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Wearable Sensors for Animal Health monitoring Using Zigbee

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Abstract: This paper presents a low cost animal health monitoring system to monitor the health parameter such as body temperature, heart rate and their postures. Posture sensing is a main feature of this system. Three accurate sensors are used to measure these health parameters. If the parameters that we got are not in the normal range, quickly recognize that the animals are not well. Thus we can provide sufficient care and also prevent the viral infection to the other animals.

Keywords: Zigbee, sensors, wireless transmission, physiological parameters, temperature humidity index.

I. INTRODUCTION

Nowadays the deseases are becoming serious threats to the farmers. An efficient system is required for the continous monitoring of the animal health parameters. We get direct information about the health of each animal in a farm by using wearable sensors.

There are many technological systems available in markets for measuring the health parameters. But they only provide the informations about heart beat and body temperature. Not only that they are not tolarable for live stock farmers in India. But the developed countries like America has already established National Animal Health Monitoring System (NAHMS). They earn a huge profit from live stock industry. But in india,especially in kerala most of the people are not ready to do live stock farming. They have no enough knowledge about this profitable industry.

Animal health monitoring system using wearable sensors can be used for every farmers in low cost. We get the direct information about the state of each animal without the presence of human beings. This system is also applicable to pets. There is a possibility to affect viral infection to the pet lovers through their bites, fur etc.Not only that today we all usually use chicken, mutton ,beef etc. What will happen if that animals had affected by the viral disease? Severe Acute Respiratory Syndrome is an example of this type of epidemic disease.It leads to shortness of breath and then to death. So it is very necessary to monitor the health parameters continously.

In this paper we can monitor heart beat, body temperature and their postures. Main feature of this paper is posture sensing. If the measured parameters are not in the normal range ,we can determine that the animal is not healthy. Then remove that animal from the farm,thus we can prevent viral infection to the other animals.

StreptococcusandStaphylococci,Campylobacter,Pasteurell osis are some of the bacterias which transmit from animals to human beings. They are very dangerous diseases and leads to a severe situation. The virus affected animals and their products are the reason for these transmitting diseases.By using wearable sensors, we get the real time graph of health parameters. So we can prevent these type of diseases,when a large deviation occur from normal change in characteristics. Health monitoring system using wearable sensors can be used for human health also. We get the informations about their human activities [1]. Canine behaviour is also easily detectable by body area networks. Some wearable sensors can be used to detect their vital signals[2].

There are two type of sensors – attached sensors and non attached sensors. In the proposed system attached sensors are used for getting direct information about the health parameters[3]. These informations are very useful to recognize their eastrus period. During this period, their motions like running, walking rates will be higher than the normal characteristics. We can realize this period very clearly from real time graph [4].

In European countries health monitoring is concentrated on herds. National Farm Animal Identification and Records (FAIR) is a pilot animal identification program established in 1999 by Holstein Association USA [5]. An energy harvesting system using kinetic generator instead of battery can be used for detecting the position of each herds [6]. A magnetic-based detection method in which amorphous ribbons can be used to determine the stress levels in knee implants [7].

By using wearable sensors in human beings, we can detect their weight, blood pressure ,ECG etc [8]. A BMOO unit for monitoring the health parameters is described in [9]. It is also useful to human beings.

All these technologies provides the importance of wearable sensors. They can give accurate information about health parameters to vetinary staff. Thus they can provide proper treatment and can prevent wide spread diseases.

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In this paper, the animal health monitoring sytem using wearable sensors can be used to monitor the health parameters such as heart rate, body temperature, and postures. There are a lot of advantages to this system. The power consumption is very low due to the use of low power components. Not only that it is energy efficient. Since the cost of the sytem is less, all farmers can establish in their farms.

