventions.

6. Security System:

The security system within the AI-based Wildlife Conservation System functions as a vital component focused on ensuring the integrity, confidentiality, and protection of sensitive information. Its roles and functionalities include:

1. Implementing robust security measures to guard against unauthorized access and cyber threats.
2. Utilizing encryption techniques for securing communication channels between system components.
3. Monitoring and logging access to the system to detect and track suspicious activities.
4. Enforcing strict authentication protocols to verify user and component identities.
5. Applying role-based access control to manage authorized actions within the system.
6. Employing encryption algorithms to secure both in-transit and at-rest wildlife data.
7. Regularly updating security protocols to address emerging threats and vulnerabilities.
8. Monitoring the system for unusual activities or security breaches.
9. Implementing an incident response plan for prompt reactions to security incidents.
10. Collaborating with the AI Module to analyze security-related data for threat detection.
11. Ensuring secure communication channels among components for seamless integration.
12. Enabling compliance with data protection and privacy regulations.
13. Facilitating regular security audits to assess the effectiveness of security measures.
14. Identifying areas for improvement to maintain the resilience and reliability of the system.

7. Communication Infrastructure:

The communication infrastructure in the AI-based Wildlife Conservation System establishes a robust network for seamless data exchange. It ensures secure communication between system components, supports real-time alerts, and enables efficient collaboration with external agencies. This infrastructure plays a pivotal role in coordinating conservation efforts, facilitating remote monitoring, and promoting interoperability for effective wildlife conservation.

8. Collaboration with Agencies:

The collaboration with external agencies is a key aspect of the AI-based Wildlife Conservation System, fostering partnerships with wildlife conservation agencies, law enforcement, and governmental bodies. This collaboration enhances information sharing, coordination of efforts, and enables a more comprehensive approach to wildlife conservation. By working together, the system can leverage collective expertise and resources, leading to more effective conservation strategies and a broader impact on preserving biodiversity.

9. Public Awareness Campaigns:

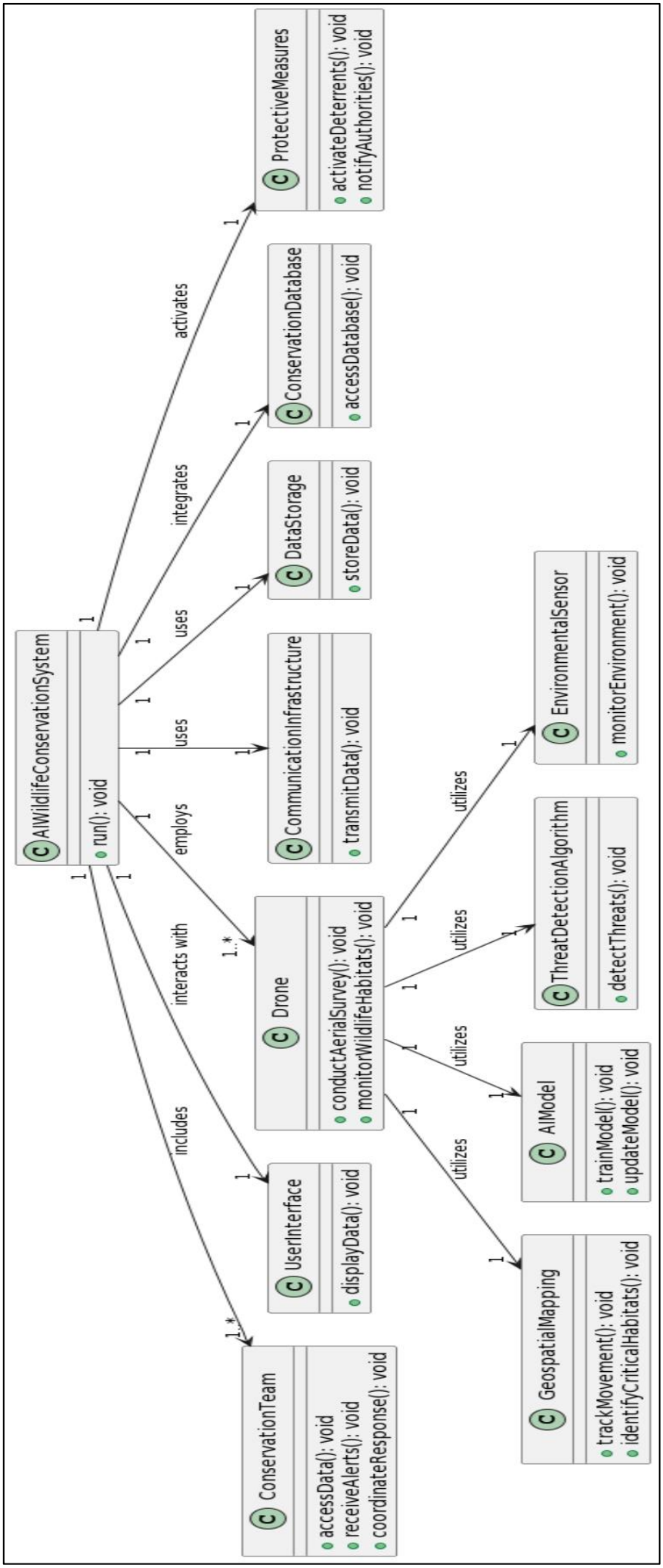
Public awareness campaigns are an essential component of the AI-based Wildlife Conservation System, aimed at engaging and educating the public on the importance of wildlife conservation. These campaigns:

