An Intelligent Guiding System for Trekkers using WUSN

K. Abirami, S. Lavanya, M. Rashmi, V. Roshan

Abstract - To design and develop an automated surveillance system to detect and intimate the presence of animals, monitoring the health parameters of the trekkers and to detect fire in the dense forest. Using sensors and wireless technology that communicate to the base station using wireless communication. In this project the image processing technique is explored for the detection of animals so that any change in pattern then the trekkers and base station are alerted. For the communication process, a wireless underground sensor network is employed which has a lot of interlinked nodes. This is because internet usage is not effective in the dense and reserved forest area. Node to node communication is performed for efficient information sharing with the base station and the communication process for trekkers is carried on with wireless sensor networks thus providing warning information to the trekkers. Animal detection based applications have a very important role in many real-life situations and also detection of forest fire in dense forest is hard and fast-spread. Therefore there must be automation and faster means of communication.

Index Terms - Arduino, Microcontroller, Sensors, Wireless Sensor Network, Wireless Underground Sensor Network

I. INTRODUCTION

In the world of adventure, trekking is an adventure hobby that is pursued by most of the people who love nature. It can be considered as both as a sport and a hobby. Trekking can offer both mental and health benefits. Trekking is mainly done in the forest area which is more adventurous and the risk factor is also high because trekkers are attacked by animals and are also affected by external and internal conditions during trekking. This project is employed to detect the presence of animals [4] and understand their behavior and also to monitor the health parameters of the trekkers. Even though trap cameras are used to monitor the behavior of the animals [2] they can be viewed only by taking the recorded tapes manually. There is no instant solution to protect them in case of an emergency. In this project the image processing technique is explored for the detection of animals. The information is transferred to the base station using a wireless underground sensor network and to the device carried by the trekker’s using a wireless sensor network to alert them for the safety purpose.

Due to different climatic conditions and different altitudes, the trekker’s health parameters vary, which may also lead to death so it is necessary to monitor the health parameters of the trekkers [6] during the trekking. In this project the trekkers are given a device that Monitor their health parameters such as heartbeat, temperature, and respiratory. If any health problems are found the information about the health condition is sent to the base station in the forest region. In order to detect the forest fire on time and to reduce the time to detect the forest fire, the proposed project consisting of wireless sensor network [3] which has many sensor nodes which are self-organization, multi-hop network. By the cooperation and communication among the nodes, the monitoring objects can be monitored in real-time. For communication wireless underground sensor network is used using node to node communication this is because the internet is not efficient in the forest region. This makes the alert about the fire in the forest with the longitude and latitude which is feed into the nodes.

II. LITERATURE REVIEW

Sachin Sharna, Dharmesh Shah, Rishikesh Bhavsar, Bhavesh Jaiswal, Kishor Bamniya proposed this for the Automated Detection of Animals in Context to Indian Scenario. The presented method has been applied for animal detection. Simulation results were applied for testing purpose to various images of dog and the system has very low false positive and false negative rates. An overall efficiency is achieved for animal detection i.e. 86.25%.

Shreyas Ramachandran Srinivasan, Soorya Sridhar, Ganeshanand Balasubramanian, proposed this for the Complex Animal Movement Capture and Live Transmission (CAMCALT). The presented concept in the paper will be very useful in achieving transmission done by integrating “Internet of Things” into the device for live feed wirelessly from any part of the world. It gives a host of options to the administrator, including poacher identification via on_x0002__board image processing algorithms and GPS location to correctly identify the location of animal motion/poacher.

Emrah Simsek, Baris Ozzer, Levent Bayndir, Gul Sah Tumulklu Ozzer, proposed this for Fotokapan Görüntülerinden İnsan-Hayvan Tanma Hımlı Animal Recognition in Camera Trap Image. In this case, it is investigated human-animal distinction image data set obtained from camera traps for smuggling detection and prevention. Support Vector Machine (SVM), k-N, and random forest algorithms are used to classify the data in two classes as humans and animals. The experiments are conducted on different type of data set. It give always the best accuracy results for all data set.
Christian A. Hofmann; Robert T. Schwarz; Andreas Knopp, proposed this Measurement and Modeling of the UHF Satellite channel for Animal Tracking Systems. In this presented system space communication systems in the Ultra-High-Frequency (UHF) band, like military communications or space crafts related communications, present and upcoming animal tracking systems introduce a novel UHF propagation channel with a larger bandwidth, low-gain antennas and new challenging propagation scenarios like for example the forest. A statistical model is provided to predict the received signal power, and to estimate the required additional fading margin to close the link of UHF animal tracking systems in the presence of a reflected signal from the ground.

III. BLOCK DIAGRAM

**Fig 1. Venturer Section**

**Fig 2: Forest Section**
IV. HARDWARE DESCRIPTION

A. Micro Controller
Arduino is an open-source platform for building electronics projects. Arduino Uno is an ATmega328P microcontroller. It consists of 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It has everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter. Arduino Uno has many number of facilities for communicating with a computer, another Arduino board, or other microcontrollers.