II. HEALTH MONITORING SYSTEM OVERVIEW

There are mainly three sensors are used to monitor the health parameters – temperature sensor, heart rate sensor, posture sensor. The module consists of tranmitter section and receiver section to transfer the data. The block diagram of each section is given below:

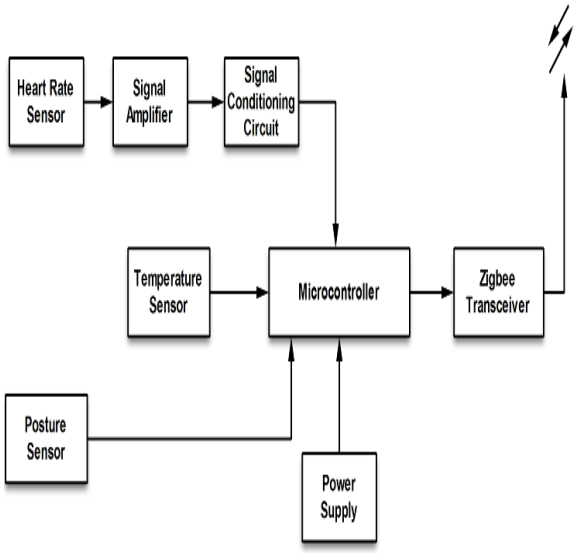

Fig 1: Block diagram of transmitter section

Heart rate sensor senses the heart beat and given the data to signal amplifier. It amplify the signal and output is given to signal conditioning circuit which consists of resistors, capacitors etc. We get signals which satisfy all the conditions to the next stage. Each heart beat count per second is going to the microcontroller 16F877A.

Temperature sensor is used to monitor body temperature. That count is also received by microcontroller. There is one more sensor called posture sensor. This sensor can be placed over anywhere on the body. We can place posture sensor on the knee to watch each movement of animals like running, walking, sleeping etc.

Almost 5v supply is sufficient to control entire system. Zigbee is used to transmit each data wirelessly in every seconds. The receiver section is also shown in fig 2.

Zigbee provide bidirectional data transmission. Each data from the transmitter section is given to the receiver section. Data from the microcontroller is received by personal computer which display real time graph of health parameters using matlab software. We can use bluetooth in mobile phone instead of personal computer

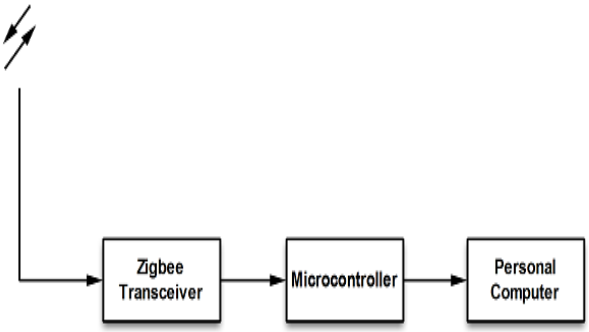

Fig 2: Block diagram of receiver section

Fig. 3. Real time graph of health parameters

III. SENSING SECTION

Three sensors such as temperature sensor, heart rate sensor, posture sensor provides accurate informations about the health prameters. The description about each sensors are given below:

A. Temperature Sensor

LM 35 is used as temperature sensor. It can provide accurate and linear output of body temperature.

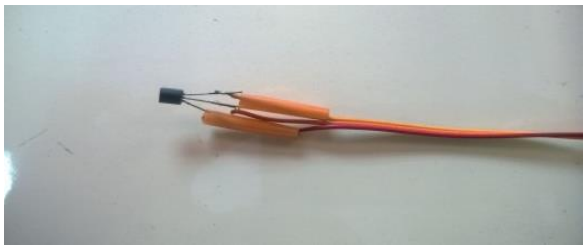

Fig. 4 Temperature sensor

Usual body temperature of an animal is in the range of 38.3 to 39.2 degrees Celsius. If the measured temperature graph shows a large deviation from this range, we can realize that the animal is not healthy.

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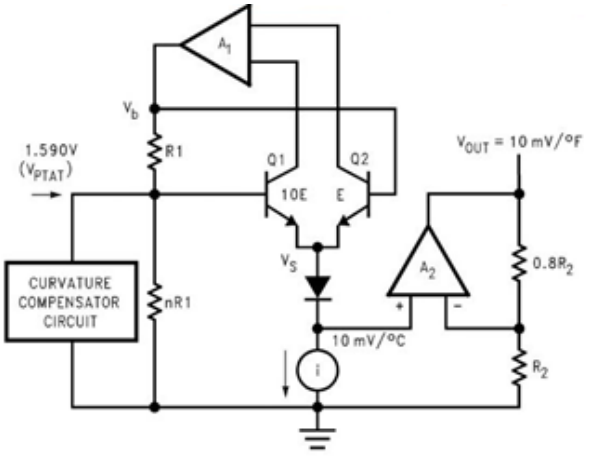

