Animal Monitoring System Using IoT

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Abstract- *Animals have become an integral part in our ecosystem. These animals may be domesticated or wild animals, they are to be taken proper care and protected from the external harsh environment. A suitable ecosystem must be provided to protect them from danger. The main aim of this paper is for monitoring the animals behaviour, which includes monitoring their habitual movement, location tracking, monitoring the health, sending the data on the cloud.The Global Positioning System (GPS) is used in tracking the location of the animals where they are sent for rearing and also for monitoring their health based on the environmental parameters such as temperature, humidity etc..The Temperature Sensors are used to measure the body temperature of the animals so that the health of the animals can be checked frequently and treated if required at an early stage. The GPS collar is used to detect the movement of the animals, which will be useful to detect the location of the animals, or if there are any threats around them.For this we make use of SigFox app which is a wireless transmission of measured values and alarm with high battery life. The Proximity sensor is used to calculate the distance and position of the animals. It will be given a certain distance beyond which if the animals seem to walk around then an alert or signal is transmitted to the mobile app. For the smart GPS collar not to be removed from the animal that results in theft "Smart Theft Detection System" or "Burglar Alarm" along with the Smart GPS Collars can be placed on the hardware to alert the user and sending notification and the location of the animal due to the presence of the spy camera within the collar to the device incase if someone hampers with the wearable devices.*

Keywords- GPS collar,Proximity sensor, SigFox, Spy camera, Temperature sensor.

I. INTRODUCTION

Animals have much importance in the human lives as they are used for the profitable purposes like production of food, clothing etc., and some animal considered very scared that are present in many mythology and religions. The animals are even domesticated for the production of food, meat and they are even helpful in the agricultural land for farming.

As the animals are being used for many purposes it is necessary for the humans to take care of them and provide them a protective environment Internet of Things provides a way to protect the animals from danger and also monitor their health regularly. Earlier humans physically had to maintain their herd from danger during rearing but now the introduction of IoT sensors and methods have made it easier to monitor animals from their place of residence.The movement of animals and their habitual are monitored by the use of GPS collar sensors. These sensors are placed around the neck of the animal such that we can track the location of the animal. Along with the GPS, Temperature Sensor is also attached within the collar such that the health of the animal can also be monitor based on their body temperature the health condition of the animals are measured and required diagnosis can be carried out at the very earliest.

GPS collar makes use of SigFox app which send and alerts owner about the animals location. SigFox that requires less power with battery life and can transmit data to wide distance which makes it possible to track the animal even if they are far away from their place. This GPS collar is not just used for domesticated animals they can be used even for the wild animals in the forest to monitor their health as national parks being a very large area physical presence and the monitoring of the animals is not a practical task instead this device can be used to easily track the location of the animal, as the temperature sensor is also being used the health of the animal, as the temperature sensor is also being used, the health of the animal is also monitored and a proper medication can be given to them.

II. LITERATURE SURVEY

In these days the GPS is used to monitor the animal that this has helped in locating the ccurate location of the animal. Several studies related to the Animal Monitoring System are described as below:

A. Animal Tracking System:

The Animal Tracking System is based on monitoring animal locations. The components that required are a

network, Global Positioning System, and at least one wireless computing devices. This GPS receives the signal, calculates the location of the animal and then transmits the notification to the owner.

B. Mobile animal tracking system using light sensors for efficient power and cost saving motion detection:

This paper proposes a system of efficiently tracking the location of the animal by using the simple analog light sensors such that the cost of battery and power is less consumed making the tracking process easier. The location of the animal is notified to the owner by sending an alert to their mobile. The Google map, GPS and sensors are used which sends the signal over the SMS-GSM netwoks.

C. IOT based animal monitoring and tracking system in zoo:

In this paper it states the presence of the PIR sensor, along with the temperature sensor which is used to track the location of the animal.The PIR sensor is used to detect the presence of any humans interference with in the animals boundary, this sensor basically works by detecting the voice of the humans at that particular restricted area by sending the alert to the forest department.

D. Animal detection methods in Digital Images:

This paper describes the method of detecting the locomotive behaviour of the wild animal and also to prevent them from moving into the residential area, this system also includes the use of RFID based mobile monitoring system which is a sensor device that is used in tracking the location of the wild animals in that area.

