

Wildlife Animal Tracking and Monitoring System

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Abstract: Animals form a big part of the ecosystem. Their existence is very important for the balance of the ecosystem. But nowadays, more and more animals are getting endangered and are on the verge of extinction. To save animals from extinction, humans reserved forest areas (Sanctuaries and national parks) for their safety. However, some animals died due to bad health which couldn't get any attention either. To avoid such casualties, an animal location tracking system with a health monitoring system is used. Proposed system uses a pulse rate and temperature sensor to keep track of the animal's health and also track the exact location of the animal. In the proposed system two main applications have been installed: location tracking, health monitoring.

Keywords: Health monitoring, Location Tracking, GPS, Wi-Fi.

I. INTRODUCTION

As per nature's rule, every living creature on this earth is important and has an important role in the ecosystem. Since the human race, or human society is growing, the wildlife is in danger. Endangered animal and wildlife, they live in the protected forest or national park where are in big area and when we need to know about the number of the special wild animals such as tiger or leopard, they become very hard to track or count them because they live in the big forest where there is no infrastructure for data communication. Hence, in order to track the location Global Positioning System receiver and Global System for Mobile communication is used. In this project a Node MUC helps to get the coordinates of the location. This modem requires a minimum of 4 satellites. The Node MCU microcontroller receives location parameters like latitude and longitude from the satellite. We have also used a GSM modem which sends these parameters to particular mobile numbers through SMS. This information is used to locate the current location using Google maps. The proposed work consist of a temperature sensor and a pulse rate sensor. If the animal has fever or if there are some wounds on the animal body and because of wounds temperature of the animal rises and sometimes there are some fluctuations in the heart rate, then it sends an SMS to the forest officer, he can give immediate attention.

II. PROBLEM STATEMENT

1. In the present arena, wildlife and forest departments are facing the problem of movement of animals from forest areas to residential areas.
2. If any accident happens to them in the zoo, physical injury or any disease may even cause death of animals in the zoo. In such situations we cannot find out the exact location of animals in such a large area.
3. Many animals also die due to lack of monitoring of their health, so it is necessary to monitor the variation in the body temperature and heartbeat of the animals.

The system proposed is more and more adopted in a wide range of applicative scenarios. To track the health of an animal, sensors such as the temperature sensor, heart rate and pulse rate sensor are used. This report proposes a system for tracking and alarming the protection of Wildlife Animals. It combines Wireless Sensor Network (WSN) Node MCU technologies to solve the above-mentioned problem.

III. LITERATURE SURVEY

IoT Based Animal Tracking And Monitoring System In Zoo [1]. The goal of this project is to track the location of animals in zoos or national parks. To monitor this, we are using a temperature sensor. It continuously monitors the animal's temperature. If there is any variation in the temperature, it will be displayed on the LCD. The PIR sensor is used to monitor the human presence in restricted areas or near the animal boundaries. When the human presence is detected, the voice processor will give alert to the people through the pre-recorded voice. it will give complete information to the website on pc or laptop.

In the Animal intrusion detection system using wireless sensor networks system [2] the bird intrusion is being detected by the use of wireless sensors and buzzers which produce acoustic sounds. When a bird is being detected by the sensors in the agricultural area the acoustic sounds get activated. This sound irritates the birds. Hence when these sounds are generated the birds will fly away as they cannot accommodate to that sound. Thus, the destruction caused by the birds in the agricultural fields can be avoided. These acoustic sounds that are being generated will be produced only when the birds are detected and continue for a while until the birds are driven away.

Intrusion detection using Passive infrared Sensor [3], a simple approach where PIR sensors are placed in the place which has to be monitored? The sensor is placed in a tower arrangement. This system is a one-way implementation of our job. The main objective of this system is to monitor the area and find any unauthorized entry into that area. Also, the end result of this system is an output which either denotes the entry of an animal or human. Even an object with similar kinds of characters is not classified, because the entire system is only reliant on a sensor tower which differentiates between the two classes based on the IR rays emitted by the object. Also the output data is to be continuously monitored by a human, else there will be no action taken against the intrusion. This is not an autonomous system since no corrective action is taken for the problem.