Fig.5. Internal circuit diagram of LM35

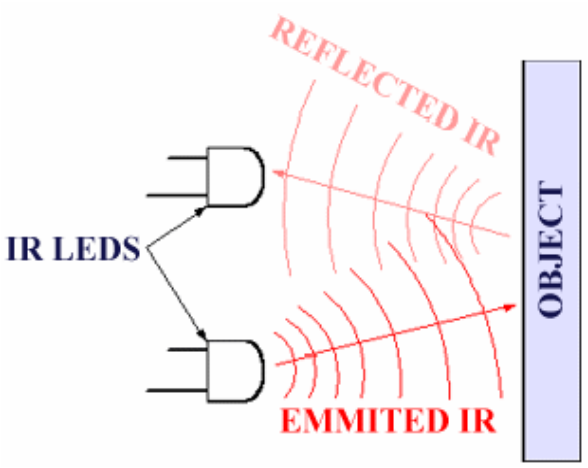

Fig. 7.Working principle of IR sensor

B. Heart Rate Sensor

Infrared (IR sensor) sensor is used to count heart beat per second. It consist of two LEDs. IR rays are transmitting from an LED. When we touches the LED rays are reflected back to the receiver and that led will blink according to each count of heart rate.

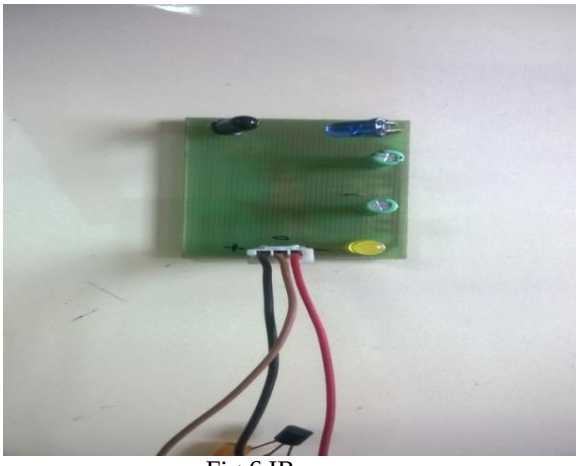

Fig.6.IR sensor

IR rays are absorbed by the oxygen molecules contained in the blood that flow through finger tip. That time led cant blink due tothe lack of reflected rays. Otherwise LED can blink by getting reflected rays.

At first, here sensing which direction consisting more voltage than the other two direction. According to that sensed data we can determine the position of the animal. Also we can determine their estrus period. During this period the abnormal movements are showing. By detecting that special moves,we can give proper insemination in time.

The posture sensor can be placed anywhere in our body. If we attach posture sensor at mouth, we can detect the deviation of rumination from the normal state during the abnormal condition. Or we can place at the leg. Then we can identify whether the animal is running, walking or sleeping.

Heart beat count is varying with size of each animal. Some normal heart beat count of animals are given below:

TABLE I NORMAL HEART BEAT OF ANIMALS

ANIMAL	HEARTBEAT
Dairy cow.	48–84.
Dog.	70–120.
Elephant	25–35.
Goat.	70–80.
Guinea Pig.	200–300.

Posture sensor consists of mainly three axis which are x axis,y axis, and axis. Usually x axis is taken as reference axis. If the animal is in lying position x axis voltage will be higher than the other two. If the animal is standing from that state, y axis voltage will gradually increase than the other two. We can identify each movements of animal in every seconds. An real time graph is also provided to recognize these situation.

Fig. 8.Posture sensor

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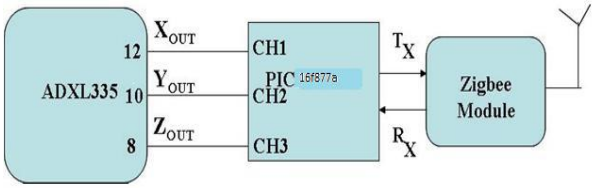

Fig. 9.Block diagram of Posture sensor

III .WIRELESS COMMUNICATION

Zigbee is used to transfer each sensing data to the receiver section. The proposed system consists of two zigbee module. One module is used transmit the data from the transmitter section and the other one is used to receive from receiver section. There is an led to indicate that the data transfer is occuring.