III. EXISTING METHODOLOGY

There are an increasing number of issues regarding various animal heal the condition and their locomotive behaviour. In this topical era, animals have become the most intergral part in the human life therefore, monitoring the animals habitual and health condition of the animal must be taken care of. The animal health monitoring and tracking of the animals is done by using the ZigBee module which is a wearable device. ZigBee device helps in transmitting small amount of data over a short distance and being less secure. This device is used to monitor the health and to track their location with the presence of temperature sensors and the GPS. The accurate location of the animal can be tracked.

IV. LIMITATIONS OF EXISTING SYSTEM

This system focuses on tracking and monitoring the health of the animals. The ZigBee being a wearable device it possess serious security threat. The ZigBee module is placed around the neck of the animal with a GPS sensor that detects the location of the animal. This system must be required to protect the animals from danger. In case of wild animals it is not practical for the humans physical presence as it would be dangerous for human lives. The Animals must be taken care of because when the herd of animals during rearing can be hampered by someone unknown or they may even forget the way back to home, hence monitoring them is a must. The use of ZigBee module whose configuration is very complex and it possess a serious security threat. Since ZigBee transmits data over a short distance tracking the animals is not much efficient. If the transmission of signal is over a large distance then it may result in signal attenuation, this being a disadvantage of efficiently monitoring the animals.

V. PROPOSED METHODOLOGY

The IoT based animal tracking and health monitoring system is used to track the location of the animal and also to monitor their health and they can be diagnosed of their problem at the earliest and a proper treatment could be given to them and help them from recovering. This proposed system makes use of the SigFox technology, the SigFox is a Low Power Wide Area Network (LPWAN) that consumes very less power and that it has a high battery life and can be operated over a wide distance. This system makes use of the GPS Collar which is placed around the neck of the animal along with a temperature sensor to monitor their health, proximity sensor that makes use of the buzzer and spy camera within the collar so that the location of the animals can be easily tracked. The GPS Collar is a wearable device such that they can be hampered easily, for the Smart GPS Collar not to be removed from the animal that results in theft a Burglar alarm can be placed on the device to alert the user and by sending the notification to the owners device. The use of SigFox makes this system work more efficiently.

The SigFox network consists of three process which makes them very efficient and that also makes it transmit data signals to a wide distance. The three networks made use by the SigFox are Object, Base stations and cloud. This network consists of three technologies and it works as follow. The Ultra narrowband technology (UNB) where signals are sent very infrequently therefore it requires less energy at a low data rates making it very efficient with less battery life. Secondly the Differential phase shift keying technology (DPSK) this method is used to debug the signal that is transmitted from the

base station by inevitably encounters interference from the environment such as the disturbance caused due to the rain thunder etc., which clears all these disturbance and it sends the same signal as it is that is received from the device, DPSK plays a vital role in transmitting the received signal to the owner's notification. Thirdly the presence of Frequency Shift Keying (FSK) which is very similar to DPSK that removes all the disturbances from the transmitted signal, so they detect the external disturbances and eliminate them and converts them back into the original signal as received, except that they first shift and then analyse rather than analyse and shift as done by DPSK. All these three network technology makes the SigFox network work more efficiently.

The GPS collar, the temperature sensor and proximity sensor which is light weight and a less complex circuit makes it available for the mediocre people with the presence of the burglar alarm that alerts the owner when someone hampers the device or while tracking the location of the animal and if they are found to have moved away from their place to a distance of 100m or if they are hampered then this proximity sensor will alert the owner by sending a notification and the photo of the current location of the animal, by doing this the animals can be saved from any external danger and they are always under the human surveillance.There are a various other advantages of this system, it does not require the physical presence of human, they can monitor them online through their mobile this could save them time and during this time they can work on some other daily chores. This device is also used to monitor the health of the animal by the presence of temperature sensors, this sensor is used to measure the body temperature of the animal, the temperature of the animals will either be increased or decreased due to the external conditions, this variations of body temperature of the animals is measured by using this sensor. The temperature of the animal will increase if there is any wounds or changes in their respiratory patterns due to all these reasons the body temperature may increase. The sudden rise and fall in their body temperature due to health condition can lead to their death if not diagnosed at the early stage.

This system can also be used to detect any physical injury or any accidents that as occurred to the animals which may even lead to the death of the animal, for example in the national parks, zoo etc., in such a large area it would be difficult for the physical presence of the humans to monitor those wide species of animals, practically it would take around many days to check the animals locomotary motions and their health condition individual, hence the presence of such devices makes the tracking of the animal in such a large area and a proper medication can be given to them, hence we make use of Internet of Things technology to detect the exact location of the animal and to help them out. They can also be used to have a count of number of animals in the herd and if any missing can also be tracked and brought back to their habitat. Finally the main aim of this system is to track the location of the animal, to monitor the health condition of the animal, the presence of the burglar alarm and the spy camera will locate the animals in case if the animals have lost its way back home or if it is been shoplift by someone else, these sensors will be used to detect the animal as they send the signal to the SigFox cloud and which will in turn be sent to the owner's mobile as notification.