i. Utilize various media channels to raise awareness about endangered species, threats, and conservation initiatives.
ii. Educate the public on the role of technology, such as AI, in wildlife protection.
iii. Encourage community participation and support for conservation efforts.
iv. Highlight the impact of individual actions on preserving biodiversity.
v. Foster a sense of responsibility and collective involvement in safeguarding the environment.

Through these campaigns, the system seeks to mobilize public support, creating a broader understanding of wildlife conservation issues and encouraging sustainable practices.

The flow of information is depicted through arrows, indicating the direction of data transfer between components. The context diagram illustrates the integration and collaboration of these components to create a comprehensive AI-based Wildlife Conservation System, facilitating data-driven decision-making for conservation efforts.

Class Diagram



Following is the detailed description of the classes in the provided class diagram for the "AI-based Wildlife Conservation System":

1. Wildlife Conservation System:

Description: The central class representing the entire conservation system.
Attributes: None in this simplified representation, but in a real-world scenario, it might include system configuration settings, logging mechanisms, or global parameters.

2. Drone:

Description: Represents the sensors deployed in the wildlife conservation areas to capture data.
Attributes:
sensorID (String): Unique identifier for each sensor.
location (GPS): Geographic coordinates indicating the sensor's position.
Methods:
conductAerialSurvey(): Conducts aerial survey of forest.
monitorWildlifeHabitat(): Monitors the natural habitat of wildlife species,

3. AI Module:

Description: Encapsulates the artificial intelligence algorithms responsible for processing wildlife data.
Methods:
processData(): ProcessedData: Initiates the processing of raw data captured by sensors, utilizing machine learning algorithms or other AI techniques. Returns processed information encapsulated in a *ProcessedData* object.
trainModel(): Trains the AI model for species recognition, their movements and identification of any threats related to current circumstances.

4. Processed Data:

Description: Represents the output of the AI Module's data processing.
Attributes: This class might include various attributes based on the specific analysis performed, such as identified species, behaviors, or environmental conditions.

5. Conservation Database:

Description: The Conservation Database class is a critical component within the AI-Based Wildlife Conservation System, serving as the central hub for managing, storing, and retrieving vital wildlife conservation data. This class acts as the interface through which various system components interact with the database, ensuring secure access and efficient handling of information related to species, habitats, conservation efforts, and incidents.

Methods:
accessDatabase(): The accessDatabase method acts as the gateway for interacting with the conservation database. It handles authentication, establishes a secure connection, and provides methods for data retrieval and storage. This method is essential for enabling seamless communication between different system components, allowing them to access the necessary data for analysis, decision-making, and reporting.

