A Surveillance System for Avoiding Human-Animal Conflict using Zigbee and RSSI

T.S. Balaji, S. Balaji, S. Amrithaavarshini, K.R. Preethi

Abstract--- Animal-Vehicle Conflict is one of the major issues across the world which affects both human and wild life. A recent research indicates many animals die due to train accidents mostly & road accidents at night time. Despite railway authorities & highway authorities instructing the drivers to reduce the speed in forest areas, there has not been much reduction in wildlife death from vehicles. The surveillance and tracking of wild animals are difficult due to their size. The proposed system automatically detects the wild animals with a small tag implanted on their ears or in their bodies. Each and every wild animal crossing zone has a receiver which can debug the implanted tag and thereby stop the vehicles when the wild animals near a crossing section. The implanted tags areRSSI,Zigbee&GPS which consumed low power will typically consume 50 mA at 3.3 V a 3amps 3.3v lithium ion battery can be used for more than 5 years. The road side unit continuously asks for the presence of wild animals within its range. It is a pronoun fact that Zigbee can transmit its data up to 80km range in open air. Hence whenever a wild animal nears a crossing point the gps value with respect to crossing units will be very less. By knowing these parameters automatically, a siren is given to the road side unit by the embedded device present in it. On successful detection of a siren the driver reduces the speed of the vehicle to a considerable limit such that the Wild animal which carries the tag is not hit by the vehicle. Also, this paper initiates an effort to tag all wild life so that when wild animals like cheetah or leopard enters into a residential area is intimated to the forest rangers by trans receiver units placed at potential places where wild animals can enter the human zone.

Keywords--- Vehicle -Animal Conflict, RSSI, Zigbee, GPS.

I. INTRODUCTION

Nowadays, Because of increasing the human population it is obvious that the shrinking of forest area. In order to extend the living environment of human beings, they demolish the forest areas, building the road densities and destroy many places which are suitable for wild animals to survive. When the boundaries of forest areas are shrinking then the wild animals will enter in to human prone areas and definitely disturb them. When humans are acquiring those forest areas then the conflict occurs between humans and wild animals. These conflicts will leads to lose of their lives, so enough buffer zones are required between them. Some remedies of protecting human beings from wild animals are maintaining a safe distance of farms or homes and the forest area, using UAV camera capturing the images of the wild

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animals activity[9], providing safe pathways for animals at the highways, wearing a mask in backside of their head which is the concept of big cat behavior and it reduces the wild animals attack at a reasonable amount. [1]Electric fences also one among the solution to avoid the attack of wild animals but the result is lost the life of those particular wild animals. We could not take a risk by implanting those electric fences where the particular wild animals are less in count. A warning is in the form text which is received by implanting a Chip on an elephant. This will reduce the human death at a considerable amount.

Fig. 1. Animal -Vehicle Conflict

II. DIVISION OF THE PROJECT

In short, the paper is divided into two sections.

Road Side and Railway Zone

The accidents caused to wildlife animals is taken. as more and more of wild animal deaths occur near railway track & other crossing points because of train hitting elephants, each and every crossing point is equipped with wireless receiver node to detect the presence of wild animals near to it by GPS values transmitted by Zigbee transceiver.

Human Prone Area

More and more cases of leopards attacking humans and human cattle are occurring nowadays to stop these events the animals are tagged with Wireless sensors which intimate the rangers about their activity when they enter a human prone area. Sufficient steps are taken thereafter to stop any carnage because of these wild animals.

III. SYSTEM ARCHITECTURE

Normally an embedded system can be constructed with the help of hardware which is suitable to import the coding that is written in software.

The design of a particular circuit can be done with hardware while the coding part of that relevant circuit is carried out by writing the coding part in software. Both are collectively called as embedded system.
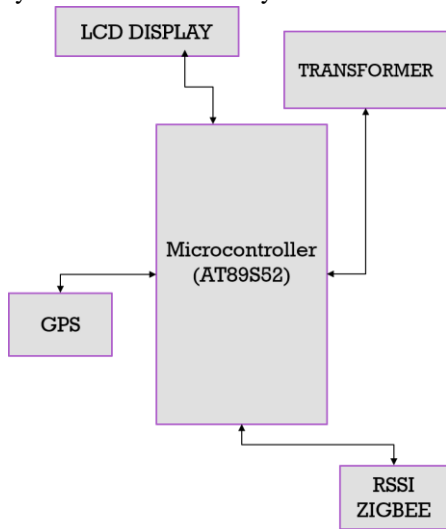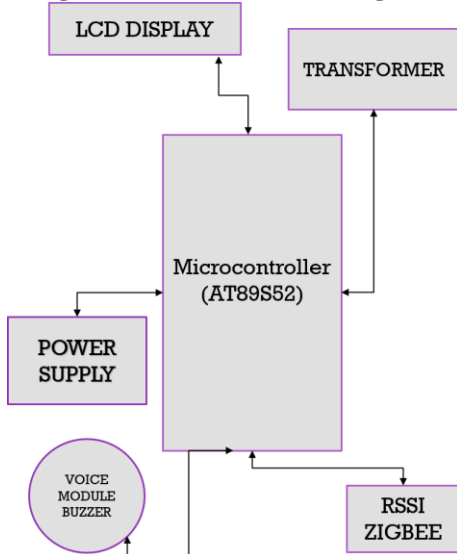

Fig. 2: Animal Unit Block Diagram

Fig. 3:Wildlife Monitoring Unit

Hardware Development

The Tracking and Monitoring system consists of RSSI (Received signal strength indicator) with Zigbee, GPS to locate the wildlife location[7]. A Power supply unit and a voice module buzzer.

