Animal Health Monitoring System Using Zigbee

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Abstract – This paper present an autonomous animal health monitoring system using zigbee. Here the physiological conditions of the animals are monitored by sensors and the output of these sensors is transmitted via zigbee there by signal is sent to the server ,from there signal is acquire to a server system. The remote wireless monitor is constructed of Zigbee and Personal Computer (PC). The measured signal has to be sent to the PC, which can be data collection. The advantages of this paper is that it will consider more parameter like temperature, humidity ,pressure,there by prior detection of possible diseases are done. In particular, when measured signals cross the standard value, the personal computer will send a message to the caretaker's mobile phone.

Index Terms – Sensors, Animal health monitoring, Animal Diseases, Veterinary, Dairy farms.

1. INTRODUCTION

Most of the diseases now a days are affecting from domestic animals from anthrax to birds flew. Animal health is an important topic in recent days because of various flews are affecting the human life are transferred from animals . People can become infected to the diseases by handling products from infected animals or by breathing in spores from infected animal products [1]. More than that animal health as a necessary tool for a more sustainable livestock production. Animal products are not only a source of high-quality food, but are also it represent a source of income for many small farmers and animal holders in developing countries and developed countries for their daily needs. Economic growth is accompanied by an increase in consumption of animal products. Changes in domestic animal production ,that include climate and circumstances increase the potential for new pathogens to emerge, grow and spread from animals to humans ,and from human to human it spreads in global scale. Healthy animals are closely related to healthy people and a healthy environment.

So it is important to develop an automated environment for monitoring the animal are for sustainable development for farmers as well as the health for human, because most of the diseases are spreading from domestic animals. So in existing system failed ,that human to check the heath condition of every animal . And also every animal need to have separate care. But this is failed in case of more animals. In existing system, in zoo, it is difficult for human to check the health condition of every animal. So it is a time consuming process. Zigbee based approach in the AHM is a new method of monitoring the animals. Zigbee is developed for applications that demand for lower data rate, longer battery life, simple design, shorter range and low cost solutions [2].

Zigbee is based on IEEE 802.15.4 industry standard. It includes the standard, adding the logical network, security and software to it. It supports up to three network topologies namely STAR, MESH and CLUSTER tree.

The Zigbee connected in the neck of the animal could able to communicate with another Zigbee, which is nearer to it. Finally the signal is reached at the system . Each animal is connected with a sensor ,for analyzing the temperature humidity and heart beat and the respiration . If any variation in the threshold ,it will send through Zigbee to the system.

The rest of this paper is organized as follows. Section 1 reviews the recent algorithms. Section 2 gives a brief introduction of zigbee . . Section 3 is hardware description ,Section 4 proposes the zigbee based methodology for animal health monitoring.. Section 5 is devoted to the result discussion . Section 6 presents conclusions.

2. RELATED WORK

A common categorization in health monitoring is depending on two methods such as direct contact (invasive) or in indirect contact (non invasive). Non-Invasive methods will not take any kind of fluids or any this directly from animal. But it consist of various sensors ,by analyzing the variation in the threshold the diseases can be analyzed . In invasive method direct contact with separate animals is needed and it is painful and time consuming . By taking blood, and various fluid and analyzing is time consuming task.

Yick et al[4]. proposed a cattle health monitoring system and which is focused on head motion, core body temperature, and heart rate. The core of the system is an AMD186 processor on

a turn microcontroller board. This paper presents results from a tele-monitoring system that utilizes wearable technology to provide continuous animal health data.