Fig 1: SigFox GPS Tracker

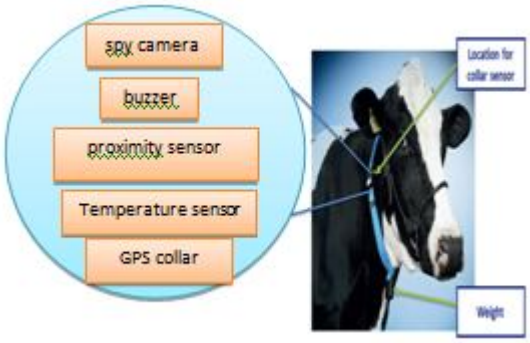

Fig 2: GPS Collar around the neck of the animal.

The animal monitoring system flowchart is as below in fig 3, this basically depicts the process and steps in which the tracking and monitoring of the animals are done.

It starts of with enabling the GPS and all other components that is the proximity sensor, temperature sensor these sensors are helpful in calculating by tracking the location of the animals, the proximity sensor is used from protecting the animals from danger, that is if in case the animal moves out of its boundary an alert will be sent to the owner or in case of wild animals the forest department will be given a signal about the current location of the animal such that the animal like say for example if a deer has lost its place and moved towards the lion's boundary an alert will be sent such

that they are again brought back to their habitat, this protects the animals from danger. Therefore this system is very helpful in monitoring the animals from danger.

FLOWCHART

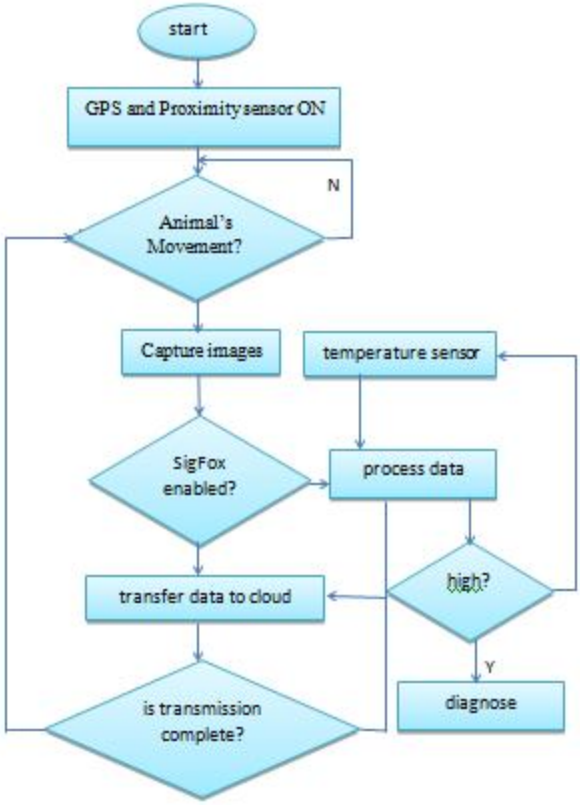

Fig 3: flowchart

VI. SYSTEM ARCHITECTURE

The system architecture design depicts the diagrammatic representation of this proposed system. The main aim of this system is Animal Monitoring, this helps in monitoring that is tracking the location of the animal and monitoring their health by using the SigFox network technology, this technology is widely used as they have the ability to transmit data over a very large distance, with a less consumption of data and power with high battery life, therefore it doesn't require frequent changing of the battery. Hence it is highly affordable for all the people around.

This system makes use of the Global positioning system that tracks the accurate location of the animal that helps in safe guarding the animal from danger. As the animals will always be under the surveillance of the human using this GPS. If the animals have lost their way back home this GPS collar can be used to locate their place and be brought back to its habitat. In this way GPS is being very helpful locating the animal even in the absence of human intervention.

