

Wildlife Animal Location Detection and Health Monitoring System

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Abstract— Every living creature on this earth has equal importance in the ecosystem. But nowadays life of wild animals is in danger. Wild animals used to move freely in the forest or in the jungle. If any accident happens to them in the forest, physical injury or any disease may cause even death of animals in the forest. In such situations we cannot find out exact location of animal in such a large area.

To avoid such problems in the finding exact geographical location of animal in the jungle, national park or in wildlife reserves, wildlife animal tracking system is used. This system utilizes technologies such as Global Positioning System and Global System for Mobile Communication.

Keywords— Wildlife animals, GPS modem, GSM modem, Low-power microcontroller, RISC CPU, Power supply, forests, National parks or reserves etc.

I. INTRODUCTION

Now a day's wild animals are becoming less in number because of industrialization and cutting of trees in the forest area. Hence it is important to save life of wild animals in the sanctuaries. Animals move freely in the area of forest without any fear. Since many years these wild animals are being tracked by using conventional methods such as using wireless transmitter and receiver pair. Here wireless transmitter is kept in the collar of animal and receiver is with forest officer. But when area of forest is large enough to not fall within the range of wireless transmitter-receiver, we can't locate animal. Usually area of sanctuaries is in the range of hundreds of kilometers in length. Fig.1 shows a cheetah with tracking collar on its neck.



Fig. 1: A cheetah showing the tracking collar

Hence we require a device which will work even when area of sanctuary is hundreds of kilometers. For this purpose we must go for technologies such as GPS. This system uses this technology to locate location of animal in sanctuary. GPS modem receives string of data from the satellites and sends it to microcontroller. Low-power microcontroller extracts latitude and longitude information from string of data received from GPS modem. It also measures temperature from temperature sensor and send this information to GSM modem. GSM modem has SIM card, which is used to send SMS to the forest authority or to any government authority [1]. This information is used to locate current position of animal using any standard map or quickly by using Google map [6].

Introduction to the need of new wild animal tracking system and disadvantages of existing animal tracking system is given in the Section-I. Section-II gives actual system design of tracking system with block diagram explanation. Justification behind selection of every component is also neatly explained in Section-II. Section-III gives actual implementation of the system. Internet technology and use of Google map for detection of wild animal is also given in the Section-IV. Finally conclusion followed by acknowledgement and references is given.

II. SYSTEM DESIGN

Fig. 2 shows overall system design. It consists of GPS modem, body temperature sensor, PIC microcontroller, GSM modem etc.

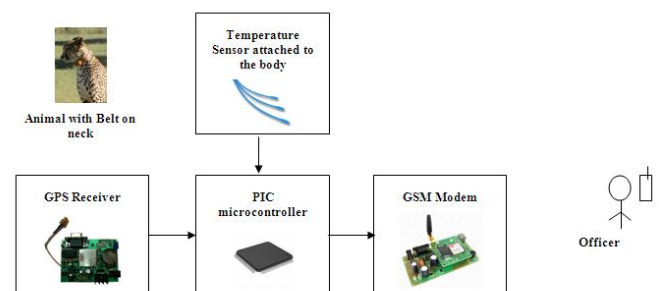


Fig. 2: Block diagram of a system design

A. GPS Modem

GPS stands for Global Positioning System. To accurately find out the geographical on the earth by receiving information from the GPS satellites, a GPS navigation device is used. It is being used in automobiles and Smartphone. It is satellite based navigation system consisting of 24 satellites placed into orbit by U. S. Department of Defense (DoD).

Initially GPS was invented for military applications only. But in 1980's U. S. Government decided to allow GPS to be used by civilians also [3]. Fig. 3 shows GPS modem is as shown in the figure.



Fig. 3: GPS Modem

GPS receiver will receive string of data from GPS satellites and sends this data serially using RS232 protocol to the microcontroller. Microcontroller on the other hand extracts latitude and longitude information from the string. GPS receiver receives data in the form of GPGGA sentence. The data is extracted as follows.

Example:

\$GPRMC, 132455.970, A, 2651.0145, N, 07547.7051, E, 0.50, 342.76, 301010,,A*64

Where,

RMC – Recommended Minimum Sentence C

132455.970 – fix taken at 13:24:55.970 UTC

A – Status, A=Active or V=Void

2651.0145, N – Latitude 26 degree 61.0145' N

07547.7051, E – Longitude 075 degree 47.7051' E

301010 – 30th Oct 2010

*64 – checksum data always begin with *

B. GSM Modem

GSM stands for Global System for Mobile Communication. GSM modem is same as that of mobile phone, which has SIM card. It is used to send SMS to the forest authority [1]. Microcontroller extracts Latitude and Longitude information from the string of data, sense body temperature of animal and sends it in the form of SMS by using GSM modem. Thus forest officer come to know the actual geographical location of animal and animal's body temperature. Output of GSM modem is sent via RS232, so we will require level converter IC RS232, which will convert RS232 levels to TTL levels, if microcontroller is to be interfaced to GSM modem. Fig. 4 shows GSM modem [2].



