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Low Cost Alert System for Monitoring the Wildlife from Entering the Human Populated Areas Using IOT Devices

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ABSTRACT: Wildlife entering populated areas has recently become common place. The space for wild animals is decreasing as humans are encroaching forests. It creates great loss to property and life when wild animals enter cities. We use latest advances in technology such as Internet of Things (IOT) to create an alert system of possible wildlife leaving the forest. We use low cost motion detectors and single board computer to achieve this. We relay information of such motion to a control center to take further actions. We also propose a deterrent such as making loud noise through speakers which can prevent wild animals from leaving the forest. The basic idea of IOT is to connect different sensors and establish communication and also provide services. In this article, we make use of several IOT devices at the periphery of natural reserve to create an alert system. This system can also be used to find out smugglers and other people illegally entering the forest.

KEYWORDS: Internet of things, Passive infrared sensors, Global positioning system, General packet radio service, Raspberry pi, Sensor network.

I. INTRODUCTION

Humans try to prevent wild animals from entering their area and agricultural land by passing high voltage electricity in the fences across the forest edge. This is a dangerous solution for both humans and wildlife. In order to avoid the conflict between humans and wild animals and to prevent endangered species like wild elephants dying from accidents, we propose an intelligent embedded solution using the latest technologies. Reduction in cost of single board computers and improvements in battery technology, combined with continued miniaturization of transmitter components, will likely reduce transmitter size further, while increasing efficiency and extending either detection range or tag life made our system low cost. We are using Raspberry Pi 2 for this project as it is a single board computer and low cost. It has a huge user base and it operates on open source software. We are showing a proof of concept which can be scaled and the cost further reduced by mass production and embedding chip with all the modules integrated on a single chip.

II LITERATURE SURVEY

Usage of sensor networks in monitoring, tracking and detection of different wildlife species is a common practice that is carried on. For small animals and birds, RF tags are used to track their motion using radio telemetry [1]. This is a costly solution and these RF tags have to be replaced after their life span. To overcome these limitations a new technology is needed that enables new ways to monitor wildlife. A team of expert researchers are working on the different aspects of such a new technology. They have also reported on their research on a sensor-network-based tracking solution for bats. A preliminary research on the real-world bird tracking system, and discussion how the system's working process and also its mechanisms such as power saving techniques, data storage, and communication indication, data transfer is done and mainly it is low cost which is beneficial [2]. To overcome

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limitation of previous approach, tracking of wildlife using radio collars was implemented. This approach also reduced implementation cost. Radio collar was tied around animal's neck which generated very high frequency. Researchers have to physically go into the field and try to pin point using directional antenna. This approach is time consuming. To improve on this approach an aircraft drone with radio on-board is used which receives the signal and collar position of animal traced [3]. A wireless sensor network system is developed to monitor the migration patterns of Swamp Deer, known as Wild CENSE. In this approach climatic and positional information of animal was collected and sent to base station using peer to peer network. Radio transceivers are used to transmit data to base station. From each peer node an external data flash memory is used to record the collected data. The collected information would be sent to database server via internet [5].

III. RELATED WORK

Incidents of wild animals entering cities and injuring peoples have become very common. This is an example of man-animal conflict arising out of wildlife straying into human areas. We propose a sensor network system to create an alert system sensor network as shown in Fig 1.