Animal situation Tracking Service using RFID and GPS system [4] a GPS tracking device is to be placed in the leader of the group of animals. A virtual border is created around the protective zone. These signals are to be continuously monitored in a base station and when the leader crosses the border an alert message is generated. Note that here the leader of the group is assumed to lead a batch of animals and also these animals always approach the human area in groups. This is not the case with most of the animals. The group may be split; the animals may not follow the animal which was identified as the leader; also finding the animal „leader is a tedious task.

Implementation of intruder recognition in a farm through a wireless sensor network [5] a Wireless Sensor network is formed by implementing motion sensors at various locations around the field. Continuously motion data is communicated to the Coordinator through a Radio-frequency transceiver. On detecting motion, an alert message is delivered to the farm owner.

Animal detection using face detection approach [6] In this approach a locomotive behavior of an animal is video recorded and stored in a system, when the animal enters the restricted area, it will be detected Destruction caused by the animals in the crop field can be avoided. Any moving obstacle can be considered as an animal.

Development of Location Detection and Human Tracking Application via GPS and GSM [7]. RFID tag is provided to the person which is interfering with the GPS system by using this we can track the location of any person. Humans can be tracked easily, when they miss in any flood, earthquake or crowd. System is not waterproof.

Patient monitoring system [8]. Thermistor is used for measurement of body temperature, the patient calling system is incorporated, and the patient heart beat rate is monitored using a photoelectric sensor. Patients in the ICU can be monitored frequently. Patients may feel inconvenience to have the tag.

Wildlife animal location detection and health monitoring system [9]. Animal location is detected using GPS, it sends information to GSM which has a sim card which sends information to the authority, temperature is monitored using a temperature sensor, Animals can be tracked and monitored easily, this system contains only the temperature sensor for health monitoring.

Conservation of wildlife from poaching by using sound detection and machine learning [10]. In this approach the foot sound of animals and human is differentiated using ML and Sound is recorded using microphones by using this we can save many animals being hunted, With the help of this system we can reduce the species becoming endangered, sometimes very low frequency sound is not identified

Real time location-based tracking using WIFI signals [11]. Numerous algorithms are described in this research to track the location of the user with the help of the wireless sensor network. Location of the user can be tracked easily; this system works accurately for only a short distance.

Dairy farm house monitoring based on IOT Technology [12]. This system is going to monitor cow feeding position and tracking taken food quality. Milk production is increased with high quality, other dairy diseases are not detected with the help of this system such as lumbar.

Realtime Animal Monitoring over the Internet with Age of Information [13]. The goal of RAMEN is to efficiently detect target animals in real time using network cameras. We propose a determination method for the monitoring interval to guarantee the target value of monitoring accuracy based on a formal theoretical analysis using the Age of Information (AoI). The proposed scheme can minimize the amount of transferred data to enable efficient and stable monitoring even

in resource-limited environments. The performance of RAMNE was evaluated with ns-3 simulations to confirm the relationship between monitoring accuracy and interval.

An Automatic Wildlife Tracking System Using GPS and Wireless Sensor Networks [14]. GPS is used to define two borders, and when a wild animal with a tag approaches the first boundary, the warning system will activate. A voice recorder and a speaker make up this alerting system. When the animal approaches the first border, a preset sound such as gunfire or crackers will be played over the speaker. Assume the animal has crossed the first border and is moving towards the secondary boundary. The location of the wild animal will be sent to the forest station base office after reaching the second boundary, and then using a GPS device, the location of the wild animal will be sent to the forest station base office.

Detecting Wild Elephants Via WSN For Early Warning System [15]. Our project was to develop a system which is feasible as well as practical to implement and with minimum amount of labor involvement. It can be determined that elephants frequently attack the agricultural field at night. Elephants seem to enter agricultural lands or home gardens mostly during the night. Only one farmer mentioned encountering elephants in the daytime, while 70% raids took place in the night, while 20% was reported at dawn and 10% at dusk. Therefore using this fact, we designed a system which is more effective at night time.