6. Data Storage:

Description: The Data Storage class is a fundamental component in the AI-Based Wildlife Conservation System, responsible for efficiently storing and managing various types of data. This class provides a streamlined mechanism for persistently storing information generated and processed by the system. It is designed to ensure data integrity, security, and accessibility for other components within the ecosystem.
Methods:
storeData(): The storeData method serves as the primary function for storing data within the system. It accepts an object as a parameter, representing the data to be stored.

7. Communication Infrastructure:

Description: The Communication Infrastructure class is a pivotal component in the AI-Based Wildlife Conservation System, serving as the backbone for seamless communication between diverse system modules.
Methods:
transmitData(): It enables the secure transmission of data from the source component to a specified destination within the system

8. Conservation Teams:

Description: This class facilitates effective collaboration and communication among conservation team members.
Methods:
accessData(): The accessData method enables the Conservation Team to retrieve essential information from the Conservation Database. This method provides access to species data, habitat information, ongoing conservation efforts, and incident logs.
receiveAlerts(): The receiveAlerts method allows the Conservation Team to receive real-time alerts generated by the AI System.
coordinateResponse(): The coordinateResponse method is responsible for communicating the conservation team's response to alerts or planned interventions.

9. Protective Measures:

Description: The Protective Measures class represents the set of actions and systems in place to safeguard wildlife based on the analysis and insights provided by the AI-based Wildlife Conservation System. This class encompasses the activation of deterrent mechanisms and the notification of relevant authorities in the event of potential threats.

Methods:
activateDeterrents(): Initiates the activation of deterrent mechanisms to prevent or discourage potential threats to wildlife.
notifyAuthorities(): Sends notifications to relevant authorities or conservationists about detected threats or unusual wildlife activities.

10. Threat Detection Algorithm:

Description: Represents the class responsible for implementing algorithms to detect potential threats to wildlife within the AI-based Wildlife Conservation System.
Attributes:
algorithmID (String): Unique identifier for the threat detection algorithm.
Methods:
detectThreats(): Initiates the threat detection process using the implemented algorithm.

11. Environmental Sensor:

Description: Represents sensors specifically designed to monitor environmental conditions within wildlife conservation areas.
Attributes:
sensorID (String): Unique identifier for each environmental sensor.
location (GPS): Geographic coordinates indicating the sensor's position.
Methods:
monitorEnvironment(): EnvironmentData: Initiates the monitoring of environmental conditions, collecting data related to factors such as temperature, humidity, and air quality. Returns the collected information encapsulated in an EnvironmentData object.

