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Elephant Safety through Cutting-Edge Monitoring Technology

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ABSTRACT: "Elephant Safety Through Cutting-Edge Monitoring Technology" addresses the urgent issue of elephant poaching and the endangered status of elephants. Leveraging advanced technologies, the project introduces an innovative IoT-based location monitoring system employing RFID tags assigned to individual elephants. These tags include vital information such as location and serial numbers, facilitating comprehensive data collection on elephant movements, behavior, and health. The integrated system incorporates GPS trackers, accelerometers, and various monitoring devices to ensure thorough data collection. RFID tags, fixed to each elephant, enable location tracking, empowering stakeholders to monitor and safeguard elephants effectively. The location tracking ensures accurate data time stamping, enhancing the precision of monitoring efforts. The project's core processing unit is an ESP32 microcontroller, which manages data from temperature, MEMS, and pressure sensors, providing insights into the well-being of elephants. In the case of abnormalities, the system triggers alerts through a buzzer, strengthening the overall approach to elephant conservation and safety. It operates by connecting the BLYNK application for monitoring purposes. In the application, stakeholders can monitor body temperature, angle of the elephant, movement, and blood pressure values. Any variations trigger notifications through Blynk, and the software shows the location of the elephant. If the RFID tag is missed, stakeholders can monitor the elephant's action by reading the missed tag data. The population of elephants The global population of Asian elephants is declining annually, mainly due to the poaching of elephants for their body parts as medicine or accessories. As a result, the recent classification of Asian elephants as endangered by the International Union for Conservation of Nature (IUCN) underscores the gravity of the situation. Data from the Indonesian Elephant Conservation Forum (FKGI) reveal that the elephant population in 2020 stood at approximately 1,544 individuals, with over 900 elephants lost in the past 11 years. This significant loss is primarily attributed to rampant poaching facilitated by the scarcity of forest rangers tasked with monitoring elephant movements in their natural habitats. This application is more adaptable for the stakeholders to monitor the elephant's action.

KEYWORDS: cutting-edge technology, internet of things (IoT), health monitoring systems, Elephant Poaching, Wildlife Protection.

I. INTRODUCTION

Animals play a crucial role in maintaining ecosystem balance, yet the growing number of endangered species threatens this delicate equilibrium. To mitigate extinction risks, humans designate protected forest areas such as sanctuaries and national parks. However, despite conservation efforts, some animals perish due to undetected health issues. To address this, an animal location tracking the system coupled with health monitoring is proposed. This system utilizes pulse rate and temperature sensors to monitor the health status of animals while also tracking their precise locations. Two main applications are integrated into the system: location tracking and health monitoring. Recognizing the importance of every living creature in the ecosystem, it is imperative to safeguard wildlife amidst the expanding human society. Protected forests and national parks, spanning vast areas, serve as habitats for endangered species like tigers and leopards. However, tracking and counting these animals pose challenges in remote forest locations lacking infrastructure for data communication. Therefore, employing Global Positioning System (GPS) receivers and Global Mobile Communication systems has been a common practice in recent years. In this project, an RFID tag affixed to the animal's body is utilized for tracking purposes. The RFID tag contains the serial number and tracking information of the elephants. When the RFID reader reads the tag, we can access information about the elephants within the assigned border. Unread tags can be manually handled by the stakeholders through Blynk software.

Every creature on Earth plays a vital role within the ecosystem. However, wild animals are increasingly vulnerable to trafficking, pushing many species towards endangerment. To protect them, countries establish wildlife reserves and