B. Transformer
The potential transformer will step down its power supply voltage from (0-230V) to (0-6V) level. Then the secondary of a potential transformer will be connected to the precision rectifier, which is constructed with the help of op-amp. The main advantages of using a precision rectifier are it will give peak voltage output as DC; the rest of the circuits will give only RMS output.

C. Camera
Wireless security cameras transmit both video and audio signals through a radio band to a wireless receiver. In this analog wireless has a transmission range of around 300 feet (91 meters) in open space. But in digital wireless the transmission of audio and video analog signals encoded as digital packets over high-bandwidth radio frequencies. The cost of individual cameras is low.

D. Temperature Sensor
It senses the temperature of an engine and provides the level of temperature. LM35 is a temperature measuring device that has an analog output voltage proportional to the temperature. It does not require any external calibration circuitry. Laser trimming ensures the specified accuracy.

E. Sound Sensor
It measures noise levels in decibels (dB) at frequencies around 3-6 kHz where the human ear is most sensitive. It will extract a sound signal from a modulated signal. The threshold-sensitivity can be adjusted on the sensor. It is slightly sensitive and easy to use.

F. Heartbeat Sensor
It gives the digital output of heart beat when a finger is placed on it. When the detector is working, for each heartbeat LED flashed in unison. Its working principle is light modulation through the finger by blood flow at each pulse.

G. Voice IC-APR9600
It can offer true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds. This device supports both random and sequential access of multiple messages. APR9600 devices reproduce voice signals in natural form. It eliminates the need for encoding as well as compression, which often introduce distortion.

H. Respiratory Sensor
It is used to monitor abdominal or thoracic breathing, in biofeedback applications such as stress management and relaxation. This sensor also gives you an indication on relative depth of breathing.

I. Wireless Sensor Network
Made by hundreds of small, low-cost nodes that are fitted with limitations in memory, energy, and processing capacity. Wireless sensor networks a multitude of sensor nodes has to be deployed. It monitors and records the physical condition and organizes it in a central location.
An Intelligent Guiding System for Trekkers using WUSN

V. SOFTWARE DESCRIPTION

A. Embedded C

To link the performance mismatch between Standard C and the embedded hardware and application architecture Embedded C is designed. It supports freestanding embedded processors in exploiting the multiple address space functionality, user-defined named address spaces, and direct access to the processor and I/O registers.

B. Arduino IDE

The Arduino software IDE is designed to write programs to Arduino and to communicate with the hardware. It consists of user written code. It employs converting the executable code into hexadecimal encoding that is loaded into the Arduino board.

VI. METHODOLOGY

The project consists of three sections forest section, venture section, and monitoring section.

A. Forest Section

The forest section consists of the camera to keep track of animal movement and to recognize [5] if there is any change in the pattern of the movement detecting them [4] and sending the alert signal to the trekkers and the base station using wireless underground sensor networks and wireless sensor network respectively. Similarly, if a forest fire occurs then the fire detecting sensors get triggered and the alert is sent from the node near the fire which contains the longitude and latitude of the location which is feed to the node during installation and sends it to the base station and trekkers via wireless underground sensor networks and wireless sensor network (ZigBee).

B. Venturer Section

The venturer section trekkers carrying a portable device that constantly monitor the health parameters of the trekker. The basic parameters which are monitored is Heart beat temperature and breathe [6]. If any unnatural activity occurs then the health alert signal is passed to the base station via WSN and WUSN. In this project ZigBee is used for WSN communication with the nearest WUSN node. The node sends the alert signal along with the latitude and longitude of the node to the base station. The portable device also accept alert signal for trekkers in case of fire by a voice output.
C. Monitoring Section

The monitoring section consists of all the information carried by the nodes and is processed to display in a monitor where logs can be accessed so that the forest rangers in charge of the base can send the operational team with no delay due to lack of information.

VII. RESULT

The animal detection data is sent to the trekkers to alert the danger and also to the base station. The health parameters of the trekkers are monitored periodically to alert in case of an emergency. In the case of a forest fire, the information is sent to the base station and the trekkers.

VIII. FUTURE SCOPE

This project can be further be improved to detect the cutting of trees in the forest which is now a major cause for the destruction of natural resources, to alert the forest officials so that all the natural resources are safeguarded in an efficient manner.

IX. CONCLUSION

In this project due to improper communication, the automation system is implemented for the detection of animals and communicates to the trekkers and base station using WUSN. Node to node communication is used for efficient data transfer. In case any health problems occur during the journey in the forest, the health parameters of the trekkers are monitored using various sensors which will help them to alert in case of emergency. The fire in the forest is detected and the data is transferred to the base station which prevents the forest from the destruction.

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Retrieval Number: G579705972020200BEIESP
DOI: 10.35940/ijitee.G5797.069820

Published By: Blue Eyes Intelligence Engineering & Sciences Publication