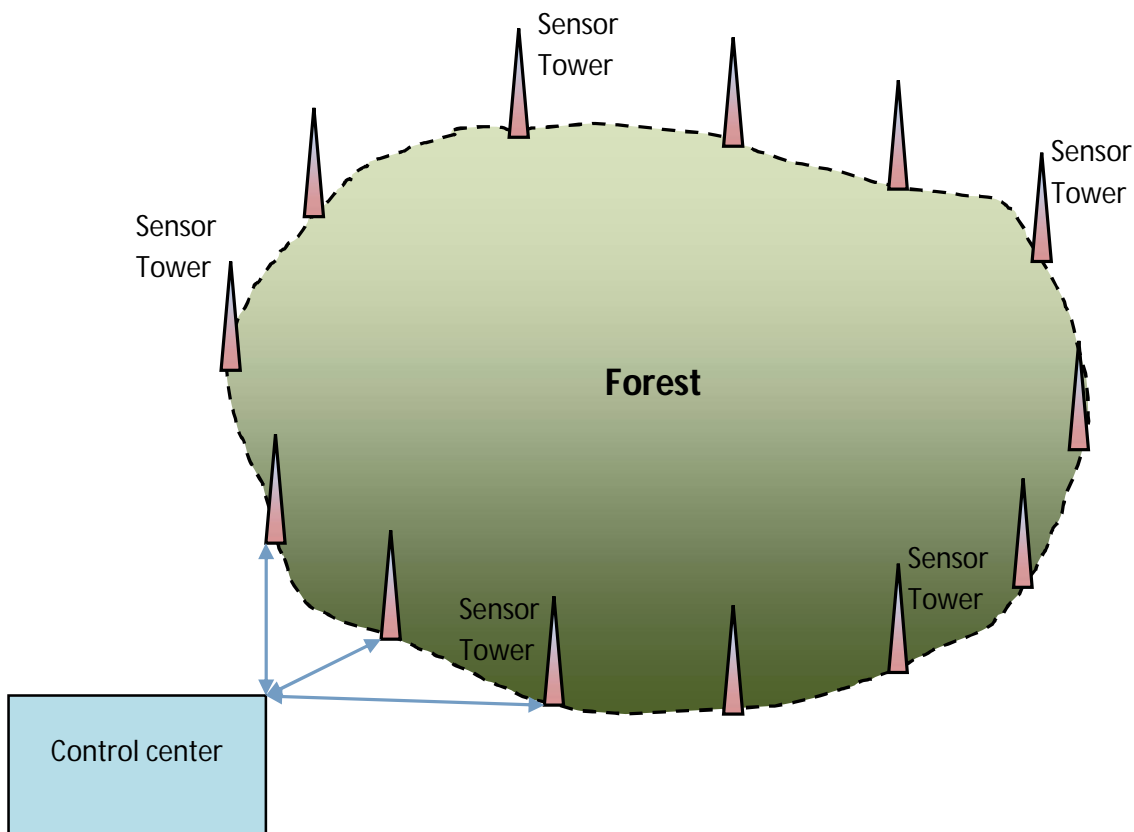


Fig.1 The forest boundary with sensor towers tracking the animal near boundary

The sensor tower in the Fig 1 is present at the boundary of the forest to track movement of wildlife and humans near the boundary. The sensor tower is made up of Raspberry Pi 2 (RPi 2) and other components. RPi 2 as it is a single board computer with Linux operating system. RPi 2 has 40 GPIO pins which can be used to control and get information from the sensors. It also has 4 USB ports which can be used to connect web camera. It works with very low power which is

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needed for our application. RPi 2 acts like a mini computer processing all the information and relaying that information to the service center.

We use PIR sensors for motion detection. An alternative can be to use IR camera but for simplicity we use PIR sensors. The sensor tower also has GPRS/3G module to connect to the control center. The boundaries of the forest have GPRS connectivity as they are closer to the human population. This makes communication easier. If a motion is detected by the PIR sensor, we take the picture of the region and send it to the control center. We also send a SMS to the concerned official. If the control center needs to make a warning sign or noise, it can send a signal to the concerned tower to make loud noise and scare the wildlife from crossing the forest boundary. We know the location of each tower as it is fixed. If needed the officials can go the location quickly and can take further measures.

The block diagram of sensor tower/ Raspberry Pi module is shown in Fig 2. Raspberry pi 2 is connected to a USB camera which takes the snaps whenever motion is sensed and sends it to a web server using internet. The snaps taken can also be used to monitor animal migration patterns and their social behavior.

We use solar power at each sensor tower as it may not be economical to have electric lines throughout the boundary of the forest. The solar panel charges a battery and this provides the power to the sensor tower. Since the power consumption is low, the system works on stored battery power even at night.

We use Python language for programming of Raspberry pi. Python language is a high level, general purpose coding language. Most importantly it is simple to understand and easy to code. Any other coding language compatible with raspberry pi can also be used. Open CV is installed on raspberry pi 2 for the purpose of image detection.

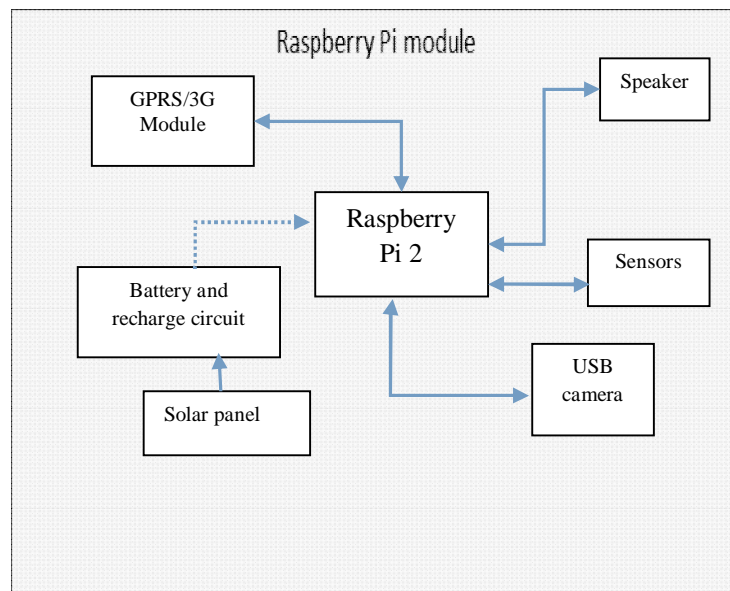


Fig.2: The block diagram of sensor tower used for wild life tracking.