national parks where these animals can thrive in their natural habitats, albeit under human supervision. Unfortunately, these protected areas have also become popular tourist destinations. Human encroachment into wildlife habitats has led to the destruction of forests, resulting in a decline in wild animal populations. It's imperative to safeguard these animals within sanctuaries. Despite threats from poaching, wild animals also face health challenges, and their movements can be disrupted by diseases. Therefore, preserving their lives is crucial for maintaining biodiversity. Endangered animals such as rhinoceroses, elephants, white tigers, pandas, and many others are under threat. Currently, there exist ten national parks, three wildlife reserves, and six conservation areas. Within these protected areas, a system is in place to transmit information regarding animal location, movement, and body temperature to wildlife/national park officers. Should an animal sustain wounds leading to a rise in body temperature, the system is programmed to send an SMS alert to the forest officer, prompting immediate attention. Furthermore, if an animal ventures beyond the boundaries of the wildlife area, the system automatically notifies the forest officer via SMS. Additionally, any significant change in an animal's movement, indicating potential harm or distress, triggers an SMS alert to the officer. Given the prevalent global concern of animal trafficking, this system plays a crucial role in providing vital animal information to the officers. The primary objectives of this project are to track animal movements, monitor temperature changes, and issue alerts using IoT technology.

II. EXISTING SYSTEM

Recent studies suggest that the adoption of the latest wireless technologies, facilitating seamless connectivity of IoT devices, is leading towards successful consumer acceptance of wildlife animal safety measures. Animals play a crucial role in ecosystems, contributing significantly to their balance. Nevertheless, the increasing number of endangered species poses a grave threat to biodiversity. In efforts to prevent extinction, humans have set aside forest areas like sanctuaries and national parks for their protection. Despite these measures, some animals succumb to poor health without receiving the necessary attention. To mitigate such losses, an animal location tracking system coupled with health monitoring has been implemented. This innovative system incorporates pulse rate and temperature sensors to monitor animal health and track their precise locations. It comprises two primary applications: location tracking and health monitoring, aimed at safeguarding endangered species and preserving biodiversity. Animal detection and information show protectiveness towards human beings. If any animal enters a living area, it will immediately send a message to the forest officer to recover the animal. This protects people from wild animals. Our project aims to prevent the poaching of elephants for their tusks and ivory.

Problem identified from the existing system:

1. Wildlife and forest departments are currently grappling with the issue of animals migrating from forested regions to residential areas.
2. In the event of an accident within a zoo, animals may suffer physical injuries or contract diseases, potentially leading to fatalities. However, locating animals within vast zoo premises during such emergencies poses a challenge.
3. Inadequate health monitoring contributes to the mortality of many animals. Hence, it's essential to monitor fluctuations in body temperature and heart rate to ensure their well-being.

The proposed system is gaining traction in various practical settings, offering a solution for monitoring animal health through the integration of temperature, heart rate, and pulse rate sensors. This report presents an IoT-based Animal Harm Detection system designed to track and protect wildlife by generating alerts using sensors. Human-animal conflicts present a significant challenge, resulting in substantial resource depletion and endangering human lives. Therefore, it is essential to develop technology capable of swiftly identifying venomous insects and reptiles responsible for human fatalities. Traditional wildlife tracking methods have long relied on wireless transmitter and receiver pairs, with the transmitter attached to the animal's collar and the receiver typically carried by a forest ranger. However, challenges arise when animals venture beyond the range of the wireless transmitter, particularly in expansive forest areas. Most sanctuaries cover vast distances, often extending hundreds of kilometers. To address this, GPS modems retrieve data from satellites, which is then transmitted to a microcontroller. Additionally, temperature readings from sensors are relayed to GSM modems equipped with SIM cards capable of sending SMS alerts to forest services or relevant government agencies. This data facilitates the real-time tracking of animals' locations using standard maps or rapidly through platforms like Google Maps.

The Conclusion part of the existing system:

Wildlife monitoring plays a vital role in safeguarding wildlife resources, ensuring their sustainable utilization, and enabling scientific management. Despite significant efforts in developing sensor systems, few have been deployed in the field and maintained for ongoing use in studying animals or conserving their habitats. The proposed system offers an optimal solution for continuous animal location and health tracking, operating around the clock. Leveraging Node MCU technology, it facilitates locating animals even across vast, dense forest areas. Real-time updates on animal health status are provided through temperature and pulse sensors, accessible via a dedicated mobile app for forest officers. Immediate alerts via the notification system enable prompt response to any anomalies, allowing caretakers to swiftly reach the animal's precise location. As a fully automated and self-sufficient system, the proposed project eliminates the need for constant human oversight. With its implementation, wildlife preservation efforts can be significantly enhanced, leading to improved conservation outcomes.