Fig. 10.Zigbee module

Every sensor sends their data every 4 s to the coordinator and we have used the unlicensed 2.4GHz frequency band. All data will display using matlab software. There is a USB (driven by codemat software) to connect PC with the receiver module.

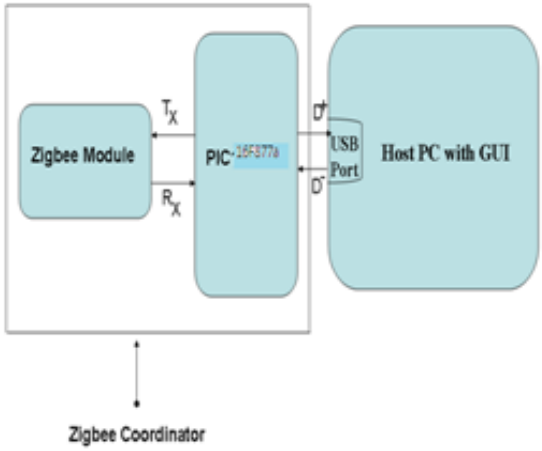

Fig. 11.Sink module

IV.HARDWARE IMPLEMENTATION

The hardware implementation of transmitter section and receiver section are given below:

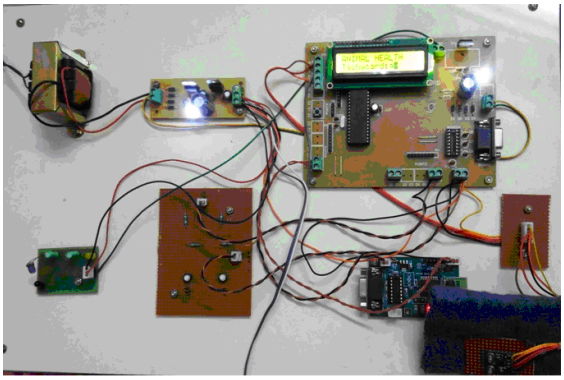

Fig. 12.Transmitter section

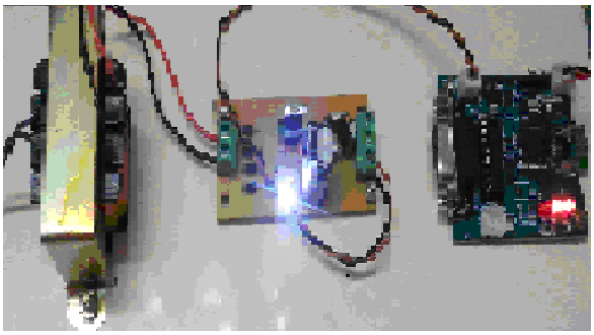

Fig. 13.Receiver section

Here provided twon switches to indicate the conditions of heart deseaes –trachycardia and brachycardia. 12V and 5V 7805 IC are used to provide sufficient voltage.

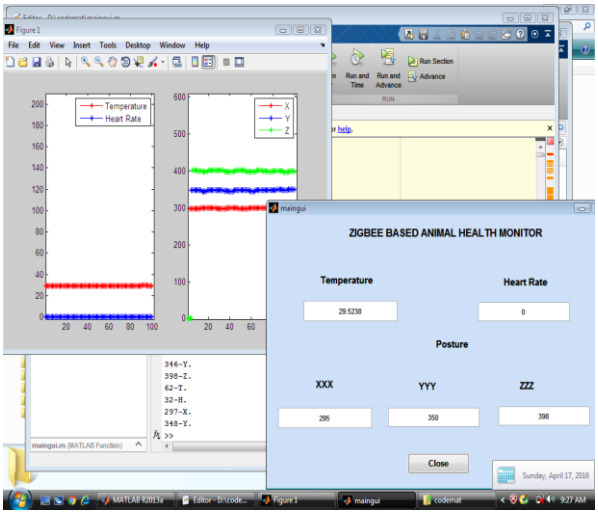

Fig. 14.Output diplay using matlab software

VI. CONCLUSION

The proposed animal health monitoring system can detect the vital signals such as body temperature, heart rate and their movements. Its cost is toleratable to all farmers. Sensors like LM35, IR sensor, ADXL 325 are used to get accurate information about the health parameters.Since the system consumes very less energy, we can use this device very efficiently. Every data will transmit in each seconds

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and they display through a real time graph by using matlab software. This system can be used in the applications like animal tracking, racing etc.

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