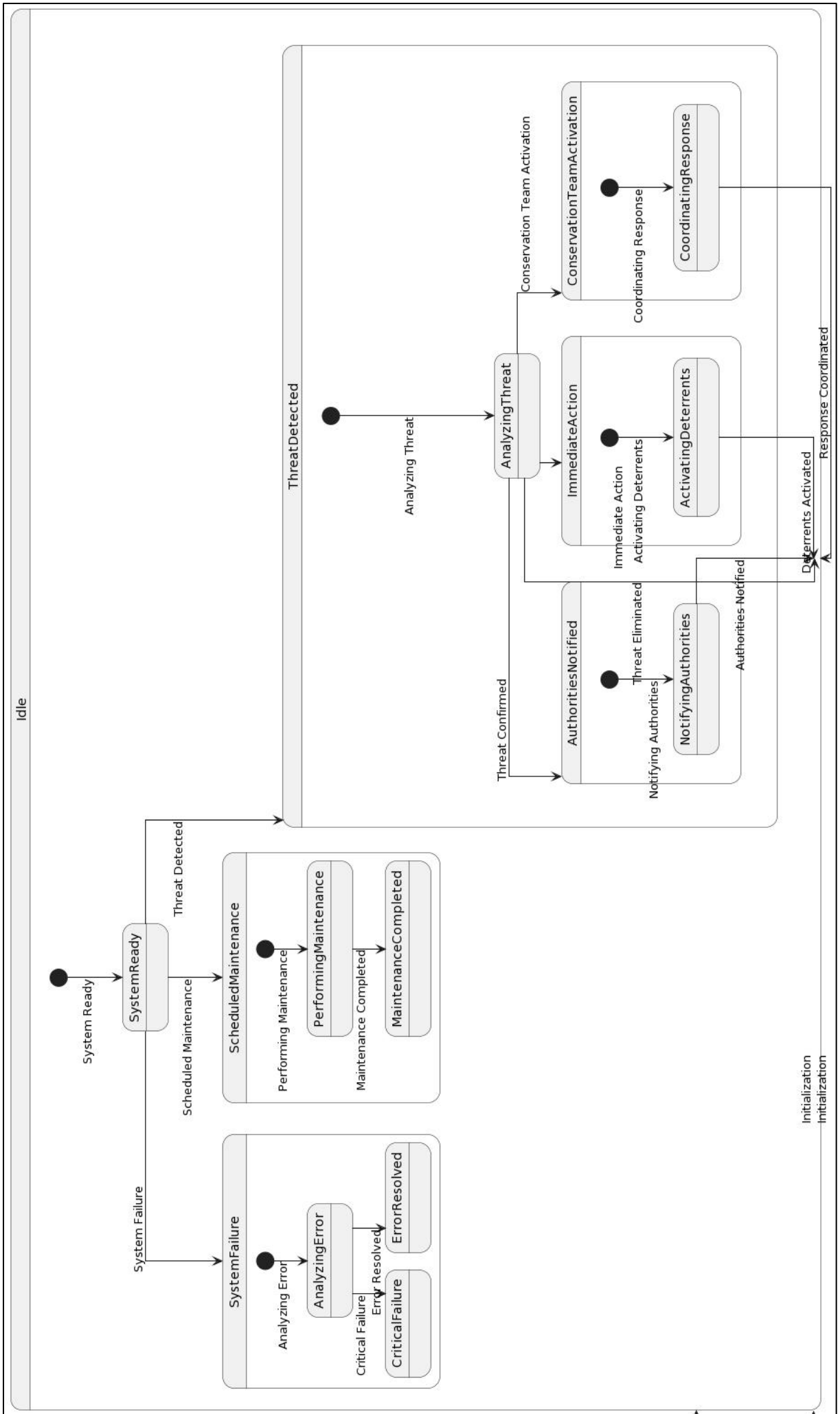
12. Geo-spatial Mapping:

Description: Manages the geospatial mapping functionalities within the AI-based Wildlife Conservation System, providing methods to track movement and identify critical habitats.
Methods:
identifyCriticalHabitats(): Analyzes geospatial data to identify and mark areas as critical habitats for specific wildlife species.
trackMovement(): Initiates the tracking of wildlife movement in the conservation area.

13. Interface:

Description: Represents an interface for displaying data to conservationists or end-users.
Methods:
displayData(): void: Defines a method for presenting processed wildlife data to conservationists. The actual implementation would be provided by classes implementing this interface.

State Transition Diagram



In this simplified state transition diagram:

1. Idle State:

Description: The initial state of the sensor when it is waiting for any activity.
Actions: The sensor continuously monitors the environment for signs of movement.

2. System Ready State:

Description: The "System Ready" state represents the normal operational state of the AI-based Wildlife Conservation System when all components are functioning correctly, and the system is ready to monitor wildlife and process data.

Transitions:
- Triggers: Scheduled Maintenance: Initiated based on a predefined maintenance schedule.
- Triggers: Threat Detected: Activated when the AI Module identifies a potential threat to wildlife.
- Triggers: System Failure: Occurs when a critical system component malfunctions.

3. Scheduled Maintenance State:

Description: Represents the system entering a state of scheduled maintenance, during which various maintenance activities are performed on system components.
Transitions:
- Triggers the inner state "Performing Maintenance" when the maintenance process begins.
- Transitions to the "Maintenance Completed" state upon the successful completion of maintenance activities.