Baker et al[5]. proposed a system by which measurement of the acceleration for the dairy cattle is used to analyze the health condition of the animal. They analyze the mobility of the dairy cows and also correlated the acceleration to the mobility of the cows. Kim et al[6] Proposed a heart rate based monitoring by polar sport tester (PST) for cattle . The body temperature and heart rate parameters are also used as a disease analyzing parameter for different animal. Dharmistha et al[7] define the ad-hoc wireless sensor network based cattle health monitoring and concluded that by using measured data, the livestock farmers can prevent the spread of diseases. Analysis of measured data also related decreased productivity and death of valuable stock Large amounts of RAM memory for buffering and Enhanced Flash program memory make it ideal for embedded control and monitoring applications that require periodic connection with a (legacy free) personal computer via USB for data upload/download and/or firmware updates. Mottram et al. [8]proposed the two stress measurement techniques for dairy cows. The proposed techniques based on polar spot tester (PST) and electrocardiograph (ECG). They are also given the results of corresponding study. They found that PST is a efficient technique for the heart rate measurement of animal and also analyze the heart rate is relevant parameter for the animal behavioral study and animal health .Radostits et al[9]. proposed a wireless sensor networks(WSN) based live-stock monitoring and disease control method. The proposed method easily classifying animal activates and behavior. In this , Fleck 2 processor board is the heart of the system and it measured the four parameters such as GPS information, accelerometer, magnetometer, and temperature. Cha et al[10]. proposed ad-hoc wireless sensor networks based monitoring and classifying animal behavior system. They used 2.4 GHz frequency based communication module and the proposed design is the following advantages such as communication consistency, energy efficient and minimum packet loss rate.

So we are proposing a new system using Zigbee. Health condition of every animal is monitored in less time . If health condition of any animal changes, automatically remedies can be taken. Without human involvement it can monitor the health status of each animal with in less time there by reduce chance of epidemics.

3. INTRODUCTION ON ZIGBEE

ZigBee is an IEEE 802.15.4 standard for data communications with business and consumer devices [2]. It is designed around low-power consumption batteries with long battery life which last forever. The ZigBee standard provides network, security, and application support services operating which works on top of the IEEE 802.15.4 Medium Access Control (MAC) and Physical Layer (PHY) wireless standard. It works a set of technologies to enable scalable, self-organizing , self-healing networks that can manage various data traffic patterns. ZigBee is a low-cost, low-power, wireless mesh networking standard [3]. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking provides high reliability and larger range.

4. HARDWARE AND SOFTWARE DESCRIPTION

Hardware specification gives a specification of hardware details used to implement in the system.

A. PIC16F877A

This powerful (200 nanosecond instruction execution) which easy-to-program. CMOS FLASH-based 8-bit microcontroller is heart of system , which packs Microchip's powerful PIC architecture into an 40- or 44-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. The PIC16F877A features include 256 bytes of EEPROM data memory, self-programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire.

The other parts are Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

B. Temperature Sensor

LM35 temperature sensor IC. Its precision with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed so it is not subjected to oxidation . With LM35, temperature can be measured more accurately and preciously than with a thermistor doing so. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in air.The operating temperature range between -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature, *i.e.,* its scale factor is 0.01V/ ^{o}C.

C. Humidity Sensor

DFRobot DHT11 Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness. Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on

humidity calibration. The calibration coefficients are stored as programs in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package.

D. Systolic diastolic unit

Systolic diastolic unit is used for analyzing the pressure of a animal. The specification of the unit is given below

Specification

- Working Voltage: +5V, 200mA regulated
- Output Format :Serial Data at 9600 baud rate(8 bits data, No parity, 1 stop bits). Outputs three parameters in ASCII.
- Sensing unit wire length is 2 meters
- Sensor Pinouts
  - TX-OUT = Transmit output. Output serial data of 3V logic level, Usually connected to RXD pin of microcontrollers/RS232/USB-UART.
  - +5V = Regulated 5V supply input.
  - GND = Board Common Ground

5. PROPOSED MODELLING

Each animal will have single unit of chip fixed behind their neck. The sensors are specifically temperature, humidity, remuratation. The signals are transmitted from Zigbee to to nearer cattle's zigbee. So signal finally reached at server device. From the by analyzing the various of temperature and humidity , heart beat the diseases is analyzed The data related diseases are passed to owner by SMS.

Figure 1 depicts the block diagram of the animal health monitoring (AHM) system. The AHM system has been developed based on IEEE1451 and IEEE802.15.4 standards.