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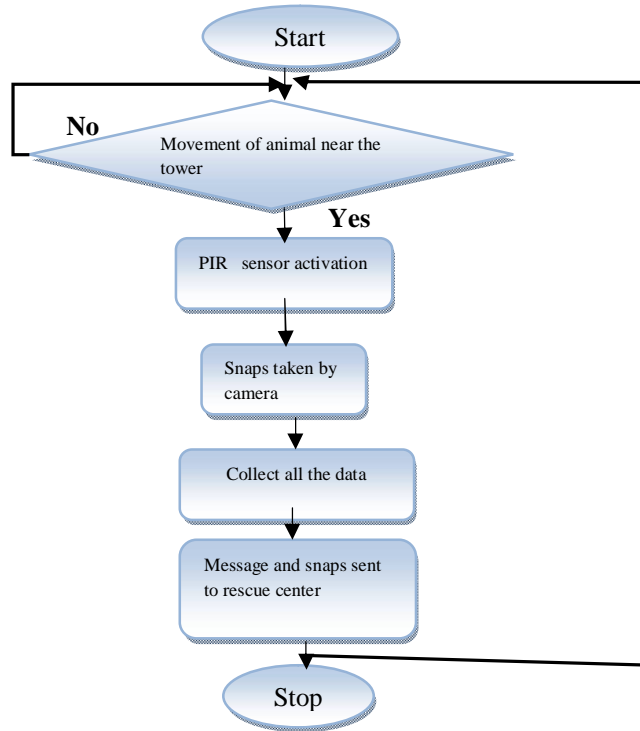


Fig.3 flowchart of the project

Fig.3 shows the flow of proposed system. Once the message have been sent the process again repeats without human interaction.

IV. EXPERIMENTAL RESULTS

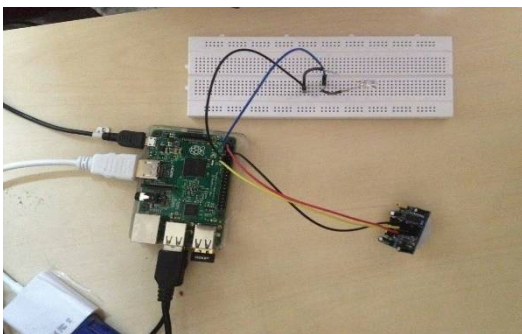


Fig 4. PIR sensor with led before motion is sensed

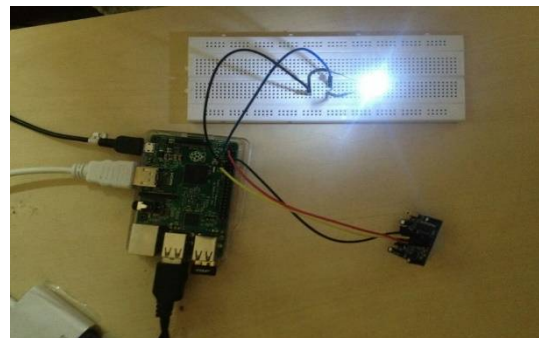


Fig 5. PIR sensor with led after motion is sensed

Fig 4, 5 shows motion detection using PIR sensors. Once the motion is sensed led glows as shown in fig 5

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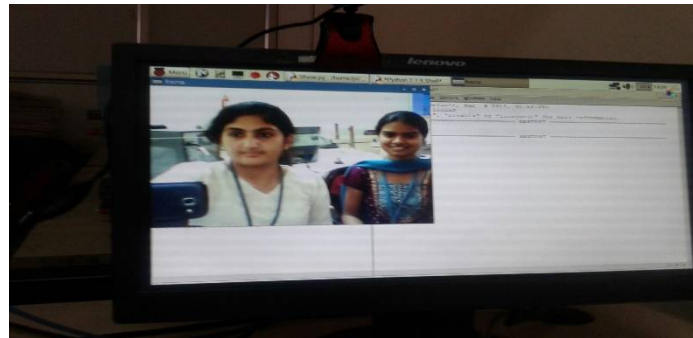


Fig 6. Image capturing after movement sensing

After sensing of motion an image would be captured and sent on internet as shown in fig 6

V. CONCLUSION

The proposed solution for wildlife alert system presents cost-effective, reliable and technically simple solution. This approach believes that using various such IOT devices the environmental balance can be achieved by saving the wild animals from getting harmed. The proposed method is also easy to implement and environmental friendly. It can save human life and property. We have various scope for improvement in our model such as better motion detection using image processing with night vision cameras. We can come up with more advanced approaches to completely avoid the wild animals from leaving forest boundaries using safer methods than electrical fence.

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