4. System Failure State:

Description: Represents a state where the AI-based Wildlife Conservation System experiences a failure or malfunction.
Transitions:
- Trigger: Error Detected: Initiates the transition to the "Analyzing Error" state.
- Trigger: Critical Error Detected: Transitions to the "Critical Error" state.
- Trigger: Error Resolved: Returns to the normal operational state.

Analyzing Error State:

Description: Represents the phase where the system is analyzing the detected error to identify its nature and possible causes.
Transitions:
- Trigger: Error Resolved: If the analysis determines that the error is non-critical and can be resolved without significant impact, the system transitions back to normal operation.
- Trigger: Critical Error Detected: If the analysis indicates a critical error, the system transitions to the "Critical Error" state.

5. Threat Detected State:

Description: The "Threat Detected" state in the AI-based Wildlife Conservation System signifies that the system has identified a potential threat to the wildlife based on the analysis of sensor data and AI processing.
Transitions: This state is typically reached when the AI module, during its data processing, determines that certain patterns or behaviors pose a risk to the well-being of the wildlife or the ecosystem.
Transitions to: "Analyzing Threat" state.
Actions:

- The system may trigger immediate alerts to conservationists or relevant authorities, indicating the nature of the identified threat.
- Data related to the threat, including the sensor readings, processed information, and the nature of the potential danger, is recorded for further analysis and documentation.
- Depending on the severity of the threat, the system may initiate predefined emergency protocols or responses to mitigate the risk.
- Considerations:
- The "Threat Detected" state serves as a critical point in the conservation system, requiring swift and effective responses to protect the wildlife.
- Conservationists and relevant stakeholders are notified promptly to take appropriate actions based on the identified threat.
- Transitioning out of this state may involve moving to an "Analyzing Threat" state for a more in-depth assessment of the situation before deciding on specific interventions.

6. Analyzing Threat State:

Description: This state represents the phase where the system is actively analyzing detected data to assess potential threats to wildlife.

Transitions:

- Triggers: Authorities Notified: The analysis indicates a potential threat that requires intervention from local authorities.
- Triggers: Conservation Team Activation: The analysis identifies a threat that necessitates the involvement of the conservation team.
- Triggers: Immediate Action: The analysis reveals an imminent threat that requires immediate intervention.

7. Authorities Notified State:

Description: Represents the state where the conservation system has detected a situation requiring immediate attention, and relevant authorities have been notified.

Inner Transition:
notifyAuthorities(): void
Description: Initiates the process of notifying relevant authorities about the identified situation.

Actions: Sends alerts or notifications to the specified authorities, providing them with the necessary information regarding the detected event. This could include details about potential threats to wildlife or urgent conservation actions required.

8. Immediate Action State:

Description: The "Immediate Action" state in the AI-based Wildlife Conservation System represents a critical phase where urgent responses are triggered based on the analysis of processed data. This state is activated when the system identifies an imminent threat to wildlife that requires immediate intervention.

Inner Transition State - Activating Deterrents:

Description: Within the "Immediate Action" state, the system enters an inner transition state specifically designed for activating deterrents.

Actions:
- Identification of Threat: The system, in collaboration with the AI Module, identifies a potential threat to wildlife. This could include the presence of poachers, predators, or other dangers.
- Deterrent Activation: Once a threat is confirmed, the inner transition state activates deterrent mechanisms, which may include:
- Deploying Drones or UAVs: Unmanned aerial vehicles equipped with surveillance capabilities can be deployed to monitor and deter potential threats.
- Auditory Deterrents: Automated sound systems emitting deterrent noises or predator calls to discourage unwanted wildlife interactions.
- Visual Alerts: Activation of visual deterrents such as flashing lights or projections to intimidate potential threats.
- Communication with Authorities: Automatic alerts are sent to wildlife conservation authorities or law enforcement for immediate response.

