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An Animal Health Monitoring System Using Zigbee Device

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Abstract— Animal detection plays a vital role in day to day life. It is important to detect the presence of animals entering into the human living areas near the forest, since it causes damage to life of people living near by the forest areas. It is important to safe guard the life of human by detecting the presence of animal and take necessary actions to safeguard human life. It is also equally important to save the animals. In order to overcome the above drawback a warning system must be developed . This paper involves the use of PIR(Passive Infra Red Sensor) which senses the presence of animal. The microcontroller is the heart of the system. It controls every component of the system. The LCD monitor displays the if the animal has been detected. Buzzer is used for alerting. With the help of GSM the warning message is sent to five persons.

Index Terms— : Detection system, GSM, Sensors, Wireless Transmission.

1 Introduction

Researches regarding animal detection have been an important field to numerous applications. Many algorithms and methods have been developed by human being in order to have a better understanding on animal behavior. Besides, these applications also can act as a warning system to human being from intrusion of dangerous wild animal for early precaution measures. These applications can be narrowed down to three main branches, namely detection, tracking and identification of animal. The animal tracking is the main topic in monitoring animal locomotive behavior and its interaction with the environment. With the technology of sensor, radio-frequency identification (RFID), and global positioning system (GPS), one of the applications is the development of new zoological systems for animal tracing ability, identification, and anti-theft for the management and security of animal in zoo. By tracking the animal movements, it helps human to have a better understanding on living creatures on earth, especially on how the animal interacts with its environment.

2 RELATED WORK

[1]The system is designed to manage the wildlife from fatal accidents in transport environments. The detector circuit on both sides of the route, detects the entry or presence of a wildlife animal which is about to cross the road. The detector circuit passes the information to the control unit by means of short range communication. The controller section comprising of a microprocessor or microcontroller manages the traffic according to the signal received, by showing a red or stop signal on both directions. Once the animal has crossed the road the controller gives ready to go signal. Incase the creature halts in between the route, for more than a prescribed time limit beyond the change of traffic signal; a warning signal/sound is generated to scare away the creatures. If the animal stays or is present in the route even after the warning signal, which may be due to a prey attack or injury, a message is passed to a security personal. The security person after receiving the information takes the necessary according to the scenario. Thus the animal and mankind both can be benefitted.

[2] This paper addresses the problem of target detection and classification using seismic and PIR sensors that monitor the infiltration of humans, light vehicles and domestic animals for border security. The major contributions of the paper are as follows:

1) Formulation of a hierarchical structure for target detection and classification.

2) Experimental validation of the SDF-based feature extraction method on seismic and PIR sensor data.

3) Performance evaluation of using seismic and PIR sensors in target payload and movement type identification.

[3]In this paper 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. 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. 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.

[4]The objectives of this research were to demonstrate registration of pasture time in a specific area (a strip with new grass) using a ZigBee (Szewczyk et al., 2004)-based wireless sensor network and single hop connectivity. Another objective was to prove two extensions: an area extension where knowledge about animal presence in a limited area is used to predict animal presence in a larger extended area. The other extension aims at determining the whole herd presence based on registration of a subset of tagged animals. Yet another objective was to solve a specific problem

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regarding packet loss using data post processing. Each node in the network was programmed to transmit data when located within communication range of a gateway in the area with new grass. The principle is single hop connectivity that is the gateway only registers presence when a specific node is within the communication range and actively participates in handshaking communication (Lewis, 2004). In this research, multi hop connectivity as used in modern communication networks was not utilized. As the area defined by the communication range does not necessarily cover the same area as the new grass strip, an area based correction factor was applied to the measured time in the gateway connectivity area to estimate the total pasture time in the new grass strip.

[5] The application domain is a paddock in which we wish to monitor the state of the animals and the landscape, and our test site is at Belmont near Rock hampton. Several Fleck 1cs are interfaced to digital weigh-bridges (via an RS232 serial link), as well as water trough flow meters (via an analog input). Some Fleck 1cs have an extension board that interfaces with up to 5 soil moisture sensors allowing measurement of the vertical moisture profile in the ground. The mobile component of this network is 20 Fleck 2s which are worn by the animals. All these Flecks are connected to a central facility via a pair of Fleck 1cs acting as gateways to a PC which provides a route to the Internet via an ISDN link. The long hop from the paddock to the central farm building is achieved using high-gain antennas. The initial testing occurred before the network link was established. The Fleck 2s were programmed to write all sensor data onto the flash memory card in plain text format. However, the Flecks were also programmed to broadcast their identity at regular intervals and to record all received broadcast messages. This allows us to build up and analyze connectivity information over time. The aim is to shortly deploy an application that relies heavily on the radio and does not require the flash memory card to be physically removed as often as it needs to in the current setup.

[6] The approach is to deploy a wireless mobile sensor and actuation network, which is capable of estimating the dynamic states of bulls, and performing real time actuation on the bulls from location and velocity observations. As it is a challenging task to implement a real-world mobile sensor/actuation.