Wireless sensor Networks for Habitat Monitoring [16]. While plants are dormant or the ground is frozen, sensors can be deployed prior to the start of the breeding season or another critical phase. Sensors can be put on small islets where repeated field research would be dangerous or undesirable. Previous studies that have generally neglected or dismissed disruption effects can be compared to the results of wireless sensor-based monitoring activities. We believe that by taking many measurements of various variables, we will be able to construct prediction models, rather than relying on a single parameter captured by wireless sensors to determine why pterrels chose a given nest site.

Animal health monitoring system using Raspberry Pi and wireless sensor [17]. In the wireless sensor based animal health monitoring system, important parameters affecting cattle health such as rumination, body temperature along with surrounding temperature and humidity are continuously monitored. The system also includes analysis of stress levels of animals in terms of thermal humidity index. Raspberry Pi model B + is used as a web server. In this system, the PIC microcontroller senses the rumination activity, body temperature and humidity. Graphical display is possible for analyzing the rumination process and stress level of the animals.

Zigbee based animal health monitoring system [18]. Animal health monitoring system for monitoring the physiological parameters, such as rumination, body temperature, and heart rate with surrounding temperature and humidity, has been developed. The developed system can also analyze the stress level corresponding to the thermal humidity index. The real time monitoring of physiological and behavioral parameters can be present on the GUI PC. The device is very helpful for inexpensive health care for livestock. A prototype model is developed and tested with high accuracy results.

Wild animals detection and alerting using X band Doppler Radar for crop protection [19]. The introduction and implementation of an ultra-sensitive tiny portable microwave life-detection system yielded promising results. Vital indicators such as heartbeats and breathing can be detected using Doppler effect-based systems, which can be used to locate animals hiding behind trees, crops, and other obstacles. This device has been tested in both simulated and real-world scenarios, and it can detect vital signs of life through dense building materials up to 1.5 meters thick and standard density materials up to 10 meters thick while working at 10.5 GHz center frequency in the x-band.

Wildlife animal location and health monitoring system [20]. The wild creatures have been followed for many years using traditional means such as a wireless transmitter and receiver pair. The wireless transmitter is attached to the animal's collar, while the receiver is retained with the forest ranger. However, we are unable to locate animals when a forest area is vast enough to fall outside of the range of a wireless transmitter-receiver. The length of most sanctuaries is in the hundreds of kilometers range. The GPS modem gets data from satellites and transfers it to the microcontroller. It also takes temperature readings from a temperature sensor and sends the data to a GSM modem. GSM modems come with a SIM card that can be used to send SMS to the forest service or any other government agency. This data is used to locate the animal's present location on any normal map or rapidly using Google Maps.

IoT based Animal Harm Detection using sensors creating alert [21]. Human-animal conflict is a huge issue that results in the loss of vast amounts of resources and puts human life in jeopardy. As a result, there should be a gadget to detect poisonous predators approaching humans in their immediate vicinity, so that humans can be alerted to protect their safety from the threat. As a result, we're developing a technology that can quickly identify the venomous insects and reptiles that cause human deaths.

Surveillance and Tracking Elephant Network Path in a Wireless Sensor Network [22]. Each sensor node has its own data transmission and reception architecture, and events are detected using a packet generation approach. Additional external factors that affect sensor network coverage include the distance between the source and the nodes, as well as tracking the elephant's movement using an event tracking algorithm. The network path was finally discovered using the position of



the sensor node in the field. We plan to focus our efforts in the future on real-time sensor node experimental analysis, data aggregation, and multiple object tracking.

Wildlife Animal Tracking using RFID and GSM[23]. A RFID (Radio Frequency Identification Device) module and a GSM (Global System Mobile) modem are used in this project. Forest officers or Government authority personnel will get these SMS containing the area in which animals observe. Wireless networks serving mobile subscribers with fixed base stations such as cellular networks have to track those subscribers to ensure adequate service delivery and efficient utilization of limited radio resources

Artemis-The Smart Wildlife tracking solution [24]. Artemis adds some useful features to existing collars while keeping the design simple, making elephant tracking, monitoring, and protection a little easier. Artemis makes use of the Arduino Nano 33 BLE Sense, which has a wide range of sensors. The integrated microphone can detect elephant sounds and vocalizations and run them through Edge Impulse Studio's trained small ML model to distinguish different sorts of elephant vocalisations. Using resources from elephant voices and categorizing them, a thorough dataset was built.