9. Conservation Team Activation State:

Description: This state represents the system's response when a situation requiring the attention of the conservation team is detected, such as the identification of a potential threat or the need for manual intervention based on AI analysis.

Inner Transition State: Coordinating Response

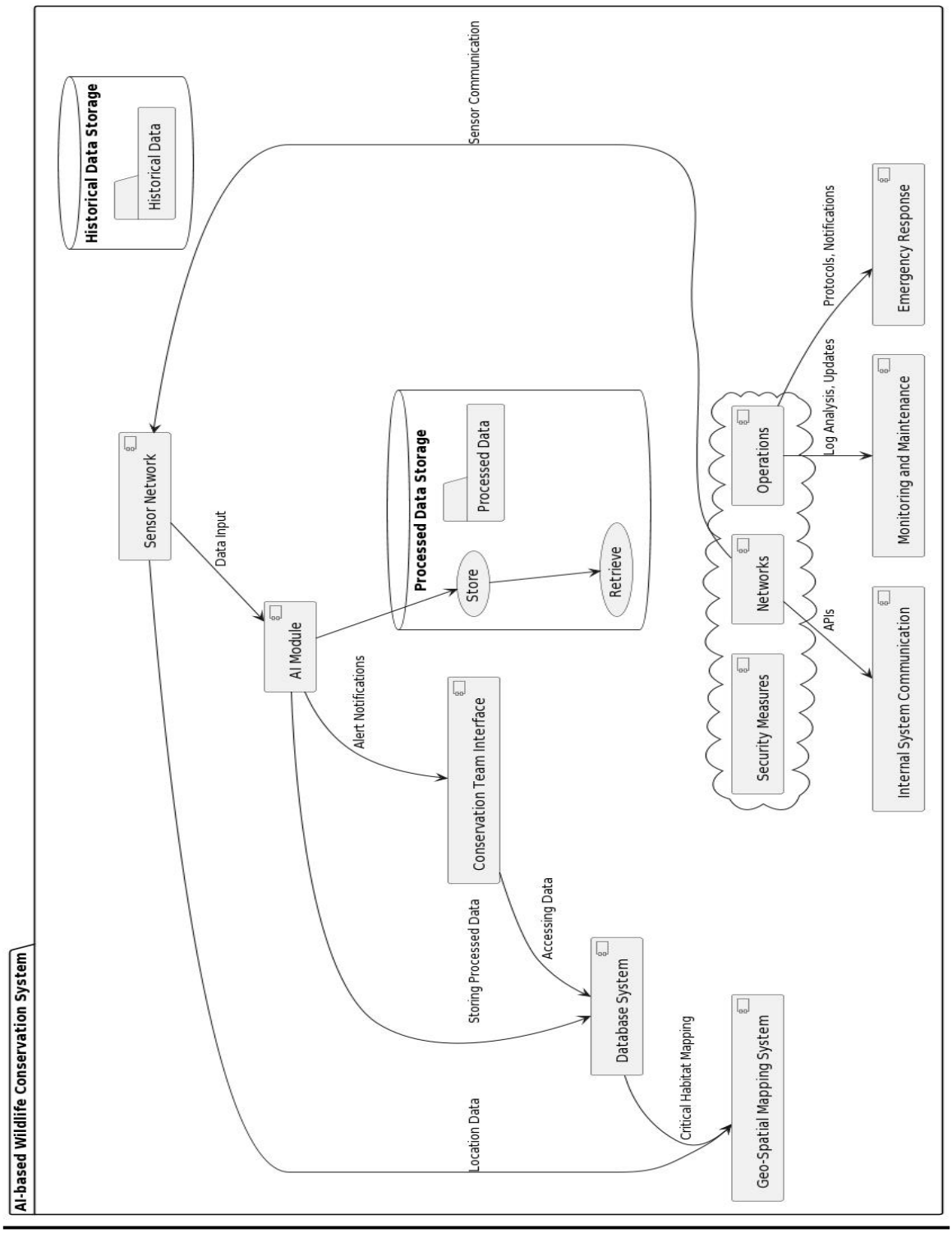
Coordinating Response State: Upon activation, the system transitions to the "Coordinating Response" state to manage and coordinate the response activities.