3.PROPOSED WORK

The proposed work combines the embedded technology with the Zigbee wireless communication technology, this project deals with a health monitoring and tracking system for animals. This device tracks the animals space and also measures the animals physiological signal by using Zigbee transceiver and GPS.

3.1 Power supply description

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired DC output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting DC voltage usually has some ripple or AC voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units. .The microcontroller circuit is connected with reset circuit, crystal oscillator circuit, LCD circuit the reset circuit is the one which is an external interrupt which is designed to reset the program. And the crystal oscillator circuit is the one used to generate the pulses to microcontroller and it also called as the heart of the microcontroller here we have used 12mhz crystal which generates pulses up to 12000000 frequency which is converted into machine cycle frequency when divided by 12 which is equal to 1000000hz i.e. about 10 lakhs frequency is generated per second to find the time we have to invert the frequency so that we get one micro second for the execution of a instruction.Reset circuitry is used to reset the circuit. It is an input and is active high (normally low). Upon applying a high pulse to this pin, the microcontroller will reset and terminate all activities. This is often referred to as a power on reset. Activating a power-on reset will cause all values in the registers to be lost.

3.2 Heart rate:

Heart rate is a term used to describe the frequency of the cardiac cycle. It is considered one of the four vital signs. Usually it is calculated as the number of contractions (heart beats) of the heart in one minute and expressed as "beats per minute" (bpm). See "Heart" for information on embryo foetal heart rates. The heart beats up to 120 times per minute in childhood. The pulse is the most straightforward way of measuring the heart rate, but it can be deceptive when some heart beats do not have much cardiac output. In these cases (as happens in some arrhythmias), the heart rate may be considerably higher than the pulse rate.

3.3 Circuit working description

This circuit is designed to measure the heart rate. The heart rate is measured by IR transmitter and receiver. Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other. The IR transmitter and receiver are placed in the pulse rate sensor. When you want measure the pulse rate, the pulse rate sensor has to be clipped in the finger. The IR receiver is connected to the Vcc through the resistor which acts as potential divider. The potential divider output is connected to amplifier section.When supply is ON the IR transmitter passes the rays to the receiver. Depending on the blood flow, the IR rays are interrupted. Due to that IR receiver conduction is interrupted so variable pulse signals are generated in the potential divider point which is given to A1 amplifier through the capacitor C1. The coupling capacitor C1 is used to block the DC component because the capacitor reactance is depends on the frequency. For DC component the frequency is zero so the reactance is infinity now capacitor acts as open circuit for DC component.The amplifier section is constructed by the LM 324 quad operational amplifier. It consists of four independent, high gains and internally frequency compensated operational amplifiers named as A1, A2, A3 and A4 amplifiers. The varying pulse from the potential divider is amplified by the A1 amplifier. In this amplifier the capacitor C2 is connected in parallel with

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feedback resistor to filter the any DC component in the amplified signal. If any spikes in the amplified signals, they are further filtered by the C3 and C4 capacitors. After filtration the signal is again amplified by the A2 amplifier. Then amplified signal is given to inverting input terminal of comparator. The comparator is constructed by the A4 amplifier in which the reference voltage is given to non inverting input terminal. The reference voltage is generated by the A3 amplifier. Then the comparator compares the two signal and delivered the +12v to -12v square wave pulse at its output. Then the square wave signal is given to base of the BC 557 and BC547 switching transistors in order to convert the TTL voltage 0 to 5v level. Finally the TTL output is given to MM 74C04 inverter to invert the square pulse. Then the final square wave signal is given to microcontroller or other interfacing circuit in order to monitor the heart rate.

3.4 Temperature sensor

A thermistor is a type of resistor used to measure temperature changes, relying on the change in its resistance with changing temperature. Thermistor is a combination of the words therma l and resistor. The Thermistor was first invented by Samuel Ruben in 1930, and has U.S. Patent #2,021,491.

If we assume that the relationship between resistance and temperature is linear (i.e. we make a first-order approximation), then we can say that:

$$\Delta R = k\Delta T$$

Where

ΔR = change in resistance

ΔT = change in temperature

k = first-order temperature coefficient of resistance

Thermistors can be classified into two types depending on the sign of k. If k is positive, the resistance increases with increasing temperature, and the device is called a positive temperature coefficient (PTC) thermistor, Posistor. If k is negative, the resistance decreases with increasing temperature, and the device is called a negative temperature coefficient (NTC) thermistor. Resistors that are not thermistors are designed to have the smallest possible k, so that their resistance remains almost constant over a wide temperature range.