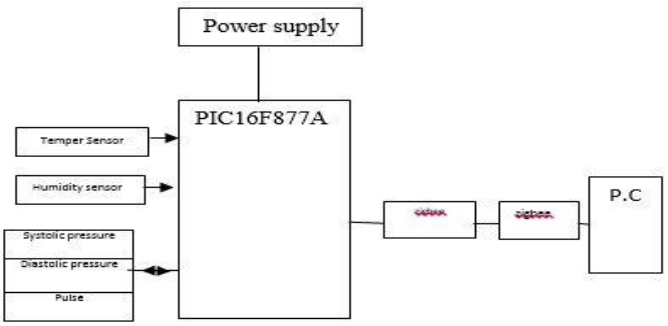


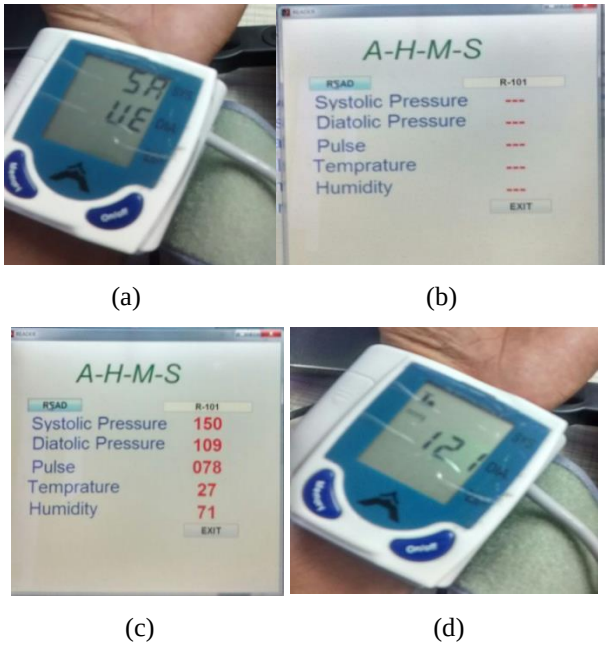
Figure.1 Block diagram of animal health monitoring system

The developed AHM system can be used to detecting the animal physiological parameters such as pressure heart rate, and body temperature with the environmental parameters (surrounding temperature and humidity). The surrounding temperature and relative humidity based real time calculation of temperature humidity index (THI) and also has been classify the stress level of the animal. The output signal of the developed sensor modules are sent to a host computer through zigbee module. The values of body temperature, surrounding humidity, surrounding temperature, rumination, heart rate, stress level, and TH index (THI) can be displayed on the GUI PC. The design of AHM system is a single autonomous device, if you need the monitoring of other health parameter which makes it comparatively easy to add extra sensor modules. The sensing unit is the main components of the developed animal health monitoring (AHM) system. The sensing unit is include a set of sensor, processor, and zigbee module.

In this paper, we have used the three sensors such as, heart rate sensor, temperature sensor, and humidity sensor. Because, these measured parameter have been used for different animal species health judgment, as we can point out a quandary of the animal.

6. RESULT AND DISCUSSION

The system is developed using zigbee. The system consist of systolic pressure analyzing unit, temperature sensor humidity sensor. If the threshold value of temperature, humidity and pressure is higher than the threshold the animal is detected with a possibility of dieses. The units consist of sensor module.



(a) (b)

(c) (d)

Figure 2 System components a) sensor module b) Initial value c) reading for normal animal

From the sensor module the signal is finally destined in the P.C. The signal is analyzed in the P.C where the animal is categorized as diseased or non-diseased.

7. CONCLUSION

In this paper we explained the animal health monitoring system using Zigbee. This method is efficient than monitoring each animal separately. There by decreasing the possibility of epidermis in human and animals.

In the development of sensing device, we have used the low power electronic components to minimize the power consumption and the device could be run continually maximum times. The developed sensor module is low power consumption, miniaturization, intelligence, easy to operate, new materials at lower cost, portability, and high performance.

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