Description: This inner transition state occurs within the "Conservation Team Activation" state and focuses on coordinating the response actions of the conservation team.

Actions:
- Initiate Emergency Protocol: If the situation demands an urgent response, the system triggers the activation of predefined emergency protocols.
- Notify Conservation Team: Informs the conservation team about the detected situation, providing relevant details and recommendations from the AI analysis.
- Coordinate Resources: Allocates resources and assigns tasks to the conservation team members based on the nature of the situation.

- Verify AI Analysis: Conservation team members may review the AI analysis to confirm the accuracy of the detected threat or situation.
- Monitor Situation: While responding, the system continues to monitor the situation, updating the conservation team with real-time data.

Architecture Diagram



Components:

1. Sensor Network:

Description: Manages a network of sensors deployed in wildlife conservation areas to capture data.
Interfaces:
Interface with AI Module for data transmission.
Interface with Geo-Spatial Mapping System for location data.
Operations:
Data capture and transmission to the AI Module.
Location and activity tracking.

2. AI Module:

Description: Processes sensor data using machine learning algorithms to analyze wildlife behavior, species identification, and potential threats.
Interfaces:
Interface with Sensor Network for data input.
Interface with Database System for storing processed data.
Operations:
Data processing using machine learning models.
Generating alerts for potential threats.

3. Database System:

Description: Stores processed data, historical records, and other relevant information.
Interfaces:
Interface with AI Module for storing processed data.
Interface with Geo-Spatial Mapping System for critical habitat mapping.
Operations:
Storing processed data.
Retrieving historical data for analysis.

4. Geo-Spatial Mapping System:

Description: Manages geospatial data, including wildlife movement tracking and critical habitat mapping.
Interfaces:
Interface with Sensor Network for location data.
Interface with Database System for critical habitat information.
Operations:
Movement tracking based on sensor data.
Identifying and mapping critical habitats.

5. Conservation Team Interface:

Description: Provides a user interface for conservation team members to receive alerts and collaborate.
Interfaces:

Interface with AI Module for alert notifications.
Interface with Database System for accessing relevant data.
Operations:
Receiving and acknowledging alerts.
Collaborating on response strategies.

Database:

1. Processed Data Storage:

Description: Stores data processed by the AI Module, including species identification, behavior analysis, and threat alerts.
Security Measures:
Encryption of sensitive data.
Role-based access control.
Backup and Recovery:
Regular data backups.
Disaster recovery plans.

2. Historical Data Storage:

Description: Archives historical data for long-term analysis and trend identification.
Security Measures:
Access controls to restrict unauthorized access.
Data anonymization for privacy.

Security:

1. Data Encryption:

Description: Ensures that data transmitted between components is secure and confidential.
Protocols:
Implementing HTTPS for data transmission.

2. Access Controls:

Description: Restricts access to sensitive components and data.
Implementation:
Role-based access control (RBAC).

3. Authentication and Authorization:

Description: Verifies the identity of users and grants appropriate permissions.
Implementation:
Multi-factor authentication.
Token-based authorization.

Networks:

1. Sensor Network Communication:

Description: Enables communication between sensors and the central system.
Protocols:
MQTT or CoAP for lightweight sensor communication.

2. Internal System Communication:

Description: Facilitates communication between AI Module, Database System, Geo-Spatial Mapping System, and Conservation Team Interface.
Protocols:
RESTful APIs for simplicity and interoperability.

Operations:

1. Monitoring and Maintenance:

Description: Regularly monitors system components and performs maintenance tasks.
Operations:
Log analysis for anomaly detection.
Regular system updates and patching.

2. Emergency Response:

Description: Defines protocols for responding to critical situations.
Operations:
Activation of emergency protocols.
Notification of the conservation team.

This breakdown provides a comprehensive view of the components, interfaces, database, security measures, networks, and operations required for an AI-based Wildlife Conservation System.