The temperature sensor that detects the body temperature of the animals so easy diagnosis of the disease or injury can be found out without even the actual physical

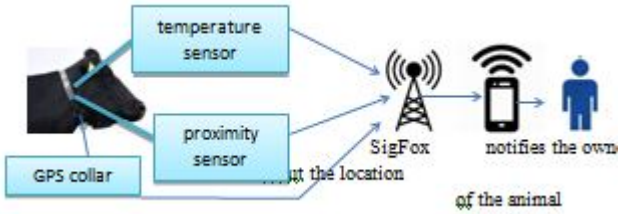

Fig 4: System Architecture of animal monitoring system

presence of the human in the ground. The temperature sensor can sense even a minute changes in the animals body, such that a pre detection of the body condition is known and can be treated accordingly.

The proximity sensor, generally a proximity sensor is used to detect the distance from an object without actually touching any other body or objects that are nearby. In this system the proximity sensor plays a role of preventing the animals from moving away from their boundary. The distance limit will be set in the sensor say a 100m such that for example if a cow is rearing in a piece of land along with its herd, and if any one of the cow is missing from its place or if it moves beyond 100m or away from the herd then this sensor will alert the owner by an alarm and will also send a notification to their mobile as the spy camera will capture the image of the animals current location and this will be notified to the owner by sending the image and the current location of the animal.

All these data that are been received by the GPS and Sensors are sent from the base station to the SigFox network where the differential phase shift keying, Frequency shift keying and Ultra narrow band technology process takes place, where the originally received signal from the base station is cleared from all the disturbances by the above mentioned process and the original signal as received from the base station is sent as a notification to the owner.

VII. HARDWARE REQUIREMENTS

The basic Block diagram representation is as shown in fig 5. This system requires hardware components like the GPS**,** temperature sensor, proximity sensors, buzzer, a power supply and a micro controller. This system is used to monitor

the animals, and the device placed around the neck of the animals.

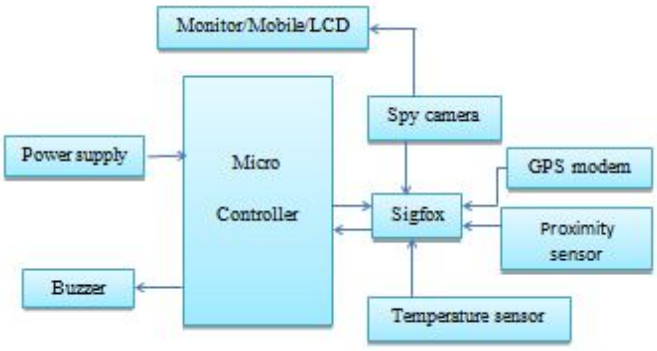

Fig 5: Hardware Components

Sensors:

a. Temperature sensors:

The Negative temperature coefficient (NTC) sensor are used in detecting the body temperature of the animals very accurately. In this type of temperature sensor the resistance decreases with increase in temperature and this sensor is basically made from polymers or ceramics, hence they rea typically used to measure temperature in the range of -55^{o}C to 200^{o}C. This sensor is highly sensitive, due to its small size it is able to measure even minute temperature changes in the body of the animal and it is very economical.

b. Proximity sensors:

The proximity sensors are used in detecting the distance of an object without actually having any physical contact with the nearby objects. The Ultrasonic distance sensor is made use of, this sensor can easily detect the distance and the objects that are around the animals by emitting an ultrasonic radiation, which has high frequency and are highly sensitive. This sensor is easy to use and does not cause any harm to the animals neither to the objects nor to the humans around it.

This system makes use of the buzzer to alert the owner if the animal or the device is been shoplift by someone, the spy camera that is present will capture the image of the location where the animal is and sends it to the owner so that it will be easy for them to find the location of the animal.

VIII. CONCLUSION

Thus the animal monitoring system is used to monitor the location of the animal, to detect the health issues in the animals based on the integration of Sigfox (LPWAN).If the animal during rearing is lost the way from its place or if it is being shoplift by someone then the burglar alarm and the spy camera helps in finding the exact location of the animals. The less complexity and low cost of the devices makes it available and can be affordable for all common people.Therefore the direct physical interaction of the human or the presence of the human in the location is not required.

IX. FUTURE ENHANCEMENT

In this paper the proposed system can be used to detect the temperature of the animal, locate the position of the animal using IoT using SigFox a wireless transmission of the measured values and alarm.It makes use of the GPS collar which is light weight and a less complex circuit with high battery power and low cost so it is affordable to all mediocre people.The presence of the spy camera, burglar alarm within the GPS collar will enable the detection easier and also less complex circuit.

The future work will be extending for monitoring the respiratory rate of the animal, the types of diseases it is suffering from so that they can be cured at the earliest.

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