3.5. Humidity sensor

The environmental parameters are affected the performance and health of the animal both directly and indirectly. The environmental factor consists of air temperature, air movement, humidity, and radiation heat. Based on these parameters, we have calculated the thermal humidity index (THI) and also analyze the stress level of the animal. To sense the humidity of the surrounding area is used the DHT11 sensor. An overview of the DHT11 specification, advantage and disadvantage were reported . The sensor data are received in the form of five segments (8 bit each). The first two segments represents the humidity (integral and decimal), third and fourth segments are represents the temperature in 0oC, and remaining (last) segments is the check sum. The last segment is the sum of the four first segments, if check sum value is not equal to the sum of four first segments that means that the received data is not correct .The operating voltage of the developed module is fixed at 3.3V. The surrounding humidity and temperature sensing range of the developed module are set from 20% to 90% and 0oC -50oC, respectively.

3.6 Liquid crystal display (LCD)

Liquid crystal displays (LCD's) have materials, which combine the properties of both liquids and crystals. The light rays passing through the LCD would be rotated by the polarizes, which would result in activating / highlighting the desired characters. The LCD's are lightweight with only a few millimeters thickness. Since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations. The LCD does not generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range. Changing the display size or the layout size is relatively simple which makes the LCD's more customers friendly.These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications.Crystalonics dot–matrix (alphanumeric) liquid crystal displays are available in TN, STN types, with or without backlight. The use of C-MOS LCD controller and driver ICs result in low power consumption. These modules can be interfaced with a 4-bit or 8-bit microprocessor /Micro controller.

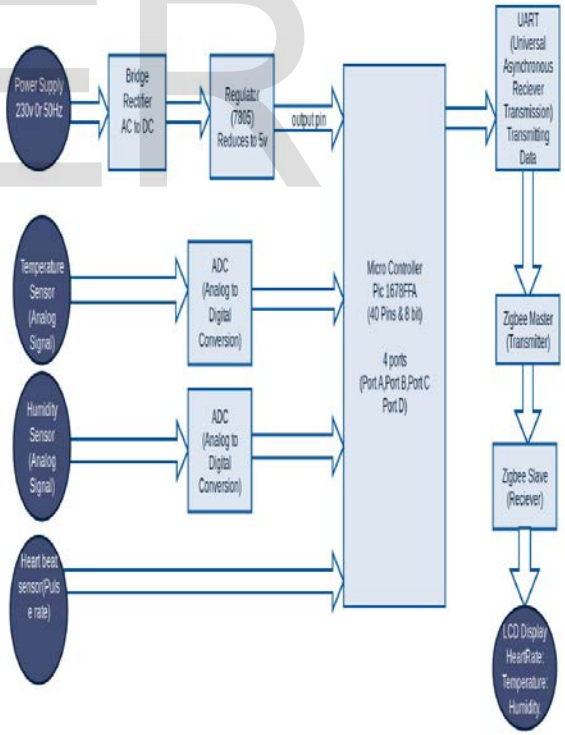

FIG 1: OVERALL ARCHITECTURE DIAGRAM

3.7 Result

The main aim of this research paper is to develop an animal health monitoring system (AHMS) which is capable to the measuring of body temperature, rumination, and heart rate parameters with environmental parameters (surrounding temperature and

humidity). The system is based on the IEEE 1451.2, IEEE 802.15.4, and IEEE1451.1 standards. The PIC18F4550 microcontroller and XBee-PRO S2 module were used to the development of AHM system. The four sensor module such as body temperature, heart rate, surrounding humidity and temperature, and rumination has been successfully developed. They measuring parameters will be helpful to analyze the animal disease or health condition of the animal. We have designed the LabVIEW 9.0 based front panel. The front panel of the AHM system handles functions of the measuring parameters such as settings the time interval, start button (ON), OFF, data saves for the access memory of the PC or in the data base, and a digital and a graphical output. Here the developed GUI module can perform for four sensing module and display the seven valuable physiological and behavioral parameters. The USB slot of the PC is present the 100mA at 5V and it does not require any external power source in the sink module during the experiments. The power consumptions in the AHM system is depend only on the wireless sensing modules. During experiment, the 11.1V battery (rated 350mAh) is used. The each sensor module could be run incessantly for 60 hours without necessitate recharge. The system has been developed ergonomically with the reference of the animal, the veterinary staff and primary user of the device. The following points are followed by the designing of the system in terms of the reduction of environmental factors, such as, the module is protective covering of PVC (Polyvinyl chloride) to shield it from rain and insects as well as the design of the casing for the collar to be threaded through, minimum noise is achieved in the case of the developed multilayer circuit board which includes a ground plane, and sensor and its associated circuitry are connected through wires with grounding connection.

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4 .CONCLUSION:

A prototype of an animal health monitoring system is presented. The prototype system consists of the sensor module and sink module. This project may be implemented in the wild life sanctuaries in addition to this fire accidents in the forest also be stopped by alerting the concern persons. Can implement it in the houses where there are pet animals. It will be specifically targets health monitoring during races, animal location and tracking applications. This technology presents very high low power consumption, low Complexity and time domain resolution. In the heart rate sensing module we have used the Rs232 transmitter and the developed module has been transmitting data only up to 2 meters. They will need the modification of the heart rate sensor module and could be increased the transmission range.

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