Fig. 4: GSM Modem

C. Temperature Sensor

The temperature sensor is used to sense the body temperature of animal to determine health of animal. Thus it should be smaller in size and lighter in weight. Sensor node allows us to for wireless monitoring of body temperature. We are using Thermometric Thermistors, which is NTC (Negative Temperature Coefficient) type.

D. Control Unit

Low power microcontroller is used for this system since entire hardware kit has to be tied to the neck of animal for duration longer than a week. PIC microcontroller suits more for this application. PIC stands for Peripheral Interface Controller. PIC is developed by Microchip Corporation. Free resource is available on the web site www.microchip.com. PIC microcontroller is available in various packages to suit applications [4]. Since we require light weight we prefer to use Quad Flat Package (QFP) as shown in Fig. 5.



Fig.: 5 PIC Microcontroller in QFP package

The MPLAB C18 compiler is freely available on this web site. It is low-power, High performance RISC CPU. It is based on the Harvard architecture. Due to RISC architecture smaller is the instruction set and due to Harvard architecture speed of operation is greater [5]. The features of PIC microcontrollers are as follows.

- Low-power, High performance
- Harvard architecture
- RISC processor, smaller instruction set
- Higher operating frequencies from DC to 40MHz
- In-built ADC with 10-bit digital output and 8 channels
- Serial Port for serial communication

III. ACTUAL IMPLIMENTATION OF SYSTEM

To the neck of animal this light weight designed system is attached such that temperature sensor will be very close to the body of that animal as shown in the Fig. 6. Thus body temperature is sensed and sends to microcontroller properly. GPS modem will receive string from satellites and send to microcontroller. Then microcontroller will extract latitude and longitude information from string and send it to the GSM modem. After receiving the SMS forest officer will come to know the body temperature and location information.



Fig. 6: Collar belt with GPS and temperature sensor attached to the neck of lion

IV. WILD ANIMAL TRACKING ON GOOGLE MAP

It is possible to locate exact geographical position of animal with the help of Google map. When latitude and longitude information is known, after entering this information on the Google map we can locate it by using internet as shown in the Fig. 7 and Fig. 8.

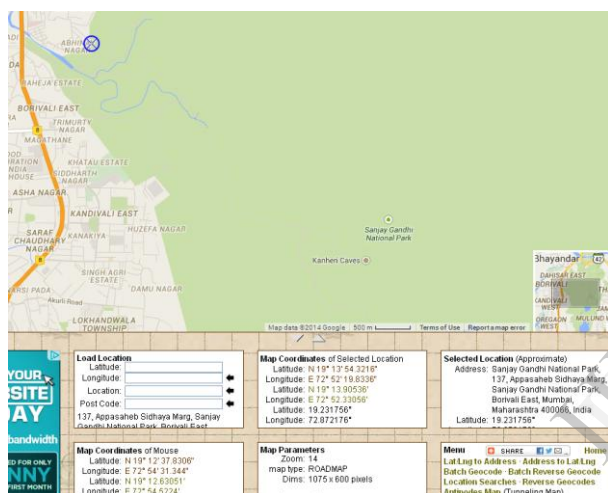


Fig. 7: Google map of Sanjay Gandhi National Park, Borivali East, Mumbai, Maharashtra 400066, India

Map Coordinates of Selected Location Latitude: N 19° 13' 54.3216" Longitude: E 72° 52' 19.8336" Location: N 19° 13.90536' Longitude: E 72° 52.33056' Latitude: 19.231756° Longitude: 72.872176°	Selected Location (Approximate) Address: Sanjay Gandhi National Park, 137, Appasaheb Sidhaya Marg, Sanjay Gandhi National Park, Borivali East, Mumbai, Maharashtra 400066, India Latitude: 19.231756°
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Fig. 8: Details of location from latitude and longitude information

CONCLUSION

It is fast and convenient method of finding out location of animal as compared to other methods. It is automated also. Only we can suffer from one situation when battery goes down. To avoid this situation we must use low power devices such as ICs, other components and microcontroller, to increase life of battery.

By increasing the sensors we can determine other hygienic parameters of animal. With the use of internet it becomes easy to locate animal on Google map thus pictorial representation is also possible. Thus by using GPS and GSM technology it becomes very easy to locate animals in the forest and monitor their health issues also. Thus we can locate and save life of animals from various deceases as well.

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