Zigbee

It is an ultra low power high performance wireless microcontroller. It is used for all wireless sensor[5]applications. Since it uses a very low power for its operation and it is connected with nearby nodes as a mesh. So this device is well enough to transfer the small data over a short range of distance[2].The range of the Zigbee is 10-100 meters and when combined with a mesh network the range of the ZigBee can be extended. TheZigBee's operate at 868Mhz and 2.4 frequencies'[11] data rate of 250kbps is best suited forperiodic as well as intermediate two-way transmission of data between sensors and controllers. In this the Zigbeetwo-way data is transferred in a non-beacon mode, the coordinators endlessly monitor active state of incoming data hence the power consumption is high[3]. They

are asleep because any time any node can wake up and communicate.

Fig. 4: Zigbee

Microcontroller(AT89S52)

It belongs to Atmel 8051 family. Why we particularly use this device is because it is suitable for any embedded control application. This microcontroller uses microchip high density non-volatile memory technology. Even when the power of the device is in OFF mode the data will still be store in the microcontroller.Since it is belongs to 80c51 family, it follows the similar kind of instructions and all the descriptions [4]. The Operating range of this microcontroller is 4-5.5v. The number of pins in this microcontroller is 44.
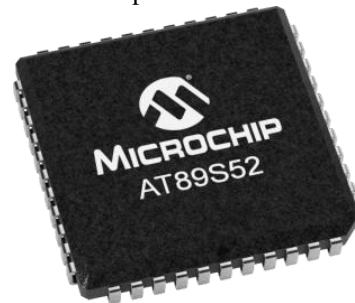

Fig. 5: Pic Microcontroller (AT89S52)

Micro Speaker

It is a dynamic speaker. Its rated input power is 1.0W. The terminal strength is Capable of withstanding 1kg load for 30 seconds without resulting in any damage or rejection. Thesespeakers are used for generating sound which can be extended to a high output frequency. The operating range is 1-5Khz and up to 100Khz. Compared to other speakers it is easy to drive. It also has several advantages compared to conventional speakers.

Fig. 6: Micro Speaker

RSSI

In telecommunications, the received signal strength indicator is nothing but a measure of the power existing in a received radio signal. RSSI is usually invisible to a user of a receiving device. It is often derived in the intermediate frequency stage(IF) before the IF amplifier[12]. It can also be sampled by an internal ADC and tge resulting codes available directly or via peripheral or internal processor bus.[10]
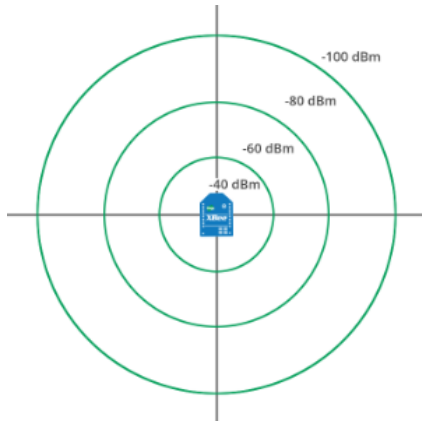

Fig. 7: RSSI Integrated with Zigbee Showing Signal Strength

IV.   WORKING

The working is done through these units: Animal unit, Monitoring unit and a road unit or human prone unit. The Animal unit is nothing but a tag[6] which is integrated with RSSI, Zigbee, Power Supply and a GPS.The RSSI is combined with the ZigBee. The RSSI is nothing but signal strength indicator which indicates the received signal strength in the monitoring unit. The monitoring unit also consists of RSSI, ZigBee, power supply and a voice module speaker [8]. When an animal is few kilometers away from the human zone area the signal strength starts picking up in the monitoring unit. The communication from one RSSI and another RSSI shows the signal strength from one and indicates in the other. If RSSI value on the monitoring unit is -50db to -70db it indicates the signal strength as high indicating that the animal is near the human area. This high signal range is nothing but to show that the signal strength is high near the fixed position and also indicates the distance between the animal zone area and the time it takes to reach the human zone area. Hence through this we can avoid the upcoming danger to be caused by the animal.

Fig. 4.1: (A) Software Output Using C++

In fig 4.1(A) the software output is done using C++ program which explains the coding for LCD display of the animal unit and the voice module buzzer. Each line explains the command for showing the RSSI value and when the value reaches its limit it intimates the buzzer

Fig. 4.2: (B) Software Output Using C++

In fig 4.2(B) the software coding shows the delay for each and every command and characters are assigned for the LCD display. The coding is compiled for unsigned character fa, fb, fc, fd, fe, ff. The "unsigned char" command is used which is the byte value (0-255). Char is nothing but numerical value in ASCII encoding.