GPS Arduino based Tracking and alarm system for protection of wild life [25]. The Arduino (Controller) is connected to the GPS device, which is used to track the location of animals. It will also convey the location of the animal that has been affected by the rise in temperature. The information regarding the animal's location, temperature, and any item movement, such as human movement, will be shown on the PC using the IOT kit. It keeps track of each animal's temperature on a regular basis.

IV. BLOCK DIAGRAM

The below figure represents the block diagram of proposed work

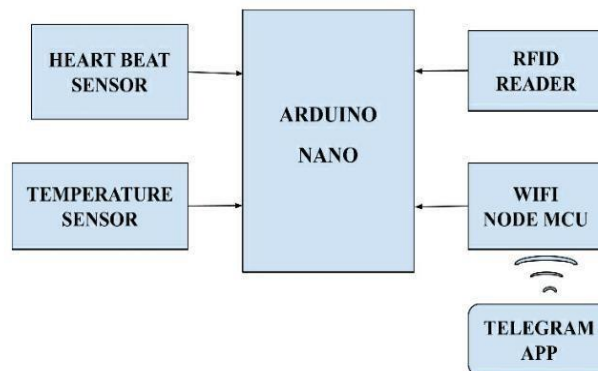


Figure: Block diagram

1. The Arduino Nano Microcontroller chip receives the string of characters from the satellites and reads the coordinates from the Node MCU and finds the location of the animals in the form of latitude and longitude.
2. It also receives the identification information of the animal from the RFID reader. RFID tags that are affixed to the animal collar in order to track them using RFID reader and antenna. RFID tags transmit data through radio waves to the antenna or reader.
3. The Temperature Sensor is used for sensing the temperature of the animal. It measures the temperature value in millivolts and sends it to the microcontroller which is converted into degrees Celsius. Using this, we get a good idea about the health of the animal.
4. The Pulse Sensor is also added the same as a temperature sensor to monitor the health of the animal. The body temperature of the animal can sometimes be manipulated by the surrounding weather. Hence, to double check it, the pulse sensor has been added, which detects the heartbeat of the wildlife. This sensor sends an analogue signal according to the heart pulse to the microcontroller. This then gets converted into a digital signal in beats/min.
5. A battery is connected to the power supply to the microcontroller and all other components for the proper functioning of the system.
6. A Control room is placed at the receiver station where the forest officer will be there, all the information is received here in the form of a message either in the Mobile or PC.
7. Telegram app is developed that can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other things.

V. METHODOLOGY

To the neck of the animal this lightweight designed system is attached such that the temperature sensor will be very close to the body of that animal. Thus, body temperature is sensed and sent to the microcontroller properly. The Node MCU will receive string from satellites and send it to the microcontroller. Then the microcontroller will extract latitude and longitude information from the string and send it to the IoT modem. After updating the Data to the forest officer, the server will come to know the body temperature and location information.

Applications

- Proposed system is used to track animals in zoos and national parks.
- Proposed work can be used to monitor pet animals and track them in public areas..

Advantages

- The proposed system can avoid the animals entering the public area.
- Proposed system can track the health of animals constantly.
- Proposed system can avoid the animals becoming endangered and extinct.

VI. CONCLUSION

Wildlife monitoring is important for effective protection, sustainable use and scientific management of wildlife resources. Although there is currently a lot of work on building real sensor systems, very few attempts have been made to deploy them in the field and then maintain and develop them. The study of the animals through this system or their conservation. Proposed system is the best possible way to keep track of the animal's location and their health 24 hours-a-day. Proposed new system can find the animal over large, dense forest areas with the help of a Node MCU. It also gives a live update of their health through the temperature and pulse sensors.

The app in the mobile phones of forest officers will allow them to keep track of the wildlife from anywhere and at all times. The notification system will alert them immediately. if anything is wrong with the species, the caretaker can reach the exact location immediately. Proposed system does not require any human attention as this is a completely self-independent and automated system. Proposed project will help us save wildlife at a much better rate.

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