III. PROPOSED METHODOLOGY

We ensure protection for elephants from poaching. We are trying to enable the IOT domain to prevent the poaching of elephants. We suggest a location monitoring system with an RFID tag. Each elephant is assigned an RFID tag, which has the details about the location and serial number of the elephant through which Stakeholders can track the movements of elephants within a forested area using location monitoring technology. We suggest monitoring both the location and health condition of the elephant and notifying stakeholders if any abnormal condition is found.

The proposed model aims to:

- Protecting the elephants from poaching and ensuring the protection of elephants, their habitats, and migration corridors is crucial, along with addressing conflicts between humans and animals. Additionally, attention should be given to the welfare of captive elephants.
- Preventing the Combatting the illegal ivory trade and safeguarding elephants from hunters and poachers are essential objectives.
- Save the Elephants strives for a future for elephants. Safe the elephants from the Endangers range.
- Protect the elephants from endangered range and maintain the sustainable population of the elephants.

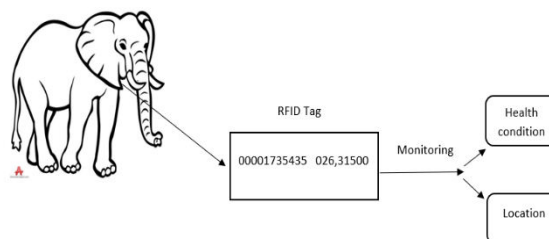


Fig 1:Outline diagram of proposed model

The proposed model aims to prevent poaching. Stakeholders can easily monitor the elephants, and if any abnormalities are identified, they can easily track the location, which will save the elephants. Each elephant is assigned an RFID tag, which consists of two pieces of information: the serial number of the elephant and its location information. The stakeholders handle the software framework of the model using the Blynk app. Through Wi-Fi, the information is shared and noticed by the stakeholders. This means that time consumption is low, thanks to the use of the IoT domain.

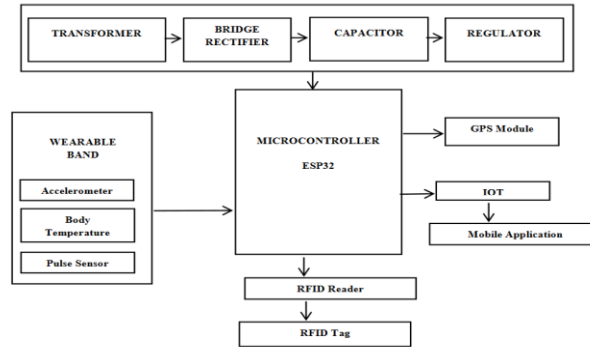


Fig 2: Block diagram of proposed system

Each elephant is assigned an RFID tag. The RFID tag contains two values: i) Serial Number and ii) GPS location. Whenever the elephants cross the assigned border, the reader reads the RFID tag and sends a notification through the software that says, "The elephant is crossing theborder".In between, if there are any abnormalities found in their health condition, the device shows the values and sends the location to the stakeholders. Here, the stakeholders can easily save the elephant from the problem. Additionally, if an elephant does not return to the forest by the expected time, stakeholders can manually monitor the location and health condition of the elephant through the software application. This project was proposed to implement a health monitoring and tracking system to help the elephants live a healthy and peaceful life. In the current scenario, there are a few applications that help the owner keep track of their wildlife animals' health conditions and medical history. This health monitoring and tracking belt will help them tackle such traumatic situations by timely monitoring, which will alert their owners by sending captured data as well as the location. This system will alert the caretaker of elephants about their health condition, mainly heart rate, temperature, and fall condition of the animal, which will help to increase attention towards elephants and reduce their death rate.