Fig 4.3: (C) Software Output Using C++

In fig 4.3 (C) the software coding shows the delay for each and every command and characters are assigned for the LCD display. The command "lcdcmd" refers to LCD command where we mention character size and "lcddisp" refers to the first display line "Wildlife".

V.   APPLICATIONS

Wild life animal tracking: To track the animal in forest and in wild life national parks and in animal zone areas.
We can use it for domestic purpose to detect pet animals.

VI.   ADVANTAGES

This method is fast and convenient as compared to other system. This does not require human attention as this is completely self independent automatic system.

VII. RESULT

When the animal unit and the monitoring unit comes in contact with respect to the received signal strength the monitoring unit starts receiving the signal. When the signal is high the voice module on the monitoring unit says "Wildlife" indicating that there is an animal detected. The RF transmitter present on the monitoring unit sends signal to the RF receiver present in the road side unit. The road side unit has a buzzer which on receiving signal alerts the passerby with the buzzer alarm.

In fig 5.1 shows the monitoring unit which consists of RSSI, Zigbee and RF transmitter. The LCD displays the RSSI of the animal unit. When the Signal strength is between the

-50 to -70 the signal strength is high and the voice module buzzer starts announcing "Wildlife".
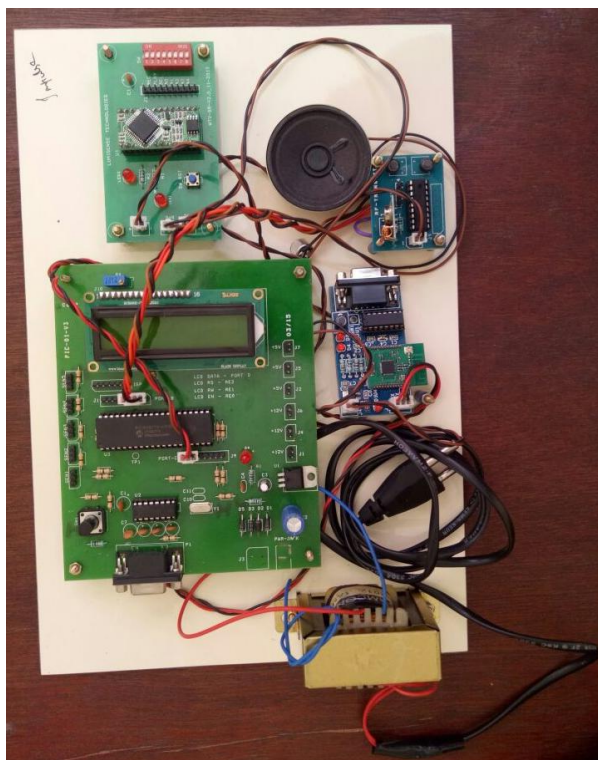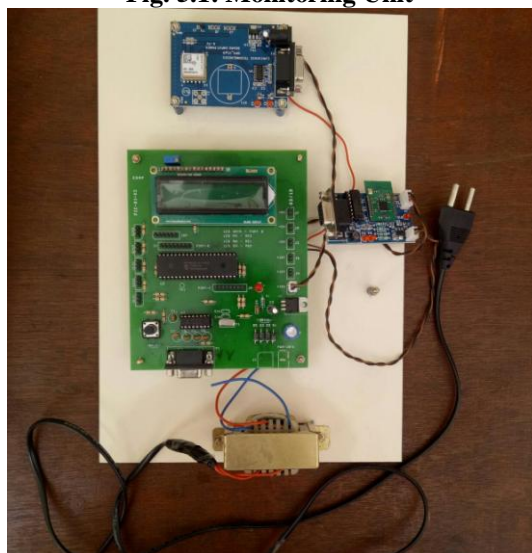

Fig. 5.1: Monitoring Unit

Fig. 5.2 Animal /Wildlife unit

In fig 5.2 the animal unit has a GPS, RSSI, Zigbee. The RSSI sends its signal to the monitoring unit to help it detect the wildlife unit.GPS integrated with RSSI Zigbee helps to detect the location of the animal.

Fig. 5.3: Road Side unit

In fig 5.3 the Road side unit consists of a RF receiver and a buzzer. As soon as the monitoring unit detects the animal the RF transmitter present in it sends RF signals to the RF receiver in the road side unit and the buzzer alarm helps in informing the passerby around.

VIII. CONCLUSION

The execution of this proposed system is a convenient method for tracking wildlife. This system is a low-cost system and can be tagged on any animal and will give us the right range and distance of the animal location. This system also alerts the human and passerby who go through the forest. Further this can be done using IOT in the future. Thissystem can also be used in the cattle, railways crossing zone. It is mainly used in villages and at national parks to avoid human death and maintain farming fields which can be destroyed by certain wildlife habitat.

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