Proposed solution crossing these stages:

1. Clearly defined project goals.
2. Evaluate potential challenges and risks.
3. Determine the project budget.
4. Investigate existing technologies and necessary software & hardware components.
5. Establish connectivity and data transmission protocols.'
6. Develop a prototype for testing.
7. Make necessary adjustments based on prototype feedback.

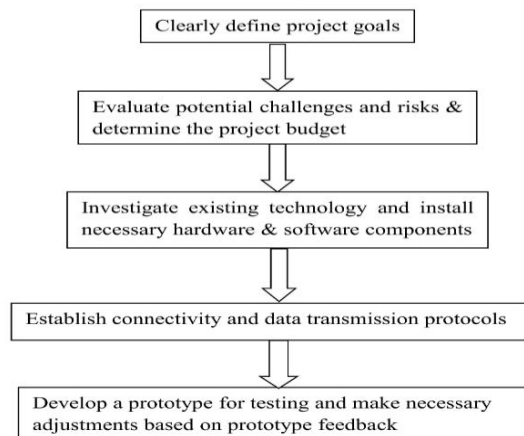


Fig 3: Process of data acquisition

IV. RESULT AND DISCUSSION

The above results show the action of the elephant:

- When the elephant crosses the border, it shows the notification that: "The Elephant is crossing the border."
- When it returns to the forest, the notification is sent: "The Elephant returned to the border."
- If there are any changes found in its health condition it will show abnormalities in the health.

In this study, our primary aim is to protect the elephants from poaching through cutting-edge monitoring systems.

- RFID tags are assigned to each elephant, which contain location information and serial number details.
- We use the GPS module to track the elephant while crossing.
- Here, the ESP32 microcontroller is used to analyze respective parameters with the help of sensors. Temperature sensors, MEMS sensors, and pressure sensors are used to gather data from the controller.
- All the sensor values are stored where stakeholders can monitor, and if any abnormalities occur, it provides an alert through notification.



Fig 4: BLYNK APPLICATION RESULT

From the above snippet, we understand the elephant's location is found. If there are any abnormalities found, the notification shows an option to track the location.

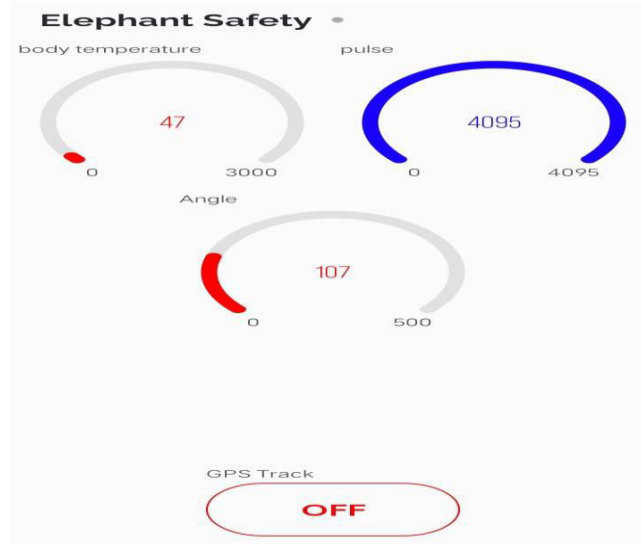


Fig 5: Blynk application result 2



Fig 6: Blynk application result 3

This project's successful outcome ensures to save elephants from endangerment, ensuring protection against poaching. By saving elephants, this technology contributes to securing a future for these majestic animals. The implementation involves advanced technologies such as IoT, a Wi-Fi module (ESP32), sensors, and a comprehensive data processing approach, as detailed in the project description.

V. CONCLUSION

Using cutting-edge monitoring technology holds immense promise for enhancing elephant safety and conservation efforts. By employing advanced surveillance systems, such as satellite imagery, drones, sensor networks, and real-time tracking devices, we can revolutionize our ability to protect these majestic creatures. Moreover, the integration of monitoring technology with other conservation initiatives fosters a holistic approach to elephant protection. By raising public awareness and engagement, serving as a deterrent to poaching, and enabling adaptive management strategies, these cutting-edge solutions offer a comprehensive framework for safeguarding elephant populations.

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